Draft Environmental Impact Report

Volume V – Technical Appendices N – V

PacifiCenter @ Long Beach

Lead Agency: City of Long Beach

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PCR

Appendix N

Surface Water Quality Study

Surface Water Quality Study

PacifiCenter @
Long Beach

December, 2003

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1. Introduction

This Surface Water Quality master plan study presents an evaluation of the effects that the proposed PacifiCenter project would have on surface water quality. The PacifiCenter project is located within the Cities of Long Beach and Lakewood. Information from this study will be used as the technical basis for Section V.G the Draft Environmental Impact Report (Draft EIR) prepared in accordance with the California Environmental Quality Act (CEQA) requirements.

1.1. Project Description

The PacifiCenter @ Long Beach project proposed by Boeing Realty Corporation would result in the redevelopment of 261 acres of the Boeing Company's C-1 aircraft production facility located within the Cities of Long Beach and Lakewood. Project implementation would provide for the replacement of existing research and development (R&D), office, warehouse, manufacturing and other aviation-related uses with new R&D, light industrial, office, retail, hotel, residential, and auxiliary uses, and potentially the continuation of some aviation-related uses. Open space and landscaped areas would also be provided throughout the PacifiCenter site. PacifiCenter is anticipated to be fully developed by the year 2020.[1]

The project site is located approximately 5 miles northeast of downtown Long Beach and immediately north of the Long Beach Municipal Airport (Airport). A majority of the site (approximately 238 acres) is located within the City of Long Beach, while the remaining portion of the site (approximately 23 acres) is within the City of Lakewood. In general, the project site is bound by Carson Street on the north, the Airport on the south and southwest, Lakewood Boulevard on the east, and the Lakewood Country Club and the Airport on the west.[2] An aerial photograph of the site is shown in Figure SW-1.

1.2. Objective

The objectives of this study are to describe the project-related environmental impacts to existing and future surface water quality and to identify mitigation measures to reduce any impacts, if required. The evaluation comprises a review of documents that provide information regarding existing site conditions, the proposed PacifiCenter project, and identification of mitigation measures necessary to reduce potential impacts, if any.

[1] Section III, Project Description in the Draft Environmental Impact Report.

[2] Although analyzed as part of the project, a small portion (less than one acre) of the PacifiCenter site on the southwest corner of Lakewood Boulevard and Carson Street is not currently under Boeing ownership. In addition, another small area of land (less than one acre) formerly used for railroad purposes and not under Boeing ownership was analyzed as a part of this project.

2. Existing Conditions

As part of this report, Kimley-Horn reviewed documents and files from the Los Angeles Regional Water Quality Control Board (LARWQCB), Boeing's Safety, Health and Environmental Affairs (SHEA), the United States Environmental Protection Agency (USEPA), the Los Angeles County Flood Control District, and the Public Works Departments for the Cities of Lakewood and Long Beach. The documents that were reviewed include:

- National Pollutant Discharge Elimination System (NPDES) permits on file at the LARWQCB;
- Monitoring reports submitted to the LARWQCB by Boeing in compliance with NPDES permits;
- Basin-wide plans, surface water maps, regional and local soil contaminant distribution maps; and
- Conceptual plans of the PacifiCenter project and plans of proposed transportation improvements and surface drainage modifications.

Section 5 of this report cites the references used.

2.1. *Existing Permits*

The current Boeing site operates under both a General Industrial Storm Water Permit and a NPDES Waste Discharge Permit (Permit Number 6116, issued October 27, 1999).[3] A Storm Water Pollution Prevention Plan (SWPPP) outlining the current Boeing site rainstorm response procedures has been prepared and filed with the LARWQCB. (See Section 2.2.)

The Boeing Enclave area will remain as part of the C-17 and 717 aircraft production for the immediate future. The Enclave area is illustrated in Figure SW-2. As a result, the Enclave area will remain under the requirements of the existing Boeing Industrial Storm Water Permit and Waste Discharge Permit. In the future, when this area is incorporated into the PacifiCenter project, it will fall under City of Long Beach's storm water requirements, as discussed in Section 3.6 of this report.

2.2. *Existing Surface Water Characteristics*

The primary sources of storm water pollution in urban areas include automobiles and activities associated with automobile use, housekeeping and landscaping practices, industrial activities, construction, non-storm water connections to the drainage system, and accidental spills. Table 1 presents a matrix of common pollutant sources and the pollutants they generate.

[3] Los Angeles Regional Water Quality Control Board, list of active permits.

Table 1: Common Sources of Pollutants in Urban Runoff

Pollutant	Atmospheric Deposition	Urban Housekeeping Landscaping Practices	Industrial Activities	Transportation Sources	Non-Storm Water Discharges	Accidental Spills
Sediments	X	X	X	X		
Nutrients	X	X	X	X	X	X
Bacteria and Viruses		X		X	X	X
Oxygen Demanding Substances		X	X	X	X	X
Oil and Grease	X	X	X	X	X	X
Anti-Freeze	X	X		X	X	X
Hydraulic Fluids	X	X	X	X	X	X
Cleaners and Solvents	X	X		X	X	X
Heavy Metals	X	X	X	X	X	X
Chromium	X	X	X			
Copper	X	X	X			
Lead	X	X	X			
Zinc	X	X	X			
Iron	X		X			
Cadmium	X		X			
Nickel	X		X			
Manganese	X		X			
Paint		X		X	X	X
Wood Preservatives		X		X	X	X
Fuels	X		X	X	X	X
PCBs	X				X	X
Pesticides	X	X	X	X	X	X
Herbicides	X		X	X	X	X
Floatables *		X	X	X		X

* Floatables in storm water are pollutants that contain significant amounts of heavy metals, pesticides, and bacteria.

2.2.1 Los Angeles County Project 456 Watershed

The PacifiCenter project site lies at the downstream end of the 1,521-acre (2.4 square miles [mi^2]) Project 456 Watershed. The watershed drains into the double 9'3" x 8'0" Reinforced Concrete Box (RCB) culverts located under Lakewood Boulevard immediately southeast of the site. The double RCB culverts are owned and maintained by the Los Angeles County Flood Control District (LACFCD) and intercept flow from the site and the areas within the

City of Lakewood and the City of Long Beach to the west and northwest of the PacifiCenter project.[4]

In February 2003, Kimley-Horn performed a site reconnaissance to identify primary surface water sources from the 1,521-acre watershed. The watershed that includes the project site is almost 100 percent built-out. Figure SW-3 illustrates the 1,521-acre watershed area within which the PacifiCenter project lies and the area's major land uses. Most of the recent development activity within the 1,521-acre watershed is redevelopment of previously developed sites. A large percentage of the area within the watershed is impervious and covered with pavement or buildings. The major exception is the Lakewood Golf Course, which drains through the project site.

Typical sources of storm water pollution of the watershed are consistent with the sources identified in Table 1. A list of active permits in the City of Long Beach, provided by the LARWQCB in June 2003, found no active NPDES permits within the 1,521-acre watershed with the exception of the existing Boeing permit number 6116 and the permit for demolition of the PacifiCenter project.[5]

2.2.2 *531-Acre Watershed (Including the Boeing Project Site)*

The existing Long Beach 7'0"x 4'6" RCB serves a 531-acre (0.83 mi^2) sub-basin consisting of the 261 acre PacifiCenter project site, the 257-acre off-site runoff from the adjacent Los Angeles County Lakewood Country Club Golf Course, and an additional 13 acres of off-site watershed, from the Long Beach Airport and the adjacent streets of Carson Street and Lakewood Boulevard.

In February 2003, Kimley-Horn performed a site reconnaissance to identify primary surface water sources from the 531-acre sub-basin. The reconnaissance determined that the water quality of the runoff is influenced primarily by the golf course, paved surfaces within the Boeing aircraft production facility, and a small portion of residential area to the north of Carson Street. Typical sources of storm water pollution for the 531-acre sub-basin would be primarily consistent with the industrial activities and landscaping practices identified in Table 1.

2.2.3 *261-Acre Sub-Basin (Including the Boeing Project Site)*

The existing 261 acre sub-basin consists primarily of surface runoff generated on-site with almost no surface flow entering the existing site. Figure SW-4 illustrates the associated influences on water quality from the existing aircraft production facility.

The existing Boeing General Industrial Storm Water Permit and the existing NPDES Waste Discharge Permit number 6116 identify industrial pollutants that could potentially enter the Boeing drainage system. These include:

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[4] Drainage Master Plan Revision Study prepared by Kimley-Horn and Associates, May 2003.
[5] Los Angeles Regional Water Quality Control Board, list of active permits.

- Fuel, solvents, coatings, and hazardous wastes that are stored temporarily in Building 47 before being shipped to disposal site;
- Fuel, solvents, coatings, and hazardous waste located in Building 10 as part of the aircraft production facility;
- Hydraulic fluids, oils and grease from the flight ramp, ramp storage, wash rack and structural test area; and
- Sediments, nutrients, bacteria, oxygen demanding substances, oils and grease, heavy metals, pesticides, and floatables from the Lakewood Country Club.

To mitigate the existing conditions and in accordance with the permits identified above, Boeing has an extensive system of controlled inlets, valves, and sensors that are designed to intercept spills and contaminants before they enter the storm drain system. The system has been in-place and operational since 1999.

Figure SW-5, Rainstorm Response Procedures, illustrates the potential point source locations and the response procedures to prevent pollutants from entering the downstream system. A series of capture pans or manually operated inlet valves are located on each catch basin within the 261 acres to eliminate the possibility of pollutants discharging into the storm drain to the downstream storm drain system. The capture pans are normally closed and manually opened by Boeing maintenance personnel to allow runoff to enter the storm drain system depending upon precipitation and level of response. Table 2 identifies the three levels of response as summarized in Figure SW-5. (From the Boeing Corporation)

Table 2: Rainstorm Response Procedures

Level	Potential Probability	Response Procedures
Level One	Potential for Industrial Spills	The capture pans are not opened until there is actual precipitation.
Level Two	Some probability for Industrial Spills	Not applicable to the 261-acre Boeing project site (defers to above level one)
Level Three	No Potential for Industrial Spills	The capture pans are opened when the chance of rain exceeds sixty percent.

In addition to the capture pans, Boeing's existing storm water response system includes valves, pH sensors (measures chemical changes in storm water) and hydrocarbon sensors (measures heavy metal presence in storm water), silt trenches, and clarifiers located throughout the site. Boeing maintenance personnel electronically operate Turner and Veeder-Root Hydrocarbon Sensors. These sensors are located in both Level One and Level Three areas, with the largest sensor located in the 4'6" x 7'0" RCB near Lakewood Boulevard and Conant Street, the downstream point of the Boeing storm drain system. PH sensors are located at the golf course, Level One, and Level Three areas. Comparatively, the existing Boeing storm water response system is considered an advanced Industrial Best Management Practice (BMP) Program.

3. Regulatory Framework

The State Water Resources Control Board (SWRCB) has adopted water quality standards that are required by Section 303 of the Federal Clean Water Act and the State Porter-Cologne Water Quality Act. The Basin Plan, prepared by the LARWQCB, establishes water quality standards and objectives for the watershed where the project is located. The following section of this report summarizes the applicable Federal, State, regional, local, and other water quality regulatory requirements. Figure SW-6 identifies the governmental agencies that will regulate the surface water quality on the PacifiCenter project.

3.1. Federal

3.1.1. Clean Water Act Section 401

Clean Water Act Section 401 is contained in the Untied States Code Title 33 Navigation and Navigable Waters, Chapter 26 Water Pollution Prevention and Control, Subchapter IV Permits and Licenses, and Section 1341 Certification. Clean Water Act Section 401 mandates certification requirements and procedures for the applicants for a Federal license or permit. Applicants for a Federal license or permit to conduct activity that may result in discharge into the navigable water including, but not limited to, the construction or operation of facilities, shall provide the licensing or permitting agency a certification from the State or from the interstate water pollution control agency that any such discharge will comply with the applicable discharge provisions, limitations, or standards so as not to violate the applicable water quality requirements. No license or permit is granted if certification has been denied by the applicable agency, unless the certification has been waived.

The certification sets forth responsibilities, limitations, and monitoring requirements. If the State determines that the discharge from the applicant's activities violates the State's water quality, the license or permit may be issued with conditions to ensure compliance with applicable water quality requirements. The Federal license or permit may be suspended or revoked if a violation of the applicable effluent limitations or water quality requirements are found.

3.2. State

3.2.1. National Pollutant Discharge Elimination System (NPDES) Permit

In 1972, the Federal Water Pollution Control Act, also known as the Clean Water Act, was amended to prevent the illegal discharge of pollutants to waters of the United States (rivers, streams, ponds, lakes, and ditches) unless the discharge was permitted under the NPDES. The owner or operator of any facility that is currently discharging, or proposing to discharge waste into any surface waters of the state, must comply with the Waste Discharge Requirements set forth by NPDES Permit from the applicable Regional Water Quality Board (RWQCB). Once permitted, the facility must comply with various terms and conditions,

including periodic sampling, analysis, and development and implementation of Best Management Practices (BMPs).

Amendments to the Clean Water Act in 1987 established a program that required NPDES permitting of point source discharges of storm water associated with industrial facilities. A facility may choose one of three options to obtain coverage under this permit: individual, group, or general permit. Permit conditions can include periodic sampling, analysis, and development of a SWPPP.

3.2.2. Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Act (Water Code §13000, *et seq.*) establishes the SWRCB and each RWQCB as the principal State agencies having primary responsibility for coordinating and controlling water quality in California. Under the Porter-Cologne Act, the SWRCB has the ultimate authority over State water rights and water quality policies. The RWQCBs oversee water quality on a day-to-day basis at the local and regional level.

There are nine RWQCBs in the State of California. RWQCBs engage in a number of water quality functions in their respective regions. One of the main functions is preparing and periodically updating Basin Plans. Each Basin Plan establishes the following:

- Beneficial uses of water designated for each water body to be protected;
- Water quality standards, known as water quality objectives, for both surface water and groundwater; and
- Actions necessary to maintain these standards in order to control non-point and point sources of pollution to the State's waters.

Permits issued to control pollution (i.e. water-discharge requirements and NPDES permits) must implement Basin Plan requirements (i.e. water quality objectives) while taking into consideration beneficial uses to be protected.

RWQCBs regulate all pollutant or nuisance discharges that may affect either surface water or groundwater. Any person proposing to discharge waste within any region must file a report of waste discharge with the appropriate RWQCB. No discharge may take place until the following two conditions are met:

- The RWQCB issues waste discharge requirements or a waiver of the waste discharge requirements; and
- 120 days have passed since complying with reporting requirements.

Under the auspices of the USEPA, the SWRCB and nine RWQCBs also have the responsibility of granting Clean Water Act NPDES permits for certain point-source discharges. California routinely issues NPDES permits to select point-source discharges and either waste discharge requirements or conditioned water quality certifications for other discharges. The nine RWQCBs differ somewhat in the extent they choose to apply waste discharge requirements and other regulatory actions.

3.3. Regional

The basic policy document for the LARWQCB is the "Water Quality Control Plan/Los Angeles Region," also known as the "Basin Plan". This document designates beneficial uses of water bodies, sets water quality objectives to protect the uses, addresses localized water quality problems, and lays out a plan for water quality protection.

General permits under the Basin Plan are used to regulate polluted storm water runoff, treated groundwater, non-hazardous soil disposal, and other discharge. Storm water permits do not contain effluent limits (except for certain industrial categories); however, they require that the discharger implement certain practices. Effluent water quality objectives are provided in the Basin Plan for the following constituents:

- Total Dissolved Solids (TDS): 900 milligrams per liter (mg/l);
- Sulfate: 300 mg/l;
- Chloride: 150 mg/l; and
- Nitrogen, as Nitrate: 8 mg/l.

All permits and clean-up orders will require the discharger to monitor the site and its discharge and to submit periodic monitoring reports. In addition, the LARWQCB staff routinely inspects regulated sites. Whenever there is a violation of a permit condition or a violation of a water quality standard (as an unpermitted facility), the LARWQCB can take enforcement action(s), issue cleanup and abatement orders and/or cease and desist orders, or impose administrative civil liabilities (fines).

Some of the non-point source pollution, including runoff from some urban, industrial, or construction activities may be regulated and enforced by the Board if the activities are determined to produce significant water pollution. Rather, it is statewide policy to generally work with potential sources of non-point pollution (i.e., ranchers or farmers) to voluntarily solve any problems. More standard regulation, such as permits and enforcement, is usually done only when the voluntary approach does not work.

3.4. Local

The municipal storm water NPDES permit (Los Angeles County Permit) issued to Los Angeles County and 85 cities (Permittees) by the LARWQCB requires the development and implementation of a program addressing storm water pollution for construction (NPDES) and permanent Standard Urban Storm Water Mitigation Plans (SUSMP). The City of Long Beach is not a part of the Los Angeles County Permit, but has elected to be issued its own municipal NPDES permit, NPDES Permit Order No. 99-060 (CAS004003/CI 8052).

3.4.1 City of Long Beach

On September 5, 2000, the City of Long Beach implemented Ordinance No. C-7703, which amended the Municipal Code by adding Chapter 18.95 relating to NPDES and SUSMP

requirements in accordance with the City's municipal NPDES permit. Through this Ordinance, the City of Long Beach can issue its own permit with regulations and requirements specific to the City. The SUSMP requirements for the City of Long Beach are similar to those for set forth by the County of Los Angeles municipal NPDES permit.

3.4.2 City of Lakewood

The City of Lakewood applies the NPDES and SUSMP requirements of the County of Los Angeles to all new facilities constructed within the City of Lakewood. On March 8, 2000, the County of Los Angeles adopted the SUSMP for Los Angeles County and Cities in Los Angeles County.

3.5. Other

3.5.1. California Code of Regulations

The California Code of Regulations (CCR) is a compilation of the existing regulations formally adopted by state agencies, reviewed and approved by the Office of Administrative Law (OAL), and filed with the Secretary of State. The CCR consists of 27 titles and contains the regulations of approximately 200 regulatory agencies. A regulation is a rule adopted by a State regulatory agency to implement, interpret, or make specific the law enforced or administered by it, or to govern its procedure. The OAL is responsible for the official compilation, printing, and publication of all regulations as they are adopted, amended, or repealed. With regard to surface water quality the PacifiCenter project must comply with Title 23, Waters, of the CCR.

3.6. Compliance with Regulatory Requirements

The storm water regulatory requirements can be divided into two categories, construction requirements and permanent (operational) requirements. Figure SW-7 identifies the regulatory requirements specific to the PacifiCenter project and to future individual developers.

3.6.1. Construction (NPDES)

The construction NPDES requires that all construction sites provide storm water controls. For construction activities, a NPDES permit is required by the RWQCB. This permit must be obtained prior to the start of construction. Permit applicants are required to prepare and retain at the construction site a SWPPP, which describes the site, potential on-site pollutant sources, pollutant control measures, erosion and sediment control measures; Best Management Practices (BMPs); post-construction control measures; and plans for monitoring and maintenance.

For both the Cities of Long Beach and Lakewood, there are three stages of construction at which storm water controls must be provided: 6

- Stage 1: Sites of one acre or less must follow a specific set of BMPs;
- Stage 2: Sites in environmentally sensitive areas or sites between one and five acres must prepare a SWPPP, which must be approved before a grading or building permit is issued; and
- Stage 3: Projects that disturb more than one (1) acre of soil or whose project disturb less than one (1) acre but are part of a larger common plan of development that in total disturbs one (1) or more acres are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction activity. This will require a SWPPP be filed with the respective City and the SWRCB.

A SWPPP has been prepared and approved by the LARWQCB and the City of Long Beach for the demolition of the existing facilities associated with the remediation activities underway at the existing 261-acre project site (Stage 3). PacifiCenter mass grading and infrastructure construction will also require an approved SWPPP. Each of the development sites within the PacifiCenter that are developed will be required to prepare a specific SWPPP prior to development of each such site.

3.6.2. Permanent (SUSMP)

As a part of the grading and building permit process, both the City of Long Beach and the City of Lakewood will require a SUSMP to be developed for each project. The requirements of the SUSMP will become a permanent feature for that project and may be integrated into the project's Covenants, Conditions, and Restrictions (CC&Rs). Within the City of Lakewood, projects that fall into one of seven categories are identified in the Los Angeles County Permit as requiring SUSMP. These categories include:

- Single-family hillside residences;
- 100,000-square foot or more commercial developments;
- Automotive repair shops;
- Retail gasoline outlets;
- Restaurants;
- Home subdivisions with 10 to 99 units; and
- Home subdivisions with 100 or more housing units.

The City of Long Beach's permit requires SUSMP for the following categories only:

- 10-99 home subdivisions;
- 100 or more home subdivisions;
- 100,000-or more square-foot commercial developments; and
- Projects located adjacent to or discharging to environmentally sensitive areas.

For the remaining four categories, source control BMPs are required to be implemented.

6 Long Beach Ordinance C-7703, Lakewood Los Angeles County SUSMP requirements

The SUSMP provisions applicable to all categories include:

- Reduce peak storm water runoff discharge rates;
- Conserve natural areas;
- Minimize storm water pollutants of concern;
- Protect slopes and channels;
- Provide storm drain stenciling and signage;
- Design outdoor material storage areas;
- Design trash storage areas;
- Provide proof of ongoing BMP maintenance; and
- Provide design standards for structural or treatment control BMP.

4. Proposed Conditions

4.1. Threshold of Significance

For the purpose of this project, surface water quality impacts will be considered significant if:

- Development of the PacifiCenter project degrades the surface water quality of receiving waters to levels above objectives (or standards) considered acceptable by the LARWQCB or other regulatory agencies;
- Activities associated with the PacifiCenter project impair the beneficial uses of the receiving waters. or
- Development of the PacifiCenter project would substantially deplete groundwater supplies or substantially interfere with groundwater recharge of the aquifer.

The development of the PacifiCenter project will implement the required BMPs to meet the water quality standards set by the LARWQCB. The project will implement BMPs for grading and construction of the project and will implement structural BMPs that will be permanent part of the PacifiCenter infrastructure. These structural BMPs will enable the project to maintain the required water quality standards after the project is completed by providing treatment of the storm water prior to discharging water into the storm drain facilities. Structural BMPs will also be included as a part of the onsite design for the specific land uses to be developed, which will also minimize degradation of the storm water quality. The development of the PacifiCenter will not substantially affect the recharge of the groundwater aquifer as the project will reduce the amount of impervious area within the project site, which will allow more surface water to infiltrate through the soils.

4.2. Project Design Features and Benefits

The construction and permanent (operational) impacts to surface water quality of the proposed PacifiCenter project were evaluated based upon the proposed development plans. The project will comply with all Federal, State, and City requirements during both the construction and permanent phases. Compliance will include procurement of all necessary permits, including NPDES permits and the Cities of Lakewood and Long Beach grading and building permits. It is important to note that the Boeing aircraft facility has an existing detailed storm water management plan consistent with the industrial use of an airplane

manufacturing facility. The storm water management plan for the PacifiCenter project will incorporate BMPs appropriate for the project.

4.2.1 Construction (NPDES):

- The project construction will concurrently dismantle the Boeing storm water system as the PacifiCenter implements the NPDES requirements consistent with the new uses of the site. All areas will be continuously protected during the construction process.
- The Boeing storm water system will be maintained for the Boeing Enclave as long as that area is functioning as an aircraft manufacturing facility. This will require the relocation of some of the monitoring equipment and isolation valves that currently are installed in the existing RCB and other facilities. The current NPDES waste discharge permit number 6116 will remain in place until the Enclave facility is removed.
- As a part of the PacifiCenter project's mass grading and backbone infrastructure construction, a NPDES permit will be secured and a SWPPP will be developed and implemented during the construction period, as required by the permit. The SWPPP will include BMPs to reduce pollutant loading to storm water runoffs. Figure SW-8 illustrates a typical BMP palette and typical BMP applications required by the SWPPP. Figure SW-12 identifies the procedural order for preparing a SWPPP and BMPs. Once the PacifiCenter mass grading and infrastructure is constructed, much of the graded site may remain vacant for a period of time. During that time frame, the erosion control features of the SWPPP will be maintained on those areas that are not developed.
- The various separate development sites within the PacifiCenter will be required to secure a separate NPDES construction permit and prepare a site specific SWPPP as they are developed. The SWPPP will include BMPs to reduce pollutant loading to storm water runoffs. Figure SW-9 illustrates a typical BMP palette and typical BMP applications that will be required by the NPDES permit. Figure SW-12 identifies the procedural order to preparing a SWPPP and BMPs.
- Short-term NPDES permits for the discharge of groundwater to the storm drain will be obtained for construction dewatering as deemed necessary. The project will comply with the permit requirements during construction dewatering. If required, compliance will include treating groundwater as needed to meet the waste discharge requirements as specified in the short-term NPDES permits before discharging the groundwater to the storm drain.
- The PacifiCenter project would be required to implement erosion control measures during post-rough grading, including, but not limited to hydroseeding, Guar Soil Binders, straw mulch, geotextiles, plastic covers and erosion control blankets/mats, wood mulching, silt fencing desilting basins, sandbag barriers, storm drain inlet protection, and stabilized construction entrances and exits. The PacifiCenter project would maintain the erosion control measures until the individual developer purchases a development site. Once a parcel is transferred to a specific developer, maintenance of the erosion control measures for that parcel will also be transferred to the developer.

Collectively, these measures will meet the NPDES requirements.

4.2.2 Permanent (SUSMP):

- The Boeing Enclave facility will continue to operate for a number of years as the PacifiCenter is developed. It will be required to operate under the storm watermonitoring program developed for its current NPDES wastewater discharge permit number 6116. The PacifiCenter project will not interfere with those requirements. The Boeing Enclave point of connection will be modified by the PacifiCenter project. Currently the storm water exits through the city's box located south of building 15 (located within the eastern portion of the Enclave). Once the area east of the Enclave is developed, the Enclave storm water will be diverted south to a new reinforced concrete box along the south property line of the project site.
- A permanent feature of the site, due to the change in land use, will be a reduction in the industrial land use that will significantly reduce the potential for hazardous storm water discharges. Also, there will be a reduction in the overall volume of storm water being discharged from the site as a result of the change in land use.
- The PacifiCenter project will consist of several different land uses, residential areas, commercial areas, and retail areas. The residential areas will have specific SUSMP requirements that may be a part of the project's CC&Rs and enforced and maintained by a property or home owners association.
- The commercial and retail areas will have a separate SUSMP prepared for those areas and may be a part of the CC&Rs that will run with the land. The SUSMP prepared for the PacifiCenter commercial areas will address the existing conditions to maintain water quality until developed. Once the areas are developed, it will specify the requirements for such areas to connect into the backbone storm drain systems.
- The PacifiCenter project will include extensive landscaped areas that will significantly decrease the amount of impervious surface areas on the project site. Currently, the 261 acre site includes approximately four acres in landscaping and 257 acres of paved surfaces. The PacifiCenter project includes approximately 51 acres of open space and passive landscaped spaces. This decrease in impervious area will reduce peak storm water runoff discharge rates.
- The PacifiCenter project will implement visible storm drain stenciling directly adjacent to storm drain inlets. Storm drain stenciling would be implemented immediately for all storm drain inlets. The Design Guidelines will require individual developers to provide stenciling as part of the project approval process.
- The PacifiCenter development will be required to comply with the City of Long Beach and City of Lakewood requirements for trash storage areas and outdoor material storage areas, where applicable.
- The PacifiCenter development will substantially decrease the amount of storm water currently being generated from the 261-acre site. Currently, the 10-year storm event flow is approximately 542 cubic feet per second (cfs). The project site's 10-year storm event flow is 403 cfs. The result is a net reduction of 139 cfs or 26% in storm water runoff.
- The PacifiCenter development will substantially decrease the amount of storm water currently being generated from the 531-acre hydrological basin. Presently, the 10-year storm event flow is approximately 613 cfs. The project site's 10-year storm event flow is 454 cfs. The result is a net reduction in 159 cfs or 26 % in storm water runoff.

- The PacifiCenter project will be designed so that each individual project will treat the volume of storm runoff produced from a 0.75-inch storm event from that parcel prior to discharging into the storm drain conveyance system. This treatment will be an integral part of the SUSUMP for each parcel. [don't we need to address this specifically?] Only if we want to prepare the SUSUM as a part of the EIR

4.3. Conclusions

- The project will comply with applicable Federal, State, Regional and local requirements during both the construction phase and the operation phase. Compliance will include obtaining all necessary permits, including NPDES permits and the grading and building permits from the Cities of Long Beach and Lakewood. For this project, the City of Long Beach and the City of Lakewood are responsible for enforcing the NPDES and the Clean Water Act requirements within their respective City limits.

- The project will obtain NPDES general construction permits. Compliance with the general construction permits will address issues related to storm water runoff, which include maintaining existing drainage flow and collecting excess water and sediments. The project will submit erosion control plans for approval and obtain a grading permit from the Cities of Long Beach and Lakewood Department of Public Works. Compliance with the NPDES general permit for construction activities shall be certified by the LARWQCB prior to issuance of building permits.

- The project will develop and implement a SWPPP and a monitoring and reporting program for the construction period, as required by the NPDES permit. The SWPPP will include BMPs to reduce pollutant loads in storm water runoffs. Short-term NPDES permits for discharge of groundwater to the storm drain will be obtained for construction dewatering, as deemed necessary. The project will comply with the permit requirements during construction dewatering. If required, compliance will include treating groundwater as needed to meet the waste discharge requirements as specified in the short-term NPDES permits before discharging the groundwater to the storm drain.

- For the operation phase, no point sources of discharge have been identified. Facilities that are constructed as part of the project that could discharge industrial storm water would be required to obtain the applicable permits from the appropriate regulatory agency and to comply with the conditions of those permits.

5. References

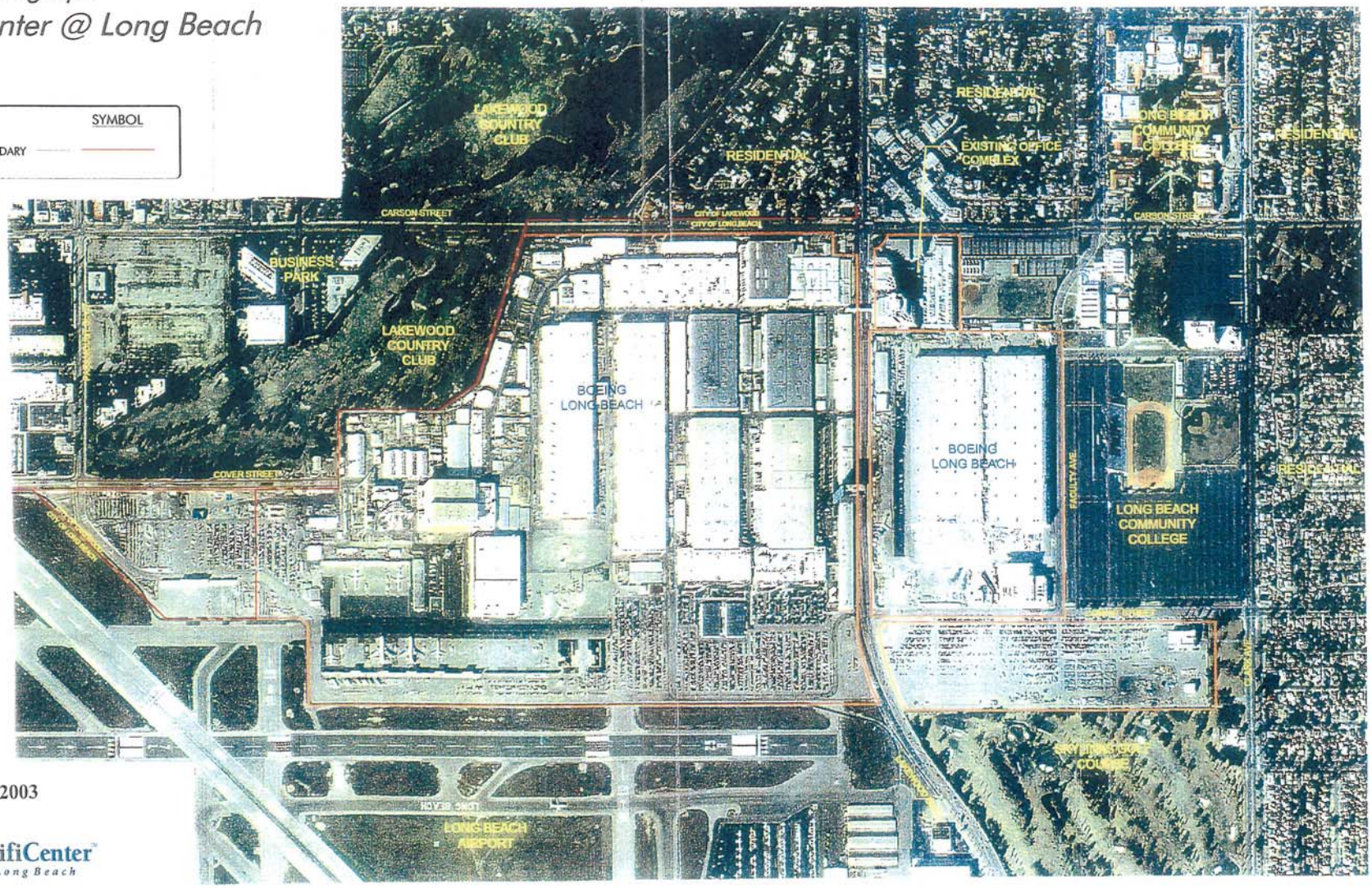
- City of Long Beach Ordinance No. C-7703, NPDES and SUSMP Regulations.
- City of Long Beach Department of Public Works, Handbook of Design Standards, June 1995.
- City of Lakewood Urban Water Management Plan Update 2000, December 12, 2000.
- Los Angeles County Department of Public Works, Development Planning for Storm Water Management, a Manual for the SUSMP, July 2000.
- County of Los Angeles and Cities of Los Angeles, Standard Urban Storm Water Mitigation Plan, March 8, 2000.
- County of Los Angeles Department of Public Works, Maintained Structural Best Management Practices, Final Report and Recommendations, October 25, 2000.
- American Public Works Association, "Clean Water Impact on New Development", Workshop Sponsored by the Water Resources Committee, May 31, 2001.

H:\P-DRIVE\PROJECTS\099000.s\099040000\Word\Surface Water Quality StudyOct2001.doc

Aerial Photograph
PacifiCenter @ Long Beach

LEGEND	SYMBOL
SUBDIVISION BOUNDARY	

Not to Scale



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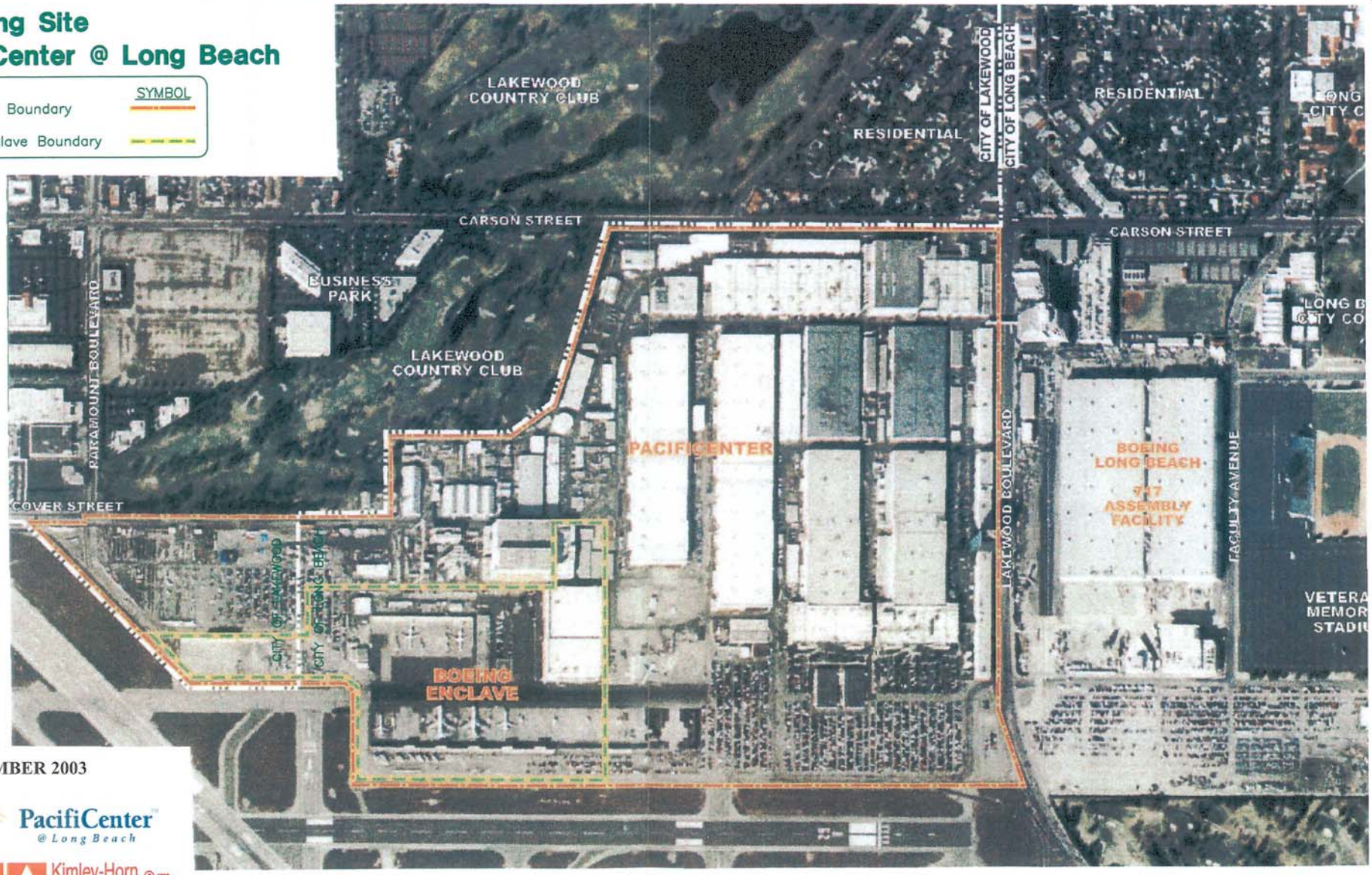
PacifiCenter™ @ Long Beach

Kimley-Horn and Associates, Inc.

Figure SW-1

Existing Site
PacfiCenter @ Long Beach

LEGEND	SYMBOL
Subdivision Boundary	
Boeing Enclave Boundary	



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PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc.

Figure SW-2

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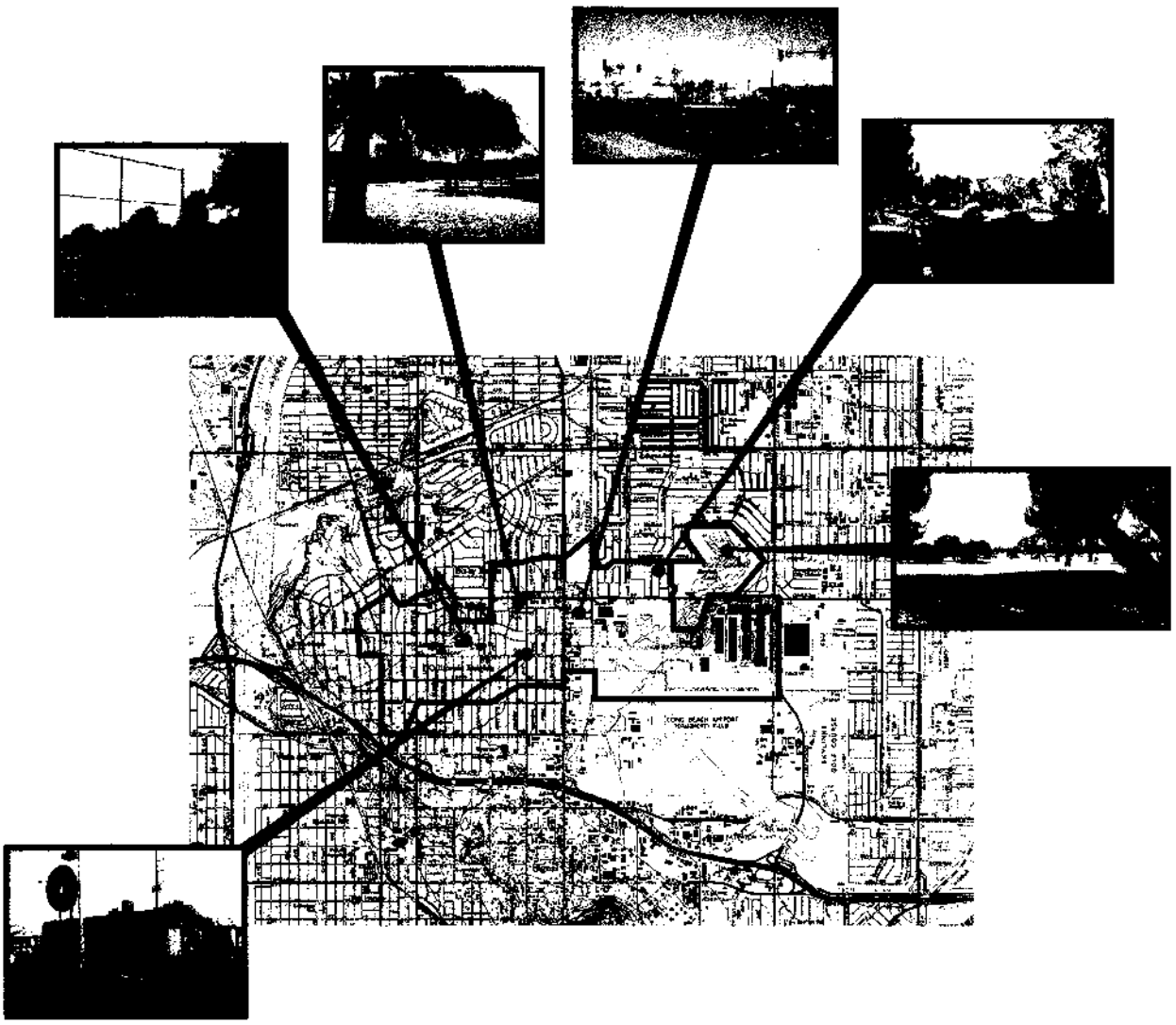

LEGEND	SYMBOL
260 ACRE BOEING SITE	
WATERSHED BOUNDARY	

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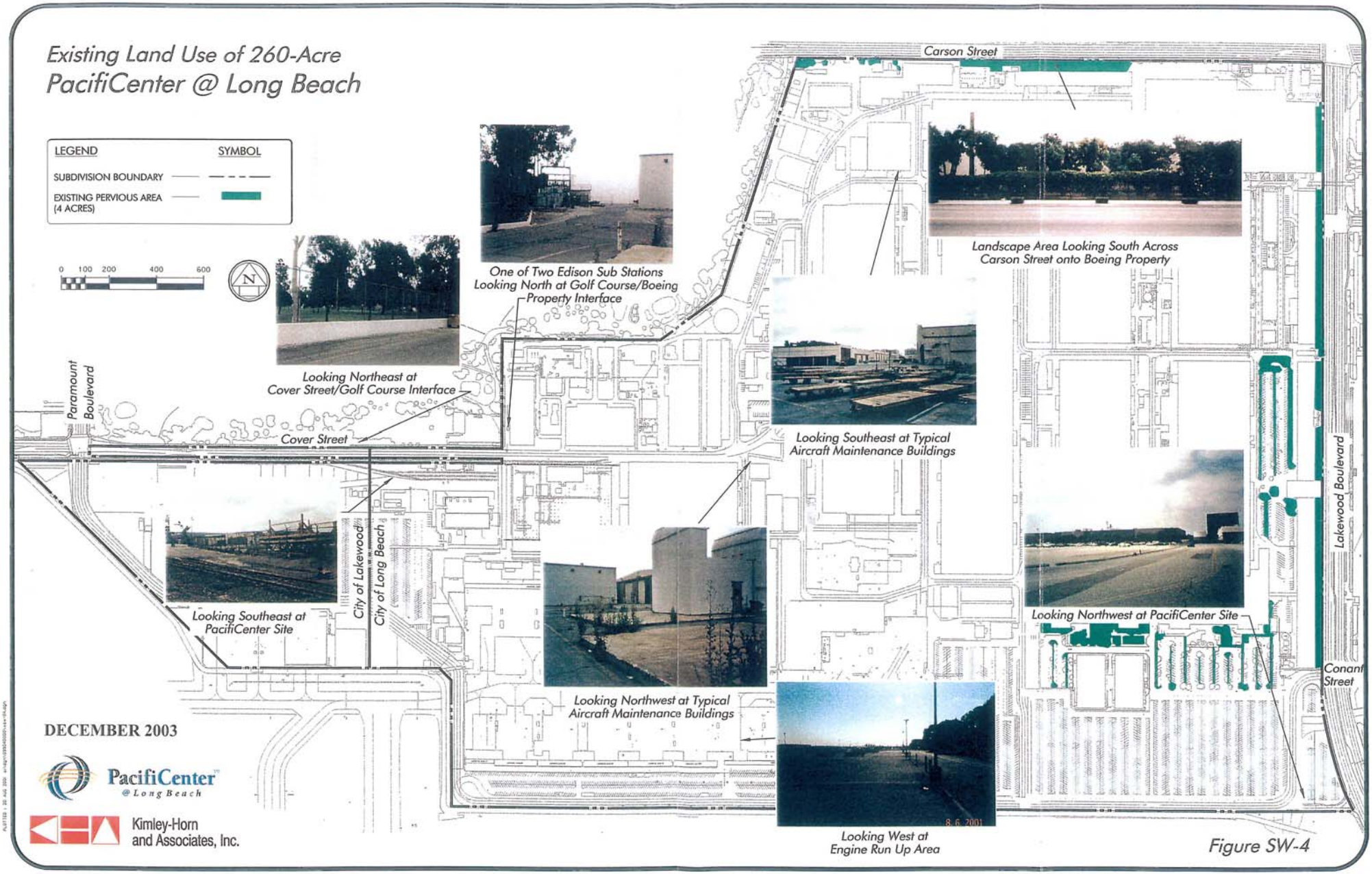
PacifiCenter
Long Beach

KIMLEY-HORN AND ASSOCIATES

Major Land Uses
of 1,484 Acre Watershed
PacifiCenter • Long Beach

Figure SW-3

Existing Land Use of 260-Acre PacifiCenter @ Long Beach



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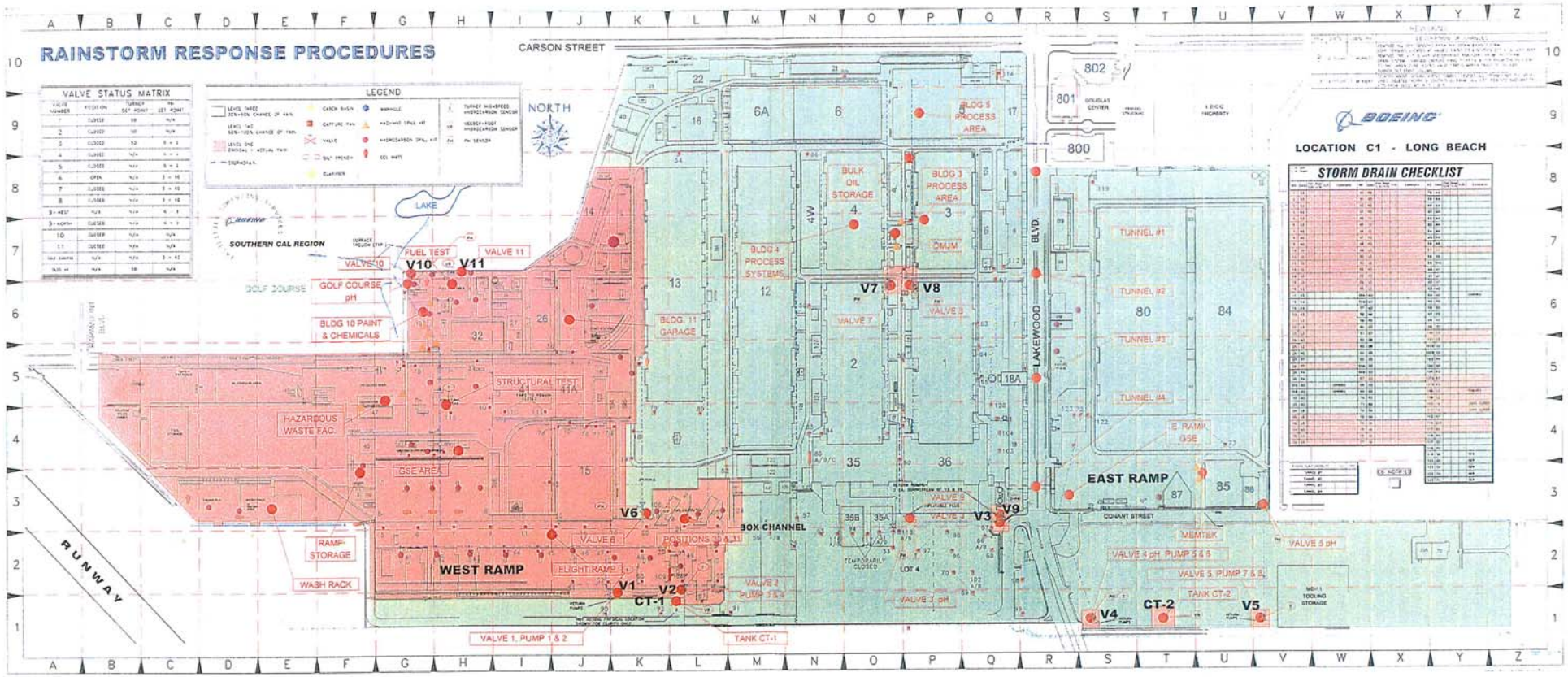
PacifiCenter™ @ Long Beach

Kimley-Horn and Associates, Inc.

Figure SW-4

Rainstorm Response Procedures
PacifiCenter @ Long Beach



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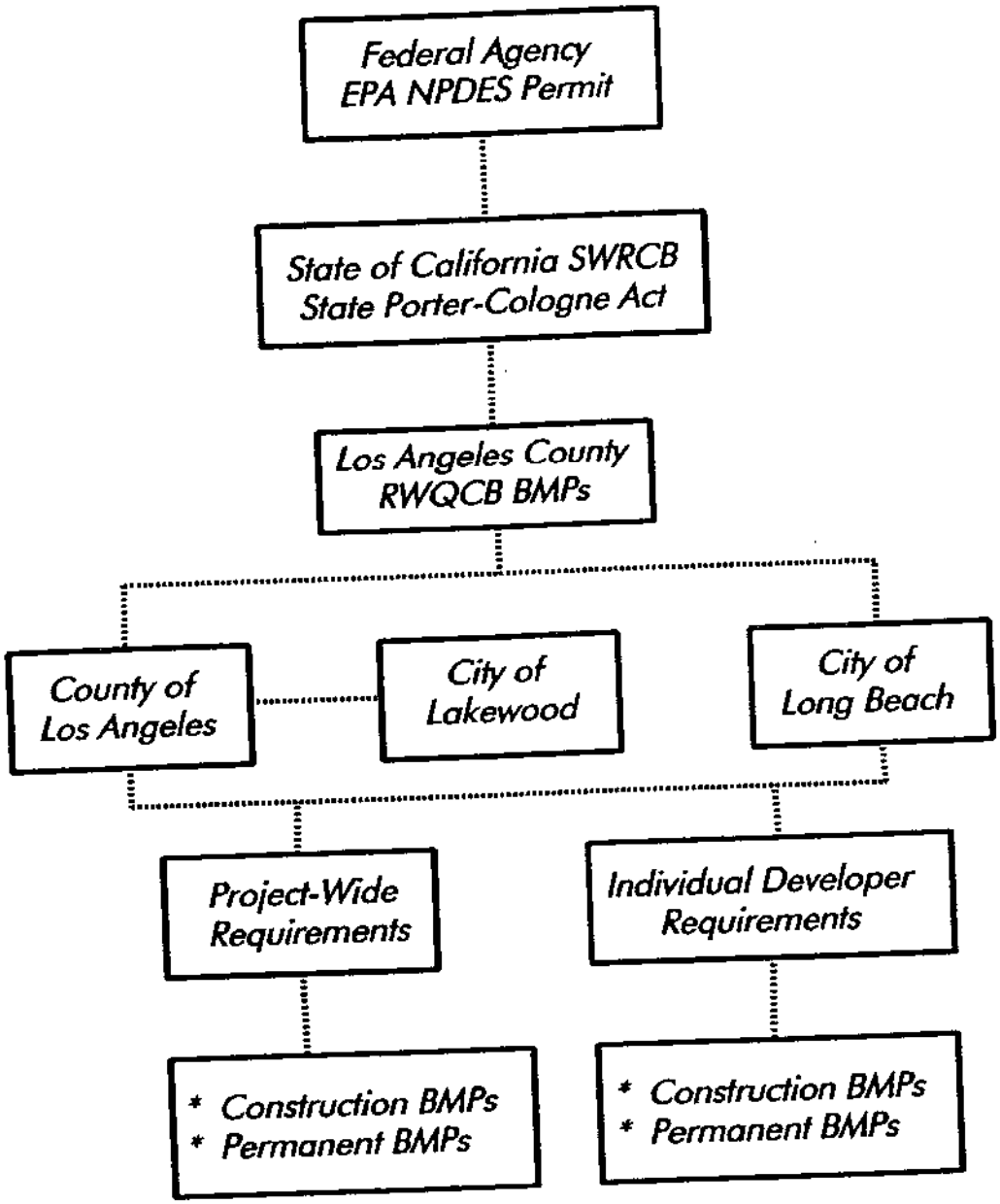
Not to Scale

Source: Boeing Aircraft Corporation

Figure SW-5

Surface Water Regulatory Agencies
PacifiCenter @ Long Beach



LEGEND

EPA	Environmental Protection Agency
NPDES	National Pollutant Discharge Elimination System
SWRCB	State Water Resources Control Board
RWQCB	Regional Water Quality Control Board
BMPs	Best Management Practices

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Figure SW-6

Agency-Proposed Project-Wide Requirements
PacifiCenter @ Long Beach

Agency Requirement	Project Wide/Project Infrastructure	Individual Site Development
Construction Activity NPDES Permit	Yes	Yes
Stormwater Pollution Prevention Plan	Yes	Yes
Erosion and Sedimentation Control Plan	Yes	Yes
Permanent SUSMP		Yes
Peak Storm Water Runoff Reduction	Yes	
Minimization of Stormwater Pollutants of Concern	Yes	Yes
Protection of Slopes and Channels	Yes	Yes
Storm Drain Stenciling and Signage	Yes	Yes
Properly Designed Outdoor Material Storage Areas		Yes
Properly Designed Trash Storage Areas		Yes
Proof of On-Going BMP Maintenance	Yes	
Design Standards for Treatment Control BMPs	Yes	Yes

LEGEND

ESC — Erosion & Sedimentation Control

SUSMP — Standard Urban Storm Water Mitigation Plan

NPDES — National Pollutant Discharge Elimination System

SWPPP — Storm Water Pollution Prevention Plan

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Figure SW-7

Potential Project Wide Illustrative Construction BMP's PacfiCenter @ Long Beach

LEGEND	SYMBOL
Proposed Storm Drain	———
Existing Storm Drain	======

NORTH
Not To Scale

SITE WIDE REQUIREMENTS

NS1– Water Conservation
NS2– Dewatering Operations
NS3– Paving and Grinding Operations
NS8– Vehicle and Equipment Washing
NS9– Vehicle and Equipment Fueling
NS10– Vehicle and Equipment Maintenance
WM3– Stockpile Management
WM4– Spill Prevention and Control
WM8– Concrete Waste Management
WM9– Sanitary/Septic Waste Management

Note: This site plan reflects a potential rough grade scenerio.
The BMP's are illustrative and the individual developers will be required to prepare a SWPP for each development as part of the building permit process.

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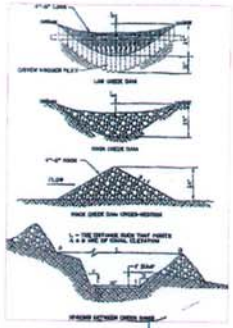
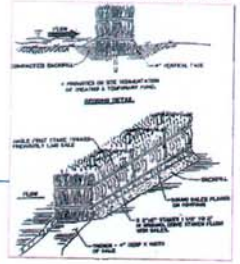
PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc.

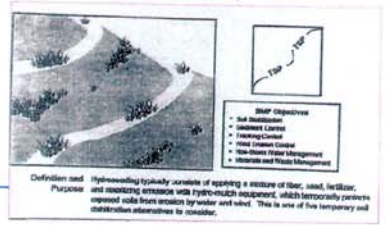
Check Dams SE–4



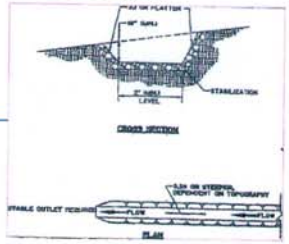
Straw Bale Barriers SE–9

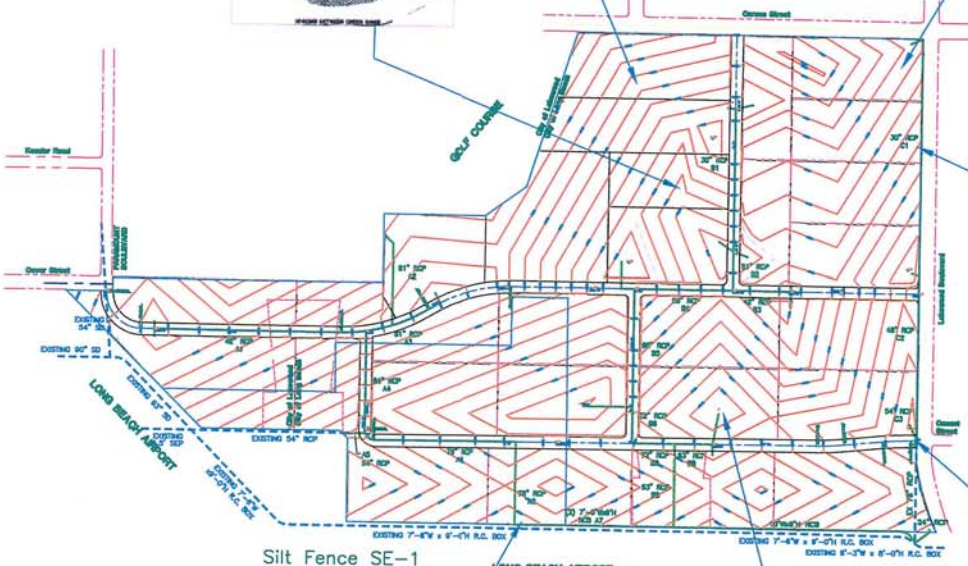


Hydroseeding EC–4

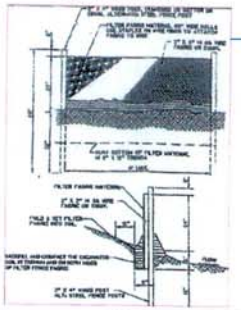


Temporary Drains and Swales EC–9 As Required

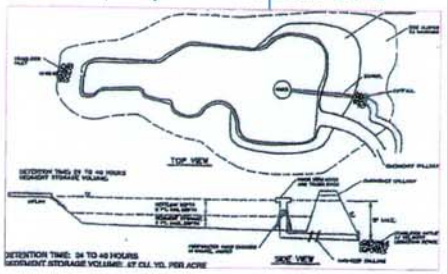




Silt Fence SE–1 @ Pavement



Temporary Sediment Basin SE–2



Sand Bag Berm SE–8 @ Project Pavement

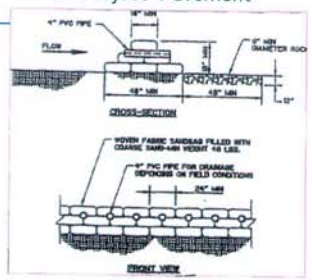


Figure SW-8

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Individual Developer's Illustrative Construction BMP's PacfiCenter @ Long Beach

LEGEND	SYMBOL
Proposed Storm Drain	———
Existing Storm Drain	======

NORTH
Not To Scale

SITE WIDE REQUIREMENTS

NS1– Water Conservation
NS2– Dewatering Operations
NS3– Paving and Grinding Operations
NS8– Vehicle and Equipment Washing
NS9– Vehicle and Equipment Fueling
NS10– Vehicle and Equipment Maintenance
WM3– Stockpile Management
WM4– Spill Prevention and Control
WM8– Concrete Waste Management
WM9– Sanitary/Septic Waste Management

Note: This site plan reflects a potential rough grade scenerio.
The BMP's are illustrative and the individual developers will be required to prepare a SWPP for each development as part of the building permit process.

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PacifiCenter @ Long Beach

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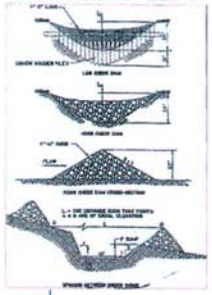
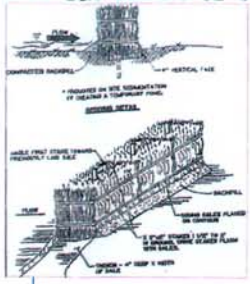
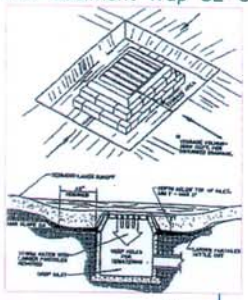
Check Dams SE–4



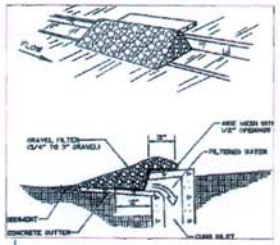
Straw Bale Barriers SE–9



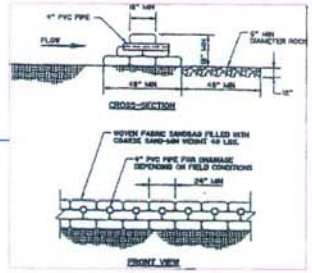
Inlet Sediment Trap SE–3

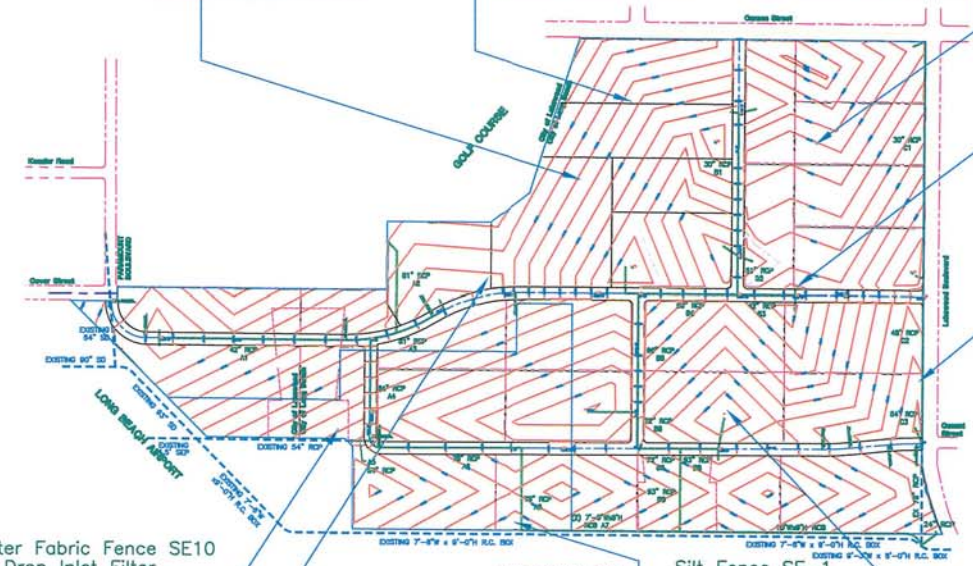


Gravel & Wire Mesh Filter SE–10 for Curb Inlet

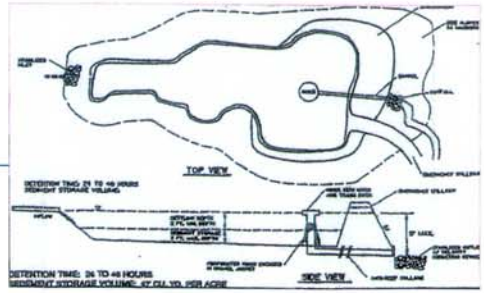


Sand Bag Berm SE–8 @ Project Pavement

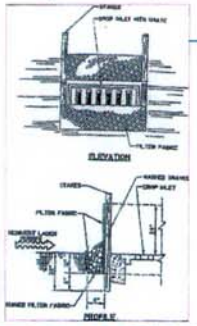




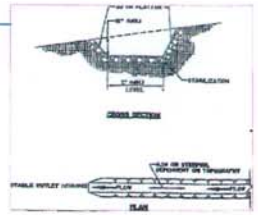
Temporary Sediment Basin SE–2



Filter Fabric Fence SE10 Drop Inlet Filter



Temporary Drains & Swales EC–9 As Required



Silt Fence SE–1 @ Pavement

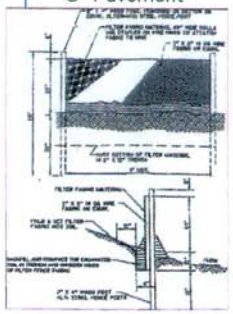


Figure SW-9

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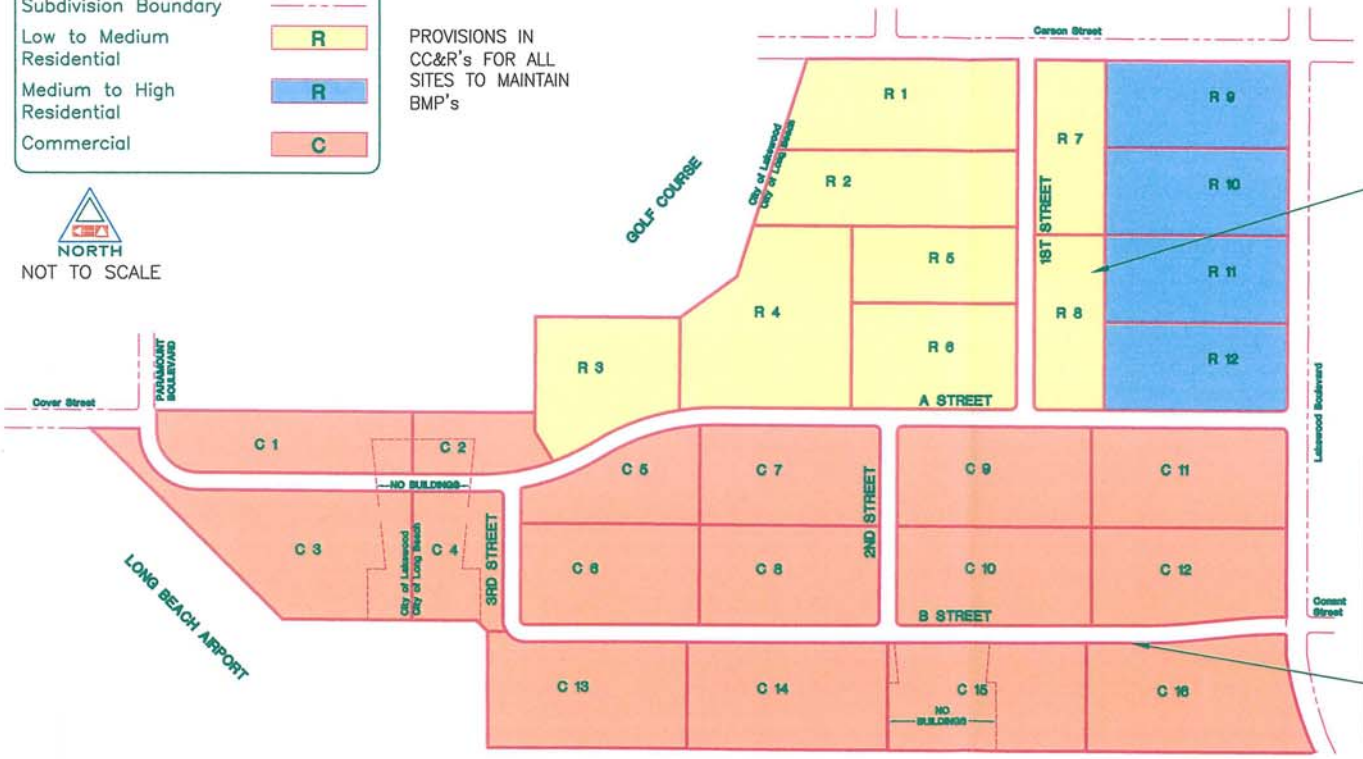
Project Wide SUSMP
Illustrative BMP's
PacifiCenter @ Long Beach

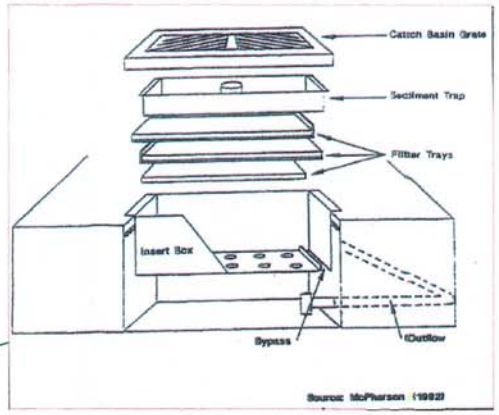
LEGEND	SYMBOL
Subdivision Boundary	
Low to Medium Residential	R
Medium to High Residential	R
Commercial	C

PROVISIONS IN CC&R's FOR ALL SITES TO MAINTAIN BMP's

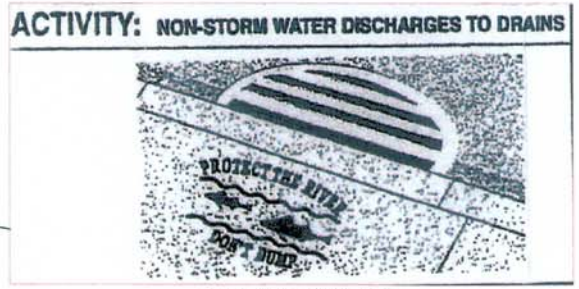
NORTH

NOT TO SCALE





CATCH BASIN FILTER
ALL CATCH BASINS
WITHIN INDIVIDUAL
DEVELOPMENT AREAS



PROHIBITIVE STENCILING
AT ALL CATCH BASIN SITES
PER CITY OF LONG BEACH
STANDARD PLAN NO. 636

DECEMBER 2003

PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc.

Figure SW-10

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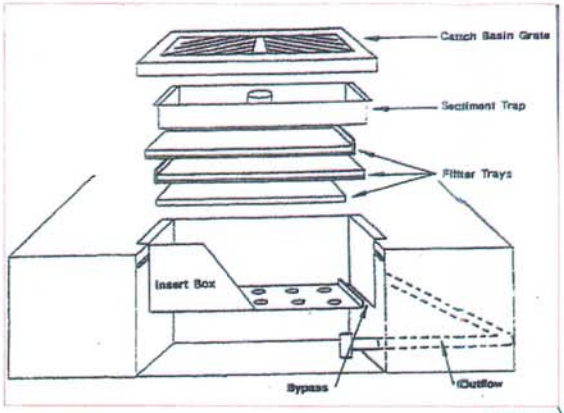
Individual Developer Permanent SUSMP Illustrative BMP's PacifiCenter @ Long Beach

LEGEND	SYMBOL
Subdivision Boundary	
Low to Medium Residential	R
Medium to High Residential	R
Commercial	C

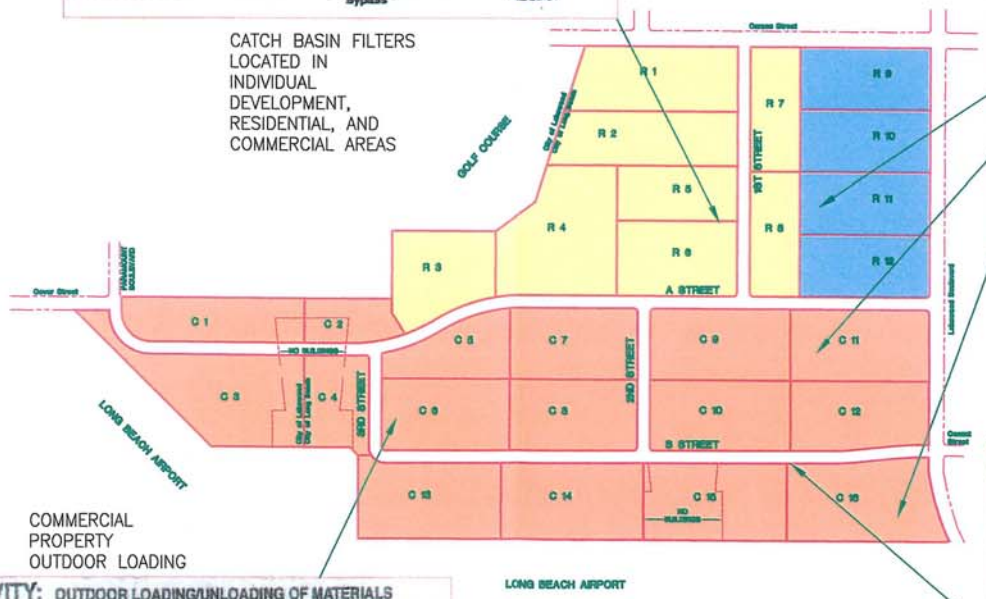
NORTH

NOT TO SCALE

PROVISIONS IN CC&R's FOR ALL SITES TO MAINTAIN BMP's



CATCH BASIN FILTERS LOCATED IN INDIVIDUAL DEVELOPMENT, RESIDENTIAL, AND COMMERCIAL AREAS



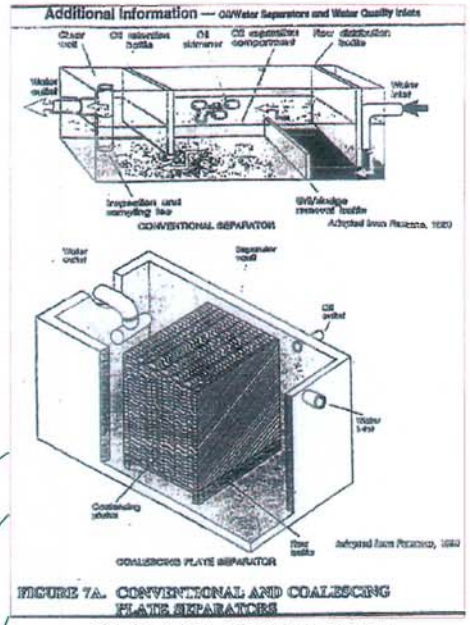
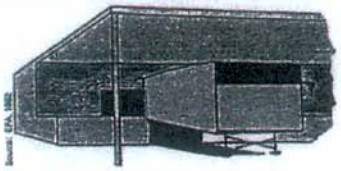


FIGURE 7A. CONVENTIONAL AND COALESCING PLATE SEPARATORS

STORM WATER TREATMENT SYSTEM COMMERCIAL AND RESIDENTIAL DEVELOPMENT

COMMERCIAL PROPERTY OUTDOOR LOADING

ACTIVITY: OUTDOOR LOADING/UNLOADING OF MATERIALS



ACTIVITY: NON-STORM WATER DISCHARGES TO DRAINS

PROHIBITIVE STENCILING AT ALL CATCH BASIN SITES PER CITY OF LONG BEACH STANDARD PLAN NO. 636

DECEMBER 2003

PacifiCenter @ Long Beach

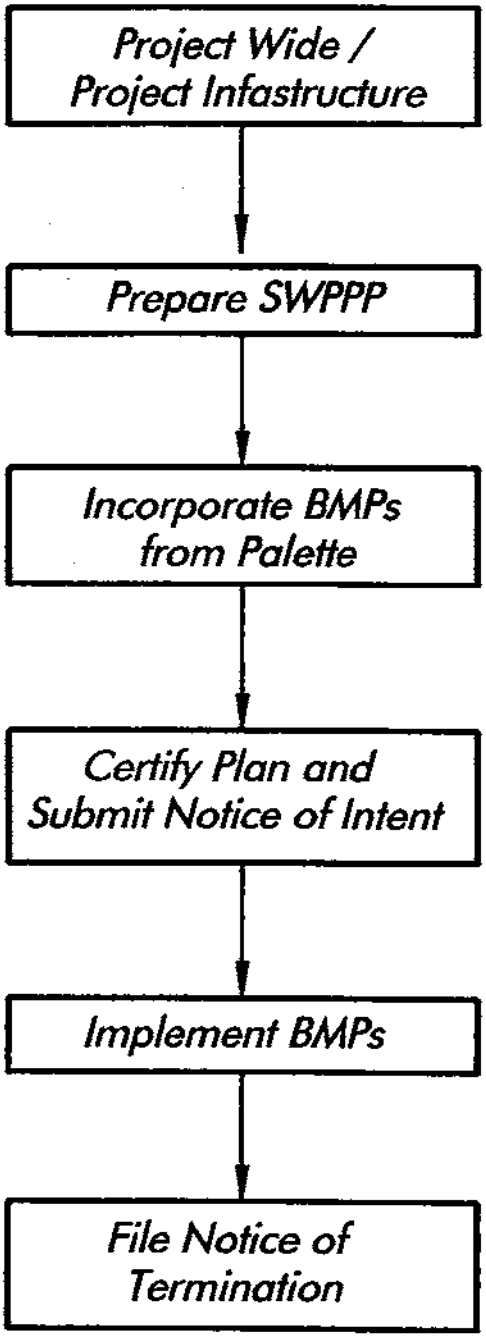
Kimley-Horn and Associates, Inc.

Figure SW-11

K:\99040006 – Master PLan Revision\Dwg\Exhibits\0006EXH-SW11.dwg 12-04-03-8:57 AM

City of Long Beach & City of Lakewood
Developing and Implementing Construction
Storm Water Pollution Prevention Plan

PacifiCenter @ Long Beach



BMP Palette

- *Hydroseeding*
- *Soil Binders*
- *Straw Mulch*
- *Silt Fence*
- *Desilting Basin*
- *Sand Bag*
- *Storm Drain Inlet Protection*
- *Stabilized Construction Enterence / Exit*
- *Stabilized Construction Storage*
- *Solid Waste Management*
- *Inlet Sediment Trap*
- *Temporary Drains and Swales*
- *Filter Fabric Fence Drop Inlet*
- *Gravel and Wire Mesh for Filter*

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Figure SW-12

City of Long Beach & City of Lakewood
Developing and Implementing Permanent SUSMPs
PacifiCenter @ Long Beach

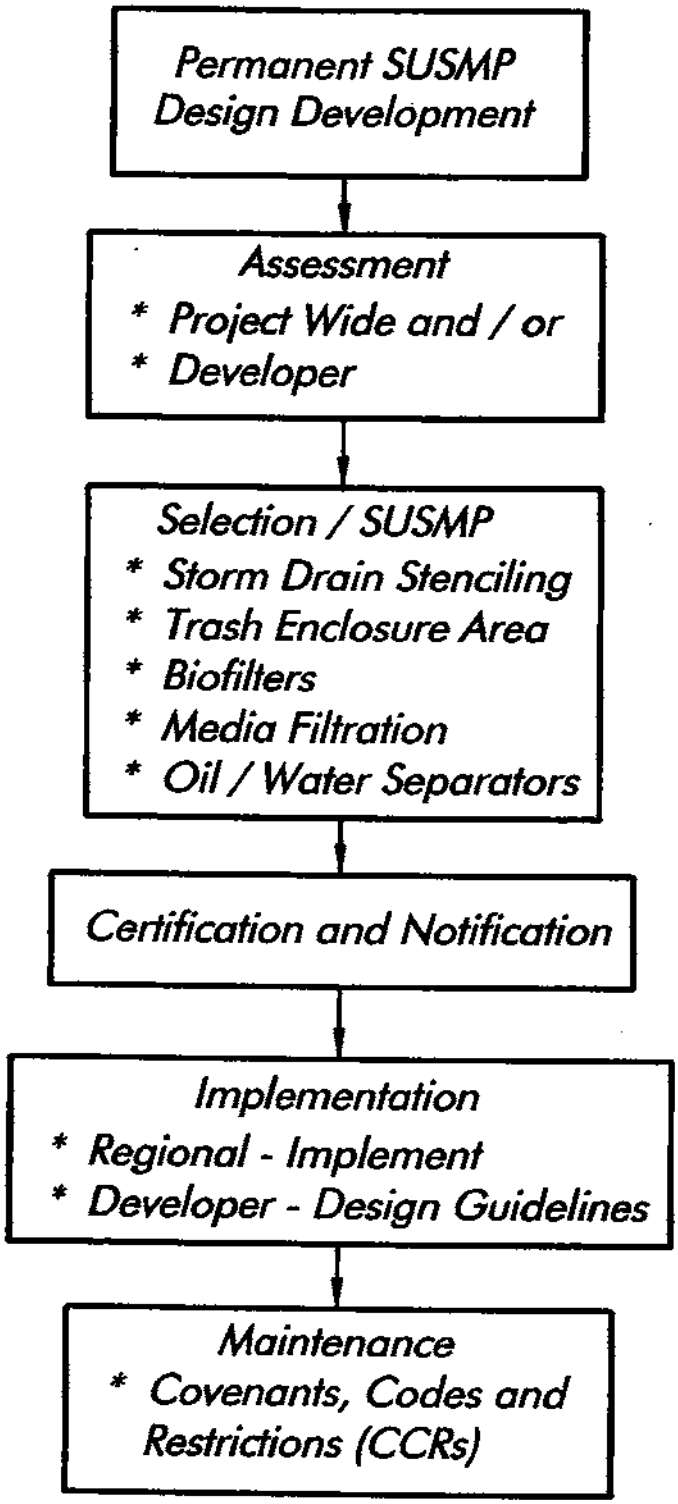

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Figure SW-13

APPENDICES

APPENDIX A

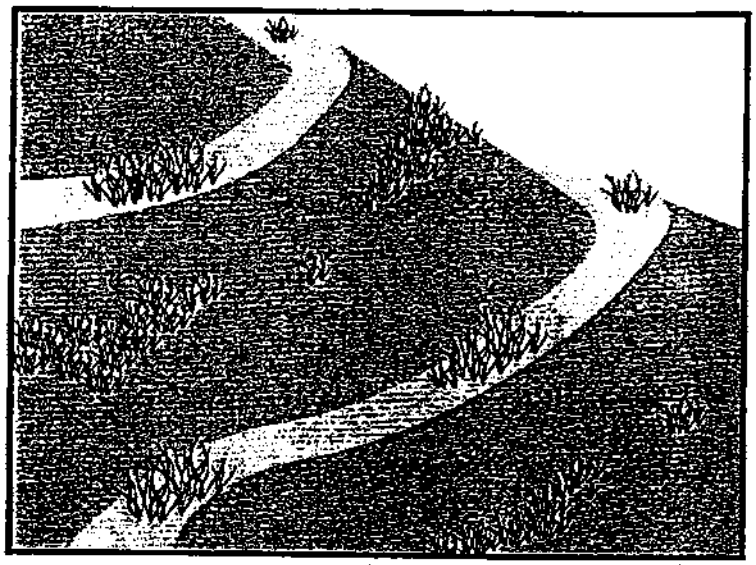
- CONSTRUCTION SITE BEST MANAGEMENT PRACTICES MANUAL: CALTRANS STORM WATER QUALITY HANDBOOKS

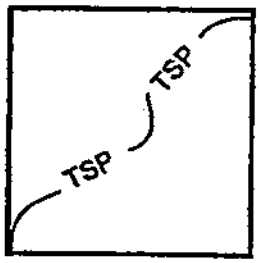
CALTRANS
STORM WATER QUALITY

HANDBOOKS
BMP

Hydroseeding

SS-4





BMP Objectives
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

Hydroseeding typically consists of applying a mixture of fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, which temporarily protects exposed soils from erosion by water and wind. This is one of five temporary soil stabilization alternatives to consider.

Appropriate Applications

- Hydroseeding is applied on disturbed areas requiring temporary protection until permanent vegetation is established, or disturbed areas that must be re-disturbed following an extended period of inactivity.

Limitations

- Straw mulching may be necessary in addition to hydroseeding during the establishment of vegetation because temporary vegetation takes several weeks to establish.
- Steep slopes are difficult to protect with temporary seeding.
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation is not appropriate for short-term inactivity.

Standards and Specifications

In order to select appropriate hydroseeding mixtures, an evaluation of site conditions shall be performed with respect to:

- Soil conditions
- Site topography
- Maintenance requirements
- Sensitive adjacent areas

- Season and climate
- Vegetation types
- Water availability
- Plans for permanent vegetation

- Selection of hydroseeding mixtures shall be approved by the Landscape Architect and the Storm Water Coordinator.

The following steps shall be followed for implementation:

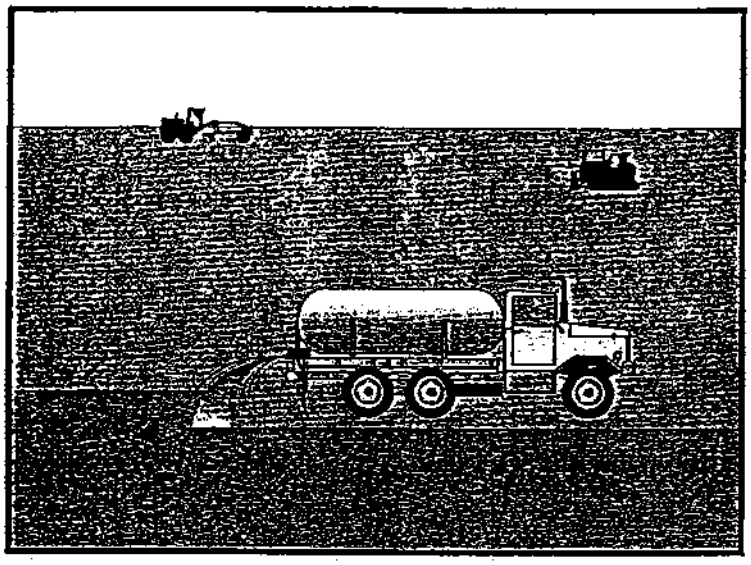
- Seed mix shall comply with the Standard Specifications, Section 20-2.10, and the project's special provisions.
- Avoid use of hydroseeding in areas where the best management practice (BMP) would be incompatible with future earthwork activities and would have to be removed.
- Hydroseeding can be accomplished using a multiple-step or one-step process. The multiple-step process ensures maximum direct contact of the seeds to soil. When the one-step process is used to apply the mixture of fiber, seed, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil.
- Prior to application, roughen the slope, fill area, or area to be seeded with the furrows trending along the contours. See "Slope Roughening/Terracing/Rounding" BMP, Caltrans Storm Water Quality Handbooks - Project Planning and Design Manual, May 2000
- Apply a straw mulch to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed shall be pellet-inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 kg of inoculant per 100 kg of seed (2-lb inoculant per 100-lb seed).
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer shall be pelleted or granular form.
- Follow-up applications shall be made as needed to cover weak spots, and to maintain adequate soil protection.
- Avoid over-spray onto the travel way, sidewalks, lined drainage channels and existing vegetation.

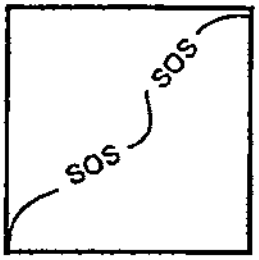
Maintenance and Inspection

- All seeded areas shall be inspected for failures and re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates. Any temporary revegetation efforts that do not provide adequate cover must be revegetated as required by the Resident Engineer (RE).
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.

Soil Binders

SS-5





BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

Soil binders consist of applying and maintaining polymeric or lignin sulfonate soil stabilizers or emulsions. Soil binders are materials applied to the soil surface to temporarily prevent water-induced erosion of exposed soils on construction sites. Soil binders typically also provide dust, wind and soil stabilization (erosion control) benefits. This is one of five temporary soil stabilization alternatives to consider.

Appropriate Applications

Soil binders are applied to disturbed areas requiring short-term temporary protection. Because soil binders can often be incorporated into the work, they may be a good choice for areas where grading activities will soon resume.

Limitations

- Soil binders are temporary in nature and may need reapplication.
- Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer, which may be 24 hours or longer.
- Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.
- Soil binders do not hold up to pedestrian or vehicular traffic across treated areas.
- Soil binders may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted.
- Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil.

- May not cure if low temperatures occur within 24 hours of application.

Standards and Specifications

General Considerations

- Regional soil types will dictate appropriate soil binders to be used.
- A soil binder must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and shall not stain paved or painted surfaces.
- Some soil binders are compatible with existing vegetation.
- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1. Use Table 1 to select an appropriate soil binder.

Factors to consider when selecting a soil binder include the following:

- Suitability to situation - Consider where the soil binder will be applied; if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with any existing vegetation. Determine the length of time soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor for the listed soil binders. The soil binders in Table 1 may also be used for dust control using the provided dust control application rates. The dust control application rates will not be adequate to provide protection from water-induced erosion.
- Soil types and surface materials - Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.
- Frequency of application - The frequency of application can be affected by subgrade conditions, surface type, traffic volumes, climate, and maintenance schedule. Frequent applications could lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean-up.

After considering the above factors, the soil binders in Table 1 will be generally appropriate as follows:

Copolymer:Appropriate for long term soil stabilization in areas where cross-traffic might occur, or where stabilization needs to be achieved in conjunction with preserving existing vegetation. Longevity can be up to 2 years, it has a high resistance to abrasion, and is compatible with existing vegetation. However, it is also relatively costly which makes it less desirable for short-term or frequent applications.

Lignin sulfonate:Appropriate for short- or medium-term soil stabilization applications in low traffic areas. The moderate relative cost makes it less desirable to reapply frequently, though it typically lasts longer than psyllium or guar. With only moderate penetration and a low resistance to abrasion, it would be more suited to areas which will not be disturbed frequently by construction activities.

Psyllium/Guar:Appropriate for typical soil stabilizing situations or short-term applications. Because of the relatively low cost, they can be applied more frequently. Their high penetration provides good stabilization but their moderate resistance to abrasion limits their longevity. They are not very compatible with vegetation.

Applying Soil Binders

After selecting an appropriate soil binder, the untreated soil surface must be prepared before applying the soil binder. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps shall be followed:

- Follow manufacturer's recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas. Track walking shall only be used where rolling is impractical.
- Soil binders shall not be applied during or immediately before rainfall.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- Do not apply soil binders to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below (40°F).
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate.

- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure times.
- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.14 to 1.4 l/m^2 (0.03 to 0.3 gal/yd^2) or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 150 to 300 mm (6 to 12 in).
  - Allow treated area to cure for the time recommended by the manufacturer; typically, at least 24 hours.
  - Apply second treatment before first treatment becomes ineffective, using 50% application rate.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.5 to 0.9 l/m^2 (0.1 to 0.2 gal/yd^2).

Maintenance and Inspection

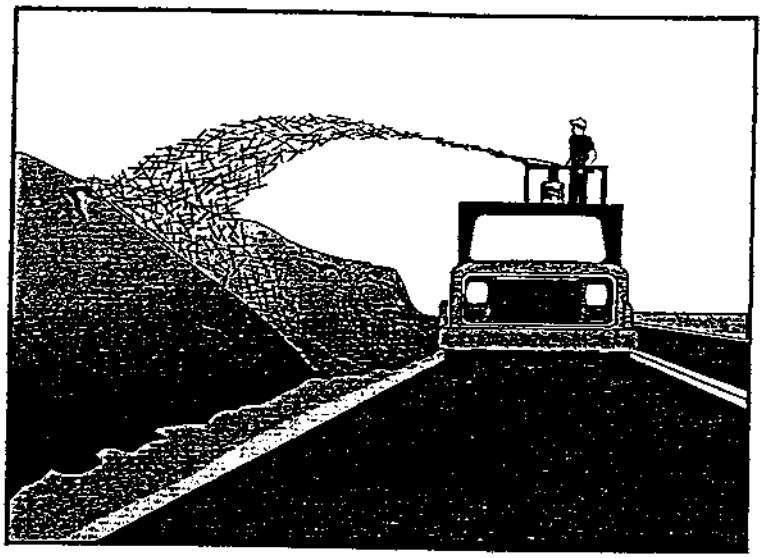
- Reapplying the selected soil binder may be needed for proper maintenance. High traffic areas shall be inspected on a daily basis, and lower traffic areas should be inspected on a weekly basis.
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.

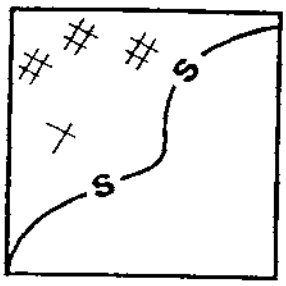
Table 1
Properties of Soil Binders for Erosion Control

Chemicals	Copolymer	Lignin Sulfonate	Psyllium	Guar
Comments	- Forms semi-permeable transparent crust. - Resists ultraviolet radiation and moisture induced breakdown.	- Paper industry waste product - Acts as dispersing agent - Best in dry climates - Can be slippery	- Effective on dry, hard soils - Forms a crust	- Effective on dry, hard soils - Forms a crust
Relative Cost	High	Moderate	Low	Low
Environmental Hazard	Low	Low	Low	Low
Penetration	Moderate	Moderate	High	High
Evaporation	Moderate	Moderate	Moderate	Moderate
Resistance to Leaching	Low	High	High	High
Resistance to Abrasion	High	Low	Moderate	Moderate
Longevity	1 to 2 years	6 months to 1 year	3 to 6 months	3 to 6 months
Minimum Curing Time before Rain	24 hours	24 hours	24 hours	24 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Chemically Degradable	Biologically/Physically/ Chemically Degradable	Biologically Degradable	Biologically Degradable
Labor Intensive	No	No	No	No
Specialized Application Equipment	Yes	Yes	Yes	Yes
Liquid/Powder	Liquid	Powder	Powder	Powder
Surface Crusting	Yes	Yes, but dissolves on rewetting	Yes, but dissolves on rewetting	Yes, but dissolves on rewetting
Clean-Up	Solvents	Solvents	Water	Water
Erosion Control Application Rate	Apply 800-1,000 l/ha (85-110 gal/ac).	Apply 5,600-6,500 l/ha (600-700 gal/ac).	Apply 170 kg/ha (150 lb./ac) with 560-2,200 kg/ha (500-2,000 lbs./ac) fiber mulch.	Apply 110-220 kg/ha (100-200 lbs./ac) with 560-2,200 kg/ha (500-2,000 lbs./ac) fiber mulch.
Dust Control Application Rate	Apply 280-520 L/ha (30-55 gal/ac).	Loosen surface 25-50mm (1-2 in). Need 4-8% fines. Apply 470-1,900 l/ha (50-200 gal/ac).	Apply 170 k/ha (150 lbs./ac).	Apply at 45-70 k/ha (40-60 lbs./ac).

Straw Mulch

SS-6





BMP Objectives
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a tackifier. This is one of five temporary soil stabilization alternatives to consider.

Appropriate Applications

- Straw mulch is used for soil stabilization as a temporary surface cover on disturbed areas until soils can be prepared for re-vegetation and permanent vegetation is established.
- Also typically used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

Limitations

- Availability of erosion control contractors and straw may be limited prior to the rainy season due to high demand.
- There is a potential for introduction of weed-seed and unwanted plant material.
- When straw blowers are used to apply straw mulch, the treatment areas must be within 45 m (150 ft) of a road or surface capable of supporting trucks.
- Straw mulch applied by hand is more time intensive and potentially costly.
- May have to be removed prior to permanent seeding or soil stabilization.
- "Punching" of straw does not work in sandy soils.

Standards and Specifications

- Straw shall be derived from wheat, rice, or barley.
- All materials shall conform to Sections 20-2.06, 20-2.07 and 20-2.11 of the Standard Specifications.
- A tackifier is the preferred method for anchoring straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track-walking may also be used to incorporate straw mulch into the soil on slopes. Track walking shall only be used where other methods are impractical.
- Avoid placing straw onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- Straw mulch with tackifier shall not be applied during or immediately before rainfall.

Application Procedures

- Apply loose straw at a minimum rate of 3,570 kg/ha (4,000 lb./acre), or as indicated in the project's special provisions, either by machine or by hand distribution.
- The straw mulch must be evenly distributed on the soil surface.
- Anchor the mulch in place by using a tackifier or by "punching" it into the soil mechanically.
- A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier shall be selected based on longevity and ability to hold the fibers in place.
- A tackifier is typically applied at a rate of 140 kg/ha (125 lb/ac). In windy conditions, the rates are typically 200 kg/ha.
- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions and longevity. If the selected method is incorporation of straw mulch into the soil, then do as follows:
  - Applying and incorporating straw shall follow the requirements in Section 20-3.03 of the Standard Specifications.
  - On small areas, a spade or shovel can be used.
  - On slopes with soils which are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the

ground using a knife-blade roller or a straight bladed coulter, known commercially as a "crimper".

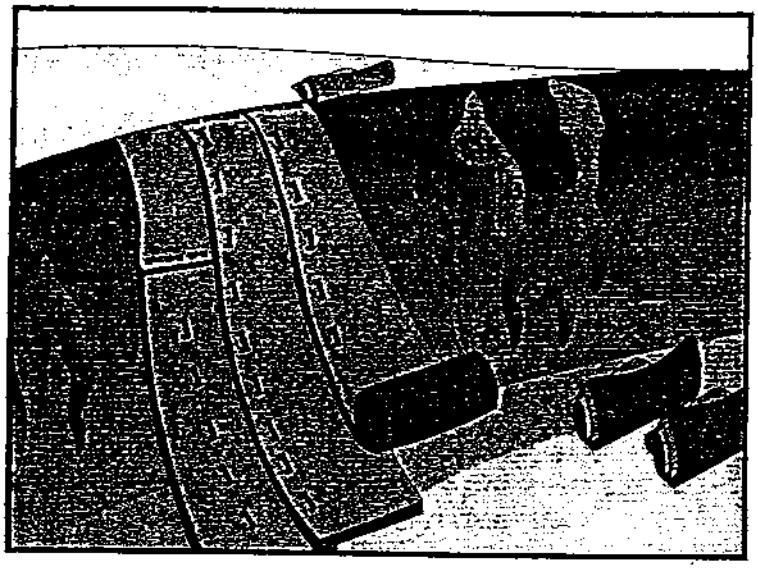
- On small areas and/or steep slopes, straw can also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextile pins or wooden stakes (as described in BMP SS-7, "Geotextiles, Plastic Covers and Erosion Control Blankets/Mats".

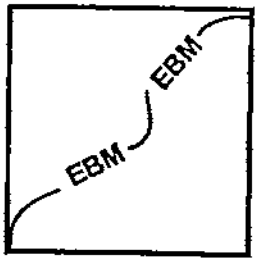
Maintenance and Inspections

- The key consideration in maintenance and inspection is that the straw needs to last long enough to achieve erosion control objectives.
- Reapplication of straw mulch and tackifier may be required by the Resident Engineer to maintain effective soil stabilization over disturbed areas and slopes.
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.

Geotextiles, Plastic Covers and Erosion Control Blankets/Mats

SS-7





BMP Objectives
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

This Best Management Practice (BMP) involves the placement of geotextiles, plastic covers, or erosion control blankets/mats to stabilize disturbed soil areas and protect soils from erosion by wind or water. This is one of five temporary soil stabilization alternatives to consider.

Appropriate Applications

These measures are used when disturbed soils may be particularly difficult to stabilize, including the following situations:

- Steep slopes, generally steeper than 1:3 (V:H).
- Slopes where the erosion hazard is high.
- Slopes and disturbed soils where mulch must be anchored
- Disturbed areas where plants are slow to develop adequate protective cover.
- Channels with flows exceeding 1.0 m/s (3.3 ft/s).
- Channels intended to be vegetated.
- Stockpiles
- Slopes adjacent to water bodies of Environmentally Sensitive Areas (ESAs).

Limitations

- Blankets and mats are more expensive than other erosion control measures, due to labor and material costs. This usually limits their application to areas inaccessible to hydraulic equipment, or where other measures are not applicable, such as channels.

- Blankets and mats are generally not suitable for excessively rocky sites, or areas where the final vegetation will be mowed (since staples and netting can catch in mowers).
- Blankets and mats must be removed and disposed of prior to application of permanent soil stabilization measures.
- Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
- Plastic results in 100 percent runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- The use of plastic shall be limited to covering stockpiles, or very small graded areas for short periods of time (such as through one imminent storm event), until alternative measures, such as seeding and mulching, may be installed.

Standards and Specifications

Material Selection

There are many types of erosion control blankets and mats, and selection of the appropriate type should be based on the specific type of application and site conditions. Selection(s) made by the Contractor must be approved by the Resident Engineer (RE). The following criteria shall be considered in selection of the appropriate material:

- Cost
  - Material cost
  - Preparation cost
  - Installation cost
  - Add-ons
- Effectiveness
  - Reduction of erosion
  - Reduction of flow velocity
  - Reduction of runoff
- Acceptability
  - Environmental compatibility
  - Institutional/regulatory acceptability
  - Visual impact

- Vegetation Enhancement
  - Native plant compatibility
  - Moisture retention
  - Temperature modification
  - Open space/coverage

- Installation
  - Durability
  - Longevity
  - Ease of installation
  - Safety

- Operation and Maintenance
  - Maintenance frequency

Geotextiles

- Material shall be a woven polypropylene fabric with minimum thickness of 15 mm, minimum width of 3.7 m and shall have minimum tensile strength of 0.67 kN (warp) 0.36 kN (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric shall be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D4491. The fabric shall have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets shall be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under Geotextile.

- Geotextiles may be reused if, in the opinion of the RE, they are suitable for the use intended.

Plastic Covers

- Temporary soil stabilization (Type plastic cover) material shall be polyethylene sheeting and shall have a minimum thickness of 6 mils. Plastic covers shall be anchored by sandbags placed no more than 3 m (10 ft) apart and by keying into the tops of slopes to prevent infiltration of surface waters under the plastic. All seams shall be taped or weighted down their entire length, and there shall be at least a 300 mm (12 in) to 600 mm (24 in) overlap of all seams.

- Plastic covers may be reused if, in the opinion of the RE, they are suitable for the use intended.

Erosion Control Blankets/Mats

- Erosion control blankets/mats shall be either straw, coconut, straw/coconut or Excelsior blanket, in accordance with the project Special Provisions, SSP 07-390.

Site Preparation

- Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 50 mm (2 in) to 75 mm (3 in) of topsoil.

Seeding

Seed the area before blanket installation for erosion control and revegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Anchoring

- U-shaped wire staples, metal geotextile stake pins or triangular wooden stakes can be used to anchor mats and blankets to the ground surface.
- Staples shall be made of 3.05 mm steel wire and shall be U-shaped with 200-mm legs and 50-mm crown. Wire staples shall be minimum of 11 gauge.
- Metal stake pins shall be 5 mm (0.188 in) diameter steel with a 40 mm (1.5 in) steel washer at the head of the pin.
- Wire staples and metal stakes shall be driven flush to the soil surface.
- All anchors shall be 150 mm (6 in) to 450 mm (18 in) long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils.

Installation on Slopes

Always consult the manufacturer's recommendations for installation. In general, these will be as follows:

- Begin at the top of the slope and anchor the blanket in a 150 mm (6 in) deep by 150 mm (6 in) wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket downslope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 50 mm (2 in) to 75 mm (3 in) and staple every 1 m (3 ft).
- When blankets must be spliced, place blankets end over end (shingle style) with 150 mm (6 in) overlap. Staple through overlapped area, approximately 300 mm (12 in) apart.
- Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
- Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples shall be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (V:H) to 1:2 (V:H), require a minimum of 2 staples/m^2 (2 staples/yd^2). Moderate slopes, 1:2 (V:H) to 1:3 (V:H), require a minimum of 1½ staples/m^2 (1 ½ staples/yd^2), placing 1 staple/m (1 staple/yd) on centers. Gentle slopes require a minimum of 1 staple/m^2 (1 staple/yd^2).

Installation in Channels

Always consult the manufacturer's recommendations for installation. In general, these will be as follows:

- Dig initial anchor trench 300 mm (12 in) deep and 150 mm (6 in) wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 150 mm (6 in) deep and 150 mm (6 in) wide across the channel at 8 m to 10 m (25 ft to 30 ft) intervals along the channels.
- Cut longitudinal channel anchor slots 100 mm (4 in) deep and 100 mm (4 in) wide along each side of the installation to bury edges of matting, whenever possible extend matting 50 mm (2 in) to 75 mm (3 in) above the crest of the channel side slopes.

- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 300 mm (12 in) intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 75 mm (3 in).
- Secure these initial ends of mats with anchors at 300 mm (12 in) intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining a 75 mm (3 in) overlap.
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 300 mm (12 in) intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for non-critical installations: Place two rows of anchors on 150 mm (6 in) centers at 8 m (25 ft) to 10 m (30 ft) intervals in lieu of excavated check slots.
- Shingle-lap spliced ends by a minimum of 300 mm (12 in) apart on 300 mm (12 in) intervals.
- Place edges of outside mats in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.
- Anchor, fill and compact upstream end of mat in a 300 mm (12 in) by 150 mm (6 in) terminal trench.
- Secure mat to ground surface using U-shaped wire staples, geotextile pins, or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

Soil Filling (if specified for turf reinforcement)

- Always consult the manufacturer's recommendations for installation.
- Do not drive tracked or heavy equipment over mat.

- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes or brooms for fine grading and touch up.
- Smooth out soil filling; just exposing top netting of mat.

Temporary Soil Stabilization Removal

- When no longer required for the work, temporary soil stabilization shall become the property of the Contractor. Temporary soil stabilization removed from the site of the work shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.

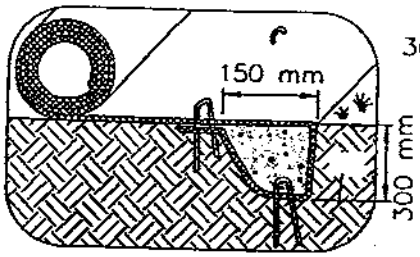
Maintenance and Inspection

Areas treated with temporary soil stabilization shall be inspected as specified in the special provisions. Areas treated with temporary soil stabilization shall be maintained to provide adequate erosion control. Temporary soil stabilization shall be reapplied or replaced on exposed soils when greater than 10 percent of the previously treated area becomes exposed or exhibits visible erosion.

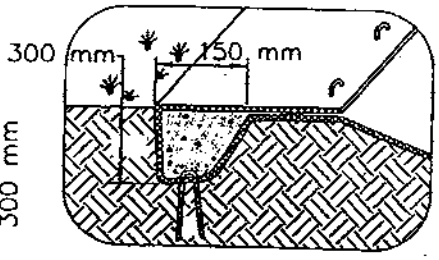
- All blankets and mats shall be inspected periodically after installation.
- Installation shall be inspected after significant rain storms to check for erosion and undermining. Any failures shall be repaired immediately.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.

Geotextiles, Plastic Covers and Erosion Control Blankets/Mats

SS-7



INITIAL CHANNEL ANCHOR TRENCH
NTS



TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH
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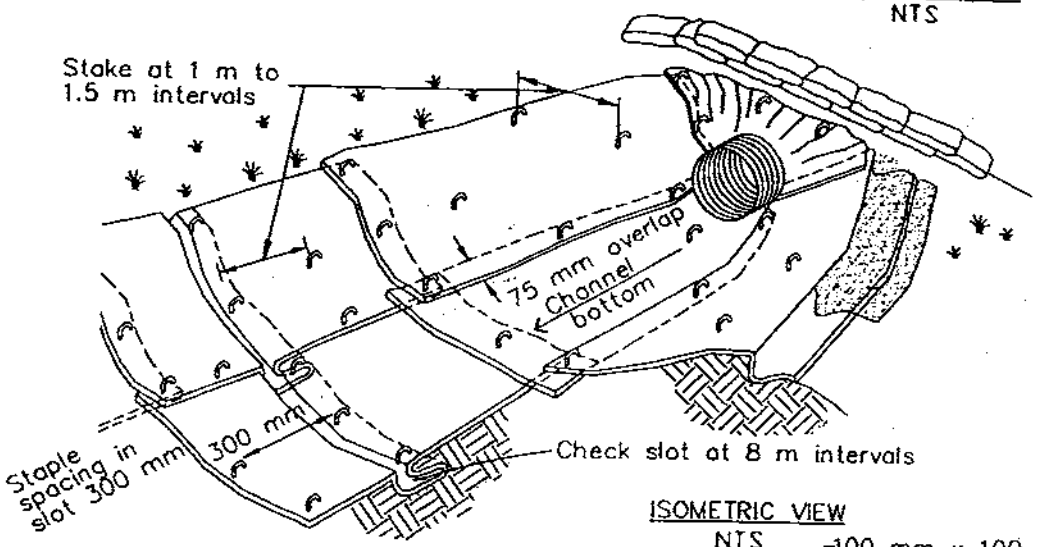
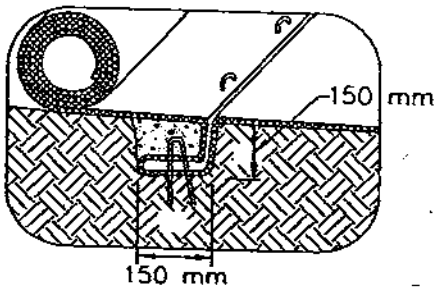


ISOMETRIC VIEW
NTS



INTERMITTENT CHECK SLOT
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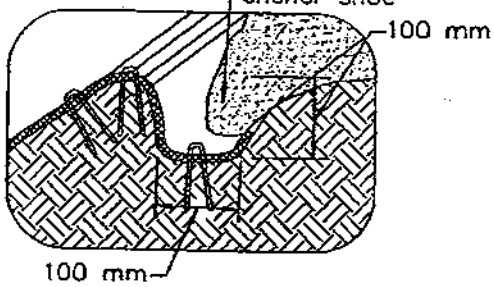
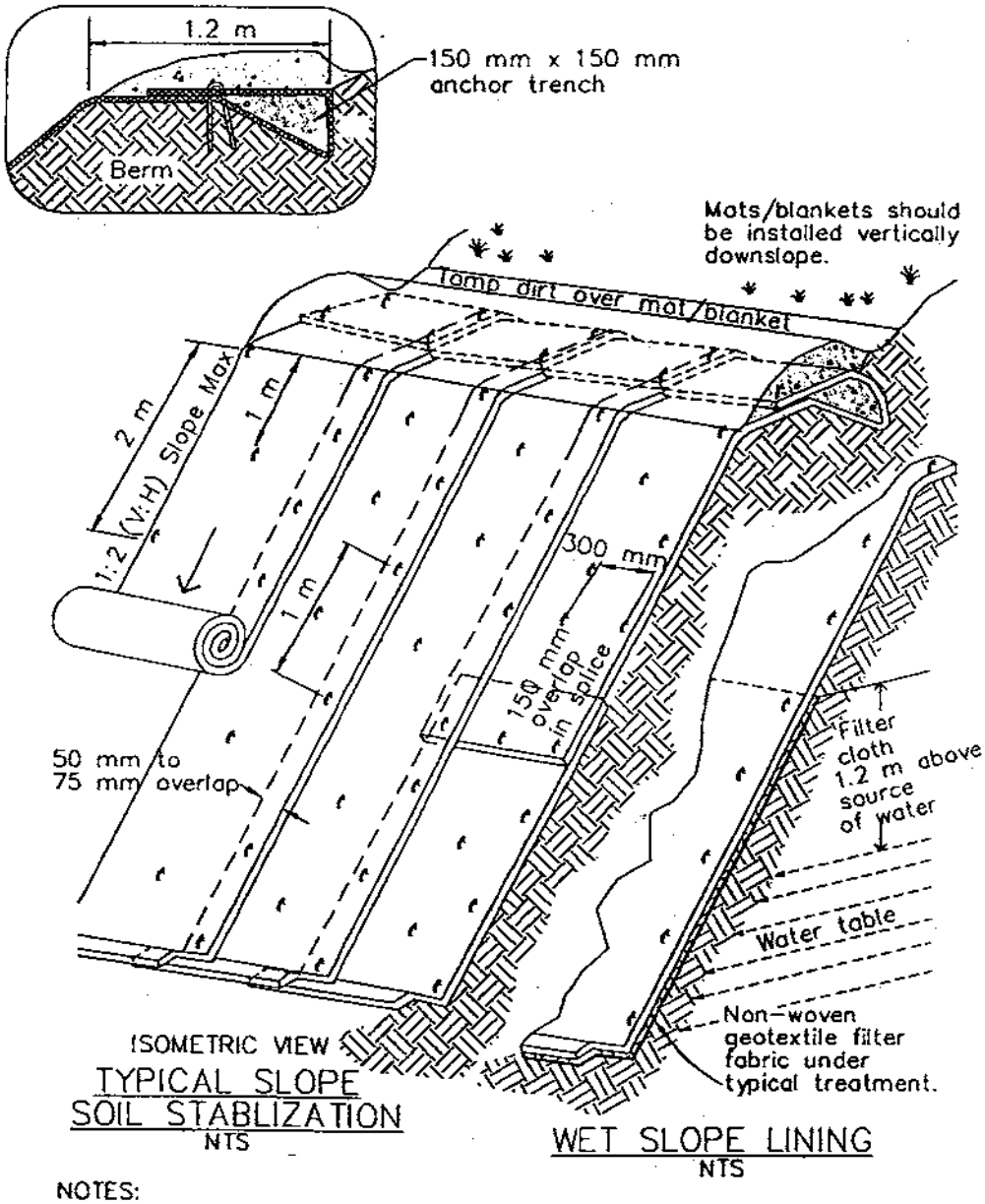


LONGITUDINAL ANCHOR TRENCH
NTS

NOTES:

1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.
3. Install per manufacturer's recommendations

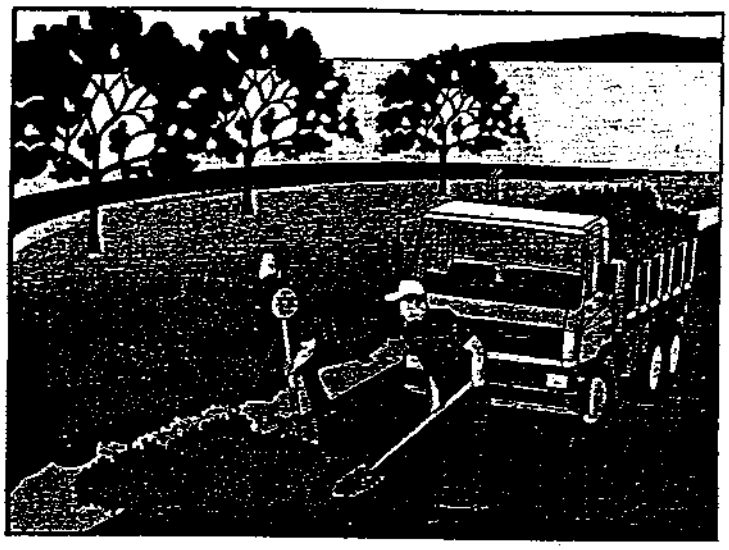


NOTES:

1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations

Wood Mulching

SS-8



BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

Wood mulching consist of applying a mixture of shredded wood mulch, bark or compost. Wood mulch is mostly applicable to landscape projects.

The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Appropriate Applications

Wood mulching is considered a temporary soil stabilization (erosion control) alternative in the following situations:

- As a stand-alone temporary surface cover on disturbed areas until soils can be prepared for revegetation and permanent vegetative cover can be established.
- As short term, non-vegetative ground cover on slopes to reduce rainfall impact, decrease the velocity of sheet flow, settle out sediment and reduce wind erosion.

Limitations

- Wood mulch may introduce unwanted species.

Shredded Wood

Shredded wood does not withstand concentrated flows and is prone to sheet erosion.

Green Material/Compost

Green material has the potential for the presence of unwanted weeds and other plant materials. Delivery system is primarily by manual labor, although pneumatic application equipment is available.

Standards and Specifications

Mulch Selection

There are many types of mulches, and selection of the appropriate type shall be based on the type of application and site conditions. Prior to use of wood mulches, there shall be concurrence with the District Landscape Architect since some mulch use on construction projects may not be compatible with planned or future projects. Selection of wood mulches by the Contractor shall comply with Section 20-2.08 of the Standard Specifications and must be approved by the Resident Engineer (RE).

Application Procedures

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a punching type roller or by track walking. The construction-application procedures for mulches vary significantly depending upon the type of mulching method specified. Two (2) methods are highlighted here:

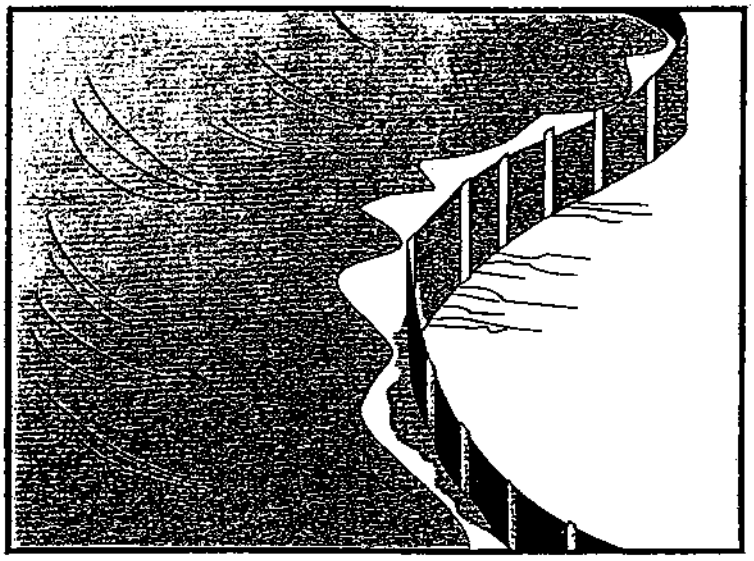
- Green Material: This type of mulch is produced by recycling of vegetation trimmings such as grass, shredded shrubs and trees. Methods of application are generally by hand, although pneumatic methods are available. Mulch shall be composted to kill weed seeds.
  - It can be used as a temporary ground cover with or without seeding.
  - The green material shall be evenly distributed on site to a depth of not more than 50 mm (2 in).
- Shredded Wood: Suitable for ground cover in ornamental or revegetated plantings.
  - Shredded wood/bark is conditionally suitable; see note under limitations.
  - Shall be distributed by hand (although pneumatic methods may be available).
  - The mulch shall be evenly distributed across the soil surface to a depth of 50 mm (2 in) to 75 mm (3 in).
- Avoid mulch placement onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- All material must be removed before re-starting work on the slopes.

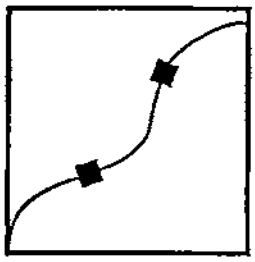
Maintenance and Inspection

- Regardless of the mulching technique selected, the key consideration in maintenance and inspection is that the mulch needs to last long enough to achieve erosion-control objectives. If the mulch is applied as a stand-alone erosion control method over disturbed areas (without seed), it shall last the length of time the site will remain barren or until final re-grading and revegetation.
- Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark or wood chips, inspection and maintenance shall focus on longevity and integrity of the mulch.

Silt Fence

SC-1





BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences allow sediment to settle from runoff before water leaves the construction site.

Appropriate Applications

Silt fences are placed:

- Below the toe of exposed and erodible slopes.
- Down-slope of exposed soil areas.
- Around temporary stockpiles.
- Along streams and channels.

Limitations

- Not effective unless trenched and keyed in.
- Not intended for use as mid-slope protection on slopes greater than 1:4 (V:H)
- Must be maintained.
- Must be removed and disposed of.

Standards and Specifications

General

- Don't use below slopes subject to creep, slumping, or landslides.
- Don't use in streams, channels, or anywhere flow is concentrated.
- Don't use silt fences to divert flow.

Design and Layout

- The maximum length of slope draining to any point along the silt fence shall be 61 m (200 ft) or less.
- Slope of area draining to fence shall be less than 1:1 (V:H).
- Limit to locations suitable for temporary ponding or deposition of sediment.
- Fabric life span generally limited to between five and eight months. Longer periods may require fabric replacement.
- Silt fences shall not be used in concentrated flow areas.
- Lay out in accordance with Page 5 of this BMP.
- For slopes steeper than 1:2 (V:H) and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be a chain link fence or a cable fence.
- For slopes adjacent to water bodies or Environmentally Sensitive Areas (ESAs), additional temporary soil stabilization BMPs shall be used.

Materials

- Silt fence fabric shall be woven polypropylene with a minimum width of 900 mm and a minimum tensile strength of 0.45-kN. The fabric shall conform to the requirements in ASTM designation D4632 and shall have an integral reinforcement layer. The reinforcement layer shall be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric shall be between 0.1 s^{-1} and 0.15 s^{-1} in conformance with the requirements in ASTM designation D4491.
- Wood stakes shall be commercial quality lumber of the size and shape shown on the plans. Each stake shall be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.
- Staples used to fasten the fence fabric to the stakes shall be not less than 45 mm long and shall be fabricated from 1.57 mm or heavier wire. The wire used to fasten the tops of the stakes together when joining 2 sections of fence shall be 3.05 mm or heavier wire. Galvanizing of the fastening wire will not be required.

Installation

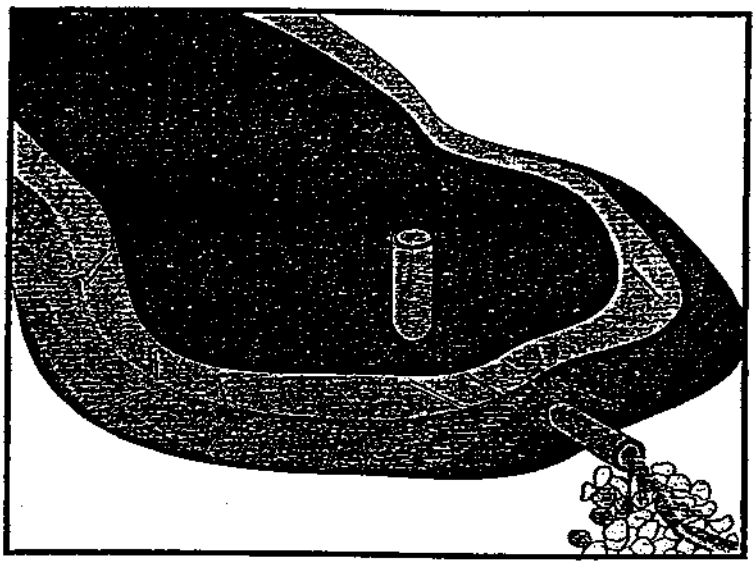
- Generally, silt fences shall be used in conjunction with soil stabilization source controls up slope to provide effective control.
- Trenches shall not be excavated wider and deeper than necessary for proper installation of the temporary linear sediment barriers.
- Excavation of the trenches shall be performed immediately before installation of the temporary linear sediment barriers.
- Construct silt fences with a set-back of at least 1m from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.
- Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case shall the reach exceed 150 meters.
- Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
- Bottom of the silt fence shall be keyed-in.
- Install in accordance with Page 5 of this BMP.

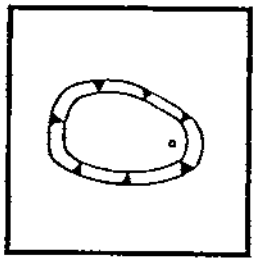
Maintenance and Inspection

- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric.
- Inspect silt fence when rain is forecast. Perform necessary maintenance, or maintenance required by the Resident Engineer (RE).
- Inspect silt fence following rainfall events. Perform maintenance as necessary, or as required by the RE.
- Maintain silt fences to provide an adequate sediment holding capacity. Sediment shall be removed when the sediment accumulation reaches one-third (1/3) of the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.
- Silt fences that are damaged and become unsuitable for the intended purpose, as determined by the RE, shall be removed from the site of work, disposed of outside the highway right-of-way in conformance with the Standard Specifications, and replaced with new silt fence barriers.

Desilting Basin

SC-2





BMP Objectives
- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A desilting basin is a temporary basin formed by excavation and/or constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

Appropriate Applications

Desilting basins shall be considered for use:

- On construction projects with disturbed areas during the rainy season; and
- Where sediment-laden water may enter the drainage system or watercourses; and
- At outlets of disturbed soil areas with areas between 2 ha and 4 ha (5ac and 10 ac).

Limitations

- Alternative BMPs must be thoroughly investigated for erosion control before selecting temporary desilting basins.
- Requires large surface areas to permit settling of sediment.
- Not appropriate for drainage areas greater than 30 ha (75 ac).
- Not to be located in live streams
- If safety is a concern, basins may require protective fencing.
- Size may be limited by availability of right-of-way.

Standards and Specifications

- Limit the contributing area to the desilting basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the desilting basin.
- Desilting basins shall be designed to have a capacity equivalent to 100 cubic meters of storage (as measured from the top of the basin to the principal outlet,) per hectare of contributory area. This design is less than the required to capture the 0.01 mm particle size but larger than that required to capture particles 0.02 mm or larger.
- The length of the basin shall be more than twice the width of the basin; the length shall be determined by measuring the distance between the inlet and the outlet.
- The depth must be no less than one (1) meter nor greater than 1.5 m.
- Basins with an impounding levee greater than 1.5 m tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 1000 cubic meters (m^3) shall be designed by a professional Civil Engineer registered with the state of California. The design must be submitted to the Resident Engineer (RE) for approval at least 7 days prior to the basin construction. The design shall include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- Design and locate desilting basins so that they can be maintained. Construct desilting basins prior to the rainy season and construction activities.
- Desilting basins, regardless of size and storage volume, shall include features to accommodate overflow or bypass flows that exceed the design storm event. The calculated basin volume and proposed location shall be submitted to the RE for approval at least 3 days prior to the basin construction.
- Basins shall be designed to drain within 72 hours following storm events.
- The outflow from the desilting basin shall be provided with outlet protection to prevent erosion and scouring of the embankment and channel.
- Basin shall be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, (3) where failure would not cause loss of life or property damage, and (4) where the basins can be

maintained on a year-round basins to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

- Areas under embankments, structural works, and desilting basin must be cleared, stripped of vegetation in accordance with Standard Specifications Section 16 - Clearing and Grubbing.
- Earthwork shall be in accordance with Standard Specifications Section 19 - Earthwork. Contractor is specifically directed to Section 19-5 , "Compaction", and 19-6, "Embankment Construction".
- Basin inlets shall be located to maximize travel distance to the basin outlet.
- Rock or vegetation shall be used to protect the basin inlet and slopes against erosion.
- A forebay, constructed upstream of the basin may be provided to remove debris and larger particles.
- Principal outlet shall consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure shall be designed to accommodate the inflow design storm.
- Structure shall be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel) which extends through the embankment to toe of fill. Provide anti-seep collars on the barrel.
- Cleanout level shall be clearly marked on the riser pipe.
- Avoid dewatering of groundwater to the desilting basin during the rainy season. Insignificant quantities of accumulated precipitation may be dewatered to the desilting basin unless precipitation is forecasted within 24 hours.
- Chain link fencing shall be provided around each desilting basin to prevent unauthorized entry to the basin or if safety is a concern. Fencing shall be in accordance with Standard Specifications Section 80 - Fencing.

- One of the dewatering configurations shown below for the principal outlet may be used. The Contractor shall verify that the outlet is properly designed to handle the design and peak flows.

  Outlet #1, See Page 6

  - Perforate the top one-third of the riser with 13 mm (0.5 in) diameter holes spaced 200 mm (8 in) vertically and 250 mm (10 in) - 300 mm (12 in) horizontally.
  - Wrap with well-secured filter fabric.
  - Place 19 mm (0.75 in) gravel over perforated holes to approximately 50 mm (2 in) minimum thickness to assist in prevention of clogging of dewatering holes. Gravel will naturally settle into a cone surrounding the riser pipe.

  Outlet #2, See Page 7

  - Perforate the lower one-half of the riser pipe with 13 mm (0.5 in) diameter holes spaced approximately 75 mm (3 in) apart, in each outside valley (corrugated metal pipe).
  - Place 19 mm (0.75 in) gravel over perforated holes to approximately 50 mm (2 in) minimum thickness to assist in prevention of clogging of dewatering holes. Gravel will naturally settle into a cone surrounding the riser pipe.

  Outlet #3, See Page 8

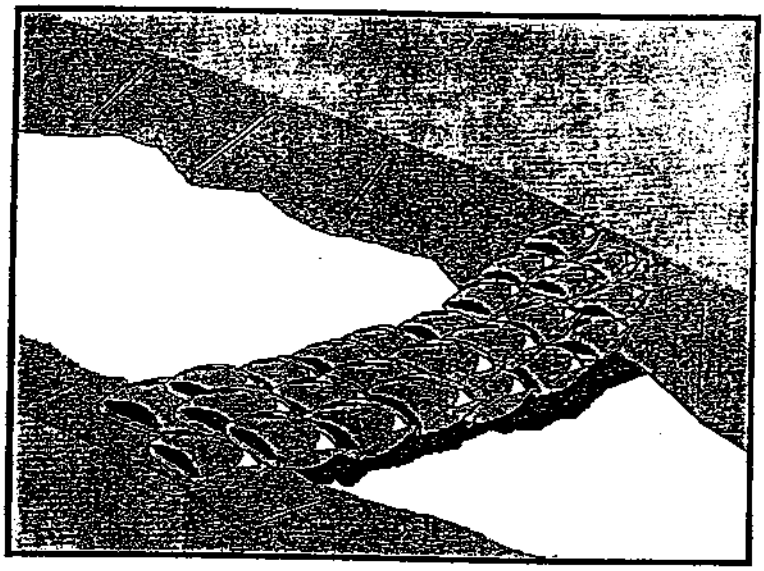
  - Provide two 25 mm (1 in) diameter holes above the sediment storage volume on opposites sides of the non-perforated riser pipe. This will typically provide sufficient detention time for basins to drain approximately 4 ha (10 ac).
  - Construct an emergency spillway to accommodate flows not carried by the principal spillway. Spillway shall consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap.
  - Spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, shall be a minimum of 6 m (20 ft) in length.
  - Use outlet protection at the pipe outlet. See BMP SS-10, "Outlet Protection/Velocity Dissipation Devices".

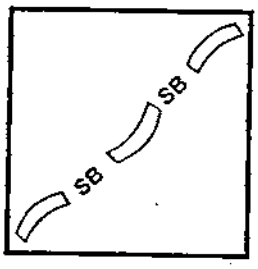
Maintenance and Inspection

- Inspect temporary desilting basins before and after rainfall events and weekly during the rest of the rainy season. During extended rainfall events, inspect at least every 24 hours.
- Examine basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed, or as directed by the RE.
- Check inlet and outlet area for erosion and stabilize if required, or if directed by the RE.
- Remove sediments when storage zone is one-third full.
- Check fencing for damage and repair as needed or as directed by the RE.

Sandbag Barrier

SC-8





BMP Objectives
- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A sandbag barrier is a temporary linear sediment barrier consisting of stacked sandbags, designed to intercept and slow the flow of sediment-laden sheet flow runoff. Sandbag barriers allow sediment to settle from runoff before water leaves the construction site. Sandbags can also be used where flows are moderately concentrated, such as ditches, swales, and storm drain inlets (see BMP SC-10, Storm Drain Inlet Protection) to divert and/or detain flows.

Appropriate Applications

- Along the perimeter of a site.
- Along streams and channels.
- Below the toe of exposed and erodible slopes.
- Down slope of exposed soil areas.
- Around stockpiles.
- Across channels to serve as a barrier for utility trenches or provide a temporary channel crossing for construction equipment, to reduce stream impacts.
- Parallel to a roadway to keep sediment off paved areas.
- At the top of slopes to divert roadway runoff away from disturbed slopes.
- To divert or direct flow or create a temporary sediment basin.
- During construction activities in stream beds when the contributing drainage area is less than 2 ha (5 ac).

- When extended construction period limits the use of either silt fences or straw bale barriers.
- Along the perimeter of vehicle and equipment fueling and maintenance areas or chemical storage areas.
- To capture and detain non-storm water flows until proper cleaning operations occur.
- When site conditions or construction sequencing require adjustments or relocation of the barrier to meet changing field conditions and needs during construction.
- To temporarily close or continue broken, damaged or incomplete curbs.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Resident Engineer (RE).

Limitations

- Limit the drainage area upstream of the barrier to 2 ha (5 ac).
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Limited durability for long term projects.
- When used to detain concentrated flows, maintenance requirements increase.

Standards and Specifications

Materials

- Sandbag Material: Sandbag shall be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight 135 g/(four ounces per square yard), mullen burst strength exceeding 2,070 kPa (300 psi) in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70 percent in conformance with the requirements in ASTM designation D4355. Use of burlap is not acceptable.
- Sandbag Size£Each sand-filled bag shall have a length of 450 mm (18 in), width of 300 mm (12 in), thickness of 75 mm (3 in), and mass of approximately 15 kg (33 lb.). Bag dimensions are nominal, and may vary based on locally available materials. Alternative bag sizes shall be submitted to the Resident Engineer (RE) for approval prior to deployment.
- Fill Material: All sandbag fill material shall be non-cohesive, Class 1 or Class 2 permeable material free from clay and deleterious material, conforming to the provisions in Section 68-1.025 "Permeable Material," of

the Standard Specifications. The requirements for the Durability Index and Sand Equivalent do not apply. Fill material is subject to approval by the RE.

Installation

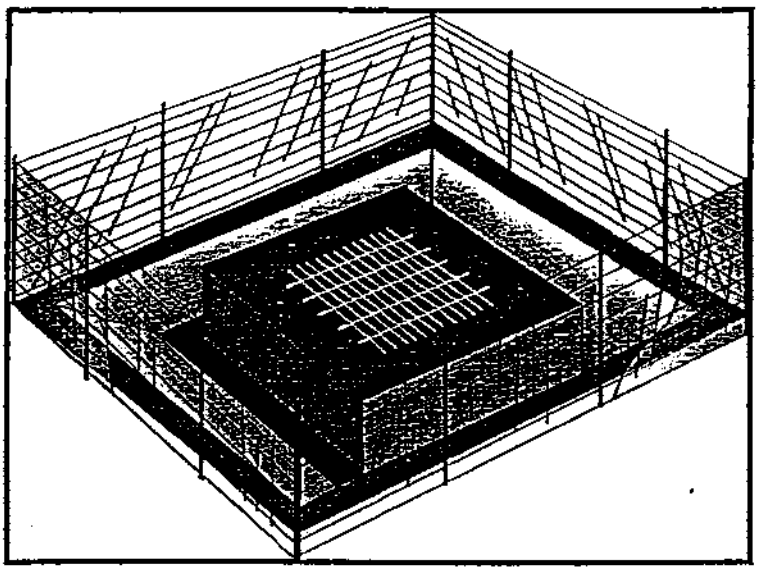
- When used as a linear control for sediment removal:
  - Install along a level contour.
  - Turn ends of sandbag row up slope to prevent flow around the ends.
  - Generally, sandbag barriers shall be used in conjunction with temporary soil stabilization controls up slope to provide effective control.
  - Install as shown in Page 4 of this BMP.
- When used for concentrated flows:
  - Stack sandbags to required height using a pyramid approach as shown in Page 4 of this BMP.
  - Upper rows of sandbags shall overlap joints in lower rows.
- Construct sandbag barriers with a set-back of at least 1m from the toe of a slope. Where it is determined to be not practicable due to specific site conditions, the sandbag barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.

Maintenance and Inspection

- Inspect sandbag barriers before and after each rainfall event, and weekly throughout the rainy season.
- Reshape or replace sandbags as needed, or as directed by the RE.
- Repair washouts or other damages as needed, or as directed by the RE.
- Inspect sandbag barriers for sediment accumulations and remove sediments when accumulation reaches one-third the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.
- Remove sandbags when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilized the area.

Storm Drain Inlet Protection

SC-10



BMP Objectives
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

Devices used at storm drain inlets that are subject to runoff from construction activities to detain and/or to filter sediment-laden runoff to allow sediment to settle and/or to filter sediment prior to discharge of storm water into storm water drainage systems or watercourses.

Appropriate Applications

- Where ponding will not encroach into highway traffic.
- Where sediment laden surface runoff may enter an inlet.
- Where disturbed drainage areas have not yet been permanently stabilized.
- Where the drainage area is 0.4 ha (1 ac) or less.
- Appropriate during wet and snow-melt seasons.

Limitations

- Use only when ponding will not encroach into highway traffic or onto erodible surfaces and slopes. If safety is a concern, use other methods of temporary protection to prevent sediment-laden storm water and non-storm water discharges to enter the storm drain system.
- Sediment removal may be difficult in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other on-site sediment trapping techniques in conjunction with inlet protection.
- Frequent maintenance is required.
- For drainage areas larger than 0.4 ha (1ac), runoff shall be routed to a sediment trapping device designed for larger flows. See BMPs SC-2, "Desilting Basin", and SC-3 "Sediment Traps".

- Filter fabric fence inlet protection appropriate in open areas is subject to sheet flow and for flows not exceeding 0.014 m^3/s (0.5 cfs).
- Sandbag barriers for inlet protection are applicable when sheet flows or concentrated flows exceed 0.014 m^3/s (0.5 cfs), and it is necessary to allow for overtopping to prevent flooding.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected and overflow capability is needed.

Standards and Specifications

Identify existing and/or planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed, and which method to use.

Methods and Installation

- DI Protection Type 1 - Filter Fabric Fence The filter fabric fence (Type 1) protection is illustrated in Page 4. Similar to constructing a silt fence. See BMP SC-1, "Silt Fence". Do not place filter fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced.
- DI Protection Type 2 - Excavated Drop Inlet Sediment Trap The excavated drop inlet sediment trap (Type 2) is illustrated in Page 5. Similar to constructing a temporary silt fence, See BMP SC-1, "Silt Fence". Size excavated trap to provide a minimum storage capacity calculated at the rate of 130 m^3/ha (67 yd^3/ac) of drainage area.
- DI Protection Type 3 - Sandbag Barrier The sandbag barrier (Type 3) is illustrated in Page 6. Flow from a severe storm shall not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct sandbags in accordance with BMP SC-8, "Sandbag Barrier".

Maintenance and Inspection

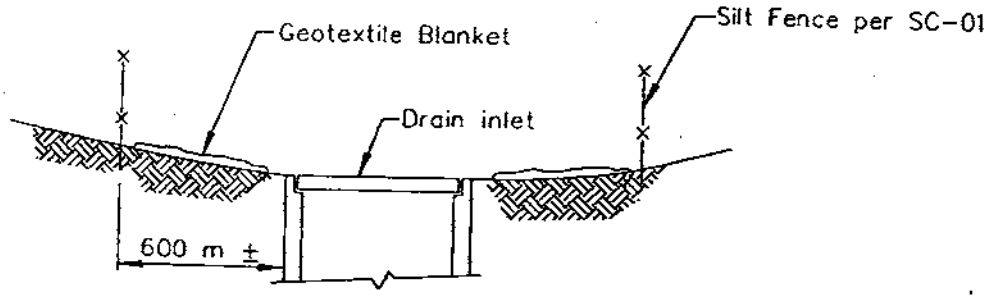
General

- Inspect all inlet protection devices before and after every rainfall event, and weekly during the rest of the rainy season. During extended rainfall events, inspect inlet protection devices at least once every 24 hours.
- Inspect the storm drain inlet after severe storms in the rainy season to check for bypassed material.
- Remove all inlet protection devices within thirty days after the site is stabilized, or when the inlet protection is no longer needed.

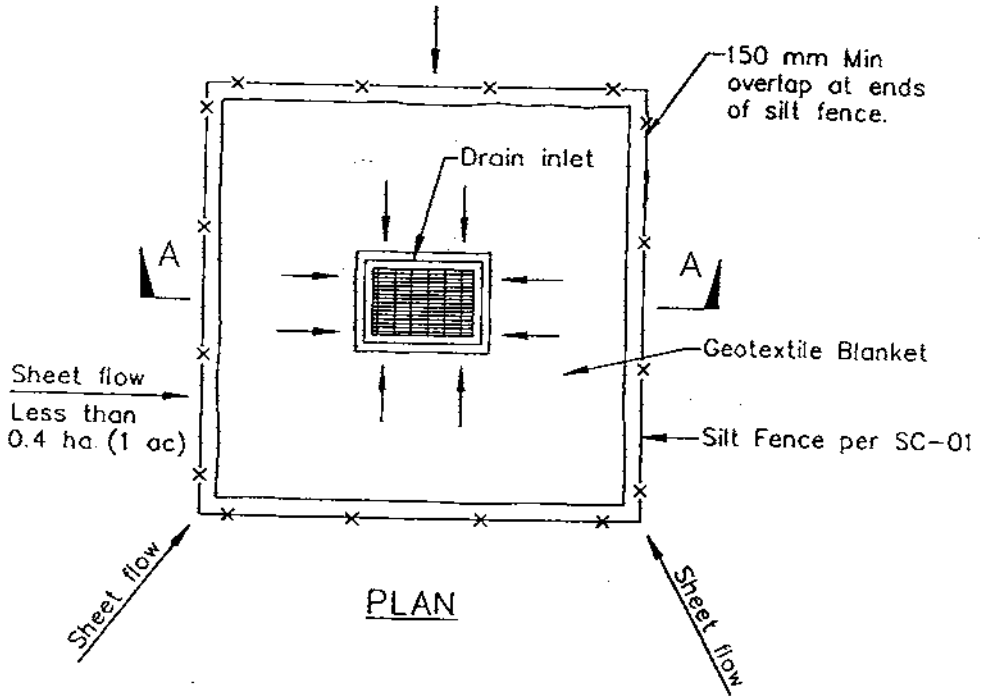
- Bring the disturbed area to final grade and smooth and compact it. Appropriately stabilize all bare areas around the inlet.
- Clean and re-grade area around the inlet and clean the inside of the storm drain inlet as it must be free of sediment and debris at the time of final inspection.

Requirements by Method

- Type 1 - Filter Fabric Fence
  - Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes.
  - Replace or clean the fabric when the fabric becomes clogged with sediment. Make sure the fabric does not have any holes or tears. Repair or replace fabric as needed or as directed by the Resident Engineer (RE).
  - At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.
- Type 2 - Excavated Drop Inlet Sediment Trap
  - Remove sediment from basin when the volume of the basin has been reduced by one-half.
- Type 3 - Sandbag Barrier
  - Inspect bags for holes, gashes, and snags.
  - Check sandbags for proper arrangement and displacement. Remove the sediment behind the barrier when it reaches one-third the height of the barrier. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.



SECTION A–A

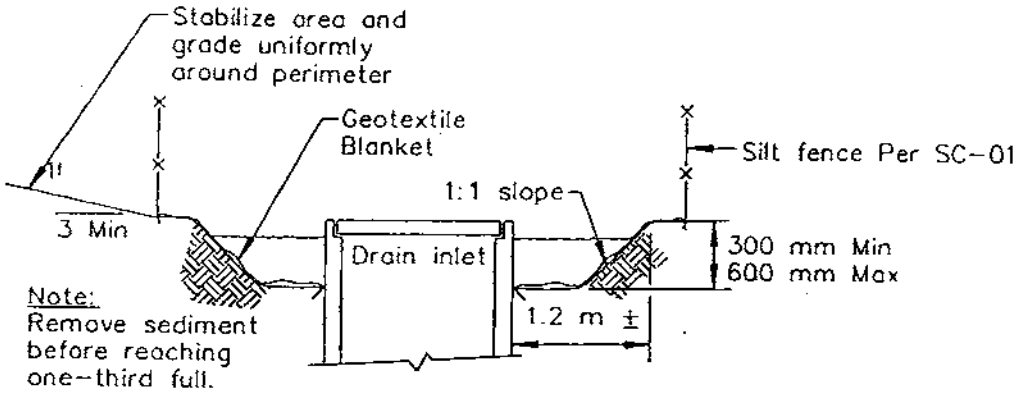


PLAN

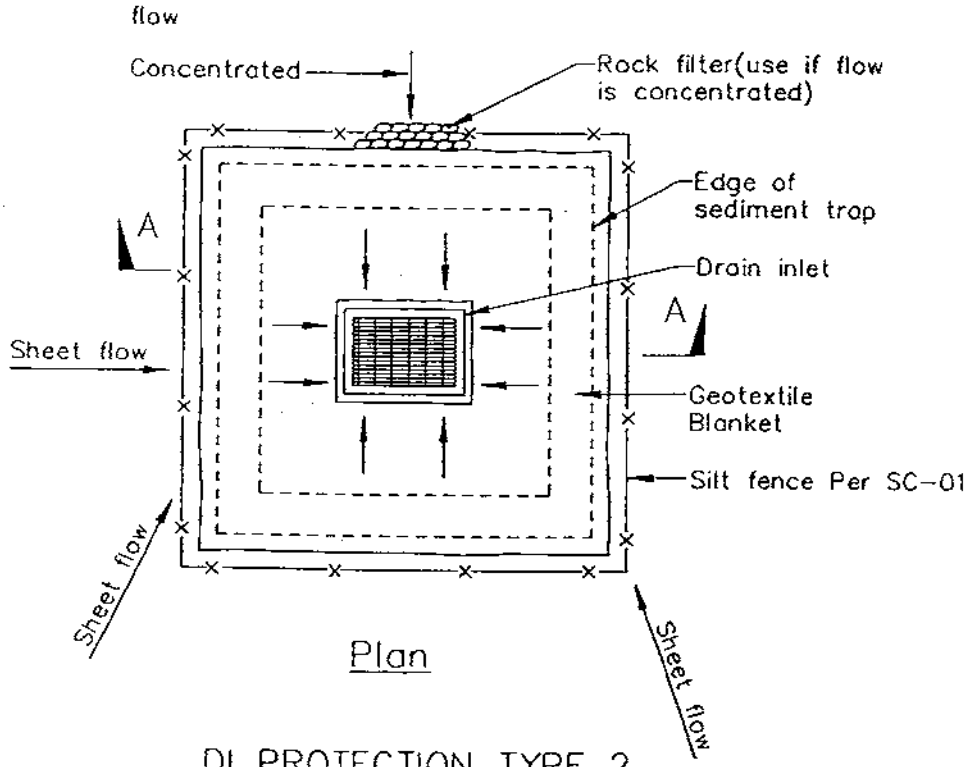
DI PROTECTION TYPE 1
NOT TO SCALE

NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



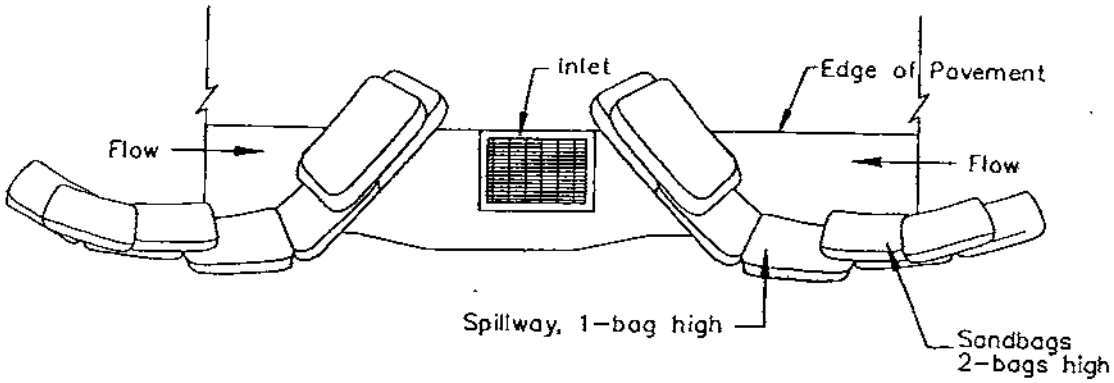
Section A–A



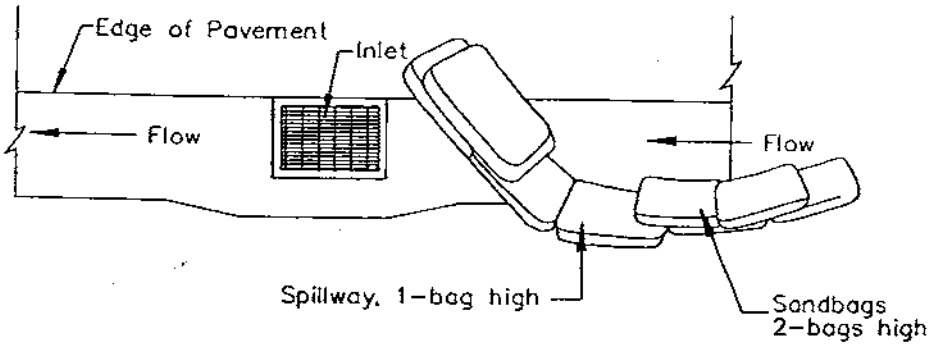
Plan

DI PROTECTION TYPE 2
NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.



TYPICAL PROTECTION FOR INLET ON SUMP



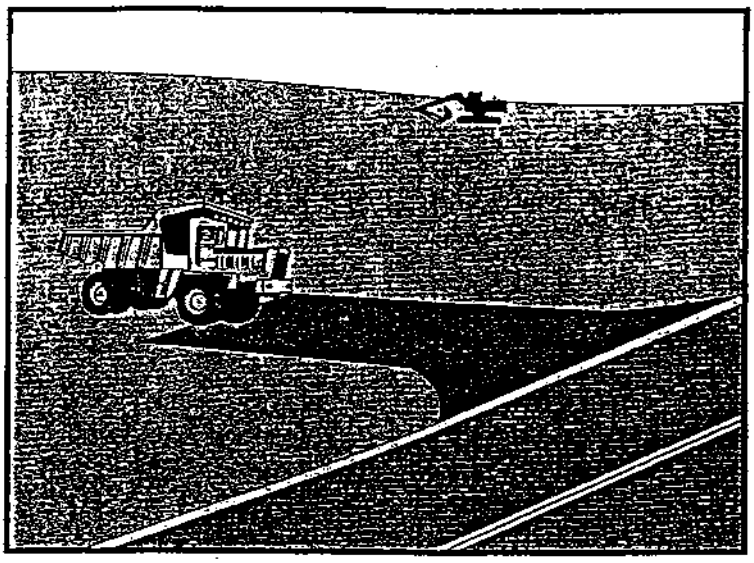
TYPICAL PROTECTION FOR INLET ON GRADE

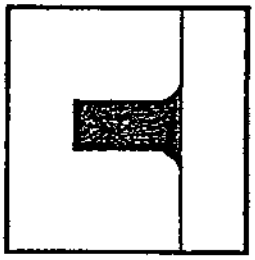
NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.

Stabilized Construction Entrance/Exit

TC-1





BMP Objectives
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

A stabilized construction access is a defined point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Appropriate Applications

- Use at construction sites:
  - where dirt or mud is tracked onto public roads
  - adjacent to water bodies
  - where poor soils are encountered
  - where dust is a problem during dry weather conditions.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Resident Engineer (RE).

Limitations

- Site conditions will dictate design and need.

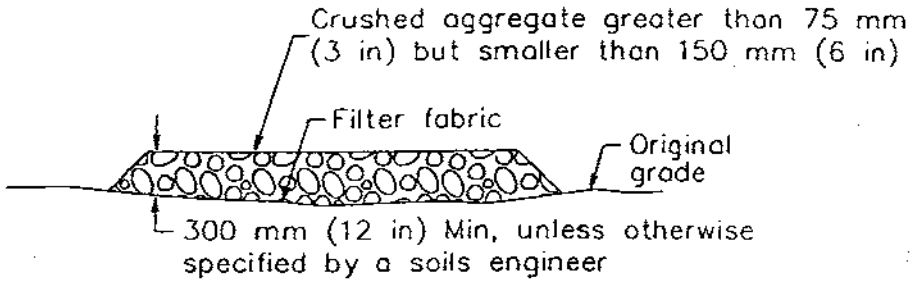
Standards and Specifications

- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment-trapping device before discharge.

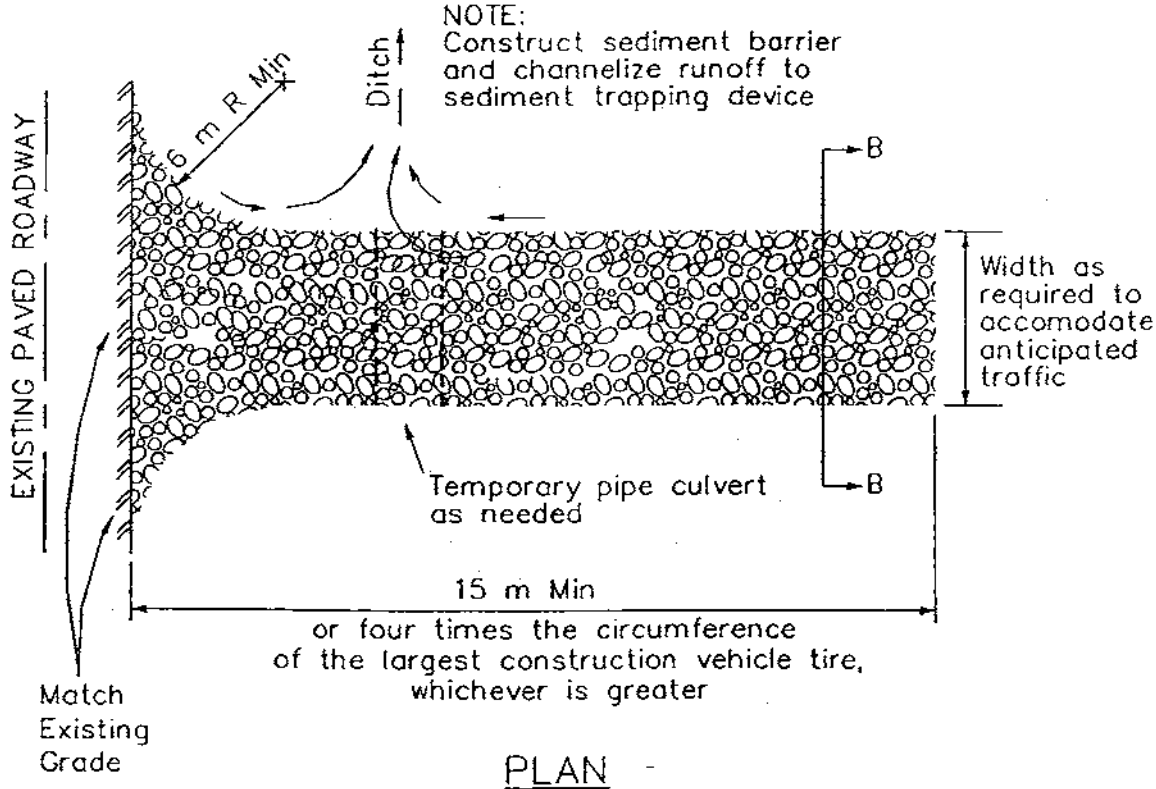
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. The use of asphalt concrete (AC) grindings for stabilized construction access/roadway is not allowed.
- Use of constructed or constructed/manufactured steel plates with ribs for entrance/exit access is allowed with written approval of the RE.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 300 mm (12 in) depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 75 mm (3 inches) but smaller than 150 mm (6 inches) shall be used.
- Designate combination or single purpose entrances and exits to the construction site. Require all employees, subcontractors and others to use them.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.

Maintenance and Inspection

- Inspect routinely for damage and assess effectiveness of the BMP. Repair if access is clogged with sediment or as directed by the RE.
- Keep all temporary roadway ditches clear.



SECTION B–B
NTS

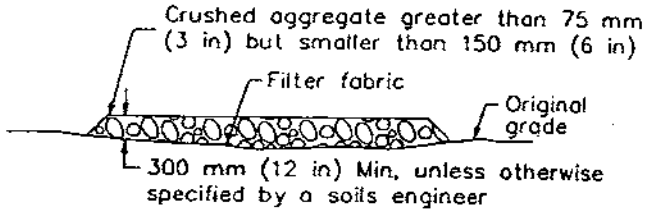


PLAN
NTS

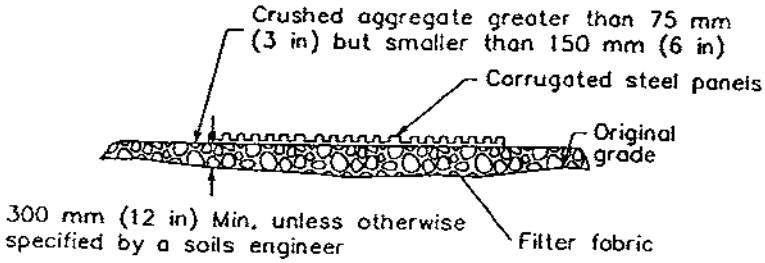
Stabilized Construction Entrance/Exit (Type 1)

Stabilized Construction Entrance/Exit

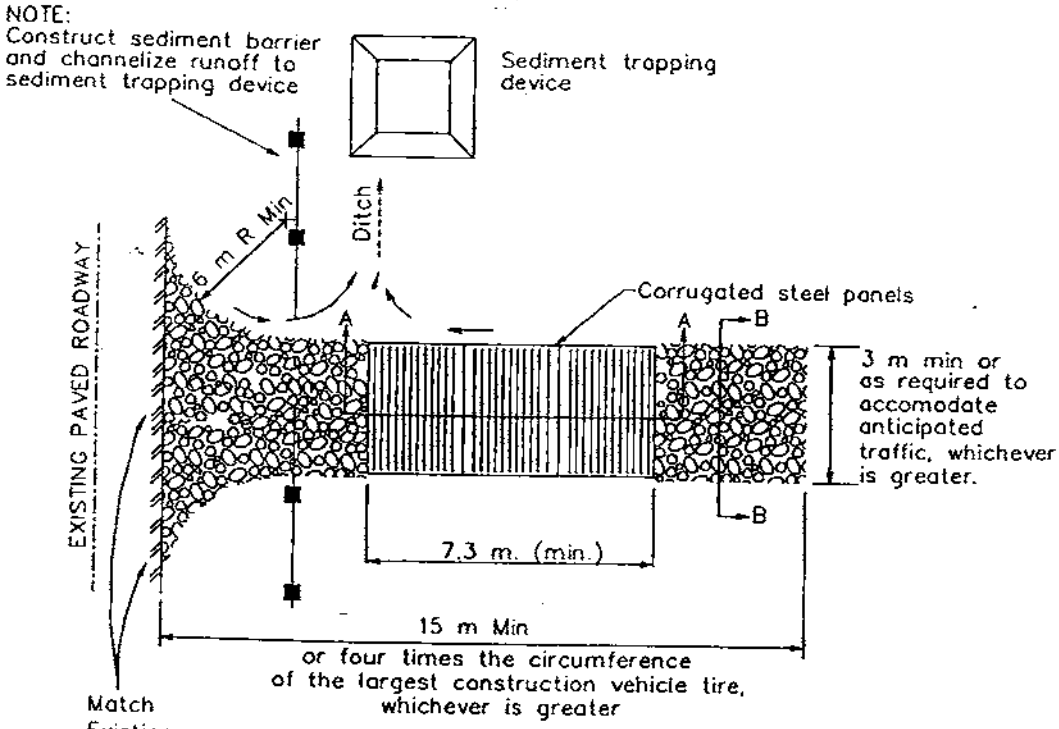
TC-1



SECTION B–B
NTS



SECTION A–A
NOT TO SCALE

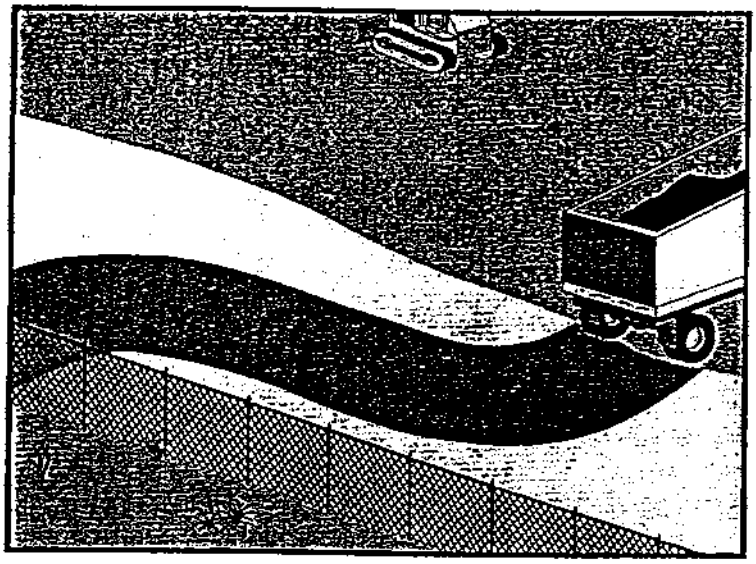


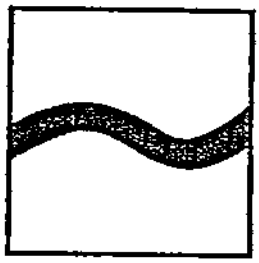
PLAN
NTS

Stabilized Construction Entrance/Exit (Type 2)

Stabilized Construction Roadway

TC-2





BMP Objectives
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

A stabilized construction roadway is a temporary access road connecting existing public roads to a remote construction area. It is designed for the control of dust and erosion created by vehicular tracking.

Appropriate Applications

- Construction roadways and short-term detour roads:
  - Where mud tracking is a problem during wet weather
  - Where dust is a problem during dry weather
  - Adjacent to water bodies
  - Where poor soils are encountered
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).

Limitations

- Materials will likely need to be removed prior to final project grading and stabilization.
- Site conditions will dictate design and need.
- May not be applicable to very short duration projects.
- Limit speed of vehicles to control dust.

Stabilized Construction Roadway

TC-2

Standards and Specifications

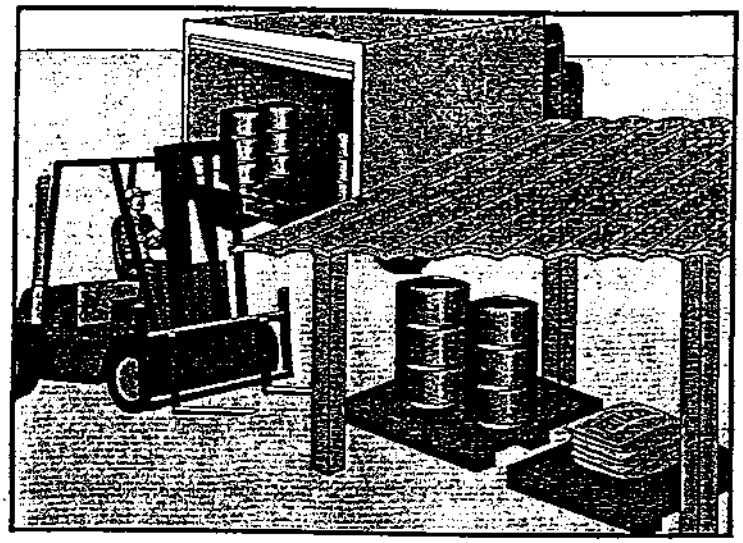
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support heaviest vehicles and equipment that will use it.
- Stabilize roadway using aggregate, asphalt concrete, or concrete based on longevity, required performance, and site conditions. The use of cold mix asphalt or asphalt concrete (AC) grindings for stabilized construction roadway is not allowed.
- Coordinate materials with those used for stabilized construction entrance/exit points.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 300 mm (12 in) depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 75 mm (3 inches) but smaller than 150 mm (6 inches) shall be used.

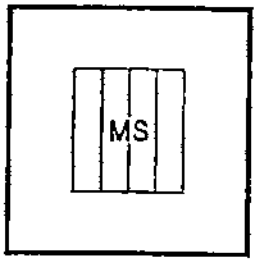
Maintenance and Inspection

- Inspect routinely for damage and repair as needed, or as directed by the Resident Engineer (RE).
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.

Material Delivery and Storage

WM-1





BMP Objectives
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

Procedures and practices for the proper handling and storage of materials in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or to watercourses.

Appropriate Applications

These procedures are implemented at all construction sites with delivery and storage of the following:

- Soil
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease
- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds must meet building & fire code requirements.

Standards and Specifications

General

- Train employees and subcontractors on the proper material delivery and storage practices.
- Temporary storage area shall be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) shall be supplied to the Resident Engineer (RE) for all materials stored.

Material Storage Areas and Practices

Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be handled in conformance with the following provisions:

- Storage, preparation, and mixing shall be accomplished in temporary containment facilities. Each temporary containment facility shall provide a spill containment volume equal to 1.5 times the volume of all containers therein and shall be impervious to the materials contained therein for a minimum contact time of 72 hours.
- Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
- To provide protection from wind and rain, throughout the rainy season, temporary containment facilities shall be covered during non-working days and prior to rain events.
- Temporary containment facilities shall be maintained free of accumulated rainwater and spills.
- Materials shall be stored in their original containers and the original product labels shall be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced immediately.
- Liquid materials, petroleum products, and substances listed in 40 CFR Parts 110, 117 or 302 shall be stored in approved containers and drums shall not be overfilled. Containers shall be placed in temporary containment facilities for storage.
- Bagged and boxed materials shall be stored on pallets and shall not be allowed to accumulate on the ground. To provide protection from wind and rain, throughout the rainy season, bagged and boxed materials shall be covered during non-working days and prior to rain events.

- Stockpiles shall be protected in accordance with BMP WM-3, "Stockpile Management".
- Minimize the material inventory stored on-site (e.g., only a few days supply).
- Store materials indoors within existing structures or sheds when available.
- Have proper storage instructions posted at all times in an open and conspicuous location.
- Do not store hazardous chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and when possible, under cover in secondary containment.
- Keep hazardous chemicals well labeled and in their original containers.
- Keep ample supply of appropriate spill clean up material near storage areas.
- Also see BMP WM-6, "Hazardous Waste Management", for storing of hazardous materials.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored on-site.
- Employees trained in emergency spill clean-up procedures shall be present when dangerous materials or liquid chemicals are unloaded.

Spill Clean-up

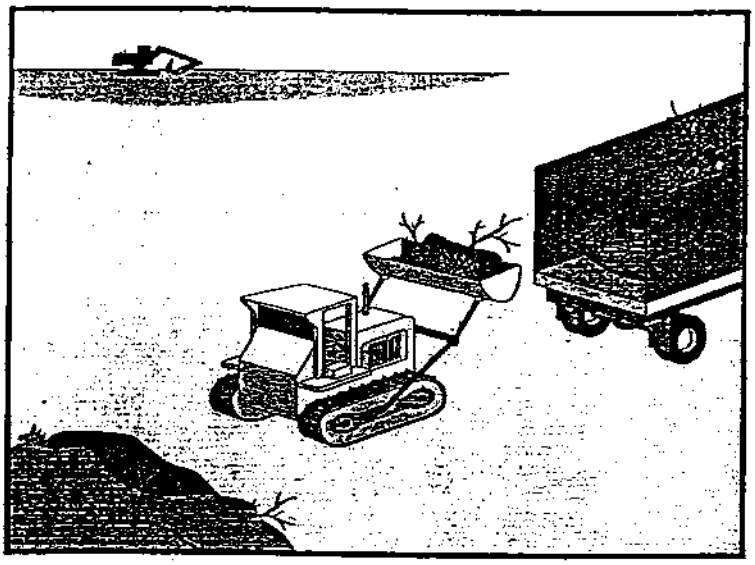
- Contain and clean up any spill immediately.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose any hazardous materials or contaminated soil.
- See BMP WM-4, "Spill Prevention and Control", for spills of chemicals and/or hazardous materials.

Maintenance and Inspection

- Storage areas shall be kept clean, well organized, and equipped with ample clean-up supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.
- Inspect storage areas before and after rainfall events, and at least weekly during other times.

Solid Waste Management

WM-5



SWM

BMP Objectives
- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

These are procedures and practices to minimize or eliminate the discharge of pollutants to the drainage system or to watercourses as a result of the creation, stockpiling, and removal of construction site wastes.

Appropriate Applications

Solid waste management practices are implemented on all construction projects that generate solid wastes.

Solid wastes include but are not limited to:

- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials.
- Highway planting wastes, including vegetative material, plant containers, and packaging materials.
- Litter, including food containers, beverage cans, coffee cups, paper bags, plastic wrappers, and smoking materials, including litter generated by the public.

Limitations

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

Standards and Specifications

Education

- The Contractor's Water Pollution Control Manager (WPCM) shall oversee and enforce proper solid waste procedures and practices.

- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Wherever possible, minimize production of solid waste materials.

Collection, Storage, and Disposal

- Littering on the project site shall be prohibited.
- To prevent clogging of the storm drainage system litter and debris removal from drainage grates, trash racks, and ditch lines shall be a priority.
- Trash receptacles shall be provided in the Contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site shall be collected and placed in water tight dumpsters at least weekly regardless of whether the litter was generated by the Contractor, the public, or others. Collected litter and debris shall not be placed in or next to drain inlets, storm water drainage systems or watercourses.
- Dumpsters of sufficient size and number shall be provided to contain the solid waste generated by the project.
- Full dumpsters shall be removed from the project site and the contents shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.
- Litter stored in collection areas and containers shall be handled and disposed of by trash hauling contractors.
- Materials that are disposed of or temporarily stockpiled outside the highway right-of-way but are visible from the Highway, shall be in a neat and orderly fashion to the satisfaction of the Resident Engineer (RE).
- Storm water run-on shall be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or

through the use of measures to elevate waste form site surfaces.

- Solid waste storage areas shall be located at least 15m from drainage facilities and watercourses and shall not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters shall be protected from wind and rain by securely covering the waste with tarps or plastic sheeting or protected in conformance with the applicable Disturbed Soil Area protection.
- Dumpster washout on the project site is not allowed
- Notify trash hauling contractors that only watertight dumpsters are acceptable for use on-site.
- Plan for additional containers during the demolition phase of construction.
- Plan for more frequent pickup during the demolition phase of construction.
- Designate on-site waste storage areas and obtain approval of the RE.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Dispose of non-hazardous waste in accordance with Standard Specification 7-1.13, Disposal of Material Outside the Highway right-of-way.
- For disposal of hazardous waste, see BMP WM-6, "Hazardous Waste Management". Have hazardous waste hauled to an appropriate disposal and/or recycling facility.
- Salvage or recycle useful vegetation debris, packaging and/or surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Maintenance and Inspection

- The WPCM shall monitor on-site solid waste storage and disposal procedures.
- Police site for litter and debris.

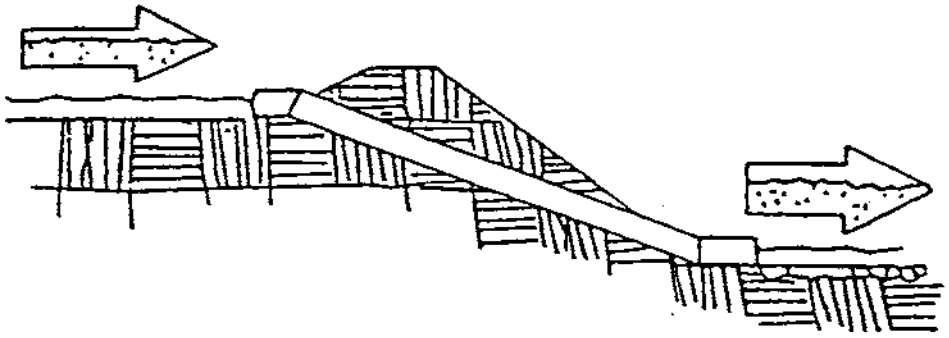
APPENDIX B

- BEST MANAGEMENT PRACTICE HANDBOOKS: CALIFORNIA STORM WATER

CALIFORNIA STORM WATER

BMP

BMP: SLOPE DRAIN



Objectives

- *Housekeeping Practices*
- *Contain Waste*
- *Minimize Disturbed Areas*
- *Stabilize Disturbed Areas*
- *Protect Slopes/Channels*
- *Control Site Perimeter*
- *Control Internal Erosion*

GENERAL DESCRIPTION

A temporary pipe or lined channel to drain the top of a slope to a stable discharge point at the bottom of a slope without causing erosion.

SUITABLE APPLICATIONS

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top of slope diversion dikes or swales.
- Emergency spillway for a sediment basin.
- Drainage for top of cut/fill slopes where water can accumulate.

The types of slope drain can include:

- Pipe drops.
- Flexible downdrains.
- Sectional downdrains.
- Lined terrace drains.

INSTALLATION/APPLICATION CRITERIA

- Secure inlet and surround with dikes to prevent gully erosion, and anchor pipe to slope.
- Size to convey at least the peak of a 10-year, 24-hour storm (See local flood control agency for requirements).
- Stabilize outlet.

REQUIREMENTS

- Maintenance
  - Structure must be inspected regularly and after storms.
  - Inlet must be free of undercutting and no water should circumvent the entry.
  - Outlet should not produce erosion; velocity dissipators must be maintained.
  - Pipe anchors must be checked to ensure that the pipe remains anchored to the slope.
- Cost
  - CalTrans Cost Schedule gives regional cost ranges.

LIMITATIONS

- Maximum drainage area per slope drain is 5 acres. (For large areas use a paved chute, rock lined channel or additional pipes.)
- Clogged slope drains will force water around the pipe and cause slope erosion.
- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.
- Failure can result in flooding and severe erosion.

Targeted Pollutants

- ● *Sediment*
- ○ *Nutrients*
- ○ *Toxic Materials*
- ○ *Oil & Grease*
- ○ *Floatable Materials*
- ○ *Other Construction Waste*

● *Likely to Have Significant Impact*
○ *Probable Low or Unknown Impact*

Implementation Requirements

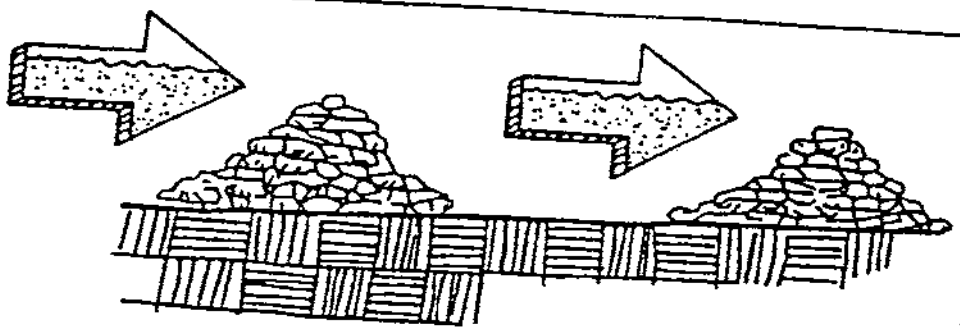
- ◒ *Capital Costs*
- ○ *O&M Costs*
- ◒ *Maintenance*
- ○ *Training*
- ◒ *Suitability for Slopes >5%*

● *High* ○ *Low*

ESC32

Best Management Practices

BMP: CHECK DAMS



Objectives

- Housekeeping Practices
- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

GENERAL DESCRIPTION

Small temporary dams constructed across a swale or drainage ditch. Check dams reduce the velocity of concentrated stormwater flows, thereby reducing erosion of the swale or ditch, and promoting sedimentation behind the dam. If properly anchored, brush or rock filter berms (ESC53) may be used for check dams.

SUITABLE APPLICATIONS

- Used to prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- May also promote sedimentation behind the dam, but should not be considered to be a primary sediment trapping device because subsequent storms will scour and resuspend much of the trapped sediment.

INSTALLATION/APPLICATION CRITERIA

- Check dams should be placed at a distance and height to allow small pools to form between each one.
- Backwater from a downstream check dam should reach the toe of the upstream check dam.
- Major floods (2 year storm or larger) should safely flow over the check dam without an increase in upstream flooding or destruction of the checkdam.
- Primarily used in small, steep channels where velocities exceed 2 fps.
- Used in steep terrain where velocity reduction is required.
- A deep sump may be provided immediately upstream of the check dam to capture excessive sediment.
- Check dams may be built of rocks or logs, which are secured against damage during significant floods.

REQUIREMENTS

- Maintenance
  - Inspect for sediment buildup behind the check dam and signs of erosion around the check dam after each rain.
  - Remove accumulated sediment whenever it reaches one-half the sump depth.
- Cost
  - See CalTrans Cost Schedule for regional cost data.

LIMITATIONS

- Use only in small open channels which drain 10 acres of less.
- Not to be used in live streams.
- Do not install in lined or vegetated channels.

Targeted Pollutants

- ● Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

● Likely to Have Significant Impact
○ Probable Low or Unknown Impact

Implementation Requirements

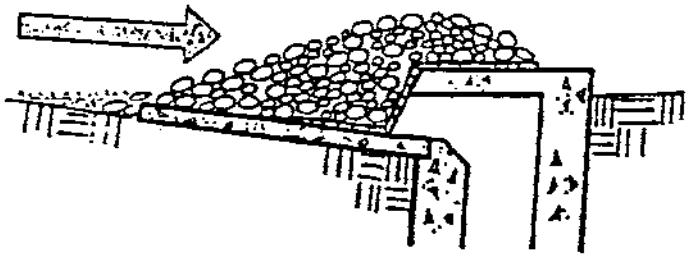
- ◒ Capital Costs
- ○ O&M Costs
- ◒ Maintenance
- ○ Training
- ○ Suitability for Slopes >5%

● High ○ Low

ESC41

Best Management Practices

BMP: STORM DRAIN INLET PROTECTION



Objectives

- Housekeeping Practices
- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

GENERAL DEFINITION

Devices of various designs which detain sediment-laden runoff and allow the sediment it to settle prior to discharge into a storm drain inlet or catch basin.

SUITABLE APPLICATIONS

- Every storm drain inlet receiving sediment-laden runoff should be protected, either by covering the inlet or promoting sedimentation upstream of the inlet.

INSTALLATION/APPLICATION

- Five types of inlet protection are presented below, however, it is recognized that other effective methods and proprietary device, exist and may be selected:
  - Filter Fabric Fence: Appropriate for drainage basins less than one acre with less than a 5 percent slope.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
  - Gravel and Wire Mesh Filter: Used on curb or drop inlets where construction equipment may drive over the inlet.
  - Sand bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (see Sediment Trap ESC 55).
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Use only for drainage areas smaller than one acre unless a sediment trap first intercepts the runoff.
- Provide area around the inlet for water to pond without flooding structures and property.

REQUIREMENTS

- Maintenance
  - Inspect weekly and after each rain.
  - Replace clogged filter fabric or stone filters immediately.
  - Remove sediment when depth exceeds half the height of the filter, or half the depth of the sediment trap.
  - Remove as soon as upstream soils are stabilized and streets are swept.
- Cost (source: EPA, 1992)
  - Average annual cost for installation and maintenance (1 year useful life) is $150 per inlet.

Targeted Pollutants

- ● Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Waste

● Likely to Have Significant Impact
○ Probable Low or Unknown Impact

Implementation Requirements

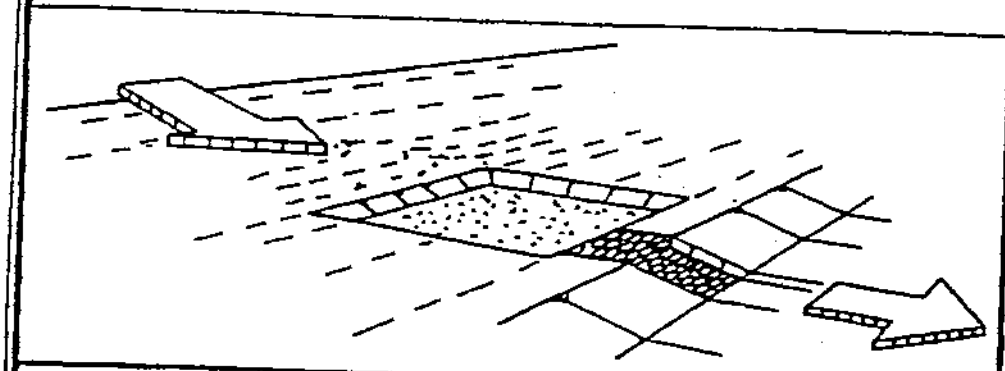
- ◒ Capital Costs
- ○ O&M Costs
- ◒ Maintenance
- ○ Training
- ○ Suitability for Slopes >5%

● High ○ Low

ESC54

Best Management Practices

BMP: SEDIMENT TRAP



Objectives

- Housekeeping Practices
- Contain Waste
- Minimize Disturbed Areas
- Stabalize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- (Control Internal Erosion)

GENERAL DEFINITION

A sediment trap is a small, excavated or bermed area where runoff from small drainage areas is detained and sediment can settle.

SUITABLE APPLICATIONS

- Any disturbed area less than 5 acres. (Sediment Basins, ESC56, must be used for drainage areas greater than 5 acres).
- Along the perimeter of the site at locations where sediment-laden runoff is discharged off-site.
- Around and/or upslope from storm drain inlet protection measures.
- At any point within the site where sediment-laden runoff can enter stabilized or natural areas or waterways.

INSTALLATION/APPLICATION CRITERIA

- Build outside the area to be graded before clearing, grubbing, and grading begin.
- Locate where the trap can be easily cleared of sediment.
- Trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency.
- The larger the trap, the less frequently sediment must be removed.
- The outlet of the trap must be stabilized with rock, vegetation, or another suitable material.
- A stable emergency spillway must be installed to safely convey major floods (see your local flood control agency).

REQUIREMENTS

- Maintenance
  - Remove sediment when the sediment storage zone is no more than 1 ft. from being full.
  - Inspect weekly and after each rain.
- Cost (source: EPA, 1992)
  - Average annual cost per installation and maintenance (18 month useful life) is \$0.70 per ft.^{3} (\$1,300 per drainage acre).

LIMITATIONS

- Only use for drainage areas up to 5 acres (see Sedimentation Basin BMP ST8 for larger areas).
- Only removes coarse sediment (medium silt size and larger) unless sized like a sedimentation basin.

Targeted Pollutants

- ● Sediment
- ○ Nutrients
- ◒ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

- ● Likely to Have Significant Impact
- ○ Probable Low or Unknown Impact

Implementation Requirements

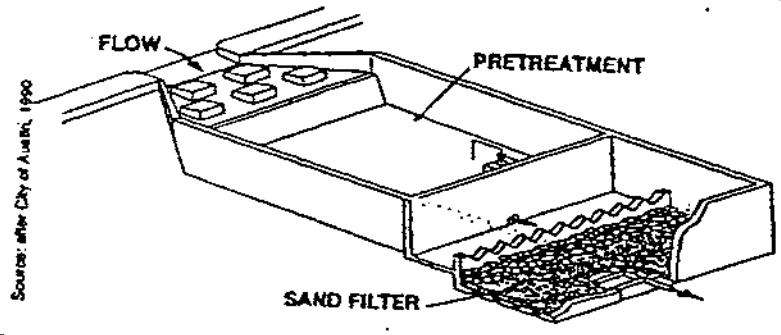
- ○ Capital Costs
- ◒ O&M Costs
- ○ Maintenance
- ○ Training
- ○ Suitability for Slopes >5%

● High ○ Low

ESC 55

Best Management Practices

BMP: MEDIA FILTRATION



Considerations

- *Soils*
- *Area Required*
- *Slope*
- *Water Availability*
- *Aesthetics*
- *Hydraulic Head*
- *Environmental Side Effects*

DESCRIPTION

Consists of a settling basin followed by a filter. The most common filter media is sand; some use peat/sand mixture.

EXPERIENCE IN CALIFORNIA

- A tenant at the Port of Long Beach recently installed a sand filter. The City of Los Angeles will soon install several experimental filters.

SELECTION CRITERIA

- Objective is to remove only sediment (particulate pollutants).
- Use where unavailability of water prevents the use of wet ponds, wetlands, or biofilters.
- Can be placed underground.
- Suitable for individual developments and small tributary areas up to about 100 acres.
- May require less space than other treatment control BMPs.

LIMITATIONS

- Filter may require more frequent maintenance than most of the other BMPs.
- Head loss.
- Dissolved pollutants are not captured by sand.
- Severe clogging potential if exposed soil surfaces exist upstream.

DESIGN AND SIZING CONSIDERATIONS

- Settling basin smaller than wet or extended detention basin.
- Spread flow across filter.
- Place filter offline to protect from extreme events.
- Minimize erosion in settling basin.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- Be certain filter sand is clean and the outlet device from the basin to the filter is level.

MAINTENANCE REQUIREMENTS

- Clean filter surface about twice annually; or more often if watershed is excessively erosive.

COST CONSIDERATIONS

- Filtration system may use less space than other systems.
- Smaller media improves performance but increases maintenance costs.

Targeted Constituents

- ● *Sediment*
- ◒ *Nutrients*
- ◒ *Heavy Metals*
- ○ *Toxic Materials*
- ● *Floatable Materials*
- ◒ *Oxygen Demanding Substances*
- ◒ *Oil & Grease*
- ◒ *Bacteria & Viruses*

● *Likely to Have Significant Impact*
○ *Probable Low or Unknown Impact*

Implementation Requirements

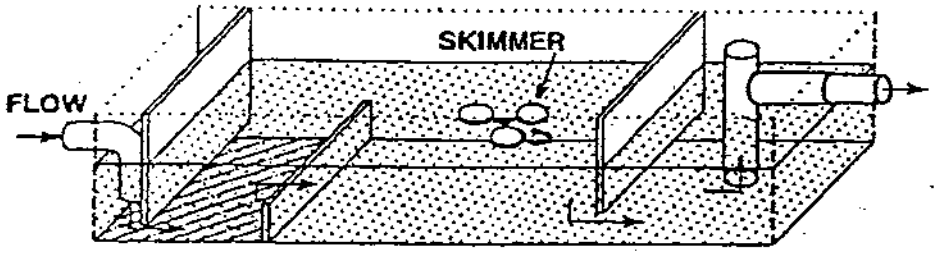
- ● *Capital Costs*
- ◒ *O&M Costs*
- ◒ *Maintenance*
- ○ *Training*

● *High* ○ *Low*

TC6

Best Management Practices

BMP: OIL/WATER SEPARATORS AND WATER QUALITY INLETS



Considerations

- Soils
- Area Required
- Slope
- Water Availability
- Aesthetics
- Hydraulic Head
- Environmental Side Effects

DESCRIPTION

Oil/water separators are designed to remove one specific group of contaminants: petroleum compounds and grease. However, separators will also remove floatable debris and settleable solids. Two general types of oil/water separators are used: conventional gravity separator and the coalescing plate interceptor (CPI).

EXPERIENCE IN CALIFORNIA

Oil/water separators are in use throughout California at industrial sites. Oil/water separators are used at all bulk petroleum storage and refinery facilities. A few jurisdictions require new commercial developments to install separators under certain situations that are environmentally sensitive.

SELECTION CRITERIA

Applicable to situations where the concentration of oil and grease related compounds will be abnormally high and source control cannot provide effective control. The general types of businesses where this situation is likely are truck, car, and equipment maintenance and washing businesses, as well as a business that performs maintenance on its own equipment and vehicles. Public facilities where separators may be required include marine ports, airfields, fleet vehicle maintenance and washing, facilities, and mass transit park-and-ride lots. Conventional separators are capable of removing oil droplets with diameters equal to or greater than 150 microns. A CPI separator should be used if smaller droplets must be removed.

LIMITATIONS

- Little data on oil characteristics in storm water leads to considerable uncertainty about performance.
- Air quality permit (conditional authorization) permit-by-rule from DTSC may be required.

DESIGN AND SIZING CONSIDERATIONS

- Sizing related to anticipated influent oil concentration, water temperature and velocity, and the effluent goal. To maintain reasonable separator size, it should be designed to bypass flows in excess of first flush.

CONSTRUCTION/INSPECTION CONSIDERATIONS

- None identified.

MAINTENANCE REQUIREMENTS

- Clean frequently of accumulated oil, grease, and floating debris.

COST CONSIDERATIONS

- Coalescing plate material is costly but requires less space than the conventional separator.

Targeted Constituents

- ◒ Sediment
- ◒ Nutrients
- ◒ Heavy Metals
- ◒ Toxic Materials
- ● Floatable Materials
- ◒ Oxygen Demanding Substances
- ● Oil & Grease
- ○ Bacteria & Viruses

● Likely to Have Significant Impact
○ Probable Low or Unknown Impact

Implementation Requirements

- ◒ Capital Costs
- ◒ O&M Costs
- ◒ Maintenance
- ○ Training

● High ○ Low

TC7

Best Management Practices

Water Conservation Practices NS-1

Objectives		
EC	Erosion Control	✓
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Suitable Applications

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Limitations

- None identified.

Implementation

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.

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- Direct construction water runoff to areas where it can soak into the ground or be collected and reused.
- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.

Costs

The cost is small to none compared to the benefits of conserving water.

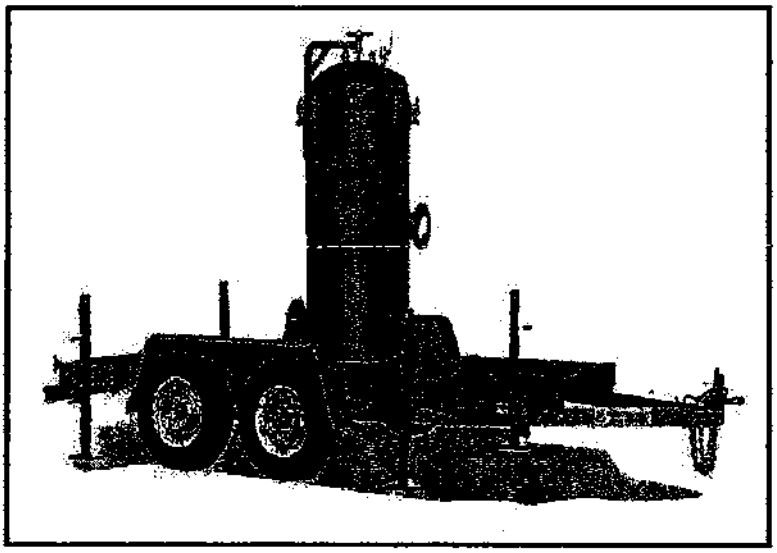
Inspection and Maintenance

- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occuring.
- Repair water equipment as needed to prevent unintended discharges.
  - Water trucks
  - Water reservoirs (water buffalos)
  - Irrigation systems
  - Hydrant connections

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Dewatering Operations NS-2



Objectives		
EC	Erosion Control	
SE	Sediment Control	✓
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	✓
Organics	

Potential Alternatives

SE-5: Fiber Roll

SE-6: Gravel Bag Berm

SE-9: Straw Bale Barrier

Description and Purpose

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation must be removed from a work location so that construction work may be accomplished.

Suitable Applications

These practices are implemented for discharges of non-stormwater from construction sites. Non-stormwaters include, but are not limited to, groundwater, water from cofferdams, water diversions, and waters used during construction activities that must be removed from a work area.

Practices identified in this section are also appropriate for implementation when managing the removal of accumulated precipitation (stormwater) from depressed areas at a construction site.

Limitations

- Site conditions will dictate design and use of dewatering operations.
- The controls discussed in this best management practice (BMP) address sediment only.
- The controls detailed in this BMP only allow for minimal settling time for sediment particles. Use only when site conditions restrict the use of the other control methods.
- Dewatering operations will require, and must comply with, applicable local permits.

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- Avoid dewatering discharges where possible by using the water for dust control, by infiltration, etc.

Implementation

- Dewatering non-stormwater cannot be discharged without prior notice to and approval from the Regional Water Quality Control Board (RWQCB) and local stormwater management agency. This includes stormwater that is co-mingled with groundwater or other non-stormwater sources. Once the discharge is allowed, appropriate BMPs must be implemented to ensure the discharge complies with all permit requirements and regional and watershed-specific requirements.

- RWQCB may require a separate NPDES permit prior to the dewatering discharge of non-stormwater. These permits will have specific testing, monitoring, and discharge requirements and can take significant time to obtain.

- The flow chart shown in Figure 1 should be utilized to guide dewatering operations.

- The owner will coordinate monitoring and permit compliance.

- Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.

- Dewatering discharges must not cause erosion at the discharge point.

A variety of methods can be used to treat water during dewatering operations. Several devices are presented below and provide options to achieve sediment removal. The size of particles present in the sediment and Permit or receiving water limitations on sediment are key considerations for selecting sediment treatment option(s); in some cases, the use of multiple devices may be appropriate.

Sediment Basin (see also SE-2)

Description:

- A sediment basin is a temporary basin with a controlled release structure that is formed by excavation or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment basins are generally larger than Sediment Traps (SE-3).

Appropriate Applications:

- Effective for the removal of gravel, sand, silt, some metals that settle out with the sediment, and trash.

Implementation:

- Excavation and construction of related facilities is required.

- Temporary sediment basins must be fenced if safety is a concern.

- Outlet protection is required to prevent erosion at the outfall location.

Maintenance:

- Maintenance is required for safety fencing, vegetation, embankment, inlet and outfall structures, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-half.

Sediment Trap (See also SE-3)

Description:

- A sediment trap is a temporary basin formed by excavation and/or construction of an earthen embankment across a waterway or low drainage area to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment traps are generally smaller than Sediment Basins (SE-2).

Appropriate Applications:

Effective for the removal of large and medium sized particles (sand and gravel) and some metals that settle out with the sediment.

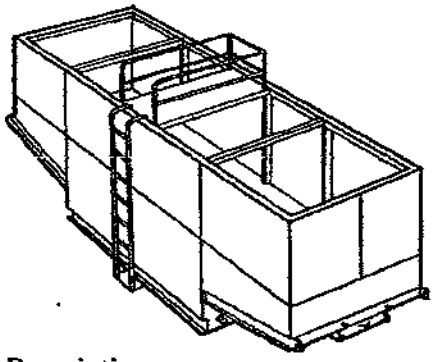
Implementation:

- Excavation and construction of related facilities is required.
- Trap inlets should be located to maximize the travel distance to the trap outlet.
- Use rock or vegetation to protect the trap outlets against erosion.

Maintenance:

- Maintenance is required for vegetation, embankment, inlet and outfall structures, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

Weir Tanks



Description:

- A weir tank separates water and waste by using weirs. The configuration of the weirs (over and under weirs) maximizes the residence time in the tank and determines the waste to be removed from the water, such as oil, grease, and sediments.

Appropriate Applications:

- The tank removes trash, some settleable solids (gravel, sand, and silt), some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

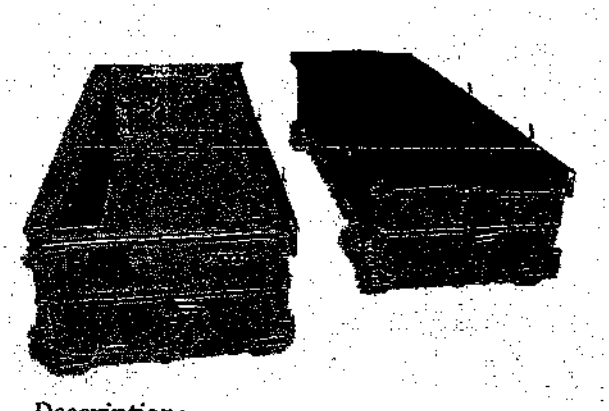
Implementation:

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal must be by licensed waste disposal company.

Dewatering Tanks



Description:

- A dewatering tank removes debris and sediment. Flow enters the tank through the top, passes through a fabric filter, and is discharged through the bottom of the tank. The filter separates the solids from the liquids.

Appropriate Applications:

- The tank removes trash, gravel, sand, and silt, some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

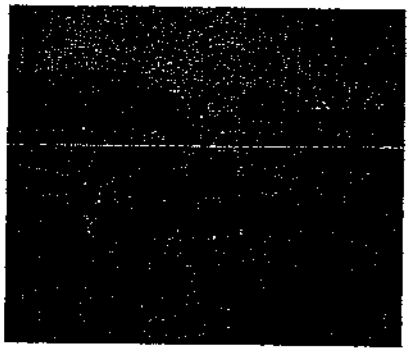
Implementation:

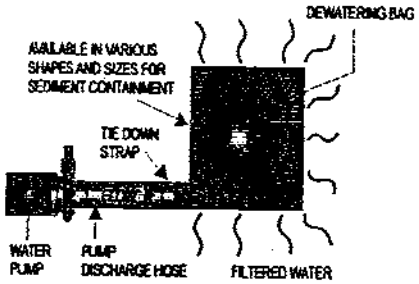
- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal must be by licensed waste disposal company.

Gravity Bag Filter





Description:

- A gravity bag filter, also referred to as a dewatering bag, is a square or rectangular bag made of non-woven geotextile fabric that collects sand, silt, and fines.

Appropriate Applications:

- Effective for the removal of sediments (gravel, sand, and silt). Some metals are removed with the sediment.

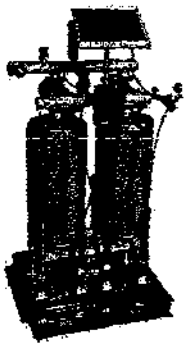
Implementation:

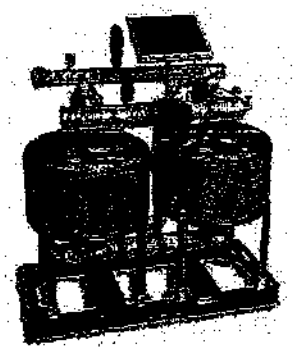
- Water is pumped into one side of the bag and seeps through the bottom and sides of the bag.
- A secondary barrier, such as a rock filter bed or straw/hay bale barrier, is placed beneath and beyond the edges of the bag to capture sediments that escape the bag.

Maintenance:

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier is required.
- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.
- The bag is disposed of offsite.

Sand Media Particulate Filter





Description:

- Water is treated by passing it through canisters filled with sand media. Generally, sand filters provide a final level of treatment. They are often used as a secondary or higher level of treatment after a significant amount of sediment and other pollutants have been removed using other methods.

Appropriate Applications:

- Effective for the removal of trash, gravel, sand, and silt and some metals, as well as the reduction of biochemical oxygen demand (BOD) and turbidity.
- Sand filters can be used for stand-alone treatment or in conjunction with bag and cartridge filtration if further treatment is required.
- Sand filters can also be used to provide additional treatment to water treated via settling or basic filtration.

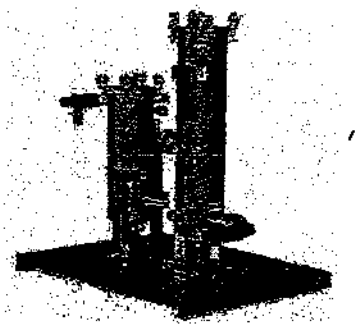
Implementation:

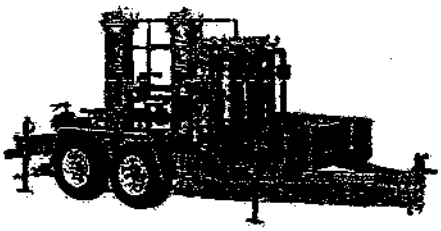
- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

Maintenance:

- The filters require regular service to monitor and maintain the level of the sand media. If subjected to high loading rates, filters can plug quickly.
- Venders generally provide data on maximum head loss through the filter. The filter should be monitored daily while in use, and cleaned when head loss reaches target levels.
- If cleaned by backwashing, the backwash water may need to be hauled away for disposal, or returned to the upper end of the treatment train for another pass through the series of dewatering BMPs.

Pressurized Bag Filter





Description:

- A pressurized bag filter is a unit composed of single filter bags made from polyester felt material. The water filters through the unit and is discharged through a header. Vendors provide bag filters in a variety of configurations. Some units include a combination of bag filters and cartridge filters for enhanced contaminant removal.

Appropriate Applications:

- Effective for the removal of sediment (sand and silt) and some metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Oil absorbent bags are available for hydrocarbon removal.
- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

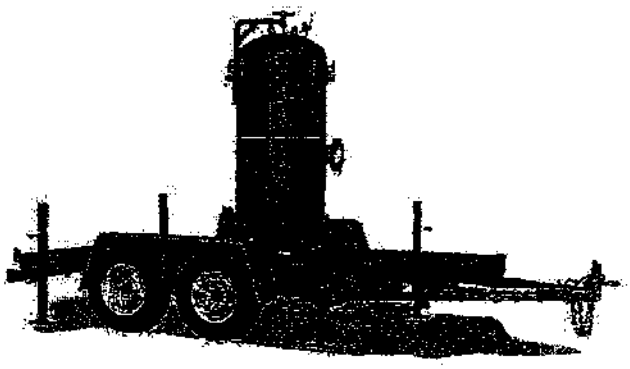
Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

Maintenance:

- The filter bags require replacement when the pressure differential equals or exceeds the manufacturer's recommendation.

Cartridge Filter



Description:

- Cartridge filters provide a high degree of pollutant removal by utilizing a number of individual cartridges as part of a larger filtering unit. They are often used as a secondary or higher (polishing) level of treatment after a significant amount of sediment and other pollutants are removed. Units come with various cartridge configurations (for use in series with bag filters) or with a larger single cartridge filtration unit (with multiple filters within).

Appropriate Applications:

- Effective for the removal of sediment (sand, silt, and some clays) and metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Hydrocarbons can effectively be removed with special resin cartridges.
- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance.

Maintenance:

- The cartridges require replacement when the pressure differential equals or exceeds the manufacturer's recommendation.

Costs

- Sediment controls are low to high cost measures depending on the dewatering system that is selected. Pressurized filters tend to be more expensive than gravity settling, but are often more effective. Simple tanks are generally rented on a long-term basis (one or more months) and can range from $360 per month for a 1,000 gallon tank to $2,660 per month for a 10,000 gallon tank. Mobilization and demobilization costs vary considerably.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Unit-specific maintenance requirements are included with the description of each unit.
- Sediment removed during the maintenance of a dewatering device may be either spread onsite and stabilized, or disposed of at a disposal site as approved by the owner.
- Sediment that is commingled with other pollutants must be disposed of in accordance with all applicable laws and regulations and as approved by the owner.

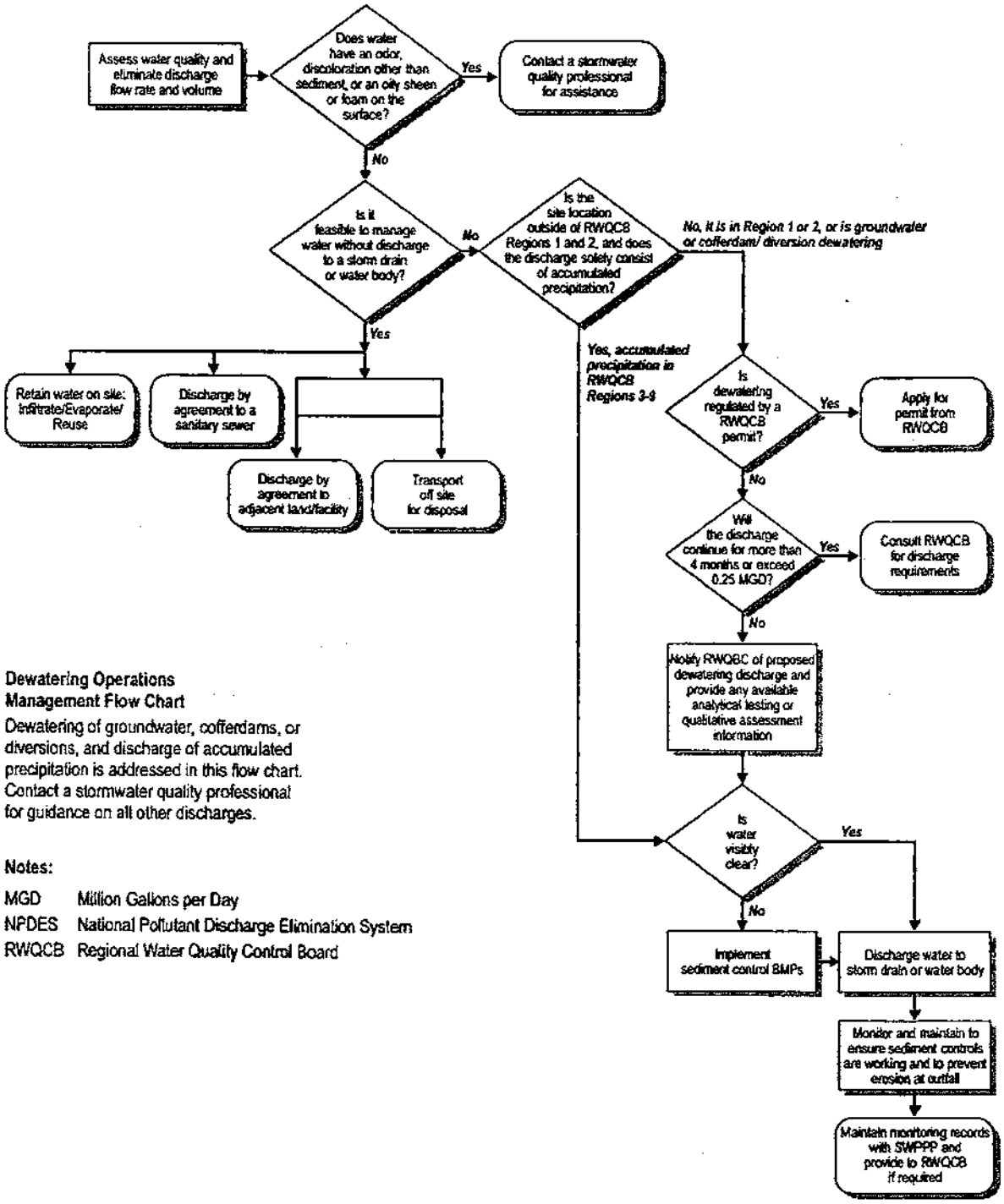
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Labor Surcharge & Equipment Rental Rates, April 1, 2002 through March 31, 2003, California Department of Transportation (Caltrans).



Dewatering Operations Management Flow Chart

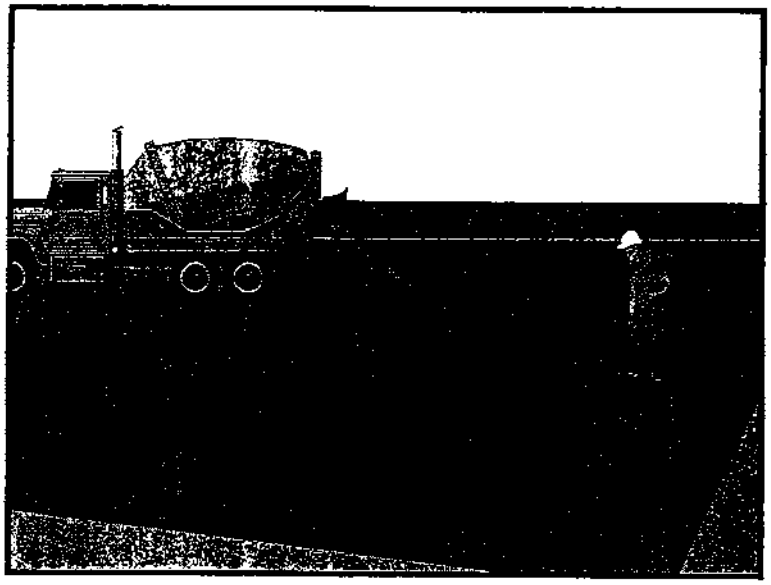
Dewatering of groundwater, cofferdams, or diversions, and discharge of accumulated precipitation is addressed in this flow chart. Contact a stormwater quality professional for guidance on all other discharges.

Notes:

MGD Million Gallons per Day
NPDES National Pollutant Discharge Elimination System
RWQCB Regional Water Quality Control Board

Figure 1
Operations Flow Chart

Paving and Grinding Operations NS-3



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	✓
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

Limitations

- Finer solids are not effectively removed by filtration systems.
- Paving opportunities may be limited during wet weather.

Implementation

General

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is in the forecast.
- Train employees and sub-contractors in pollution prevention and reduction.
- Store materials away from drainage courses to prevent stormwater runon (see WM-1, Material Delivery and Storage).

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- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- If paving involves an onsite mixing plant, follow the stormwater permitting requirements for industrial activities.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses, These materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC and AC waste should be in conformance with WM-8, Concrete Waste Management.

Saw Cutting, Grinding, and Pavement Removal

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:
  - AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drains or watercourses. Install silt fence until structure is stabilized or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; or SE-5, Fiber Rolls.
  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt must be recycled or disposed.
  - Any AC chunks and pieces used in embankments must be placed above the water table and covered by at least 1 ft of material.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Dig out activities should not be conducted in the rain.
- Collect dig out material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.
- If dig out material cannot be recycled, transport the material back to an approved storage site.

Asphaltic Concrete Paving

- If paving involves asphaltic cement concrete, follow these steps:

- Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.

- Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

Portland Cement Concrete Paving

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect and return to aggregate base stockpile or dispose of properly.

- Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if allowed by the local wastewater authority.

Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized.

- Drainage inlet structures and manholes should be covered with filter fabric during application of seal coat, tack coat, slurry seal, and fog seal.

- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

Paving Equipment

- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials rather than burying. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.

- Substances used to coat asphalt transport trucks, and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.

- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.

- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.

- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.

Thermoplastic Striping

- Thermoplastic striper and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Pre-heaters should be filled carefully to prevent splashing or spilling of hot thermoplastic. Leave six inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move when the vehicle is deadheaded.
- Do not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.
- Clean truck beds daily of loose debris and melted thermoplastic. When possible, recycle thermoplastic material.

Raised/Recessed Pavement Marker Application and Removal

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.
- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing when vehicle is deadheaded.
- When servicing or filling melting tanks, ensure all pressure is released before removing lids to avoid spills.
- On large-scale projects, use mechanical or manual methods to collect excess bituminous material from the roadway after removal of markers.

Costs

- All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

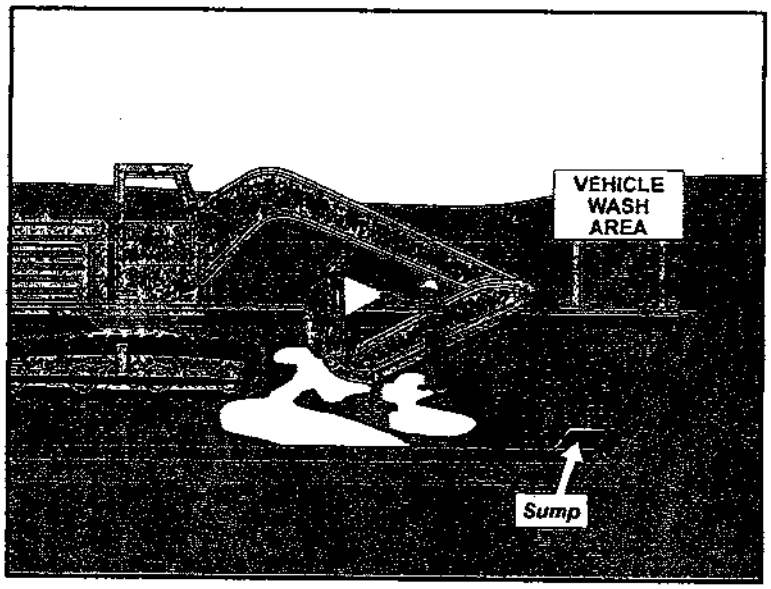
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Hot Mix Asphalt-Paving Handbook AC 150/5370-14, Appendix I, U.S. Army Corps of Engineers, July 1991.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Vehicle and Equipment Cleaning NS-8



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	

Legend:

✓ **Primary Objective**

✓ **Secondary Objective**

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning by using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

Implementation

Use an offsite commercial washing business as much as possible. These businesses are better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.

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- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried, and must be captured and recycled or disposed according to the requirements of WM-10, Liquid Waste Management or WM-6, Hazardous Waste Management, depending on the waste characteristics. Minimize use of solvents. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runon and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and should not discharge to the storm drainage system, watercourses, or to groundwater

Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.

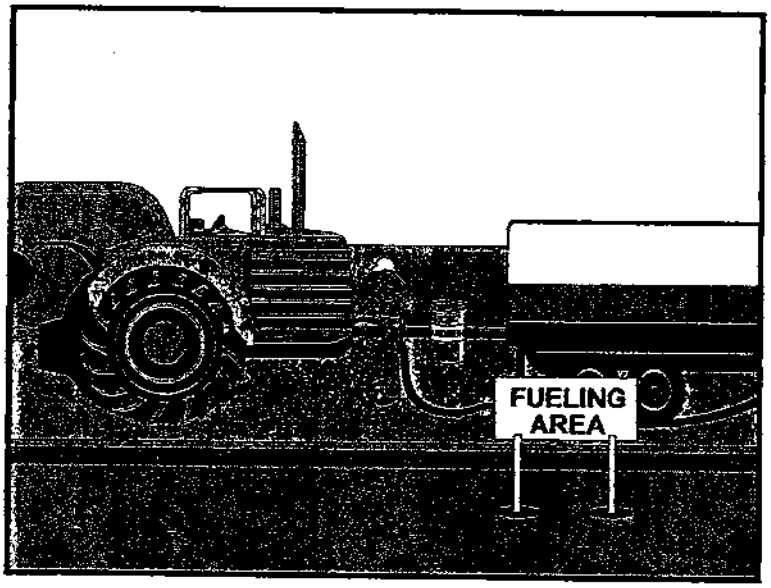
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.
- Inspect sump regularly and remove liquids and sediment as needed.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.

Vehicle and Equipment Fueling NS-9



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	✓
Organics	

Potential Alternatives
None

Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage "topping-off" of fuel tanks.

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- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks, and should be disposed of properly after use.
- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.
- Dedicated fueling areas should be protected from stormwater runon and runoff, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent runon, runoff, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

Inspection and Maintenance

- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately or problem vehicles or equipment should be removed from the project site.
- Keep ample supplies of spill cleanup materials onsite.
- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

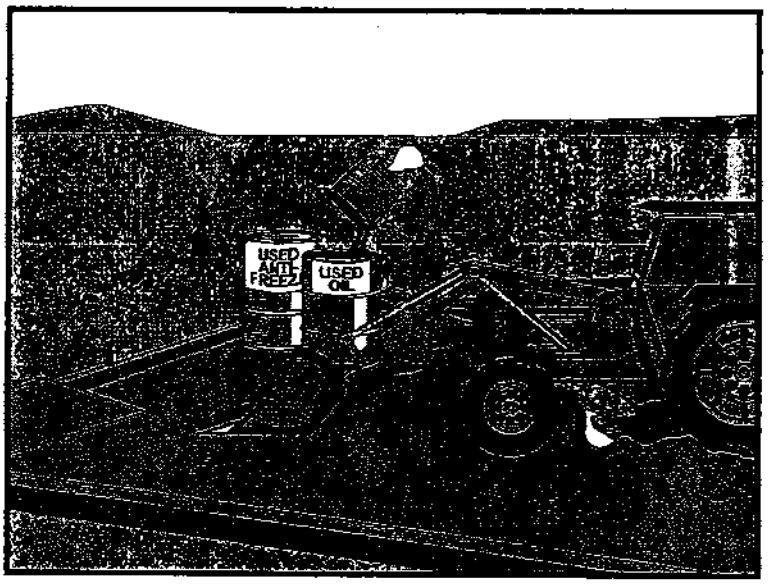
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle & Equipment Maintenance NS-10



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	✓
WM	Waste Management and Materials Pollution Control	

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	✓
Trash	✓
Metals	
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a "dry and clean site". The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

Suitable Applications

These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8, Vehicle and Equipment Cleaning, and NS-9, Vehicle and Equipment Fueling.

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NS-10 Vehicle & Equipment Maintenance

Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runon and runoff, and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.
- Repair leaks of fluids and oil immediately.

Vehicle & Equipment Maintenance NS-10

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

Safer Alternative Products

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an "environmentally friendly" label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling and Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like,-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Costs

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

NS-10 Vehicle & Equipment Maintenance

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Keep ample supplies of spill cleanup materials onsite.
- Maintain waste fluid containers in leak proof condition.
- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately or the problem vehicle(s) or equipment should be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stockpile Management WM-3

Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Stockpile Management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other materials.

Limitations

None identified.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

- Locate stockpiles a minimum of 50 ft away from concentrated flows of stormwater, drainage courses, and inlets.
- Protect all stockpiles from stormwater runon using a temporary perimeter sediment barrier such as berms, dikes, fiber rolls, silt fences, sandbag, gravel bags, or straw bale barriers.

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- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.

Protection of Non-Active Stockpiles

Non-active stockpiles of the identified materials should be protected further as follows:

Soil stockpiles

- During the rainy season, soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- During the non-rainy season, soil stockpiles should be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- During the rainy season, the stockpiles should be covered or protected with a temporary perimeter sediment barrier at all times.
- During the non-rainy season, the stockpiles should be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.

Stockpiles of "cold mix"

- During the rainy season, cold mix stockpiles should be placed on and covered with plastic or comparable material at all times.
- During the non-rainy season, cold mix stockpiles should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

Stockpiles/Storage of pressure treated wood with copper, chromium, and arsenic or ammonical, copper, zinc, and arsenate

- During the rainy season, treated wood should be covered with plastic or comparable material at all times.
- During the non-rainy season, treated wood should be covered with plastic or comparable material at all times and cold mix stockpiles should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

Protection of Active Stockpiles

Active stockpiles of the identified materials should be protected further as follows:

- All stockpiles should be protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of "cold mix" should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

Costs

All of the above are low cost measures.

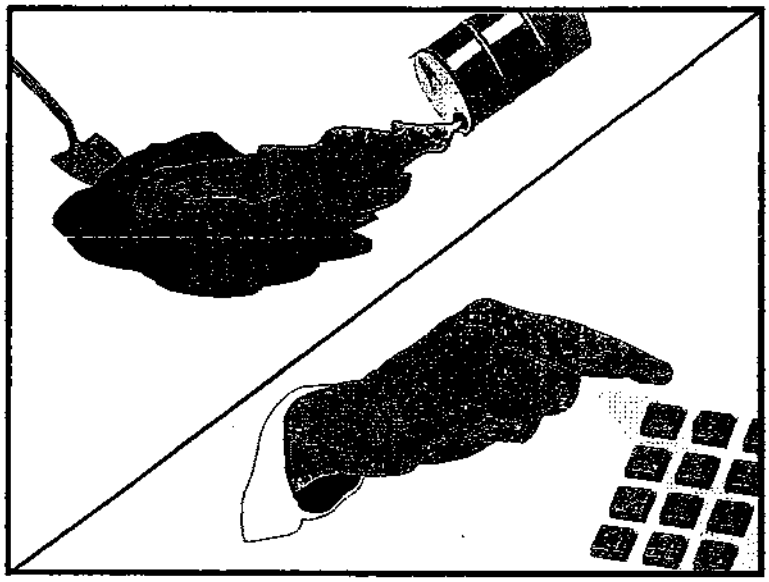
Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Spill Prevention and Control WM-4



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

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- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
  - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
  - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  - Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
  - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

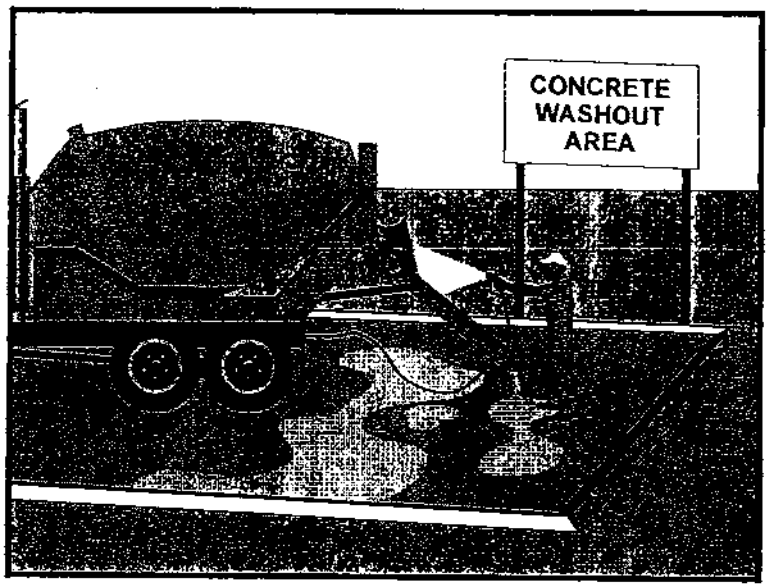
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Concrete Waste Management WM-8



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout offsite, performing onsite washout in a designated area, and training employee and subcontractors.

Suitable Applications

Concrete waste management procedures and practices are implemented on construction projects where:

- Concrete is used as a construction material or where concrete dust and debris result form demolition activities
- Slurries containing portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition
- Concrete trucks and other concrete-coated equipment are washed onsite
- Mortar-mixing stations exist
- See also NS-8, Vehicle and Equipment Cleaning

Limitations

- Offsite washout of concrete wastes may not always be possible.

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Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.
- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete.
- Perform washout of concrete trucks offsite or in designated areas only.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - Locate washout area at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
  - Wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed properly.
- Avoid creating runoff by draining water to a bermed or level area when washing concrete to remove fine particles and expose the aggregate.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.

Education

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.
- Arrange for contractor's superintendent or representative to oversee and enforce concrete waste management procedures.

Concrete Slurry Wastes

- PCC and AC waste should not be allowed to enter storm drains or watercourses.
- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility.
- A sign should be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.

- Below grade concrete washout facilities are typical. Above grade facilities are used if excavation is not practical.
- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.
- Saw-cut PCC slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.
- Slurry residue should be vacuumed and disposed in a temporary pit (as described in OnSite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.
- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete wash out.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of hardened concrete on a regular basis.
- Temporary Concrete Washout Facility (Type Above Grade)
  - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and

minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.

- Straw bales, wood stakes, and sandbag materials should conform to the provisions in SE-9, Straw Bale Barrier.

- Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- Temporary Concrete Washout Facility (Type Below Grade)

  - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.

  - Lath and flagging should be commercial type.

  - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and disposed of. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and disposed of.

- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

- Temporary concrete washout facilities should be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and disposed of.

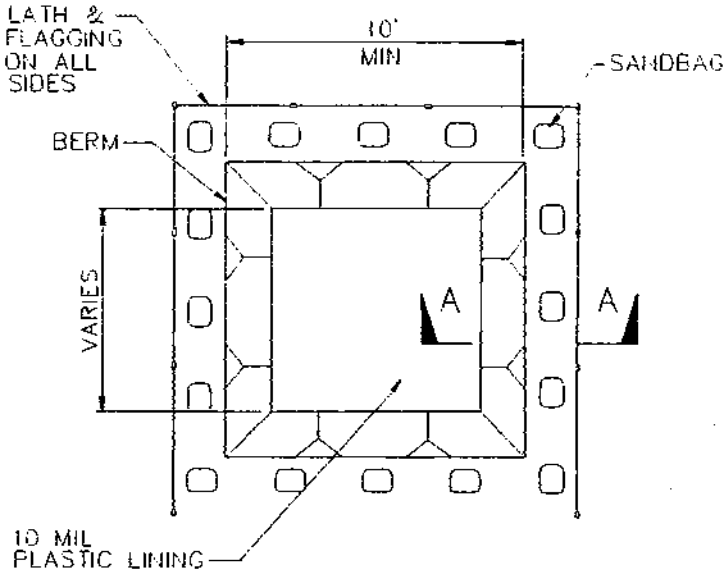
- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

References

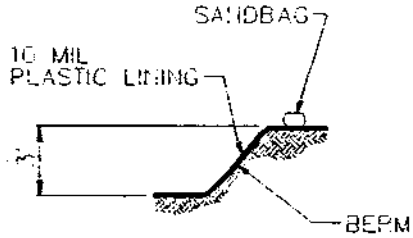
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

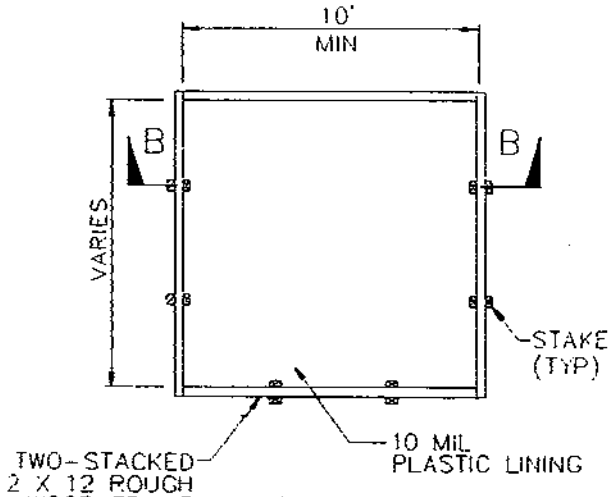
Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



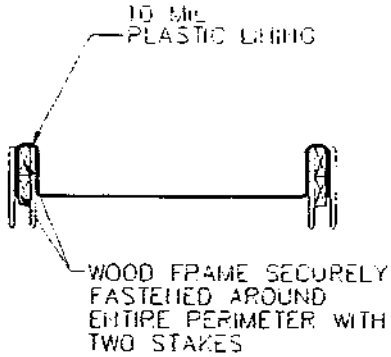
PLAN
NOT TO SCALE
TYPE "BELOW GRADE"



SECTION A–A
NOT TO SCALE



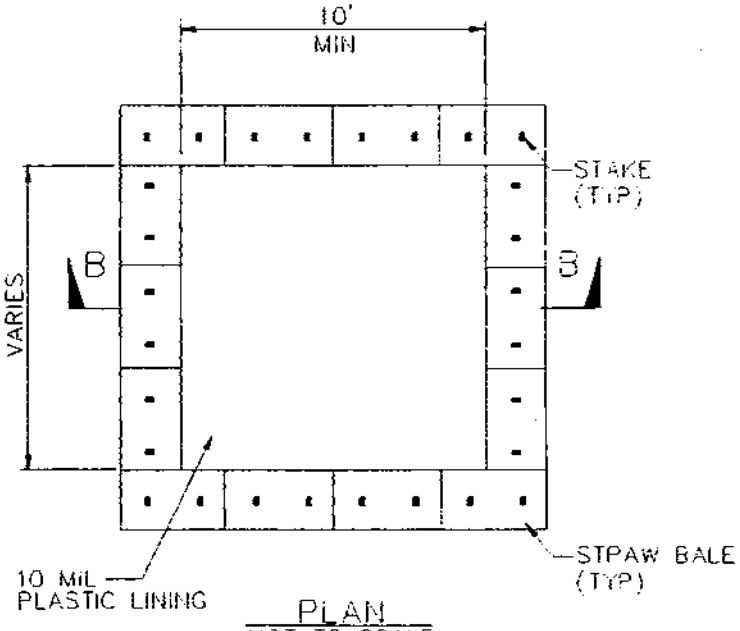
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"



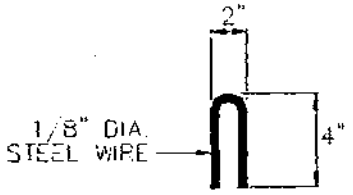
SECTION B–B
NOT TO SCALE

NOTES

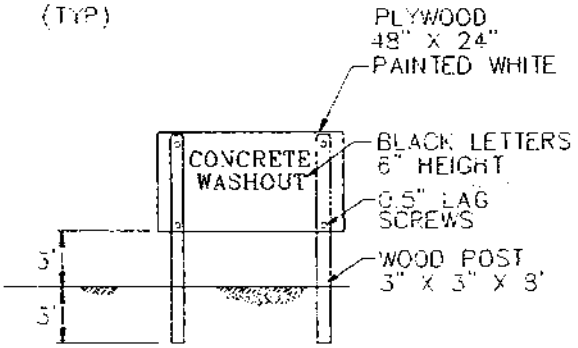
1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



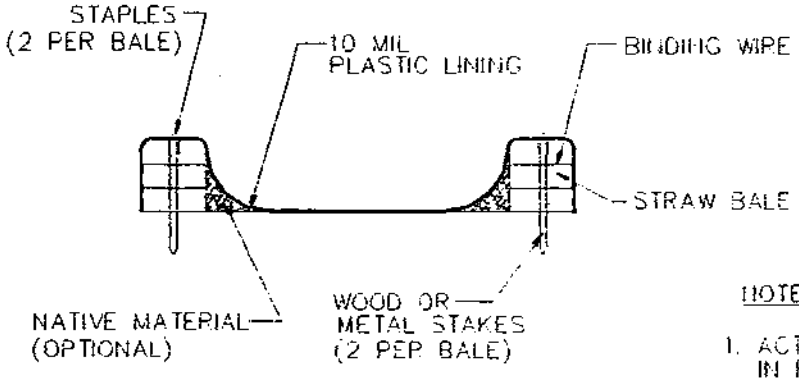
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"
WITH STRAW BALES



STAPLE DETAIL



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)

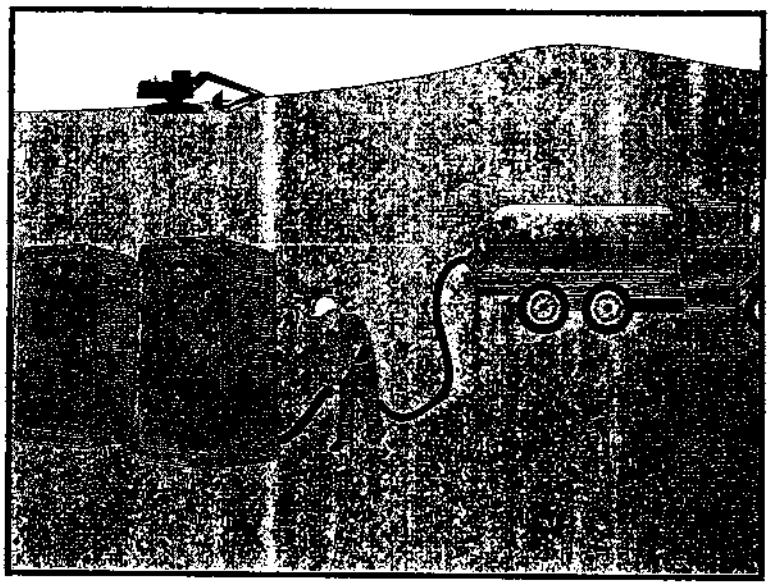


SECTION B-B
NOT TO SCALE

NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

Sanitary/Septic Waste Management WM-9



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	✓

Legend:
✓ **Primary Objective**
✓ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	✓
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	✓

Potential Alternatives

None

Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.
- Wastewater should not be discharged or buried within the project site.

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WM-9 Sanitary/Septic Waste Management

- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Untreated raw wastewater should never be discharged or buried.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.

Education

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Appendix O

Overview of Regional Groundwater and Surface Water Conditions in the Vicinity of Boeing Realty Corporation's Former C-1 Facility

MAY 12, 2003

D R A F T

REVISION 1.0

OVERVIEW OF REGIONAL GROUNDWATER AND SURFACE WATER CONDITIONS IN THE VICINITY OF BOEING REALTY CORPORATION'S FORMER C-1 FACILITY LONG BEACH, CALIFORNIA

PREPARED FOR:
BOEING REALTY CORPORATION

HARGIS + ASSOCIATES, INC.
HYDROGEOLOGY • ENGINEERING

OVERVIEW OF REGIONAL GROUNDWATER AND SURFACE WATER CONDITIONS IN THE VICINITY OF BOEING REALTY CORPORATION'S FORMER C-1 FACILITY LONG BEACH, CALIFORNIA

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1.1.1 Local Conditions 2
1.2 GROUNDWATER USE / WATER RESOURCES 4
2.0 SURFACE WATER FEATURES 6
3.0 REFERENCES 8

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2	CROSS SECTION LOCATIONS	410-2759 C
3	CROSS SECTIONS E'-E" AND M'-M"	310-0294 A
4	WATER SUPPLY WELLS WITHIN APPROXIMATELY 1 MILE OF FORMER C-1 FACILITY	410-3011 C
5	TOTAL MONTHLY GROUNDWATER PRODUCTION WITHIN APPROXIMATELY 1 MILE OF FORMER C-1 FACILITY	620-0347A
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ACRONYMS AND ABBREVIATIONS

BRC	Boeing Realty Corporation
CDWR	California Department of Water Resources
DOI-FWS	U.S. Department of the Interior, Fish and Wildlife Services
ESA	Environmental Site Assessment
H+A	Hargis + Associates, Inc.
RWQCB	Regional Water Quality Control Board

OVERVIEW OF REGIONAL GROUNDWATER AND SURFACE WATER CONDITIONS IN THE VICINITY OF BOEING REALTY CORPORATION'S FORMER C-1 FACILITY LONG BEACH, CALIFORNIA

At the request of the Boeing Realty Corporation (BRC), Hargis + Associates, Inc. (H+A) has prepared the following report regarding groundwater and surface water resources in the vicinity of the BRC former C-1 facility located in Long Beach, California.

1.0 GROUNDWATER CONDITIONS

This section provides an overview of the geology, hydrogeology, beneficial groundwater use, and water resources in the vicinity of the former C-1 facility. The definition of hydrogeologic units utilized in this section is based on information contained in the California Department of Water Resources (CDWR), Bulletin 104 (CDWR, 1961), and on data developed during groundwater assessment conducted at the Site (H+A, 2002).

The former C-1 facility is located within the Bouton Plain physiographic area of the Los Angeles Basin. The Bouton Plain slopes northward from Signal Hill, located approximately 2 miles southwest of the former C-1 facility, toward the Downey Plain. Signal Hill is part of the Newport-Inglewood Uplift, which is characterized by a northwest trending belt of low-lying hills created by folding and faulting along the Newport-Inglewood Fault Zone.

The physical nature of the sediments underlying the former C-1 facility and the surrounding area strongly influences the occurrence and usability of groundwater resources as well as the migration of chemicals dissolved in groundwater. The following sections summarize the subsurface conditions that pertain to the groundwater resources and groundwater quality in the former C-1 facility vicinity.

1.1 NATURE OF SEDIMENTS

The Site is located in the southwestern portion of the Central Basin Pressure Area of the Central Groundwater Basin in the Los Angeles Coastal Plain. Known water-bearing deposits in the Lakewood and San Pedro Formations extend to depths greater than 1,250 feet below ground surface near the Site. Aquifer systems identified in this area of the Central Basin include the shallow aquifer system of the Lakewood Formation and the deep aquifer system of the San Pedro Formation (Figure 1). The shallow aquifer system includes the Artesia and Gage aquifers, which are not currently used as a water supply. The deep aquifer system includes the underlying Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside aquifers, which are used for beneficial water supply purposes.

1.1.1 Local Conditions

The hydrostratigraphic units at the Site have been defined based on a review and evaluation of data generated during groundwater assessment at the Site (H+A, 2002). The groundwater assessment program included detailed analysis and sample collection from the water table in the Bellflower aquitard to the Gage aquifer. The hydrostratigraphic unit definition included comprehensive analysis of lithologic and geophysical data collected during well and exploratory borehole construction, analysis of CPT logs, and analysis of vertical hydraulic gradients across various stratigraphic zones.

The hydrostratigraphic units of interest include the Bellflower aquitard, a deeper sand on the western portion of the Site, the Artesia aquifer on the eastern portion of the Site, the Gage aquifer, which is the first laterally continuous aquifer underlying the Site, and the deep aquifer system (Figures 2 and 3). The depth intervals of the aquifers and aquitards vary beneath the former C-1 facility, but can be generally characterized as follows from east to west:

Hydrogeologic Unit(s)	East Side (Approximate feet below land surface)	West Side (Approximate feet below land surface)
Shallow Bellflower Aquitard	0 to 50	0 to 10
Middle Bellflower Aquitard	65 to 80	40 to 45
Deep Bellflower Aquitard	85 to 120	45 to 55
Deeper Sand	80 to 95	Does not appear to be present
Artesia Aquifer (shallow aquifer system)	125 to 164	Does not appear to be present
Unnamed Aquitard	164 to 201	110 to 136
Gage Aquifer (shallow aquifer system)	201 to 277	136 to 206
Unnamed Aquitard	277 to 290	206 to 250
Deep aquifer system (aquifers and aquitards)	290 to 1,000+	250 to 1,000+

The hydrostratigraphic units of interest are briefly described below:

- BELLFLOWER AQUITARD: First groundwater is encountered under the Site within the Bellflower aquitard. The Bellflower aquitard comprises the upper unit of the Lakewood Formation. The Bellflower aquitard is a heterogeneous mixture composed primarily of low permeability silts and clays, with lenses and layers of fine sand. The Bellflower aquitard is known to have relatively low hydraulic conductivities due to the predominant fine-grained nature of this unit. The Bellflower aquitard has been divided into different zones based on lithology. There are relatively coarse and fine zones within the Bellflower aquitard.

- DEEPER SAND: On the western portion of the Site, there is a zone referred to as the deeper sand. The deeper sand underlies a silt/clay stratum near the base of the Bellflower aquitard. It is not clear whether the deeper sand is part of the Bellflower aquitard or a zone underlying the Bellflower aquitard. Moving to the east under the center of the Site, the deeper sand zone appears to transition into a finer grained zone.

- ARTESIA AQUIFER: On the eastern portion of the Site near Lakewood Boulevard, there is a relatively sandy zone underlying the Bellflower aquitard. Based on published information (CDWR, 1961), this sandy zone may be the Artesia aquifer. The Artesia

aquifer gains thickness to the east of the Site (CDWR, 1961). The Artesia aquifer is part of the shallow aquifer system, which is not currently used for water supply purposes in the vicinity of the Site.

- UNNAMED AQUITARD: Underlying the deeper sand on the western portion of the Site, the finer sediments in the center of the Site, and the Artesia aquifer on the eastern portion of the Site is another aquitard, referred to as the unnamed aquitard.

- GAGE AQUIFER: Underlying the unnamed aquitard, is the first laterally continuous aquifer under the Site, the Gage aquifer. The Gage aquifer is at the base of the Lakewood Formation and is the lowest aquifer within the shallow aquifer system. The Gage aquifer is not currently used for water supply purpose in the vicinity of the Site.

- DEEP AQUIFER SYSTEM: Underlying the Gage aquifer is another aquitard, which in turn is underlain by the deeper aquifer system that is used for water supply in the vicinity of the Site. The uppermost aquifers in the deep aquifer system are in the San Pedro Formation.

1.2 GROUNDWATER USE / WATER RESOURCES

This section provides an overview of groundwater use in the vicinity of the former C-1 facility, including the California Environmental Protection Agency Regional Water Quality Control Board's (RWQCB's) beneficial use policy, ambient groundwater conditions, and local groundwater production. The RWQCB Basin Plan Policy designates groundwater at and in the vicinity of the facility as having existing beneficial uses for municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply (RWQCB, 1994). The Central Basin has been adjudicated and; therefore, groundwater extraction and use can only be conducted by those entities that have water rights.

In practice, ambient water quality conditions in shallow water bearing zones within the Central Basin frequently do not meet water quality objectives for municipal water supply purposes. In

addition, first groundwater is encountered in the Bellflower aquitard, which does not yield adequate quantities of ground water for municipal supply purposes. Water supply wells in the area of the facility do not currently produce groundwater from the Bellflower aquitard, Artesia aquifer, or Gage aquifer. The water supply wells are generally perforated adjacent to aquifers of the deep aquifer system. Groundwater production in this portion of the Central Basin is primarily from the deep regional aquifer system, which occurs below the Gage aquifer and includes the Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside aquifers.

Information obtained from the City of Long Beach and the CDWR, was used to update the number and location of water supply wells in the vicinity of the former C-1 facility. Ten active water supply wells are located within approximately one mile of the former C-1 facility (Figure 4). In addition, Figure 4 depicts the locations of two aquifer storage and recovery wells currently being constructed in the vicinity of the former C-1 facility.

The nearest active municipal supply wells to the former C-1 facility are well 937A located approximately 1,200 feet west of the former C-1 facility and well 967J located approximately 500 feet east of the former C-1 facility (Figure 4). Well 937A is perforated from 260 to 1,030 feet and well 967J is perforated in the depth interval from 300 to 800 feet.

The Watermaster has published monthly production totals for all holders of water rights in their annual reports since about 1963. Watermaster data are current through June 2002. A graph of monthly groundwater production since 1963 for wells located within approximately one mile of the Long Beach Airport has been prepared (Figure 5).

2.0 SURFACE WATER FEATURES

The following section provides an overview of surface water features in the vicinity of the former C-1 facility, and is based primarily on information provided in the Phase I Environmental Site Assessment (ESA) Report For The Boeing Long Beach C-1 Facility (Tetra Tech, 2000). There are no surface water bodies or wetlands located on the former C-1 facility property. The primary surface water bodies identified within a 2-mile radius of the former C-1 facility are ponds associated with golf courses or public parks, and flood control channels. Although none of these surface water bodies have significant domestic or industrial value, they have been included in the U. S. Department of the Interior Fish and Wildlife Services (DOI-FWS) National Wetlands Inventory for their ecological importance. Figure 6 shows the locations of these surface water bodies and wetlands.

According to DOI-FWS, wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. A wetland typically has one or more of the following characteristics: 1) predominantly hydrophytes (plants specifically adapted to live in wetlands) at least periodically; 2) the substrate is predominantly undrained hydric (wetland) soils; 3) the substrate is non-soil and is saturated with water or is covered by shallow water at some times during the growing season of each year. Based on the DOI-FWS classification, a total of 10 wetlands are present within a 2-mile radius of the former C-1 facility. Nine are grouped in the Palustrine System and one in the Riverine System. The Palustrine System includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all wetlands that occur in tidal areas with less than 0.5 parts per thousand salinity from ocean-derived salts. Therefore, the Palustrine System contains most of the shallow freshwater wetlands in the United States. The Riverine System includes tidal and non-tidal wetlands associated with rivers, channels, or streams with water depths greater than 6.6 feet in low water. The following table lists the 10 wetlands, their complete classification, and distance to the former C-1 facility.

Wetlands within a 2-Mile Radius of the Former C-1 facility

Location	NWI Wetland Designation	No. of Sites	Classifications	Approx. Distance to C-1 Facility
Lakewood Golf Course (Bouton Lake)	P-OW-Z	3	Palustrine, Open Water, Intermittently Exposed or Permanent	400 feet to the north
	S-SS-Y	1	Palustrine, Scrub/Scrub, Saturated/Semi-permanent/Seasonals	600 feet to the northwest
Skylinks Golf Course	P-OW-Y	2	Palustrine, Scrub/Scrub, Saturated/Semi-permanent/Seasonals	1,200 feet to the southeast
Heartwell Park	P-OW-Y	1	Palustrine, Scrub/Scrub, Saturated/Semi-permanent/Seasonals	3,250 feet to the east
All Souls Cemetery	P-EM-Y	1	Palustrine, Scrub/Scrub, Saturated/Semi-permanent/Seasonals	3,250 feet to the northwest
Los Cerritos Channel	R-4-SB-Y	1	Palustrine, Scrub/Scrub, Saturated/Semi-permanent/Seasonals	4,500 feet to the southeast
E. of Redondo Ave. W. of Kilroy Airport Way, S. of LB Airport, and N. of Frwy 405	P-OW-Z	1	Palustrine, Open Water, Intermittently Exposed or Permanent	5,000 feet to the south

The nearest surface water body to the former C-1 facility is Bouton Lake, which is located at the Lakewood golf course approximately 400 feet to the north.

3.0 REFERENCES

California Department of Water Resources (CDWR), 1961. Bulletin No. 104, Planned Utilization of the Ground Water Basins of the Coastal Plain of Los Angeles County, Appendix A Ground Water Geology. June 1961. Reprinted May 1990.

California Environmental Protection Agency, Regional Water Quality Control Board (RWQCB), 1994. Water Quality Control Plan, Los Angeles Region. June 13, 1994.

Hargis + Associates, Inc., 2002. Site Wide Groundwater Assessment Report, Boeing Realty Corporation, Former C-1 Facility, Long Beach, California. Prepared for Boeing Realty Corporation. February 28, 2002.

Tetra Tech, Inc., 2000. Phase I Environmental Site Assessment (ESA) Report for the Boeing Long Beach C-1 Facility. February 2000.

SYSTEM	SERIES	FORMATION	LITHOLOGY	AQUIFERS AND AQUITARDS	LOCAL THICKNESS (feet)
QUATERNARY	RECENT	ALLUVIUM		BELLFLOWER AQUITARD	10-200
	UPPER PLEISTOCENE	LAKEWOOD FORMATION		ARTESIA AQUIFER	0-140
				GAGE AQUIFER	15-115
		UNCONFORMITY			
	LOWER PLEISTOCENE	SAN PEDRO FORMATION		HOLLYDALE AQUIFER	0-90
				JEFFERSON AQUIFER	0-60
				LYNWOOD AQUIFER	25-180
				SILVERADO AQUIFER	170-460
				SUNNYSIDE AQUIFER	70-500
	LOCAL UNCONFORMITY				
TERTIARY	UPPER PLIOCENE	PICO FORMATION		UNDIFFERENTIATED	

LEGEND OF LITHOLOGY

- GRAVEL AND SAND
- SAND
- SILTY OR SANDY CLAY
- CLAY OR SHALE

NOTE: ADAPTED FROM CALIFORNIA DEPARTMENT OF WATER RESOURCES BULLETIN NO. 104 APPENDIX A, 1961.

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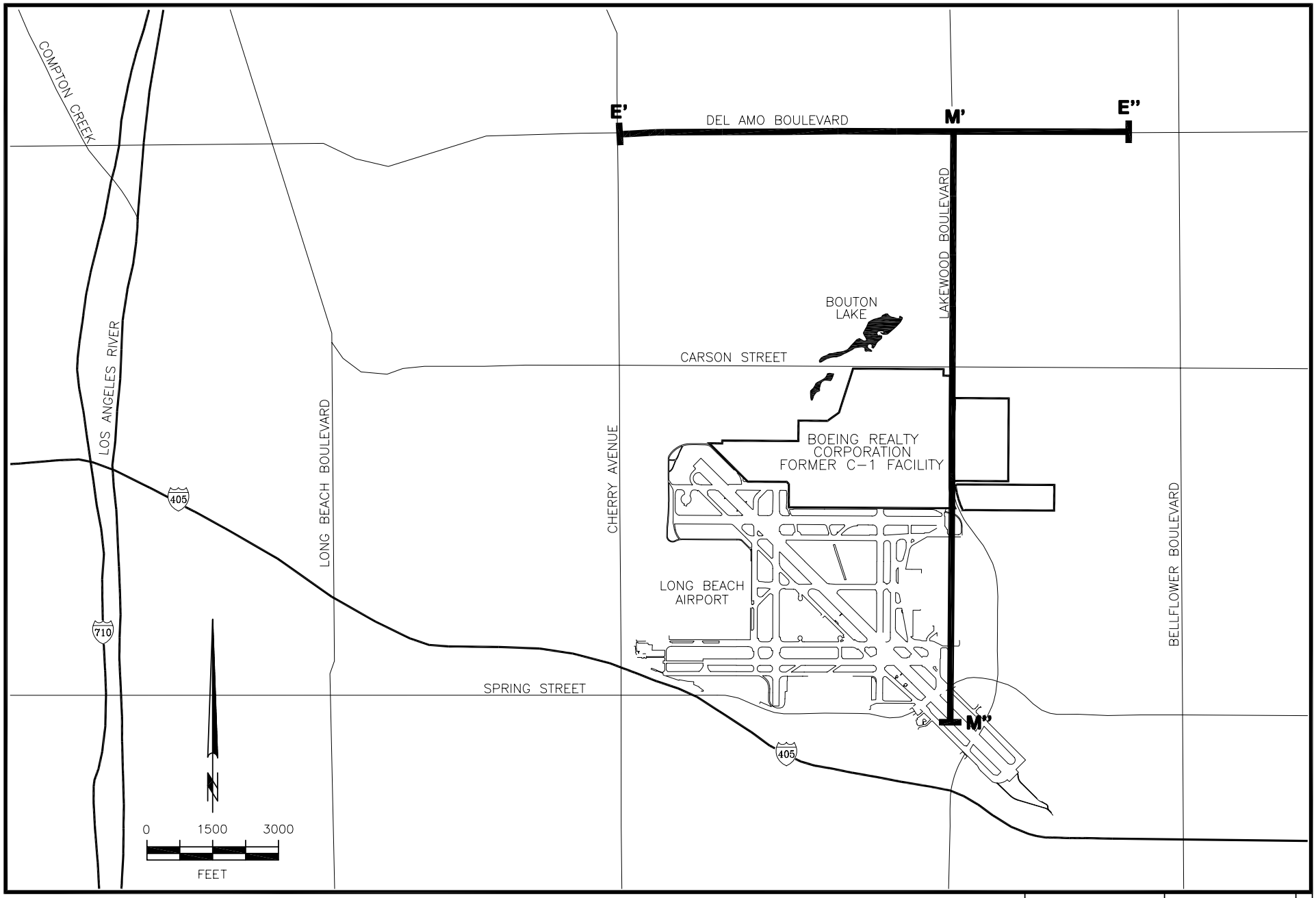
FIGURE 1. GENERALIZED STRATIGRAPHIC COLUMN



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RPT NO. 766.04 | 410-2759 | C

FIGURE 2. CROSS SECTION LOCATIONS

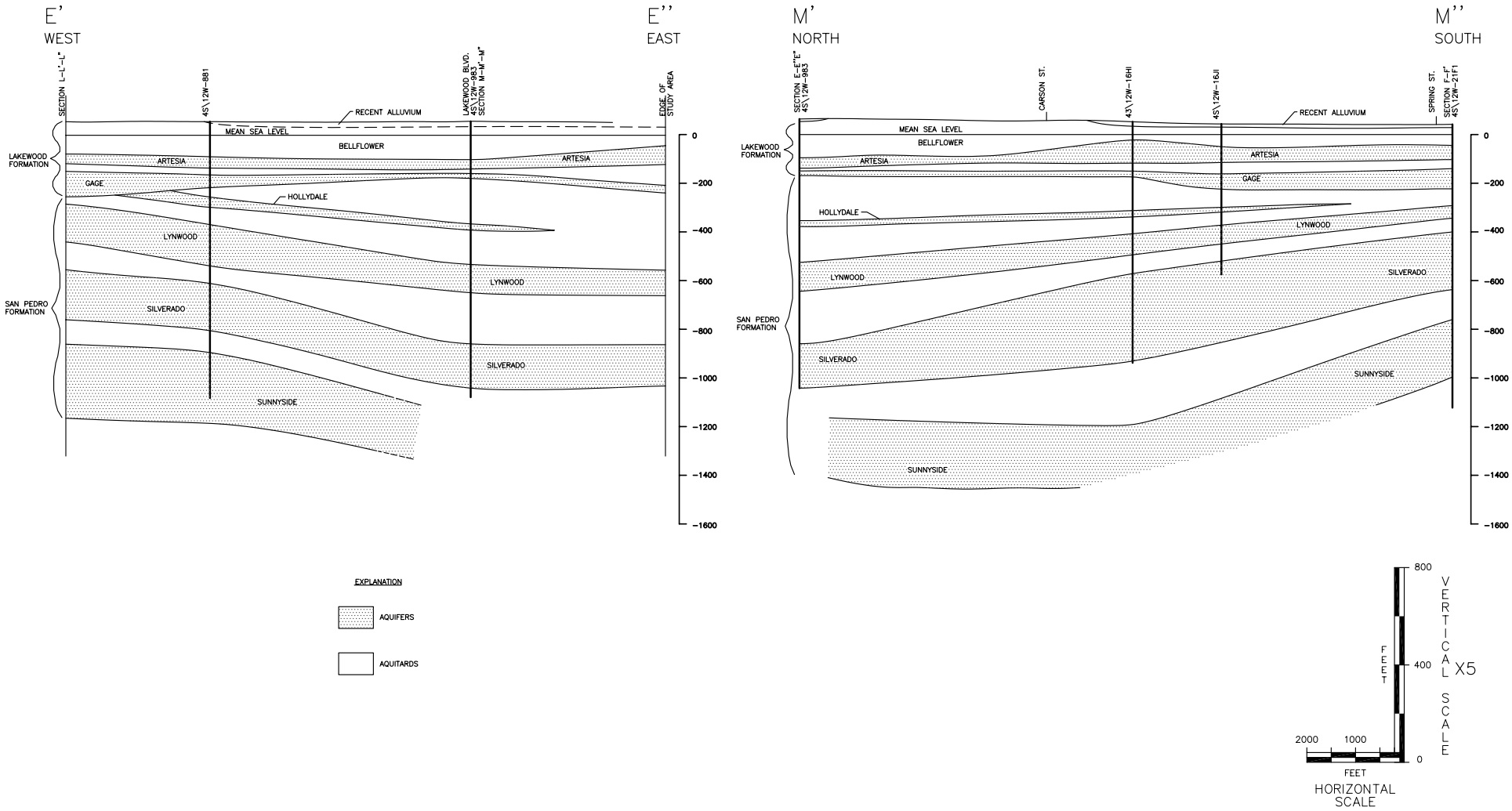

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FIGURE 3. CROSS SECTIONS E'-E" AND M'-M"

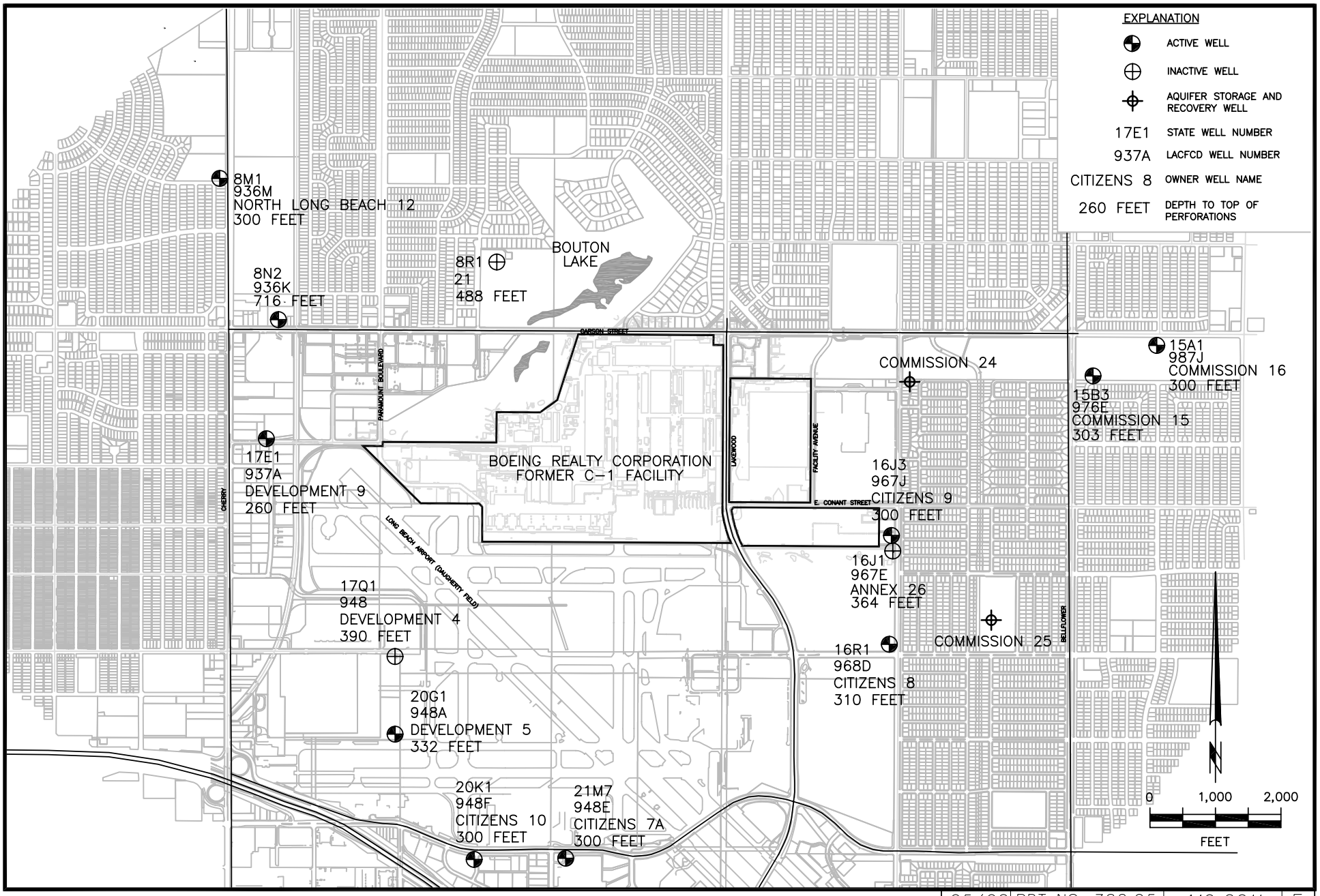

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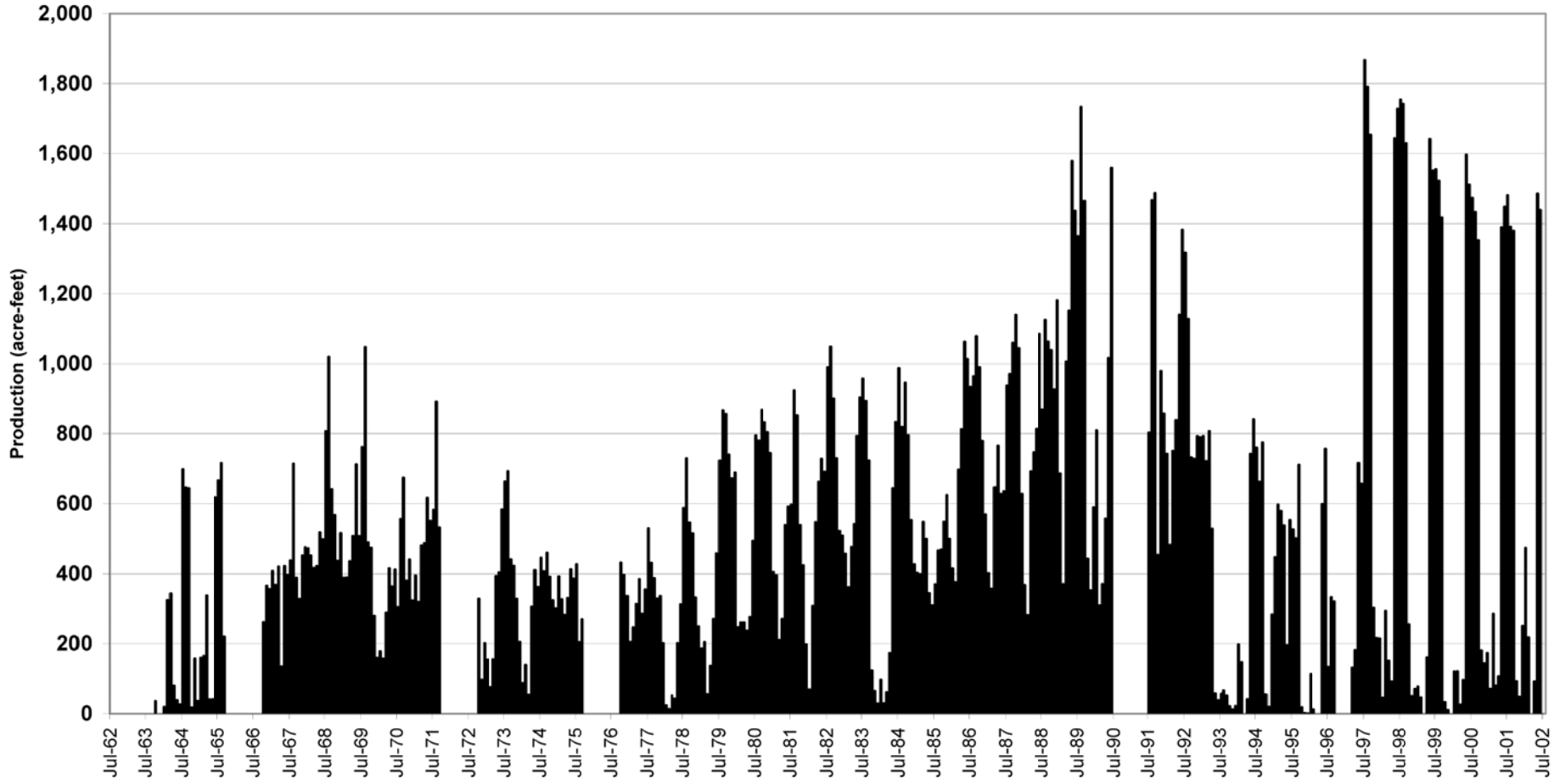
FIGURE 4. WATER SUPPLY WELLS WITHIN APPROXIMATELY 1 MILE OF THE FORMER C-1 FACILITY



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05/03	RPT NO. 766	620-0347	A

FIGURE 5.
TOTAL MONTHLY GROUNDWATER PRODUCTION WITHIN APPROXIMATELY 1-MILE OF FORMER C-1 FACILITY

Appendix P

Noise Assessment Technical Report

DRAFT NOISE ASSESSMENT TECHNICAL REPORT

PacifiCenter @ Long Beach

Prepared by:

PCR SERVICES CORPORATION

January 2004

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1.0 INTRODUCTION

Boeing Realty Corporation, the project Applicant, proposes PacifiCenter @ Long Beach (hereafter referred to as the PacifiCenter or proposed project), which will result in the redevelopment of approximately 261 acres of the former and existing Boeing C-1 aircraft production facilities located within the Cities of Long Beach and Lakewood. Project implementation will provide for the replacement of over five million square feet of research and development (R&D), office, warehousing, manufacturing, and other aviation-related floor area previously occupied on the project site with new R&D, light industrial, office, retail, hotel, residential, aviation-related, a 66 kV substation, and ancillary uses. The PacifiCenter is anticipated to be fully developed by the year 2020.

The purpose of this report is to: (1) address existing noise sources around the proposed project site; and (2) evaluate future noise and vibration levels from construction activities, vehicular traffic, and facility operations associated with the proposed project. To determine if there are noise and vibration impacts, predicted noise levels are compared to the appropriate noise and vibration standards as well as recognized noise and vibration criteria. This report is divided into the following subsections:

- Section 2.0, Noise and Vibration Descriptors;
- Section 3.0, Receptor Locations;
- Section 4.0, Significance Criteria;
- Section 5.0, Baseline Conditions;
- Section 6.0, Analysis of Impacts;
- Section 7.0, Mitigation Measures; and
- Section 8.0, Conclusions.

2.0 NOISE AND VIBRATION DESCRIPTORS

2.1 NOISE

Noise is most often defined as unwanted sound. Although sound can be easily measured, the perceptibility of sound is subjective and the physical response to sound complicates the analysis of its impact on people. People judge the relative magnitude of sound sensation in subjective terms such as “noisiness” or “loudness.” Sound pressure magnitude is measured and quantified using a logarithmic ratio of pressures, the scale of which gives the level of sound in decibels (dB).

The human hearing system is not equally sensitive to sound at all frequencies. Therefore, to approximate this human, frequency-dependent response, the A-weighting filter system is used to adjust measured sound levels. The A-weighted sound level is expressed in "dBA" or "dB(A)." Figure 1 on page 3 provides typical A-weighted sound levels measured for various sources, as well as people’s responses to these levels.

When sound is measured for distinct time intervals, the statistical distribution of the overall sound level can be obtained for that period. The energy-equivalent sound level (L_{eq}) is the most common parameter associated with such measurements. The L_{eq} metric is a single-number noise descriptor that represents the average sound level over a given period of time, where the actual sound level varies with time. L_{max}, L_{min}, and L_{XX} are also common noise descriptors. L_{max} and L_{min} are the maximum and minimum noise levels, respectively, over a given period of time and L_{XX}, known as a statistical sound level, is the time-varying noise level which will be exceeded xx percent of the time.

Although the A-weighted scale accounts for the range of people’s response and, therefore, is commonly used to quantify individual event or general community sound levels, the degree of annoyance or other response effects also depends on several other perceptibility factors. These factors include:

- ambient (background) sound level;
- magnitude of the event sound level with respect to the background;
- duration of the sound event;
- number of event occurrences and their repetitiveness; and
- time of day that the event occurs.

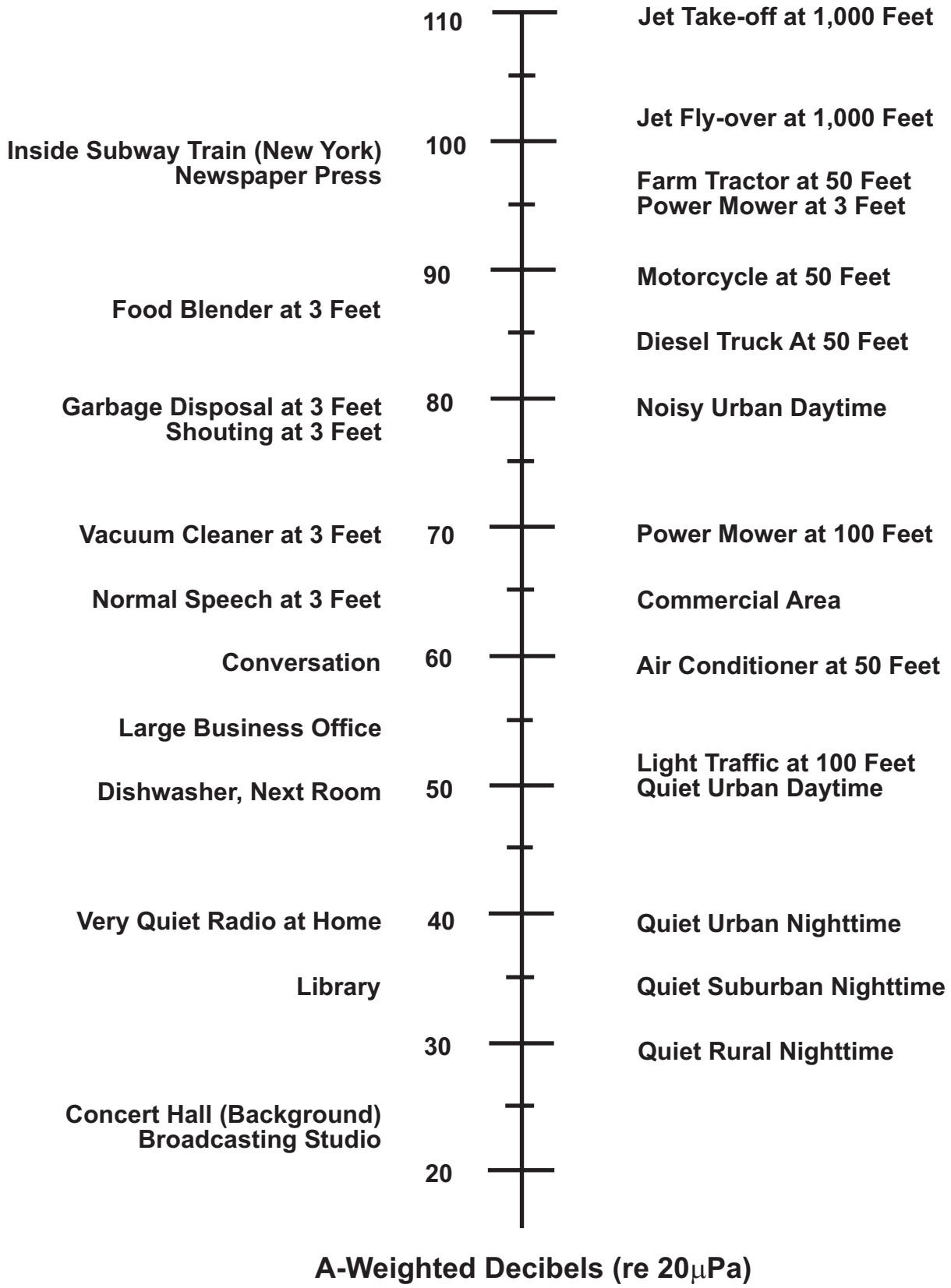

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Figure 1
A-Weighted Sound Levels

Source: Compiled by Hodges & Shutt from Various Sources (December 1993)

Noise metrics can be categorized as single event metrics and cumulative metrics. Single event metrics describe the noise from individual events, such as an individual aircraft flyover. Cumulative metrics describe the noise in terms of total noise exposure throughout an extended period of time, such as a full day.

A Single Event Noise Exposure Level (SENEL) is a single event metric reported for aircraft takeoffs and landings. This metric is essentially equivalent to the Sound Exposure Level (SEL) metric and accounts for the maximum noise level of the event and the duration of the event. The relationship between SENEL and the L_{max} is not constant, however. For most aircraft noise events, SENEL is about 5 to 10 dB higher than L_{max}. The SENEL value is the integration of all the acoustic energy contained within the event. Previous studies have addressed the effects of SENEL on speech and sleep. The Federal Interagency Committee on Aviation Noise (FICAN) in 1997 recommended use of a particular dose-response curve that can be used to estimate "the maximum percent of the exposed population expected to be behaviorally awakened" from the SENEL. This is referred to as the FICAN 1997 curve. This curve has been used to estimate population percentage awakenings for various interior SENEL levels. As an example, an interior noise level of 65 SENEL corresponds to a five percent probability of awakening.[1]

Several methods have been devised to relate noise exposure over time to community response. A commonly used noise metric for this type of study is the Community Noise Equivalent Level (CNEL). The CNEL, originally developed for use in the California Airport Noise Regulation, adds a 5 dBA penalty to noise occurring during evening hours from 7:00 P.M. to 10:00 P.M., and a 10 dBA penalty to sounds occurring between the hours of 10:00 P.M. to 7:00 A.M. to account for the increased sensitivity to noise events that occur during the quiet late evening and nighttime periods. Thus, the CNEL noise metric provides a 24-hour average of A-weighted noise levels at a particular location, with an evening and a nighttime adjustment that reflects increased sensitivity to noise during these times of the day.

2.2 GROUND-BORNE VIBRATION

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Vibration displacement is the distance that a point on a surface moves away from its original static position. The instantaneous speed at which a point on a surface moves is described as the velocity, and the rate of change of speed is described as the acceleration. Each of

[1] *FICAN, Annual Report Federal Interagency Committee on Aviation Noise, 1997.*

these three vibration descriptors can be used to correlate vibration to human response, building damage and acceptable equipment vibration. However, vibration velocity and acceleration are most often used in seismic or ground-borne vibration analysis.

The three main wave types of concern in the propagation of ground-borne vibrations are surface waves (also referred to as Rayleigh waves), compression waves (also referred to as P-waves), and shear waves (also referred to as S-waves). A description of each wave type is provided below:

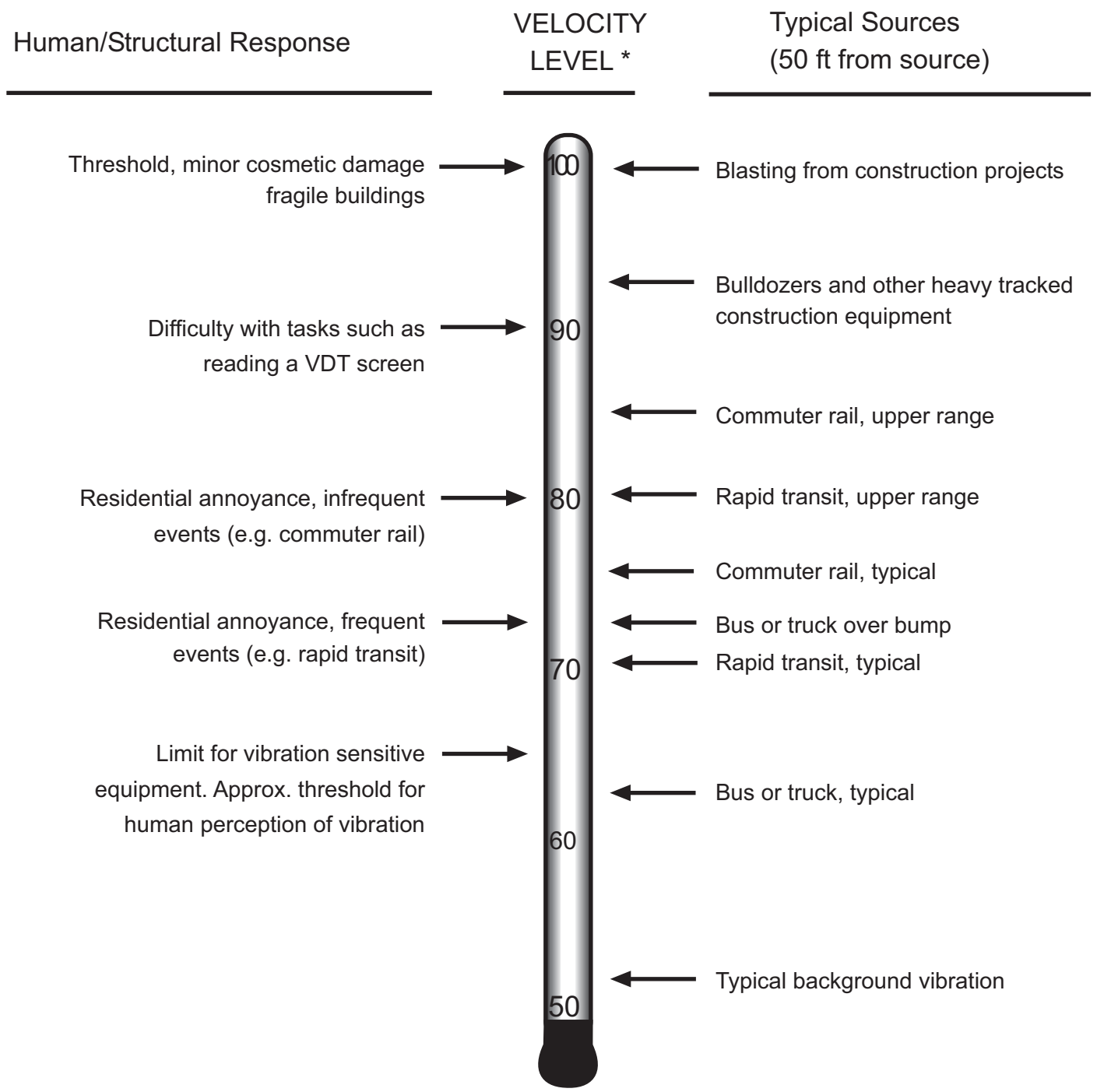
- Surface, or Rayleigh waves travel along the ground surface. They carry most of their energy along an expanding cylindrical wave front, similar to the ripples produced by throwing a rock into a lake. The particle motion is more or less perpendicular to the direction of propagation (known as retrograde elliptical).

- Compression, or P-waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal, in a “push-pull” motion. P-waves are analogous to airborne sound waves.

- Shear, or S-waves, are also body waves, carrying their energy along an expanding spherical wave front. Unlike P-waves, however, the particle motion is transverse, or perpendicular to the direction of propagation.

The peak particle velocity (PPV) or the root mean square (RMS) velocity is usually used to describe vibration amplitudes. PPV is defined as the maximum instantaneous peak of the vibration signal while RMS is defined as the square root of the average of the squared amplitude of the signal. The units for PPV and RMS velocity are normally in inches per second. Often, vibration is presented and discussed in decibel (dB) units in order to compress the range of numbers required to describe vibration. All PPV and RMS velocity levels in this study are in inches per second (inch/sec) and all vibration levels in this study are in dB relative to one micro inch per second (abbreviated as VdB).

Figure 2 on page 6 shows common vibration sources and the human and structural response to ground-borne vibration. The threshold of perception identified by the Federal Transit Administration (FTA) is shown to be approximately 65 VdB. This is equivalent to an RMS velocity of approximately 0.00178 inch per second. The FTA also identifies crest factors which relate the RMS velocity to peak particle velocity. The range in crest factors is from 1.7 to 8, which result in PPV of 0.003 to 0.0142 inch per second. This is within the approximate range of the threshold of human perception of 0.01 inch per second.



*** RMS Vibration Velocity Level in VdB relative to 10^{-6} inches/second**

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Figure 2
Typical Levels of Ground-Borne Vibration

Source: Federal Transit Administration, US Department of Transportation, April 1995

Typically, ground-borne vibrations generated by man-made activities attenuate rapidly with distance from the source of the vibration. Even the more persistent Rayleigh waves decrease relatively quickly. Man-made vibration problems are therefore usually confined to short distances (i.e., 500 feet or less) from the source.

Both construction and operation of development projects can generate ground-borne vibration. In general, demolition of structures preceding construction generates the highest vibrations. Construction equipment such as vibratory compactors or rollers, pile drivers, and pavement breakers can generate perceptible vibration during construction activities. Heavy trucks can also generate ground-borne vibrations that vary depending on vehicle type, weight, and pavement conditions.

3.0 RECEPTOR LOCATIONS

Some land uses are considered more sensitive to intrusive noise than others, due to the types of activities typically involved at the receptor location. Specifically, residences, schools, libraries, religious institutions, hospitals and nursing homes are generally more sensitive to noise than are commercial and industrial land uses. Noise exposure at these receptor locations is determined by event noise magnitude and exposure time.

The project site is located approximately five miles northeast of downtown Long Beach and immediately north of the Long Beach Municipal Airport (Airport). A majority of the site (approximately 238 acres) is located within the City of Long Beach, while the remaining portion of the site (approximately 23 acres) is within the City of Lakewood. In general, the project site is bounded by Carson Street on the north, the Airport on the south and southwest, Lakewood Boulevard on the east, and the Lakewood Country Club and Airport on the west.

The nearest sensitive residential receptors that may be affected by the proposed project are the single-family residences located along and north of Carson Street. Other potentially sensitive uses in the more distant area include multi-family and single-family residential areas, schools, libraries, religious institutions, hospitals and nursing homes.

4.0 SIGNIFICANCE CRITERIA

4.1 REGULATORY FRAMEWORK

Many government agencies have established noise standards and guidelines to protect citizens from potential hearing damage and various other adverse physiological and social effects associated with noise and ground-borne vibration. The Cities of Long Beach and Lakewood have adopted a number of policies, which are in part, based on federal and state regulations that are directed at controlling or mitigating environmental noise effects. City policies and standards that are relevant for project development and operation are discussed below.

4.1.1 Noise

City of Long Beach Municipal Code

Operational Noise Levels

Chapter 8.80 of the Long Beach Municipal Code (LBMC) controls unnecessary, excessive and annoying noise and vibration in the City of Long Beach. However, this chapter does not control noise sources that are preempted by other jurisdictions. Enforcement of these regulations is understood by the City Council to be restricted, in addition to other limitations, by the following:

- It is not the intent of this chapter to control aircraft noise at Long Beach Airport (Airport). Federal law controls noise levels of aircraft in flight; and where federal preemption does not apply to aircraft on the ground, the appropriate provisions of the California Noise Law (Title 21, California Code of Regulations, Division 2.5) will be applicable.

- Local noise control of motor vehicles operating on public rights-of-way is preempted by state or federal laws and regulations.

- Noise in occupational environments is controlled by the California Department of Industrial Relations, whose Division of Industrial Safety enforces the 1973 California Occupational Safety and Health Act (CALOSHA).

As outlined in Section 8.80.150 of the LBMC and presented in Table 1 on page 11, the City of Long Beach has established maximum exterior noise levels based on land use districts. Noise levels in excess of the levels indicated in Table 1 are conditionally permitted, depending on the intensity of the noise and the duration of exposure. As the project site is located in District Four the Noise District Map in Section 8.80 of the LBMC will need to be updated to reflect land uses designated as part of the project. As indicated in this section, noise levels from stationary sources at an affected property are not to exceed:

- The noise standard for that land use district for a cumulative period of more than thirty minutes in any hour; or
- The noise standard plus five decibels for a combined period of more than fifteen minutes in any hour; or
- The noise standard plus ten decibels for a combined period of more than five minutes in any hour; or
- The noise standard plus fifteen decibels for a combined period of more than one minute in any hour; or
- The noise standard plus twenty decibels, or the maximum measured ambient, for any period of time.

As outlined in Section 8.80.170 of the LBMC and presented in Table 2 on page 12, the City of Long Beach has also established maximum interior noise levels based on land use districts. Noise levels in excess of these levels are conditionally permitted, depending on the intensity of the noise and the duration of exposure. As indicated in this section, noise levels inside the dwelling unit are not to exceed:

- The noise standard for a combined period of more than five minutes in any hour; or
- The noise standard plus five decibels for a combined period of more than one minute in any hour; or
- The noise standard plus ten decibels, or the maximum measured ambient, for any period of time.

If the existing interior or exterior ambient noise level exceeds that permissible within the noise limit categories, the allowable noise exposure standard is increased to ambient

Table 1

EXTERIOR NOISE LIMITS

Land Use District	Land Uses within District	Maximum Noise Levels (dBA) L_{eq}		
		Daytime [a]	Nighttime [b]	Anytime
One	Predominately residential	50	45	—
Two	Predominately commercial	60	55	—
Three	Predominately industrial	—	—	65 [c]
Four	Predominately industrial	—	—	70 [c]
Five	Airports, freeways, and waterways	Regulated by other agencies and laws		

[a] *7:00 A.M. to 10 P.M.*
[b] *10:00 P.M. to 7 A.M.*
[c] *Districts Three and Four limits are intended primarily for use at their boundaries rather than for noise control within those districts.*

Source: LBMC, Section 8.80.150.

conditions (Section 8.80.150 and 8.80.170 of the LBMC). In this event, noise levels from stationary sources are not to exceed the ambient noise level by 5 dBA.

In addition, Section 8.80.240 of the LBMC provides an exemption to the exterior and interior noise limits set forth under Section 8.80.150 and 8.80.170 of the LBMC for aircraft within the airport property or within any other aviation-related property abutting it.

Construction Noise

For projects requiring a building or other related permit, construction noise within the City of Long Beach is regulated by Section 8.80.202 of the LBMC. During the week (including weekday Federal holidays), construction activities are generally limited to between the hours of 7 A.M. and 7 P.M. On the weekend, construction activities are limited to between the hours of 9 A.M. and 6 P.M. on Saturdays and are prohibited on Sundays, unless a Sunday Work Permit is authorized. Section 8.80 of the LBMC requires a Noise Variance for all construction activity that falls outside the approved construction hours. The LBMC does not provide specific standards for noise levels associated with construction activities. Although there is no upper threshold for construction noise, the LBMC Section 8.80 does give the Noise Control Officer authority to address extremely

Table 2

INTERIOR NOISE LIMITS

Land Use District	Land Uses within District	Maximum Noise Levels (dBA) L_{eq}		
		Daytime [a]	Nighttime [b]	Anytime
All	Residential	45	35	—
All	School	45	—	—
All	Hospital, designated quiet zone	—	—	40

[a] *7:00 A.M. to 10 P.M.*
[b] *10:00 P.M. to 7 A.M.*

Source: LBMC, Section 8.80170.

loud or unusual noises (e.g., employee use of radios or other noises not associated with the construction activity).[2]

Airport Noise Compatibility

The City began efforts to control airport-related noise through adoption of an ordinance more than 20 years ago. These efforts were groundbreaking and precedent setting—and they were continuously challenged in the courts. It took more than a dozen years to strike a balance between air commerce and community noise exposure. The resulting Airport Noise Compatibility Ordinance (LBMC Chapter 16.43), passed in 1995, gives Long Beach one of the strictest noise-controlled airports in the United States. LBMC Chapter 16.43 controls the maximum SENEL (Single Event Noise Exposure Limits) limits, prohibited activities, cumulative noise limits (CNEL) and noise budgets, compliance with noise budgets, violation enforcement, general exemptions, and flight limits. In addition, the Noise Ordinance regulates certain ground-related activities (e.g., touch-and-go practice and engine run-ups that occur on Airport property).[3] LBMC Chapter 16.43 does not regulate in-flight aircraft. The goal of Chapter 16.43 of the LBMC is to prevent incompatible properties (i.e., residences, churches, and schools) from being exposed to noise above 65 CNEL. In order to achieve this goal, CNEL budget and enforcement limits

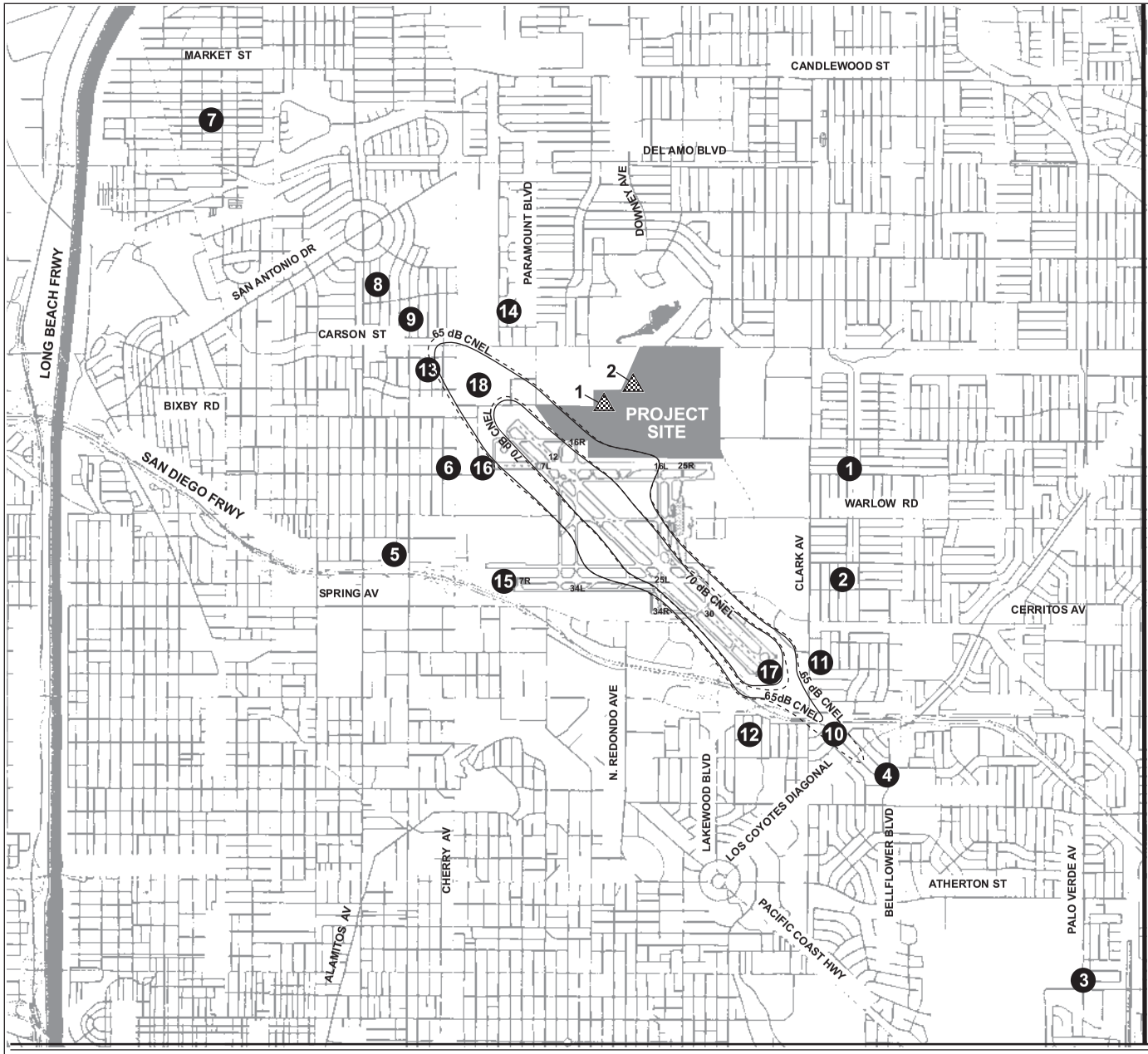
[2] *"Noise Control Officer" means the city officer appointed by the city manager to direct the noise control office.*

[3] *To determine compliance with LBMC Chapter 16.43, aircraft approach and departure SENEL noise levels are monitored by a comprehensive noise monitoring system which is made up of 18 noise monitors located throughout the City of Long Beach and within the City of Lakewood. The monitors are concentrated northwest and southeast of the Runway 12/30 as air carrier aircraft use this runway and are the predominant noise source at the Airport.*

have been established for five separate user groups (i.e., air carrier, charter, commuter, general aviation, and industrial) based on the baseline year of 1989-90. Baseline noise budgets were established by the actual monitored noise levels of each group during the cumulative 12-month period from November 1, 1989, to October 31, 1990. CNEL noise contours for the purpose of compliance with LBMC Chapter 16.43 noise budget and enforcement limits are provided in Figure 3 on page 14. As illustrated, the noise contours generally extend from northwest to southeast due to the larger aircraft associated with Runway 12/30.

With the exception of general aviation, all aircraft are required to comply with the Federal Aviation Regulations Part 36 Stage 3 noise standards and operations are limited to between 7 A.M. and 10 P.M. The commuter and air carriers are allowed not less than 25 and 41 flights per day, respectively. The number of flights for commuter and air carriers may be increased as long as the cumulative noise exposure levels do not exceed the noise budget for each user group. As for general aviation and charter operations, the number of flights is not specified or limited. However, if noise levels from one or both of the user groups exceeds its cumulative noise budget, voluntary noise reduction measures will be instituted by the respective noise committee. If these voluntary procedures do not sufficiently reduce the cumulative noise levels after two calendar quarters, mandatory reductions must then be implemented. Lastly, the number of annual flights for industrial operations is limited to the number of flights during the 12-month period ending October 31, 1990, as adjusted to account for flights associated with aircraft manufacturing and testing that were under design during this time period but had not yet entered service. The number of flights may be increased pending compliance with the applicable noise budget.

Chapter 16.43 of the LBMC also regulates certain types of activities (e.g., touch-and-go practice and engine run-ups) and establishes permissible SENEL for categories of Airport users in order to reduce each group's cumulative noise levels, which are presented in Table 3 on page 15. However, this chapter does not establish acceptable land use noise levels related to SENEL from the Airport. Touch-and-go operations are only permitted at the Airport between 7 A.M. and 7 P.M. on weekdays and between 8 A.M. and 3 P.M. on Saturdays, Sundays, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. Engine run-ups are permitted only between the hours of 7 A.M. and 9 P.M. on weekdays and 9 A.M. and 9 P.M. on weekends and holidays. Such run-ups may be conducted only at locations designated for such purposes by the Airport Manager.



LEGEND

1) Monlaco St. / Charlemagne Av.
2) Pageantry St. / Charlemagne Av.
3) Palo Verde Av. / Anaheim St.
4) Los Altos Park
5) Corner of the Boundary Lines City of Signal Hill / Long Beach North of 405 Fwy
6) North Alley of 36th Street between Gardena Av. / Cherry Av.
7) Elm Av. / Home St.
8) Tehachapi Dr. / Gundry Av.
9) Cartagena St. between Gaviota & Rose Av.
10) Stearnlee Av. between Burnett & Eagle St.
11) Greenbrier Rd. / 28th St.
12) Quincy Av. / Burnett St
13) Ally west of Gardena Av. & South of Marshall Pl.
14) Pixie Av. / Greenmeadow Rd. - City of Lakewood
15) Runway 7R Approach End.
16) Runway 7L Approach End.
17) Runway 30 Approach End.
18) Runway 12 Approach End.

Budget Limits

Enforcement Limits with 41 Air Carrier Flights per Day

Airport Noise Monitoring Location

On-Site Monitoring Locations

PCR

Source: City of Long Beach Airport Bureau, 2001

Figure 3
65 dB and 70 dB CNEL Contours-Noise Ordinance Budget Limits and Enforcement Limits with 41 Air Carrier Flight Per Day

Table 3

MAXIMUM SENEL LIMITS FOR ALL NON-GOVERNMENTAL OPERATIONS AT LONG BEACH AIRPORT

Runway	7 A.M. to 10 P.M. (Departure/Arrival)	10 P.M. to 11 P.M. and 6 A.M. to 7 A.M. (Departure/Arrival)	11 P.M. to 6 A.M. (Departure/Arrival)	Noise Monitoring Station Number
30	102.5/101.5	90/90	79/79	9/10
12	102.5/101.5	90/90	79/79	10/9
25R	92/88	[a]	[a]	6/15/2
25L	95/93	[a]	[a]	—
7R	95/92	[a]	[a]	2/5
7L	88/92	[a]	[a]	1/6

[a] *Except in case of emergency or air traffic direction, all aircraft operations between the hours of 10 P.M. and 7 A.M. are limited to runways 30 and 12.*

Source: Chapter 16.43 of the LBMC, 1994; PCR Services Corporation, 2004.

City of Long Beach General Plan Noise Element

The Noise Element of the City of Long Beach General Plan suggests criteria for maximum acceptable outdoor and indoor noise levels based on land use type.[4] The criteria are presented in Table 4 on page 16. The criteria are for planning purposes only and do not carry any regulatory authority.

Contained within the City of Long Beach General Plan Noise Element are five general goals that can be summarized by the following statement: *the City desires to attain a healthier and quieter environment for all of its citizens while maintaining a reasonable level of economic progress and development*. The five general goals are as follows:

1. To improve and preserve the unique and fine qualities of Long Beach and eliminate undesirable and harmful elements.

2. To develop a well balanced community the offers planned and protected residential districts, well distributed commercial districts, planned and restricted industrial districts, and a coordinated circulation system that

[4] *The Noise Element of the City of Long Beach General Plan was adopted on March 25, 1975.*

Table 4

CITY OF LONG BEACH NOISE CRITERIA

	Outdoor			Indoor
Major Land Use Type	**Maximum Single Hourly Peak**	**L_{10}[a]**	**L_{50}[a]**	**L_{dn}[b]**
Residential (7 A.M. to 10 P.M.)	70	55	45	45
Residential (10 P.M. to 7 A.M.)	60	45	35	35
Commercial (anytime)	75	65	55	—
Industrial (anytime)	85	70	60	—

[a] *L_{10} and L_{50} are the time-varying noise levels that would be exceeded 10 and 50 percent of the time.*
[b] *L_{dn} is a 24-hour average of A-weighted noise levels with a nighttime adjustment of 10 dBA to reflect increased sensitivity to noise during the hours of 10 P.M. to 7 A.M.*

Source: Noise Element of the City of Long Beach General Plan, 1976; PCR Services Corporation, 2004.

provides for the fast, safe, and efficient movement of people and commodities.

3. To improve the urban environment in order to make Long Beach a more pleasant place to live, work, play, and raise a family.

4. To establish noise policy guidelines and promote noise abatement action programs.

5. To develop specific neighborhood noise plans with the participation of resident citizen groups.

In addition, the Noise Element contains a list of more specific goals and strategies related to land use planning, the general noise environment, transportation noise, construction and industrial noise, population and housing noise, and public health and safety that can be summarized as follows:

- To protect and preserve both the property rights of owners and the right to quietness of the citizenry at large.
- To make the City a quieter, more pleasant place in which to live.
- To diminish transportation noise impacts on the population.

- To respond to demands for a reasonably quiet environment this is compatible with both existing ambient noise levels and continuing building (i.e., construction noise) and industrial development.

- To reduce both noise exposure to the population and noise level outputs generated by the population.

- To attain the lowest possible level of harmful effects of noise on people by the implementation of information, monitoring, and advisory programs.

The Noise Element of the City of Long Beach General Plan recommends a numerical criteria to judge whether noise from construction and demolition sites is reasonable or not. In considering what criteria will be appropriate in the daytime, most weight is given to the following factors:

1. The noise should not interfere unduly with lives and the work of people in nearby buildings.

2. The work on most construction and demolition sites does not last very long, usually for some weeks or months at most.

3. A great deal of building is done in urban areas where there is noise from other sources, such as traffic.

4. The efficiency of the building industry depends upon the use of machines.

5. Any criterion must be economically and operationally practicable for contractors.

Based on the above mentioned factors, the Noise Element of the City of Long Beach General Plan suggests an acceptable construction noise level, where an average maximum noise level outside the nearest building at the window of an occupied room closest to the site boundary, should not exceed:

- 70 dBA in areas away from main roads and sources of industrial noise; and

- 75 dBA in areas near main roads and heavy industries.

City of Lakewood Municipal Code

Operational Noise

Noise in residential areas is addressed in Section 9376 of the Lakewood Municipal Code (LMC). In the City of Lakewood, no person within any area zoned for residential use or any area adjacent thereto may operate air conditioners, mechanical equipment or machinery, which causes the noise level at the residential property line to exceed 65 dB L_{eq}. Section 9347 of the LMC limits commercial noise levels to 60 dBA L_{eq}, as measured at the property line of residentially zoned or occupied property. Similarly, Section 9368 of the LMC limits heavy manufacturing noise to 60 dBA L_{eq}, as measured at the property line of residentially zoned property, or otherwise 70 dBA L_{eq}. No other applicable operational noise standards were identified in the LMC.

Construction Noise

Section 8020 of the LMC regulates construction noise within the City of Lakewood. Construction activities are generally limited to between the hours of 7 A.M. and 7 P.M. Monday through Saturday, and 9 A.M. and 7 P.M. on Sundays within 500 feet of a residential zone. However, specific construction noise level standards are not provided within the LMC.

City of Lakewood General Plan

The City of Lakewood General Plan does not identify any planning standards with respect to noise levels. The Noise Element of the General Plan does specify the types of land uses that are noise sensitive including residential uses, convalescent and rest homes, hospitals, libraries, churches, and schools. The following General Plan policies are applicable to the proposed project:

Policy 1.1—Ensure that new and expanded commercial projects do not generate adverse noise impacts on adjacent residential areas.

Los Angeles County

State law requires the creation of Airport Land Use Commissions (ALUCs) to coordinate planning efforts for those areas surrounding public use airports. Under the Los Angeles County Department of Regional Planning, the Regional Planning Commission is responsible for acting as the ALUC for airports in Los Angeles County, including the Long Beach Municipal Airport. Although the ALUC does not have jurisdiction over airport

operations, it has been given the authority to review and make recommendations regarding local agency regulations.

One of the primary functions of the ALUC is to ensure compatibility between aircraft noise and various land uses. The Los Angeles County Comprehensive Airport Land Use Plan (ALUP) provides policies related to noise levels and sources associated with airport operations. These policies include:

- N-1: Use the CNEL method for measuring noise impacts near airports in determining suitability for various land use types.
- N-2: Require sound insulation to insure a maximum interior 45 CNEL in new residential, educational, and health-related uses in areas subject to exterior noise levels of 65 CNEL or greater.
- N-3: Utilize the Table Listing Land Use Compatibility for Airport Noise Environments in evaluating projects within the planning boundaries.
- N-4: Encourage local agencies to adopt procedures to ensure that prospective property owners in aircraft noise exposure areas above a current or anticipated 60 CNEL are informed of these noise levels associated with high noise exposure.

California Department of Transportation, Division of Aeronautics

In 1990, California legislation (AB 4164) directed the California Department of Transportation (Caltrans), Division of Aeronautics, to develop and implement a program to assist in the training and development of airport land use commissions. Caltrans published the *Airport Land Use Planning Handbook* (Handbook) in 1993, with a revised version published in 2002, to satisfy these requirements. As discussed in Section V.E., Hazards, the Handbook provides recommendations and suggestions for consideration by individual airport land use commissions, counties and cities in developing an airport land use plan. With regard to noise, the Handbook provides discussion on the nature of airport noise, the effects of noise on people, established regulations and policies, noise exposure measurement issues, and determination of acceptable noise levels. The Handbook suggests land use compatibility criteria, stating that residential uses in urban areas should not be located within the 65 dB CNEL contour.

Title 21 of the California Code of Regulations, Division 2.5 (Caltrans, Division of Aeronautics), requires a minimum standard of exterior sound transmission control for

residential buildings that are located within the 65 CNEL contour such that internal noise levels due to external noise sources should not exceed 45 dB (CNEL) for habitable rooms.

California Department of Health, Office of Noise Control

The California Department of Health establishes noise criteria for various land uses. Figure 4 on page 21 identifies the typically acceptable limit of noise exposure for various land use categories. Figure 4 shows that the noise exposure for a residential land use is "normally acceptable" when the CNEL at exterior residential locations is equal to or below 60 dBA, "conditionally acceptable" when the CNEL is between 60 to 70 dBA, "normally unacceptable" when the CNEL is between 70 to 75 dBA, and "clearly unacceptable" when the CNEL is greater than 75 dBA. For office and industrial land uses a CNEL of 75 dBA is considered "normally acceptable," while a CNEL level of greater than 75 dBA is considered "normally unacceptable." These guidelines apply to noise sources such as vehicular traffic.

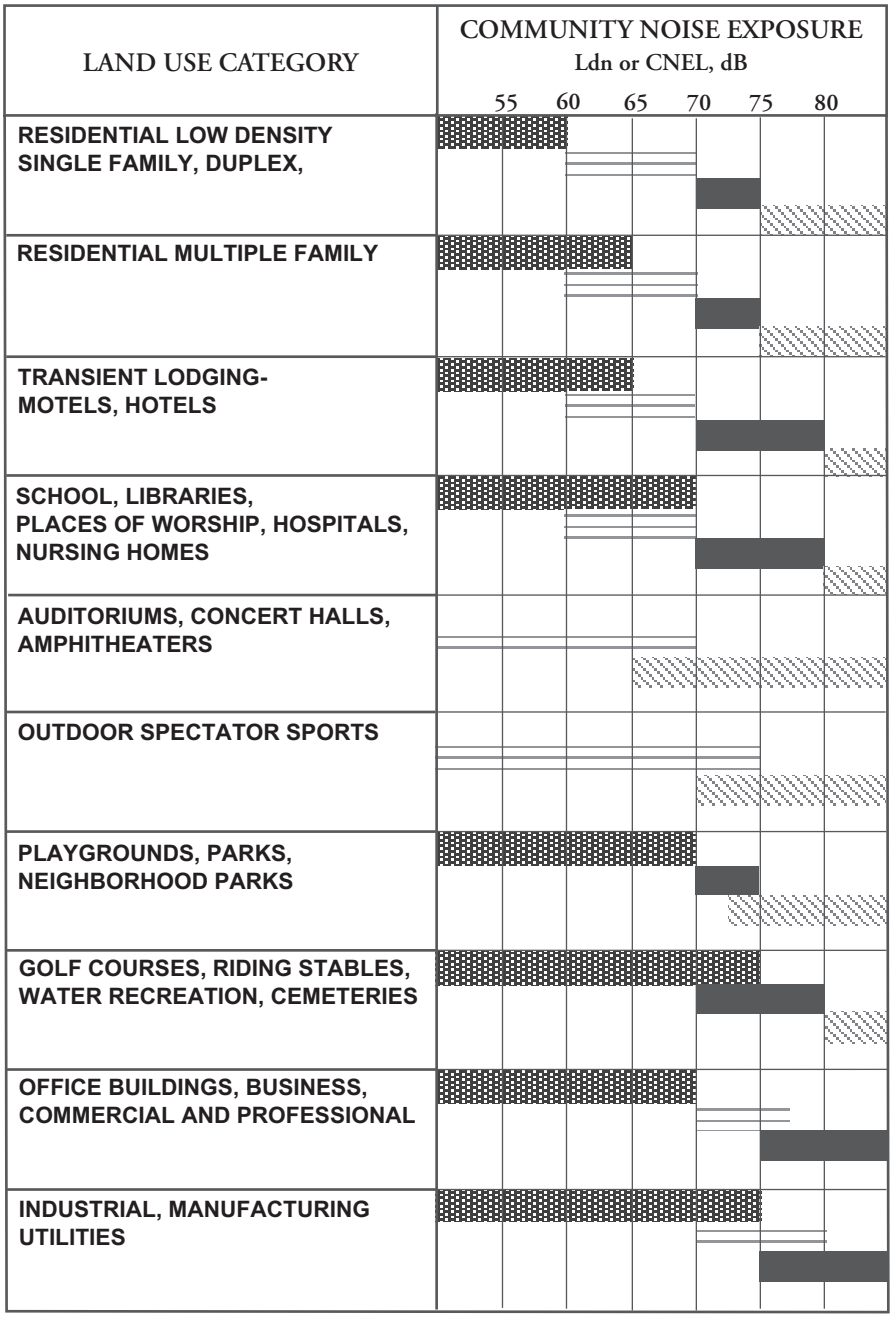
4.1.2 Ground-Borne Vibration

4.1.2.1 City of Long Beach

The City of Long Beach does not have any adopted standards for ground-borne vibration associated with construction activities.[5]

Policies and standards related to operational ground-borne vibration are provided in Section 8.80.200 of the LBMC, where the operation of any device that creates a vibration which is above the vibration perception threshold of an individual at or beyond the property boundary of the source if on private property, or at 150 feet from the source if on a public space or public right-of-way is a code violation. The Ordinance defines the vibration perception threshold as the minimal ground- or structure-borne vibrational motion necessary to cause a normal person to be aware of the vibration by such direct means as, but not limited to, sensation by touch or visual observation of moving objects. The perception threshold is presumed to be 0.001 g's in the frequency range 0 to 30 hertz and 0.003 g's in the frequency range between 30 to 100 hertz, which is equivalent to a peak velocity in terms of RMS of 0.01 inches per second over the range of 1 to 100 hertz.

[5] *However, the Federal Transit Authority (FTA) provides a construction equipment vibration damage threshold criterion of 0.20 inches per second PPV for fragile buildings (U.S.DOT, 1995).*



INTERPRETATION

NORMALLY ACCEPTABLE
Specified land use is satisfactory. Based upon the assumption that any buildings involved are of normal conventional construction without any special noise insulation requirements.

CONDITIONALLY ACCEPTABLE
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.

NORMALLY UNACCEPTABLE
New construction or development should generally be discouraged, If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE
New construction or development should generally not be undertaken.

Source: Guidelines for the Preparation and Content of the Noise Element of the General Plan, California Department of Health Services, in coordination with the office of Planning and Research.

PCR

Figure 4
Land Use Compatibility for Community Noise

4.1.2.2 City of Lakewood

There are no adopted City of Lakewood policies or standards for ground-borne vibration.

4.2 THRESHOLDS OF SIGNIFICANCE

In general, impacts to noise will be considered significant if the project will 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;
- Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project; or
- 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, will the project expose people residing or working in the project area to excessive noise levels.

In order to determine if the project exceeds any of the general thresholds listed above, more specific noise thresholds are typically applied. The following specific significance thresholds were used to evaluate the project's short-term construction and long-term operations impacts. These thresholds are based on applicable federal, state, and local policies and regulations described earlier.

4.2.1 Construction Noise

Neither the City of Long Beach nor the City of Lakewood have established significance thresholds for construction noise impacts. In the absence of such thresholds

and consistent with thresholds often used in other jurisdictions, including the City of Los Angeles, a significant impact associated with construction noise will result if : [6]

- Project construction activities lasting more than 10 days in a three month period will exceed existing ambient exterior noise levels by 5 dBA L_{eq} or more at a noise sensitive use.

In addition, an evaluation of L_{max} noise levels is provided as part of the construction impact analysis. However, neither the City of Long Beach nor the City of Lakewood have established significance thresholds, and as such, the L_{max} discussion is provided for informational purposes only.

4.2.2 Roadway Noise

Mobile noise sources, such as project-generated traffic traveling on public roadways, are exempt from the requirements of the Cities of Long Beach and Lakewood Municipal Codes but still subject to CEQA. Therefore, the City of Long Beach and the City of Lakewood use the State Noise/Land Use Compatibility Matrix, provided earlier in Figure 4 on page 21, to define acceptable mobile source noise levels. Thus, a significant impact will occur if any of the significance thresholds listed below are exceeded:

- Project traffic causes an increase in CNEL along any roadway segment by 5 dBA or more when the CNEL is within the acceptable range as shown on the Community Compatibility Matrix.

- Project traffic increases the CNEL along any roadway segment by an audible amount (3 dBA or more) and causes the noise levels to move from acceptable range to unacceptable range as shown on the Community Compatibility Matrix.

4.2.3 Airport Noise

In compliance with California Title 21, Caltrans' California Airport Land Use Planning Handbook, and FAA Guidelines, a significant impact will occur if proposed residential uses and associated outdoor recreational areas were located within the Airport 65 CNEL contour based upon the maximum-expected operating scenario allowed by LBMC Chapter 16.43.

[6] *L.A. CEQA Thresholds Guide, August 2001.*

4.2.4 Aviation-Related Uses

In compliance with Chapter 16.43 of the LBMC, a significant impact will occur if proposed aviation-related uses will result in aircraft using the Long Beach Airport that will not comply with the Noise Ordinance SENEL limitations.

4.2.5 On-Site Activities

The criteria and guidelines identified in the Regulatory Framework section above were used to determine operational noise impacts. Within the portion of the project site located within the City of Long Beach, a significant impact associated with on-site activities (i.e., aviation-related uses, mechanical, equipment, parking facilities) will occur during daytime (7:00 A.M. to 10:00 P.M.) and nighttime (10:00 P.M. to 7:00 A.M.) hours if:

- Exterior noise levels for predominantly residential or commercial uses exceed those set forth by Section 8.80.150 of the LBMC and presented in Table 1 on page 11. Noise levels in excess of the levels indicated in Table 1 are conditionally permitted, depending on the intensity of the noise and the duration of exposure. Specifically, noise levels may not exceed the exterior noise standard for a cumulative period of more than thirty minutes in any hour; or plus five decibels for a combined period of more than fifteen minutes in any hour; or plus ten decibels for a combined period of more than five minutes in any hour; or plus fifteen decibels for a combined period of more than one minute in any hour; or plus twenty decibels for any period of time (maximum noise level). [7]

- Interior noise levels for residential uses exceed those set forth by Section 8.80.170 of the LBMC and presented in Table 2 on page 12. Noise levels in excess of the levels indicated in Table 2 are conditionally permitted, depending on the intensity of the noise and the duration of exposure. Specifically, noise levels may not exceed the interior noise standard for a cumulative period of more than five minutes in any hour; or plus five decibels for a combined period of more than one minute in any hour; or plus ten decibels for any period of time (maximum noise level). [8]

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[7] *If the existing exterior ambient noise level exceeds that permissible within the noise limit categories, the allowable noise exposure standard is increased to ambient conditions (Section 8.80.150 of the LBMC). In addition, Section 8.80.240 of the LBMC (vehicle, motorboat or aircraft repair and testing) provides an exemption to the exterior noise limits (Section 8.80.150 of the LBMC) for aircraft within the airport property or within any other aviation-related property abutting it.*

[8] *If the existing interior ambient noise level exceeds that permissible within the noise limit categories, the allowable noise exposure standard is increased to ambient conditions (Section 8.80.170 of the LBMC).*
(Footnote continued on next page)

In addition, a significant impact will occur as a result of on-site activities in the City of Lakewood portion of the site if:

- In accordance with the LMC, any person within any area zoned for residential use or any area adjacent to residential use operates air conditioners, mechanical equipment, or mechanical machinery that causes the noise level at the residential property line to exceed 65 dBA L_{eq}.[9]

- In accordance with the LMC, commercial noise levels exceed 60 dBA L_{eq} at residentially zoned or occupied property.[10]

4.2.6 Ground-Borne Vibration

The City of Long Beach and Lakewood do not have any adopted policies or standards for construction ground-borne vibration. However, the Federal Transit Authority (FTA) provides a construction equipment vibration damage threshold criterion of 0.20 inches per second PPV for fragile buildings (U.S.DOT, 1995). In the absence of any City significance thresholds for vibration associated with construction, an exceedance of the FTA standard was used to determine construction vibration impacts.

The City of Long Beach's vibration perception criteria described above will be used to evaluate potential impacts associated with operation of the project site. A significant impact will occur if;

- Project operation activities cause a RMS of 0.01 inch/sec at or beyond the property boundary of the source if on a private property or at 150 feet from the source if on a public space.

Section 8.80.240 of the LBMC (vehicle, motorboat or aircraft repair and testing) provides an exemption to the interior noise limits (Section 8.80.170 of the LBMC) for aircraft within the airport property or within any other aviation-related property abutting it.

[9] *LMC, Section 9376.*

[10] *LMC, Section 9347.*

4.3 PROJECT FEATURES

4.3.1 Construction

The following project features will be included to reduce noise levels in the surrounding communities and on-site proposed residential uses.

- The project applicant will provide a construction relations officer to serve as liaison with surrounding communities and on-site residents.
- All construction equipment, fixed or mobile, shall be equipped with properly operating and maintained muffler exhaust systems.
- Construction activities will be scheduled to the extent feasible so as to avoid operating several pieces of equipment simultaneously, which causes high noise levels.
- Engine idling from construction equipment such as dozers and haul trucks will be limited, to the extent feasible.
- Construction routes will be established to avoid residential streets in order to prevent noise and vibration impacts in residential areas. Generally, construction delivery and haul trucks will access the project site from I-405 along Lakewood Boulevard or along Cherry Boulevard.

4.3.2 Residential

Project features will be incorporated to provide insulation for all residential buildings on the project site to reduce interior noise levels below 45 dBA CNEL. Achieving this level of sound insulation may include the following: (1) air-conditioning/mechanical ventilation such that the units will not have to rely on open windows for ventilation; (2) dual insulating glazed systems; (3) doors and windows opening to the exterior with acoustical seals; (4) adding insulation to attics; and/or (5) fitting chimneys and vents with dampers and/or acoustic louvers.[11, 12] The residential developer will incorporate necessary measures

[11] *The primary path of aircraft noise into buildings is usually through the windows, so the acoustical performance of buildings is strongly dependent upon the type, location, and size of windows. If the windows are acoustically treated, then other building components become acoustically significant. For this reason, sound insulation programs almost always include windows and doors with acoustically rated assemblies. In addition, most programs include insulation of attic spaces, and sealing or baffling of openings and vents to limit the effects of other common building elements on the interior noise levels. Fireplaces may also be treated with chimney cap dampers or glass doors. The use of these measures can provide up to 35 dB aircraft noise reduction (California Airport Land Use Planning Handbook, January 2002).*

during the detailed design stage of the project to comply with the minimum sound insulation design standard and will appoint an acoustical consultant to confirm that the proposed residential buildings will achieve this standard. The project features included to reduce noise levels at residences from aircraft noise will also serve to reduce noise levels from parking facilities.

The project will also limit the development of residential uses in close proximity to the Boeing Enclave until such time that run-up activities permanently cease in the 717 Run-up area. Also, Boeing will preferentially use the testing positions along the southern side of the Boeing Enclave (Numbers 1-6). These testing positions have the tail end of the planes (i.e., engines) facing towards the airport and, more importantly, away from proposed residences.

In addition, all persons purchasing, leasing, or renting residential land or property within the PacifiCenter development will be required to sign an "acknowledgement covenant" which acknowledges the fact that residential properties are near an airport, that there may be low level aircraft overflights, and that there may be noise impacts because of proximity to the Airport and overflights. In addition, the acknowledgment convenat shall acknowledge the avigation easements, which waive the right to take legal action in connection with aircraft noise.

4.3.3 Parking Facilities

The floors of parking structures will utilize a broom finish to minimize noise from tires and 42-inch solid spandrels will be used to reduce noise transmission. Parking structures will also include walls or barriers in the design that block the line-of-site from sensitive receptors to parking stalls. Landscaping will be provided along the exterior of all parking structures and surface parking lots to assist in buffering noise. In addition, project features specified above to reduce noise levels at residences from aircraft noise will also reduce noise levels from parking facilities.

4.3.4 66kV Substation

A 66-kV substation with a maximum footprint of approximately 305 feet by 230 feet is proposed within either the Commercial or Housing areas of the site. As discussed in Section V.M. Energy, this substation is anticipated to be developed around the year 2009 and will serve the project site as well as other off-site areas. An illustration of potential areas within the site that may be utilized for this substation is provided in Section III,

[12] *Martin Newson & Associates, Acoustical Requirements for Developers of Residential Components at PacifiCenter @ Long Beach, July 2001.*

Project Description. If located in the residential portion of the project site or fronting A Street in the commercial area, the substation will be a low profile structure (equipment will be approximately 12 feet in height) with underground feed lines, with an eight-foot perimeter masonry screen wall located at the building setback line, and associated perimeter landscaping between the right-of-way and the wall consisting of trees, shrubs, and ground cover. If the substation is located in the commercial area not fronting on A Street, the equipment will be approximately 20 feet in height and will include an eight-foot masonry wall located at the building setback line with landscaping between the right-of-way and the wall. Such landscaping will include trees, shrubs, and ground cover.

4.3.5 Mechanical Equipment

All mechanical equipment will incorporate noise control measures to ensure that City of LBMC and LMC requirements are satisfied.

5.0 EXISTING CONDITIONS

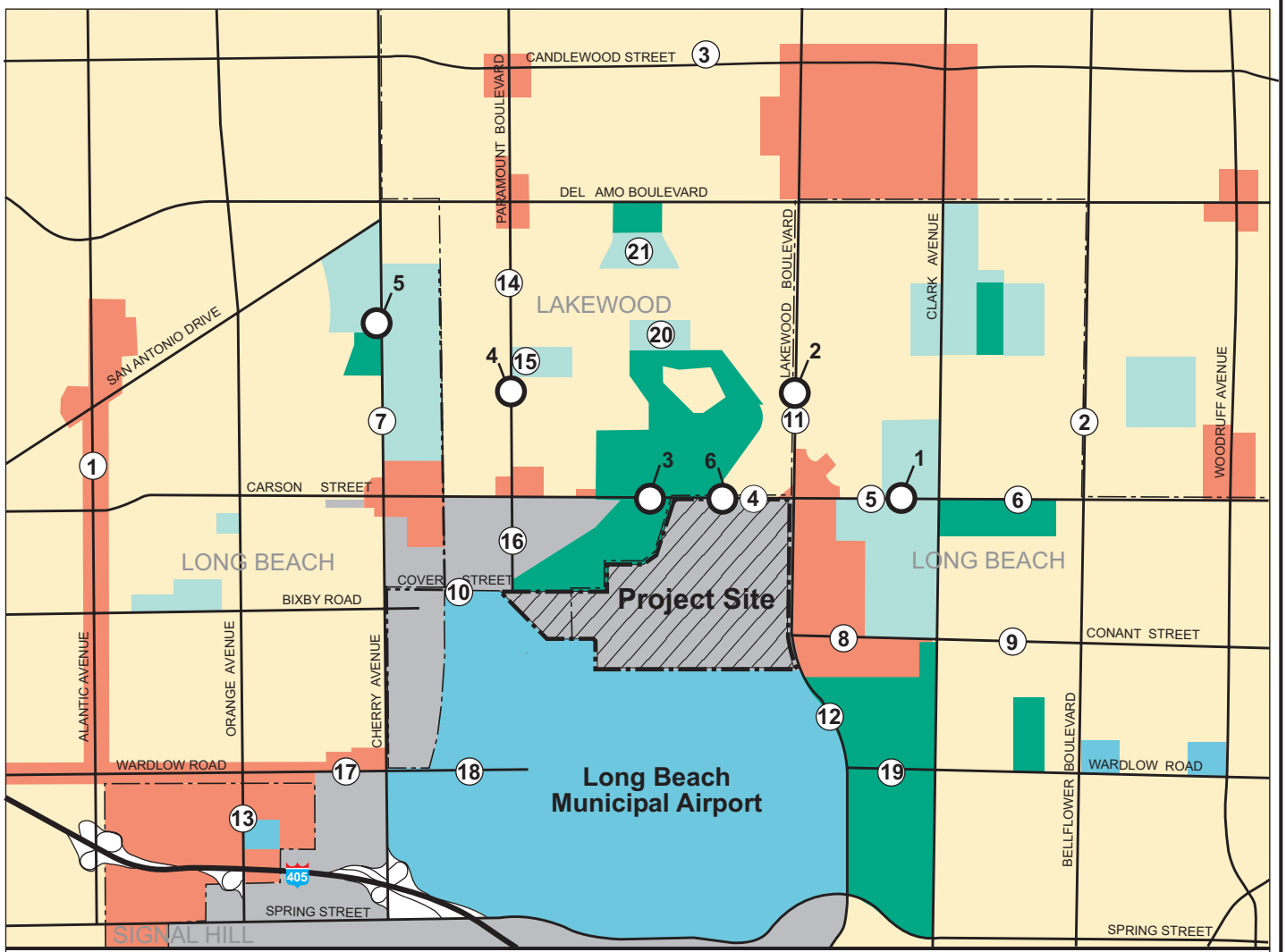
5.1 NOISE MEASUREMENTS

Short-term, 15-minute noise measurements were conducted at five segments of arterial roadways at the rights-of-way to determine ambient noise levels in the project area. Figure 5 on page 30 shows the measurement locations. The measurement locations were selected based on their proximity to the project site and were focused on sensitive land uses. The measurement data indicate L_{eq} levels ranging from 68.0 to 75.1 dBA during the peak traffic hours, and levels ranging from 64.0 to 73.5 dBA during the off-peak hours. These noise levels are indicative of noise levels at the right-of-way and noise levels at more distant locations will be substantially less. As an example, a typical four-lane roadway with a sidewalk will result in a 3-dBA reduction in noise levels approximately 14 feet from the right-of-way and a 6-dBA reduction will occur approximately 48 feet from the right-of-way. A 24-hour measurement was also conducted on the northern end of the project site, 15 feet from the right-of-way of Carson Street. The measurement resulted in an L_{eq} of 69.9 dBA, with a CNEL of 73.6 dBA. Table 5 on page 31 provides a summary of the noise measurement data.

5.2 EXISTING NOISE

According to Section 8.80 of the LBMC, the project site is located within District Four, which limits noise at its boundary to 70 dB at any time.[13] The project site and nearby vicinity are primarily exposed to noise generated by traffic on the surrounding roadways and freeways, noise generated by operations at the Airport including aircraft takeoffs and landings, noise generated by engine testing at Boeing's engine run-up area, and noise generated by the separate and ongoing remediation efforts pursuant to the LARWQCB Cleanup and Abatement Order 95-048. Each of these noise sources is discussed in the following sections.

[13] *The Noise District Map in Section 8.80 of the LBMC may have to be updated to reflect land uses designated as part of the project.*



LEGEND

- Measurement Locations
- Analysis Locations
- Residential
- Commercial
- Park/Golf Course
- Industrial
- Institutions & Schools

NOTABLE OFF-SITE RECEPTORS

- (5) Long Beach City College
- (6) Heartwell Park
- (12)(19) Skylinks Golf Course
- (13) John Burroughs Elementary School
- (15) James Madison Elementary School
- (20) Herbert Hoover Middle School
- (21) Riley Elementary School

Note: The land uses identified on this map are intended to provide a general representation of the uses surrounding the measurement and analysis locations. As such, not all uses are depicted.

PCR

N

0 0.5 Miles

Source: PCR Services Corporation, 2004

Figure 5
Off-Site Noise Measurement and Analysis Locations

Table 5

AMBIENT NOISE MEASUREMENT DATA

Measurement Number[a]	Time	Duration[b,c]	A-Weighted Sound Pressure Level (dBA) L_{max}	L_{min}	L_{eq}
1	07:03	15 minutes	83.1	52.6	73.9
	10:05	15 minutes	78.9	49.7	67.4
	14:52	15 minutes	93.0	52.9	70.5
	16:05	15 minutes	82.4	55.1	69.4
	19:33	15 minutes	80.5	51.8	69.1
	22:30	15 minutes	77.2	46.0	65.5
2	07:24	15 minutes	83.0	47.1	72.7
	10:27	15 minutes	84.2	50.5	70.8
	13:04	15 minutes	81.9	49.6	70.6
	16:32	15 minutes	80.5	50.0	71.0
	19:55	15 minutes	78.2	47.5	68.3
	22:52	15 minutes	93.9	44.9	69.2
3	07:43	15 minutes	81.6	49.4	72.5
	10:51	15 minutes	81.9	54.6	72.7
	13:23	15 minutes	87.0	54.2	73.5
	16:58	15 minutes	86.5	48.0	75.1
	20:20	15 minutes	81.0	51.7	71.1
	23:15	15 minutes	79.9	44.4	67.4
4	08:03	15 minutes	83.6	47.3	68.0
	11:12	15 minutes	79.4	50.3	69.7
	13:51	15 minutes	80.8	49.5	69.9
	17:20	15 minutes	80.9	49.4	72.5
	20:45	15 minutes	79.2	46.8	68.7
	23:40	15 minutes	79.5	44.0	67.3
5	08:24	15 minutes	85.0	53.9	71.9
	11:42	15 minutes	82.7	53.8	72.7
	14:15	15 minutes	85.6	51.7	70.9
	17:42	15 minutes	82.0	55.4	72.1
	21:10	15 minutes	76.6	50.4	67.0
	00:02	15 minutes	77.0	45.1	64.0
6	09:00	24 hours	91.9	38.15	69.9

[a] *Receptor locations are shown on Figure 5.*

[b] *The 15-minute measurements were conducted August 8, 2001, for each time period as follows: morning peak (7 to 9 A.M.), midmorning (10 A.M. to 12 P.M.), midday (1 to 3 P.M.), evening peak (4 to 6 P.M.), late evening (7 to 9 P.M.), and nighttime (10 P.M. to 12 A.M.).*

[c] *The 24-hour measurement was conducted August 7-8, 2001. The calculated CNEL is 73.6.*

Source: PCR Services Corporation, 2004.

5.2.1 Traffic Noise

Traffic noise at the project site and at nearby receptors is attributed to vehicle movements on the surrounding arterial system. The noise levels generated by existing traffic on these roadways have been estimated using the Federal Highway Administration (FHWA) traffic noise prediction model and existing traffic data provided by Crain and Associates.[14] Figure 5 on page 30 shows the measurement locations and land use categories. Table 6 on page 33 provides the estimated existing traffic noise levels at these locations.

The predicted CNEL from existing vehicular traffic range from 56.2 to 70.9 dBA at 50 feet from the right-of-way of the analyzed roadway segments. The existing CNEL from traffic along the analyzed roadway segments and traffic volumes are provided in Table A-1. These noise levels are representative of conditions immediately adjacent to the right-of-way and decrease as the distance from the roadway is increased or as features such as block walls, structures or landscaping are introduced.[15]

5.2.2 Long Beach Airport

The proposed PacifiCenter project is located immediately north of the 1,166 acre Airport which is designated as a non-hub airport (i.e., serving less than 0.05 percent of the total nation-wide enplanements) with 350,603 annual operations (landings and takeoffs) in 2002. The airport serves a large number of private non-commercial aircraft and is one of the nation's busiest airports in terms of general aviation activity, in which 93 percent of the annual operations are general aviation.[16, 17] The remaining seven percent of the operations are as follows: five percent of the operations is by air carrier, two percent is by commuter carrier, and less than one percent is by

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[14] *The actual short-term (15-minute) measurements are consistent with the modeled traffic noise levels. The FHWA traffic noise model (FHWA-RD-77-108) was used to model existing and all future L_{eq} traffic noise levels. This methodology allows for evaluation of the Average Daily Traffic Volumes provided by the Traffic Technical Report. This methodology also avoids use of inaccurate data that often results from monitoring during atypical traffic conditions (e.g., periods with reduced or increased vehicle volumes over a specific time frame which can generate atypical noise conditions). Such atypical traffic conditions are generally unpredictable.*

[15] *A typical four-lane roadway with a sidewalk will result in a 3-dBA reduction in noise levels approximately 14 feet from the right-of-way and a 6-dBA reduction approximately 48 feet from the right-of-way.*

[16] *Long Beach Airport, LGB Monthly Airport Activity Report, December 2002.*

[17] *General aviation is defined as activity other than operation by air carrier, commuter carrier, industrial operations, charter operations, and public aircraft (i.e., private non-commercial aircraft).*

Table 6

PREDICTED EXISTING VEHICULAR TRAFFIC NOISE LEVELS

Analyzed Segments	Roadway Segment at Right-of-Way	Land Use	Predicted Existing CNEL (dBA) at Referenced Distances from Roadway Right-of-Way		
			Adjacent	50 Feet	100 Feet
1	Atlantic Ave. North of Carson St.	Commercial	73.4	69.4	67.3
2	Bellflower Blvd. North of Carson St.	Residential	73.5	69.3	67.2
3	Candlewood St. West of Lakewood Blvd.	Residential	72.7	68.0	65.7
4	Carson St. West of Lakewood Blvd.	Residential	58.4	61.1	59.7
5	Carson St. East of Lakewood Blvd.	School	57.8	60.5	59.1
6	Carson St. East of Clark Ave.	Residential, Park	57.8	60.7	59.3
7	Cherry Ave. North of Carson St.	Residential	71.1	68.6	67.0
8	Clark Ave. North of Conant St.	Residential	73.4	68.3	66.0
9	Clark Ave. South of Conant St.	Residential	70.4	67.2	65.4
10	Conant St. East of Lakewood Blvd.	Golf Course	60.7	56.2	54.0
11	Conant St. East of Clark Ave.	Residential	61.3	56.8	54.6
12	Cover St. West of Paramount Blvd.	Commercial	71.0	65.4	63.1
13	Lakewood Blvd. North of Carson St.	Residential	74.7	70.2	68.0
14	Lakewood Blvd. North of Wardlow Rd.	Golf Course	75.1	70.9	68.7
15	Orange Ave. South of Wardlow Rd.	Residential, School	72.2	67.5	65.3
16	Paramount Blvd. South of Del Amo Blvd.	Residential	67.5	65.5	64.2
17	Paramount Blvd. North of Carson St.	Residential, School	67.1	65.2	63.8
18	Paramount Blvd. South of Carson St.	Commercial	71.1	66.3	64.1
19	Wardlow Rd. West of Cherry Ave.	Residential	69.0	65.4	63.5
20	Wardlow Rd. East of Cherry Ave.	Commercial	67.0	63.3	61.4
21	Wardlow Rd. East of Lakewood Blvd.	Golf Course	67.5	63.9	61.9

Source: PCR Services Corporation, 2004.

industrial.[18, 19] In 2002, the airport handled approximately 58,600 tons of air cargo. In addition, between August 2001 and 2003, the number of passengers has increased from 600,000 annual passengers to almost 3,000,000 annual passengers. The Airport includes scheduled flights by America West, American, Airborne Express, Federal Express, Horizon, Jet Blue Airways, and United Parcel Service.[20]

The Airport has five runways, ranging in total length from 4,267 feet to 10,000 feet.[21] There are two sets of parallel runways aligned in an east-west (7L/25R and 7R/25L) and north-south (16L/34R and 16R/34L) direction forming a rectangle, and an additional 10,000-foot runway (Number 12/30) that is aligned in a northwest-southeast direction splitting the two sets of runways. All of the runways are used for general aviation. Runway 12/30 is used for commercial flights as well as general aviation. Runway 7L/25R is used as the back-up runway for commercial flights, but is typically used only during rare circumstances (e.g., during repaving of Runway 12/30). Airport runways are identified in Figure 3 on page 14 as they relate to the project site and runway utilization characteristics are provided in Table 7 on page 35.

The City of Long Beach Airport Bureau monitors aircraft noise levels at several locations around the airport. Noise from daily operations, including takeoffs and landings are calculated in terms of CNEL, from which noise contours are developed. This data is updated on a quarterly basis in compliance with California Title 21 of the California Code of Regulations. Noise reports and noise contours are prepared quarterly to determine whether user groups are operating within their individual noise budgets, and the reports are submitted to the County of L.A., which monitors residential and other sensitive land uses in areas impacted by greater than 65 dBA CNEL. The most recent Long Beach Airport Noise Report demonstrates compliance with the LBMC Chapter 16.43 noise budget, in which the noise contours were within the noise budget contours provided in Figure 3 on page 14.[22] As illustrated, the noise contours generally extend from northwest

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[18] *Long Beach Airport, LGB Monthly Airport Activity Report, December 2002.*

[19] *Air carrier is defined as a scheduled carrier operating aircraft having a certified maximum takeoff weight of 75,000 pounds or more, transporting passengers or cargo. Commuter carrier is defined as a scheduled carrier operating aircraft having a certified maximum takeoff weight of less than 75,000 pounds, transporting passengers or cargo. Industrial operation refers to aircraft over 75,000 pounds for purposes of production, testing, remanufacturing, or delivery by or under the control of a manufacturer based at the Long Beach Airport.*

[20] *Long Beach Airport, LGB Monthly Airport Activity Report, December 2002.*

[21] *Measured end to end of pavement. There is a short piece of pavement at the south and north ends of Runway 16/34 that is not counted as pavement or as a stopway probably because of an east-west taxiway at the end.*

[22] *Acoustical Analysis Associates, Incorporated, Analysis of Long Beach Airport Noise Monitoring Data for the First Quarter of 2003, May 19, 2003.*

Table 7

LONG BEACH MUNICIPAL AIRPORT RUNWAY CHARACTERISTICS

Orientation	Runway Number	Aircraft Runway Usage (%)	Length (feet)	Width (feet)	Use
East-West	7R/25L	7R (2.5%) 25L (25.0%)	5,420	150	General Aviation
East-West	7L/25R	7L (2.5%) 25R (25.0%)	6,192	150	General Aviation and airline alternate for Runway 12/30
North-South	16R/34L	16R (7.0%) 34L (0.5%)	4,470	75	General Aviation
North-South	16L/34R	16L (7.0%) 34R (0.5%)	4,267	75	General Aviation
Northwest-Southeast	12/30	12 (6.0%) 30 (24.0%)	10,000	200	General Aviation and Commercial

Source: www.airnav.com/airport/KLGB, 2003 and US Department of Transportation, FAA, personal correspondence, November 24, 2003.

to southeast due to the larger aircraft associated with Runway 12/30. The 70-CNEL contour is generally contained within the Airport boundaries. However, the 65-CNEL contour extends to approximately the intersection of Carson Street and Cherry Street. As shown in Figure 3, the southwestern portion of the project site is within the 65-CNEL contour.

The Airport's noise monitoring system is made up of 18 noise monitors located throughout the City of Long Beach and one within the City of Lakewood. The monitors are concentrated northwest and southeast of the Runway 12/30 as air carrier aircraft use this runway and are the predominant noise source at the Airport. Monitoring Station No. 14 is the most representative station for the Lakewood portion of the project site and is located near Pixie Avenue and Greenmeadow Road within the City of Lakewood (see Figure 3 on page 14). Monitoring data from Station Number 14 for the last consecutive 12-month period ending in the first quarter of 2003 is provided in Table 9 on page 40. As shown in this table, SENEL noise levels average approximately 83 dB for arrival and 91 dB for departures.

Air carrier operations during the first quarter of 2003 were predominately A-320s and to a lesser extent MD-80s, where A-320s and MD-80s were approximately 69 and 15 percent of the 33.8 average daily flights, respectively. SENEL noise contours illustrated in Figure 6 on page 37 show a hypothetical typical sound exposure level for a single

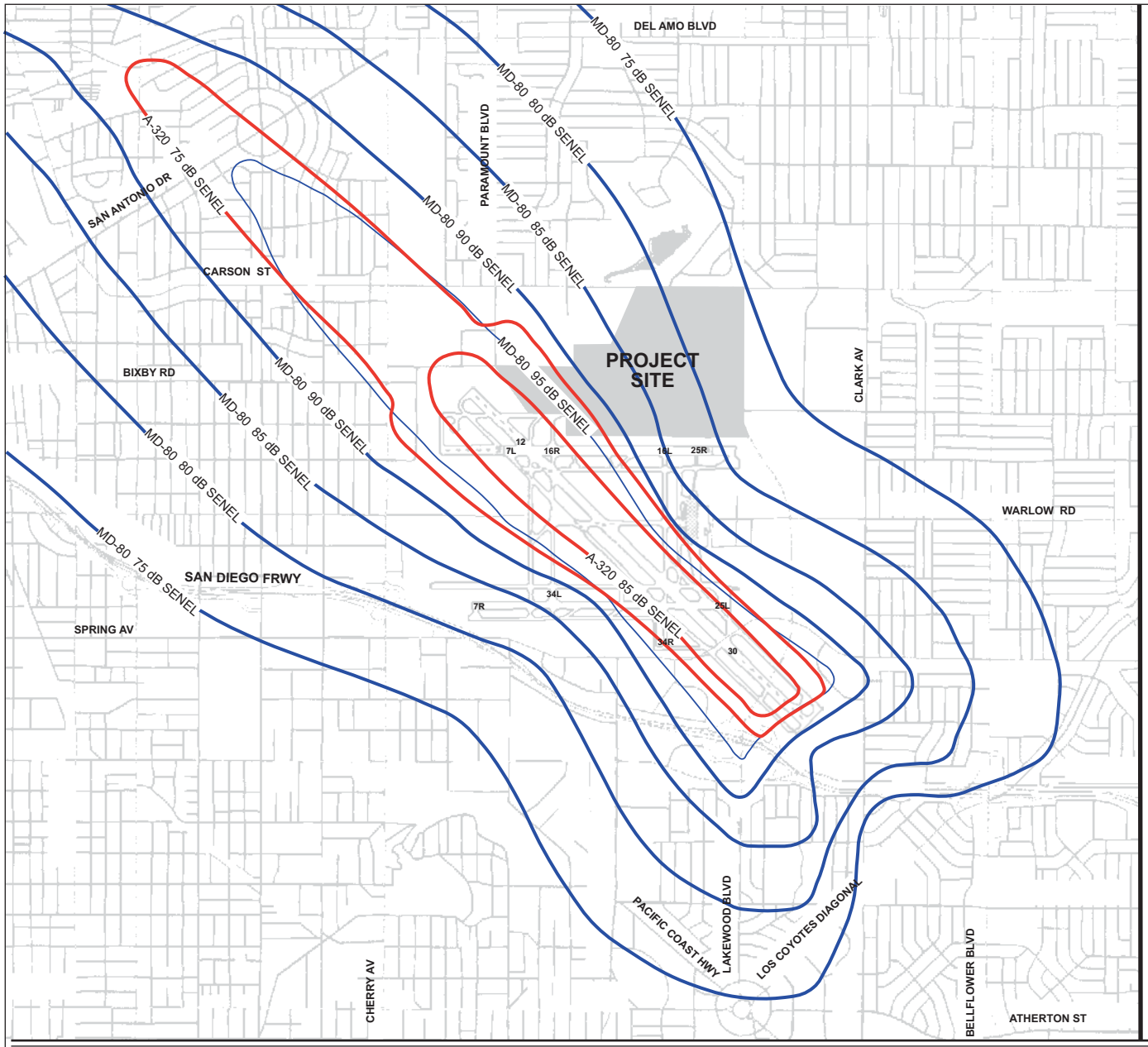
MD-80 and A-320 commercial jet aircraft departure on Runway 30.[23] While the MD-80 and A-320 commercial jet departures are the most common air carrier departure operations, other aircraft will generally produce less noise, while some may on occasion be louder. The SENEL exposure for a typical MD-80 departure ranges from 100 to 75 SENEL from west to east across the proposed project site. The SENEL exposure is reduced substantially for the more predominate A-320 departure and is approximately 90 SENEL along the western boundary of the project site and quickly dissipates below 75 SENEL for most of the project site.

Continuous noise monitoring was conducted at two representative locations on the project site from January 16 through January 19, 2004 to further characterize airport related noise levels north of the Airport (see Figure 5 on page 30). Monitoring data from two positions indicates that the SENEL ranges from 80.2 dBA to 81.8 dBA and the CNEL ranges from 58 dBA to 59 dBA. This measurement data is consistent with measurement data from Long Beach Airport Station No. 14.

Scientific research has found that the minimum continuous sound level that will permit relaxed conversation within 100 percent intelligibility throughout a typical residential living room (talker/listener separation greater than approximately 3.5 feet) is 45 dB (L_{eq} = 45 dB). A 95 percent intelligibility conversation (considered to be "satisfactory conversation") can be obtained with a steady sound level of up to 64 dB.[24] The majority of residential units in the project vicinity comply with California Title 21 (i.e., interior and exterior noise levels of 45 and 65 dB CNEL, respectively). Therefore, longer-duration noise levels (i.e., CNEL and L_{eq}) are not expected to be problematic from a speech interference level as the majority of residential units in the project vicinity comply with California Title 21 and aircraft related interior noise levels are typically less than 45 dBA L_{eq} at residential units. However, noise events produced by aircraft overflights in the project vicinity could exceed an internal 65 SENEL and may intermittently be problematic from a speech interference level. In addition, during outdoor activities aircraft overflights may briefly interfere with speech communication.

[23] *City of Long Beach, Airport Bureau, Written Communication, May 2001 and Jet Blue Long Beach Airport Analysis, May 29, 2001.*

[24] *Source: Caltrans, California Airport Land Use Planning Handbook, January 2002.*



LEGEND

A-320 SENEL Contours

MD-80 SENEL Contours

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Source: City of Long Beach Airport Bureau, 2001 and Jet Blue Long Beach Airport Analysis, 2001

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Figure 6
SENEL Contours for A-320 and MD-80
(Typical Hypothetical Departure from Runway 12/30)

Airport related noise complaints concentrate along the arrival and departure flight track for Runway 12/30 and to a much lesser extent north of Carson Street.[25] Based on general aviation flight track data provided by the City of Long Beach Airport Bureau, the predominant east/west (7L/25R and 7R/25L) runway flight pattern results in over flights north of Carson Street. The north/south (16L/34R and 16R/34L) runway flight pattern is used infrequently and therefore results in few complaints.[26] These overflights may be a source of annoyance to existing sensitive receptors in the project vicinity as the general community attitude toward a CNEL of 60 dB results in approximately seven percent of the population to be highly annoyed.[27]

The Airport has approximately 60,000 annual helicopter operations per year, in which the predominant east/west configuration is used most of the time and inbound and outbound routes occur between 7L/25R and 7R/25L generally in line with Wardlow Road. The north/south configuration is used less frequently and inbound and outbound routes occur between 16R/34L and 16L/34R generally in line with Downey Avenue and Redondo Avenue. The north/south configuration is the only path that crosses the project site. Helicopter corridor utilization characteristics and operational data are provided in Table 8 on page 39. These helicopter operations are included in the noise measurement data provided above in Table 9 on page 40. Noise measurements conducted for overflight helicopter operations on the project site resulted in a maximum noise level of 72 dBA during departure and 75 dBA during an approach for an R-22 helicopter. Emergency services helicopters also operate out of the Airport. The Los Angeles Sheriff's Department typically has two to six operations per night which travel north across the project site following Downey Avenue. In addition, the Long Beach Police Department has eight to ten operations per night and typically take the most direct path to the emergency, which could occur across the project site. These events are infrequent and are unscheduled.

5.2.3 Boeing Engine Run-Up Area

Engine run-up tests for newly manufactured 717 and C-17 aircraft are currently conducted within a 48-acre area known as the Boeing Enclave, located within the western portion of the project site and depicted in Figure 7 on page 41. Refer to Section III of the EIR, Project Description, for a more detailed discussion of operations within the Boeing Enclave.

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[25] *Long Beach Airport, http://www.lgb.org/content/Noise%20Activity.htm*

[26] *Long Beach Airport, http://www.lgb.org/content/Noise%20Activity.htm*

[27] *Source: Federal Interagency Committee on Noise, Federal Agency Review of Selected Airport Noise Analysis Issues, August 1992.*

Table 8

LONG BEACH MUNICIPAL AIRPORT HELICOPTER CHARACTERISTICS

Approach and Departure Corridor	Corridor Usage (%)	Annual Operations (%)	Daily Operations (%)
North Atlantic	2	1,200	3.3
North Downey	22	13,200	36.2
Bellflower	2	1,200	3.3
East Wardlow	22	13,200	36.2
West Wardlow	22	13,200	36.2
Lakewood	3	1,800	4.9
South Redondo	22	13,200	36.2
South Cherry	5	3,000	8.2
Total	100	60,000	164.4

Source: US Department of Transportation, FAA, personal correspondence, November 24, 2003.

C17 Engine Run-Up Tests

Boeing performs a single, identical, run-up test procedure for each individual C-17 aircraft produced prior to delivery (i.e., the procedure requires that tests are conducted at the same engine thrust for each aircraft). These tests are always performed at the same location and always between the hours of 7 A.M. and 9 P.M. on weekdays and 9 A.M. and 9 P.M. on weekends and holidays. While engine runs are allowed to take place into the evening, they are typically not performed after sunset. Boeing projects a limited number of such tests, totaling 16 per year through year 2008.

To characterize the noise levels produced by a C-17 aircraft engine run-up, one such test was surveyed on July 5, 2001 at a single measurement position located in the vicinity of the proposed residential development closest to the run-up area. The measurement position was approximately 35 feet above ground level on top of an existing water tank and approximately 3,200 feet northeast of the run-up position. (The elevated location was chosen to minimize the influence of acoustical screening from buildings closer to the runway).

As perceived from the measurement location, the engine run-up test was comprised of five separate audible events that were audible for periods ranging from 10 seconds to 69 seconds. A period of approximately 13 minutes elapsed between the start of the first audible event and completion of the last audible event. The measured single event levels for the individual events ranged from 67 to 79 (SEL). The maximum measured noise level during the C-17 engine run-up test was 71 dBA (L_{max}). All of the

Table 9

NOISE MONITORING DATA FOR LONG BEACH AIRPORT STATION NO. 14[a]

		Arrival				Departure			
		SENEL		L_{max}		SENEL		L_{max}	
Quarter	CNEL	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
Q4 2001	58.8	84.8	93.0	76.1	82.8	90.7	103.2	81.6	95.7
Q1 2002	59.3	82.9	90.9	72.8	80.8	90.7	106.8	81.6	97.6
Q2 2002	60.6	83.0	92.8	74.4	84.7	91.8	116.9	83.1	109.8
Q3 2002	60.5	80.5	87.8	71.6	79.0	91.1	102.3	82.2	93.9

[a] *The monitoring station is located near Pixie Avenue and Greenmeadow Road within the City of Lakewood*

Source: Dennis Rambeau, Noise/Operations Supervisor of Long Beach Airport, March 5, 2003.

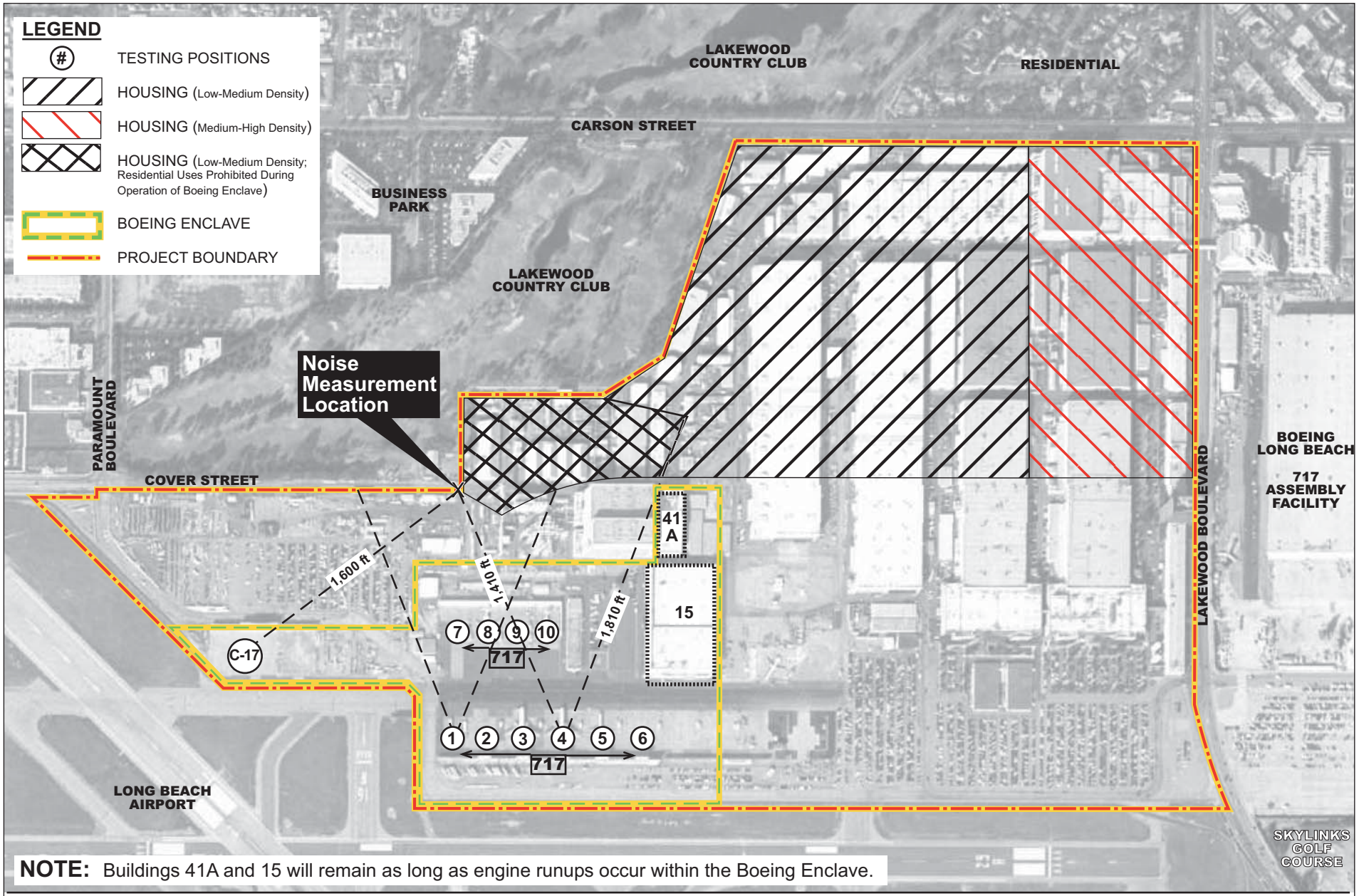
measured single events for the C-17 engine run-up test were lower than the hypothetical typical sound exposure level for a single MD-80 commercial jet aircraft departure on Runway 30, which could be as high as 85 SENEL at the monitoring position.[28] A summary of measured noise levels is provided in Appendix B.

717 Engine Run-Up Tests

Boeing 717 engine tests are conducted in the engine run-up area, which is also used as a staging area for commercial delivery and has a capacity to support up to 10 aircraft in the engine run-up area at any time. Each aircraft is tested individually based on the production schedule, delivery date, and specific engine functions checked. Engine tests vary from brief periods of idle (10 to 30 minutes) to full-thrust runs (1 to 5 minutes) throughout the day and may occur for a second day depending upon whether problems are encountered. It is not typical for two or more aircraft to be at full thrust at the same time. While engine tests are allowed to take place Monday through Sunday 7 A.M. to 9 P.M., primary hours of operation typically occur Monday though Friday 7 A.M. to 5 P.M. Boeing projects a 717 production rate of 12 per year through year 2005.

Test flights are performed for each aircraft and include Boeing test flights, customer acceptance flights, and customer delivery flights. Boeing pilots or customer pilots power off the Boeing Delivery Center ramp located within the Boeing Enclave onto the airport

[28] *SENEL and L_{max} do not have a linear relationship. However, SENEL is typically 5 to 10 dBA higher than L_{max}.*



NOTE: Buildings 41A and 15 will remain as long as engine runups occur within the Boeing Enclave.

PCR

N

Scale not Provided

Sources: Boeing Realty Corporation and PCR Services Corporation, 2004

Figure 7
Boeing 717 Engine Run-Up Noise and Proposed Residential Uses

runway, take off and land, then power back to the ramp. The aircraft may return to the ramp for further engine checks including additional engine run-ups at the ramp. The aircraft may or may not take another test flight based on the requirements of the customer. These test flights are accounted for in the LBMC Chapter 16.43 noise budget.

To characterize the noise levels produced by a 717 aircraft engine run-up, one such test was surveyed on July 17, 2003. The existing water tank position used in the C-17 measurement could not be used for this survey, since Building 41 (approximately 100 feet high) was located between the engine run-up positions and the measurement position. To avoid acoustical screening from this building, an alternate monitoring position was selected, which was located approximately 1,410 feet north-northwest of the engine run-up area along Cover Street. This position was at a similar horizontal angle to the aircraft engine axis that will exist at the C-17 monitoring position located on top of the existing water tank. Noise measurements were conducted at approximately 5 feet above grade to replicate ambient noise conditions for proposed land uses. Noise levels at the water tank monitoring location were estimated from the measured noise data by simply adding a 6 dBA correction per doubling of distance for the increased distance of the monitoring position from the engines compared to the noise survey location. A summary of measured noise levels is provided in Appendix B.

With reference to the measured noise levels, noise levels can be seen to vary, generally rising as the engine thrust was increased. The highest maximum (L_{max}) noise level measured was 91 dBA. Taking this worst-case measured noise level and applying the 6 dBA acoustical loss for distance discussed above, results in an estimated noise level of 87 dBA at the water tank monitoring location of the Boeing C-17 engine run-up tests. The measured maximum noise levels for the 717 engine run-up test will be similar to the hypothetical typical sound exposure level for a single MD-80 commercial jet aircraft departure on Runway 30, which could be as high as 85 SENEL at the monitoring position.

5.3 EXISTING GROUND-BORNE VIBRATION

The predominant source of vibration in the project vicinity is heavy trucks traveling on the local roadways. Other possible sources of vibration located in the vicinity of the southern portion of the project site may include Airport operations (primarily jet aircraft and

helicopters) and Boeing's engine run-up area, where low frequency noise from these sources could cause rattling of doors and windows. [29]

5.4 ONGOING REMEDIATION ACTIVITIES

As discussed in detail in Section V.E. Hazards, a soil and groundwater remediation program is presently being implemented at the project site in accordance with Cleanup and Abatement Order 95-048 issued by the California Regional Water Quality Control Board, Los Angeles Region. The remediation and associated demolition activities result in noise from the use of heavy-duty earthmoving equipment and control equipment (e.g., soil vapor extraction systems, pumps, and motors). These sources of noise affect the existing ambient community noise levels to a much lesser extent then the other sources described above.

[29] *Low frequency noise can travel long distances and it does not decay as rapidly as higher frequency noise. In addition, typical noise attenuation features such as noise barriers are not effective for secondary vibration caused by low frequency noise. However, using new construction materials/methods that include weather-stripping can minimize rattling doors and windows.*

6.0 ANALYSIS OF IMPACTS

Regardless of whether implementation of the PacifiCenter project occurs, the project site and nearby vicinity will continue to be exposed to noise generated by future vehicular traffic increases and continued aviation operations within the Airport. Noise sources associated with implementation of the PacifiCenter project will include intermittent construction activity associated with the proposed project, continued aviation-related uses, and the potential proposed power substation. The future noise levels associated with each of these noise sources and the methodologies used to evaluate these sources are discussed in the following sections.

6.1 METHODOLOGY

A summary of the methodology used to evaluate noise and ground-borne vibration impacts that may result from project construction and long-term operations is provided below.

6.1.1 On-site Construction Noise

Construction noise impacts were evaluated by determining the noise levels generated by construction activity, calculating the construction-related noise level at surrounding residential property locations, and comparing construction-related noise to ambient noise levels (i.e., non-construction noise) to determine significance. More specifically, the following steps were undertaken to ascertain construction-period noise impacts:

1. Noise levels for each construction phase and individual construction equipment were obtained from *Noise from Construction Equipment and Operations, Building Equipment, and Home* Appliances published by the EPA and the *Transit Noise and Vibration Impact Assessment* published by the FTA, respectively.

2. Distances between construction site locations (noise source) and surrounding sensitive receptors (receiver locations) were measured.

3. The construction noise level was then calculated for sensitive receptors locations based on the standard point source noise-distance attenuation factor of 6.0 dBA for each doubling of distance.

4. Impacts were compared to construction-noise impact criteria (i.e., 75 dBA in areas away from main roads and sources of industrial noise) to determine significance.

5. Where significant impacts were identified, feasible mitigation measures were prescribed.

6.1.2 Traffic Noise

Roadway noise impacts were evaluated using the FHWA traffic noise prediction model and forecasted data provided by Crain and Associates.[30,31] The FHWA traffic noise prediction model allows the user to define traffic variables such as vehicles per hour, average travel speed, and fleet mix assumptions (i.e., percentage of light-duty automobiles, medium-duty trucks, and heavy-duty trucks).

Using the FHWA traffic noise prediction model and roadway traffic volume data provided in the project traffic study, the following steps were undertaken to ascertain project-related roadway noise impacts:

1. The project traffic study was reviewed to identify roadway segments that have a potential to be adversely impacted by project-related traffic volumes. Roadway segments were selected based on percentage of project-related traffic to total traffic volumes, percentage of cumulative traffic to baseline traffic volumes, and presence of sensitive receptor locations.

2. Using the FHWA traffic noise prediction model, roadway noise was predicted for the existing, ambient growth without project, ambient growth with project, and ambient growth with project plus all traffic mitigation measures for roadway sections identified from step 1 above.

3. The peak-hour L_{eq} traffic noise level for each roadway segment, obtained above from Step 2, was converted to CNEL using a version of the FHWA traffic noise

[30] *FHWA, The Federal Highway Administration's Traffic Noise Prediction Model FHWA RD-77-108, 1978.*

[31] *Crain & Associates, Traffic Impact Study Report for PacifiCenter, January 2004.*

prediction methodology (FHWA RD-77-108), combined with a Caltrans' peak-hour L_{eq} to CNEL conversion procedure.

4. Impacts were compared to the following roadway noise impact criteria to determine significance:

   a. Criterion 1 – Project-related traffic causes a 5 dBA increase in CNEL along any roadway segment when the overall noise level remains within the acceptable range as shown on the City's Noise/Land Use Compatibility Matrix.

   b. Criterion 2 – Project-related traffic causes a 3 dBA increase in CNEL along any roadway segment when the overall noise level changes from an acceptable range to an unacceptable range; or, the baseline noise level is already within an unacceptable range, as shown on the City's Noise/Land Use Compatibility Matrix.

5. Where significant impacts were identified, feasible mitigation measures were prescribed.

6.1.3 Airport Noise

In compliance with California Title 21 and FAA Guidelines, the published Airport CNEL contours were used to assess potential noise impacts upon the proposed residential uses and associated outdoor recreational areas within the PacifiCenter development resulting from airport noise. More specifically, the following steps were undertaken to ascertain construction-period noise impacts:

1. Proposed residential uses and associated outdoor recreational areas were located on the published Airport CNEL contours and then compared to the 65 CNEL thresholds.

2. The FICAN curve was used to estimate population percentage awakenings for various interior SENEL levels.

6.1.4 Aviation-Related Uses

1. Noise levels associated with proposed aviation-related uses (i.e., a possible corporate jet use) were compared to SENEL curves created using the Federal Aviation Administration's Industrial Noise Model (INM) Version 6.0.

2. Impacts were compared to Chapter 16.43 of the LBMC to determine significance.

6.1.5 On-Site Activities

1. Noise levels associated with on-site activities (e.g., mechanical equipment, truck movements, parking facilities, continued use of engine run-up areas, a potential 66kV Substation) were assessed based on measured and referenced noise levels.

2. The on-site activity noise level was then calculated for sensitive receptors locations based on the standard point source noise-distance attenuation factor of 6.0 dBA for each doubling of distance.

3. Impacts were compared to appropriate noise impact criteria to determine significance.

6.1.6 Ground-Borne Vibration

1. Ground-borne vibration levels associated with construction and operation were identified using FTA and FICAN published documents.

2. Distances between vibration sources and surrounding sensitive receptors were calculated.

3. Impacts were compared to appropriate noise impact criteria to determine significance.

6.2 ANALYSIS OF IMPACTS

The project site and vicinity will be exposed to noise generated by intermittent construction activities associated with the proposed project, including the demolition associated with the separate remediation project, vehicular traffic from the project and other ambient traffic growth, and aviation-related uses. Similar to existing on-site conditions, other sources of noise from the project site will include aircraft engine run-up, power substation, mechanical equipment, truck deliveries, trash pickups, and parking facilities. The future noise levels associated with each of these noise sources are discussed in the following sections.

6.2.1 Construction

Construction Noise Levels

Noise impacts from construction activities occurring within the project site will be a function of the noise generated by construction equipment, the equipment location, and the timing and duration of the noise-generating activities. Construction activities will include six stages: (1) demolition;[32] (2) site preparation; (3) excavation; (4) foundation construction; (5) building construction; and (6) finishing and cleanup. Each stage involves the use of different kinds of construction equipment and, therefore, has its own distinct noise characteristics. As discussed above in the Regulatory Framework, construction activities will be limited to the hours specified in the Long Beach Municipal Code, which is more restrictive than the Lakewood Municipal Code, thereby limiting the hours during which construction noise will be generated.

The nearest sensitive receptors with potential to be disturbed by construction activities include single-family residences located on the north side of Carson Street. These residential structures are located approximately 125 feet from the closest project construction and approximately 175 feet from the nearest construction area. In addition, a nine-foot wall separates the residences from Carson Street and the project site. This nine-foot wall was built to reduce traffic-related noise levels, but will also reduce construction noise levels by approximately 9 dBA.[33] The closest non-residential sensitive receptor is the Herbert Hoover Middle approximately 2,700 feet northwest of the project site and is well screened from the project site by the nine-foot wall along Carson Street. In addition, Long Beach City College is located approximately 500 feet west of the project site and 550 feet from the nearest construction area. However, Long Beach Community College is well shielded from any potential noise from the project site, as several large buildings east of Lakewood Boulevard are located between the project site and such uses.

As with most development projects, construction will require the use of mobile heavy equipment with high noise level characteristics. Individual pieces of construction equipment that will be used for project construction and referenced noise levels are provided in Table 10 on page 49. As indicated in Table 10, construction equipment will

[32] *Some demolition activities associated with the remediation program underway within the project site may overlap with project construction activities. In addition, when activities within the Boeing Enclave cease, the Boeing Enclave may be demolished as part of the remediation program or as part of the project. For purposes of providing a conservative analysis, activities it is assumed that demolition of the Boeing Enclave will occur as part of the proposed project*

[33] *EPA, Noise from Construction Equipment and operations, Building Equipment and Home Appliances, PB 206717, 1971.*

Table 10

CONSTRUCTION EQUIPMENT MAXIMUM NOISE LEVELS

Equipment	Noise Level (dBA) at 50 feet
Air Compressor	81
Backhoe	80
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	81
Grader	85
Jack Hammer	88
Loader	85
Paver	89
Pile Driver (Impact)	101
Pile Driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Roller	74
Saw	76
Scraper	89
Truck	88

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment, 1995.

produce maximum noise levels of 74 dBA to 101 dBA at a reference distance of 50 feet from the noise source. These maximum noise levels will occur when equipment is operating under full power conditions or during “impact” activities such as pile driving, jack hammering, or sawing. Using the industry standard sound attenuation rate of 6 dB per doubling of distance for point sources (e.g., construction equipment), a noise level of 101 dBA at a distance of 50 feet will be about 95 dBA at 100 feet, and 89 dBA at 200 feet. As heavy equipment passes near the project site boundary, the maximum noise level at a given moment at the nearest residential receptor could reach as high as 93 dBA, but noise levels will be reduced to 84 dBA with consideration of barrier insertion loss from the existing sound wall. As the equipment travels toward the center of the project site, the maximum noise level at the property line will diminish considerably into the 60’s dBA.

These estimated maximum noise levels will not be continuous, nor will they be typical of noise levels throughout the construction period.

Equipment used on construction sites often operates under less than full power conditions, or part power. Actual measurements performed while equipment is performing work indicate that shift-long equivalent L_{eq} sound levels are typically 2 dBA to 15 dBA less than maximum noise levels. For project-long equivalent L_{eq} levels, these values can be further reduced to account for the percentage of time that equipment actually operate on the construction site.[34] Table 11 on page 51 lists the highest noise levels associated with each phase of construction. These estimated construction noise levels are governed primarily by the high noise-producing pieces of equipment to be used and represent conservative worst-case conditions in which the maximum amount of construction equipment will be operating during a one-hour period. These estimated maximum hourly noise levels will not be typical of noise levels throughout the construction period. To account for multiple construction crews operating in close proximity to each other, a maximum 89 dBA L_{eq} at 50 feet was used as a worst-case construction L_{eq}. The estimated aggregate construction noise levels during the heaviest periods of activity at each receptor are provided in Table 12 on page 52. Table 12 shows that the residences located to the north of the project site along Carson Street (Receptor 2) will occasionally experience construction noise levels of 70 dBA (hourly L_{eq}) during the heaviest periods of construction. If pile driving is required in the northern section of the project site along Carson Street, nearby residences could experience maximum noise levels of 84 dBA. As the worst-case hourly L_{eq} exceeds ambient noise levels by more than the 5 dBA incremental significance threshold, construction of the proposed project will result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity and a significant impact to off-site sensitive receptors without incorporation of mitigation measures.

Since proposed residential areas will be constructed prior to project buildout and construction of the 66kV Substation, on-site sensitive receptors could be located as close as 75 feet from a construction zone and will therefore occasionally experience construction noise levels as high as 83 dBA. If pile driving is required on-site, sensitive receptors could experience maximum noise levels of 98 dBA. These noise levels will be considerably higher than ambient noise levels. As the worst-case hourly L_{eq} will be more than the 5 dBA incremental significance threshold, construction of the proposed project will result in a significant impact to proposed on-site sensitive receptors without incorporation of mitigation measures. However, such noise levels will be experienced for short-durations as only portions of the project site will be under construction at any one time. The majority

[34] *Beranek and Ver, Noise and Vibration Control Engineering, Principles and Applications, p. 652, 1992.*

Table 11

OUTDOOR CONSTRUCTION NOISE LEVELS WITH MUFFLERS

Construction Stage	L_{eq} (dBA) at 50 feet
Ground Clearing	82
Excavation, Grading	86
Foundation	77
Structural	83
Finishing	86

Source: EPA, Noise from Construction Equipment and Operations, Building Equipment and Home Appliances, PB 206717, 1971.

of the time construction noise levels at on-site sensitive locations will be much lower due to reduced construction activity and the phasing of construction (i.e., construction noise levels at a given location will be reduced as construction activities conclude or move to another more distant location of the site). Furthermore, the estimated highest noise levels do not account for shielding that may be provided by future structures located between construction activity areas and adjacent receptors.

Based on the size of the project, a number of delivery trucks and haul trucks will require access to the site on a daily basis. Therefore, a project feature has been included to avoid sensitive land uses (e.g., schools and residences) by accessing the project site from the I-405 along Lakewood Boulevard and Cherry Boulevard.

Construction Vibration

Construction operations can generate varying degrees of ground vibration, depending on the construction procedures and the construction equipment used. Operation of construction equipment generates vibrations that spread through the ground and diminish in amplitude with distance from the source. The effect on buildings located in the vicinity of the construction site often varies depending on soil type, ground strata, and construction characteristics of the receptor building(s). The results from vibration can range from no perceptible effects at the lowest vibration, to low rumbling sounds and perceptible vibrations at moderate levels, to slight damage at the highest levels. Ground vibrations from construction activities rarely reach the levels that can damage structures. Typically, pile driving generates the highest vibration. The FTA has published standard vibration velocities for construction equipment operations. The root mean square velocity level and peak particle velocities are listed in Table 13 on page 53.

Table 12

HIGHEST ESTIMATED L_{eq} CONSTRUCTION NOISE LEVELS AT RECEPTOR LOCATIONS (During Heaviest Periods of Construction Activity for One-Hour Period)

Receptor Number and Land Use [a]	Presumed Ambient Noise Level (dBA) [b]	Distance to Construction Zone (feet)	Predicted Aggregate Construction Noise (dBA) [c]	Predicted Pile Driving Noise (dBA)
1-Residential	60	1,850	58	70
2-Residential	60	175	70 [c]	84 [d]
3-School	60	2,700	45 [d]	57 [d]
On-site Residential	60	75	86	98

[a] *Receptors are shown in Figure 5.*
[b] *Based on the exterior noise level standards identified in Table 1 (LBMC Section 8.80.150).*
[c] *Based on heaviest period of construction activity over a one-hour period.*
[d] *A 9 dB noise reduction adjustment was applied to the calculated value to account for shielding and barrier effects from the ten-foot sound wall along Carson Street.*

Source: PCR Services Corporation, 2004.

As indicated in Table 13, based on the FTA data, vibration velocities from typical heavy construction equipment operations range from 0.003 to 0.644 inch/sec at 25 feet from the source of activity. At 75 feet from the source of activity, vibration velocities from typical heavy construction equipment operations range from 0.001 to 0.124 inch/sec. Within the project site, the highest vibration will be generated during pile driving operations, while more consistent, but lower ground vibration will be generated during the clearing, excavation, and grading processes when heavy materials are moved. Both off-site and on-site sensitive land uses will be located at a sufficient distance (greater than 75 feet) from any potential pile driving activity so that vibration from such activities will be below the peak particle velocity threshold of 0.2 inch/sec. Therefore, the project will not generate excessive ground-borne vibration or ground-borne noise levels and vibration impacts associated with construction will be less than significant.

Table 13

VIBRATION VELOCITIES FOR CONSTRUCTION EQUIPMENT

Equipment	Approximate Velocity Level at 25 ft, VdB	Approximate Peak particle Velocity at 25 ft, inch/second	Approximate Peak Particle Velocity at 75 ft, inch/second
Pile Driver (impact) [a]	104	0.644	0.124
Pile Driver (sonic) [a]	93	0.170	0.033
Hydromill (slurry wall in soil)	66	0.008	0.002
Hydromill (slurry wall in rock)	75	0.017	0.003
Large bulldozer	87	0.089	0.017
Caisson drilling	87	0.089	0.017
Loaded trucks	86	0.076	0.015
Jackhammer	79	0.035	0.007
Small bulldozer	58	0.003	0.001

[a] *Data reflects typical vibration level.*

Source: USDOT Federal Transit Administration, 1995.

6.2.2 Operational Noise Levels

Traffic Noise Levels

The CNEL generated by future traffic on the local roadways that serve the project site has been estimated using the FHWA traffic noise prediction model and forecasted traffic data provided by Crain and Associates.[35, 36] The roadway segments were selected for study based upon two factors: (1) the volume of project-generated traffic; and (2) the presence of sensitive receptors. In general, study segments are those that are proximal to the project site and a sensitive noise receptor such as a residence, or school. The traffic noise analysis considered the roadway configuration, percentage of 2-axle and 3-axle trucks, 24-hour count data to develop day/evening/night split, average vehicle speeds, and right-of-way distances to calculate future traffic noise levels. Table 14 on page 54 provides the estimated traffic CNEL at the selected roadway segments for the following scenarios for year 2020: ambient growth without the project; ambient growth plus project development; and ambient growth Plus project development plus all traffic mitigation. Table 14 also lists the project-related increase in CNEL above future without project noise levels and the cumulative increase in CNEL above existing traffic noise levels. As

[35] *FHWA, The Federal Highway Administration's Traffic Noise Prediction Model RD-77-108, 1978.*

[36] *Crain and Associates, Traffic Impact Study Report for PacifiCenter, January 2004.*

Table 14

PREDICTED FUTURE TRAFFIC NOISE LEVELS—PROJECT BUILDOUT (2020)

Roadway Segment #	Roadway Segment	Existing CNEL	Predicted Future CNEL (dBA) at the Right-of-Way of Roadway				
			Ambient Growth Without Project [a]	Ambient Growth With Project	Ambient Growth Plus Project and All Traffic Mitigation	Project Increase [b]	Cumulative Increase [c]
1	Atlantic Avenue North of Carson Street	69.4	70.2	70.2	70.2	0.0	0.8
2	Bellflower Boulevard North of Carson Street	69.3	69.7	69.9	69.9	0.2	0.6
3	Candlewood Street West of Lakewood Boulevard	68.0	69.4	69.4	69.4	0.1	1.5
4	Carson Street West of Lakewood Boulevard	61.1	62.0	62.5	62.5	0.5	1.4
5	Carson Street East of Lakewood Boulevard	60.5	61.1	61.9	61.8	0.7	1.3
6	Carson Street East of Clark Avenue	60.7	61.2	61.8	61.6	0.4	0.9
7	Cherry Avenue North of Carson Street	68.6	69.3	69.6	69.9	0.6	1.3
8	Clark Avenue North of Conant Street	68.3	68.7	69.0	68.9	0.2	0.6
9	Clark Avenue South of Conant Street	67.3	67.7	67.7	67.8	0.1	0.5
10	Conant Street East of Lakewood Boulevard	56.2	57.5	64.9	64.5	7.0	8.3
11	Conant Street East of Clark Avenue	56.8	57.1	61.7	61.4	4.3	4.6
12	Cover Street West of Paramount Boulevard	65.4	65.9	69.4	69.2	3.3	3.8
13	Lakewood Boulevard North of Carson Street	70.2	70.5	71.7	71.6	1.1	1.4
14	Lakewood Boulevard North of Wardlow Road	70.9	71.7	73.7	73.5	1.9	2.7

Table 14 (Continued)

PREDICTED FUTURE TRAFFIC NOISE LEVELS—PROJECT BUILDOUT (2020)

Roadway Segment #	Roadway Segment	Existing CNEL	Predicted Future CNEL (dBA) at the Right-of-Way of Roadway				
			Ambient Growth Without Project [a]	Ambient Growth With Project	Ambient Growth Plus Project and All Traffic Mitigation	Project Increase [b]	Cumulative Increase [c]
15	Orange Avenue South of Wardlow Road	67.5	67.6	67.6	67.6	0.0	0.1
16	Paramount Boulevard South of Del Amo Boulevard	65.5	66.4	67.4	66.9	0.5	1.4
17	Paramount Boulevard North of Carson Street	65.2	66.2	67.5	67.0	0.8	1.8
18	Paramount Boulevard South of Carson Street	66.3	67.8	69.5	68.9	1.1	2.6
19	Wardlow Road West of Cherry Avenue	65.4	66.1	66.3	66.3	0.2	0.9
20	Wardlow Road East of Cherry Avenue	63.3	63.8	63.9	63.9	0.0	0.5
21	Wardlow Road East of Lakewood Boulevard	63.9	64.6	66.7	66.5	1.9	2.6

[a] *Includes ambient traffic growth projected through year 2020.*

[b] *Increase relative to traffic noise levels associated with ambient growth without the project, resulting from ambient growth plus project development and all traffic mitigation.*

[c] *Cumulative increase relative to existing traffic noise levels, resulting from ambient growth plus project development and all traffic mitigation.*

Source: PCR Services Corporation, 2004.

indicated therein, existing CNEL traffic noise levels at 50 feet from the right-of-way of the analyzed segments range from 56.2 to 70.9 dBA. Future without project CNEL traffic noise levels (ambient growth without the project) at the segment locations will range from 57.1 to 71.7 dBA. Future CNEL noise levels with ambient growth plus project development and all traffic mitigation measures will range from 61.3 to 73.5 dBA for the roadway segments. The future traffic-generated CNEL along the analyzed roadway segments and traffic volumes are provided in Table A-1 of Appendix A.

Compared with the future without project conditions, the increase in future predicted CNEL with ambient growth plus project development and all traffic mitigation will be a maximum of 4.3 dBA and will be less than significant for all roadway segments presented in Table 14, with the exception of Conant Street east of Lakewood Boulevard (Roadway Segment No. 8), which will increase by 7.0 dBA. This roadway segment is bordered by parking facilities and the Boeing 717 Assembly Facility. While noise levels associated with project traffic at this roadway segment will be a significant and unavoidable impact, no sensitive receptors will be impacted. An additional analysis was completed for A Street located within the western portion of the site as this street may be located farther to the north and adjacent to the Lakewood Country Club Golf Course (in the vicinity of where Cover Street is currently located). Given the low level of traffic that currently travels on this segment, mobile noise levels were predicted to increase by 18.7 dBA at this location. However, this roadway segment is bound by the Airport to the south and a golf course to the north, and, therefore no sensitive residential receptors will be impacted. Nonetheless, noise levels associated with project traffic at this roadway segment will result in a significant and unavoidable impact.[37]

Additional analysis was conducted to account for the increase in heavy duty truck trips associated with any accessory warehouse uses. If the project were to include up to the permitted amount of warehouse uses in the PCC-1 and PCC-2 areas, roadway noise levels will increase by a maximum of 0.1 dBA over the project noise levels displayed in Table 14 at roadways where heavy duty trucks are likely to travel. Therefore, increased heavy duty truck trips associated with potential warehouse uses will not significantly exacerbate the impact at Conant Street east of Lakewood Boulevard nor create new significant impacts.

Airport Noise Exposure at the Site

In compliance with the policies of the ALUP, California Title 21 and FAA Guidelines, the published Airport CNEL contours were used to assess potential noise impacts upon

[37] *Predicted project traffic related noise levels will drop below airport noise CNEL noise levels at approximately 175 feet north of the roadway right-of-way which is based on a 4.5 dBA per doubling of distance drop-off rate for soft sites (i.e., soft dirt, grass or scattered bushes and trees).*

the proposed residential uses and associated outdoor recreational areas within the PacifiCenter development resulting from airport noise. LBMC Chapter 16.43.050(A) states that, "it is the goal of the City that incompatible property in the vicinity of the Airport shall not be exposed to noise above 65 CNEL." CNEL noise contours produced by landing and takeoff activity at the Airport, which are based upon the maximum expected operating scenario allowed by LBMC Chapter 16.43, are shown in Figure 8 on page 57. As indicated by Figure 8, the residential uses and associated outdoor recreational areas proposed within the PacifiCenter site will be outside of the 65 CNEL contour. Therefore, the project will not expose people residing or working in the project area to excessive noise levels and noise impacts from airport operations upon such land uses such as residential development and associated outdoor recreational areas will be less than significant since these uses will be exposed to appreciably lower noise levels than cited by California Title 21, FAA Guidelines, and LBMC policy.

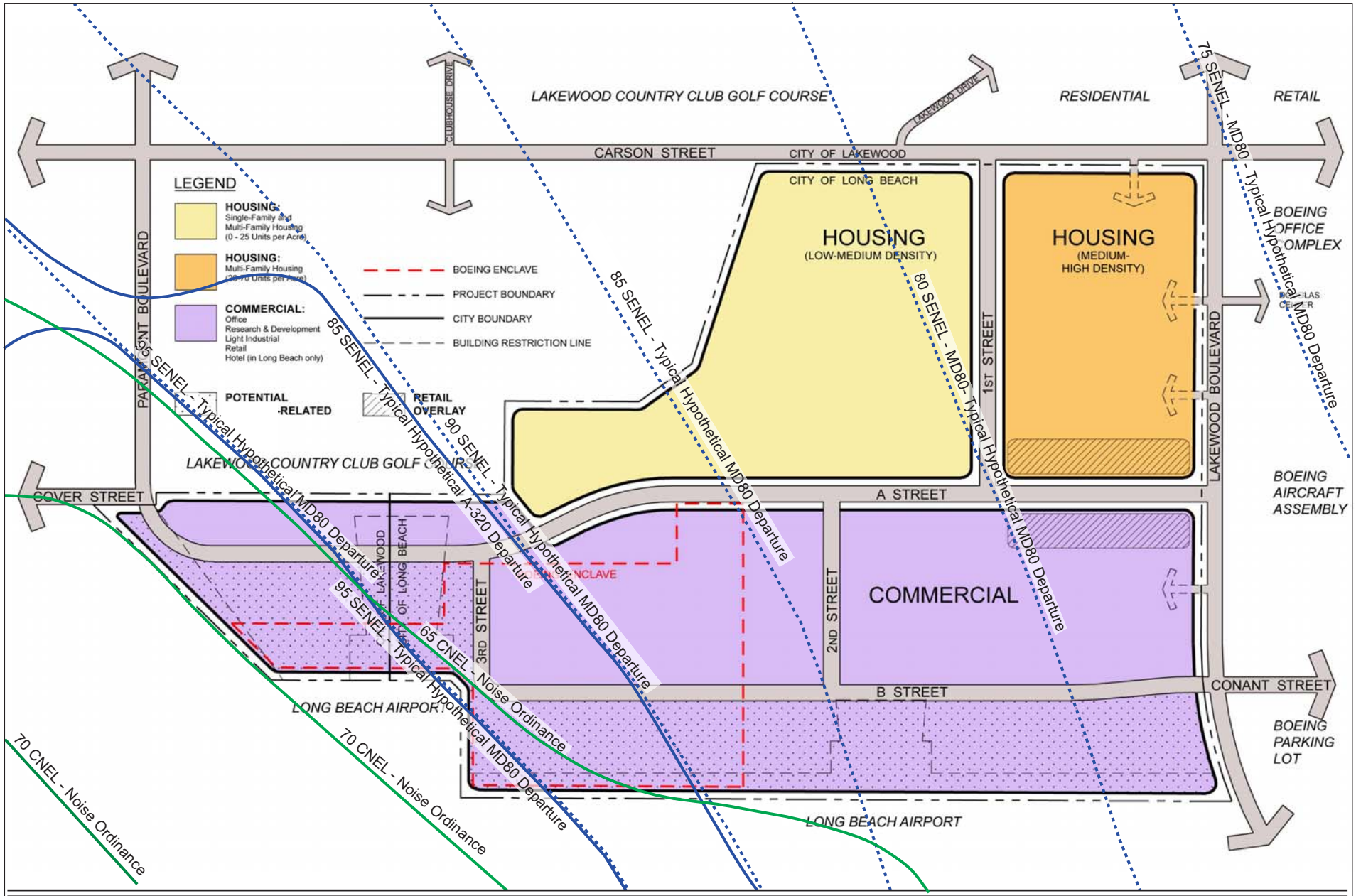
Consistent with the ALUP, Title 21 of the California Code of Regulations, Division 2.5 (Caltrans, Division of Aeronautics), requires a minimum standard of exterior sound transmission control for residential buildings that are located within the 65 CNEL contour such that internal noise levels due to external noise sources should not exceed 45 dB CNEL for habitable rooms. Although proposed residential buildings will be outside of the 65 CNEL contour, project features discussed above will be incorporated into the project to ensure that all habitable rooms of residential buildings on the project site will not exceed 45 dB CNEL.

The SENEL noise contours illustrated in Figure 8 show a hypothetical typical sound exposure level for a single MD-80 and A-320 commercial jet aircraft departure on Runway 30.[38] While the MD-80 and A-320 commercial jet departures are the most common air carrier departure operations, other aircraft will generally produce less noise, while some may on occasion be louder. The SENEL exposure for the proposed residential uses within PacifiCenter located closest to the Airport from the louder typical MD-80 departure could be as high as 90 SENEL, which with typical residential outside-to-inside modern construction noise insulation of 25 dBA will yield an internal 65 SENEL.[39]

The Federal Interagency Committee on Aviation Noise (FICAN) in 1997 recommended use of a particular dose-response curve that can be used to estimate "the maximum percent of the exposed population expected to be behaviorally awakened" from the SENEL. This is referred to as the FICAN 1997 curve. This curve has been used to estimate population percentage awakenings for various interior SENEL levels. In

[38] *City of Long Beach, Airport Bureau, Written Communication, May 2001 and Jet Blue Long Beach Airport Analysis, May 29, 2001.*

[39] *California Land Use Planning Handbook, January 2004.*



PCR

Source: MVE Architects, January 2004

Figure 8
Airport Compatibility with Future Proposed Project Land Uses

evaluating the typical MD-80 departure contour supplied by the City of Long Beach and based upon data published by FICAN in 1997, an interior noise level of 65 SENEL corresponds to only a five percent probability of awakening.[40] Also, with the exception of general aviation, the Airport has a curfew that limits operations to between 7 A.M. and 10 P.M. Although there is no established significance threshold for SENEL, the low probability of awakening from a typical MD-80 departure coupled with the fact that the Airport has a curfew, indicates a low possibility of such sleep disruption.

As discussed earlier, a "satisfactory conversation" can be obtained with a steady sound level of up to 64 dBA. Therefore, an internal 65 SENEL during a typical MD-80 departure could be intermittently problematic from a speech interference level. In addition, during outdoor activities aircraft operations may briefly interfere with speech communication. Airport related noise complaints concentrate along the arrival and departure flight track for Runway 12/30 and to a much lesser extent north of Carson Street and does not impact the project site. Based on general aviation flight track data provided by the City of Long Beach Airport Bureau, the predominant east/west (7L/25R and 7R/25L) runway flight pattern results in over flights north of Carson Street. The north/ south (16L/34R and 16R/34L) runway flight pattern likely results in few complaints as it is used infrequently due to the short runway length, limitation for only visual operations, and curfew after 10:00 P.M. These overflights may be a source of annoyance to proposed sensitive receptors on the project site as a portion of the proposed residential uses are within the 60 CNEL contour and the general community attitude toward a CNEL of 60 dB results in approximately seven percent of the population to be highly annoyed.[41]

The Airport has approximately 60,000 annual helicopter operations per year, in which the predominant east/west configuration is used most of the time and inbound and outbound routes occur between 7L/25R and 7R/25L generally in line with Wardlow Road. Thus the majority of potential helicopter flights do not occur over the project site. In fact, as shown in Table 8, only approximately 39 helicopter overflights occur over the project site per 24-hour period and typically occur during daytime hours. Emergency services helicopters also operate out of the Airport. The Los Angeles Sheriff's Department typically has two to six operations per night which travel north across the project site following Downey Avenue. In addition the Long Beach Police Department has eight to ten operations per night and typically take the most direct path to the emergency, which could occur across the project site. These events are infrequent and are unscheduled. Noise measurements conducted for overflight helicopter operations on the project site resulted in

[40] *FICAN, Annual Report Federal Interagency Committee on Aviation Noise, 1997.*

[41] *Source: Federal Interagency Committee on Noise, Federal Agency Review of Selected Airport Noise Analysis Issues, August 1992.*

a maximum noise level of 72 dBA during departure and 75 dBA during an approach for a R-22 helicopter. These noise levels will not be problematic from a speech interference level as aircraft related interior noise levels will be below 64 dBA L_{eq}. Also, project features discussed above will be incorporated into the project to ensure that all habitable rooms of residential buildings on the project site will not exceed 45 dB CNEL and will substantially lessen annoyance to residential uses.

Aviation-Related Uses

The project could also include an optional component allowing for the continuation of a limited amount of aviation-related uses on the PacifiCenter site. The uses will primarily serve as an amenity to businesses at the project site and will include hanger space for corporate jets and line maintenance "A" checks.[42] As illustrated by the Federal Aviation Administration's Industrial Noise Model (INM) Version 6.0 SENEL curves provided in Appendix A-4, all reasonably foreseeable types of aircraft that may use the Airport will comply with LBMC Chapter 16.43 SENEL requirements. In addition, the proposed operations will not affect overall activity at the Airport since it must maintain compliance with LBMC Chapter 16.43 noise budgets. Furthermore, in accordance with the LBMC, if noise levels from general aviation exceed its cumulative noise budget, the General Aviation Noise Committee will institute voluntary noise reduction measures. If these voluntary procedures do not sufficiently reduce the cumulative noise levels after two calendar quarters, the Airport Manager will require mandatory reductions.

The potential aviation-related uses will employ several tugs, several service carts and auxiliary power units. These pieces of equipment will only be operated intermittently in support of aircraft operations. In addition, the structures related to the hanger space will be positioned between any aviation activity and adjacent on-site land uses, thus limiting the amount of noise perceptible from these operations. Therefore, noise levels associated with operation of the aviation-related uses will be less than significant.

Boeing Engine Run-Up Area

As discussed above, Boeing will continue to conduct engine run-up tests for newly manufactured 717 and C-17 aircraft in the Boeing Enclave. The published airport noise contours make no allowance for these ground activities. As discussed earlier, the project will limit the development of residential uses in close proximity to the Boeing Enclave until

[42] *Line Maintenance "A" checks are scheduled functional inspections performed from a checklist. The activities include lubrication of moving parts, servicing of fluids, inspection of components, hoses, electrical items and aircraft structure. Lighting and a ground power unit are used during these checks.*

such time that 717 run-up activities permanently cease. Please see Figure 7 on page 41 for a delineation of this zone. In addition, Boeing will preferentially use the testing positions along the southern side of the Boeing Enclave (Numbers 1-6) so that the engines are facing away from proposed residential uses and towards the Airport.

With incorporation of project features, the closest proposed residential uses will be located approximately 1,810 feet northeast of the 717 engine run-up area. Adjusting the measured maximum noise levels measured in the engine run-up tests will result in a 717 maximum noise level of 88 dBA (L_{max}). Based upon the specified noise insulation that will be required for the completed residential buildings, the maximum internal noise level in a residential unit attributable to these tests will be approximately 63 dBA. As shown in Appendix B, the maximum L_{eq} for the 717 engine run-up testing will occur for approximately five minutes and will result in a 78 dBA exterior or 53 dBA interior noise level at the closest proposed residential uses. This interior noise level will not be expected to significantly interfere with typical speech communication, watching television or similar activities taking place indoors. However, 717 engine run-up noise may interfere with speech communication during outdoor activities.

The closest proposed residential uses will be located approximately 1,600 feet northeast of the C-17 run-up area. Adjusting the measured maximum noise levels measured in the engine run-up tests will result in C-17 maximum noise level of 83 dBA (L_{max}). Based upon the specified noise insulation that will be required for the completed residential buildings, the maximum internal noise level in a residential unit attributable to these tests will be approximately 58 dBA (L_{max}) and is less than the 717 maximum noise levels. This noise level will occur for brief moments during the engine run-ups. In addition, commercial uses immediately north of the C-17 engine run-up area could reach a maximum noise level of 89 dBA (L_{max}). This noise level is less than the maximum noise levels from aircraft departing Runway 12/30, as shown in Table 4 (Station No. 14). However, C-17 engine run-up noise may interfere with speech communication during outdoor activities.

Given the relative infrequency of these C-17 and 717 engine run-up tests (compared to the 41 air courier flights per day as well as commuter, industrial, charter, and military operations already accounted for in the City's CNEL noise contours for the airport), together with the fact that the associated single event and L_{max} noise levels measured for the C-17 and 717 are similar to the average levels monitored over the last consecutive 12-month period at the most representative station for the project site (Station No. 14), it is reasonable to rely upon the published CNEL contours for the Airport in order to assess the

potential noise impact upon the residential land uses of the PacifiCenter project.[43] Therefore, as residential development and associated outdoor recreational areas will not be located within the 65 CNEL contour, no significant impact will occur from the Boeing engine run-up tests.

6.2.4 Substation

The proposed 66kV substation will include four 28 MVA transformers. In addition, as described in the project features an eight-foot high wall will enclose the substation area (approximately 340 feet by 230 feet) if it is located within a residential area.

Operation of the substation will result in the production of long-term noise from transformers. The substation may be located near residential or commercial uses but this conservative analysis assumed the substation will be located near residential uses. The City of Long Beach's noise ordinance specifies a noise level of 55 and 45 dBA at the receiving property boundary as the acceptable limit during the daytime and nighttime hours, respectively. Each transformer will generate a maximum sound level of 61 dBA at approximately six feet. Using accepted additive noise methodology, four transformers will generate a maximum noise level of 67 dBA at approximately six feet. For point sources such as transformers, noise decrease by approximately 6 dBA for each doubling of distance for a hard, flat site (no topography). Therefore, with distance attenuation alone and not accounting for the eight-foot wall project feature, the worst-case noise level will be less than 45 dBA at the substation property line, which will comply with the strictest LBMC and LMC nighttime noise standards. Therefore, noise impacts resulting from operation of the substation will be less than significant.

6.2.5 Mechanical Equipment

Project development will include mechanical equipment, which could generate noise levels that are audible at both on- and off-site noise sensitive locations. Such equipment may include, but will not be limited to, air conditioners, fans, blowers, compressors, and pumps that will be used to support the basic functioning of various structures and/or facilities on the property. However, most of this mechanical equipment will be expected to be located within enclosures or behind new buildings or otherwise shielded from the nearby sensitive land uses. In addition to this physical shielding, proper engineering during the detailed design phases, including noise control engineering of the mechanical equipment, should ensure that the noise generated by mechanical equipment

[43] *Station No. 14 is the most representative station for the project site and is located near Pixie Avenue and Greenmeadow Road within the City of Lakewood (see Figure 3 on page 14).*

operations will meet both LBMC and LMC noise standards. Impacts are expected to be less than significant.

6.2.6 Truck Movements

The noise produced by delivery and trash pick-up trucks at the project site will also be a potential source of annoyance. The noise level within 50 feet of a delivery and trash truck will be approximately 86 dBA during the heaviest periods of activity. These sources of noise currently occur within the project site and vicinity and are typical in an urban environment. As these operations will be intermittent and will occur for short durations, impacts will be less than significant at both on-site receptors and the receptors nearest to the project site.

6.2.7 Parking Facilities

Various sounds, including automobile movement, car alarms, car horns, door slams, and tire squeals, may occur at the parking facilities (surface parking areas and parking structures). The activation of car alarms, sounding of car horns, slamming of car doors, and tire squeals will occur periodically and may occasionally be audible. Noise from these sources, even though intermittent and short-term in nature, may be intermittently audible to nearby sensitive land uses. Automobile movement will result in the most continuous source of noise and will result in a noise level of approximately 50 dBA at a distance of 25 feet. The resultant noise levels at any nearby sensitive land uses without incorporation of project design features will be over the nighttime residential noise standard of 45 dBA specified in Section 8.80 of the LBMC. As described above, the floors of parking structures will be broom finished to minimize noise from tires, and 42-inch solid spandrels will be used to reduce noise transmission. Parking structures will also include walls or barriers that block the line-of-site from sensitive receptors to parking stalls. Landscaping will be provided along the exterior of all parking structures and parking lots to assist in buffering noise. In addition, project features proposed to reduce interior noise levels at residences from aircraft noise will also reduce noise levels from parking facilities. Noise levels will thus, be reduced with implementation of these project features. A conservative attenuation rate of 6 dBA, only accounting for blocking the line-of-site from sensitive receptors, will result in a noise level of 44 dBA at a distance of 25 feet, which is in compliance with Section 8.80 of the LBMC. Therefore, noise levels associated with operation of the parking facilities will be less than significant.

6.3 FUTURE VIBRATION

Future ground-borne vibration in the project vicinity will continue to be generated by heavy trucks traveling on the local roadways. Potential ground-borne vibration impacts from the airport and Boeing Enclave are not anticipated to affect the new residential uses within the PacifiCenter project site, since all airplanes are equipped with compressed air rubberized tires that act as vibration isolators. In addition, project features to reduce interior noise levels at residences from aircraft noise will help to reduce vibration.

Additional measurements of a Boeing 717 engine run-up test were conducted on July 17, 2003, to determine if low frequency noise levels may cause structure borne vibration and secondary interior noise impacts from possible rattling of doors and windows. These measurements were conducted using the C-weighted scale, which is a better indicator of low-frequency noise as compared to the A-weighted scale. The results indicate that noise levels within the proposed residential uses north of the Boeing Enclave could reach levels of 81 dBC L_{eq} and 89 dBC L_{max}. A complete discussion of the measurements is provided in Appendix B.

Information provided by the Federal Interagency Committee on Aviation Noise (FICAN) Expert Panel[44] suggests that the ideal descriptor for measuring low frequency sound level (LFSL) is the sum of the maximum sound levels in the 25-80 Hz one-third octave bands during individual noise events. The documentation provides a low frequency survey response curve conducted at MSP and LAX. The C-weighted measurements best represent the LFSL and were therefore used with the response curve to determine the prevalence of high annoyance due to rattle or vibration. Based on a maximum noise level of 89 dBC, approximately 38 percent of the people will be highly annoyed due to rattle or vibration. Also, the Expert Panel recommended that LFSL doses above 87 dB be identified as incompatible with residential use and not susceptible to remedial treatment. Therefore, as discussed above, a project feature has been incorporated to limit proposed residential uses until the 717 engine run-ups stop within the area identified on Figure 7 on page 41. Areas outside this area will experience a noise level of less than 87 dBC. This, coupled with the project feature discussed above, which will provide insulation for all residential buildings on the project site to reduce interior noise levels below 45 dBA CNEL, the project will not generate excessive ground-borne vibration or ground-borne noise levels and impacts will be less than significant.

[44] *FICAN on the Findings of the Minneapolis-St. Paul International Airport (MSP) Low-Frequency Noise (LFN) Expert Panel.*

7.0 MITIGATION MEASURES

7.1 MITIGATION MEASURES

The following mitigation measures are recommended to reduce noise and vibration impacts resulting from the proposed project. In addition to these mitigation measures, the project features presented and evaluated above will further reduce impacts associated with noise.

7.1.2. Construction

V.I-1 In compliance with Section 8.80.202 of the LBMC, site preparation, grading, and construction within the City of Long Beach shall be limited to the hours of 7 A.M. and 7 P.M., Monday through Friday, 9 A.M. and 6 P.M. on Saturdays, and prohibited on Sundays.

V.I-2 In compliance with Section 8020 of the LMC, site preparation, grading, and construction within the City of Lakewood shall be limited to the hours of 7 A.M. and 7 P.M., Monday through Saturday and 9 A.M. and 7 P.M. on Sundays within 500 feet of a residential zone.

V.I-3 All construction equipment, fixed or mobile, shall be equipped with properly operating and maintained muffler exhaust systems.

V.I-4 The project applicant shall provide a construction relations officer to serve as a liaison with surrounding communities and future on-site residents.

V.I-5 Construction activities shall be scheduled so as to avoid operating several pieces of equipment simultaneously, which causes high noise levels.

V.I-6 Engine idling from construction equipment such as dozers and haul trucks shall be limited, to the extent feasible.

V.I-7 Equipment and materials staging shall be located as far from noise-sensitive uses as practical.

V.I-8 Semi-stationary heavy equipment shall be located as far from noise-sensitive uses as practical.

V.I-9 Electrically powered equipment shall be used instead of equipment driven by internal combustion engines where feasible.

V.I-10 Active construction sites within 400 feet of on-site occupied residential uses shall be acoustically screened with a temporary ten-foot, ½ inch thick plywood fence around the construction zone, to the extent feasible. The plywood fence will have an approximate sound transmission classification level of 18.

V.I-11 An on-site area shall be designated for delivery of materials and equipment. No construction deliveries shall be permitted outside the hours of 7 A.M. and 10 P.M. on weekdays.

V.I-12 Pile shields (i.e., sound blankets) shall be used where pile driving activities occur within 200 feet from the northern property boundary along Carson Street or within 400 feet of on-site residential uses on the project site.

V.I-13 Construction routes will be established to avoid residential streets in order to prevent noise and vibration impacts in residential areas. Generally, construction delivery and haul trucks will access the project site from I-405 along Lakewood Boulevard and Cherry Boulevard.

7.1.2. Operation

V.I-14 The residential developer shall provide insulation for all residential buildings on the project site to reduce interior noise levels below 45 dBA CNEL with doors and windows closed and shall provide confirmation of this noise level through an acoustical consultant. In addition, any residential development within the delineated residential area (i.e., hatched area) provided in Figure 54 of this EIR shall require a minimum outside-to-inside noise insulation of 30 dBA and shall appoint an acoustical consultant to confirm that the proposed residential buildings will achieve this design standard before submitting an application for a building permit.[45]

[45] *As discussed previously, the California Airport Land Use Handbook documents that this level of sound insulation may include the following: 1) air-conditioning/mechanical ventilation such that the units would not have to rely on open windows for ventilation; 2) ½-inch thick glazing, or a dual insulating glazed*
(Footnote continued on next page)

V.I-15 All persons purchasing, leasing, or renting residential land or property within the PacifiCenter development shall be required to sign an "acknowledgement covenant" which acknowledges the fact that residential properties are near an airport, that there may be low level aircraft overflights, and that there may be noise impacts because of proximity to the Airport and overflights. In addition, the acknowledgment covenant shall acknowledge the avigation easements, which waive the right to take legal action in connection with aircraft noise.

V.I-16 Aircraft related to new aviation-related uses proposed within the project site shall comply with requirements in LBMC Chapter 16.43.030(B) which limits engine run-ups to designated areas at the Airport and between the hours of 7 A.M. and 9 P.M. on weekdays and 9 A.M. and 9 P.M. on weekends and holidays.

V.I-17 Development of residential uses in close proximity to the Boeing Enclave shall be prohibited until such time that run-up activities permanently cease in the 717 Run-up area. The delineation of this area is provided in Figure 54 of this EIR.

V.I-18 Boeing shall preferentially use the testing positions along the southern side of the Boeing Enclave (Numbers 1-6), as shown in Figure 54 of this EIR

V.I-19 The substation shall include an eight-foot high wall surrounding the substation area if it is to be located within a residential area.

V.I-20 All mechanical equipment shall incorporate noise control measures to ensure that City of LBMC and LMC requirements are satisfied.

system comprised of $^{3}/_{8}$-inch thick laminated glass/½-inch air space/¼-inch glass (or acoustical equivalent); 3) doors and windows opening to the exterior with acoustical seals; 4) adding insulation to attics; and/or 5) fitting chimneys and vents with dampers and/or acoustic louvers.

8.0 CONCLUSION

8.1 CONSTRUCTION

Noise and vibration associated with the proposed project have been evaluated to determine the level of impact from construction activities and future operations related to vehicular traffic and facility operations.

Construction noise levels at the closest off-site sensitive receptor (i.e., single family residences located on the north side of Carson Street) during the heaviest periods of activity could be as high as 70 dBA L_{eq} and during pile driving short-term, impulsive noise could be as high as 84 dBA. With implementation of the proposed mitigation measures, future construction operations will be expected to generate noise levels at proposed residential areas in close proximity to the construction zone as high as 77 dBA L_{eq} and will not substantially reduce the pile driving short-term, impulsive noise level of 98 dBA. These noise levels will be considerably higher than ambient noise levels. As the worst-case hourly L_{eq} exceeds ambient noise levels by more than the 5 dBA significance threshold, construction of the proposed project will result in a significant and unavoidable impact to proposed on-site sensitive receptors and off-site sensitive receptors (i.e., residential uses located along and north of Carson Street). However, such noise levels will be experienced for short-durations as only portions of the project site will be under construction at any one time. The majority of the time, construction noise levels at adjacent sensitive locations will be much lower due to reduced construction activity and staging of construction (i.e., construction noise levels at a given location will be reduced as construction activities conclude or move to another more distant location of the site.) Furthermore, the estimated highest noise levels do not account for shielding that may be provided by future structures located between construction activity areas and adjacent receptors.

At 75 feet from the source of activity, vibration velocities from typical heavy construction equipment operations range from 0.001 to 0.124 inch/sec. Within the project site, the highest vibration will be generated during pile driving operations, while more consistent, but lower ground vibration will be generated during the clearing, excavation, and grading processes when heavy materials are moved. Both off-site and on-site sensitive land uses will be located at a sufficient distance (greater than 75 feet) from any potential pile driving activity so that vibration from such activities will be below the peak particle velocity threshold of 0.2 inch/sec. Therefore, the project will not generate excessive ground-borne noise levels, and vibration impacts associated with construction will be less than significant.

8.2 OPERATION

8.2.1 Traffic

The increase in future traffic noise associated with the proposed project and all traffic mitigation will be less than significant for all roadway segments presented in Table 14, with the exception of Conant Street east of Lakewood Boulevard which will increase by 7.0 dBA and will exceed the 5 dBA significance threshold. This roadway segment is bordered by parking facilities and the Boeing 717 Assembly Facility. While noise levels associated with project traffic at this roadway segment will result in a significant and unavoidable impact, no sensitive receptors will be impacted. An additional analysis was completed for A Street located within the western portion of the site as this street may be located farther to the north and adjacent to the Lakewood Country Club Golf Course (in the vicinity of where Cover Street is currently located). Given the low level of traffic that currently travels on this segment, mobile noise levels were predicted to increase by 18.7 dBA. However, this roadway segment is bound by the Airport to the south and a golf course to the north, and, therefore no sensitive residential receptors will be impacted. Nonetheless, noise levels associated with project traffic at this roadway segment will result in a significant and unavoidable impact.

8.2.2 Airport Noise Exposure

Residential uses and associated outdoor recreational areas proposed within the PacifiCenter site will be outside of the 65 CNEL contour produced by landing and takeoff activity at the airport, which are based upon the future worst-case operating scenario allowed by LBMC Chapter 16.43. Therefore, the project will not expose people residing or working in the project area to excessive noise levels and noise impacts from airport operations upon “incompatible” land uses such as residential development and associated outdoor recreational areas will be less than significant since these uses will be exposed to appreciably lower noise levels than cited by California Title 21, FAA Guidelines, and allowed by the LBMC.

8.2.3 Aviation-Related Uses

As illustrated by the Federal Aviation Administration’s Industrial Noise Model (INM) Version 6.0 SENEL curves provided in Appendix A-4, all proposed types of aircraft to be used by on-site aviation-related activities will comply with LBMC Chapter 16.43 SENEL requirements. In addition, proposed operations will not affect overall activity at the Airport, since the Airport must maintain compliance with LBMC Chapter 16.43 noise budgets. The ground support equipment will only be operated intermittently based on the low number of

estimated flights per day. In addition, the structures related to the hangars will be positioned between any aviation activity and adjacent land uses, thus limiting the amount of noise from these operations. Therefore, noise levels associated with operation of the aviation-related uses will be less than significant.

8.2.4 Boeing Engine Run-Up Area

Boeing C-17 and 717 engine run-up tests will not be expected to significantly interfere with typical speech communication, watching television or similar activities taking place indoors. However, engine run-up noise may interfere with speech communication during outdoor activities. While production rates could increase in the future, current and projected levels of production (i.e., 16 for C-17's and 12 for 717's) will result in infrequent engine run-up tests.

Given the relative infrequency of these C-17 and 717 engine run-up tests (compared to the 41 air courier flights per day as well as commuter, industrial, charter, and military operations already accounted for in the City's CNEL noise contours for the airport), together with the fact that the associated single event and L_{max} noise levels measured for the C-17 and 717 are similar to the average levels monitored over the last consecutive 12-month period at the most representative station for the project site (Station No. 14), it is reasonable to rely upon the published CNEL contours for the Airport in order to assess the potential noise impact upon the residential land uses of the of the PacifiCenter project.[46] Therefore, as residential development and associated outdoor recreational areas will not be located within the 65 CNEL contour, no significant impact will occur from the Boeing engine run-up tests.

8.2.5 Substation

Operation of the substation will result in the production of long-term noise from transformers. Four transformers will generate a maximum noise level of 67 dBA at approximately six feet. Accounting for noise attenuation of 6 dBA for each doubling of distance, the worst-case noise level will be less than 45 dBA at the substation property line, which will comply with the more strict LBMC and LMC nighttime noise standards. Therefore, noise impacts resulting from operation of the substation will be less than significant.

[46] *Noise measurement data is not available for the 717 engine run-up testing area. However FAA's INM Version 6.0 SENEL Aircraft Curves demonstrate that the 717 is a much quieter aircraft than the C-17 and MD-80. Therefore, it is reasonable to assume that noise levels from the 717 engine run-up tests are quieter than both the C-17 engine run-up tests and the hypothetical typical MD-80 departure SEL.*

8.2.6 Future Facility Noise Levels

Most of this mechanical equipment will be expected to be located within enclosures or behind new buildings or otherwise shielded from the nearby sensitive land uses. In addition to this physical shielding, proper engineering during the detailed design phases, including noise control engineering of the mechanical equipment, should ensure that the noise generated by mechanical equipment operations will meet both LBMC and LMC noise standards. Impacts will be expected to be less than significant.

The noise produced by delivery and trash pick-up trucks at the project site will also be a potential source of annoyance. These sources of noise currently occur within the project site and vicinity and are typical in an urban environment. As these operations will be intermittent and will occur for short durations, impacts will be less than significant at both on-site receptors and the receptors nearest to the project site.

Various sounds, including automobile movement, car alarms, car horns, door slams, and tire squeals, may occur at the parking facilities (surface parking areas and parking structures). Noise from these sources even though intermittent and short-term in nature may be intermittently audible to nearby sensitive land uses. Noise from parking facilities will incorporate project features discussed earlier in Section 6.4.3. These project features will result in a noise level in compliance with Section 8.80 of the LBMC. In addition, project features included to reduce noise levels at residences from aircraft noise will also reduce noise levels from parking facilities. Therefore, noise levels associated with operation of the parking facilities will be less than significant.

8.2.7 Future Vibration

Future ground-borne vibration in the project vicinity will continue to be generated by heavy trucks traveling on the local roadways. Potential ground-borne vibration impacts from the airport and Boeing Enclave are not anticipated to affect the new residential uses within the PacifiCenter project site, since all airplanes are equipped with compressed air rubberized tires that act as vibration isolators. In addition, project features to reduce interior noise levels at residences from aircraft noise will help to reduce vibration. Therefore, the project will not generate excessive ground-borne vibration or ground-borne noise levels and impacts will be less than significant.

An analysis was conducted to determine if low frequency noise levels from Boeing 717 engine run-up tests may cause structure borne vibration and secondary interior noise impacts from possible rattling of doors and windows. A project feature has been incorporated to limit proposed residential uses in close proximity to the Boeing Enclave

until such time that run-up activities permanently cease. This, coupled with other project features which will provide insulation for all residential buildings on the project site to reduce noise levels below 45 dBA CNEL, will ensure the project will not generate excessive ground-borne vibration or ground-borne noise levels and impacts will be less than significant impact.

APPENDIX A

Table A-1

MODELED EXISTING AND FUTURE TRAFFIC NOISE LEVELS—PROJECT BUILDOUT

Roadway Segment #	Roadway Segment	Existing Roadway ADT	Existing CNEL (dBA)	Ambient Growth Without Project Roadway ADT [a]	Ambient Growth Without Project CNEL (dBA) [a]	Ambient Growth With Project Roadway ADT [a]	Ambient Growth With Project CNEL (dBA) [a]	Ambient Growth Plus Project and All Traffic Mitigation Roadway ADT [a]	Ambient Growth Plus Project and All Traffic Mitigation CNEL (dBA) [a]
1	Atlantic Avenue North of Carson Street	2,314	69.4	2,774	70.2	2,801	70.2	2,798	70.2
2	Bellflower Boulevard North of Carson Street	2,240	69.3	2,464	69.7	2,558	69.9	2,550	69.9
3	Candlewood Street West of Lakewood Boulevard	1,519	68.0	2,117	69.4	2,153	69.4	2,151	69.4
4	Carson Street West of Lakewood Boulevard	3,119	61.1	3,830	62.0	4,315	62.5	4,268	62.5
5	Carson Street East of Lakewood Boulevard	2,711	60.5	3,124	61.1	3,713	61.9	3,654	61.8
6	Carson Street East of Clark Avenue	2,856	60.7	3,185	61.2	3,708	61.8	3,545	61.6
7	Cherry Avenue North of Carson Street	2,679	68.6	3,156	69.3	3,413	69.6	3,611	69.9
8	Clark Ave. North of Conant St.	1,561	68.3	1,721	68.7	1,769	69.0	1,818	68.9
9	Clark Ave. South of Conant St.	1,646	67.3	1,845	67.7	1,877	67.7	1,872	67.8
10	Conant Street East of Lakewood Boulevard	117	56.2	157	57.5	875	64.9	789	64.5
11	Conant Street East of Clark Avenue	134	56.8	145	57.1	419	61.7	385	61.4
12	Cover Street West of Paramount Boulevard	779	65.4	863	65.9	1,963	69.4	2,037	69.2
13	Lakewood Boulevard North of Carson Street	2,601	70.2	2,859	70.5	3,787	71.7	3,689	71.6

Table A-1 (Continued)

MODELED EXISTING AND FUTURE TRAFFIC NOISE LEVELS—PROJECT BUILDOUT

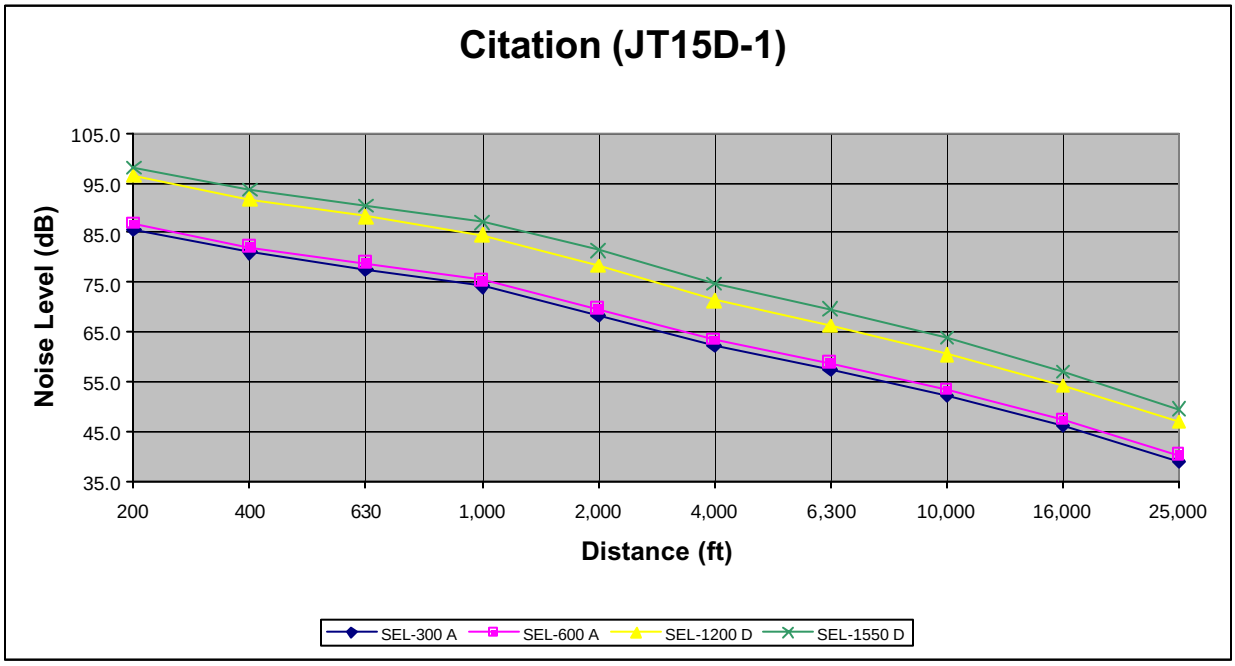
Roadway Segment #	Roadway Segment	Existing Roadway ADT	Existing CNEL (dBA)	Ambient Growth Without Project Roadway ADT [a]	Ambient Growth Without Project CNEL (dBA) [a]	Ambient Growth With Project Roadway ADT [a]	Ambient Growth With Project CNEL (dBA) [a]	Ambient Growth Plus Project and All Traffic Mitigation Roadway ADT [a]	Ambient Growth Plus Project and All Traffic Mitigation CNEL (dBA) [a]
14	Lakewood Boulevard North of Wardlow Road	3,135	70.9	3,871	71.7	6,238	73.7	5,987	73.5
15	Orange Avenue South of Wardlow Road	1,368	67.5	1,400	67.6	1,407	67.6	1,406	67.6
16	Paramount Boulevard South of Del Amo Boulevard	1,598	65.5	1,964	66.4	2,450	67.4	2,174	66.9
17	Paramount Boulevard North of Carson Street	1,473	65.2	1,870	66.2	2,511	67.5	2,223	67.0
18	Paramount Boulevard South of Carson Street	1,037	66.3	1,474	67.8	2,177	69.5	1,884	68.9
19	Wardlow Road West of Cherry Avenue	1,117	65.4	1,294	66.1	1,361	66.3	1,356	66.3
20	Wardlow Road East of Cherry Avenue	692	63.3	777	63.8	789	63.9	788	63.9
21	Wardlow Road East of Lakewood Boulevard	782	63.9	923	64.6	1,483	66.7	1,425	66.5

[a] *Includes ambient traffic growth projected through year 2020.*

Source: PCR Services Corporation, 2004.

Table A-2

FAA's INM 6.0 SENEL CURVES FOR AIRCRAFT



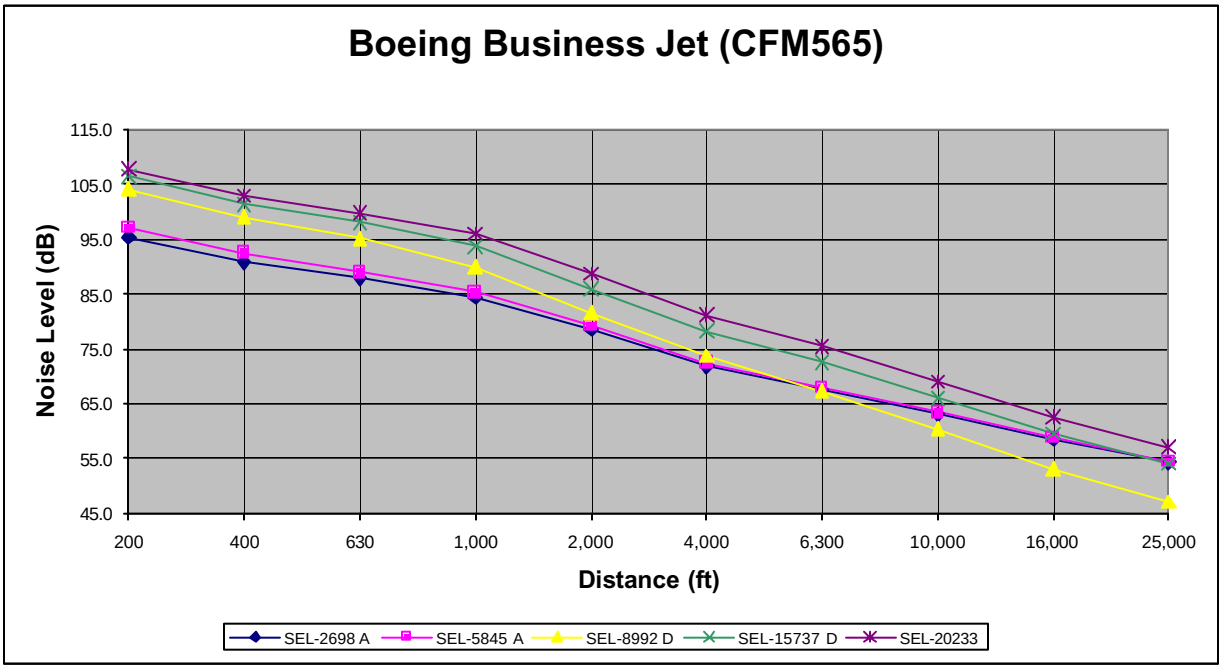
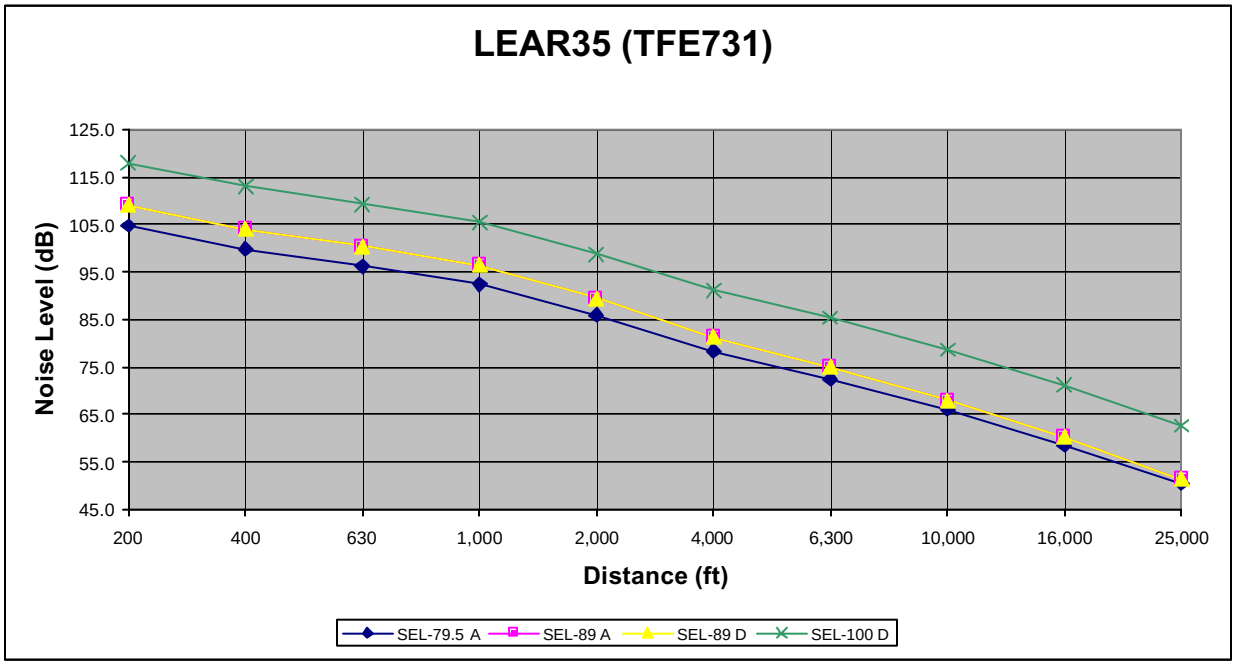
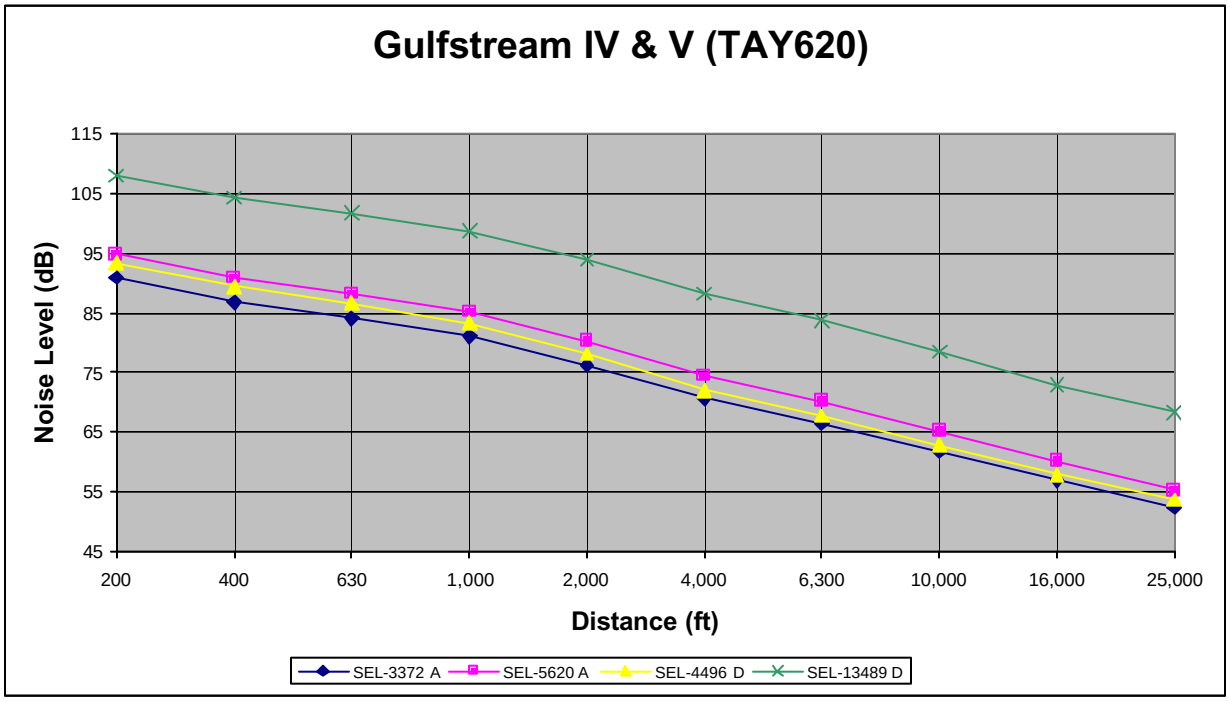


Table A-2 (Continued)

FAA's INM 6.0 SENEL CURVES FOR PROPOSED AIRCRAFT





APPENDIX B

Technical Memorandum

PCR

TO: Jon Conk
CC: Michael Brown, Stephanie Eyestone
FROM: Mark Hagmann
RE: 717 NOISE SURVEY

DATE: November 09, 2001

PCR Services Corporation conducted an aircraft noise survey between 9:30 A.M. and 5:00 P.M. on November 6, 2001 to determine the noise levels during engine testing in the Boeing 717 engine run-up area.

Noise levels were measured using a Type I Larson-Davis (LD) Model 820 Sound Level Meter. Instrumentation was within the standard laboratory calibration cycle and was operated according to the manufacturer's specifications (calibration records are available upon request). Also, all equipment was field calibrated during the various measurement sessions and experienced no more than a 0.2 dB drift during the measurement program. The following instruments were used in the noise measurements: LD 820 Sound Level Meter, SN A1065; LD 2560 Microphone, SN 2765; LD 828 Pre-Amp, SN 1472; and LD CA250, Acoustic Calibrator, SN 1985.

Meteorological conditions (air temperature, relative humidity, wind speed, and wind direction) were observed and noted. Weather conditions during the survey sessions were noted to be typical for the area in autumn. Daytime temperatures (°F) ranged from the mid-60's to the low-70's. The relative humidity was typically less than 40%. Mild winds (0 to 10 mph) were observed during the measurement period. These wind speeds are below the limits specified in industry standards for conducting outdoor measurements. In addition, the noise impact from the winds at these speeds is judged to be negligible, since there is a lack of heavy foliage at the site (which cause rustling noise) and since the measurement microphone included a windscreen, as is standard industry practice for outdoor measurements. There was no precipitation encountered during the measurement program.

Boeing 717 engine run up tests take place only at specific positions, see Figure 1 on page 3. Tests on each of the four northern positions are conducted with jet engine discharges facing to the north. Tests on each of the six southern positions are conducted with jet engine discharges facing to the south. Due to the closer proximity of the northern positions to proposed residences and more importantly, due to the northward-pointing engine exhaust, it is considered that run-up tests on the northern positions would generate significantly higher noise levels at the residential buildings than for tests on the southern positions. All reported noise measurements relate to an aircraft on one of the northern positions (see Figure 1). The closest proposed buildings in the residential portion of the project would be approximately 1,600 feet away from this aircraft position, to the north northeast. Although any residential buildings located in the Mixed-Use area of the project could be slightly closer

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(approximately 1,400 feet), these buildings would be much less exposed to aircraft engine noise due to a number of tall (50 feet or more) buildings (building 15 and 41a) located directly between the engine run up areas and these buildings (see Figure 1). It is intended that these buildings will remain in place as long as Boeing continues aircraft production.

Currently there is a very tall building (building 41 - approximately 100 feet high), located between the engine run-up positions and the future residential area of the proposed development (see Figure 1). This building is scheduled for demolition. In order to predict the noise levels attributable to 717 engine run-ups at the future residential buildings without this building in place, noise measurements were conducted at a measurement position approximately 775 feet north-northwest of the engine run-up area along Cover Street. This position was at a similar horizontal angle to the aircraft engine axis as the residential properties. By taking noise measurements at approximately 29 feet above grade, the amount of acoustical screening obtained from the blast wall located immediately behind the engines was calculated to be equal to that for a sixty feet high residential building located at 1,600 feet from the engine. Noise levels at the most exposed window of the future residential buildings can therefore be estimated from the measured noise data by simply subtracting a 6 dBA correction for the increased distance of the residences from the engines compared to the noise survey location. A summary of measured noise levels and predicted noise levels at the future residential buildings is provided in Table 1, on page 4.

With reference to the measured noise levels, noise levels can be seen to vary, generally rising as the engine thrust was increased. The highest maximum (L_{max}) noise level measured was 73 dBA. It is understood that this engine condition, with both engines at high thrust, was created specifically to create a worst-case noise level simulating two aircraft engine run up tests conducted at the same time and that normally, only one engine is operated at high thrust at any time. Taking this worst case measured noise level and applying the 6 dBA acoustical loss for distance discussed above leads to an estimated noise level of 67 dBA attributable to Boeing 717 engine run-up tests at the facade of the most exposed residential building. Based upon the specified 25 dBA outside-to-inside aircraft noise insulation that will be required for the completed residential buildings, the maximum internal noise level in a residential unit attributable to these tests would be approximately 42 dBA (L_{max}). This is a relatively low noise level that would not be expected to significantly interfere with typical speech communication, watching television or similar activities taking place indoors.

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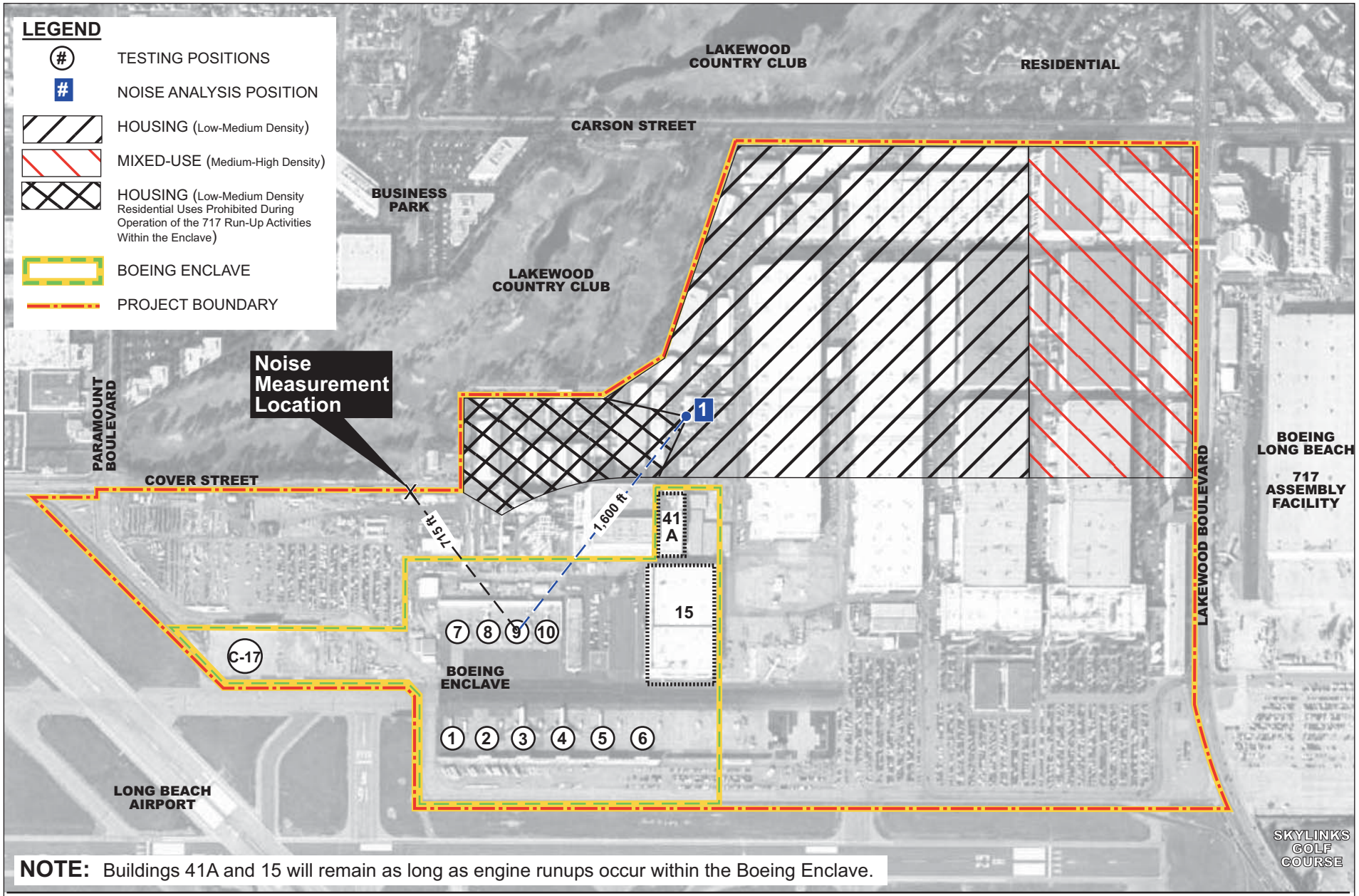


NOTE: Buildings 41A and 15 will remain as long as engine runups occur within the Boeing Enclave.

PCR

Scale not Provided

Sources: Boeing Realty Corporation and PCR Services Corporation, 2004

Figure 1
Boeing 717 Engine Run-Up Noise

Table 1

Noise Levels Attributable to Boeing 717 Engine Run-Up Tests at the Most Exposed Residential Building[a]

Event	Thrust Setting[b,c]		Start Time	Duration (min.)	L_{eq} (dBA)	L_{max} (dBA)
Engine Start & Hydraulic Bleed	Right: 61%	Left: 61%	9:28	16:00	Not Audible	Not Audible
	Right: 61%	Left: 61%	9:40	16:00	55.1	57.4
	Right: 61%	Left: 61%	9:57	10:00	53.6	57.3
Engine Settings[d]	Right: 61%	Left: 61%	12:14	8:00	54.5	57.2
	Right: 61%	Left: 89.5%	12:22	5:00	63.2	66.8
	Right: 61%	Left: 85.6%	12:28	0:40	58.1	61.1
	Right: 61%	Left: 88.6%	12:29	4:00	60.4	64.4
	Right: 89.8%	Left: 61%	12:34	5:00	63.7	66.9
	Right: 88.5%	Left: 61%	12:41	1:50	63.3	66.0
	Right: 90%	Left: 90%	12:44	0:42	65.1	67.4
	Right: 74.4%	Left: 74.4%	12:49	2:47	56.5	58.5
	Right: 74.4%	Left: 74.4%	12:53	1:00	56.4	59.1
	Right: 74.4%	Left: 74.4%	12:56	2:41	54.3	57.8
Icing Test	Right: 61%	Left: 61%	15:44	10:00	52.4	57.0
	Right: 70%	Left: 70%	15:54	1:30	56.3	58.3
	Right: 70%	Left: 70%	16:00	1:30	56.6	58.8
	Right: 70%	Left: 70%	16:03	1:00	56.8	59.7
	Right: 70%	Left: 70%	16:04	0:30	56.8	61.3
	Right: 61%	Left: 61%	16:07	15:00	55.1	58.1
Reverse Thrust	Right: 70%	Left: 70%	16:27	3:00	59.5	61.7
	Right: 70%	Left: 70%	16:43	3:20	60.1	63.7

[a] *Measurements taken 775 feet north-northwest of the engine run-up area were reduced by 6 dBA to predict noise levels at the closest on-site proposed residences (1,600 feet north-northeast of the engine run-up area).*
[b] *Idle thrust setting equals 61%.*
[c] *The Boeing 717 is equipped with two engines.*
[d] *The 90% Right/90% Left high thrust engine condition is not typical and was created specifically to create a worst-case noise level simulating two aircraft engine run up tests conducted at the same time.*

Source: PCR Services Corporation, November 6, 2001.

PRELIMINARY WORKING DRAFT – Work-in-Progress

Memorandum

TO: Jon Conk
DATE: July 28, 2003
CC: James Schulte, DeDe Soto, Dale Neal, Stephanie Eyestone-Jones, Walt Gillifillan
FROM: Mark Hagmann, P.E.
RE: FOLLOW-UP DISCUSSION REGARDING BOEING 717 ENGINE RUN-UP NOISE

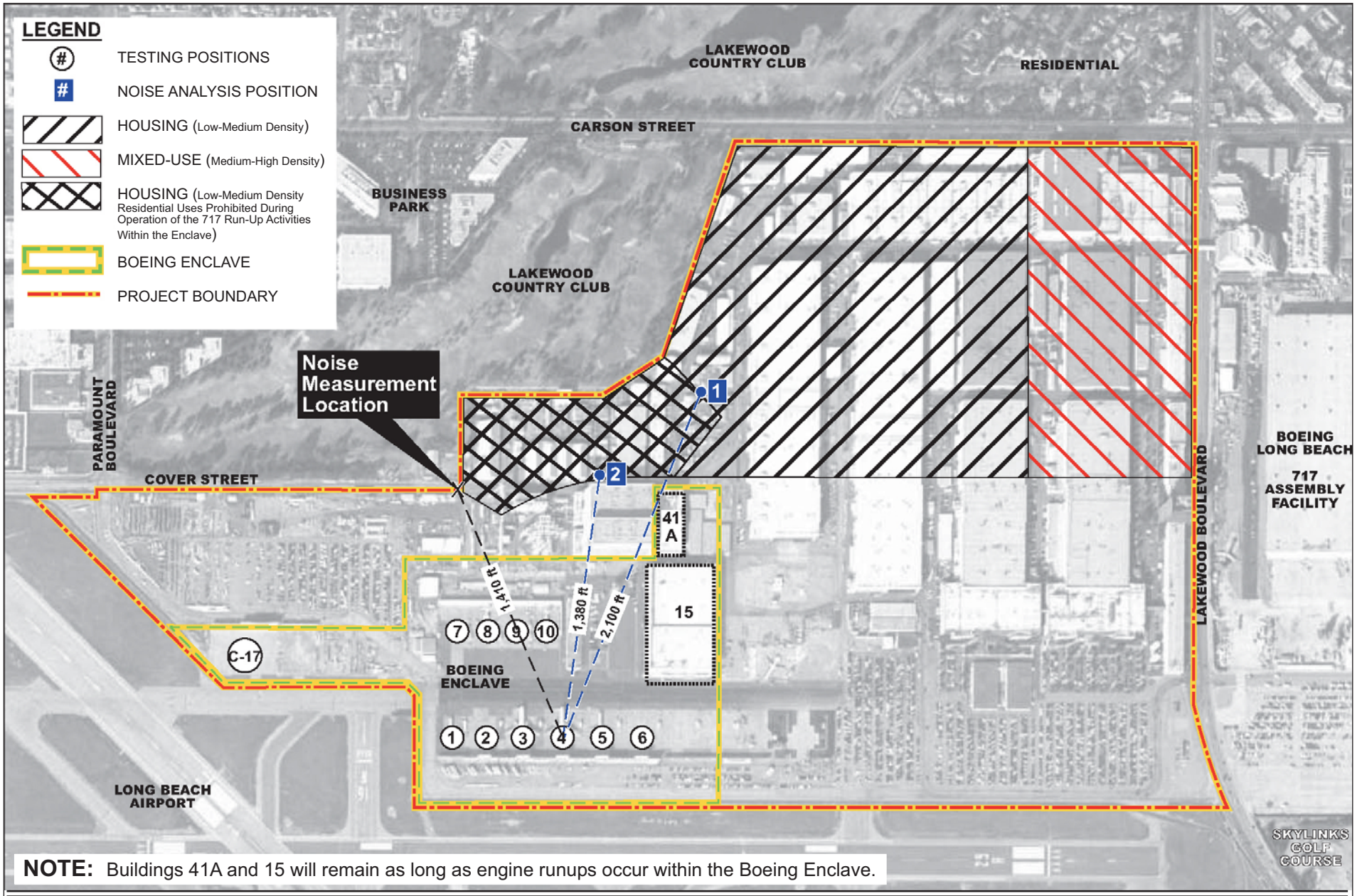
Per Jon Conk's request, PCR Services Corporation has further characterized the extent of potential low frequency noise/vibration impacts related to the Boeing Enclave. This memorandum serves as both an update to our previous memorandum, dated July 28th, 2003 (Additional Boeing 717 Engine Run-Up Noise Measurements), and to serve as a tool for further discussion of potential impacts to proposed residential uses.

PCR conducted an assessment of potential noise levels at select areas of proposed residential development to determine whether any perceptible vibration may occur.[1] As previously discussed, low-frequency noise/vibration is a relatively new and controversial issue. Information provided by the Federal Interagency Committee on Aviation Noise (FICAN) Expert Panel[2] suggests that the ideal descriptor for measuring low frequency sound level (LFSL) is the sum of the maximum sound levels in the 25-80 Hz one-third octave bands during individual noise events. The documentation provides a low frequency survey response curve conducted at MSP and LAX. The G-weighted measurements best represent the LFSL and were therefore used with the response curve to determine the prevalence of high annoyance due to rattle or vibration. The documentation also provides recommended rattle prevention and limits for interior LFSL for new residential construction, in which levels greater than 87 db LFSL are not compatible with residential use and not susceptible to remedial treatment. Table 1 presents the data for the noise measurement location and noise analysis locations 1 and 2. These locations are also shown in Figure 1.

---

[1] Section 8.80.200(G) Vibration of the Long Beach Municipal Code specifically prohibits operating or permitting the operation of any device that creates vibration which is above the vibration perception threshold of an individual at or beyond the property boundary of the source if on private property or at one hundred fifty feet (forty-six meters) from the source if on a public space or public right-of-way. For the purposes of this subsection, "vibration perception threshold" means the minimum ground or structure-borne vibrational motion necessary to cause a normal person to be aware of the vibration by such directed means as, but not limited to, sensation by touch or visual observation of moving objects. The perception threshold shall be presumed to be 0.001 g's in the frequency range 0 - 30 hertz and 0.003 g's in the frequency range between thirty and one hundred hertz.

[2] FICAN on the Findings of the Minneapolis-St. Paul International Airport (MSP) Low-Frequency Noise (LFN) Expert Panel.



NOTE: Buildings 41A and 15 will remain as long as engine runups occur within the Boeing Enclave.

PCR

Scale not Provided

Sources: Boeing Realty Corporation and PCR Services Corporation, 2004

Figure 1
Boeing 717 Engine Run-Up Noise

Table 1
Noise Levels from Boeing 717 Engine Run-Up Area

		Testing Position 4[a]			
Position	**Distance (ft)**	**L_{eq} (dBA)**	**L_{max} (dBA)**	**L_{eq} (dBC)**	**L_{max} (dBC)**
Measurement Location	1,410	80.7	90.6	80.6	88.7
Noise Analysis Location 1	2,100	77.2	87.1	78.0	86.1
Noise Analysis Location 2	1,380	80.9	90.8	80.7	88.8

[a] *This evaluation is based on the worst-case run-up event at Testing Position #4 which occurred for approximately 5 minutes and the engine settings were 61%L and 89.8%R.*

[a] *Noise levels represent the maximum levels that would occur in each zone.*

Source: PCR Services Corporation, 2003.

Appendix Q

Traffic Impact Study Report

DRAFT

TRAFFIC IMPACT STUDY REPORT

FOR PACIFICENTER @ LONG BEACH PROJECT

Prepared for:

BOEING REALTY CORPORATION

Prepared by:

Crain & Associates
2007 Sawtelle Boulevard
Los Angeles, California 90025
(310) 473-6508

January 2004

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INTRODUCTION

On its approximate 260-acre site within the Cities of Long Beach and Lakewood, Boeing Realty Corporation proposes a redevelopment project which would replace nearly five million square feet of existing permitted density consisting of office, research and development (R&D), warehousing, manufacturing and other aviation-related usable floor area on the project site. Existing zoning and plans provide for an estimated 6.4 million square feet of development. The redevelopment project being proposed for the site, PacifiCenter @ Long Beach, is being designed as a master-planned, mixed-use project consisting of new office, R&D, light industrial, residential, retail, hotel, aviation-related, and ancillary uses. PacifiCenter is anticipated to be completed by the year 2020.

Crain & Associates prepared this traffic study assessing the impact of PacifiCenter on the transportation system in the surrounding area. The analysis documented and presented in this report examines existing and future transportation conditions, without and with the project. Using a computerized transportation model, detailed analyses were made of these conditions for 109 study intersections, freeway mainlines and on-ramps, selected residential streets, public transit and bicycle facilities in the study area. Feasible mitigation measures were identified to reduce project impacts to a level of insignificance. In addition, a proposed phasing program for the implementation of the traffic mitigation measures was developed.

PROJECT DESCRIPTION

The project site is an irregularly-shaped property of approximately 260 acres. It is located approximately five miles northeast of downtown Long Beach and immediately north of the Long Beach Municipal Airport, as shown in Figure 1, Project Site Vicinity Map. The site is generally bounded by Carson Street on the north, Lakewood Boulevard on the east, the Airport on the south and southwest, and the Lakewood Country Club and Cover Street on the west and northwest. Most of the site, approximately 238 acres, is within the City of Long Beach. The westerly portion, approximately 22 acres, is within the City of Lakewood.

The site is owned by Boeing Realty Corporation (except for approximately one acre on the southwest corner of Carson Street and Lakewood Boulevard that is owned by the City of Long Beach) and contains nearly five million square feet of permitted usable office, manufacturing and R&D floor area. Approximately 536,862 square feet of this floor area was occupied as of November 2002, with approximately 515,000 square feet of the existing floor area used for production relating to with the C-17 and 717 aircraft. Accounting for demolition activities associated with the remediation program underway within the project site, approximately 380,000 square feet of floor area will remain until such time that operations within the Boeing Enclave cease.

PacifiCenter, the project proposed for the site, is a master-planned, mixed-use project. It would replace the existing entitled uses with the following primary land uses: Commercial (office, R&D, light industrial, retail, hotel and aviation-related uses) and Housing (single-family and multiple-family uses). These land uses are conceptually illustrated in Figure 2. Completion of PacifiCenter is anticipated by the year 2020.

To optimize its ability to respond to market conditions, the project proposal includes development flexibility which allows the project to be market-driven. This proposal includes a “cap” on the maximum number of PM peak-hour trips that can be generated

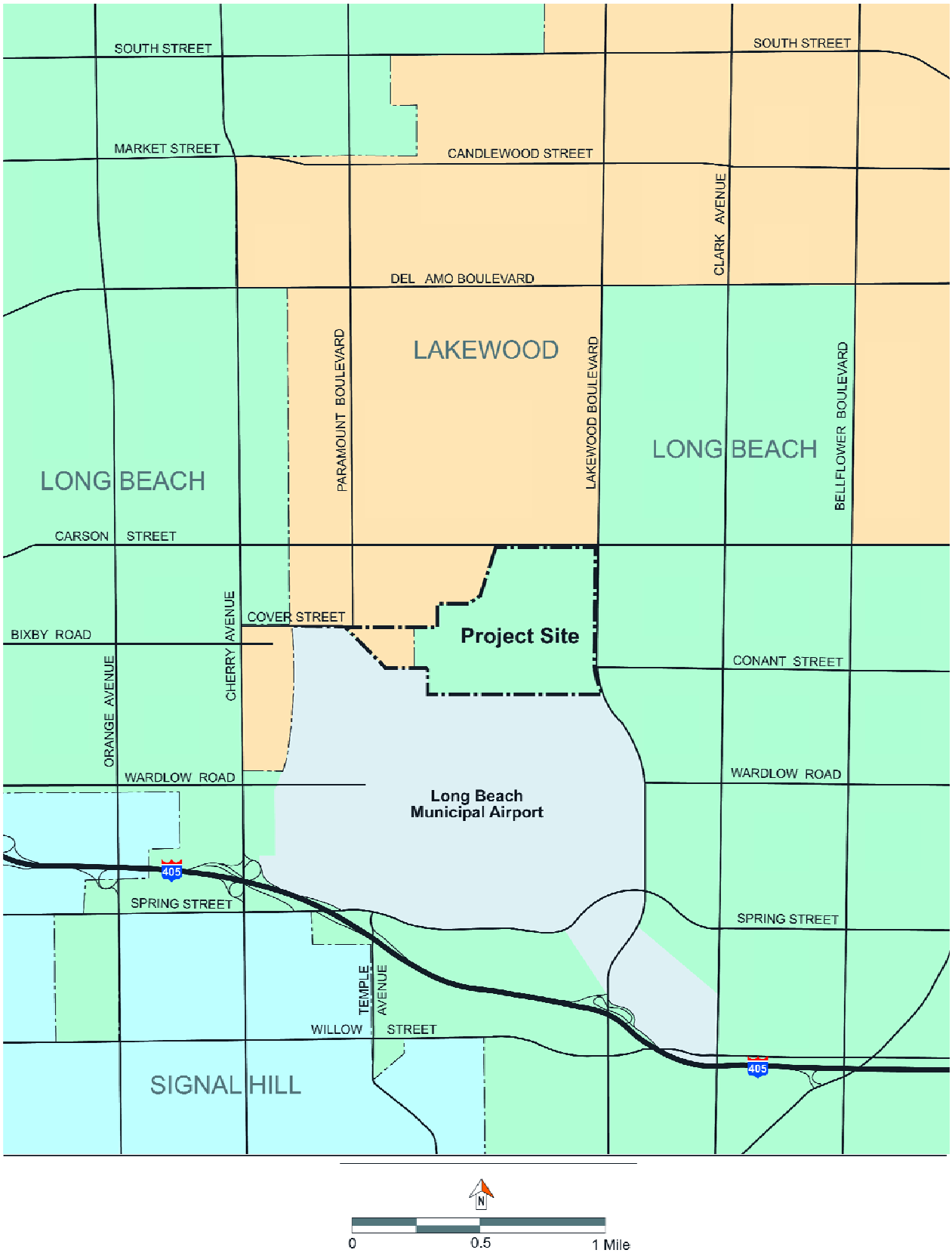

FIGURE 1

8/14/03

:FN BOEING-LNGBCH\VICINITY

PROJECT SITE VICINITY MAP

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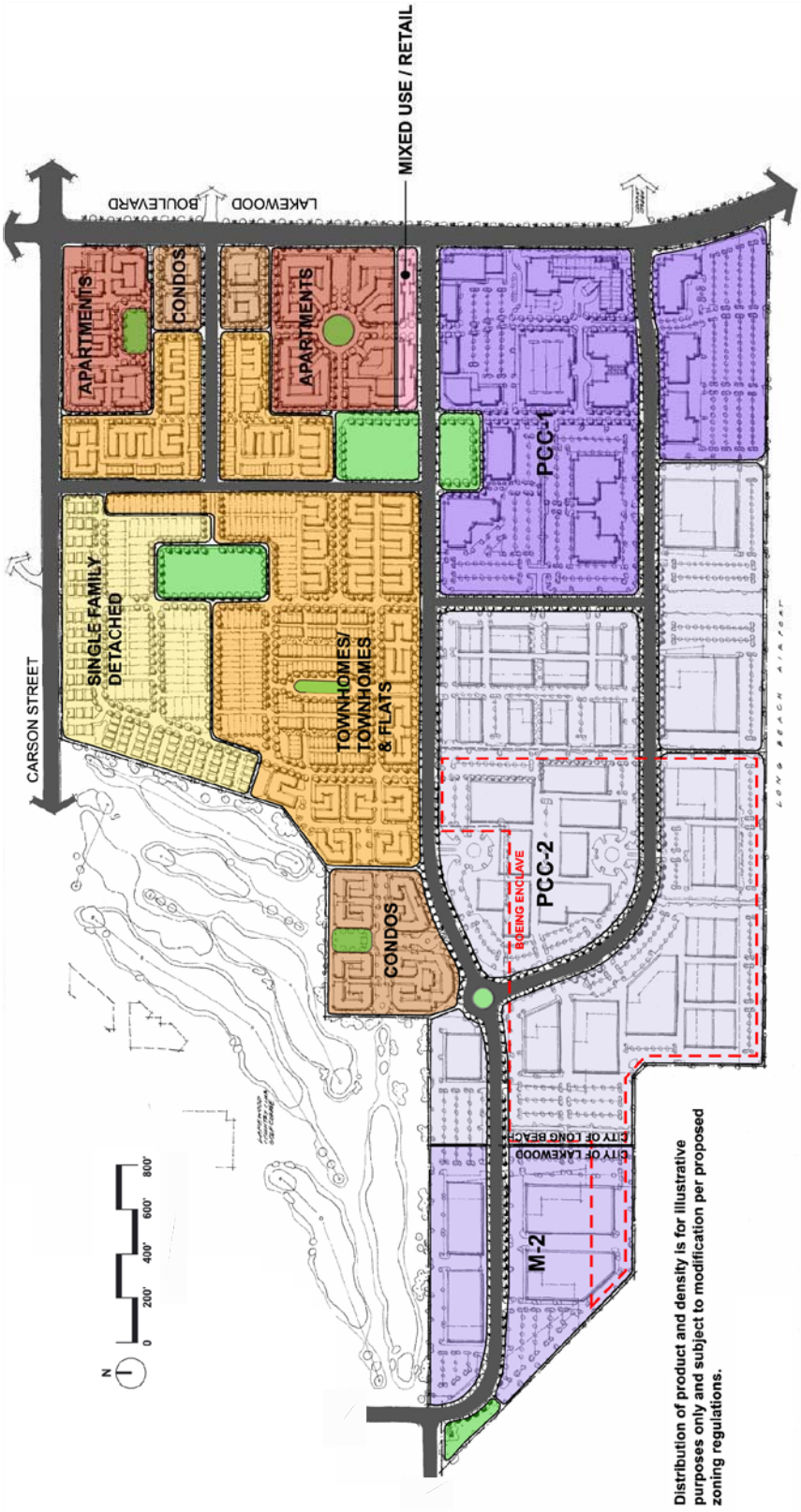

FIGURE 2

11/24/2003

:FN BOEING-LNGBCH\LANDUSE4

CONCEPTUAL PROJECT LAND USES

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by the project and a limit on the floor area or the number of dwelling units within each land use category.

To manage the flexibility of specific land uses that can be developed within the Commercial category, a development implementation program is proposed as part of the project. This program includes maximum heights and setbacks from existing and proposed roadways, both of which are described in detail below. As indicated in Table 1, this program also specifies a maximum floor area that can be developed within the project site. In accordance with the development implementation program, a maximum of 3.3 million square feet of non-residential floor area (excluding hotel uses) could be developed in the Commercial category, including a varying mix of office, R&D, light industrial and retail uses. Within this category, retail uses would be limited to a maximum of 150,000 square feet, and warehouse and distribution uses would each be limited to 20 percent of permitted uses. As indicated above, within the project site, a maximum of 400 hotel rooms could also be developed within the Commercial category.

Table 1

Proposed Project Land Use Program

Land Use	**Acres**	**Maximum Land Use Square Feet/RoomsUnits**
Commercial (office, R&D, light industrial Retail, hotel and airfield-related)	160	3.3 million sf (including up to 150,000 sf of retail uses)
Housing (Single-Family and Multi-Family)	100	2,500 units
Total Site Acreage	260	
Total Maximum Development		
Non-Residential Floor Area (excluding hotel rooms)		3.3 million sf (including up to 150,000 sf of retail uses)
Residential Units		2,500 units
Hotel Rooms		400

For purposes of this study, the development scenario shown in Table 2 was assumed and analyzed for the project. The breakdown of the Residential use reflects the current estimate of the type and number of dwelling units that may be developed.

Table 2
Project Development Scenario for Traffic Analysis

Land Use	Size
Commercial (Office Park)	3,150,000 sf
Residential	
Single-Family Housing	255 du
Apartment	1,220 du
Condominium/Townhouse	1,025 du
Retail	150,000 sf
Hotel	400 rm

The project could also include an optional component allowing for the continuation of a limited amount of aviation-related uses on the site. These uses could be located along the southern property boundary next to the Airport and may include general aviation products, as permitted by the Federal Aviation Administration.

Project Access

Development of the project would provide circulation improvements within and adjacent to the site. Vehicular access would be available at several locations around the site, as shown in Figure 3, Proposed Circulation Plan. New entry and exit points are proposed on Carson Street at First Street, which would be offset to the east from Lakewood Drive, and at a driveway/roadway between First Street and Lakewood Boulevard; and on Lakewood Boulevard at a access driveway/roadway opposite Douglas Center Drive, at A Street, at B Street and at two other driveways. The existing access points at the intersections of Cover Street/Paramount Boulevard at the western end of the site and Conant

Street/Lakewood Boulevard at the southeast corner of the site would be reconstructed. New traffic signals, along with left-turn channelization, are also proposed at Carson Street and First Street, and at Lakewood Boulevard and A Street. The existing signal at Lakewood Boulevard and Douglas Center Drive would remain and also serve the access driveway/roadway on the opposite side of Lakewood Boulevard.

Within the project site, several roadways are proposed as illustrated in Figure 3. It is anticipated that A Street, B Street, First Street, Second Street and Third Street would be public streets. A Street and B Street would likely have up to two lanes in each direction, plus a lane for left turns, depending on the intensity of uses. First Street, Second Street and Third Street are expected to have one to two lanes per direction and left-turn channelization as appropriate. These new roadways and other project access points would be subject to review and approval by the City of Long Beach Director of Public Works.

Project Parking

Sufficient parking would be provided on-site to accommodate the demand generated by the proposed project uses. The parking supply would be designed to minimize internal traffic and disruption to the street system, as well as walking distances for employees, residents and visitors. The amount of parking provided on each development parcel would generally correspond to the type and intensity of uses proposed on that parcel and may include surface, structured and on-street parking. Surface parking would generally be associated with Commercial uses. In areas with higher development densities, parking may be consolidated into subterranean or above grade structures. On-street parking may also be provided near residential and retail uses.

It is preliminarily estimated that approximately 13,000 to 13,400 parking spaces could be required by code for the project. However, it is anticipated that the amount of parking

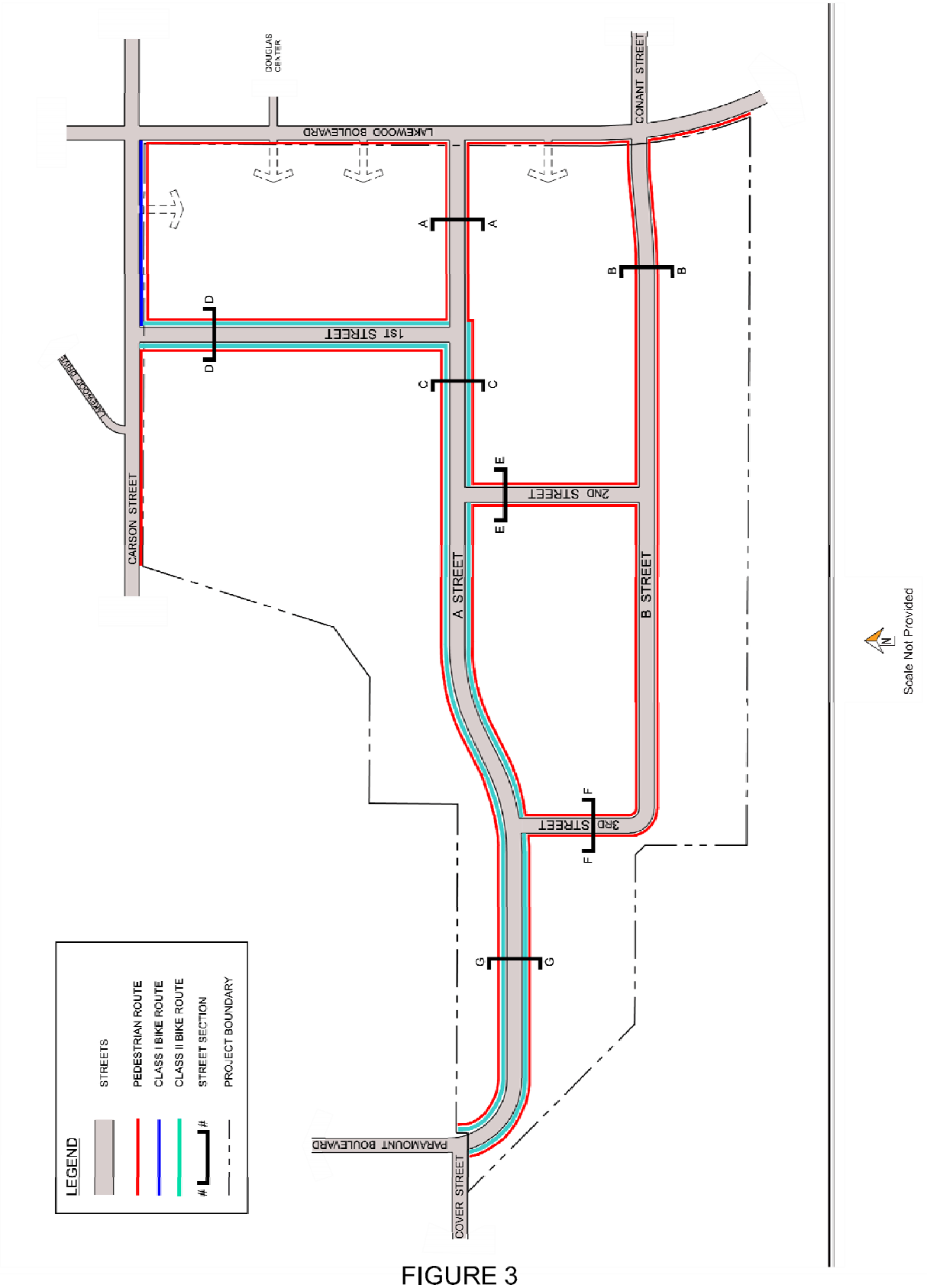

FIGURE 3

8/14/03

:FN BOEING-LNGBCH\CIRCULATION3

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CONCEPTUAL CIRCULATION PLAN

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spaces actually provided would be less than calculated on a “stand alone” basis due to the effects of shared parking and measures to reduce trips generated by the project. Shared parking is defined as parking space that can be used to serve two or more individual uses without conflict or encroachment. Shared parking can be implemented when there are variations in the peak accumulation of parked vehicles as the result of different activity patterns of adjacent or nearby land uses occur, and when there are relationships among the uses that result in people’s attraction to two or more land uses on a single vehicle trip to a given area or development. By taking into account the shared parking phenomena for mixed-use projects such as PacifiCenter, it would be possible to provide sufficient parking serving all of the uses that is less than the sum of the peak parking required of each individual use. Thus, it is recommended that shared parking be allowed in determining the amount of parking required of the project.

ENVIRONMENTAL SETTING

The project site is located approximately five miles northeast of downtown Long Beach and immediately north of the Long Beach Municipal Airport. Approximately 238 acres of the approximate 260-acre site is within the City of Long Beach, with the westerly portion of approximately 22 acres within the City of Lakewood. The irregularly-shaped site is generally bounded by Carson Street on the north, Lakewood Boulevard on the east, the Airport on the south and southwest, and the Lakewood Country Club and Cover Street on the west and northwest, as shown in Figure 4, Aerial View of Project Site and Vicinity.

The site, almost all of which is owned by the Boeing Company, contains nearly five million square feet of permitted density. Approximately one acre of the site on the southwest corner of Carson Street and Lakewood Boulevard is currently owned by the City of Long Beach. As of November 2002, approximately 278,464 square feet of office, 177,128 square feet of manufacturing, 25,000 square feet of R&D, 17,913 square feet of warehousing and 38,357 square feet of mechanical area, totaling 536,862 square feet, was occupied. In addition, approximately 515,000 square feet of this existing floor area is being used for production associated with the C-17 and 717 aircraft. As previously indicated, when accounting for demolition activities associated with the on-site remediation program that is underway, approximately 380,000 square feet of floor area will remain until such time that the Boeing Enclave ceases operation.

Surrounding land uses, in addition to the Airport, include Boeing's 717 aircraft assembly plant and office center on the east side of Lakewood Boulevard, and Boeing's C-17 aircraft facility west of the airport. North of Carson Street are single-family residences and the Lakewood Country Club. There is some commercial development near the intersection of Carson Street and Lakewood Boulevard, as well as west of the Lakewood Country Club and to the west on Cover Street. To the southeast is the Sky Links Golf Course. Long Beach City College is to the east of the Boeing 717 facility.

FIGURE 4

8/14/03

:FN BOEING-LNGBCH\AERIAL_REGION2

AERIAL VIEW OF PROJECT SITE AND VICINITY

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In addition to Carson Street and Lakewood Boulevard, other major roadways near the site are Spring Street to the south, and Paramount Boulevard and Cherry Avenue to the west. Proximate regional facilities include the San Diego Freeway (I-405) to the south, the Artesia Freeway (SR-91) to the north, the San Gabriel River Freeway (I-605) to the east and the Long Beach Freeway (I-710) to the west. These and other transportation facilities are described below.

FREEWAYS

The San Diego Freeway (I-405) is generally a north-south oriented freeway that connects the northern San Fernando Valley to the north and Orange County to the south. It is the freeway closest to the project site, located approximately one and one-half miles to the south. Freeway ramps used primarily to access the site include Orange Avenue, Cherry Avenue, Spring Street, Lakewood Boulevard and Bellflower Boulevard. In the study area, the San Diego Freeway generally has four lanes in each direction, plus a high-occupancy vehicle (HOV) lane each way. Full interchange is provided with the Long Beach Freeway and the San Gabriel River Freeway.

The Artesia Freeway (SR-91) is an east-west freeway located approximately three and one-half miles north of the project site. This freeway connects the Harbor Freeway (I-110) to the west with the Golden State Freeway (I-5) to the east through the Cities of Torrance, Carson, Compton, Long Beach, Bellflower, Cerritos, Artesia, La Palma and Buena Park. In the study area, it generally has four to five lanes per direction, in addition to an HOV lane each way. The Artesia Freeway has a full interchange with the Long Beach and San Gabriel River Freeways. Site access is provided primarily by freeway ramps at Cherry Avenue, Paramount Boulevard, Lakewood Boulevard and Bellflower Boulevard.

The Long Beach Freeway (I-710) is a north-south freeway connecting the Long Beach Harbor area with the San Gabriel Valley. This freeway is approximately three miles west of the project site and has three to four lanes in each direction, with no HOV lanes. It has a full interchange with the Artesia and San Diego Freeways. Site access is available via ramp connections at Del Amo and Long Beach Boulevards.

The San Gabriel River Freeway (I-605) is a north-south freeway approximately three miles east of the project site. The San Gabriel River Freeway connects western Orange County with northeastern Los Angeles County. In the study area, this freeway interchanges with the Garden Grove Freeway (SR-22), the San Diego Freeway and the Artesia Freeway. Four lanes per direction are generally provided in the study area. HOV lanes are also present on the San Gabriel River Freeway. Freeway ramps at Carson Street provide the most direct access to the site.

STREETS AND HIGHWAYS

The following generally describes the streets and highways primarily expected to be used for project site access. More detailed characteristics of segments of these roadways are presented in Table 3.

Rosecrans Avenue is an east-west major arterial north of the project site. It extends from the Pacific Ocean to the City of Fullerton in Orange County, providing access to many cities and communities. At Lakewood Boulevard, Rosecrans Avenue provides two lanes in each direction and left-turn channelization. Rosecrans Avenue interchanges with both the Long Beach and San Gabriel River Freeways.

Alondra Boulevard is north of the project site. It is an east-west major arterial traversing several cities from Los Angeles to La Miranda. There are two lanes per directions, along

with left-turn channelization, on Alondra Boulevard. There are also interchanges with the Long Beach Freeway and San Gabriel River Freeway for Alondra Boulevard.

Flower Street is an east-west collector street. It is primarily within the City of Bellflower and north of the project site. It becomes 70th Street to the west where is serves the Cities of Paramount and Long Beach. Two lanes in each direction are provided on Flower Street near Lakewood Boulevard.

Artesia Boulevard is an east-west major arterial south of and parallel to the Artesia Freeway, and north of the project site. In the study area, Artesia Boulevard traverses the Cities of Bellflower and Cerritos into Orange County to the east. It generally has two lanes per direction, along with left-turn channelization. A partial interchange with the Long Beach Freeway is provided for Artesia Boulevard.

South Street is designated an east-west major arterial east of Cherry Avenue and a minor arterial between Atlantic Avenue and Cherry Avenue. It is north of the project site and from the Los Angeles River, traverses the Cities of Long Beach, Lakewood, and Cerritos. South Street generally has two lanes in each direction and left-turn channelization. Some portions of the street include a bike lane. South Street also has ramp connections with the San Gabriel River Freeway.

Market Street-Candlewood Street is an east-west minor arterial located approximately one and one-half miles north of the project site and within the Cities of Long Beach and Lakewood. One to two lanes in each direction, plus left-turn channelization at key intersections, are provided on this arterial in the study area. From the Los Angeles River to east of Cherry Avenue, this arterial is Market Street. Continuing from east of Cherry Avenue, it becomes Candlewood Street.

Del Amo Boulevard is an east-west major arterial approximately one mile north of the project site. It interchanges with both the Long Beach and the San Gabriel River Freeways, and extends through the Cities of Long Beach and Lakewood. Del Amo Boulevard has two to three lanes in each direction, as well as left-turn channelization. In addition, a bicycle lane is provided on some portions of Del Amo Boulevard.

San Antonio Drive is a northeast-southwest oriented minor arterial in the City of Long Beach that terminates at Cherry Avenue just south of Del Amo Boulevard. Located northwest of the project site, it provides one to two lanes in each direction, with left-turn channelization at key intersections.

Carson Street is an east-west major arterial that extends easterly from Long Beach Boulevard, past the San Gabriel River Freeway where it has ramp connections, and into Orange County where it becomes Lincoln Avenue. It serves the Cities of Long Beach, Lakewood and Hawaiian Gardens. Carson Street is also the northern boundary of the project site and a boundary street between the Cities of Long Beach and Lakewood. It has one lane per direction west of Atlantic Avenue, and two to three lanes per direction east of Atlantic Avenue, along with left-turn channelization. A bike path is also provided along portions of Carson Street.

Centralia Street runs east-west approximately one-half mile north of the project site. It is a local street within the Cities of Lakewood and Long Beach. Portions of this street are discontinuous, with the longest continuity being between Lakewood Boulevard and the San Gabriel River. One lane in each direction is available on Centralia Street.

Bixby Road is an east-west local street that is to the west of the project site. This roadway is approximately two miles long and extends from Country Club Drive to Industry Avenue. One lane per direction is generally provided along Bixby Road.

Cover Street is an east-west local street that extends easterly from Cherry Avenue into the project site, forming a portion of the northern edge of the site. It has one to two lanes in each direction and is within both the City of Long Beach and the City of Lakewood.

Conant Street is an east-west local street that extends easterly from Lakewood Boulevard. Direct project site access is provided via Conant Street at Lakewood Boulevard. Conant Street has two lanes per direction directly east of Lakewood Boulevard and one lane per direction east of Clark Avenue.

Wardlow Road is an east-west minor arterial approximately one-third mile south of the project site. Its continuity is disrupted by the Long Beach Municipal Airport. Two lanes per direction generally are provided on Wardlow Road, as well as left-turn channelization at key locations. West of Lakewood Boulevard and within the Airport area, Wardlow Road becomes Donald Douglas Drive. Wardlow Road has a partial interchange with the Long Beach Freeway.

Spring Street is an east-west roadway located approximately one mile south of the project site. Spring Street extends easterly from the Los Angeles River to the Los Angeles County/Orange County boundary near the San Gabriel River Freeway where it becomes Cerritos Avenue. It is designated a collector street between Magnolia Avenue and Pacific Avenue, and a major arterial east of Pacific Avenue. Spring Street generally has three lanes in each direction, plus left-turn channelization. It is also a boundary street between the Cities of Long Beach and Signal Hill.

28th Street is a short east-west local street between Clark Avenue and Bellflower Boulevard. This street, located southeast of the project site, provides one lane in each direction.

Willow Street is an east-west major arterial approximately one and one-half miles south of the project site. This arterial extends westerly to the Terminal Island Freeway (SR-103) where it turns into Sepulveda Boulevard. Extending easterly to the Los Angeles County/Orange County boundary, it becomes Katella Avenue. In the study area, Willow Street has three to four lanes per direction and left-turn channelization. Willow Street connects with the Long Beach Freeway, the San Diego Freeway and the San Gabriel River Freeway.

Hill Street is an east-west collector street located south of the project site. It is within the Cities of Long Beach and Signal Hill and has one lane in each direction.

Stearns Street is south of the project site. It is an east-west collector street from Redondo Avenue to Clark Avenue and a minor arterial from Clark Avenue easterly in the City of Long Beach. Stearns Street generally has one to two lanes per direction and left-turn channelization.

Pacific Coast Highway (PCH) is a State highway (SR-1) and a regional corridor facility. In the study area, it generally runs east-west south of the project site. At the Traffic Circle in the City of Long Beach, PCH angles off in a southeasterly direction. PCH serves a wide area, including the Cities of Torrance, Lomita, Los Angeles, Long Beach and areas of Orange County. It generally has three lanes per direction and left-turn channelization. PCH also has an interchange with the Long Beach Freeway.

Anaheim Street is an east-west major arterial in the City of Long Beach and located south of the project site. It also continues westerly into the City of Los Angeles. Anaheim Street provides two lanes per direction, along with left-turn channelization. At both the Long Beach and Terminal Island Freeways, there are ramp connections for Anaheim Street.

7th Street is an east-west major arterial and a primary transit corridor south of the project site and within the City of Long Beach. It extends easterly from its connection with the Long Beach Freeway to approximately the Los Cerritos Channel where it feeds into the Garden Grove Freeway. 7th Street generally has two lanes in each direction and left-turn channelization.

Santa Fe Avenue is a north-south major arterial beginning at 9th Street in the City of Long Beach. It passes through several cities, ending in the City of Lynwood. Near Del Amo Boulevard, west of the project site, it has two lanes per direction and left-turn channelization. Santa Fe Avenue also has connections with both the San Diego and Artesia Freeways.

Long Beach Boulevard is a north-south major arterial and a primary transit corridor west of the project site. It traverses the Cities of Long Beach, Compton, Lynwood, and South Gate. The Metro Blue Line light rail runs along the center median of Long Beach Boulevard between First Street and Willow Street. There are generally two lanes per direction and left-turn channelization on Long Beach Boulevard in the study area. Interchange with the San Diego Freeway, the Long Beach Freeway and the Artesia Freeway is provided for Long Beach Boulevard.

Atlantic Avenue is a north-south major arterial west of the project site. It runs through the City of Long Beach, past the Artesia Freeway and into several cities to the north. Two travel lanes per direction and left-turn channelization are generally provided on Atlantic Avenue in the study area. Ramp connections with the San Diego Freeway and Artesia Freeway are also available for Atlantic Avenue.

Alamitos Avenue, located southwest of the project site, is a north-south regional corridor facility in the City of Long Beach. It branches from Ocean Boulevard on the south and

terminates at PCH to the north. There are two lanes per direction and left-turns channelization on Alamitos Avenue.

Orange Avenue is a north-south collector street approximately one and one-half miles west of the project site. South of the San Diego Freeway, it is designated a major arterial. Generally, Orange Avenue has one lane per direction; however, additional lanes are available near its interchange with the San Diego Freeway. In addition, bicycle facilities are provided along some portions of Orange Avenue. Orange Avenue traverses the Cities of Long Beach and Signal Hill in the study area.

Cherry Avenue is a north-south major arterial approximately 0.4 miles west of the project site. Cherry Avenue extends from Ocean Boulevard, through the Cities of Long Beach and Signal Hill, and forms the western boundary of the City of Lakewood. Between Ocean Boulevard and Pacific Coast Highway, it is a collector street and a minor arterial. Two to three travel lanes per direction and left-turn channelization are provided on Cherry Avenue in the study area, along with ramp connections with the San Diego and Artesia Freeways.

Temple Avenue is a north-south collector street that is to the south of the project site and discontinuous at the Long Beach Municipal Airport. It continues north from Cover Street as Paramount Boulevard. Temple Avenue has two lanes per direction near Spring Street and partial ramp connections with the San Diego Freeway.

Paramount Boulevard is a north-south major arterial for most of its length. It terminates on the south at Cover Street and at the western end of the project site. It serves the City of Lakewood and the northern portion of the City of Long Beach, and reaches as far north as the City of Pico Rivera. There are two lanes in each direction, along with left-turn channelization, on Paramount Boulevard. Some portions also have bike lanes. Paramount Boulevard has ramp connections with the Artesia Freeway.

Redondo Avenue is a north-south major arterial that is to the south of the project site. It forms the eastern boundary of the City of Signal Hill and traverses the City of Long Beach. Redondo Avenue has two lanes per direction, except at Spring Street where it has three lanes northbound, plus left-turn channelization.

Lakewood Drive is a northeast-southwest oriented local street adjacent to the Lakewood Country Club in the City of Lakewood and also opposite the project site. Its southerly terminus is Carson Street and at its northeasterly end, it turns into Harvey Way west of Lakewood Boulevard. Lakewood Drive provides one lane in each direction.

Lakewood Boulevard is a north-south regional corridor facility that forms the eastern border of the project site. It extends through the Cities of Long Beach, Lakewood and Bellflower, and is a State highway from Del Amo Boulevard northerly. In part of the study area, Lakewood Boulevard has two to three travel lanes in each direction and left-turn channelization. Within the City of Long Beach, Lakewood Boulevard was recently improved between Carson Street and Willow Street, and provides up to four lanes per direction on some segments, plus additional turn lanes on Lakewood Boulevard. Lakewood Boulevard has interchanges with the San Diego and Artesia Freeways.

Faculty Avenue, approximately one-fourth mile east of the project site, is a north-south local street within the Cities of Long Beach and Lakewood. It has one lane in each direction.

Ximeno Avenue is a north-south collector street for most of its length, with a short portion being a minor arterial between Anaheim Street and PCH. Ximeno Avenue is southeast of the project site and provides two lanes in each direction and left-turn channelization.

Clark Avenue is a north-south roadway one-half mile east of the project site. It is designated a collector street and a minor arterial north and south of Carson Street,

respectively. This street traverses the Cities of Downey, Bellflower, Lakewood and Long Beach, terminating to the south at Pacific Coast Highway. There generally are two to three lanes in each direction, along with left-turn channelization on Clark Avenue, with the segment between Del Amo Boulevard and Carson Street providing one lane in each direction.

Los Coyotes Diagonal is a major arterial that is to the southeast of the project site. It extends through the City of Long Beach in a northeasterly direction, terminating north of Carson Street in the City of Lakewood. There are one to three lanes in each direction and left-turn channelization on Los Coyotes Diagonal.

Bellflower Boulevard is a north-south major arterial approximately one mile east of the project site. It has two to four lanes in each direction and left-turn channelization, plus a bike lane on some segments. Bellflower Boulevard provides access through the Cities of Long Beach, Lakewood, Bellflower and Downey. This roadway connects with both the San Diego and Artesia Freeways.

Woodruff Avenue is a north-south minor arterial approximately one and one-half miles east of the project site. It traverses the Cities of Long Beach, Lakewood, and Bellflower with two travel lanes per direction and left-turn channelization. Woodruff Avenue also has a partial interchange with the San Diego Freeway.

Palo Verde Avenue is a north-south collector street east of the project site. Palo Verde Avenue runs between the City of Bellflower and the California State University Long Beach campus. It is also a boundary street between the Cities of Lakewood and Cerritos. Palo Verde Avenue has two lanes in each direction and left-turn channelization, and a partial ramp connection with the San Diego Freeway.

Studebaker Road is a north-south major arterial from Second Street to Spring Street and a minor arterial from there to Los Coyotes Diagonal in the City of Long Beach. It is located east of the project site and is discontinuous for a portion north of Los Coyotes

Diagonal due to the San Gabriel River. In the City of Lakewood, it continues northerly into the Cities of Cerritos, Norwalk and Downey. In the vicinity of Del Amo Boulevard, Studebaker Road has two lanes in each direction, along with left-turn channelization. It also has partial ramp connections with the Garden Grove Freeway and the San Diego Freeway.

Pioneer Boulevard is a major arterial near Carson Street, with two lanes per direction and left-turn channelization at that location. This street, which is east of the project site and east of the San Gabriel River Freeway, traverses the Cities of Hawaiian Gardens, Lakewood and Cerritos, and is a boundary street between the Cities of Long Beach and Hawaiian Gardens.

Norwalk Boulevard is a north-south major arterial east of the project site which traverses the Cities of Long Beach, Hawaiian Gardens, Cerritos, Artesia and Norwalk. It continues south into Orange County where it changes name to Los Alamitos Boulevard. Norwalk Boulevard has two to three lanes per direction, along with left-turn channelization.

EXISTING (2002) TRAFFIC VOLUMES

One hundred and nine (109) intersections, including nine Congestion Management Program intersections, were analyzed in this study. These intersections are listed on page 36 and shown in Figure 5, page 39. These intersections are those that potentially could be the most affected by project traffic. As agreed to by the City of Long Beach, the base year for existing traffic conditions is 2002. The traffic volumes used in the analysis of existing conditions at these intersections were obtained from manual traffic counts, the large majority of which were conducted in the fall of 2002. Intersection traffic counts that were conducted in 2001 were growth-factored by 1.5 percent to reflect 2002 conditions. Traffic counts taken in 2003 were assumed to be valid for 2002 conditions.

Table 3
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
Rosecrans Av.	Castana	Lakewood	2		2		PM	2HR: 7AM-6PM		NSAT		40
"	Lakewood	Sonrisa	2		2		PM	NR		NR		40
Alondra Bl.	Vermont	Paramount	2		2		RM	NR		NR		40
"	Paramount	Orizaba	2		2		RM	NR		NR		40
"	Hayter	Lakewood	2		2		RM	NR		NR		40
"	Lakewood	Virginia	2		2		RM	NR		NR		40
Flower St.	Hayter	Lakewood	2		2		DY	NR		NR		35
"	Lakewood	Virginia	2		2		DY	NR		NR		35
Artesia Bl.	Orange	Walnut	2		2		RM	NR		NR		35
"	Walnut	Rose	2		2		RM	NR		NR		35
"	Rose	Cherry	2		2		RM	NR		NR		35
"	Cherry	Paramount	2		2		RM	NR		NR		35
"	Paramount	Orizaba	2		2		RM	NR		NR		35
"	Orizaba	Obispo	2		2		RM	NR		NR		35
"	Obispo	Indiana	2		2		RM	NR		NR		35
"	Indiana	Downey	2		2		RM	2 HR: 7AM-6PM		2 HR: 7AM-6PM		35
"	Downey	Coke	2		2		M	2 HR: 7AM-6PM		2 HR: 7AM-6PM		35
"	Coke	Lakewood	2		2		M	2 HR: 7AM-6PM		2 HR: 7AM-6PM		35
"	Lakewood	Virginia	2		2		M	2 HR: 7AM-6PM		2 HR: 7AM-6PM		35
"	Virginia	Clark	2		2		M	2 HR: 7AM-6PM		2 HR: 7AM-6PM		35
South St.	Lemon	Orange	2		2		DY	2HR: 9AM-6PM		2HR: 9AM-6PM		35
"	Orange	Falcon	2		2		DY	NR		NR		35
"	Gaviota	Gardenia	2		2		M	NP: 7AM-5PM		NR		35
"	Gardenia	Cherry	2		2		RM	NR		NR		35
"	Cherry	RR Tracks	2		2		RM	NR		NP		35
"	RR Tracks	Paramount	2		2		M	NR		NR		35
"	Paramount	Obispo	2		2		M	NR		NR		35
"	Hayter	Lakewood	2*		2*		M	NSAT		NSAT		40

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
"	Lakewood	Graywood	2*		2*		M	NSAT		NSAT		40
"	Autry	Bellflower	2		2		M	NSAT		NSAT		40
"	Bellflower	Ademoor	2		2		M	NSAT		NSAT		40
"	Ademoor	Dunrobin	2		2		RM	NSAT		NSAT		40
Market St.	Pacific	Long Beach	1		1		DY	NR		NR		30
"	Long Beach	Pine	1		1		PM	NR		NR		30
"	Walnut	Cherry	2		2		PM	NR		NR		35
"	Cherry	RR Tracks	2		2		PM	NPAT		NPAT		40
Candlewood St.	RR Tracks	Paramount	2		2		DY	NR		NR		40
"	Paramount	Obispo	2		2		PM	NSAT		NSAT		40
"	Hayter	Lakewood	2		2		M	NSAT		NSAT		35
"	Lakewood	Graywood	2		2		M	NPAT		NPAT		35
"	Faculty	Clark	2		2		PM	NPAT		NPAT		35
"	Clark	Lorelei	1		1		DY	NP: 7-9AM, 4-6PM		NP: 7-9AM, 4-6PM		30
"	Lorelei	Montair	1		1		SDY	NP: 7-9AM, 4-6PM		NP: 7-9AM, 4-6PM		30
"	Montair	Bellflower	1		1		SDY	NPAT		NPAT		30
"	Bellflower	Dunrobin	1		1		SDY	NR		NR		30
Del Amo Bl.	Santa Fe	RR Tracks	2		2		RM	NSAT		NSAT		40
"	RR Tracks	Susan Rd	3		3		RM	NSAT		NSAT		45
"	Virginia	Long Beach Bl.	3		3		RM	NR		NR		40
"	Long Beach Bl.	Locust	3		3		RM	NR		NR		40
"	Locust	Atlantic	3		3		RM	NS: 3PM-6PM		NPAT		40
"	Atlantic	Orange	3		3		RM	NPAT		NPAT		40
"	Orange	Rose	3		3		RM	NPAT		NPAT		40
"	Rose	Cherry	3		3		RM	NPAT		NPAT		40
"	Cherry	Deeboyar	2		2		RM	NS: 3-6PM		NR		40
"	Paramount	Obispo	2		2		RM	NR*		NR*		40
"	Oliva	Lakewood	3		3		RM	NPAT		NPAT		40
"	Lakewood	Graywood	3		3		RM	NPAT		NPAT		40

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping: Lanes EB	Striping: Lanes NB	Striping: Lanes WB	Striping: Lanes SB	Striping: Median Type	Stopping and Parking Prohibition: Eastbound	Stopping and Parking Prohibition: Northbound	Stopping and Parking Prohibition: Westbound	Stopping and Parking Prohibition: Southbound	Speed Limit (MPH)
"	Faculty	Clark	3		3		RM	NPAT		NPAT		40
"	Clark	Lorelei	2		2		PM	NPAT		NPAT		40
"	Autry	Bellflower	2		2		M	NPAT*		NPAT*		40
"	Bellflower	Eastbrook	2		2		M	NPAT*		NPAT*		40
"	Eastbrook	Woodruff	2		2		M	NPAT*		NPAT*		40
"	Woodruff	Gondar	2		2		M	NPAT*		NPAT*		40
"	Gondar	Palo Verde	2		2		PM	NPAT		NPAT		40
"	Palo Verde	Knoxville	2		2		PM	NR		NR		40
"	Knoxville	Studebaker	2		2		RM	NPAT		NPAT		40
"	Studebaker	I-605 Ramps	2		2		RM	NPAT		NPAT		40
Centralia St.	Castana	Lakewood	1		1		SDY	NR		NR		25
"	Lakewood	Clark	1		1		SDY	NR		NR		25
"	Clark	Bellflower	1		1		SDY	NR		NP: 7AM-4PM, M-F		25
"	Bellflower	Briercrest	1		1		SDY	NR		NR		30
San Antonio Dr.	Virginia	Long Beach Bl.	1		1		SDY	2HR: 9AM-6PM		2HR: 9AM-6PM		25
"	Long Beach Bl.	Elm	2		2		RM	NR		NPAT		35
Carson St.	Long Beach Bl.	Atlantic	1		1		M	NR		NR		30
"	Atlantic	Orange	2		2		M	NR		NR		35
"	Orange	Cherry	2		2		M	NR		NR		40
"	Cherry	Paramount	3		3		RM	NSAT		NSAT		40
"	Paramount	Obispo	3		3		RM	NSAT		NSAT		40
"	Lakewood Dr.	Lakewood Bl.	3		3		M	NPAT		NPAT		40
"	Lakewood	Norse	3		3		M	2HR: 9AM-3PM		1HR: 9AM-6PM		40
"	Norse	Clark	3		2		RM	2HR: 9AM-3PM		2HR: 9AM-6PM		40
"	Clark	Bellflower	3		2		RM	NP: 3-6PM		NR		40
"	Bellflower	Woodruff	3		2		RM	NP: 2-6AM		NP: 2-6AM		40
"	Woodruff	Palo Verde	3		2		RM	NP: 3-6PM		NP: 2-6AM		40
"	Palo Verde	Los Coyotes	3		2		RM	NP: 2-6AM		NP: 2-6AM		40
"	Los Coyotes	San Gabriel R.	2		2		RM	NP: 2-6AM		NP: 2-6AM		40

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
"	Nectar	605 Fwy	3		3		RM	NSAT		NSAT		40
"	605 Fwy	Pioneer	3		3		RM	Construction		Construction		40
"	Pioneer	Violeta	2		2		RM	NR		NSAT		40
"	Juan Av	Norwalk	2		2		RM	RC		NR		35
"	Norwalk	Claretta	2		2		RM	RC		2HR: 7AM-6PM		35
Cover St.	Cherry	Industry	1		1		DY	NR		NR		30
"	Industry	Paramount	2		2		RM	NSAT		NSAT		30
Bixby Rd.	Rose	Cherry	1		1		SDY	NR		NR		30
"	Cherry	Industry	1		1		DY	NR		NR		30
Conant St.	Lakewood	Faculty	2		2		DY	NR		NPAT		30
"	Faculty	Clark	2		2		DY	NR/NPAT		NPAT		30
"	Clark	Charlemagne	1		1		RM	NR		NR		30
"	Charlemagne	Bellflower	1		1		RM	NR		NR		30
"	Bellflower	Ocana	1		1		RM	NR		NR		30
Wardlow Rd.	Pasadena	Atlantic	2		2		DY	NR		NR		35
"	Atlantic	Orange	2		2		DY	NR		NR		35
"	Orange	Cherry	2		2		DY	NR		NR		35
"	Cherry	Globmaster	2		2		M	NPAT		NPAT		30
"	Lakewood	Clark	2		2		M	NR		NR		35
"	Clark	Charlemagne	2		2		RM	NR		NR		35
"	Charlemagne	Bellflower	2		2		RM	NR		NR		35
"	Bellflower	San Anseline	2		2		RM	NR		NR		35
Spring St.	Pasadena	Atlantic	2		2		DY	NPAT		NPAT		40
"	Atlantic	California	2		2		RM	NR		NR		40
"	California	Orange	2		2		DY	NR		NR		40
"	Orange	Walnut	2		2		RM/M	NR		NR		40
"	Walnut	Cherry	2		2		M	NR		NR		40

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
"	Cherry	405 SB	2		2		M	NSAT		NSAT		40
"	405 SB	405 NB	2		2		RM	NR		NSAT		40
"	405 NB	Temple	2		2		RM	NSAT		NSAT		40
"	Temple	Redondo	2		2		RM	NR		NSAT		40
"	Redondo	Lakewood	2		2		RM	NSAT		NSAT		40
"	Lakewood	Airport Plaza	3		3		RM	NPAT		NSAT		40
"	Airport Plaza	Clark	3		3		RM	NPAT		NSAT		40
"	Clark	Bellflower	3		3		RM	NPAT		NPAT		40
"	Bellflower	Los Coyotes	3		3		RM	NPAT		NPAT		40
28th St.	Clark	Rutgers	1		1		SDY	NR		NR		25
"	Rutgers	Bellflower	1		1		SDY	NR		NR		25
Willow St.	Pasadena	Atlantic	3		3		RM	NP: 4-6PM		NP: 6:30-8:30AM		40
"	Atlantic	California	3		3		RM	NP: 4-6PM		NSAT		40
"	California	Orange	3		3		RM	NSAT		NSAT		40
"	Orange	Cherry	3		3		RM	NSAT		NSAT		40
"	Cherry	Junipero	3		3		RM	NSAT		NSAT		40
"	Junipero	Redondo	3		3		RM	NSAT		NSAT		40
"	Redondo	Grand	3		3		RM	NPAT		NPAT		40
"	Grand	Lakewood	3		3		RM	NPAT		NPAT		40
"	Lakewood	Clark	3		3		RM	NSAT		NPAT		40
"	Clark	Los Coyotes	3		3		RM	NPAT		NPAT		40
Hill St.	Walnut	Legion	1		1		SDY	NR		NR		30
"	Legion	Cherry	1		1		SDY	NR		NR		30
Stearns St.	Redondo	Euclid	1		1		SDY	NPAT		NPAT		35
"	Euclid	Lakewood	1		1		SDY	NR		NR		35
"	Lakewood	Clark	1		1		SDY	NR		NR		35
"	Clark	Fidler	2		2		DY	NR		NR		35

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping: Lanes EB	Striping: Lanes NB	Striping: Lanes WB	Striping: Lanes SB	Striping: Median Type	Stopping and Parking Prohibition: Eastbound	Stopping and Parking Prohibition: Northbound	Stopping and Parking Prohibition: Westbound	Stopping and Parking Prohibition: Southbound	Speed Limit (MPH)
Pacific Coast Hwy.	Lemon	Orange	3		3		PM	NS: 3P-6P, 2HR: 9A-3P		NS: 7A-9A, 2HR: 9A-6P		35
"	Orange	Walnut	3		3		PM	NS: 3PM-6PM		NS: 7AM-9AM		35
"	Walnut	Temple	3		3		PM	NS: 3PM-6PM		NSAT		35
"	Temple	Obispo	3		3		PM	NS: 3PM-6PM		NSAT		35
"	Obispo	Redondo	3		3		PM	NS: 3PM-6PM		NSAT		35
"	Redondo	Termino	3		3		PM	NS: 3PM-6PM		NS: 7AM-9AM		35
"	Ximeno	Clark	2		2		PM	NR		NR		45
"	8th	7th	3		2		PM	NR		NR		45
"	7th	Bellflower	3		3		RM	NPAT		RC		45
Anaheim St.	Orizaba	Redondo	2		2		PM	2HR: 9AM-6PM		2HR: 9AM-6PM		30
"	Redondo	Loma	2		2		PM	2HR: 9AM-6PM		2HR: 9AM-6PM		30
8th St.	Lime	Alamitos	--		3		None	--		NR		30
"	Redondo	Termino	2		2		PM	NR		2HR: 9AM-6PM		35
"	Pacific Coast	Los Altos	3		2		RM	NPAT		NPAT		40
7th St.	Orange	Alamitos	2		2		PM	NR		NR		35
"	Orizaba	Redondo	2		2		PM	2HR: 9AM-6PM		NR		35
"	Pacific Coast	Bellflower	3		3		PM	NPAT		RC		40
Santa Fe Av.	19800 Block	Del Amo		2		2	PM		NR		NR	45
"	Del Amo	RR Tracks		2		2	PM		NR		NR	40
Long Beach Bl.	Randolph	Carson		2		2	M		2HR: 9AM-6PM		2HR: 9AM-6PM	35
"	Carson	44th Street		2		2	M		2HR: 9AM-6PM		2HR: 9AM-6PM	35
"	Arbor	Del Amo		2		2	M		NR		RC	30
"	Del Amo	Sunset		2		2	M		RC		RC	30
"	53rd	Market		2		2	None		2HR: 9AM-6PM		2HR: 9AM-6PM	30
"	Market	Ellis		2		2	None		2HR: 9AM-6PM		2HR: 9AM-6PM	30
Atlantic Av.	Sunrise	Willow		2		2	DY		NR		NR	35

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition			
			Lanes				Median				
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound
"	Willow	Mem Med Cntr		2		2	RM		NPAT		NR
"	Mem Med Cntr	Columbia		2		2	RM		NPAT		RC
"	Columbia	29th		2		2	DDY		NPAT		2HR: 9AM-6PM
"	29th	Spring		2		2	RM		NPAT		NPAT
"	Spring	405 SB		2		2	RM		NPAT		NPAT
"	405 SB	33rd		2		2	RM		NSAT		NSAT
"	33rd	Wardlow		2		2	DY		RC		RC
"	Wardlow	35th		2		2	DY		NR/RC		RC
"	35th	36th		2		2	DY		NR		RC
"	36th	37th		2		2	DY		NR		2HR: 9AM-6PM
"	37th	Bixby		2		2	DY		2HR: 9AM-6PM		2HR: 9AM-6PM
"	Bixby	Roosevelt		2		2	RM		2HR: 9AM-6PM		2HR: 9AM-6PM
"	Roosevelt	Carson		2		2	DY		2HR: 9AM-6PM		2HR: 9AM-6PM
"	Carson	San Antonio		2		2	DY		2HR: 9AM-6PM		2HR: 9AM-6PM
"	45th	Del Amo		2		2	RM		NP: 4AM-8AM		NP: 4AM-8AM
"	Del Amo	52nd		2		2	RM		NR		NR
Alamitos Av.	5th	7th		2		2	DY		2HR: 9AM-6PM		2HR: 9AM-6PM
"	7th	10th		2		2	DY		NR		NR
"	14th	17th		2		2	DY		NR		NR
"	17th	Pacific Coast		2		2	DY		NR		NR
Orange Av.	14th	Alamitos		1		1	SDY		NR		NR
"	Alamitos	Pacific Coast		1		1	DY		RC		NR
"	Pacific Coast	20th		1		1	SDY		NR		NR
"	25th	Willow		1		1	M		NSAT		NSAT
"	Willow	29th		1		1	M		NSAT		NSAT
"	29th	Spring		2		1	M		NSAT		NSAT
"	Spring	405 SB		2		2	RM		NSAT		NPAT
"	405 SB	32nd		1		2	DY		NSAT		NSAT
"	32nd	33rd		1		1	DY		RC,NP: 8AM-5PM		NR
"	33rd	Wardlow		1		1	DY		NR		NR

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
"	Wardlow	36th		1		1	M		NR		NR	35
"	37th	Bixby		1		1	M		NR		NR	35
"	Bixby	Marshall		1*		1*	M		NR		NR	35
"	Marshall	Carson		1*		1*	M		NR		NR	35
"	Carson	Cartagena		1*		1*	M		NR		NR	35
"	Goldfield	Del Amo		1		1	PM		NR		NR	35
"	Del Amo	Via Wanda		1		1	PM		NR		NR	35
"	56th	South		1		1	PM		NR		NR	35
"	South	59th		1		1	PM		2HR: 9AM-6PM		2HR: 9AM-6PM	30
Cherry Av.	15th	Pacific Coast		1		1	PM		NR		NR	25
"	Pacific Coast	21st		1		1	PM		NR		NR	40
"	21st	Hill		2		2	RM		NSAT		NSAT	40
"	Hill	Burnett		2		2	RM		NSAT		NSAT	40
"	Burnett	25th		3		3	M		NSAT		NSAT	40
"	25th	Willow		3		3	M		NSAT		NSAT	40
"	Willow	28th		3		3	M		NSAT		NSAT	40
"	28th	Spring		3		3	M		NSAT		NSAT	40
"	Spring	EB Ramps		3		3	RM		NSAT		NSAT	40
"	EB Ramps	WB Ramps		3		2	RM		NSAT		NSAT	40
"	WB Ramps	33rd		2		2	M		RC		NR	40
"	33rd	Wardlow		2		2	M		RC		RC	40
"	Wardlow	35th		2		2	RM		2HR: 9AM-6PM		2HR: 9AM-6PM	40
"	35th	36th		2		2	RM		NSAT		NSAT	40
"	36th	37th		2		3	M		2HR: 9AM-6PM		NSAT	40
"	37th	Bixby		3		3	M		NSAT		NSAT	40
"	Bixby	Roosevelt		2		3	M		RC		NSAT	40
"	Roosevelt	Carson		3		3	M		RC		NSAT	40
"	Carson	Cartagena		3		3	RM		NR		NR*, NP:2-6AM	40
"	45th	Del Amo		3		3	RM		NR		NR*, NP:2-6AM	40
"	Del Amo	52nd		3		3	RM		NR		NR*, NP:2-6AM	35
"	52nd	Market		2		2	RM		NR		NP: 2AM-6AM	35

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
"	Market	Cherry Indus		2		2	RM		NP: 2AM-6AM		NP: 2AM-6AM	35
"	56th	South		2		2	M		NR		NR	35
"	South	Hungerford		2		2	M		RC		NR	35
"	65th	Artesia		2		2	M		RC		NR	35
"	Artesia	WB Ramps		2		2	RM		NSAT		NSAT	35
"	WB Ramps	68th		2		2	RM		NSAT		NR	35
Temple Av.	Willow	28th		2		2	M		NR		NR	40
"	28th	405 Fwy		2		2	M		NR		NR	40
Paramount Bl.	Cover	Carson		2		2	M		NSAT		NSAT	40
"	Carson	Village		2		2	M		NSAT		NSAT	40
"	Sandwood	Del Amo		2*		2*	M		NPAT		NSAT	40
"	Del Amo	Hardwick		2*		2*	M		NSAT		NSAT	40
"	Hardwick	Candlewood		2		2	PM		NSAT		NSAT	40
"	Candlewood	56th		2		2	PM		NR		NR	35
"	55th	South		2		2	M		NR		NR	35
"	South	Seaboard		2		2	M		NR		NR	35
"	65th	Artesia		2		2	M		NR		NR	35
"	Artesia	EB Ramps		2		2	M		NSAT		NSAT	35
"	EB Ramps	WB Ramps		2		2	RM		NSAT		NSAT	35
"	WB Ramps	68th		2		2	M		NR		NR	35
"	70th	Alondra		2		2	RM		2HR: 9AM-6PM		2HR: 9AM-6PM	35
"	Alondra	Jefferson		2		2	RM		NR		2HR: 9AM-6PM	35
Redondo Av.	4th	6th		2		2	DYL		NR		NR	30
"	6th	7th		2		2	DYL		NSAT		NSAT	30
"	7th	11th		2		2	DYL		NR		NR	30
"	11th	Anaheim		2		2	DYL		RC		RC	30
"	Anaheim	14th		2		2	DYL		RC		RC	30
"	14th	17th		2		2	DYL		NR		NR	30
"	17th	Pacific Coast		2		2	RM		NR		RC	30

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
"	Pacific Coast	19th		2		2	DYL		NR		RC	30
"	19th	Stearns		2		2	DYL		NSAT		NR	30
"	Stearns	Hill		2		2	DYL		NPAT		NSAT	30
"	Hill	Willow		2		2	DYL		NPAT		NSAT	30
"	Willow	Kilroy Airport		3		2	M		NPAT		NPAT	40
"	Kilroy Airport	Spring		3		2	M		NPAT		NPAT	40
Lakewood Dr.	Carson	Ann Arbor		1		1	NONE		NR		NR	25
"	Ann Arbor	Harvey		1		1	NONE		NR		NR	25
Lakewood Bl.	Rosada	Stearns		2		2	RM		NP: 2AM-6AM		NP: 2AM-6AM	40
"	Stearns	23rd		3		2	RM		NPAT		NPAT	40
"	23rd	Willow		3		3	RM		NPAT		NPAT	40
"	Willow	Spring		3		3	RM		NPAT		NSAT	40
"	Spring	Wardlow		4		4	RM		NPAT		NSAT	40
"	Wardlow	Conant		4		4	RM		NPAT		NSAT	40
"	Conant	Carson		3		3	RM		NPAT		NSAT	40
"	Carson	Harvey		2		2	RM		NSAT		NR: Except Com.	40
"	Harvey	Centralia		2		2	RM		2HR: 9AM-6PM		NR: Except Com.	40
"	Centralia	Arbor		2		2	RM		NR		NR: Except Com.	40
"	Arbor	Del Amo		2		2	RM		NR		NR: Except Com.	40
"	Del Amo	Hardwick		3		3	RM		NPAT		NPAT	40
"	Hardwick	Candlewood		3		3	RM		NPAT		NPAT	40
"	Candlewood	Pimenta		3		3	RM		NPAT		NPAT	40
"	Pimenta	South		3		3	RM		NPAT		NPAT	40
"	South	Hedda		3		3	RM		NSAT		NSAT	40
"	Hedda	Ashworth		3		3	RM		NSAT		NSAT	40
"	Ashworth	Rose		3		3	RM		NSAT		NSAT	40
"	Rose	Cedar		3		3	M		NS: 6-8AM		NSAT: 6-8AM	40
"	Cedar	Ramona		3		3	2LT		NS: 6-8AM		NSAT: 6-8AM	40
"	Ramona	Artesia		3		3	M		NS: 6-8AM		NSAT: 6-8AM	40
"	Artesia	EB Ramps		3		3	RM		NSAT		NSAT	40

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
"	EB Ramps	WB Ramps		3		3	RM		RC		RC	40
"	WB Ramps	Park		3		3	RM		RC		NSAT	40
"	Park	Walnut		2		2	M		2HR: 7AM-6PM		NR	40
"	Walnut	Alondra		2		2	PM		NR		NR	40
"	Alondra	Hegel		2		2	RM		NR		2HR: 7AM-6PM	40
"	Paramount Pl	Rosecrans		2		2	RM		NP: 7-9AM, 4-6PM		NP: 7-9AM, 4-6PM	40
"	Rosecrans	Reydon		2		2	RM		NP: 7-9AM, 4-6PM		NP: 7-9AM, 4-6PM	40
Ximeno Av.	14th	15th		1		2	DY		NR		NR	30
"	15th	Pacific Coast		2		2	DY		RC		RC	30
"	Pacific Coast	Atherton		2		2	PM		NR		NR	30
Faculty Av.	Conant	Carson		1		1	SDY		NPAT		NPAT	30
"	Carson	Harvey		1		1	None		2HR: 9AM-6PM		NPAT	30
Clark Av.	Garford	Stearns		2		2	DY		NR		NPAT	35
"	Stearns	Eagle		2		2	PM		NR		NPAT	40
"	Eagle	23rd		2		2	M		NR		NR	40
"	23rd	Willow		2		2	M		NSAT		NSAT	40
"	Willow	28th		2		2	M		NSAT		NSAT	40
"	28th	Spring		3		2	DY		NPAT		NSAT	40
"	Spring	Wardlow		3		3	M		NPAT		NSAT	40
"	Wardlow	Conant		2		3	M		NPAT		NPAT	40
"	Conant	Harco		2		2	M		NR		NPAT	40
"	Harco	Lew Davis		2		2	M		2HR: 6-10AM, 3-7PM		NPAT	40
"	Lew Davis	Carson		2		2	M		NR		NPAT	40
"	Carson	Harvey		1		2	M		1HR: 9AM-6PM		NPAT	35
"	Harvey	Centralia		1		1	PM		NR		NR	35
"	Centralia	Del Amo		1		1	PM		NR		NR	35
"	Del Amo	Hardwick		2		2	PM		NPAT		NPAT	35
"	Hardwick	Candlewood		2		2	PM		NPAT		NPAT	35
"	Candlewood	South		2		2	DY		NR		NR	35

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping					Stopping and Parking Prohibition				Speed Limit (MPH)
			Lanes				Median					
			EB	NB	WB	SB	Type	Eastbound	Northbound	Westbound	Southbound	
"	South	Hedda		2		2	DY		NR		NR	35
Bellflower Bl.	23rd	Los Coyotes		3		3	RM		NPAT		NR	40
"	Los Coyotes	Willow		3		3	RM		NPAT		NSAT	40
"	Willow	27th		3		3	RM		NPAT		NSAT	40
"	27th	Spring		3		3	RM		NPAT		NSAT/NR	40
"	Spring	Mezzanine		3		3	RM		NR: Except Com*		NR: Except Com*	40
"	Mezzanine	Wardlow		2		2	RM		NP: 2AM-6AM		NP: 2AM-6AM	40
"	Wardlow	Conant		2		2	RM		NP: 2AM-6AM		NP: 2AM-6AM	40
"	Conant	Harco		2		2	RM		NP: 2AM-6AM		NP: 2AM-6AM	40
"	Harco	Carson		2*		2*	RM		NR: Except Com**		NR: Except Com*	40
"	Carson	Harvey		2		2	RM		NR: Except Com**		NR: Except Com*	40
"	Harvey	Centralia		2		2	PM		NR		NR	40
"	Centralia	Arbor		2		2	PM		NR		NR	40
"	Arbor	Del Amo		2		2	M		NR: Except Com**		NR: Except Com*	40
"	Del Amo	Hardwick		2		2	M		NR		NR	40
"	Hardwick	Candlewood		2		2	M		NR		NR	40
"	Candlewood	Michelson		2		2	M		NR		NR	40
"	Michelson	South		2		2	M**		NR		NR	40
"	South	Allington		2		2	M		NPAT		NPAT	40
Los Coyotes Diag.	Park	Stearns		3		3	RM		NPAT		NPAT	40
"	Stearns	Stanbridge		3		3	RM		NR		NR	40
"	Parkcrest	Carson		2		2	RM		NPAT		NPAT	40
"	Carson	Harvey		1		2	M		NSAT		NR	35
Woodruff Av.	Harco	Carson		2*		2*	M		NR		NR	40
"	Carson	Harvey		2*		2*	M		RC		NSAT	40
"	Arbor	Del Amo		2		2	M		NSAT*		NSAT*	40
"	Del Amo	Hardwick		2		2	M		NSAT*		NSAT*	40
"	Arabella	Allington		2		2	PM		3MIN M-F: 7A-3:30P		NR	40
"	Allington	Rose		2		2	PM		NR		NR	40

Table 3 (cont.)
Existing Street Physical Characteristics

Primary Street	From	To	Striping: Lanes EB	Striping: Lanes NB	Striping: Lanes WB	Striping: Lanes SB	Striping: Median Type	Stopping and Parking Prohibition: Eastbound	Stopping and Parking Prohibition: Northbound	Stopping and Parking Prohibition: Westbound	Stopping and Parking Prohibition: Southbound	Speed Limit (MPH)
Palo Verde Av.	Parkcrest	Carson		2		2	M		NSAT		NSAT	35
"	Carson	Harvey		2		2	DY		NR		NR	35
"	Arbor	Del Amo		2		2	DYL		NR		NR	35
"	Del Amo	Yearling St		2		2	DYL		NSAT		NSAT	40
Studebaker Rd.	Hornet	Del Amo		2		2	RM		NR		NR	40
"	Del Amo	Bradford Circle		2		2	RM		NR		NR	45
Pioneer Bl.	215th	Carson		2		2	RM		NR		NR	40
"	Carson	Civic Center		1		2	DY		NR		NSAT	25
Norwalk Bl.	Civic Center	Carson		2		2	RM		2HR: 7AM-6PM		NR	35
"	Carson	216th		2		2	DYL		2HR: 7AM-6PM		2HR: 7AM-6PM	35

Notes:

[1] Lanes:	# = Number of Lanes	**[3] Parking:**	/M = Metered Parking
	* = Plus Bike Lane		NPAT = No Parking Any Time
			NSAT = No Stopping Any Time
			NS = No Stopping
[2] Median Types:	DY = Double Yellow Centerline		NR = No Restrictions
	2 LT = 2-Way Left Turn		RC = Red Curb
	SDY = Single Dashed Yellow Centerline		* = Except by Permit
	M = Painted Median		** = NP: 2-6AM
	RM = Raised Median		
	** = Short RM north and south of South St. (0.5 block ea.)		

Traffic Study Intersections

1. Rosecrans Avenue and Lakewood Boulevard (also CMP intersection)
2. Alondra Boulevard and Paramount Boulevard
3. Alondra Boulevard and Lakewood Boulevard
4. Flower Street and Lakewood Boulevard
5. SR-91 W/B On/Off Ramps and Cherry Avenue
6. SR-91 E/B On/Off Ramps and Cherry Avenue
7. SR-91 W/B On/Off Ramps and Paramount Boulevard
8. SR-91 E/B On/Off Ramps and Paramount Boulevard
9. SR-91 W/B On/Off Ramps and Lakewood Boulevard
10. SR-91 E/B On/Off Ramps and Lakewood Boulevard
11. Artesia Boulevard and Cherry Avenue
12. Artesia Boulevard and Paramount Avenue
13. Artesia Boulevard and Lakewood Boulevard (also CMP intersection)
14. South Street and Orange Avenue
15. South Street and Cherry Avenue
16. South Street and Paramount Boulevard
17. South Street and Lakewood Boulevard (also CMP intersection)
18. South Street and Clark Avenue
19. South Street and Bellflower Boulevard
20. Market Street and Long Beach Boulevard
21. Market Street and Cherry Avenue
22. Candlewood Street and Paramount Boulevard
23. Candlewood Street and Lakewood Boulevard
24. Candlewood Street and Clark Avenue
25. Candlewood Street and Bellflower Boulevard
26. Del Amo Boulevard and Santa Fe Avenue
27. Del Amo Boulevard and Long Beach Boulevard
28. Del Amo Boulevard and Atlantic Avenue
29. Del Amo Boulevard and Orange Avenue
30. Del Amo Boulevard and Cherry Avenue
31. Del Amo Boulevard and Paramount Avenue
32. Del Amo Boulevard and Lakewood Boulevard
33. Del Amo Boulevard and Clark Avenue
34. Del Amo Boulevard and Bellflower Boulevard
35. Del Amo Boulevard and Woodruff Avenue
36. Del Amo Boulevard and Palo Verde Avenue
37. Del Amo Boulevard and Studebaker Road

38. Centralia Street and Clark Avenue
39. Centralia Street and Bellflower Boulevard
40. San Antonio Drive and Long Beach Boulevard
41. Carson Street and Atlantic Boulevard
42. Carson Street and Orange Boulevard
43. Carson Street and Cherry Boulevard
44. Carson Street and Paramount Boulevard
45. Carson Street and Lakewood Boulevard (also CMP intersection)
46. Carson Street and Faculty Avenue
47. Carson Street and Clark Avenue
48. Carson Street and Bellflower Boulevard
49. Carson Street and Woodruff Avenue
50. Carson Street and Palo Verde Avenue
51. Carson Street and Los Coyotes Diagonal
52. Carson Street and I-605 S/B Off-Ramp
53. Carson Street and I-605 N/B On-Ramp
54. Carson Street and Pioneer Boulevard
55. Carson Street and Norwalk Boulevard
56. Cover Street and Paramount Boulevard/A Street (new)
57. Bixby Road and Atlantic Avenue
58. Bixby Road and Orange Avenue
59. Bixby Road and Cherry Avenue
60. Conant Street/B Street (new) and Lakewood Boulevard
61. Conant Street and Clark Avenue
62. Conant Street and Bellflower Boulevard
63. Wardlow Road and Atlantic Avenue
64. Wardlow Road and Orange Avenue
65. Wardlow Road and Cherry Avenue
66. Wardlow Road/Donald Douglas Drive and Lakewood Boulevard
67. Wardlow Road and Clark Avenue
68. Wardlow Road and Bellflower Avenue
69. Wardlow Road and Woodruff Avenue
70. Wardlow Road and Palo Verde Avenue
71. Wardlow Road and Studebaker Road
72. Spring Street and Atlantic Avenue
73. Spring Street and Orange Avenue
74. Spring Street and Cherry Avenue
75. Spring Street and I-405 Southbound Off-Ramp
76. Spring Street and Temple Street

77. Spring Street and Redondo Avenue
78. Spring Street and Lakewood Avenue
79. Spring Street and Clark Avenue
80. Spring Street and Bellflower Avenue
81. Spring Street and Los Coyotes Diagonal
82. Spring Street and Woodruff Avenue
83. Spring Street and Palo Verde Avenue
84. Spring Street and Studebaker Road
85. Willow Street and Atlantic Avenue
86. Willow Street and Orange Avenue
87. Willow Street and Cherry Avenue
88. Willow Street and Redondo Avenue
89. Willow Street and Lakewood Boulevard (also CMP intersection)
90. Willow Street and Clark Avenue
91. I-405 N/B Off Ramp and Bellflower Boulevard
92. Willow Street and Bellflower Boulevard
93. Hill Street and Cherry Avenue
94. Stearns Street and Redondo Boulevard
95. Stearns Street and Lakewood Boulevard
96. Stearns Street and Clark Avenue
97. Pacific Coast Highway and Orange Avenue
98. Pacific Coast Highway and Cherry Avenue
99. Pacific Coast Highway and Redondo Avenue
100. Pacific Coast Highway and Ximeno Avenue (also CMP intersection)
101. Anaheim Street and Redondo Avenue
102. Seventh Street and Alamitos Avenue (also CMP intersection)
103. Seventh Street and Redondo Avenue (also CMP intersection)
104. Seventh Street and Pacific Coast Highway (also CMP intersection)
105. Douglas Center Drive/Driveway (new) and Lakewood Boulevard
106. A Street (new) and Lakewood Boulevard (future intersection)
107. Carson Street and Lakewood Drive
108. Cover Street and Cherry Avenue
109. Carson Street and First Street (new) (future intersection)

(CMP: Congestion Management Program)

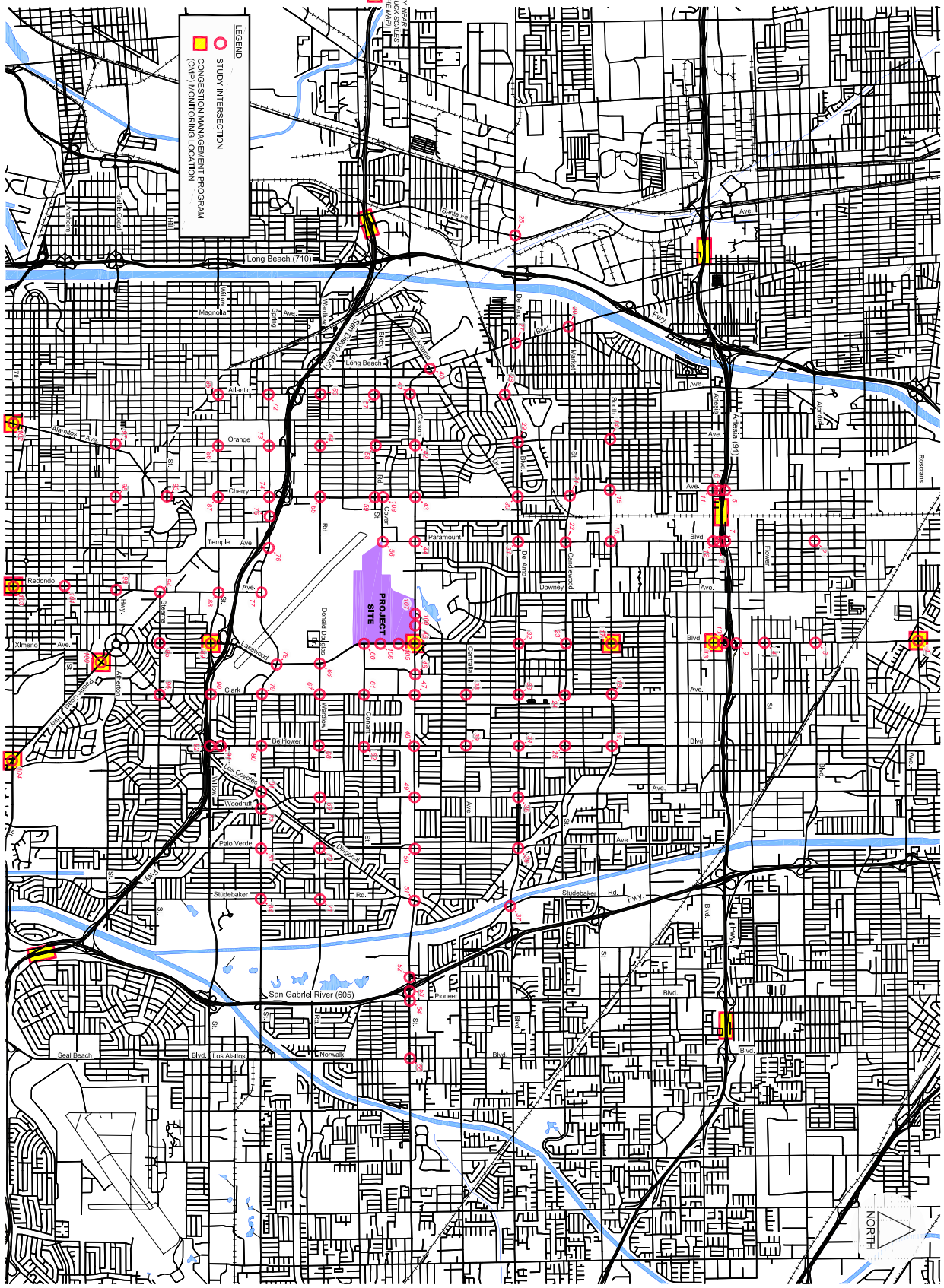

FIGURE 5

12/8/2003

:FN BOEING-LBCH_109 STUDY INTERSECTIONS

STUDY INTERSECTIONS AND CMP MONITORING LOCATIONS

C&A
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2007 Sawtelle Boulevard
Los Angeles, California 90025
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Transportation Planning • Traffic Engineering

The existing AM and PM peak-hour turning movement volumes at the above intersections are presented in Figures 6(a) and 6(b). The intersection traffic count sheets are contained in Appendix D.

Traffic volumes for the two freeways expected to be the most affected by project traffic, the San Diego Freeway and the Artesia Freeway, were obtained from Caltrans. Freeway mainline volumes were from 2002. The freeway ramp volume data were for the years 2001 and 2002. These data were the most current at the time of this analysis. Based on comparative growth trends, the freeway volumes were factored up as appropriate to reflect conditions for the 2002 base year. The existing volumes for the mainlines and on-ramps of the San Diego and Artesia Freeways, including CMP monitoring locations, are included in Tables 6(a), 6(b) and 7, page 62. The freeway mainline and on-ramp traffic count sheets are also in Appendix D.

EXISTING PUBLIC TRANSIT

Long Beach Transit (LBT) is the primary service provider in the City of Long Beach and the project site vicinity. The LBT network of 38 bus routes connects with the Metro Blue Line light rail service and several Metro bus routes as illustrated in Figure 7, Regional Transit Service. Three LBT bus routes provide direct access to the site. LBT Route 111 operates along Lakewood Boulevard, which adjoins the east side of the site. It is on this side of the site that two hotels and much of the higher density commercial uses are proposed. LBT Routes 101 and 103 operate along Carson Street, the northern boundary of the site, where much of the project's residential development is proposed. Routes 101 and 103 are also among the LBT routes that connect to the Wardlow Station of the Metro Blue Line, approximately three miles west of the site. These three bus routes and the Metro Blue Line are described in greater detail below.

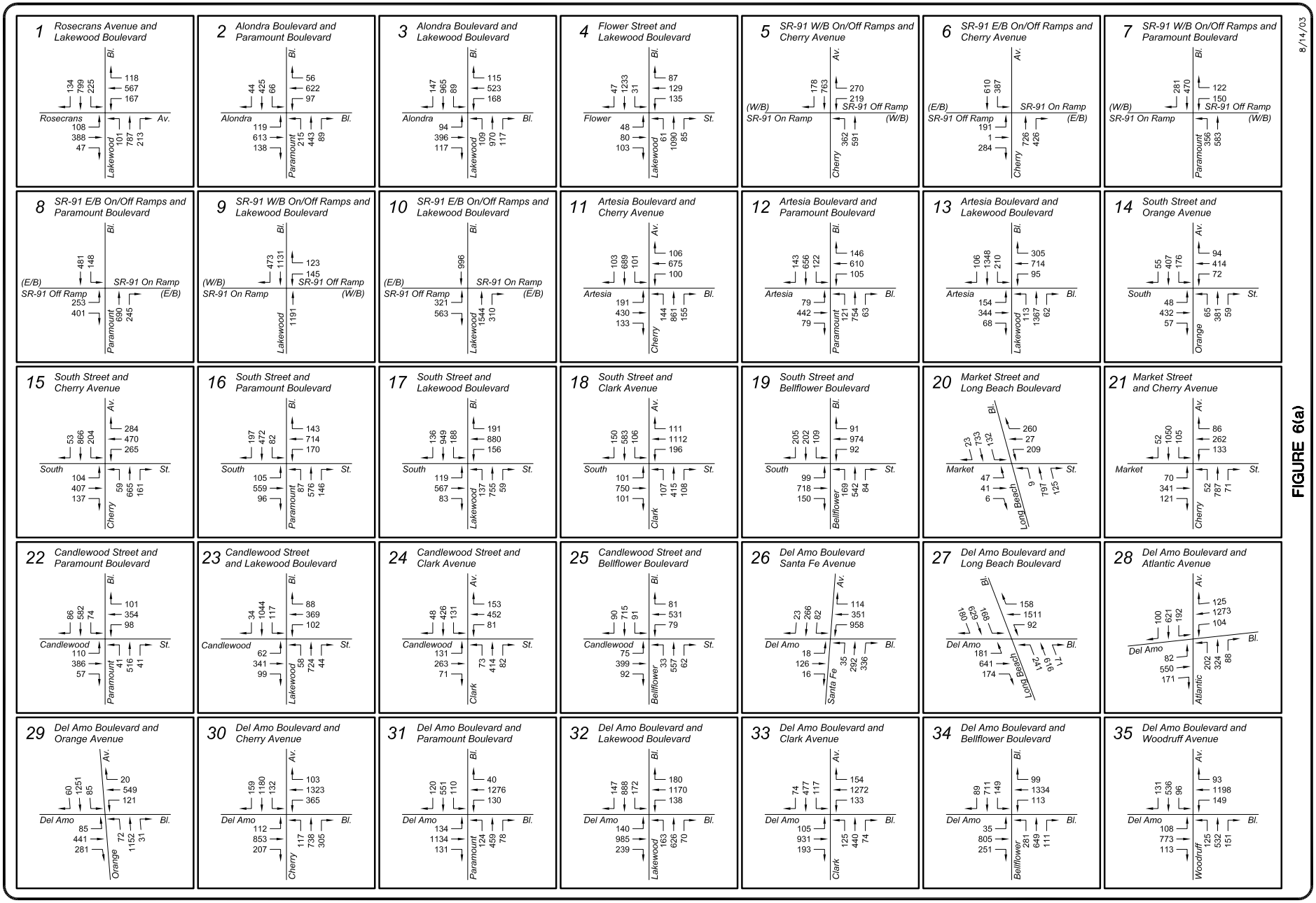

FIGURE 6(a)

8/14/03

BOEING–LNGBCH \AM2002–GRID1
109NTS–STICK–GRID–1

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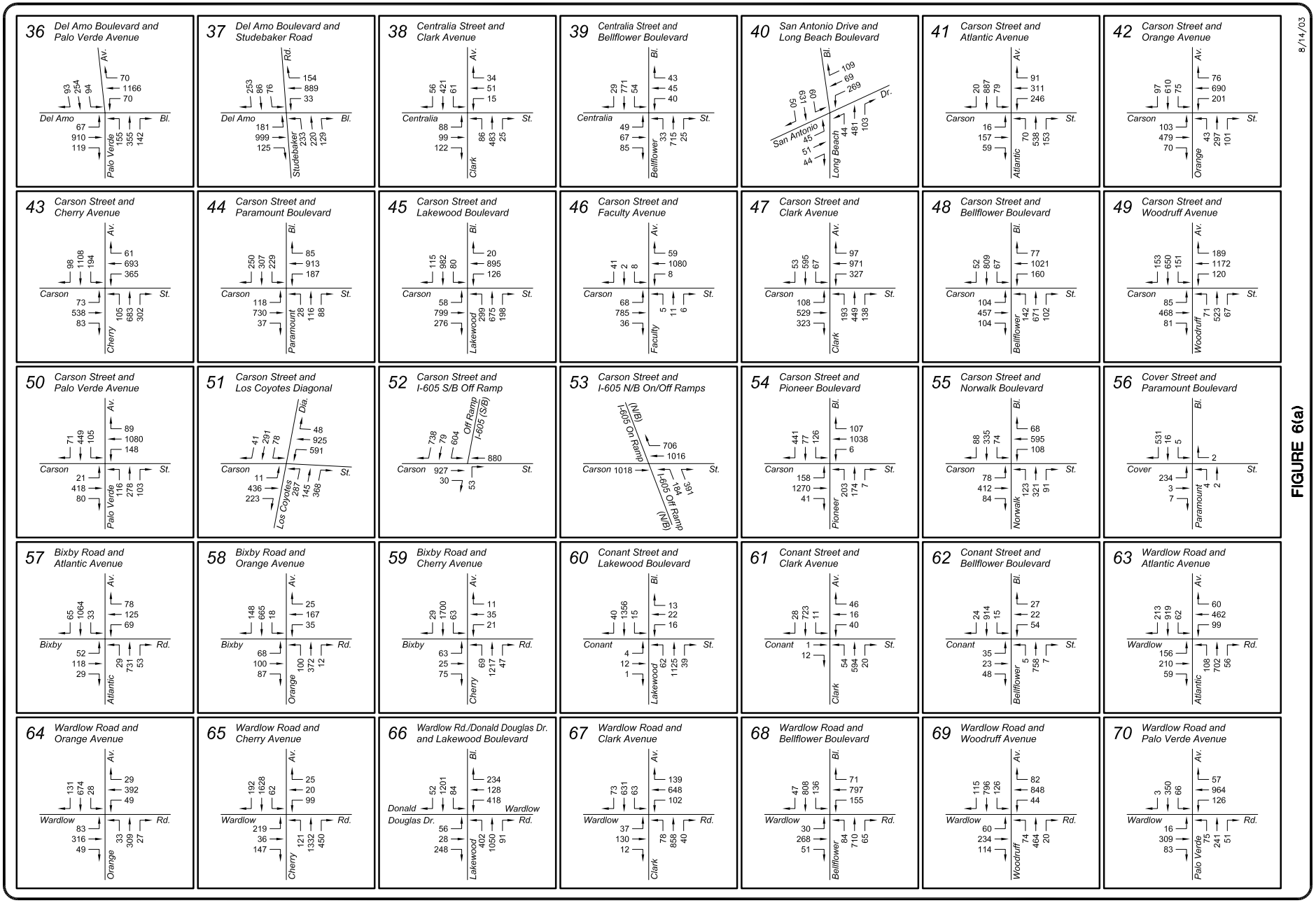
EXISTING (2002) TRAFFIC VOLUMES
AM PEAK HOUR



8/14/03

BOEING–LNGBCH \AM2002–GRID2

FIGURE 6(a)

EXISTING (2002) TRAFFIC VOLUMES
AM PEAK HOUR

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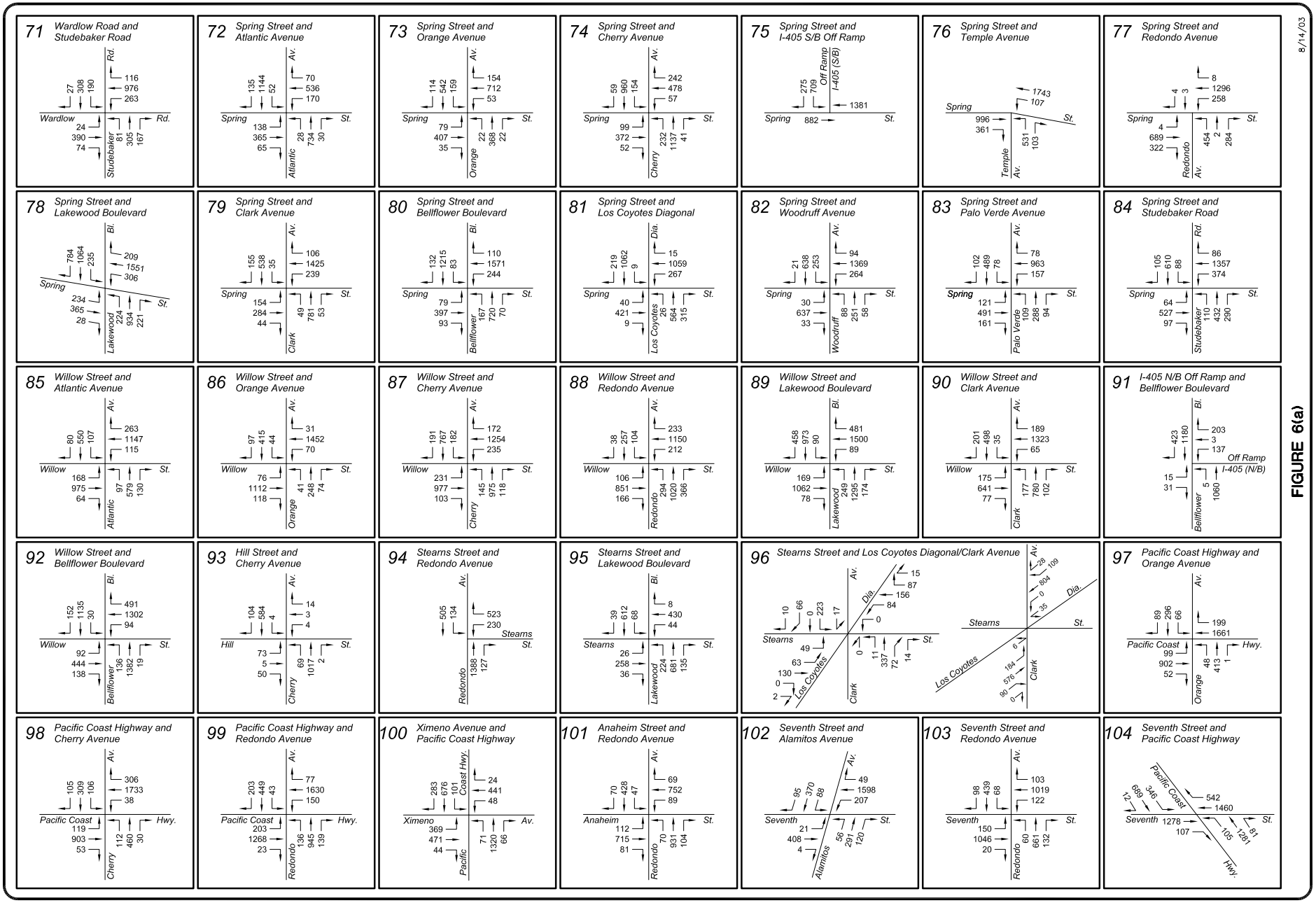

FIGURE 6(a)

8/14/03

BOEING–LNGBCH\AM2002–GRID3

109INTS–STICK–GRID–3

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EXISTING (2002) TRAFFIC VOLUMES
AM PEAK HOUR

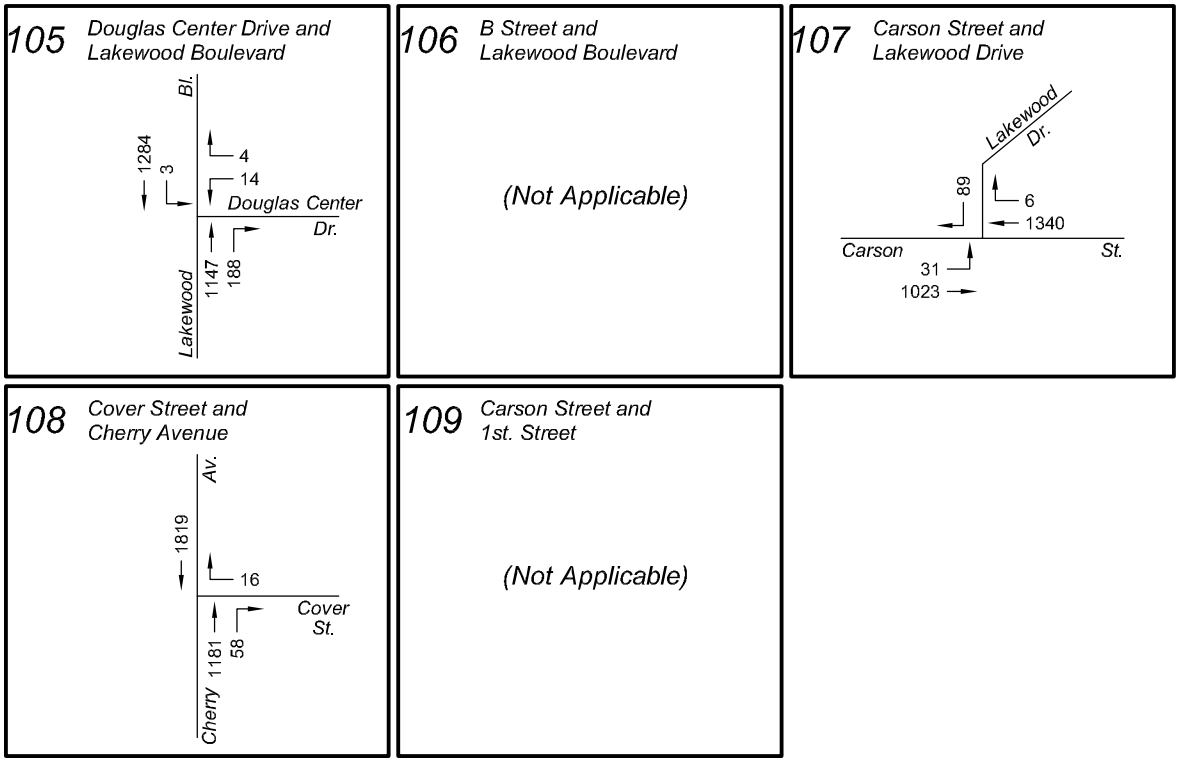

FIGURE 6(a)

8/14/03

FN: BOEING-LNGBCH\AM2002-GRID4

EXISTING (2002) TRAFFIC VOLUMES
AM PEAK HOUR

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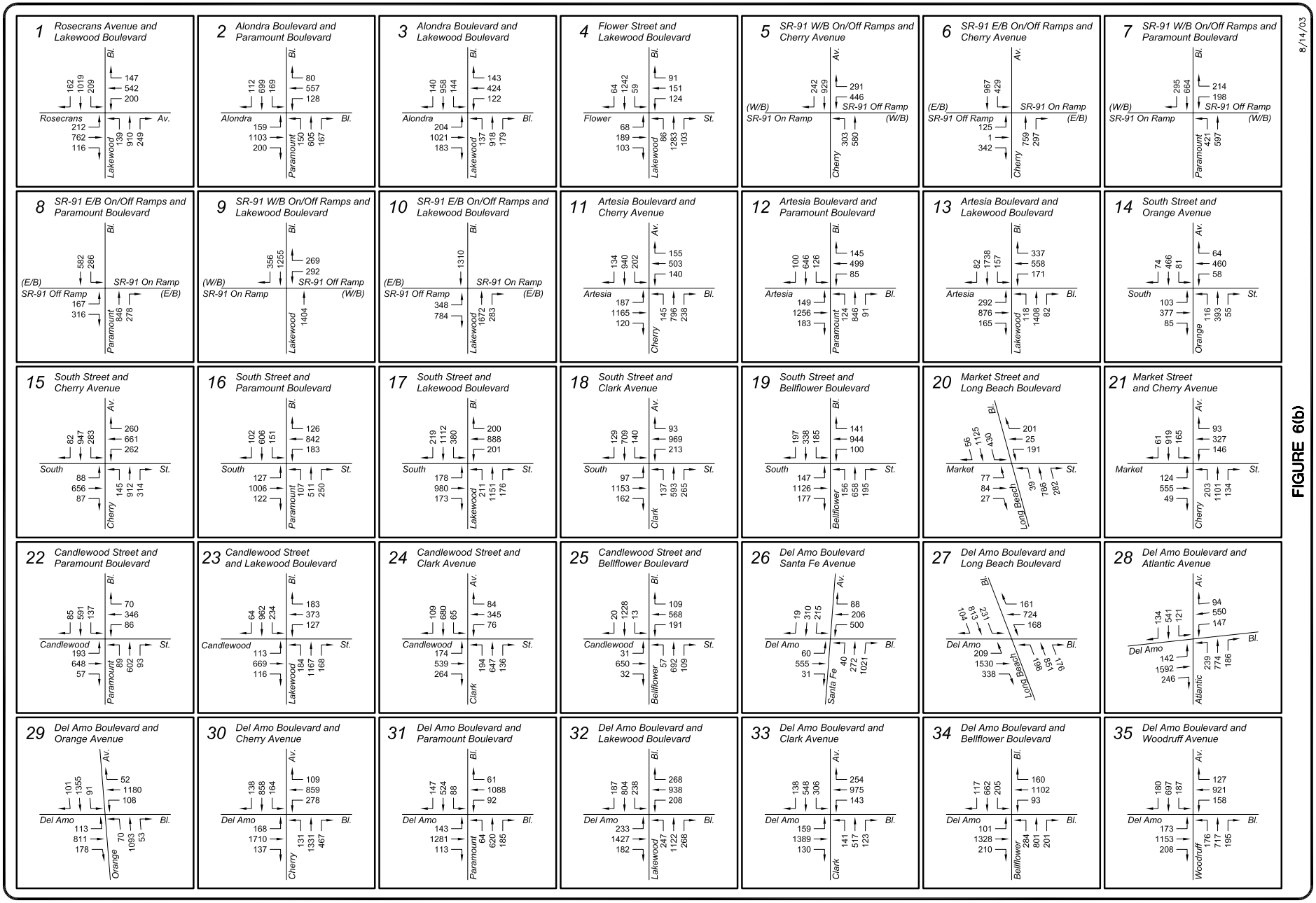

FIGURE 6(b)

8/14/03

BOEING–LNGBCH\PM2002–GRID1

109NTS–STICK–GRID–1

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EXISTING (2002) TRAFFIC VOLUMES
PM PEAK HOUR

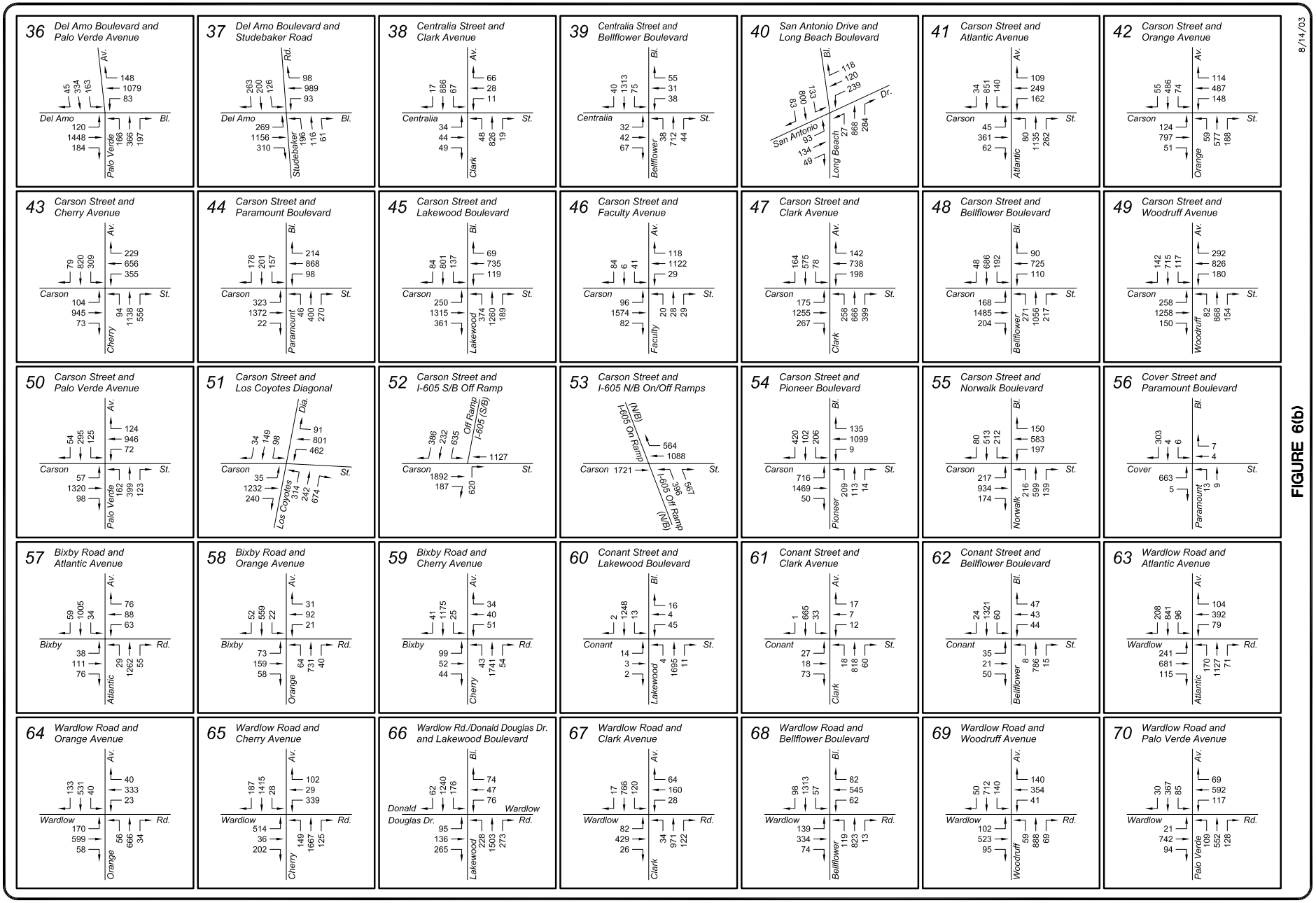

FIGURE 6(b)

EXISTING (2002) TRAFFIC VOLUMES
PM PEAK HOUR

8/14/03

BOEING–LNGBCH\PM2002–GRID2

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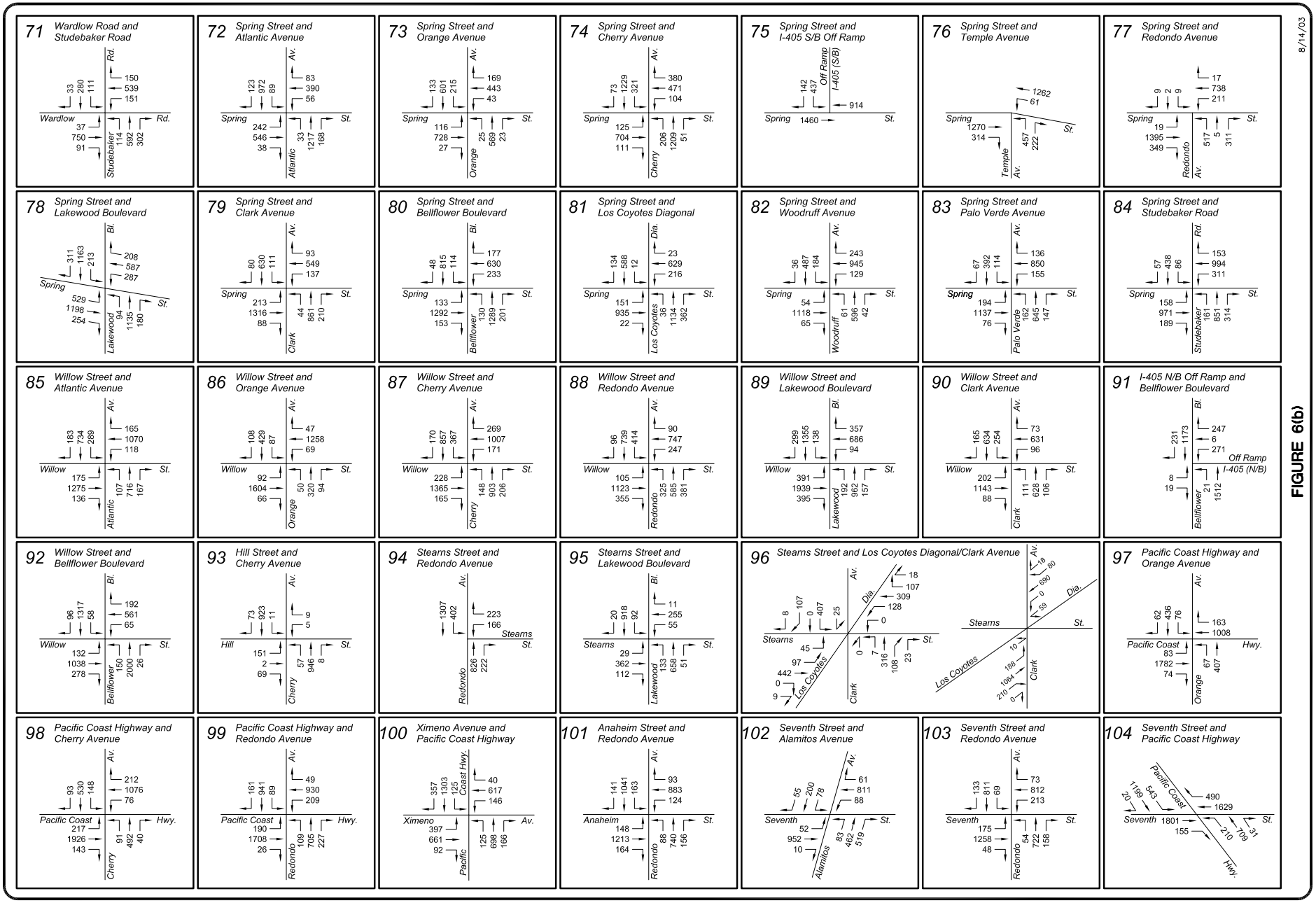

FIGURE 6(b)

8/14/03

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1109NTS–STICK–GRID–3

EXISTING (2002) TRAFFIC VOLUMES
PM PEAK HOUR

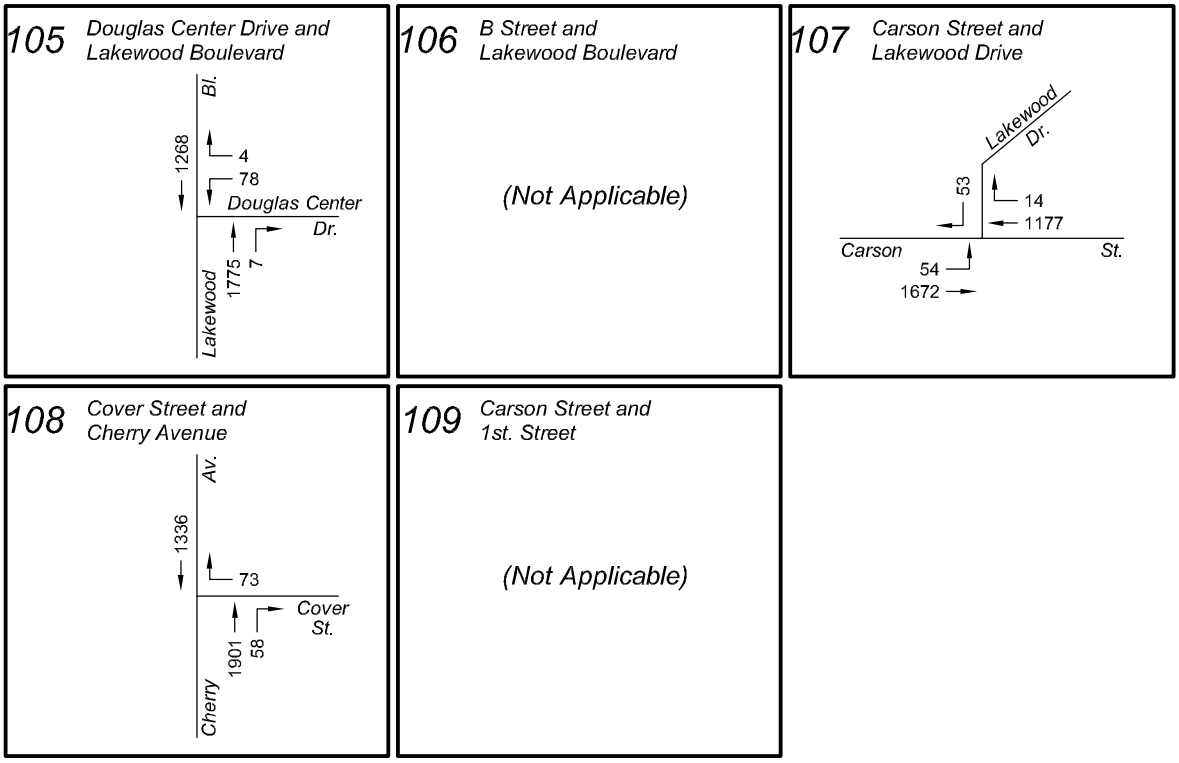

FIGURE 6(b)

8/14/03

FN: BOEING-LNGBCH\PM2002-GRID4

_109INTS-STICK-GRID-4

EXISTING (2002) TRAFFIC VOLUMES
PM PEAK HOUR

C&A
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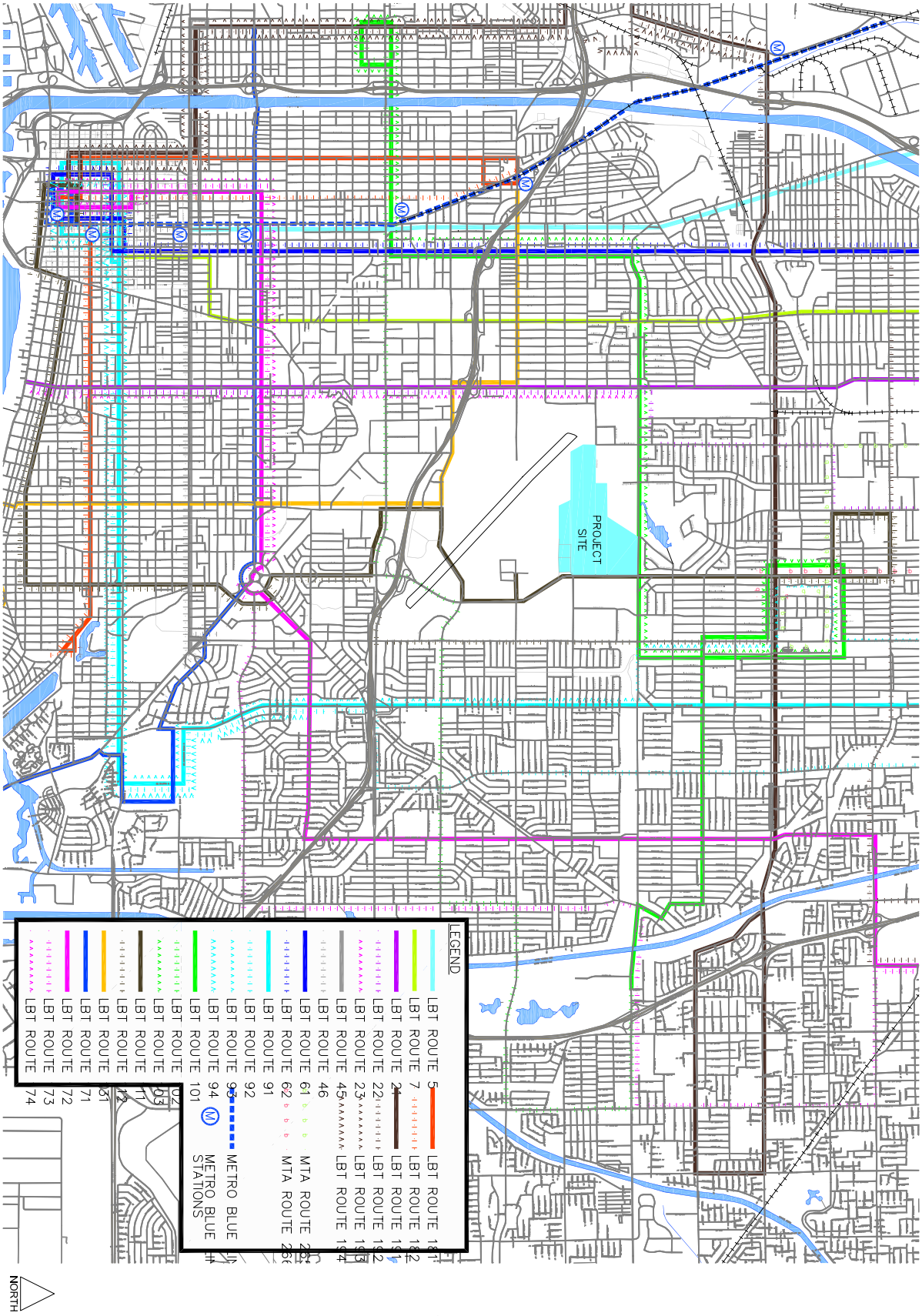

FIGURE 7

8/14/03

:FN BOEING-LNGBCH\REGIONAL-TRANSIT-MAP

REGIONAL TRANSIT SERVICES

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LBT Route 111 – Route 111 follows a north-south orientation, operating between the Lakewood Regional Medical Center to the north and the First Street Transit Mall in downtown Long Beach to the south. Other major destinations along this route include the Lakewood Center Mall, the Long Beach Municipal Airport, Wilson High School, and within a few short blocks of the route the Long Beach Convention & Entertainment Center. In the project site vicinity, Route 111 travels by way of Lakewood Boulevard, which is immediately adjacent to the site, and provides stops at Carson Street and at Conant Street. Weekday service on Route 111 is from approximately 5:30 AM to 1:00 AM. The service operates on 30-minute headways throughout most of the day, increasing to hourly service at night. Route 111 also provides hourly service on weekends and holidays, operating between 6:30 AM and 11:00 PM.

LBT Route 101 – Route 101 generally follows an east-west orientation between the Long Beach Towne Center to the east and the intersection of Santa Fe Avenue and Willow Street to the west. Other destinations along this bus route include Lakewood High School, several Long Beach City elementary and/or middle schools, the Long Beach City College Liberal Arts Campus, the Lakewood Center Mall, Wal-Mart, and the Willow Station for the Metro Blue Line light rail service. Route 101 travels by way of Carson Street, which is also the northern boundary of the project site, with bus stops at Lakewood Boulevard and at Lakewood Drive. Weekday service on Route 101 is generally provided between 6:00 AM and 7:00 PM, with somewhat longer service hours for westbound travel. The frequency of service per direction is 30 minutes throughout the day. Route 101 also operates on Saturdays, between approximately 6:00 AM and 6:30 PM, on 30-minute headways.

LBT Route 103 – Route 103 travels the same alignment as Route 101, but has as its eastern terminus the Lakewood Center Mall. As such, it has the same two bus stops

adjacent to the project site on Carson Street. Route 103 supplements the peak-period service of Route 101, effectively decreasing the headways experienced by most riders from 30 minutes to 15 minutes per travel direction. Route 103 operates weekdays only, between the hours of 6:30 AM to 10:00 AM and 2:00 PM to 5:30 PM.

As stated previously, the above bus routes not only serve the project site, but also provide the opportunity to connect with other routes within the LBT system, as well as the Metro Blue Line and other Metro services. Listed below per CMP guidelines are additional local fixed-route bus services that operate within one mile of the site. These and the above three routes are shown in Figure 8, Project Area Transit Service.

LBT Route 7 – Route 7 travels a north-south alignment between Rosecrans Avenue in the City of Paramount and the First Street Transit Mall in downtown Long Beach. It uses Orange Avenue in the project site vicinity. Route 7 operates daily, with weekday service hours from approximately 5:30 AM to 8:00 PM and 20-minute headways throughout most of the day.

LBT Route 21/22/23 – This route cluster follows a north-south alignment and travels primarily by way of Cherry Avenue. All three routes operate between Carson Street to the north and the First Street Transit Mall. Route 21 extends north beyond Carson Street to Alondra Boulevard just past the Long Beach city limit. Route 22 turns east at Carson Street and zigzags north towards the intersection of Alondra Boulevard and Downey Avenue, serving the west end of the City of Lakewood en route. Routes 21/22/23 operate daily and collectively serve the project site area from approximately 5:00 AM to midnight, although service north of Carson Street via Routes 21 and 22 ends earlier in the evening. On weekdays, headways for the alignment between Carson Boulevard and downtown Long Beach are generally 15 minutes per direction, and 30 minutes for the Route 21 and Route 22 extensions north of Carson Street.

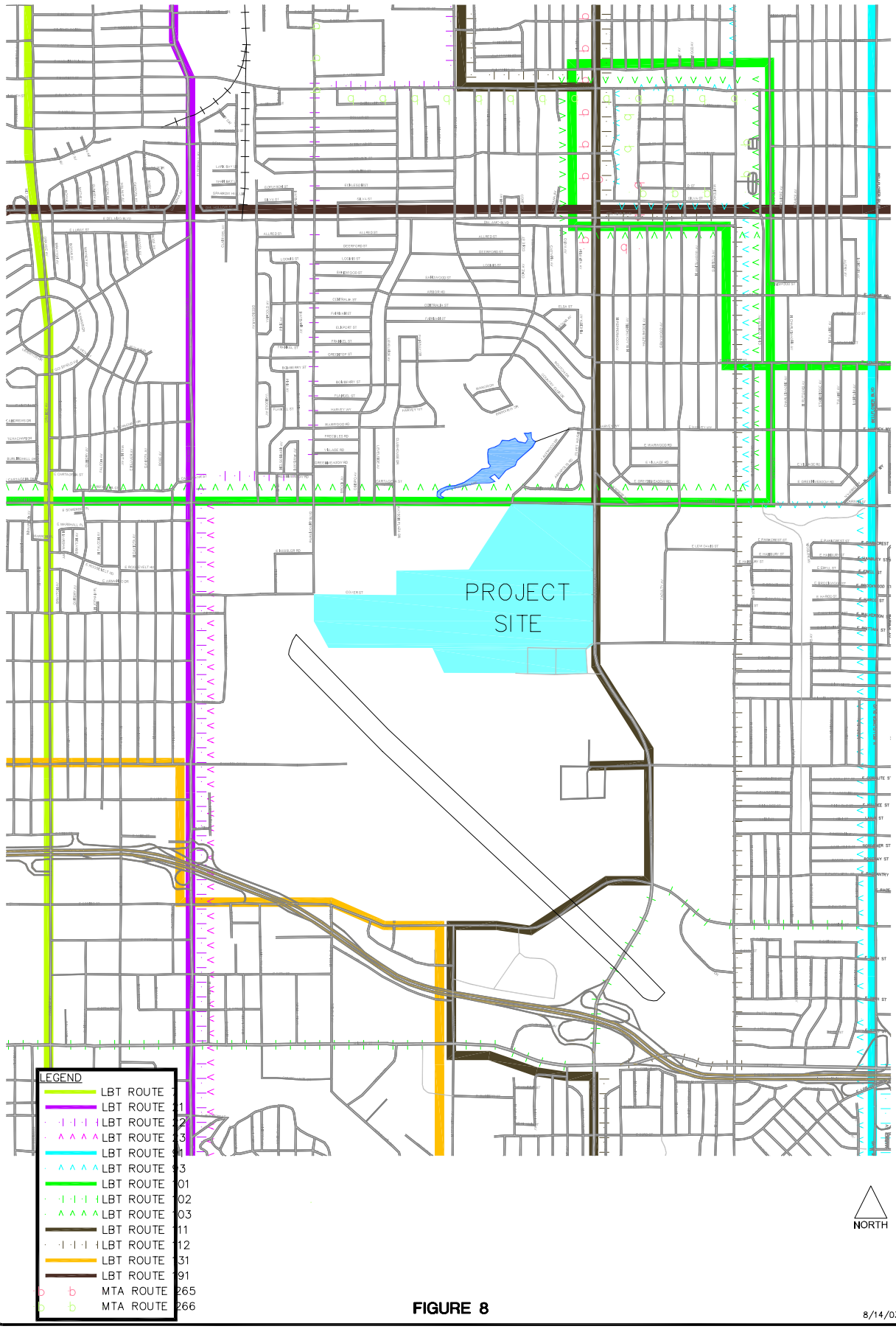

FIGURE 8

8/14/03

:FN BOEING-LNGBCH\REGIONAL-TRANSIT-MAP

PROJECT AREA TRANSIT SERVICES

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LBT Route 91/93 – This route group shares a generally north-south alignment between Alondra Boulevard in the City of Bellflower and the First Street Transit Mall. Both routes travel Bellflower Boulevard near the project site, and both routes share identical alignments between Carson Street and downtown Long Beach. North of Carson Street, however, Route 91 continues on Bellflower Boulevard to Alondra Boulevard, while Route 93 turns west towards Lakewood Boulevard to serve the Lakewood Center Mall and Civic Center. Weekday service in the site vicinity is between approximately 5:30 AM and 10:30 PM on Route 91, and between 7:00 AM and 9:00 PM on Route 93. Both routes generally operate on 60-minute headways and combine to provide 25 to 35-minute headways from Carson Street south. Route 91 also operates on weekends and holidays.

LBT Route 102 – Route 102 travels an east-west alignment between the Long Beach Towne Center to the east and the intersection of Santa Fe Avenue and 25th Street to the west. Route 102 routes along of Spring Street and Willow Street in the project site vicinity, and provides weekday service between the hours of 6:00 AM and 7:30 PM, with 30-minute headways throughout most of the day. Route 103 operates weekdays only.

LBT Route 112 – Route 112 follows the same north-south alignment as Route 111 described previously, except that in the project site vicinity, it travels by way of Clark Avenue instead of Lakewood Boulevard. Like Route 111, Route 112 operates daily.

LBT Route 131 – Route 131 operates between the Wardlow Metro Blue Line Station to the west of the project site, and Belmont Shore and the Long Beach Marina to the south, and also extends east into the City of Seal Beach. Closer to the site, Route 131 travels by way of Wardlow Road, Cherry Avenue and Spring Street. Route 131 operates daily, generally providing service from 6:00 AM to 7:30 PM on 30-minute headways per direction.

LBT Route 191 – Route 191 is a circuitous route that operates between Artesia High School to the east, and downtown Long Beach and the First Street Transit Mall to the south. Route 191 travels via Del Amo Boulevard in the project site area, providing service daily from approximately 6:00 AM to 7:30 PM. Weekday headways are generally 30 minutes per direction.

METRO Route 265 – This bus route is operated by the Los Angeles County Metropolitan Transportation Authority (MTA). It provides weekday-only service between 5:30 AM and 7:30 PM on generally 60-minute headways. It operates between the Lakewood Center Mall and the Pico Rivera Plaza further to the north, serving the Metro Green Line's Lakewood/I-105 Station en route.

METRO Route 266 – This bus route, also operated by the MTA, has as its southernmost terminus the Lakewood Center Mall, and serves the Metro Green Line's Lakewood/I-105 Station. From the Mall, Route 266 travels to Pasadena via Lakewood Boulevard and Rosemead Boulevard. This route operates daily and generally serves the Mall between 5:30 AM and 10:30 PM, although the service hours are somewhat shorter on Sundays and holidays. Weekday headways are generally 25 to 40 minutes per direction.

The CMP guidelines also call for a summary of express bus and rail services operating within a two-mile radius of the project, of which there are none. However, the Metro Blue Line is expected to be an important facility for the project and is thus described in greater detail below.

Metro Blue Line LRT– The Blue Line Light Rail Transit (LRT) provides service between the First Street Transit Mall in Long Beach and downtown Los Angeles, and in turn provides transfer opportunities to the Metro Green Line, the Metro Red Line and much of the regional public transit system. In addition, the Blue Line LRT now connects

easterly into Pasadena via the Gold Line LRT. As noted earlier, connection service between the Metro Blue Line's Willow Station and the project site is available via LBT Routes 101 and 103. Even closer to the site is the Blue Line's Wardlow Station at 3420 N. Pacific Avenue, approximately three miles to the west. However, direct connection service between the Wardlow Station and the site does not currently exist.

The Blue Line LRT operates between 4:30 AM and 1:00 AM every day of the week. Weekday headways range from five to 12 minutes throughout most of the day, increasing to 20 minutes late at night. Headways on weekends and holidays generally range from 12 to 15 minutes, also increasing to 20 minutes at night.

It can be concluded from the above that there are numerous access opportunities to and from the project site via public transit. Three LBT routes provide direct site access, and when transfer opportunities to other services are considered, such as to the Metro Blue Line and the other bus routes described, many areas within the Los Angeles region are linked via public transit for project users. Thus, there are opportunities for the project to reduce its vehicle trips through the use of existing and enhanced public transit services.

EXISTING BICYCLE FACILITIES

The City of Long Beach has a system of Class I, II and III bikeways that collectively cover approximately 63 miles. The three general classes of bikeways are defined as follows: Class I facilities separate bicyclists from motor vehicles through dedicated paths that are separated from streets and highways; Class II facilities provide restricted bicycle right-of-ways on streets and highways, and are most often designated by a painted line and road signs (i.e., bicycle lanes); and Class III bikeways share travel lanes with motor vehicles and are identified through signs only (i.e., bicycle routes).

The City's bikeway system is not yet continuous or complete, but there are segments within the vicinity of the project site that could be useful to commuters trying to reach the project, or to project residents and visitors who are traveling locally and/or interested in recreational bicycling. The most notable existing bikeway relative to the site is the Hartwell Park Bike Path because of its Class I classification and adjacency to the site. This facility is described below, as are the other existing bikeways that are proximate to the site (i.e., within 1.5 miles). These facilities, and those mentioned in association with them, are identified by the City as in "good" condition on a four-point scale of poor to excellent.

Hartwell Park Bike Path – The Hartwell Park Bike Path is a Class I bicycle facility that follows an east-west alignment off of Carson Street. The west end of the path is immediately adjacent to the project site's northern boundary. The path extends from the Lakewood Country Club golf course and the immediate site vicinity, approximately 3.5 miles east to the Long Beach Towne Center and the adjacent San Gabriel River bicycle trail. This facility also connects with several Class II bikeways, including the Bellflower Boulevard Bike Lane, the Woodruff Avenue Bike Lane and the Studebaker Road Bike Lane. All three connecting bike lanes extend south from Carson Street towards California State University Long Beach. The Woodruff Avenue Bike Lane also extends north of Carson Street and connects to the Del Amo Bike Lane and other City of Lakewood bikeway facilities. All of these bike lanes, in conjunction with the Hartwell Park Bike Path, the San Gabriel River Bike Path Trail and a few other facilities, collectively serve areas east, southeast and northeast of the project site.

Bellflower Boulevard Bike Lane – This Class II facility is approximately one mile east of the project site. It has a north-south alignment from Carson Street to within a few blocks of California State University Long Beach. It is linked to the site via the Hartwell

Park Bike Path and a Class III facility on Conant Street that extends as far west as Clark Avenue, which is within one-half mile of the site.

Orange Avenue Bike Lane – The Orange Avenue Bike Lane is a Class II, north-south aligned facility, that is approximately 1.5 miles west of the project site. This bicycle lane extends from Bixby Road north to the Long Beach city limit. It is one of only two City of Long Beach bikeways that exist west and north of the site.

In summary, the City's existing system of bikeways provide reasonable access to the project site from the east, southeast and northeast, and also provide residents and visitors with opportunities for recreational bicycling. Bicycle access to the site from the west and north is also available, although limited in the current bikeway system. According to the Long Beach Bicycle Master Plan, bicycle parking is also available at various locations throughout the City, such as at the Long Beach Towne Center, all schools and parks, and most public buildings.

ANALYSIS OF EXISTING (2002) INTERSECTION CONDITIONS

The analysis of existing conditions at the study intersections was performed using established traffic engineering procedures and in accordance with the assumptions, methodology and procedures discussed with the lead agency, the City of Long Beach. Field checks of existing traffic lane configurations and geometry, traffic controls and parking conditions were also conducted to assist with the analysis.

Except as noted later, the methodology used for this analysis is based on procedures outlined in the Transportation Research Board Circular 212, Interim Materials on Highway Capacity.[1] In the discussion of the Critical Movement Analysis (CMA) for

[1] Interim Materials on Highway Capacity, Circular Number 212, Transportation Research Board, Washington, D.C., 1980.

signalized intersections, procedures were developed for determining operating characteristics of an intersection in terms of the "Level Of Service" (LOS) provided for different levels of traffic volume and other variables, such as the number of traffic signal phases. Level of service describes the quality of traffic flow. Levels of Service A to C denote conditions in which traffic operations are proceeding quite well, with no interruptions in traffic flow due to traffic volumes. Level D, a more constrained condition, is the level for which a metropolitan area street system is typically designed. Level E represents volumes at or near roadway capacity which will result in possible stoppages of momentary duration and occasional unstable flow. Level F is a forced-flow condition occurring when a facility is overloaded and vehicles experience stop-and-go traffic with delays of long duration.

A determination of the LOS at an intersection where traffic volumes are known or have been projected can be obtained through a summation of the critical movement volumes at that intersection. Once the sum of critical movement volumes has been obtained, the values indicated in Table 4 can be used to determine the applicable LOS.

Table 4
Critical Movement Volume Ranges*
For Determining Levels of Service

Level of Service	Maximum Sum of Critical Volumes (VPH) Two Phase	Three Phase	Four or More Phases
A	900	855	825
B	1,050	1,000	965
C	1,200	1,140	1,100
D	1,350	1,275	1,225
E	1,500	1,425	1,375
F	----------Not Applicable----------		

* For planning applications only, i.e., not appropriate for operations and design applications. Also, a computerized traffic signal coordination system, such as the combination of an Automated Traffic Surveillance and Control (ATSAC) System and an Adaptive Traffic Control System (ATCS), has been found to further increase these values by 10 percent or more, based on studies by and the experience of the Los Angeles Department of Transportation.

Capacity is defined to represent the maximum total hourly movement volume that has a reasonable expectation of passing through an intersection under prevailing roadway and traffic conditions. For planning purposes, capacity equates to the maximum value of Level of Service E, as indicated in Table 4. The CMA indices used in this study were calculated by dividing the sum of critical movement volumes by the appropriate capacity value, as adjusted above, for the type of signal control present or proposed at the study intersections. The level of service corresponding to a range of CMA values is shown in Table 5.

Table 5
Level of Service
As a Function of CMA Values

Level of Service	Description of Operating Characteristics	Range of CMA Values
A	Uncongested operations; all vehicles clear in a single cycle.	0.00 - 0.60
B	Same as above.	0.61 - 0.70
C	Light congestion; occasional backups on critical approaches.	0.71 - 0.80
D	Congestion on critical approaches, but intersection functional. Vehicles required to wait through more than one cycle during short peaks. No long-standing lines formed.	0.81 - 0.90
E	Severe congestion with some long-standing lines on critical approaches. Blockage of intersection may occur if traffic signal does not provide for protected turning movements.	0.91 - 1.00
F	Forced flow with stoppages of long duration.	1.01+

It should be noted that while the City of Long Beach traffic study guidelines for analyzing signalized intersections are based on Circular 212, those guidelines recommend an initial basic capacity of 1,600 vehicles per lane per hour, which is more than that inherent in the standard CMA methodology. However, the City guidelines further recommend various reduction adjustments to the basic capacity to account for signal clearance intervals and lost time. For consistency with the City guidelines, therefore, the CMA capacity values corresponding to LOS E in Table 4 were adjusted downward for this analysis as follows:

Adjusted CMA Capacity Values

Signal With Two Phases	Signal With Three Phases	Signal With Four or More Phases
1,440	1,360	1,312

To facilitate the determination of project impacts, a two-phase traffic signal was assumed in lieu of the Stop sign control at the existing intersections of Carson Street/Lakewood Drive, Carson Street/Faculty Avenue and Cover Street/Cherry Avenue. A two-phase signal was also assumed for analysis purposes at the future intersections of A Street/Lakewood Boulevard and Carson Street/First Street.

The analysis results for existing conditions at the study intersections are presented in Table 12, page 102. Sixty-eight (68) of the 107 existing study intersections are operating within capacity, with no level of service worse than “D”. Thirty-nine (39) study intersections are currently operating at LOS E or F in one or both peak hours, indicating substantial delay to vehicles traversing those intersections. Two study intersections, A Street/Lakewood Boulevard and Carson Street/First Street are future intersections and do not exist. The CMA worksheets for existing conditions are in Appendix E.

ANALYSIS OF EXISTING (2002) FREEWAY CONDITIONS

The focus of the freeway analysis was the San Diego Freeway and the Artesia Freeway. Based on preliminary analyses, these two regional facilities are expected to be the most affected by project traffic. Both are also the two facilities requested for analysis by Caltrans in its response to the Notice of Preparation for the Draft EIR. As with the study intersections, the mainline and ramp volumes for these two freeways were analyzed for existing conditions, as shown in Tables 6(a), 6(b) and 7.

Consistent with CMP guidelines, the freeway mainline analysis was performed as a traffic demand-to-capacity (D/C) ratio calculation for each freeway segment per direction. Mainline capacities were estimated to be 2,000 vehicles per hour per lane (vphpl) for the main travel lanes and 1,600 vphpl for high-occupancy vehicle (HOV) lanes. The D/C ratios for the freeway mainlines were obtained by dividing the AM and PM peak-hour directional volumes by the directional capacities for those segments.

Table 6(a)
San Diego Freeway (I-405)
Demand/Capacity (D/C) and Level of Service (LOS) Summary
Existing (2002) Traffic Conditions

	Freeway Segment	Peak Hour	Direction	Existing (2002) Freeway Capacity	Daily Volume	Peak Hour Volume	D/C	LOS
1	San Diego Freeway (I-405)	AM	N/B	9,600	244,000	9,850	1.026	F
	s/o Route 110 at Carson Scales		S/B	9,600		7,240	0.754	C
	(CMP Station)	PM	N/B	9,600		8,140	0.848	D
			S/B	9,600		9,660	1.006	F
2	San Diego Freeway (I-405)	AM	N/B	7,600	283,000	9,780	1.287	F
	at Santa Fe Ave		S/B	7,600		8,560	1.126	F
	(CMP Station)	PM	N/B	7,600		9,270	1.220	F
			S/B	7,600		9,830	1.293	F
3	San Diego Freeway (I-405)	AM	N/B	9,600	276,000	11,440	1.192	F
	betw. I-710 and Atlantic Ave		S/B	9,600		9,010	0.939	E
		PM	N/B	9,600		10,470	1.091	F
			S/B	9,600		10,830	1.128	F
4	San Diego Freeway (I-405)	AM	N/B	9,600	281,000	9,310	0.970	E
	betw. Atlantic Ave and Cherry Ave		S/B	9,600		9,600	1.000	E
		PM	N/B	9,600		9,210	0.959	E
			S/B	9,600		10,490	1.093	F
5	San Diego Freeway (I-405)	AM	N/B	9,600	271,000	9,750	1.016	F
	betw. Cherry Ave and Lakewood Blvd		S/B	9,600		9,060	0.944	E
		PM	N/B	9,600		8,730	0.909	D
			S/B	9,600		10,870	1.132	F
6	San Diego Freeway (I-405)	AM	N/B	9,600	269,000	8,860	0.923	D
	betw. Lakewood Blvd and Bellflower Blvd		S/B	9,600		7,560	0.788	D
		PM	N/B	9,600		7,810	0.814	D
			S/B	9,600		9,290	0.968	E
7	San Diego Freeway (I-405)	AM	N/B	9,600	256,000	9,500	0.990	E
	betw. Bellflower Blvd and Woodruff Ave		S/B	9,600		7,390	0.770	C
		PM	N/B	9,600		8,900	0.927	D
			S/B	9,600		8,700	0.906	D
8	San Diego Freeway (I-405)	AM	N/B	9,600	254,000	9,020	0.940	E
	betw. Woodruff Ave and Studebaker Rd		S/B	9,600		7,390	0.770	C
		PM	N/B	9,600		7,480	0.779	D
			S/B	9,600		9,620	1.002	F
9	San Diego Freeway (I-405)	AM	N/B	7,600	256,000	9,560	1.258	F
	n/o Route 22		S/B	9,600		7,630	0.795	D
	(CMP Station)	PM	N/B	7,600		7,910	1.041	F
			S/B	9,600		9,990	1.041	F

Table 6(b)
Artesia Freeway (SR-91)
Demand/Capacity (D/C) and Level of Service (LOS) Summary
Existing (2002) Traffic Conditions

				Existing (2002)				
	Freeway Segment	Peak Hour	Direction	Freeway Capacity	Daily Volume	Peak Hour Volume	D/C	LOS
1	Artesia Freeway (SR-91)	AM	E/B	11,600	208,000	11,510	0.992	E
	e/o Alameda St / Santa Fe Ave		W/B	11,600		5,990	0.516	B
	(CMP Station)	PM	E/B	11,600		7,790	0.672	C
			W/B	11,600		9,710	0.837	D
2	Artesia Freeway (SR-91)	AM	E/B	9,600	255,000	11,120	1.158	F
	betw. I-710 and Cherry Ave		W/B	9,600		10,780	1.123	F
		PM	E/B	9,600		9,710	1.011	F
			W/B	9,600		12,190	1.270	F
3	Artesia Freeway (SR-91)	AM	E/B	9,600	259,000	10,510	1.095	F
	betw. Cherry Ave and Paramount Blvd		W/B	9,600		10,190	1.061	F
	(CMP Station)	PM	E/B	9,600		9,180	0.956	E
			W/B	9,600		11,520	1.200	F
4	Artesia Freeway (SR-91)	AM	E/B	9,600	248,000	11,160	1.163	F
	betw. Paramount Blvd and Lakewood Blvd		W/B	9,600		8,640	0.900	D
		PM	E/B	9,600		9,140	0.952	E
			W/B	9,600		10,660	1.110	F
5	Artesia Freeway (SR-91)	AM	E/B	9,600	250,000	9,590	0.999	E
	betw. Lakewood Blvd and Bellflower Blvd		W/B	9,600		9,910	1.032	F
		PM	E/B	9,600		8,670	0.903	D
			W/B	9,600		10,830	1.128	F
6	Artesia Freeway (SR-91)	AM	E/B	7,600	265,000	8,960	1.179	F
	betw. Norwalk Blvd and Pioneer Blvd		W/B	7,600		10,140	1.334	F
	(CMP Station)	PM	E/B	7,600		8,730	1.149	F
			W/B	7,600		10,370	1.364	F

Table 7
Freeway On-Ramp Demand/Capacity (D/C) and Level of Service (LOS) Summary
Existing (2002) Traffic Conditions

					AM PEAK HOUR						PM PEAK HOUR					
			Capacity		Volume		Demand/Capacity		LOS		Volume		Demand/Capacity		LOS	
No.	Route	On-Ramp	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane
1	405	SB from NB Bellflower Bl.	900		327		0.363		A		296		0.329		A	
2	405	SB from SB Bellflower Bl.	900		211		0.234		A		271		0.301		A	
3	405	NB from SB Bellflower Bl.	900		482		0.536		A		253		0.281		A	
4	405	NB from NB Bellflower Bl.	1,600		567		0.354		A		489		0.306		A	
5	405	SB from EB Willow St.	900	1,600	360	74	0.400	0.046	A	A	428	88	0.476	0.055	A	A
6	405	SB from SB Lakewood Bl.	900	1,600	203	41	0.226	0.026	A	A	385	79	0.428	0.049	A	A
7	405	NB from NB Lakewood Bl.	900	1,600	795	163	0.883	0.102	D	A	474	97	0.527	0.061	A	A
8	405	NB from SB Lakewood Bl.	900	1,600	282	58	0.313	0.036	A	A	391	80	0.434	0.050	A	A
9	405	SB from Spring St.	900	1,600	265	54	0.294	0.034	A	A	372	76	0.413	0.048	A	A
10	405	SB from SB Cherry Av.	900		474		0.527		A		569		0.632		B	
11	405	NB from WB Spring St.	900	1,600	631	129	0.701	0.081	C	A	713	146	0.792	0.091	C	A
12	405	SB from Orange Av.	900	1,600	274	56	0.304	0.035	A	A	257	53	0.286	0.033	A	A
13	405	NB from NB Cherry Av.	900		454		0.504		A		548		0.609		B	
14	405	NB from SB Cherry Av.	900	1,600	273	56	0.303	0.035	A	A	294	60	0.327	0.038	A	A
15	405	NB from EB 32nd St.	900		388		0.431		A		330		0.367		A	
16	405	SB from NB Atlantic Av.	900		254		0.282		A		399		0.443		A	
17	405	SB from SB Atlantic Av.	900		246		0.273		A		284		0.316		A	
18	405	NB from NB Atlantic Av.	900		186		0.207		A		227		0.252		A	
19	91	EB from Atlantic Av.	1,600		512		0.320		A		556		0.348		A	
20	91	WB from Cherry Av.	900	1,600	434	89	0.482	0.056	A	A	442	91	0.491	0.057	A	A
21	91	EB from Cherry Av.	1,600		797		0.498		A		705		0.441		A	
22	91	WB from Paramount Bl.	1,600		532		0.333		A		643		0.402		A	
23	91	EB from Paramount Bl.	1,600		352		0.220		A		401		0.251		A	
24	91	WB from Downey Av.	900	1,600	741	152	0.823	0.095	D	A	496	101	0.551	0.063	A	A
25	91	EB from Downey Av.	1,600		498		0.311		A		400		0.250		A	
26	91	WB from SB Lakewood Bl.	1,600		795		0.497		A		807		0.504		A	
27	91	WB from NB Lakewood Bl.	900	1,600	629	129	0.699	0.081	B	A	537	110	0.597	0.069	A	A
28	91	EB from SB Lakewood Bl.	900	1,600	168	34	0.187	0.021	A	A	166	34	0.184	0.021	A	A
29	91	EB from NB Lakewood Bl.	900	1,600	247	51	0.274	0.032	A	A	255	52	0.283	0.033	A	A
30	91	EB from Clark Av.	900	1,600	455	93	0.506	0.058	A	A	344	70	0.382	0.044	A	A
31	91	WB from Bellflower Bl.	1,600		636		0.398		A		638		0.399		A	
32	91	EB from Bellflower Bl.	900	1,600	116	24	0.129	0.015	A	A	143	29	0.159	0.018	A	A

According to the CMP, freeway mainline levels of service have the correlations shown below. These same correlations were also used for the analysis of freeway ramps.

Congestion Management Program
D/C Ratios and Levels of Service

D/C Ratio	Level of Service
0.01-0.35	A
0.36-0.54	B
0.55-0.77	C
0.78-0.93	D
0.94-1.00	E
1.00	F

The analysis results in Table 6(a) indicate that all nine San Diego Freeway mainline segments from south of the 110 Freeway to north of the 22 Freeway are now operating at LOS E or F in one or both peak hours. Table 6(b) shows that for the Artesia Freeway, all six mainline segments are at LOS E or F in one or both peak hours.

Freeway ramp operation is influenced by several factors, including entry and exit geometrics, signal and/or ramp metering timing, and the number of lanes on the ramp. All of the on-ramp lanes of the San Diego and Artesia Freeways are controlled by ramp-metering signals, except for the HOV lanes. For this analysis, a single ramp-metered lane was assumed to have a capacity of 900 vehicles per hour, based on one vehicle per green indication every four seconds; for two ramp-metered lanes, a capacity of 1,600 vehicles per hour was assumed, taking into account merging conditions approaching the freeway mainline. A non-metered on-ramp lane, including an HOV lane, was assumed to have a capacity of 1,600 vehicles per hour, which is consistent with the CMP lane capacity for a surface street. For an on-ramp with an HOV lane, it was assumed that approximately 17 percent of the on-ramp volume utilizes the HOV

lane, based on similar analyses in other studies accepted by Caltrans. As can be seen from Table 7, all of the analyzed on-ramps serving the San Diego and Artesia Freeways are operating at LOS D or better under existing conditions.

As with other freeways, the off-ramps of the San Diego and Artesia Freeways are controlled by signals, stop signs or other at-grade factors, such as the nearest surface street intersection. These at-grade intersections exhibit capacity constraints which control the operation of the off-ramps. Thus, the operational service of the off-ramps expected to be the most affected by project traffic is inherently reflected in the analysis of the study intersections in the vicinity. These already analyzed intersections include off-ramps which are signalized at their intersections with surface streets, as well as signalized surface street intersections proximate to non-signalized off-ramp intersections. For these reasons, the focus of the freeway ramp analysis was the on-ramps and the off-ramps were not further analyzed.

PROJECT TRAFFIC

The following section describes the vehicular trip-generating characteristics of the PacifiCenter project, along with the methodology used to estimate trip generation. Trip (traffic) distribution and assignment for the proposed project are addressed in subsequent sections. The referenced transportation model used in the analyses is discussed in more detail in the Future Traffic Conditions section.

PROJECT TRIP GENERATION

The trip-generating characteristics of various land uses, including those which comprise the project, have been documented in the nationally recognized reference manual, Trip Generation, 6th Edition, published by the Institute of Transportation Engineers (ITE) in 1997. It was determined that the ITE "Office Park" land use has higher trip generation characteristics per 1,000 square feet than land uses such as general office, research and development, industrial, manufacturing and warehousing. Therefore, in order to provide a more conservative analysis, as well as ensure that the aforementioned land uses are adequately analyzed should any or all of them be developed within the project, the ITE Office Park land use and its trip generation equations were assumed for the Commercial component of the project, excluding the Retail and Hotel components. For the Retail and Hotel components, the ITE "Shopping Center" and "Hotel" land use categories were respectively applied. The trip generations for the Residential components were based on the ITE "Single-Family Detached Housing," "Apartment" and "Condominium/Townhouse" land use categories. The ITE trip generation equations and rates for the project uses are shown in Table 8.

As the project is a large multi-use development, internal trip-making would be expected to occur within the site boundaries. Internal trips occur when persons going to one use at a site, such as an office use, may also visit or patronize other uses and businesses within the same site, such as a retail or hotel use, on a single trip to the site. This

Table 8
Project Trip Generation Equations and Rates

Office Park (per 1,000 sf)

Daily:	T = 10.422 (A) + 409.040
AM Peak Hour:	Ln(T) = 0.836 Ln(A) + 1.540; I/B = 89%, O/B = 11%
PM Peak Hour:	T = 1.213 (A) + 106.215; I/B = 14%, O/B = 86%

Single-Family Detached Housing (per dwelling unit)

Daily:	Ln(T) = 0.920 Ln(D) + 2.707
AM Peak Hour:	T = 0.700 (D) + 9.477; I/B = 25%, O/B = 75%
PM Peak Hour:	Ln(T) = 0.901 Ln(D) + 0.527; I/B = 64%, O/B = 36%

Apartment (per dwelling unit)

Daily:	T = 5.994 (D) + 134.114
AM Peak Hour:	T = 0.497 (D) + 3.238; I/B = 16%, O/B = 84%
PM Peak Hour:	T = 0.541 (D) + 18.743; I/B = 67%, O/B = 33%

Condominium/Townhouse (per dwelling unit)

Daily:	Ln(T) = 0.850 Ln(D) + 2.564
AM Peak Hour:	Ln(T) = 0.790 Ln(D) + 0.298; I/B = 17%, O/B = 83%
PM Peak Hour:	Ln(T) = 0.827 Ln(D) + 0.309; I/B = 67%, O/B = 33%

Shopping Center (per 1,000 sf)

Daily:	Ln(T) = 0.643 Ln(A) + 5.866
AM Peak Hour:	Ln(T) = 0.596 Ln(A) + 2.329; I/B = 61%, O/B = 39%
PM Peak Hour:	Ln(T) = 0.660 Ln(A) + 3.403; I/B = 48%, O/B = 52%

Hotel (per room)

Daily:	T = 8.23 (R)
AM Peak Hour:	T = 0.56 (R); I/B = 61%, O/B = 39%
PM Peak Hour:	T = 0.61 (R); I/B = 53%, O/B = 47 %

General Aviation Airport (per employee)

Daily:	T = 14.24 (E)
AM Peak Hour:	T = 1.29 (E); I/B = 50%, O/B = 50%
PM Peak Hour:	T = 1.46 (E); I/B = 55%, O/B = 45%

Where:

Ln	= Logarithmic function	A	= building area in 1,000's of square feet
T	= trip ends	R	= room
I/B	= inbound	D	= dwelling unit
O/B	= outbound		

results in multiple trip purposes being accomplished while only one inbound and one outbound vehicle trip is generated by the site. This phenomenon is widely recognized in the traffic engineering profession. For this analysis, therefore, a five percent internal trip adjustment factor was assumed to account for some Commercial (Office Park) trips being made by project residents walking or bicycling to and from the Commercial development.

As discussed earlier, the project site currently has nearly five million square feet of permitted density for office, manufacturing and R&D uses. The traffic generated by the nearly five million square feet of permitted uses could be assumed in the traffic analysis to determine the incremental impacts due to the project. However, for purposes of a more conservative analysis, only the traffic attributable to the occupied site uses (536,862 square feet) as of November 2002 was incorporated in the analysis. Based on traffic counts conducted at the site driveways in November 2002, it is estimated that the occupied uses generate approximately 1,250 trips per day, including 205 AM and 159 PM peak-hour trips.

The trip generation equations and rates in Table 8 were applied to the project development scenario previously described in Table 2. As shown in Table 9, adjusting for internal trips and existing driveway volumes, it is estimated that this project development would generate approximately 57,280 daily trips, including 5,171 AM and 6,093 PM peak-hour trips. These trips were analyzed for project traffic impacts, prior to mitigation.

As part of its traffic mitigation package, the project will implement a comprehensive Transportation Demand Management (TDM) program that will exceed the requirements of the City ordinance. The TDM program will generally target commute trips, i.e., the trips associated with the Commercial land use of the project. A 20 percent reduction

Table 9
Project Trip Generation

Land Use	Size		Daily	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Office Park	3,150,000	sf	33,240	3,490	431	3,921	550	3,377	3,927
Single-Family Residential	255	du	2,450	47	141	188	160	90	250
Apartment	1,220	du	7,450	98	512	610	455	224	679
Condominium/Townhouse	1,025	du	4,710	55	267	322	282	139	421
Retail	150,000	sf	8,850	124	79	203	394	427	821
Hotel	400	rm	3,290	137	87	224	129	115	244
			59,990	3,951	1,517	5,468	1,970	4,372	6,342
Internal Trip Reductions									
Single-Family Housing, 5%			(120)	0	(7)	(7)	(8)	0	(8)
Office Park			(120)	(7)	0	(7)	0	(8)	(8)
			(240)	(7)	(7)	(14)	(8)	(8)	(16)
Apartment, 5%			(370)	0	(26)	(26)	(23)	0	(23)
Office Park			(370)	(26)	0	(26)	0	(23)	(23)
			(740)	(26)	(26)	(52)	(23)	(23)	(46)
Condominium/Townhouse, 5%			(240)	0	(13)	(13)	(14)	0	(14)
Office Park			(240)	(13)	0	(13)	0	(14)	(14)
			(480)	(13)	(13)	(26)	(14)	(14)	(28)
Existing Driveway Volumes			(1,250)	(152)	(53)	(205)	(30)	(129)	(159)
Project Trip Generation minus Internal Trips and Driveway Volumes			**57,280**	**3,753**	**1,418**	**5,171**	**1,895**	**4,198**	**6,093**
TDM Trip Reductions									
Office Park, 20% Peak Hours			(1,360)	(689)	0	(689)	0	(666)	(666)
Total Net Project Trip Generation			**55,920**	**3,064**	**1,418**	**4,482**	**1,895**	**3,532**	**5,427**

(Note: Daily trips rounded to nearest “10”.)

was assumed for the AM peak-hour inbound and PM peak-hour outbound Office Park trips to account for the demand-reducing effects of the TDM/transit program measures. With this mitigation measure, the total net trip generation for the project, as indicated in Table 9, is expected to decrease to 4,482 AM and 5,427 PM peak-hour trips. These trips were incorporated in the mitigation analysis discussed in a later section.

For purposes of establishing a “trip cap” for the project, such a cap should be based on the trip generation resulting in the most significant traffic impacts, which in this case would be the PM peak-hour trip generation. Taking into account internal and TDM trip reductions, and excluding existing driveway volumes as they would cease to exist when the existing uses are removed to develop the project, the trip cap for the project would be 5,586 PM peak-hour trips.

In addition, as was discussed in the Project Description section, the project proposal includes a development program with flexibility. To assist with the procedural steps likely to be involved with such a development program, trip generation equivalency rates for the proposed uses have been calculated for the critical PM peak hour and are presented in Table 10.

TRIP DISTRIBUTION

The next step in the process was to determine the geographic distribution of the project trips. Each trip has two trip ends, an origin and a destination. If the PacifiCenter project is the origin for a trip, then the destination must be another site somewhere else in the region. Likewise, if the project is a trip destination, it must be originated somewhere else. All trips that were initiated at the project site were linked to appropriate destinations. Likewise, trips destined for the site were linked to appropriate trip origins. For example, a morning work commute (trip) from the project would originate at the project site, and the evening work commute would normally terminate

Table 10
Project Trip Generation Equivalency Rates
For Proposed Uses

Proposed Land Use and Unit of Measure	Trip Generation Equivalency Rate (PM Peak Hour)			
Office Park, 1,000 gsf	=	1.076	du	Single-Family Housing
	=	1.900	du	Apartment
	=	2.573	du	Condominium/Townhouse
	=	186.648	gsf	Retail
	=	1.675	rm	Hotel
Single-Family Housing, 1 du	=	978.869	gsf	Office Park
	=	1.765	du	Apartment
	=	2.390	du	Condominium/Townhouse
	=	173.390	gsf	Retail
	=	1.556	rm	Hotel
Apartment, 1 du	=	526.341	gsf	Office Park
	=	0.567	du	Single-Family Housing
	=	1.354	du	Condominium/Townhouse
	=	98.241	gsf	Retail
	=	0.881	rm	Hotel
Condominium/Townhouse, 1 du	=	388.682	gsf	Office Park
	=	0.418	du	Single-Family Housing
	=	0.738	du	Apartment
	=	72.547	gsf	Retail
	=	0.651	rm	Hotel
Retail, 1,000 gsf	=	5,357.676	gsf	Office Park
	=	5.767	du	Single-Family Housing
	=	10.179	du	Apartment
	=	13.784	du	Condominium/Townhouse
	=	8.973	rm	Hotel
Hotel, 1 rm	=	597.112	gsf	Office Park
	=	0.643	du	Single-Family Housing
	=	1.134	du	Apartment
	=	1.536	du	Condominium/Townhouse
	=	111.450	gsf	Retail

at the same residence. Friction factors (data) from the SCAG computerized transportation model were used to determine trip length and SCAG modeling procedures were followed to link the project trips to appropriate origins and destinations. This model considers the land use patterns throughout the Southern California area to estimate current trip-making patterns. It also considers future land use growth patterns to determine how trip linkages and travel patterns may change over time, due to shifts in the housing and/or employment base locations. In particular, the model considers the amount of housing and employment growth or decline within each sub-area comprising the modeled area to determine changes in the distance each area's residents must travel to find adequate employment opportunities.

The transportation model was also used to estimate trip linkages for non-project trips, such as those to and from retail developments within the area. For these trips, the locations of housing and employment sites were taken into account in relation to the retail facilities. In this manner, utilizing information for both commute and non-commute trips, a set of data was created representing each trip made in Southern California, including those made to and from the project site.

TRIP ASSIGNMENT

Using the above trip distribution results, the computerized transportation model then assigned both future growth and project-related traffic to individual roadways within the study area. As a result, the model accounted for the level of congestion on each roadway and determined which travel path produced the shortest travel time for each trip.

Project trip assignments reflect anticipated future site access point usages based on several factors, including current access point utilizations, internal site circulation patterns, on-site area uses and their access points, and parking supplies. The results of this computerized traffic assignment were carefully examined for “reasonableness”. It should be noted that the computerized model assumes drivers follow the most direct, rational path, i.e., the path of least travel time. The direct path methodology has been shown to produce the most reliable overall traffic projections. This procedure also concentrates traffic volumes and, therefore, any necessary roadway improvements on the preferred (major) routes, rather than encouraging use of minor routes.

In addition, the model determines separate travel route assignments for the AM and PM peak periods. Separate trip generation rates are used for the AM and PM peak periods for both project and non-project traffic to reflect the differences in travel patterns between the morning and evening time periods.

FUTURE TRAFFIC CONDITIONS

Future year 2020 traffic volumes in the Cities of Long Beach and Lakewood and in the surrounding areas were projected using a microcomputer version of the Southern California Association of Governments (SCAG) regional traffic forecasting computer model. The SCAG transportation model is the primary long-range transportation planning tool in the Los Angeles region. This model projected future traffic conditions assuming current trends, although several changes were incorporated into the base model to account for programmed future transportation improvements and projections of regional land use.

There are a number of other projects either under construction or planned for development which could contribute to traffic volumes in the study area. For this reason, the analysis of future traffic conditions was expanded to include potential traffic volume increases expected to be generated by projects that have not yet been developed.

The methodology for estimating future traffic volumes is a multi-step process. First, existing traffic volumes were determined from traffic counts as described in a preceding section. Next, traffic growth estimates, without any PacifiCenter development, were identified by a computerized transportation model created for the PacifiCenter traffic study. This transportation model was developed by expanding the street network in the current SCAG regional traffic model, as well as updating the vehicle trip distribution data provided by SCAG. In addition, vehicle trips generated by related projects in specific zones were compared to the traffic growth estimates in the same zones. Generally, the greater of the two vehicle trip growth estimates was used as the traffic growth for the future "Without Project" condition. Computerized model runs were then conducted in order to compare model-generated traffic volumes between the base or existing (2002) study year and the future (2020) study year. This growth increment between the base

and future years was used to calculate traffic growth for the year 2020. Traffic growth estimates for the year 2020 were then added to the existing traffic count volumes, producing the future (2020) Without Project traffic volumes. Finally, the net new traffic volumes attributable to the PacifiCenter project were analyzed as incremental additions to the 2020 Without Project volumes, resulting in the 2020 volumes for the "With Project" condition. These future traffic volumes were used to analyze potential cumulative and project traffic impacts.

SCAG MODEL AND PLANNED/PROGRAMMED HIGHWAY IMPROVEMENTS

The SCAG model has been developed for several alternative future year scenarios. The most current model has forecasts of land use patterns for the year 2020. This "baseline" scenario was selected as the most appropriate starting point for development of the project-specific model, as the project is expected to be completed by that year. This baseline model only includes those improvements now under construction or otherwise reasonably assured. Of particular relevance, it includes provision of an expanded HOV lane network on the San Diego, Golden State and Garden Grove Freeways. It also accounts for the current improvements to Carson Street at Lakewood Boulevard, Spring Street between California Street and Long Beach Boulevard, and eastbound and westbound left-turn lanes on Wardlow Road at Orange Avenue. However, other improvements considered less assured or which may not be implemented by year 2020 were not assumed. Examples include trip reduction measures required by the South Coast Air Quality Management District (SCAQMD) and the Los Angeles County Congestion Management Program (CMP). Thus, this model forms a very conservative baseline rather than reflecting all likely improvements.

While the SCAG model provides an overall view of the transportation patterns and characteristics within the Metropolitan Los Angeles area (including Los Angeles, Ventura, Orange, San Bernardino and Riverside Counties), its emphasis on regional planning does not provide the level of detail necessary to forecast individual traffic

volumes at specific intersections with acceptable precision. For this study, the roadway network contained within the SCAG model was refined to better reflect the capacities and constraints of the transportation system within the study area.

To accomplish the model refinement process, the base SCAG network was transferred to a microcomputer model format. Specifically developed micro-computer programs that emulate the SCAG trip generation and distribution procedures were developed and utilized in this modeling effort, which not only accounted for projected traffic volume increases in the immediate study vicinity, but throughout the Southern California five-county region as well.

In order to more precisely represent traffic patterns within and around the study area, several modifications to the base SCAG transportation network were necessary. Additional roadway links were added to represent streets and highways in and around the project site vicinity, specifically in the Cities of Long Beach, Lakewood and Signal Hill. While not important in a regional sense, these roadways are very important to local traffic circulation. Field surveys were also conducted in the study area to document roadway geometrics, turning restrictions, traffic signal phasing, on-street parking and other factors that may affect vehicle travel speeds and routes. This information was also entered into the model to replicate the current traffic conditions in the project area. The SCAG model, modified as described above, was the basis of the traffic forecasts for this study.

As part of the PacifiCenter development, A Street, B Street, First Street, Second Street and Third Street are proposed as public roadways within the project site, as previously described in the Project Access section and illustrated in Figure 3. These new roadways were added to the model for analysis of With Project conditions.

RELATED PROJECTS/CUMULATIVE GROWTH

The SCAG transportation model determines the amount of local and regional traffic that will be generated, based on socioeconomic projections. The most current SCAG socio-economic projections associated with the 2001 Regional Transportation Plan were used in the modeling analysis. This socioeconomic data has been developed by SCAG in close consultation with all of the relevant jurisdictions charged with regulating development in the five-county area. This data is used to provide an estimate of the number of vehicle trips going from and to each zone to another zone. This vehicle trip distribution data, as with the base network, was refined to represent smaller zones within the study area than were provided by the SCAG model. This system of smaller zones allowed for a finer level of detail near the project site and throughout the study area. New "centroid connectors" were also added to the model to better replicate the traffic access patterns to and from the zones.

For the future year analyses, updated vehicle trip distribution projections for the five-county area were incorporated into the model. Future vehicle trip distribution data near the project site was also disaggregated into smaller zones to better replicate traffic patterns.

The SCAG socioeconomic data were augmented by a search for specific development projects within the study area that would be on file with the appropriate jurisdictions. These "related projects" included projects which are completed but not fully occupied, are currently under construction or beginning construction, or are presently only proposed but which could become operational within the time frame examined in this study. A composite list with 86 related projects in the study area was compiled from lists of related projects provided by the Cities of Long Beach, Lakewood and Signal Hill. The related projects' descriptions, locations and trip generations are presented in Table 11. Figure 9 depicts the locations of the related projects. The trip generation equations and rates applied to the related projects are in Appendix A.

Table 11
Related Projects Description and Trip Generation

Map No.	Jurisdiction	Size		Description	Location	Daily	AM Peak Hour I/B	AM Peak Hour O/B	AM Peak Hour Total	PM Peak Hour I/B	PM Peak Hour O/B	PM Peak Hour Total
1	Lakewood	1,131	sf	Market Expansion	5453 South Street	130	0	0	0	10	10	20
2	Lakewood	16,500	sf	Church	3114 South Street	150	6	6	12	6	5	11
3	Lakewood	11	du	Apartment	20808 Seine Avenue	200	1	8	9	17	8	25
4	Lakewood	15	du	Apartment	20603 Seine Avenue	220	2	9	11	18	9	27
5	Lakewood	19,676	sf	Shopping Center	4116-4128 South Street	2,400	37	24	61	103	112	215
6	Lakewood	94,268	sf	Department Store (Kohl's)	2650 Carson Street	6,560	94	60	154	290	314	604
7	Lakewood	8,015	sf	Restaurant/Bar	4634 Candlewood Street	720	5	1	6	40	20	60
8	Lakewood	6,853	sf	Restaurant	4404 Candlewood Street	620	5	1	6	34	17	51
9	Lakewood	168,000	sf	Department Store (Target)	Del Amo and Lakewood (Lakewood Center Mall)	9,520	133	85	218	424	460	884
10	Lakewood	14,436	sf	Drug Store (Walgreens)	5829 Lakewood Boulevard	1,290	41	29	70	54	56	110
11	Lakewood	35,192	sf	Retail (tenant improvement)	Del Amo and Lakewood (Lakewood Center Mall)	1,430	108	118	226	39	52	91
12	Lakewood	9,587	sf	Commercial Retail	2700-18 Carson Street	390	29	32	61	11	14	25
13	Lakewood	12,000	sf	Drug Store (CVS)	4909 Paramount Boulevard	1,070	28	19	47	45	47	92
14	Lakewood	2,700	sf	Commercial Retail	4925-63 Paramount Boulevard	110	8	9	17	3	4	7
15	Lakewood	10	du	Condominium	11716-24 205th Street	90	1	7	8	6	3	9
16	Lakewood	8	du	Condominium	11711-19 216th Street	80	1	6	7	5	3	8
17	Lakewood	20	du	Condominium	20741-20809 Seine Avenue	170	2	12	14	11	5	16
18	Lakewood	8	du	Single-Family Residential (planned development)	5813 Allington Street	100	5	13	18	8	4	12
19	Lakewood	20	du	Single-Family Residential (planned development)	SE corner of Paramount and Candlewood	240	7	19	26	17	9	26
20	Long Beach	430	rm	Hotel	100 East Ocean Boulevard	3,840	177	129	306	149	155	304
21	Long Beach	16,200	sf	Drug Store (Sav-On)	6000 Atlantic Avenue	1,450	51	36	87	61	63	124
22	Long Beach	160	du	Apartment	3801 Pacific Coast Highway	1,090	13	70	83	70	35	105
23	Long Beach	106	du	Single-Family Residential	2080 Obispo Avenue	1,090	22	65	87	74	41	115
24	Long Beach	500,000	sf	Commercial/Entertainment	Shoreline Drive & Pine Avenue	19,190	254	163	417	872	944	1,816
25	Long Beach	162	rm	Hotel	201 The Promenade	1,450	56	41	97	49	50	99
26	Long Beach	400,000	sf	Technology Park Industrial/R&D	2000 West 19th Street	3,240	412	84	496	65	367	432

Table 11 (cont.)
Related Projects Description and Trip Generation

Map No.	Jurisdiction	Size		Description	Location	Daily	AM Peak Hour I/B	AM Peak Hour O/B	AM Peak Hour Total	PM Peak Hour I/B	PM Peak Hour O/B	PM Peak Hour Total
27	Long Beach	82	du	Condominium (50 adaptive reuse/ 32 new construction)	835 Locust Street	550	7	37	44	35	17	52
28	Long Beach	92,000	sf	Self Storage	4200 Pacific Coast Highway	220	8	6	14	14	8	22
29	Long Beach	66	du	Condominium	1000 E. Ocean Boulevard	460	6	31	37	29	15	44
30	Long Beach	770	du	Apartment	300 W. Ocean Boulevard	4,750	62	324	386	291	144	435
		500	rm	Hotel		4,460	209	152	361	177	185	362
		25,000	sf	Commercial		2,800	43	27	70	121	131	252
						12,010	314	503	817	589	460	1,049
31	Long Beach	302	du	Residential	6400 E. Pacific Coast Highway	2,870	56	169	225	186	104	290
		199	rm	Hotel		1,780	73	53	126	61	64	125
						4,650	129	222	351	247	168	415
32	Long Beach	470,000	sf	Retail	301 Long Beach Boulevard	18,440	245	157	402	837	907	1,744
		250	du	Apartment		1,630	20	107	127	103	51	154
						20,070	265	264	529	940	958	1,898
33	Long Beach	75,100	sf	Self Storage	2323 South Street	180	6	5	11	12	6	18
34	Long Beach	179,000	sf	General Office	5950 Spring Street	2,080	261	36	297	48	232	280
35	Long Beach	15,200	sf	Drug Store	1250 E. Pacific Coast Highway	1,360	46	32	78	57	59	116
36	Long Beach	34	du	Condominium	834 E. 4th Street	260	4	18	22	17	8	25
		6,900	sf	Commercial		280	21	23	44	8	10	18
						540	25	41	66	25	18	43
37	Long Beach	20,000	sf	Police Station	4891 Atlantic Avenue	1,380	99	19	118	164	57	221
38	Long Beach	10	du	Condominium	23 4th Place	90	1	7	8	6	3	9
39	Long Beach	556	du	Condominium	350 E. Ocean Boulevard	2,800	34	165	199	170	84	254
40	Long Beach	48	du	Apartment	248 W. Broadway	420	4	23	27	30	15	45
		9,000	sf	Commercial		370	28	30	58	10	13	23
						790	32	53	85	40	28	68
41	Long Beach	105,800	sf	Hospital	2702 Long Beach Boulevard	3,020	101	37	138	30	96	126
42	Long Beach	8,000	sf	Specialty Retail Center	2302 Bellflower Boulevard	330	24	27	51	9	12	21
43	Long Beach	66	du	Apartment	1601 Pacific Avenue	530	6	30	36	36	18	54
44	Long Beach			Boeing - Cleanup and Abatement Order 95-048	Lakewoood Boulevard and Carson Street	nom.	nom.	nom.	nom.	nom.	nom.	nom.
45	Long Beach	63	du	Senior Citizens Assisted Living (conversion)	117 E. 8th Street	N/A	5	8	13	9	5	14

Table 11 (cont.)
Related Projects Description and Trip Generation

Map No.	Jurisdiction	Size		Description	Location	Daily	AM Peak Hour I/B	AM Peak Hour O/B	AM Peak Hour Total	PM Peak Hour I/B	PM Peak Hour O/B	PM Peak Hour Total
46	Long Beach			Queen Mary Expanded Attractions	1126 Queen's Highway[1]							
		50,000	sf	Attraction Venue		4,370	65	41	106	191	206	397
		1,300	sp	Parking Structure								
47	Long Beach	52	du	Single-Family Residential	301 Manila Avenue	570	12	37	49	39	22	61
48	Long Beach	69	rm	Hotel	517 E. 1st Street	620	14	10	24	18	19	37
49	Long Beach			Parking Structure for Carnival Cruise Ships	1126 Queen's Highway[1]	nom.	nom.	nom.	nom.	nom.	nom.	nom.
50	Long Beach	7,000	sf	Retail	3400 Long Beach Boulevard	280	22	23	45	8	10	18
		1,500	sf	Fast-Food Restaurant with Drive-Thru		740	38	37	75	26	24	50
51	Long Beach	19,500	sf	Commercial	190 Marina Drive	2,380	37	23	60	102	111	213
52	Long Beach	16	du	Residential Lofts (conversion)	829 Pine Avenue	230	2	9	11	18	9	27
53	Long Beach	35	du	Condominium	6000 Loynes Drive	270	4	18	22	17	9	26
54	Long Beach	71,536	sf	Self-Storage	5400 Paramount Boulevard	170	6	5	11	11	6	17
		1,100	sf	General Office		40	4	1	5	14	67	81
						210	10	6	16	25	73	98
55	Long Beach	106,636	sf	Self-Storage Facility and RV Parking	6897 Paramount Boulevard	250	9	7	16	17	9	26
56	Long Beach	58,500	sf	Shopping Center	120 Studebaker Road	4,830	71	45	116	212	229	441
57	Long Beach	6,172	sf	Commercial	3918-3926 Long Beach Boulevard	250	19	21	40	7	9	16
		2,714	sf	Fast-Food Restaurant with Drive-Thru		1,350	69	66	135	47	44	91
58	Long Beach	11,984	sf	Commercial	1570-1598 Long Beach Boulevard	490	37	40	77	13	18	31
59	Long Beach	3,200	sf	Fast-Food Restaurant with Drive-Thru	1840 Long Beach Boulevard	1,590	82	78	160	56	51	107
60	Long Beach	519,135	sf	Self-Storage	712 W. Baker Street	1,250	46	32	78	83	46	129
61	Long Beach	11,550	sf	Drug Store with Drive-Thru	3570 Atlantic Avenue	1,030	25	18	43	43	45	88
62	Long Beach	30,000	sf	Education Building	2244 Clark Avenue	1,570	24	10	34	91	98	189
63	Long Beach	15,000	sf	Commercial	2005-2011 Long Beach Boulevard	610	46	50	96	17	22	39
64	Long Beach	5	du	Single-Family Residential	315 Flint Avenue	70	4	12	16	5	3	8
65	Long Beach	11	du	Condominiums (conversion)	201-205 E. Broadway	100	2	7	9	7	3	10
66	Long Beach	10,000	sf	Office/Retail	1900 Atlantic Avenue	230	26	4	30	15	76	91
67	Long Beach	4,000	sf	Expansion/Remodel of Target Store (net increase)	2270 Bellflower Boulevard	160	12	14	26	4	6	10

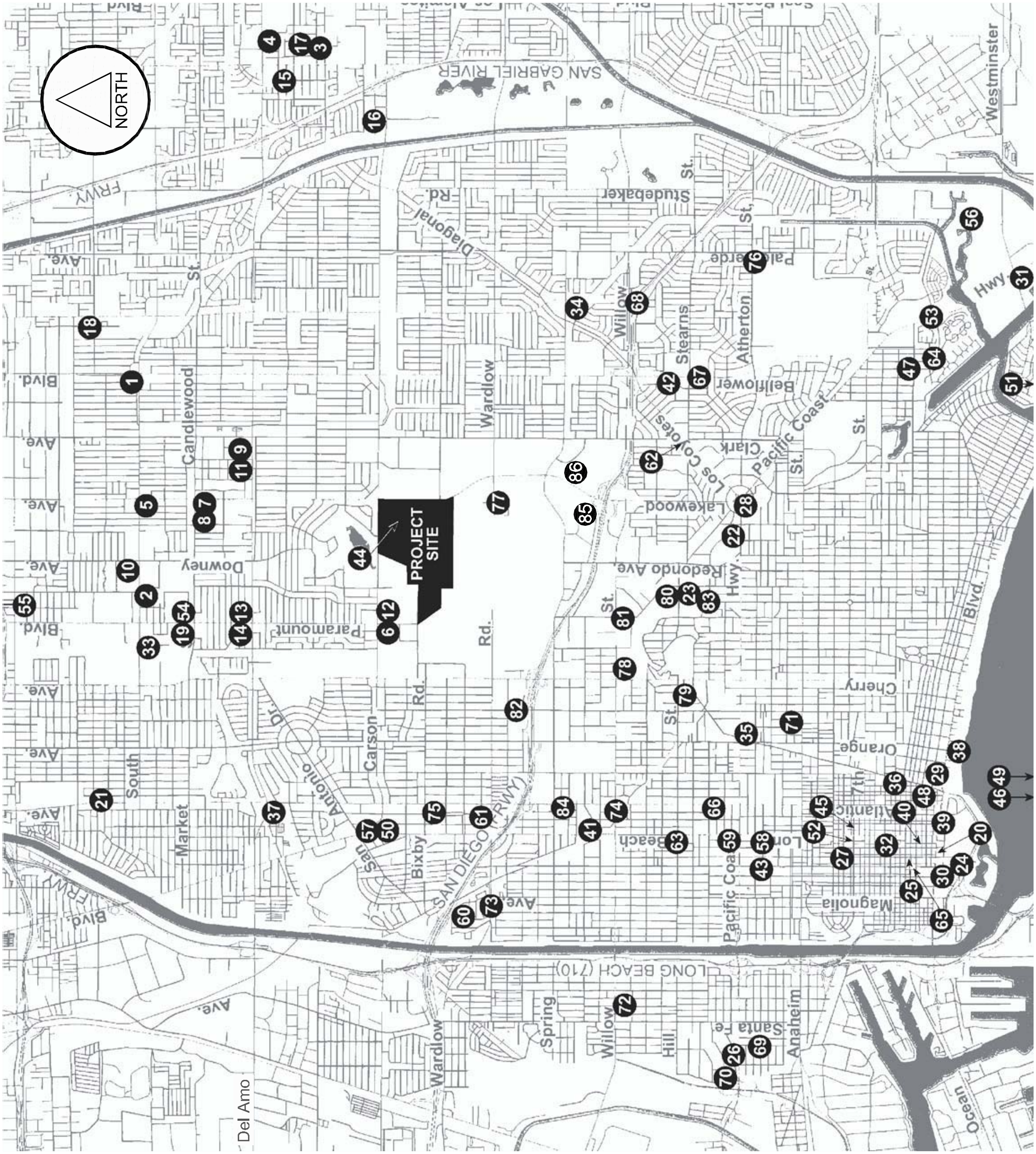
Table 11 (cont.)
Related Projects Description and Trip Generation

Map No.	Jurisdiction	Size		Description	Location	Daily	AM Peak Hour I/B	AM Peak Hour O/B	AM Peak Hour Total	PM Peak Hour I/B	PM Peak Hour O/B	PM Peak Hour Total
68	Long Beach	41,000	sf	Church Expansion	5950 E. Willow Street	370	16	14	30	15	12	27
69	Long Beach	6,356	sf	Industrial Building	1690-1694 Cota Avenue	44	5	1	6	1	5	6
70	Long Beach	201	rm	Transitional Housing Facility	2001 River Avenue	1,340	16	87	103	85	42	127
71	Long Beach	16,000	sf	Public Library	1401 E. Anaheim Street	1,020	12	4	16	52	57	109
72	Long Beach	5,750	sf	Commercial Shopping Center	1422 W. Willow Street	230	18	19	37	6	9	15
73	Long Beach	26,000	sf	Self-Storage Facility	3401 Golden Avenue	60	2	2	4	4	2	6
74	Long Beach	7,200	sf	Medical Office	2760 Atlantic Avenue	80	14	3	17	7	20	27
75	Long Beach	5,800	sf	Retail	4085 Atlantic Avenue	240	18	19	37	6	9	15
76	Long Beach			California State University Long Beach Expansion	Atherton Street and Palo Verde Avenue	nom.	nom.	nom.	nom.	nom.	nom.	nom.
		120,000	sf	Recreation Center								
				New Parking Structure								
77	Long Beach			Long Beach Airport Terminal Area Improvements	4100 Donald Douglas Drive	3,177	92	75	167	97	82	179
		43,000	sf	Building Improvements								
		4,000	sp	Parking Structure								
78	Long Beach	156	du	Senior Assisted Housing	SW corner of Cherry Avenue and Willow Street	N/A	12	21	33	23	13	36
79	Signal Hill	270	du	Single-Family Residential	Hill Street between	2,590	51	151	202	168	95	263
		44	du	Duplexes	Cherry Avenue/Temple Avenue	320	5	22	27	21	10	31
		150	du	Multi-Family Residential		1,030	12	66	78	67	33	100
						3,940	68	239	307	256	138	394
80	Signal Hill	172	du	Single-Family Residential	North of Hill Street at Hathaway Avenue	1,710	33	100	133	113	63	176
81	Signal Hill	20	du	Single-Family Residential	Hathaway Avenue and Temple Avenue	240	7	19	26	17	9	26
82	Signal Hill	120,000	sf	Self Storage Facility	California and 32nd Street	280	11	7	18	19	10	29
83	Signal Hill	4	du	Single-Family Residential	Freeman Avenue and 20th Street	50	4	11	15	4	2	6
84	Signal Hill	130,000	sf	Retail	Atlantic Avenue and Spring Street	8,070	114	73	187	359	388	747
85	Long Beach			Kilroy (est. remaining entitlement)	South of Spring Street between Lakewood							
		359	ksf	359,000 sf Office	Boulevard and Redondo Avenue	20	454	62	516	82	400	482
		220	rm	220-Room Hotel		1,960	82	60	142	69	72	141
						1,980	536	122	658	151	472	623

Table 11 (cont.)
Related Projects Description and Trip Generation

Map No.	Jurisdiction	Size	Description	Location	Daily	AM Peak Hour I/B	AM Peak Hour O/B	AM Peak Hour Total	PM Peak Hour I/B	PM Peak Hour O/B	PM Peak Hour Total
86	Long Beach		Airport Business Park (est. remaining entitlement)	SE Corner of Lakewood Boulevard and Spring Street							
		288 sf	288,000 sf Office		10	381	52	433	68	334	402
		105 rm	105-Room Addition to Existing Hotel		940	30	22	52	29	31	60
					950	411	74	485	97	365	462

* The improvements will accommodate a total of 41 air carrier flights and 25 commuter flights per day (approximately 3.8 MAP per year).



SOURCE: PCR SERVICES CORPORATION, 2002

FIGURE 9

10/21/03

FN: BOEING-LNGBCH\RELPROJS-PCR

RELATED PROJECTS LOCATION MAP

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The highest trip generation value for each zone, based on a comparison of the SCAG vehicle trip growth projections data and the sum of the known related projects proposed for each zone, was used as the incremental growth for that zone. This incremental growth was then added to the existing vehicle trip data contained in the model for the existing condition. It should be noted that since it could not be ascertained whether the SCAG projections adequately accounted for the traffic growth attributable to three related projects, i.e., Queen Mary Expanded Attraction (no. 46), Long Beach Airport Terminal Area Improvements (no. 77) and the Kilroy project (no. 85) for purposes of a conservative analysis, those traffic growths were estimated and added to the SCAG growth projections.

Thus, the combination of the local refinements to the traffic model transportation network and the growth projections from SCAG and the related projects formed the basis for the forecasts of future Without Project conditions in the study area.

SIGNIFICANT IMPACT CRITERIA

The City of Long Beach, the lead agency, considers a traffic impact to be significant if the traffic/circulation increases generated by a project result in an intersection level of service falling below the minimum acceptable service level of D, or a worsening of the volume-to-capacity ratio by 0.02 or more of an intersection that currently operates at LOS E or F.

ANALYSIS OF FUTURE (2020) INTERSECTION CONDITIONS, WITHOUT AND WITH PROJECT

Traffic conditions in the study area were forecast for the future study year of 2020. The future year scenario was developed by combining the incremental forecast traffic growth (from the previously discussed SCAG vehicle trip projection data and related

projects assumed to be developed by 2020) with the existing traffic volumes in the study area, resulting in the 2020 Without Project condition volumes. Only those transportation improvements considered reasonably assured were assumed for the future year projections.

The 2020 Without Project intersection traffic volumes, shown in Figures 10(a) and 10(b), not only provide the baseline against which the determination of project traffic impacts is made, but also a gauge of the impact of ambient traffic growth and cumulative development in the study area.

Future 2020 traffic volumes with the addition of the PacifiCenter project were then analyzed by adding the project trips and new project roadways to the Without Project condition. The traffic growth as a result of the project was used to determine project traffic impacts. Figures 11(a) and 11(b) depict the 2020 With Project traffic volumes at the study intersections.

Applying the same Critical Movement Analysis (CMA) methodology and procedures used in the analysis of existing conditions, the CMA and LOS values were determined for the 2020 Without and With Project conditions at the study intersections. Table 12 summarizes the results of the future year analyses, and for purposes of comparison, the existing (2002) CMA and LOS results as well. The CMA worksheets for all of these conditions are provided in Appendix E.

The PacifiCenter project would significantly impact 60 study intersections, prior to implementation of proposed mitigation measures. Of these 60 intersections, 26 intersections would be significantly impacted in both the AM and PM peak hours. Combined with the study intersections that are currently operating at unacceptable LOS, a total of 79 study intersections would be operating at LOS E or F in one or both peak hours after project completion, without mitigation.

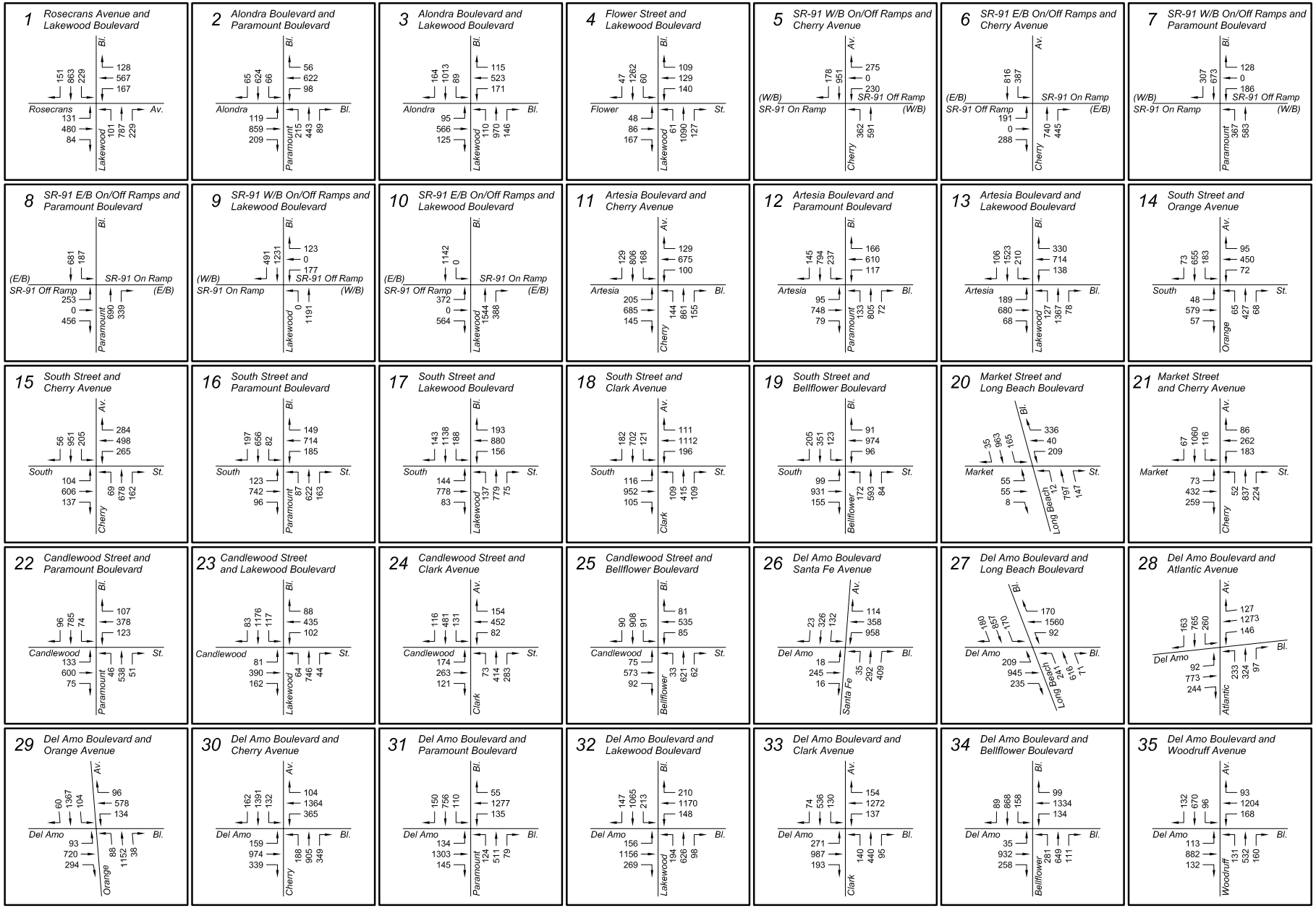

FIGURE 10(a)

9/2/2003

BCEING-LNGBCH\9-2-03\AM2020WO-G1

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FUTURE (2020) TRAFFIC VOLUMES
WITHOUT PROJECT
AM PEAK HOUR

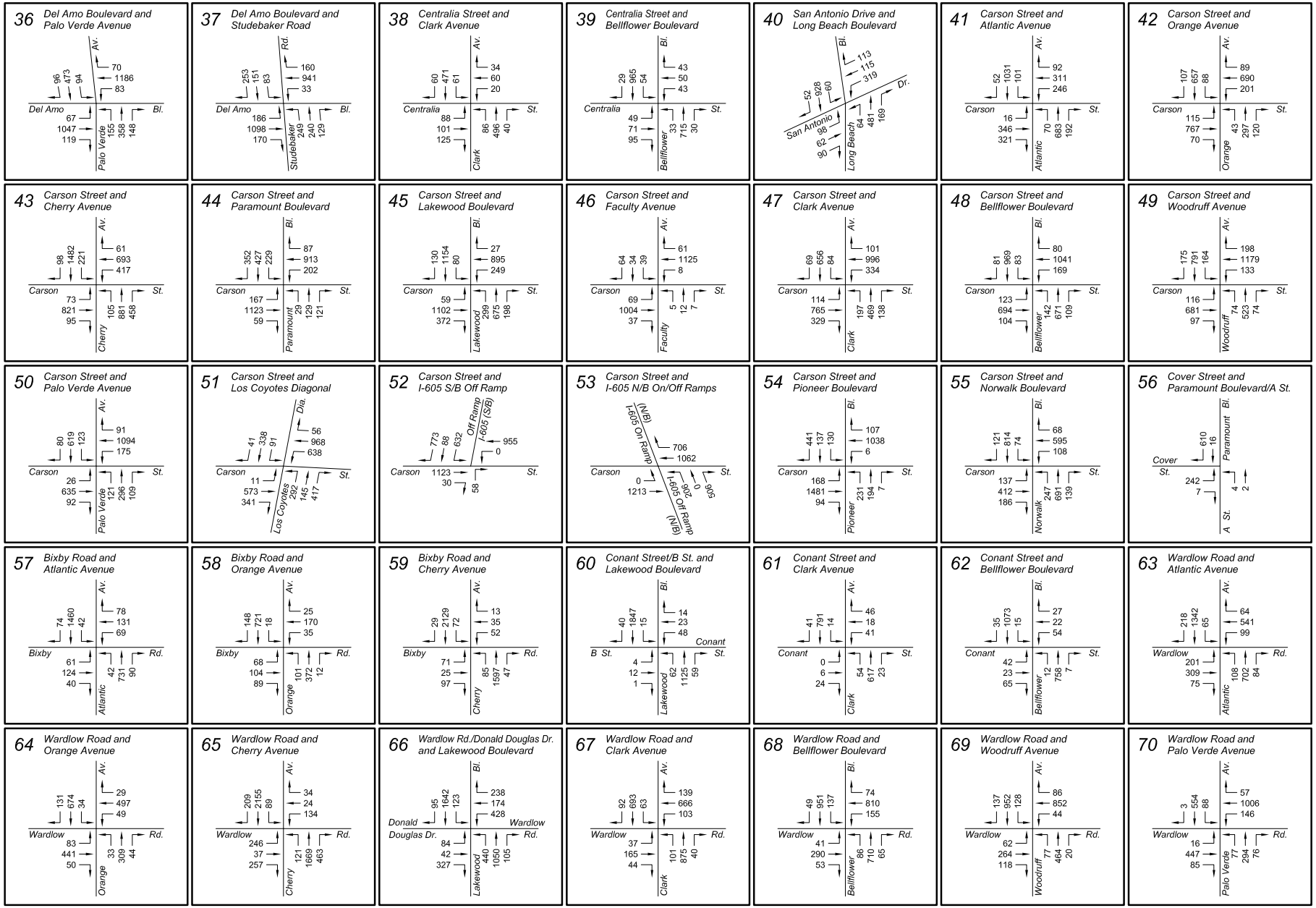

FIGURE 10(a)

9/2/2003

BOEING-LNGBCH\9-2-03\AM2020WO-G2

110INTS-STICKFUT-GRID-2

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FUTURE (2020) TRAFFIC VOLUMES
WITHOUT PROJECT
AM PEAK HOUR

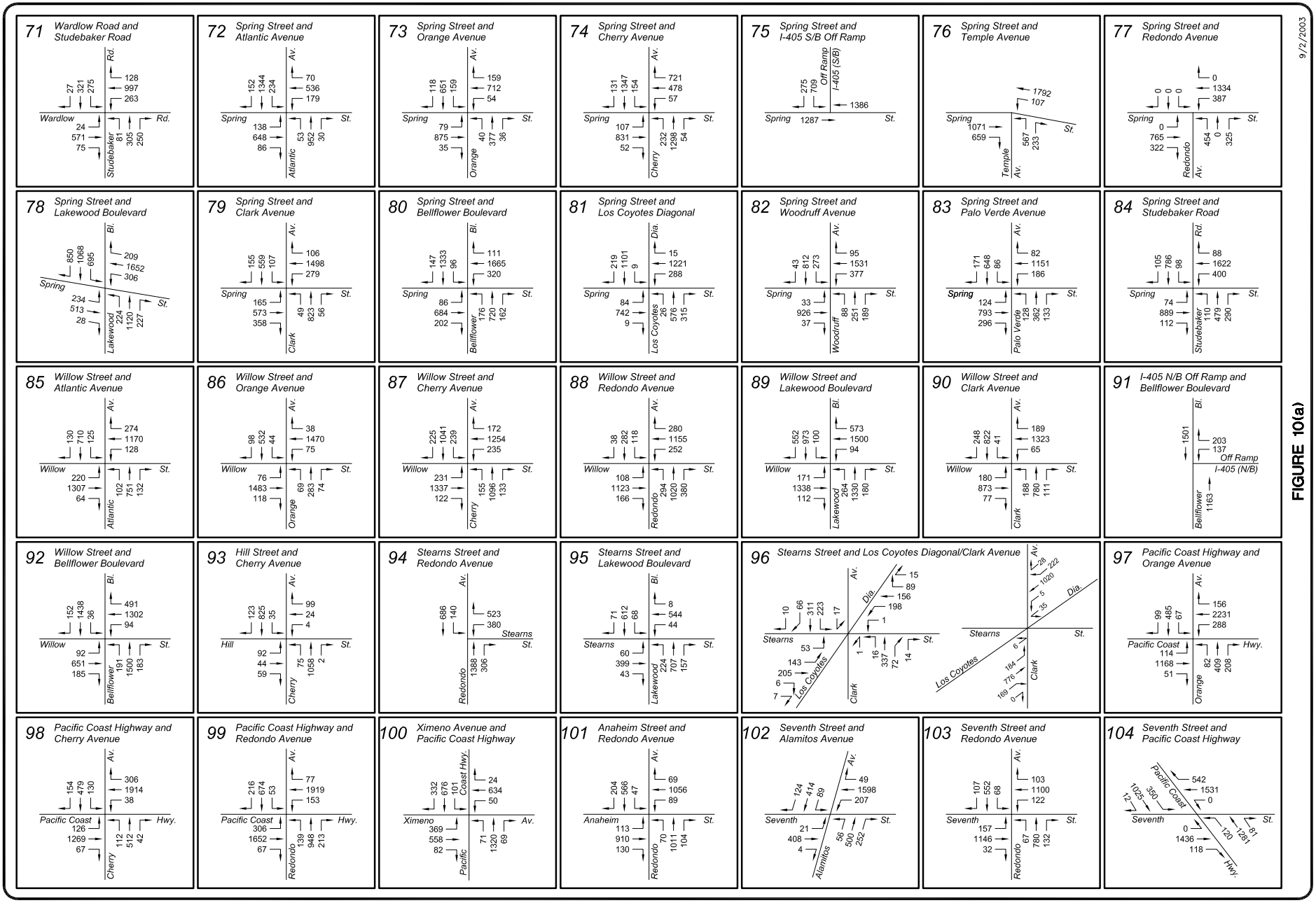

FIGURE 10(a)

9/2/2003

BOEING–LNGBCH\9–2–03\AM2020WO–G3

110INTS–STICKFUT–GRID–3

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FUTURE (2020) TRAFFIC VOLUMES
WITHOUT PROJECT
AM PEAK HOUR

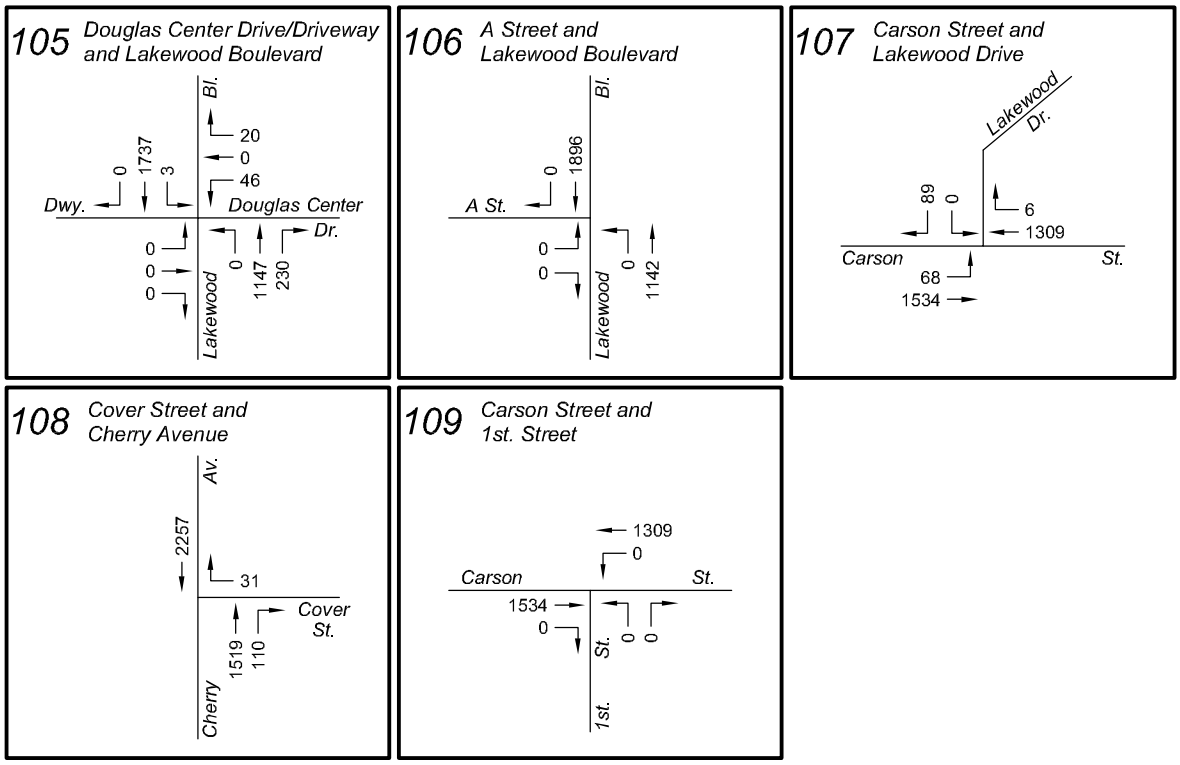

FIGURE 10(a)

9/2/2003

BOEING-LNGBCH\9-2-03\AM2020WO-G4

_110INTS-STICKFUT-GRID-4

FUTURE (2020) TRAFFIC VOLUMES
WITHOUT PROJECT
AM PEAK HOUR

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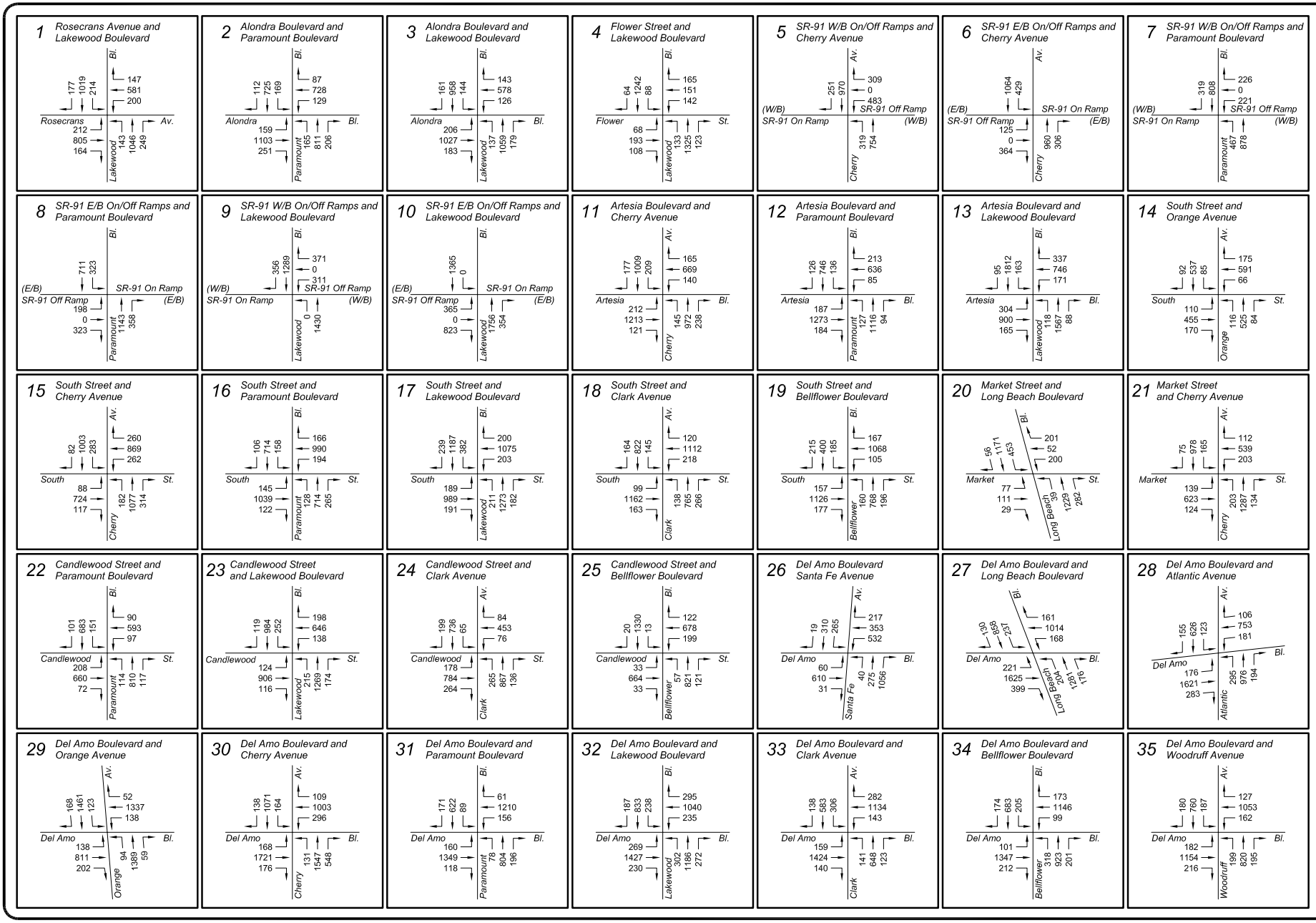

FIGURE 10(b)

9/2/2003

BOEING-LNGBCH\9-2-03\PM2020WO-G1

110INTS-STICKFUT-GRID-1

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FUTURE (2020) TRAFFIC VOLUMES
WITHOUT PROJECT
PM PEAK HOUR

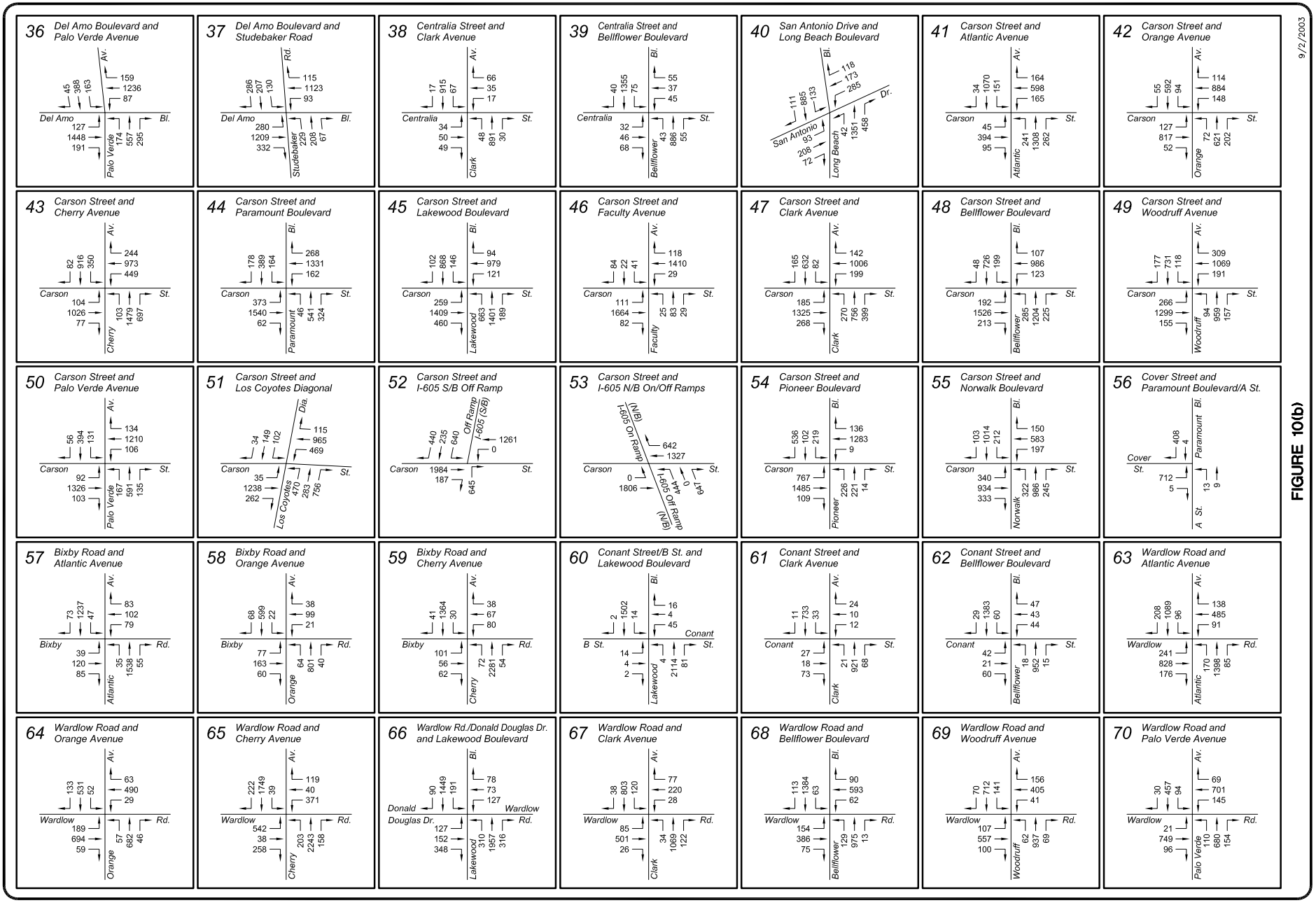

FIGURE 10(b)

9/2/2003

BOEING-LNGBCH\9-2-03\PM2020WO-G2

110INTS-STICKFUT-GRID-2

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FUTURE (2020) TRAFFIC VOLUMES
WITHOUT PROJECT
PM PEAK HOUR

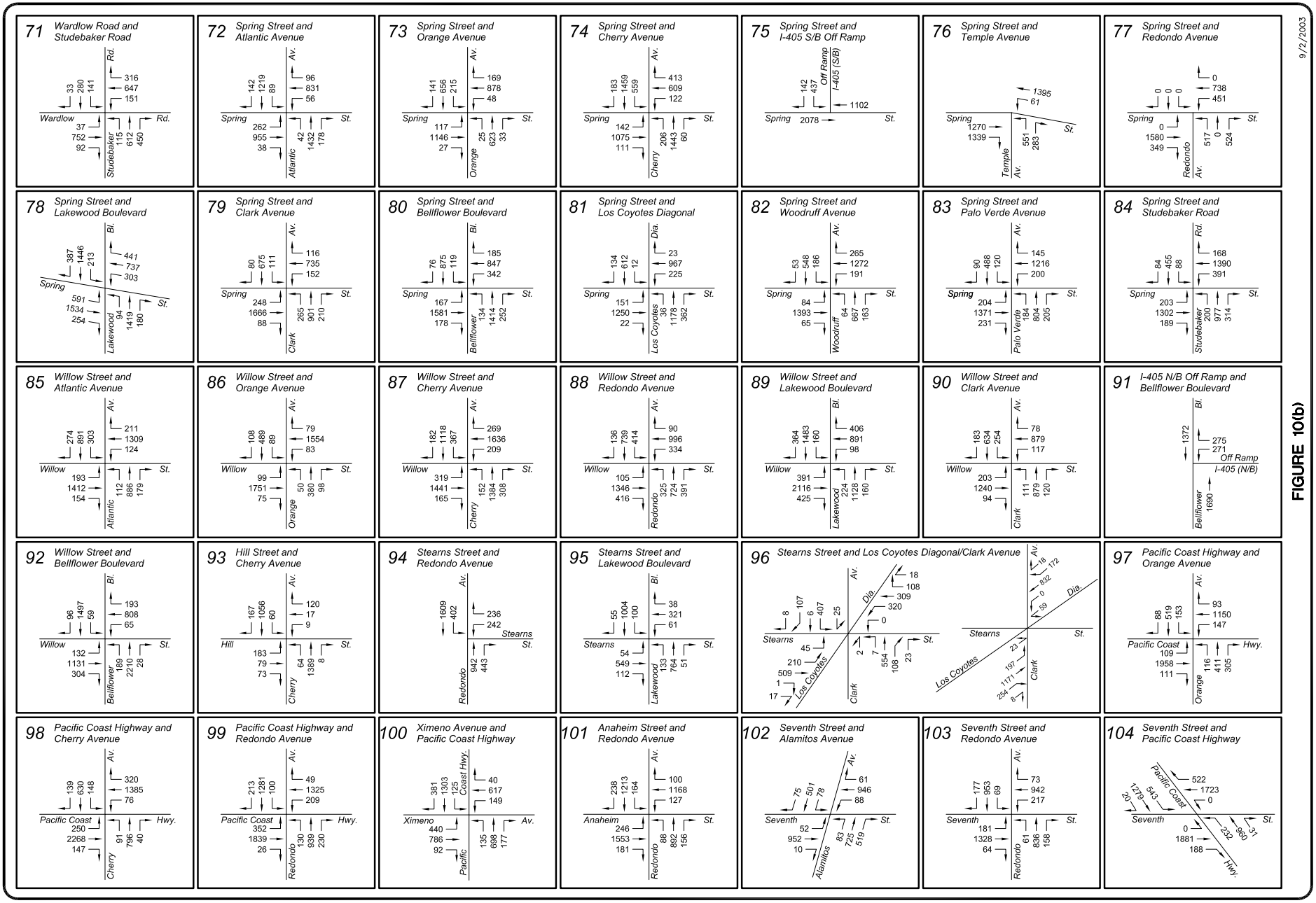

FIGURE 10(b)

FUTURE (2020) TRAFFIC VOLUMES
WITHOUT PROJECT
PM PEAK HOUR

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110INTS-STICKFUT-GRID-3
9/2/2003

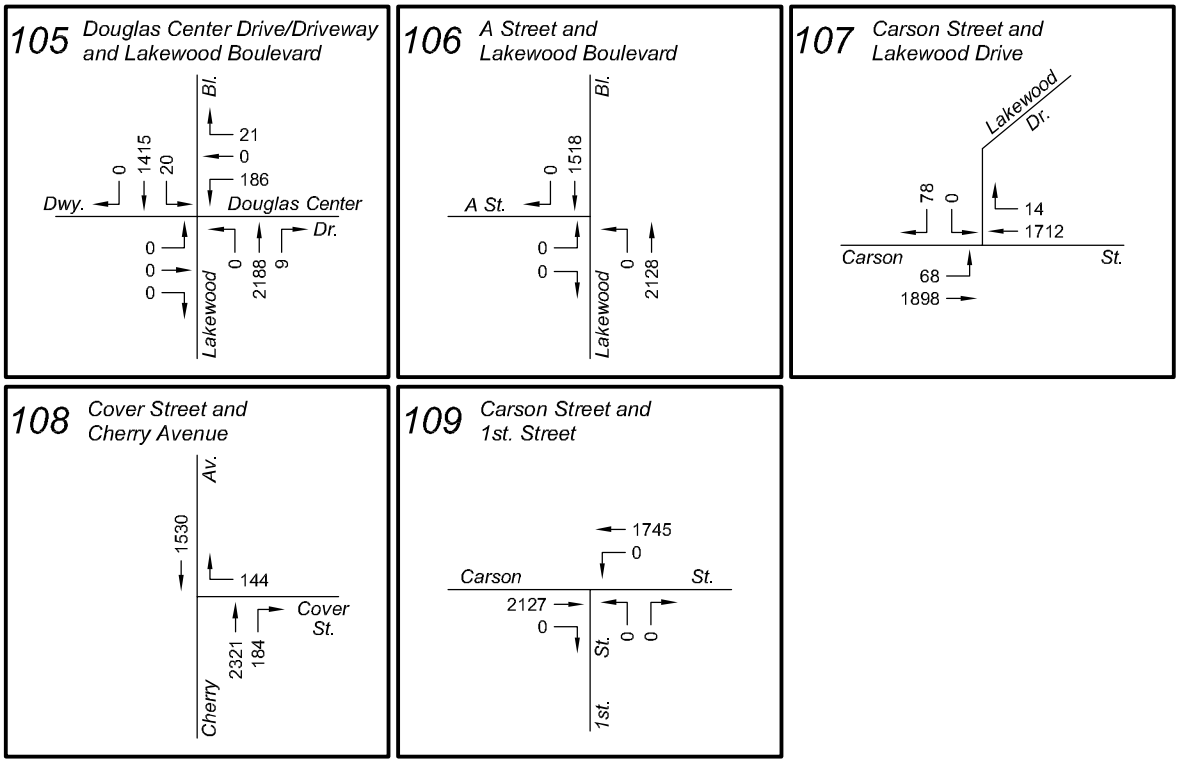

FIGURE 10(b)

9/2/2003

BOEING-LNGBCH\9-2-03\PM2020WO-G4

_110INTS–STICKFUT–GRID–4

FUTURE (2020) TRAFFIC VOLUMES
WITHOUT PROJECT
PM PEAK HOUR

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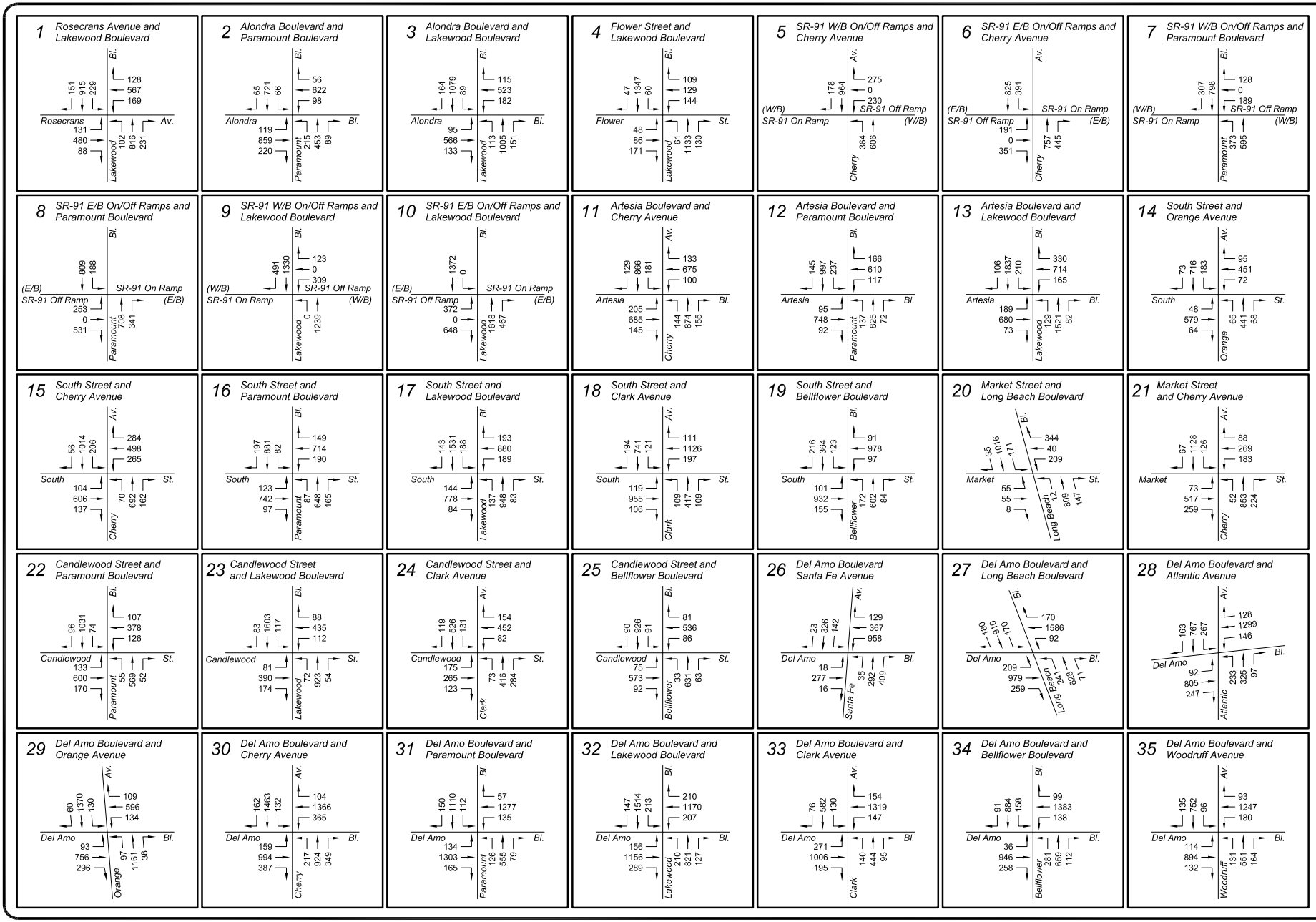

FIGURE 11(a)

9/2/2003

BOEING-LNGBCH\9-2-03\AM2020WP-G1

110INTS-STICKFUT-GRID-1

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FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
AM PEAK HOUR

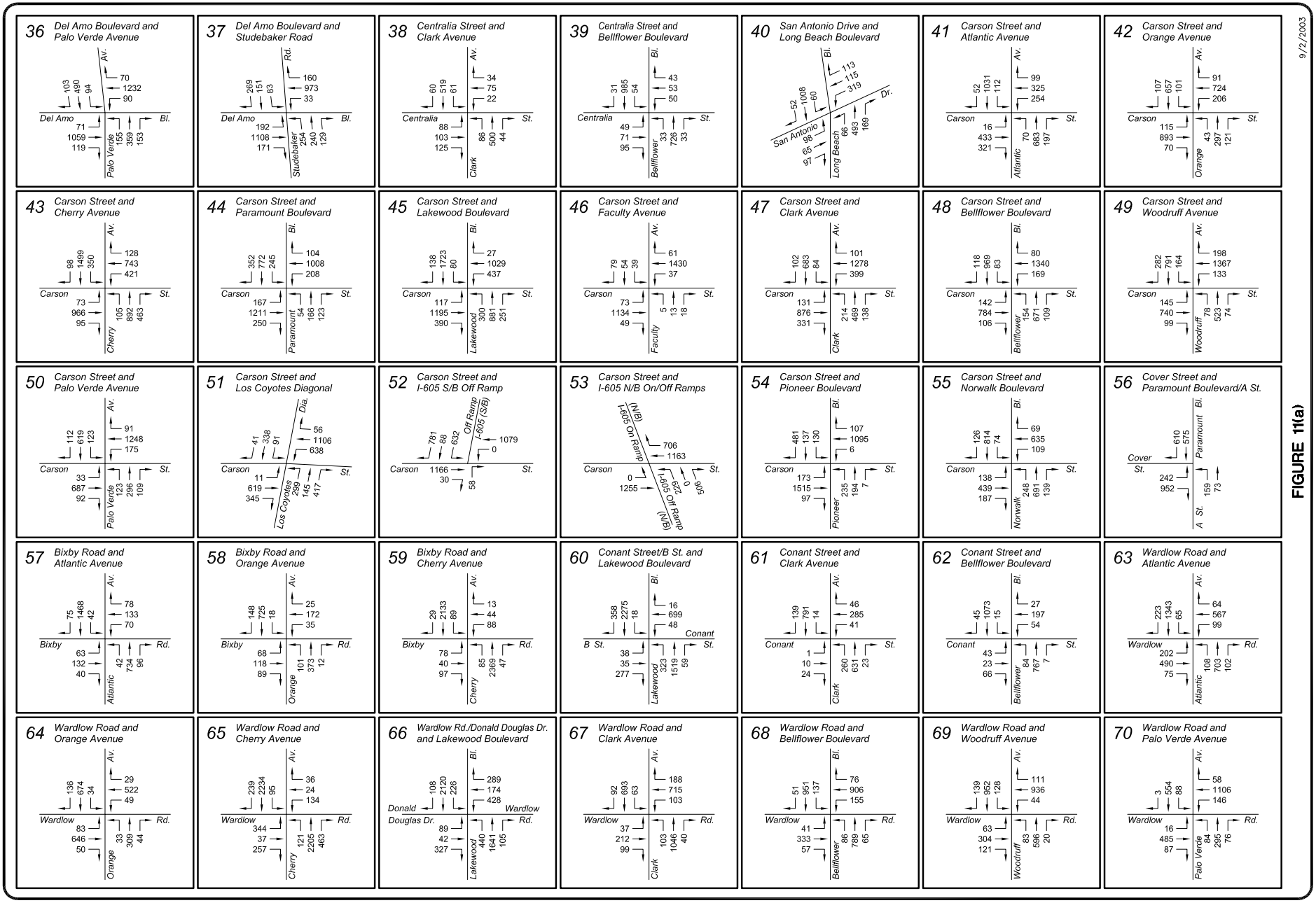

FIGURE 11(a)

FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
AM PEAK HOUR

9/2/2003

BOEING-LNGBCH\9-2-03\AM2020WP-G2

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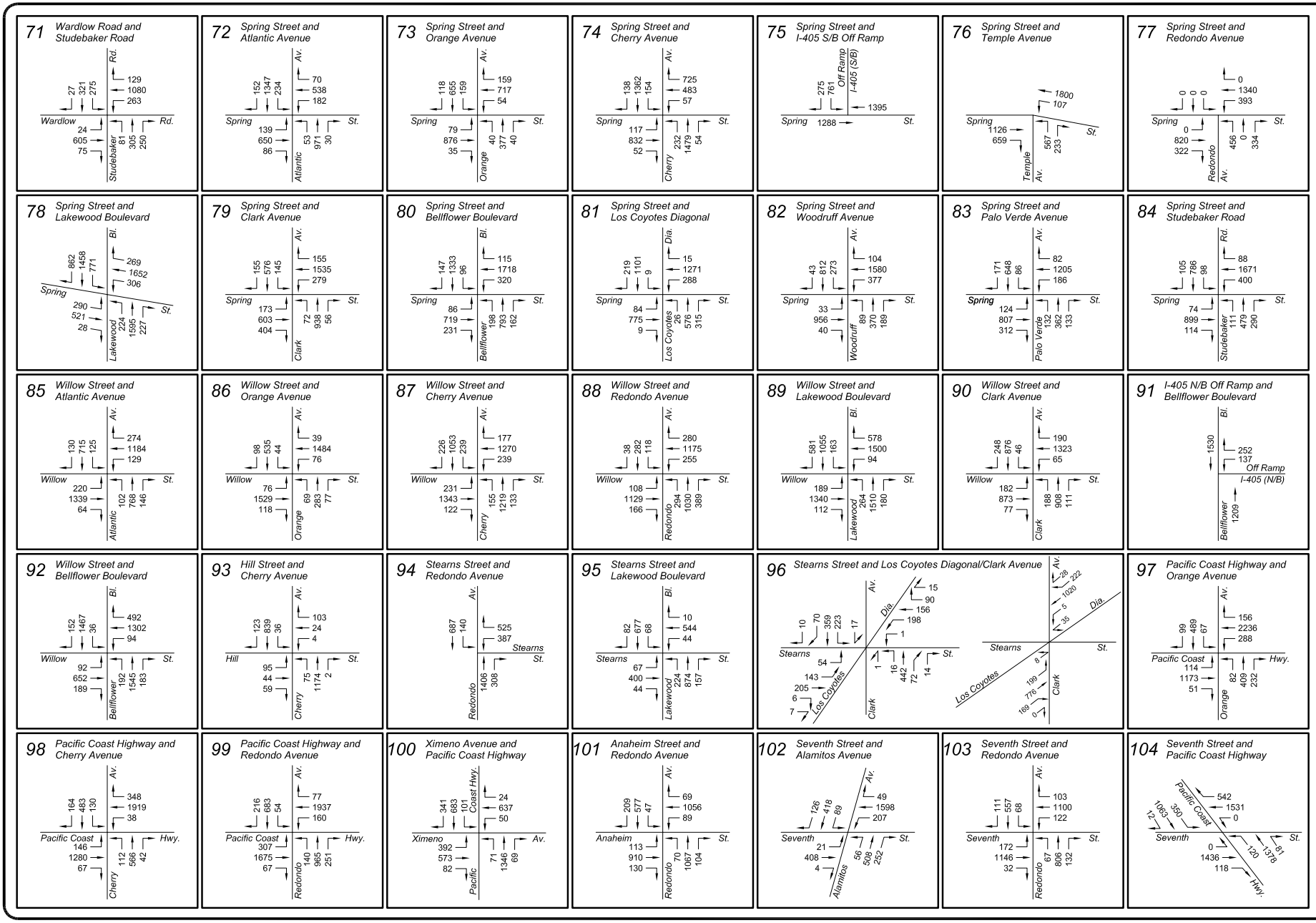

FIGURE 11(a)

9/2/2003

BOEING-LNGBCH\9-2-03\AM2020WP-G3

110INTS-STICKFUT-GRID-3

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FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
AM PEAK HOUR

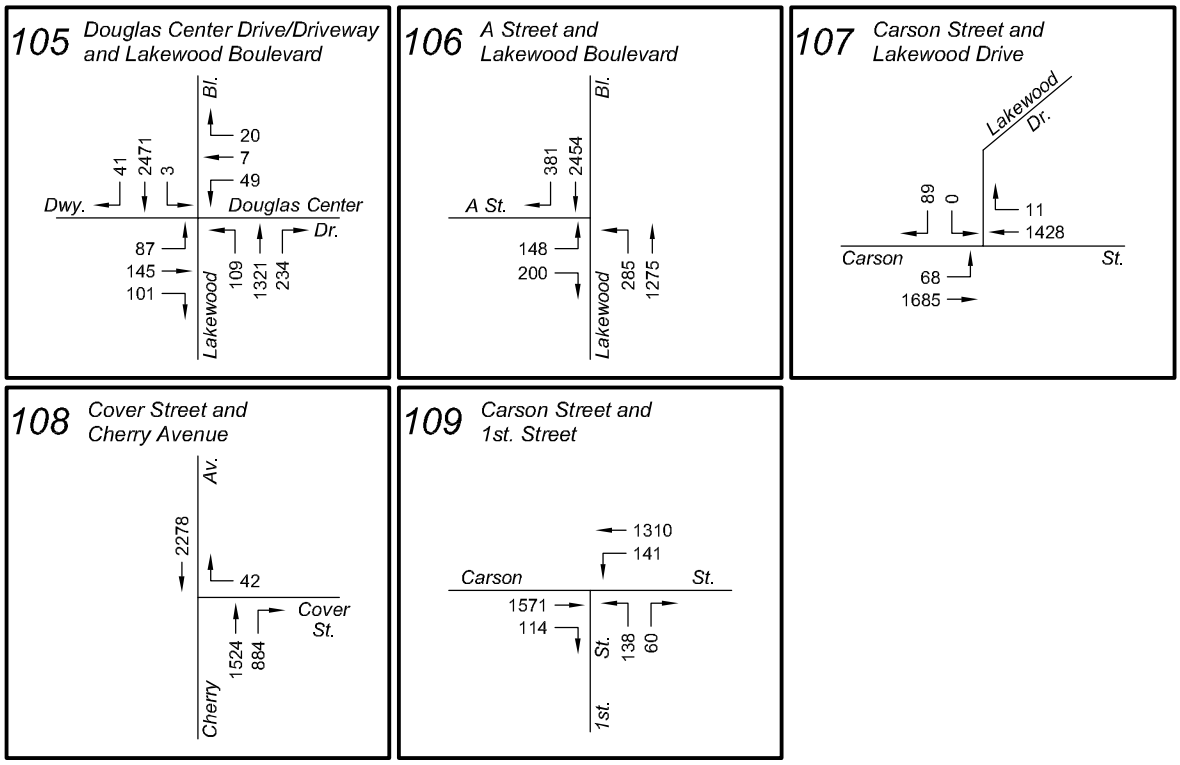

FIGURE 11(a)

9/2/2003

BOEING-LNGBCH\9-2-03\AM2020WP-G4

_110INTS-STICKFUT-GRID-4

FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
AM PEAK HOUR

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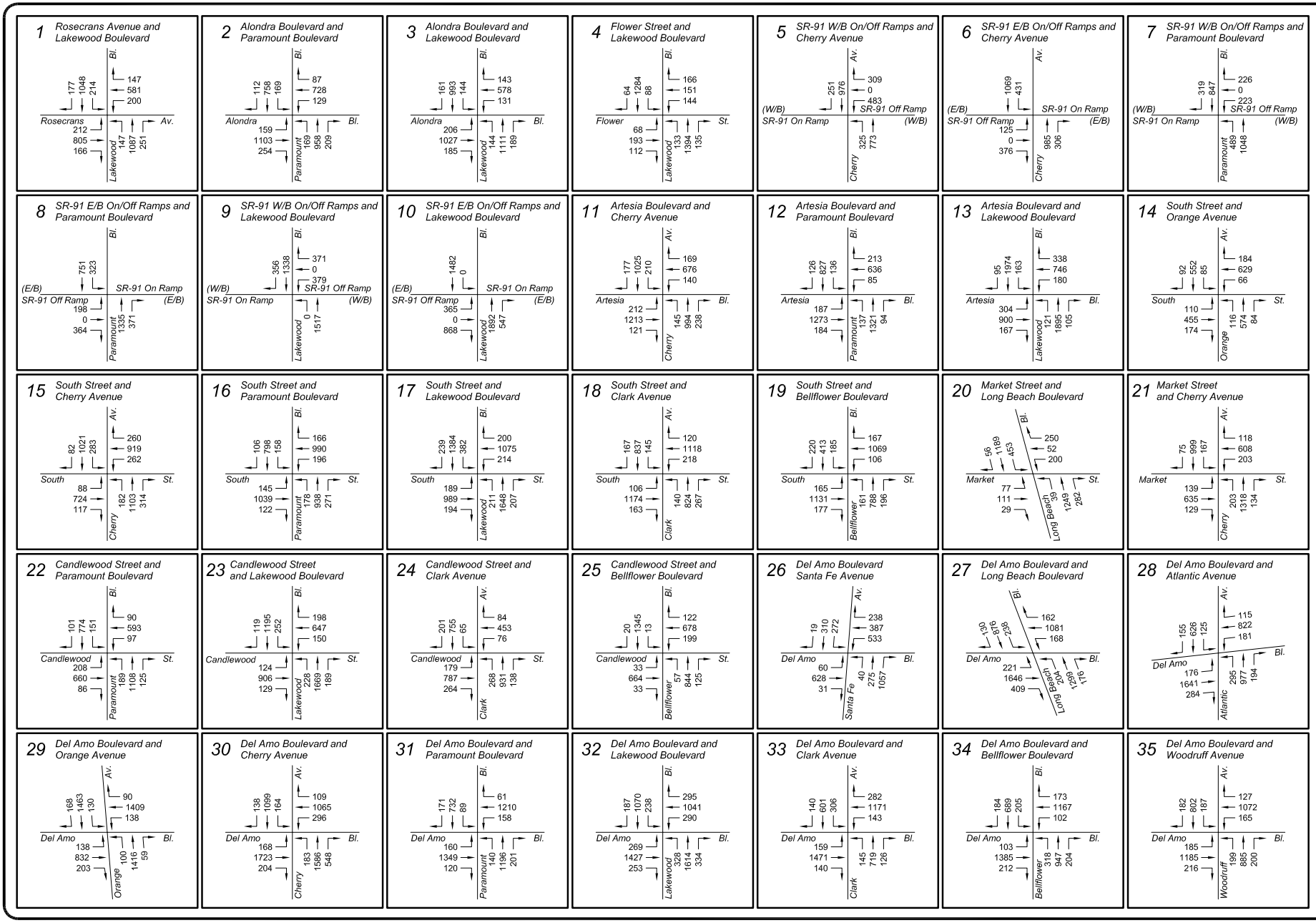

FIGURE 11(b)

9/2/2003

BOEING-LNGBCH\9-2-03\PM2020WP-G1

110INTS-STICKFUT-GRID-1

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FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
PM PEAK HOUR

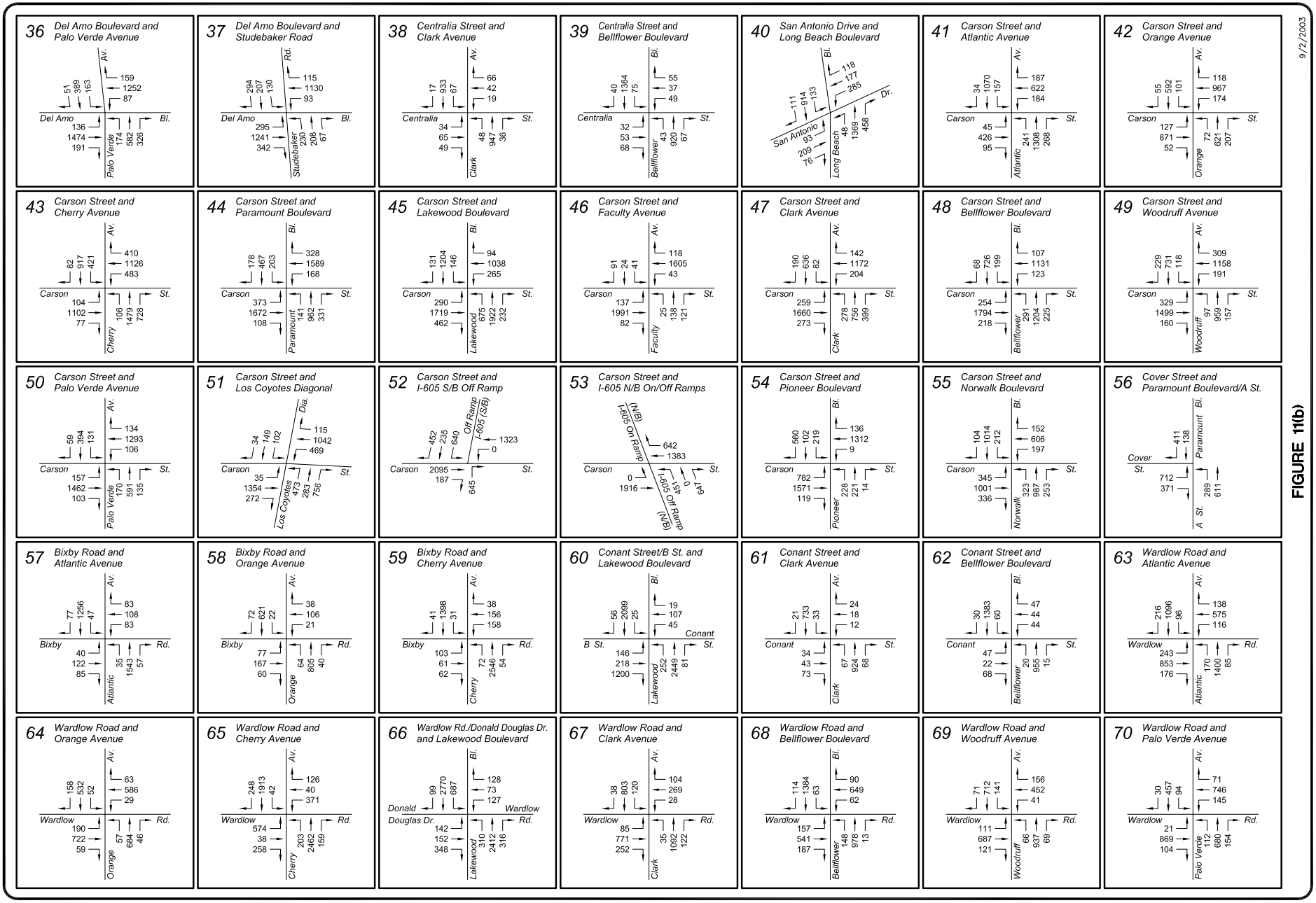

FIGURE 11(b)

FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
PM PEAK HOUR

9/2/2003

BOEING-LNGBCH\9-2-03\PM2020WP-G2

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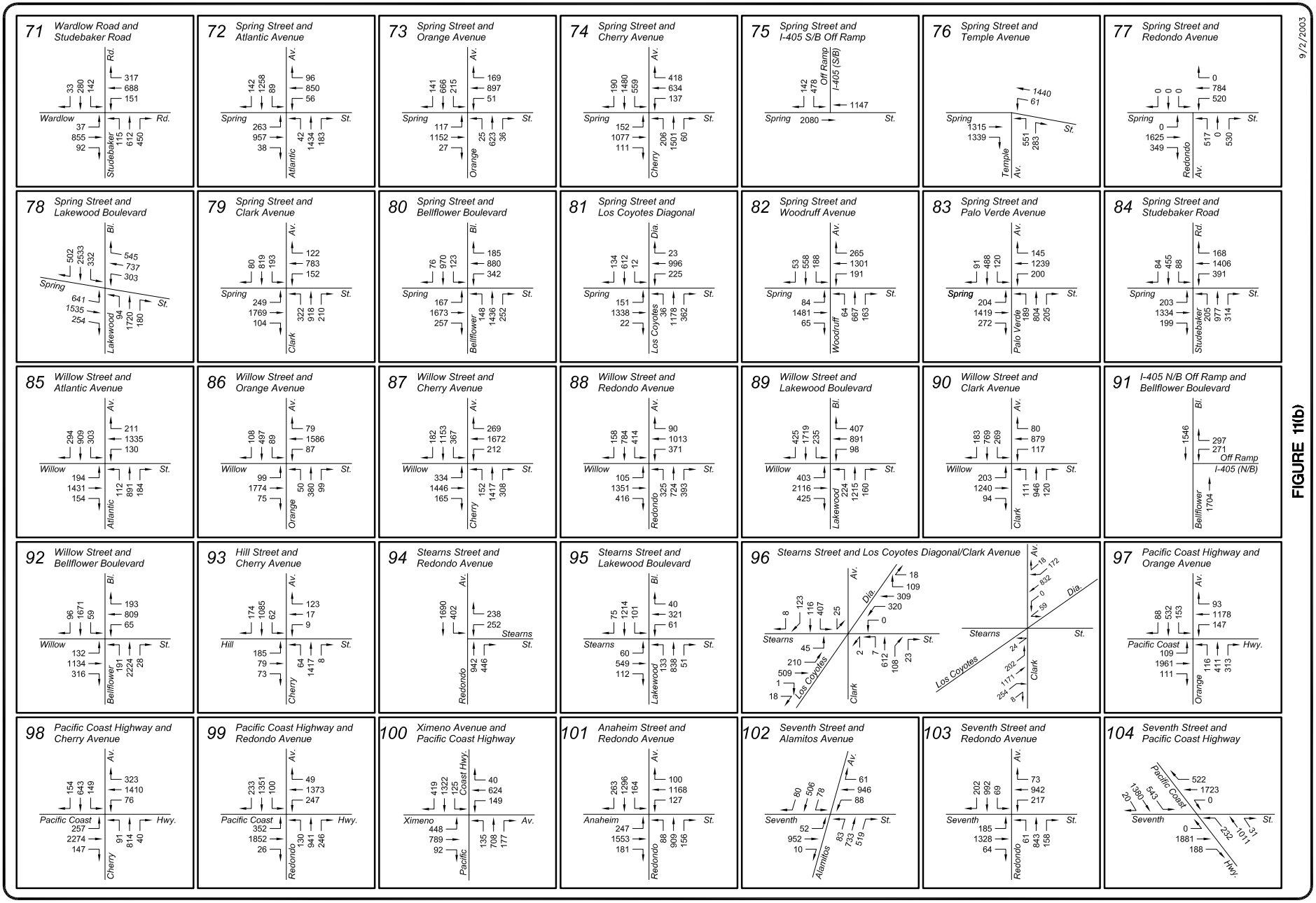

FIGURE 11(b)

9/2/2003

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FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
PM PEAK HOUR

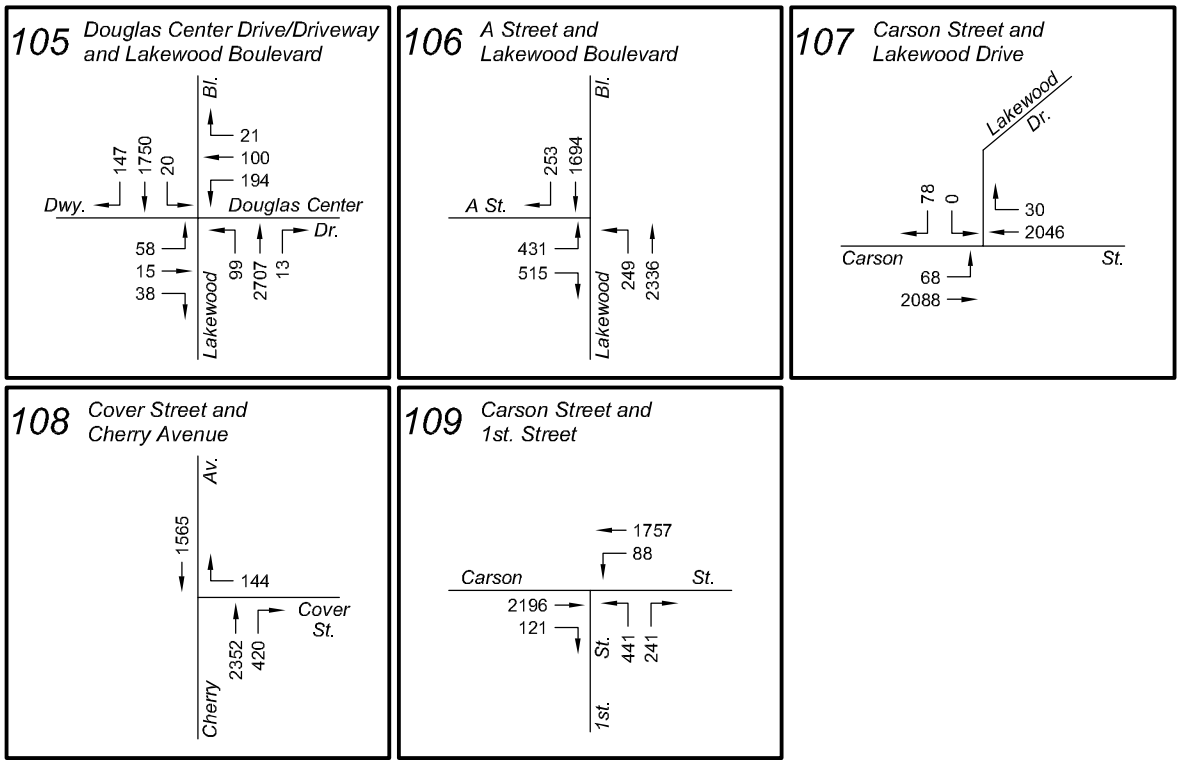

FIGURE 11(b)

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FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
PM PEAK HOUR

C&A
CRAIN & ASSOCIATES
2007 Sawtelle Boulevard
Los Angeles, California 90025
(310) 473-6508
Transportation Planning • Traffic Engineering

Table 12
Intersection V/C and LOS Summary
Future (2020) Traffic Conditions

No.	Intersection	Peak Hour	Existing V/C	Existing LOS	Future Without Project V/C	Future Without Project LOS	Future With Project V/C	Future With Project LOS	Future With Project Impact	With Project + All Transportation/ Mitigation Measures V/C	With Project + All Transportation/ Mitigation Measures LOS	With Project + All Transportation/ Mitigation Measures Impact
1	Rosecrans Avenue and	AM	0.851	D	0.878	D	0.890	D	0.012	0.863	D	-0.015
	Lakewood Boulevard	PM	1.044	F	1.116	F	1.132	F	0.016	1.098	F	-0.018
2	Alondra Boulevard and	AM	0.653	B	0.804	D	0.841	D	0.037	0.796	C	-0.008
	Paramount Boulevard	PM	0.899	D	0.957	E	1.013	F	0.056 *	0.953	E	-0.004
3	Alondra Boulevard and	AM	0.801	D	0.893	D	0.932	E	0.039 *	0.899	D	0.006
	Lakewood Boulevard	PM	1.041	F	1.099	F	1.126	F	0.027 *	1.090	F	-0.009
4	Flower Street and	AM	0.684	B	0.712	C	0.750	C	0.038	0.676	B	-0.036
	Lakewood Boulevard	PM	0.782	C	0.851	D	0.884	D	0.033	0.801	D	-0.050
5	SR-91 W/B On/Off Ramps and	AM	0.534	A	0.584	A	0.588	A	0.004	0.548	A	-0.036
	Cherry Avenue	PM	0.615	B	0.650	B	0.656	B	0.006	0.606	B	-0.044
6	SR-91 E/B On/Off Ramps and	AM	0.546	A	0.571	A	0.587	A	0.016	0.543	A	-0.028
	Cherry Avenue	PM	0.554	A	0.626	B	0.638	B	0.012	0.608	B	-0.018
7	SR-91 W/B On/Off Ramps and	AM	0.545	A	0.654	B	0.707	C	0.053	0.659	B	0.005
	Paramount Boulevard	PM	0.699	B	0.803	D	0.835	D	0.032	0.793	C	-0.010
8	SR-91 E/B On/Off Ramps and	AM	0.565	A	0.656	B	0.738	C	0.082	0.672	B	0.016
	Paramount Boulevard	PM	0.644	B	0.804	D	0.874	D	0.070	0.810	D	0.006
9	SR-91 W/B On/Off Ramps and	AM	0.476	A	0.483	A	0.538	A	0.055	0.481	A	-0.002
	Lakewood Boulevard	PM	0.617	B	0.654	B	0.700	B	0.046	0.633	B	-0.021
10	SR-91 E/B On/Off Ramps and	AM	0.62	B	0.656	B	0.718	C	0.062	0.646	B	-0.010
	Lakewood Boulevard	PM	0.727	C	0.770	C	0.853	D	0.083	0.767	C	-0.003
11	Artesia Boulevard and	AM	0.907	E	0.978	E	0.994	E	0.016	0.904	E	-0.074
	Cherry Avenue	PM	1.144	F	1.236	F	1.245	F	0.009	1.162	F	-0.074
12	Artesia Boulevard and	AM	0.71	C	0.838	D	0.893	D	0.055	0.820	D	-0.018
	Paramount Boulevard	PM	1.023	F	1.138	F	1.216	F	0.078 *	1.138	F	0.000
13	Artesia Boulevard and	AM	1.029	F	1.069	F	1.134	F	0.065 *	1.021	F	-0.048
	Lakewood Boulevard	PM	1.117	F	1.220	F	1.277	F	0.057 *	1.152	F	-0.068
14	South Street and	AM	0.494	A	0.570	A	0.592	A	0.022	0.573	A	0.003
	Orange Avenue	PM	0.522	A	0.641	B	0.663	B	0.022	0.642	B	0.001
15	South Street and	AM	0.88	D	0.962	E	0.968	E	0.006	0.892	D	-0.070
	Cherry Avenue	PM	1.166	F	1.266	F	1.275	F	0.009	1.194	F	-0.072

Table 12 (cont.)
Intersection V/C and LOS Summary
Future (2020) Traffic Conditions

No.	Intersection	Peak Hour	Existing V/C	Existing LOS	Future Without Project V/C	Future Without Project LOS	Future With Project V/C	Future With Project LOS	Future With Project Impact	With Project + All Transportation/ Mitigation Measures V/C	With Project + All Transportation/ Mitigation Measures LOS	With Project + All Transportation/ Mitigation Measures Impact
16	South Street and	AM	0.653	B	0.776	C	0.858	D	0.082	0.790	C	0.014
	Paramount Boulevard	PM	0.887	D	0.988	E	1.068	F	0.080 *	0.995	E	0.007
17	South Street and	AM	0.776	C	0.838	D	0.938	E	0.100 *	0.842	D	0.004
	Lakewood Boulevard	PM	1.153	F	1.215	F	1.316	F	0.101 *	1.187	F	-0.028
18	South Street and	AM	0.785	C	0.849	D	0.874	D	0.025	0.846	D	-0.003
	Clark Avenue	PM	0.943	E	1.014	F	1.039	F	0.025 *	1.005	F	-0.009
19	South Street and	AM	0.71	C	0.739	C	0.746	C	0.007	0.677	B	-0.062
	Bellflower Boulevard	PM	0.865	D	0.926	E	0.940	E	0.014	0.853	D	-0.073
20	Market Street and	AM	0.682	B	0.785	C	0.800	C	0.015	0.775	C	-0.010
	Long Beach Boulevard	PM	0.988	E	1.196	F	1.203	F	0.007	1.166	F	-0.030
21	Market Street and	AM	0.672	B	0.816	D	0.858	D	0.042	0.801	D	-0.015
	Cherry Avenue	PM	0.855	D	1.008	F	1.026	F	0.018	0.975	E	-0.033
22	Candlewood Street and	AM	0.495	A	0.658	B	0.785	C	0.127	0.693	B	0.035
	Paramount Boulevard	PM	0.641	B	0.809	D	0.915	E	0.106 *	0.831	D	0.022
23	Candlewood Street and	AM	0.543	A	0.634	B	0.756	C	0.122	0.673	B	0.039
	Lakewood Boulevard	PM	0.768	C	0.906	E	1.002	F	0.096 *	0.900	D	-0.006
24	Candlewood Street and	AM	0.597	A	0.703	C	0.705	C	0.002	0.685	B	-0.018
	Clark Avenue	PM	0.885	D	1.171	F	1.183	F	0.012	1.148	F	-0.023
25	Candlewood Street and	AM	0.834	D	0.908	E	0.916	E	0.008	0.831	D	-0.077
	Bellflower Boulevard	PM	1.097	F	1.225	F	1.230	F	0.005	1.118	F	-0.107
26	Del Amo Boulevard and	AM	0.723	C	0.791	C	0.807	D	0.016	0.782	C	-0.009
	Sante Fe Avenue	PM	1.195	F	1.282	F	1.293	F	0.011	1.254	F	-0.028
27	Del Amo Boulevard and	AM	0.883	D	0.994	E	1.021	F	0.027 *	0.926	E	-0.068
	Long Beach Boulevard	PM	1.027	F	1.219	F	1.232	F	0.013	1.118	F	-0.101
28	Del Amo Boulevard and	AM	0.808	D	0.895	D	0.903	E	0.008 *	0.821	D	-0.074
	Atlantic Avenue	PM	1.037	F	1.162	F	1.169	F	0.007	1.062	F	-0.100
29	Del Amo Boulevard and	AM	0.834	D	0.971	E	0.989	E	0.018	0.896	D	-0.075
	Orange Avenue	PM	1.008	F	1.150	F	1.184	F	0.034 *	1.073	F	-0.077
30	Del Amo Boulevard and	AM	0.869	D	1.023	F	1.068	F	0.045 *	1.000	E	-0.023
	Cherry Avenue	PM	1.027	F	1.105	F	1.121	F	0.016	1.058	F	-0.047

Table 12 (cont.)
Intersection V/C and LOS Summary
Future (2020) Traffic Conditions

No.	Intersection	Peak Hour	Existing V/C	Existing LOS	Future Without Project V/C	Future Without Project LOS	Future With Project V/C	Future With Project LOS	Future With Project Impact	With Project + All Transportation/ Mitigation Measures V/C	With Project + All Transportation/ Mitigation Measures LOS	With Project + All Transportation/ Mitigation Measures Impact
31	Del Amo Boulevard and	AM	0.807	D	0.948	E	1.079	F	0.131 *	0.913	E	-0.035
	Paramount Boulevard	PM	0.831	D	0.971	E	1.117	F	0.146 *	0.945	E	-0.026
32	Del Amo Boulevard and	AM	1.015	F	1.118	F	1.335	F	0.217 *	1.053	F	-0.065
	Lakewood Boulevard	PM	1.237	F	1.275	F	1.441	F	0.166 *	1.220	F	-0.055
33	Del Amo Boulevard and	AM	0.721	C	0.876	D	0.905	E	0.029 *	0.820	D	-0.056
	Clark Avenue	PM	0.938	E	0.997	E	1.035	F	0.038 *	0.937	E	-0.060
34	Del Amo Boulevard and	AM	0.951	E	1.006	F	1.031	F	0.025 *	0.933	E	-0.073
	Bellflower Boulevard	PM	1.039	F	1.094	F	1.119	F	0.025 *	1.014	F	-0.080
35	Del Amo Boulevard and	AM	0.838	D	0.900	D	0.949	E	0.049 *	0.856	D	-0.044
	Woodruff Avenue	PM	0.975	E	1.018	F	1.056	F	0.038 *	0.958	E	-0.060
36	Del Amo Boulevard and	AM	0.689	B	0.767	C	0.790	C	0.023	0.716	C	-0.051
	Palo Verde Avenue	PM	0.933	E	1.039	F	1.067	F	0.028 *	0.967	E	-0.072
37	Del Amo Boulevard and	AM	0.778	C	0.812	D	0.842	D	0.030	0.762	C	-0.050
	Studebaker Road	PM	0.883	D	0.974	E	0.989	E	0.015	0.897	D	-0.077
38	Centralia Street and	AM	0.62	B	0.660	B	0.697	B	0.037	0.672	B	0.012
	Clark Avenue	PM	0.757	C	0.792	C	0.845	D	0.053	0.814	D	0.022
39	Centralia Street and	AM	0.468	A	0.547	A	0.560	A	0.013	0.507	A	-0.040
	Bellflower Boulevard	PM	0.62	B	0.647	B	0.658	B	0.011	0.597	A	-0.050
40	San Antonio Drive and	AM	0.544	A	0.745	C	0.783	C	0.038	0.707	C	-0.038
	Long Beach Boulevard	PM	0.822	D	1.164	F	1.175	F	0.011	1.066	F	-0.098
41	Carson Street and	AM	0.61	B	0.828	D	0.863	D	0.035	0.781	C	-0.047
	Atlantic Avenue	PM	0.842	D	0.934	E	0.965	E	0.031 *	0.874	D	-0.060
42	Carson Street and	AM	0.613	B	0.725	C	0.773	C	0.048	0.697	B	-0.028
	Orange Avenue	PM	0.714	C	0.786	C	0.822	D	0.036	0.744	C	-0.042
43	Carson Street and	AM	0.672	B	0.864	D	0.908	E	0.044 *	0.854	D	-0.010
	Cherry Avenue	PM	0.886	D	1.052	F	1.133	F	0.081 *	1.021	F	-0.031
44	Carson Street and	AM	0.575	A	0.699	B	0.835	D	0.136	0.682	B	-0.017
	Paramount Boulevard	PM	0.865	D	1.104	F	1.368	F	0.264 *	1.045	F	-0.059
45	Carson Street and	AM	0.729	C	0.835	D	1.085	F	0.250 *	0.854	D	0.019
	Lakewood Boulevard	PM	0.857	D	0.934	E	1.170	F	0.236 *	1.017	F	0.083 *

Table 12 (cont.)
Intersection V/C and LOS Summary
Future (2020) Traffic Conditions

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46	Carson Street and	AM	0.482	A	0.558	A	0.692	B	0.134	0.674	B	0.116
	Faculty Avenue[2]	PM	0.602	B	0.731	C	0.919	E	0.188 *	0.899	D	0.168
47	Carson Street and	AM	0.724	C	0.758	C	0.843	D	0.085	0.757	C	-0.001
	Clark Avenue	PM	0.942	E	1.043	F	1.142	F	0.099 *	1.028	F	-0.015
48	Carson Street and	AM	0.884	D	0.967	E	1.105	F	0.138 *	0.857	D	-0.110
	Bellflower Boulevard	PM	1.062	F	1.146	F	1.236	F	0.090 *	1.114	F	-0.032
49	Carson Street and	AM	0.7	B	0.768	C	0.839	D	0.071	0.754	C	-0.014
	Woodruff Avenue	PM	0.882	D	0.973	E	1.041	F	0.068 *	0.940	E	-0.033
50	Carson Street and	AM	0.88	D	1.024	F	1.111	F	0.087 *	1.000	E	-0.024
	Palo Verde Avenue	PM	0.924	E	1.096	F	1.146	F	0.050 *	1.037	F	-0.059
51	Carson Street and	AM	0.718	C	0.807	D	0.830	D	0.023	0.751	C	-0.056
	Los Coyotes Diagonal	PM	1.022	F	1.093	F	1.124	F	0.031 *	1.019	F	-0.074
52	Carson Street and	AM	0.553	A	0.518	A	0.537	A	0.019	0.485	A	-0.033
	I-605 SB Off-Ramp	PM	0.899	D	0.703	C	0.729	C	0.026	0.660	B	-0.043
53	Carson Street and	AM	0.581	A	0.608	B	0.615	B	0.007	0.558	A	-0.050
	I-605 NB On/Off Ramps	PM	0.622	B	0.685	B	0.700	B	0.015	0.635	B	-0.050
54	Carson Street and	AM	0.725	C	0.737	C	0.783	C	0.046	0.706	C	-0.031
	Pioneer Boulevard	PM	1.101	F	1.229	F	1.248	F	0.019	1.133	F	-0.096
55	Carson Street and	AM	0.542	A	0.877	D	0.895	D	0.018	0.867	D	-0.010
	Norwalk Boulevard	PM	0.896	D	1.177	F	1.204	F	0.027 *	1.166	F	-0.011
56	Cover Street and	AM	0.453	A	0.510	A	0.629	B	0.119	0.640	B	0.130
	Paramount Boulevard	PM	0.681	B	0.545	A	0.578	A	0.033	0.768	C	0.223
57	Bixby Road and	AM	0.637	B	0.797	C	0.804	D	0.007	0.730	C	-0.067
	Atlantic Avenue	PM	0.681	B	0.810	D	0.817	D	0.007	0.743	C	-0.067
58	Bixby Road and	AM	0.839	D	0.778	C	0.789	C	0.011	0.765	C	-0.013
	Orange Avenue	PM	0.767	C	0.822	D	0.828	D	0.006	0.804	D	-0.018
59	Bixby Road and	AM	0.532	A	0.679	B	0.777	C	0.098	0.707	C	0.028
	Cherry Avenue	PM	0.553	A	0.704	C	0.830	D	0.126	0.774	C	0.070
60	Conant Street/B Street and	AM	0.402	A	0.551	A	1.367	F	0.816 *	0.936	E	0.385 *
	Lakewood Boulevard	PM	0.473	A	0.581	A	1.201	F	0.620 *	0.888	D	0.307

Table 12 (cont.)
Intersection V/C and LOS Summary
Future (2020) Traffic Conditions

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61	Conant Street and	AM	0.342	A	0.371	A	0.734	C	0.363	0.668	B	0.297
	Clark Avenue	PM	0.342	A	0.385	A	0.397	A	0.012	0.384	A	-0.001
62	Conant Street and	AM	0.44	A	0.521	A	0.669	B	0.148	0.588	A	0.067
	Bellflower Boulevard	PM	0.59	A	0.625	B	0.631	B	0.006	0.573	A	-0.052
63	Wardlow Road and	AM	0.793	C	1.011	F	1.024	F	0.013	0.928	E	-0.083
	Atlantic Avenue	PM	0.86	D	1.040	F	1.067	F	0.027 *	0.967	E	-0.073
64	Wardlow Road and	AM	0.817	D	0.822	D	0.861	D	0.039	0.827	D	0.005
	Orange Avenue	PM	0.868	D	0.865	D	0.900	D	0.035	0.870	D	0.005
65	Wardlow Road and	AM	0.838	D	1.115	F	1.145	F	0.030 *	0.835	D	-0.280
	Cherry Avenue	PM	0.982	E	1.175	F	1.246	F	0.071 *	0.965	E	-0.210
66	Wardlow Road/D. Douglas Dr.	AM	0.688	B	0.852	D	0.946	E	0.094 *	0.849	D	-0.003
	and Lakewood Boulevard	PM	0.564	A	0.722	C	0.995	E	0.273 *	0.879	D	0.157
67	Wardlow Road and	AM	0.585	A	0.598	A	0.690	B	0.092	0.659	B	0.061
	Clark Avenue	PM	0.514	A	0.562	A	0.740	C	0.178	0.699	B	0.137
68	Wardlow Road and	AM	0.772	C	0.835	D	0.882	D	0.047	0.797	C	-0.038
	Bellflower Boulevard	PM	0.931	E	1.003	F	1.120	F	0.117 *	1.007	F	0.004
69	Wardlow Road and	AM	0.76	C	0.829	D	0.876	D	0.047	0.844	D	0.015
	Woodruff Avenue	PM	0.76	C	0.808	D	0.873	D	0.065	0.841	D	0.033
70	Wardlow Road and	AM	0.54	A	0.627	B	0.667	B	0.040	0.643	B	0.016
	Palo Verde Avenue	PM	0.667	B	0.749	C	0.793	C	0.044	0.766	C	0.017
71	Wardlow Road and	AM	0.692	B	0.791	C	0.820	D	0.029	0.793	C	0.002
	Studebaker Road	PM	0.784	C	0.865	D	0.901	E	0.036 *	0.871	D	0.006
72	Spring Street and	AM	0.876	D	1.081	F	1.087	F	0.006	0.988	E	-0.093
	Atlantic Avenue	PM	0.983	E	1.349	F	1.353	F	0.004	1.230	F	-0.119
73	Spring Street and	AM	0.747	C	0.837	D	0.842	D	0.005	0.765	C	-0.072
	Orange Avenue	PM	0.728	C	0.918	E	0.931	E	0.013	0.845	D	-0.073
74	Spring Street and	AM	0.633	B	0.857	D	0.882	D	0.025	0.799	C	-0.058
	Cherry Avenue	PM	0.774	C	1.010	F	1.037	F	0.027 *	0.940	E	-0.070
75	Spring Street and	AM	0.75	C	0.752	C	0.776	C	0.024	0.702	C	-0.050
	I-405 Southbound Off-Ramp	PM	0.674	B	0.888	D	0.905	E	0.017 *	0.821	D	-0.067

Table 12 (cont.)
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76	Spring Street and	AM	0.641	B	0.701	C	0.793	C	0.092	0.654	B	-0.047
	Temple Avenue	PM	0.617	B	1.140	F	1.140	F	0.000	1.037	F	-0.103
77	Spring Street and	AM	0.56	A	0.628	B	0.646	B	0.018	0.585	A	-0.043
	Redondo Avenue	PM	0.762	C	0.895	D	0.936	E	0.041 *	0.847	D	-0.048
78	Spring Street and	AM	0.857	D	1.023	F	1.169	F	0.146 *	1.046	F	0.023 *
	Lakewood Boulevard	PM	0.825	D	0.989	E	1.264	F	0.275 *	1.123	F	0.134 *
79	Spring Street and	AM	0.583	A	0.643	B	0.707	C	0.064	0.637	B	-0.006
	Clark Avenue	PM	0.732	C	0.879	D	0.987	E	0.108 *	0.887	D	0.008
80	Spring Street and	AM	0.896	D	0.961	E	0.992	E	0.031 *	0.897	D	-0.064
	Bellflower Boulevard	PM	0.96	E	1.157	F	1.210	F	0.053 *	1.095	F	-0.062
81	Spring Street and	AM	0.791	C	0.900	D	0.908	E	0.008 *	0.825	D	-0.075
	Los Coyotes Diagonal	PM	0.819	D	0.919	E	0.940	E	0.021 *	0.853	D	-0.066
82	Spring Street and	AM	0.65	B	0.843	D	0.851	D	0.008	0.773	C	-0.070
	Woodruff Avenue	PM	0.639	B	0.792	C	0.813	D	0.021	0.737	C	-0.055
83	Spring Street and	AM	0.642	B	0.799	C	0.810	D	0.011	0.735	C	-0.064
	Palo Verde Avenue	PM	0.786	C	0.999	E	1.021	F	0.022 *	0.926	E	-0.073
84	Spring Street and	AM	0.772	C	0.949	E	0.952	E	0.003	0.865	D	-0.084
	Studebaker Road	PM	0.89	D	1.076	F	1.087	F	0.011	0.987	E	-0.089
85	Willow Street and	AM	0.78	C	0.891	D	0.906	E	0.015 *	0.823	D	-0.068
	Atlantic Avenue	PM	1.005	F	1.129	F	1.143	F	0.014	1.037	F	-0.092
86	Willow Street and	AM	0.754	C	0.890	D	0.904	E	0.014 *	0.820	D	-0.070
	Orange Avenue	PM	0.812	D	0.905	E	0.919	E	0.014	0.835	D	-0.070
87	Willow Street and	AM	0.812	D	0.909	E	0.915	E	0.006	0.832	D	-0.077
	Cherry Avenue	PM	0.844	D	1.123	F	1.147	F	0.024 *	1.041	F	-0.082
88	Willow Street and	AM	0.675	B	0.700	B	0.704	C	0.004	0.640	B	-0.060
	Redondo Avenue	PM	0.807	D	0.901	E	0.934	E	0.033 *	0.846	D	-0.055
89	Willow Street and	AM	0.887	D	0.918	E	0.940	E	0.022 *	0.851	D	-0.067
	Lakewood Boulevard	PM	0.996	E	1.101	F	1.174	F	0.073 *	1.060	F	-0.041
90	Willow Street and	AM	0.859	D	1.011	F	1.032	F	0.021 *	0.936	E	-0.075
	Clark Avenue	PM	0.742	C	0.784	C	0.835	D	0.051	0.754	C	-0.030

Table 12 (cont.)
Intersection V/C and LOS Summary
Future (2020) Traffic Conditions

No.	Intersection	Peak Hour	Existing V/C	Existing LOS	Future Without Project V/C	Future Without Project LOS	Future With Project V/C	Future With Project LOS	Future With Project Impact	With Project + All Transportation/ Mitigation Measures V/C	With Project + All Transportation/ Mitigation Measures LOS	With Project + All Transportation/ Mitigation Measures Impact
91	I-405 N/B Off Ramp and	AM	0.464	A	0.413	A	0.432	A	0.019	0.390	A	-0.023
	Bellflower Boulevard	PM	0.49	A	0.517	A	0.526	A	0.009	0.477	A	-0.040
92	Willow Street and	AM	0.838	D	0.950	E	0.959	E	0.009	0.870	D	-0.080
	Bellflower Boulevard	PM	0.943	E	1.027	F	1.035	F	0.008	0.940	E	-0.087
93	Hill Street and	AM	0.475	A	0.576	A	0.625	B	0.049	0.563	A	-0.013
	Cherry Avenue	PM	0.549	A	0.810	D	0.824	D	0.014	0.748	C	-0.062
94	Stearns Street and	AM	0.603	B	0.683	B	0.689	B	0.006	0.668	B	-0.015
	Redondo Avenue	PM	0.579	A	0.684	B	0.688	B	0.004	0.668	B	-0.016
95	Stearns Street and	AM	0.778	C	0.899	D	0.933	E	0.034 *	0.844	D	-0.055
	Lakewood Boulevard	PM	0.853	D	1.058	F	1.146	F	0.088 *	1.034	F	-0.024
96	Stearns Street/Clark Ave and	AM	0.907	E	1.053	F	1.106	F	0.053 *	1.067	F	0.014
	Los Coyotes Diagonal	PM	1.142	F	1.458	F	1.486	F	0.028 *	1.439	F	-0.019
97	Pacific Coast Highway and	AM	0.833	D	0.907	E	0.910	E	0.003	0.834	D	-0.073
	Orange Avenue	PM	0.822	D	0.898	D	0.904	E	0.006 *	0.829	D	-0.069
98	Pacific Coast Highway and	AM	1.004	F	1.109	F	1.175	F	0.066 *	1.060	F	-0.049
	Cherry Avenue	PM	1.034	F	1.342	F	1.357	F	0.015	1.233	F	-0.109
99	Pacific Coast Highway and	AM	0.998	E	1.179	F	1.206	F	0.027 *	1.167	F	-0.012
	Redondo Avenue	PM	1.004	F	1.177	F	1.235	F	0.058 *	1.193	F	0.016
100	Ximeno Avenue and	AM	0.912	E	0.986	E	1.006	F	0.020 *	0.974	E	-0.012
	Pacific Coast Highway	PM	0.842	D	0.882	D	0.888	D	0.006	0.862	D	-0.020
101	Anaheim Street and	AM	0.755	C	0.889	D	0.908	E	0.019 *	0.879	D	-0.010
	Redondo Avenue	PM	1.035	F	1.256	F	1.293	F	0.037 *	1.252	F	-0.004
102	Seventh Street and	AM	0.791	C	0.910	E	0.913	E	0.003	0.886	D	-0.024
	Alamitos Avenue	PM	0.779	C	0.881	D	0.884	D	0.003	0.858	D	-0.023
103	Seventh Street and	AM	0.864	D	0.943	E	0.964	E	0.021 *	0.934	E	-0.009
	Redondo Avenue	PM	1.024	F	1.132	F	1.155	F	0.023 *	1.119	F	-0.013
104	Seventh Street and	AM	1.01	F	1.038	F	1.062	F	0.024 *	1.028	F	-0.010
	Pacific Coast Highway	PM	1.051	F	1.123	F	1.148	F	0.025 *	1.111	F	-0.012
105	Douglas Center Drive/Project	AM	0.456	A	0.635	B	0.897	D	0.262	0.768	C	0.133
	Access and Lakewood Blvd	PM	0.494	A	0.651	B	0.832	D	0.181	0.739	C	0.088

Table 12 (cont.)
Intersection V/C and LOS Summary
Future (2020) Traffic Conditions

No.	Intersection	Peak Hour	Existing V/C	Existing LOS	Future Without Project V/C	Future Without Project LOS	Future With Project V/C	Future With Project LOS	Future With Project Impact	With Project + All Transportation/ Mitigation Measures V/C	With Project + All Transportation/ Mitigation Measures LOS	With Project + All Transportation/ Mitigation Measures Impact
106	A Street and	AM	[1]		[1]		1.013	F	*	0.784	C	
	Lakewood Boulevard	PM	[1]		[1]		0.977	E	*	0.781	C	
107	Carson Street and	AM	0.418	A	0.441	A	0.449	A	0.008	0.444	A	0.003
	Lakewood Drive[2]	PM	0.449	A	0.530	A	0.591	A	0.061	0.582	A	0.052
108	Cover Street and	AM	0.426	A	0.549	A	0.628	B	0.079	0.591	A	0.042
	Cherry Avenue[2]	PM	0.71	C	0.906	E	0.917	E	0.011	0.682	B	-0.224
109	Carson Street and	AM	[1]		[1]		0.590	A		0.511	A	
	First Street[2]	PM	[1]		[1]		0.883	D		0.771	C	

* Denotes a significant project impact.
[1] This intersection does not exist and would be created with the development of the project.
[2] This intersection currently is not signalized; signalization has been assumed for analysis purposes.

Measures addressing significant project traffic impacts are described in the Mitigation Measures section.

It should be noted that the procedure described above substantially overstates project traffic impacts, especially at the edges of the study area. The procedure assumes that all employees at the project site will also continue to work at the jobs they otherwise hold. For example, in the residential neighborhoods to the east of the project, just as many people are assumed to commute to downtown Los Angeles each day, without or with the project, despite the fact that some of these commuters would instead be working in the more proximate jobs available in the PacifiCenter project. Thus, traffic volumes through study intersections to the east tend to be overstated under the With Project condition due to, among other factors, those employees working at PacifiCenter who will not need to find jobs in downtown Los Angeles or elsewhere. The assumption of added traffic from the project, rather than a shift in traffic as tends to actually occur, has been made in this study to assure that it is conservative. Therefore, when evaluating the magnitude of impacts, especially near the boundaries of the study area, this overstatement of volumes should be considered.

ANALYSIS OF FUTURE (2020) FREEWAY CONDITIONS

To address the increasing public concern that traffic congestion was impacting the quality of life and economic vitality of the State of California, the Congestion Management Program (CMP) was enacted by Proposition 111. The intent of the CMP is to provide the analytical basis for transportation decisions through the State Transportation Improvement Program (STIP) process. A Countywide approach has been established by the Metropolitan Transportation Authority, the Local CMP agency, to implement the statutory requirements of the CMP. The Countywide approach includes designating a highway network that includes all state highways and

arterials with the County and monitoring the network's level of service standards. This monitoring of the CMP network is one of the responsibilities of local jurisdictions. If level of service standards deteriorate, then local jurisdictions must prepare a deficiency plan to be in conformance with the Countywide plan.

All development projects which are required to prepare an EIR are subject to the Land Use Analysis program of the CMP. This requirement is to provide decision-makers with the project-specific traffic impacts created by large projects on the CMP highway network.

In order to analyze the impact of the project on the regional transportation system (i.e., the freeway network), the results of the computerized transportation model were again examined. Year 2020 freeway volumes, including project traffic, were forecast in the same manner as for the surface street study intersections. Both the mainline segments, including CMP monitoring locations, and the freeway on-ramps of the San Diego and Artesia Freeways were analyzed in the study area to assess the project's effect on the regional transportation system.

The 2020 Without Project freeway mainline segment and on-ramp volumes are shown in Tables 13(a), 13(b) and 14(a). Traffic volumes attributable to the project, as determined earlier, were then analyzed as an incremental increase to the Without Project volumes, resulting in the With Project volumes, also provided in Tables 13(a), 13(b) and 14(b). This methodology allowed both an assessment of overall future freeway conditions and a determination of project impacts to these regional transportation facilities, as indicated in these tables.

These tables show that the San Diego Freeway and the Artesia Freeway would be heavily congested without the project. Almost all of the analyzed mainline segments would be operating at LOS E or F in one or both peak hours, with both freeways being

Table 13(a)
San Diego Freeway (I-405) Demand/Capacity (D/C) and Level of Service (LOS) Summary
Future (2020) Without and With Project Traffic Conditions

				Future (2020) Without Project				Future (2020) With Project				
Freeway Segment	Peak Hour	Direction	Freeway Capacity	Daily Demand	Peak Hour Demand	D/C Ratio	LOS	Daily Demand	Peak Hour Demand	D/C Ratio	LOS	Project Impact
1 San Diego Freeway (I-405)	AM	N/B	9,600	269,400	10,780	1.123	F	273,900	10,861	1.131	F	0.008
s/o Route 110 at Carson Scales		S/B	9,600		8,270	0.861	D		8,483	0.884	D	0.023
(CMP Station)	PM	N/B	9,600		8,900	0.927	D		9,157	0.954	E	0.027
		S/B	9,600		10,570	1.101	F		10,665	1.111	F	0.010
2 San Diego Freeway (I-405)	AM	N/B	7,600	312,300	10,700	1.408	F	319,500	10,815	1.423	F	0.015
at Santa Fe Ave		S/B	7,600		9,730	1.280	F		10,056	1.323	F	0.043 *
(CMP Station)	PM	N/B	7,600		10,140	1.334	F		10,506	1.382	F	0.048 *
		S/B	7,600		10,750	1.414	F		10,891	1.433	F	0.019
3 San Diego Freeway (I-405)	AM	N/B	9,600	302,900	12,510	1.303	F	310,900	12,657	1.318	F	0.015
betw. I-710 and Atlantic Ave		S/B	9,600		10,010	1.043	F		10,372	1.080	F	0.037 *
	PM	N/B	9,600		11,450	1.193	F		11,975	1.247	F	0.054 *
		S/B	9,600		11,850	1.234	F		12,021	1.252	F	0.018
4 San Diego Freeway (I-405)	AM	N/B	9,600	307,400	10,180	1.060	F	315,400	10,290	1.072	F	0.012
betw. Atlantic Ave and Cherry Ave		S/B	9,600		10,500	1.094	F		10,880	1.133	F	0.039 *
	PM	N/B	9,600		10,080	1.050	F		10,515	1.095	F	0.045 *
		S/B	9,600		11,480	1.196	F		11,659	1.214	F	0.018
5 San Diego Freeway (I-405)	AM	N/B	9,600	296,800	10,670	1.111	F	300,800	10,786	1.124	F	0.013
betw. Cherry Ave and Lakewood Blvd		S/B	9,600		9,950	1.036	F		9,954	1.037	F	0.001
	PM	N/B	9,600		9,550	0.995	E		9,997	1.041	F	0.046 *
		S/B	9,600		11,890	1.239	F		11,891	1.239	F	0.000
6 San Diego Freeway (I-405)	AM	N/B	9,600	295,700	9,690	1.009	F	298,300	9,691	1.009	F	0.000
betw. Lakewood Blvd and Bellflower Blvd		S/B	9,600		8,460	0.881	D		8,550	0.891	D	0.010
	PM	N/B	9,600		8,540	0.890	D		8,540	0.890	D	0.000
		S/B	9,600		10,160	1.058	F		10,397	1.083	F	0.025 *
7 San Diego Freeway (I-405)	AM	N/B	9,600	282,700	10,390	1.082	F	291,100	10,705	1.115	F	0.033 *
betw. Bellflower Blvd and Woodruff Ave		S/B	9,600		8,440	0.879	D		8,607	0.897	D	0.018
	PM	N/B	9,600		9,740	1.015	F		9,949	1.036	F	0.021 *
		S/B	9,600		9,520	0.992	E		9,959	1.037	F	0.045 *
8 San Diego Freeway (I-405)	AM	N/B	9,600	282,300	9,870	1.028	F	291,500	10,280	1.071	F	0.043 *
betw. Woodruff Ave and Studebaker Rd		S/B	9,600		8,530	0.889	D		8,695	0.906	D	0.017
	PM	N/B	9,600		8,330	0.868	D		8,535	0.889	D	0.021
		S/B	9,600		10,520	1.096	F		10,954	1.141	F	0.045 *
9 San Diego Freeway (I-405)	AM	N/B	7,600	294,200	10,460	1.376	F	302,100	10,819	1.424	F	0.048 *
n/o Route 22		S/B	9,600		9,530	0.993	E		9,681	1.008	F	0.015
(CMP Station)	PM	N/B	7,600		9,400	1.237	F		9,587	1.261	F	0.024 *
		S/B	9,600		10,930	1.139	F		11,320	1.179	F	0.040 *

* Denotes a significant project impact prior to additional mitigation considerations.

Table 13(b)
Artesia Freeway (SR-91) Demand/Capacity (D/C) and Level of Service (LOS) Summary
Future (2020) Without and With Project Traffic Conditions

				Future (2020) Without Project				Future (2020) With Project				
Freeway Segment	Peak Hour	Direction	Freeway Capacity	Daily Demand	Peak Hour Demand	D/C Ratio	LOS	Daily Demand	Peak Hour Demand	D/C Ratio	LOS	Project Impact
1 Artesia Freeway (SR-91)	AM	E/B	11,600	227,600	12,590	1.085	F	228,400	12,647	1.090	F	0.005
e/o Alameda St / Santa Fe Ave		W/B	11,600		6,550	0.565	C		6,559	0.565	C	0.000
(CMP Station)	PM	E/B	11,600		8,520	0.734	C		8,546	0.737	C	0.003
		W/B	11,600		10,630	0.916	D		10,671	0.920	D	0.004
2 Artesia Freeway (SR-91)	AM	E/B	9,600	278,900	12,160	1.267	F	281,300	12,371	1.289	F	0.022 *
betw. I-710 and Cherry Ave		W/B	9,600		11,790	1.228	F		11,822	1.231	F	0.003
	PM	E/B	9,600		10,620	1.106	F		10,711	1.116	F	0.010
		W/B	9,600		13,330	1.389	F		13,403	1.396	F	0.007
3 Artesia Freeway (SR-91)	AM	E/B	9,600	283,300	11,500	1.198	F	285,400	11,652	1.214	F	0.016
betw. Cherry Ave and Paramount Blvd		W/B	9,600		11,150	1.161	F		11,181	1.165	F	0.004
(CMP Station)	PM	E/B	9,600		10,040	1.046	F		10,120	1.054	F	0.008
		W/B	9,600		12,600	1.313	F		12,668	1.320	F	0.007
4 Artesia Freeway (SR-91)	AM	E/B	9,600	271,300	12,210	1.272	F	272,600	12,291	1.280	F	0.008
betw. Paramount Blvd and Lakewood Blvd		W/B	9,600		9,450	0.984	E		9,478	0.987	E	0.003
	PM	E/B	9,600		10,000	1.042	F		10,054	1.047	F	0.005
		W/B	9,600		11,660	1.215	F		11,709	1.220	F	0.005
5 Artesia Freeway (SR-91)	AM	E/B	9,600	273,500	10,490	1.093	F	276,900	10,567	1.101	F	0.008
betw. Lakewood Blvd and Bellflower Blvd		W/B	9,600		10,840	1.129	F		11,000	1.146	F	0.017
	PM	E/B	9,600		9,480	0.988	E		9,694	1.010	F	0.022 *
		W/B	9,600		11,850	1.234	F		11,929	1.243	F	0.009
6 Artesia Freeway (SR-91)	AM	E/B	7,600	289,800	9,800	1.289	F	291,000	9,828	1.293	F	0.004
betw. Norwalk Blvd and Pioneer Blvd		W/B	7,600		11,090	1.459	F		11,143	1.466	F	0.007
(CMP Station)	PM	E/B	7,600		9,550	1.257	F		9,613	1.265	F	0.008
		W/B	7,600		11,340	1.492	F		11,370	1.496	F	0.004

* Denotes a significant project impact prior to additional mitigation considerations.

Table 14(a)
Freeway On-Ramp Demand/Capacity (D/C) and Level of Service (LOS) Summary
Future (2020) Without Project Traffic Conditions

					YEAR 2020 WITHOUT PROJECT											
					AM PEAK HOUR						PM PEAK HOUR					
			Capacity		Demand		Demand/Capacity		LOS		Demand		Demand/Capacity		LOS	
No.	Route	On-Ramp	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane
1	405	SB from NB Bellflower Bl.	900		359		0.398		A		310		0.345		A	
2	405	SB from SB Bellflower Bl.	900		243		0.269		A		285		0.317		A	
3	405	NB from SB Bellflower Bl.	900		499		0.555		A		279		0.310		A	
4	405	NB from NB Bellflower Bl.	1,600		567		0.354		A		513		0.321		A	
5	405	SB from EB Willow St.	900	1,600	404	83	0.449	0.052	A	A	492	101	0.547	0.063	A	A
6	405	SB from SB Lakewood Bl.	900	1,600	217	44	0.241	0.027	A	A	394	81	0.437	0.050	A	A
7	405	NB from NB Lakewood Bl.	900	1,600	795	163	0.883	0.102	D	A	534	109	0.594	0.068	A	A
8	405	NB from SB Lakewood Bl.	900	1,600	320	66	0.355	0.041	A	A	504	103	0.560	0.064	A	A
9	405	SB from Spring St.	900	1,600	283	58	0.315	0.036	A	A	372	76	0.413	0.048	A	A
10	405	SB from SB Cherry Av.	900		640		0.711		C		580		0.644		B	
11	405	NB from WB Spring St.	900	1,600	664	136	0.737	0.085	C	A	713	146	0.792	0.091	C	A
12	405	SB from Orange Av.	900	1,600	283	58	0.314	0.036	A	A	259	54	0.288	0.033	A	A
13	405	NB from NB Cherry Av.	900		858		0.953		E		548		0.609		B	
14	405	NB from SB Cherry Av.	900	1,600	331	68	0.368	0.042	A	A	377	77	0.419	0.048	A	A
15	405	NB from EB 32nd St.	900		388		0.431		A		381		0.423		A	
16	405	SB from NB Atlantic Av.	900		303		0.336		A		428		0.476		A	
17	405	SB from SB Atlantic Av.	900		250		0.278		A		285		0.317		A	
18	405	NB from NB Atlantic Av.	900		265		0.294		A		227		0.252		A	
19	91	EB from Atlantic Av.	1,600		512		0.320		A		556		0.348		A	
20	91	WB from Cherry Av.	900	1,600	434	89	0.482	0.056	A	A	462	95	0.514	0.059	A	A
21	91	EB from Cherry Av.	1,600		809.0949		0.506		A		705		0.441		A	
22	91	WB from Paramount Bl.	1,600		568		0.355		A		716		0.447		A	
23	91	EB from Paramount Bl.	1,600		482		0.301		A		516		0.323		A	
24	91	WB from Downey Av.	900	1,600	764	157	0.848	0.098	D	A	541	110	0.601	0.069	B	A
25	91	EB from Downey Av.	1,600		538		0.336		A		400		0.250		A	
26	91	WB from SB Lakewood Bl.	1,600		813		0.508		A		807		0.504		A	
27	91	WB from NB Lakewood Bl.	900	1,600	661	136	0.735	0.085	C	A	595	122	0.661	0.076	B	A
28	91	EB from SB Lakewood Bl.	900	1,600	168	34	0.187	0.021	A	A	166	34	0.184	0.021	A	A
29	91	EB from NB Lakewood Bl.	900	1,600	310	64	0.345	0.040	A	A	310	63	0.344	0.039	A	A
30	91	EB from Clark Av.	900	1,600	455	93	0.506	0.058	A	A	388	79	0.431	0.049	A	A
31	91	WB from Bellflower Bl.	1,600		643		0.402		A		698		0.436		A	
32	91	EB from Bellflower Bl.	900	1,600	185	38	0.205	0.024	A	A	190	39	0.211	0.024	A	A

Table 14(b)
Freeway On-Ramp Demand/Capacity (D/C) and Level of Service (LOS) Summary
Future (2020) With Project Traffic Conditions

					WITH PROJECT															
					AM PEAK HOUR								PM PEAK HOUR							
			Capacity		Demand		Demand/Capacity		LOS		Impact		Demand		Demand/Capacity		LOS		Impact	
No.	Route	On-Ramp	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane
1	405	SB from NB Bellflower Bl.	900		368		0.409		A		0.011		378		0.420		A		0.075	
2	405	SB from SB Bellflower Bl.	900		252		0.280		A		0.011		353		0.392		A		0.075	
3	405	NB from SB Bellflower Bl.	900		499		0.555		A		0.000		279		0.310		A		0.000	
4	405	NB from NB Bellflower Bl.	1,600		567		0.354		A		0.000		513		0.321		A		0.000	
5	405	SB from EB Willow St.	900	1,600	458	94	0.509	0.059	A	A	0.060	0.007	560	115	0.622	0.072	B	A	0.075	0.009
6	405	SB from SB Lakewood Bl.	900	1,600	298	60	0.331	0.038	A	A	0.090	0.010	606	124	0.673	0.078	B	A	0.236	0.027
7	405	NB from NB Lakewood Bl.	900	1,600	795	163	0.883	0.102	D	A	0.000	0.000	534	109	0.594	0.068	A	A	0.000	0.000
8	405	NB from SB Lakewood Bl.	900	1,600	426	87	0.473	0.055	A	A	0.118	0.014	908	186	1.009	0.116	F	A	0.448 *	0.052
9	405	SB from Spring St.	900	1,600	283	58	0.315	0.036	A	A	0.000	0.000	372	76	0.413	0.048	A	A	0.000	0.000
10	405	SB from SB Cherry Av.	900		640		0.711		C		0.000		580		0.644		B		0.000	
11	405	NB from WB Spring St.	900	1,600	664	136	0.738	0.085	C	A	0.000	0.000	713	146	0.792	0.091	C	A	0.000	0.000
12	405	SB from Orange Av.	900	1,600	283	58	0.314	0.036	A	A	0.000	0.000	259	54	0.288	0.033	A	A	0.000	0.000
13	405	NB from NB Cherry Av.	900		858		0.953		E		0.000		548		0.609		B		0.000	
14	405	NB from SB Cherry Av.	900	1,600	376	77	0.418	0.048	A	A	0.050	0.006	493	101	0.547	0.063	A	A	0.129	0.015
15	405	NB from EB 32nd St.	900		388		0.431		A		0.000		381		0.423		A		0.000	
16	405	SB from NB Atlantic Av.	900		304		0.337		A		0.001		429		0.477		A		0.001	
17	405	SB from SB Atlantic Av.	900		250		0.278		A		0.000		285		0.317		A		0.000	
18	405	NB from NB Atlantic Av.	900		265		0.294		A		0.000		227		0.252		A		0.000	
19	91	EB from Atlantic Av.	1,600		529		0.331		A		0.011		564		0.352		A		0.005	
20	91	WB from Cherry Av.	900	1,600	435	89	0.484	0.056	A	A	0.002	0.000	468	96	0.520	0.060	A	A	0.006	0.001
21	91	EB from Cherry Av.	1,600		812.8995		0.508		A		0.002		706.5389		0.442		A		0.001	
22	91	WB from Paramount Bl.	1,600		575		0.359		A		0.004		738		0.461		A		0.014	
23	91	EB from Paramount Bl.	1,600		484		0.302		A		0.001		529		0.331		A		0.008	
24	91	WB from Downey Av.	900	1,600	764	157	0.848	0.098	D	A	0.000	0.000	542	110	0.602	0.069	B	A	0.001	0.000
25	91	EB from Downey Av.	1,600		538		0.336		A		0.000		400		0.250		A		0.000	
26	91	WB from SB Lakewood Bl.	1,600		813		0.508		A		0.000		807		0.504		A		0.000	
27	91	WB from NB Lakewood Bl.	900	1,600	684	140	0.760	0.088	C	A	0.025	0.003	637	130	0.707	0.082	C	A	0.046	0.005
28	91	EB from SB Lakewood Bl.	900	1,600	168	34	0.187	0.021	A	A	0.000	0.000	166	34	0.184	0.021	A	A	0.000	0.000
29	91	EB from NB Lakewood Bl.	900	1,600	379	78	0.421	0.049	A	A	0.076	0.009	476	97	0.529	0.061	A	A	0.185	0.021
30	91	EB from Clark Av.	900	1,600	455	93	0.506	0.058	A	A	0.000	0.000	403	82	0.448	0.051	A	A	0.017	0.002
31	91	WB from Bellflower Bl.	1,600		643		0.402		A		0.000		698		0.436		A		0.000	
32	91	EB from Bellflower Bl.	900	1,600	185	38	0.205	0.024	A	A	0.000	0.000	197	40	0.218	0.025	A	A	0.007	0.001

* Denotes significant project traffic impact.

mostly at LOS F in both peak hours. The on-ramps of both freeways would be operating at acceptable service levels in both peak hours, except for the San Diego Freeway northbound on-ramp from northbound Cherry Avenue during the AM peak hour.

The addition of project traffic would exacerbate these conditions. The CMP defines a regional project impact as being significant if the D/C ratio increases by 0.020 or more and the final (With Project) LOS is F. On the San Diego Freeway, the project would therefore significantly impact eight of the nine mainline segments analyzed, including at two of the three CMP locations. Of the 18 on-ramps analyzed for this freeway, one would be significantly impacted by the project. This would be the northbound on-ramp from southbound Lakewood Boulevard during the PM peak hour.

On the Artesia Freeway, the project would significantly impact two mainline segments. However, none of the analyzed Artesia Freeway on-ramps would be significantly impacted by the project.

Furthermore, it can be expected that continuing growth throughout the Los Angeles Basin will cause significant deterioration on all of the freeways in the general area, not just on the San Diego and Artesia Freeways. Alleviating conditions such as these are addressed by a variety of measures in the CMP. The CMP credits and debits analysis in Appendix B indicates that the project contribution to these measures would total at least 164,688 credit points, well in excess of the estimated 38,270 debit points resulting from development of the project.

ANALYSIS OF RESIDENTIAL NEIGHBORHOOD STREET IMPACTS

City staff expressed concern that project trips might use residential streets near the project site. Staff suggested Conant Street, Bixby Road, Clark Avenue, Lakewood Drive and 28th Street as candidates for a traffic impact assessment. Therefore, an

analysis was performed for the following five street segments: Conant Street between Clark Street and Bellflower Boulevard; Bixby Road between Orange Avenue and Cherry Avenue; Clark Avenue between Arbor Road and Centralia Street; Lakewood Drive between Ann Arbor Road and Carson Street; and 28th Street between Clark Avenue and Bellflower Boulevard.

For this analysis, 24-hour machine traffic counts were conducted in 2002 for the Conant Street, Bixby Road, Clark Avenue and Lakewood Drive segments. However, 24-hour machine counts could not be conducted on the 28th Street segment as the equipment was vandalized or disconnected at this location, despite two count attempts. Consequently, for this segment, daily traffic volumes were estimated from manual traffic counts taken in 2002 at the intersections of 28th Street/Clark Avenue and 28th Street/Bellflower Boulevard (see traffic count sheets in Appendix D). Future traffic volumes for the five segments were projected on the same basis as for the study intersections. All of these volumes are summarized in Table 15. This table also compares the increase due to project traffic with the total segment volumes.

City staff has recommended that as a guideline for residential street analysis, a significant impact may be determined for a project if it contributes 500 or more net daily trips (total both directions) or 50 or more net trips in one hour (total both directions) to a residential street. Based on this guideline, the project would significantly impact three residential street segments, Conant Street between Clark Avenue and Bellflower Boulevard, Bixby Road between Orange Avenue and Cherry Avenue, and Clark Avenue between Arbor Road and Centralia Street, prior to any mitigation.

Table 15
Existing (2002) and Future (2020) Traffic Volumes on Residential Streets

Segment	Period	Existing (2002)	Future (2020) Without Project	Future (2020) With Project	Future (2020) Project Volume (Net)		Future (2020) Project Percent
Conant St.	AM Peak Hour	130	173	437	264	*	60%
bet. Clark Av. &	PM Peak Hour	135	190	214	24		11%
Bellflower Bl.	Daily	1,770	2,330	3,780	1,450	*	38%
Bixby Rd.	AM Peak Hour	295	340	372	32		9%
bet. Orange Av. &	PM Peak Hour	320	395	505	110	*	22%
Cherry Av.	Daily	3,620	4,330	5,040	710	*	14%
Clark Av.	AM Peak Hour	1,145	1,205	1,259	54	*	4%
bet. Arbor Rd. &	PM Peak Hour	1,895	1,985	2,058	73	*	4%
Centralia St.	Daily	19,510	20,470	21,110	640	*	3%
Lakewood Dr.	AM Peak Hour	125	165	168	3		2%
bet. Ann Arbor Rd. &	PM Peak Hour	120	155	171	16		9%
Carson St.	Daily	1,080	1,440	1,540	100		6%
28th St.	AM Peak Hour	135	200	206	6		3%
bet. Clark Av. &	PM Peak Hour	125	190	197	7		4%
Bellflower Bl.	Daily	1,480	2,220	2,290	70		3%

* Denotes a significant project impact.

FUTURE PUBLIC TRANSIT CONDITIONS

Public Transit Improvements

Long Beach Transit (LBT) is the primary service provider in the City of Long Beach and the project vicinity. In discussions with LBT, no specific near- or long-term transit improvements were identified, other than LBT's near-term plan to use articulated coaches on Routes 101 and/or 103 in the AM and PM peak periods. The agency is also preparing a plan to serve the PacifiCenter project. This plan would likely include a new bus stop on Lakewood Boulevard, possibly near A Street or some other location between Carson and Conant Streets.

The MTA has also indicated it is undertaking a project to increase peak-hour capacity on the Metro Blue Line by expanding the station platforms to accommodate up to three train cars instead of just two cars. Although weekday passenger volumes are much lower in the project vicinity and Long Beach in general than along segments closer towards downtown Los Angeles, the additional train car capacity would support increased ridership as a result of this and other Long Beach area projects.

CMP Transit Impacts

The project is expected to increase usage of LBT bus routes operating near the project site and add new riders to the Metro Blue Line LRT due to demand generated by employees, residents and patrons of the various project land uses. Based on transit analysis guidelines in the CMP, it is estimated that approximately 253 net person trips during the AM peak hour (184 inbound and 69 outbound) and 299 net person trips during the PM peak hour (93 inbound and 206 outbound) could be added to the existing fixed route transit services. The daily total would be approximately 2,807 net person trips. As the CMP does not provide guidance as to what constitutes a transit impact, it

cannot be determined whether these person trips would have a significant impact. However, LBT has indicated that it currently has the rolling stock and facilities to absorb moderate increases in demand generated by the project. In addition, the project proposes to work with the transit agencies to develop plans and strategies to address the project's transit needs.

Project Transit-Supportive Measures

The project proposes to provide several services that are specifically targeted to increase the transit friendliness of the project and facilitate public transit use. Although the project is claiming trip-reduction credit for only the Commercial (Office Park) use in the analysis, these services would be available to a broader cross-section of the project and may attract participants beyond the targeted use. Such services are expected to include but not necessarily be limited to the following:

Centralized Information Board with Transit Component – Chapter 21.64 of the City Municipal Code requires non-residential developments to display information on alternative transportation via a centralized bulletin board or kiosk. The project would comply with this requirement and also provide a centralized information board for residents. The centralized information boards would include a dedicated transit component that displays information regarding the Metro Blue Line, public bus routes serving the site and site vicinity, and websites for LBT, MTA and TranStar, a free automated transit trip planning system that is available through the Southern California Association of Governments (SCAG).

On-Site Transit Pass Sales – Monthly LBT, joint LBT/MTA and MTA passes would be available for purchase through the on-site transportation management office (TMO).

FUTURE BICYCLE FACILITY CONDITIONS

The City of Long Beach plans to make a number of near- and long-term improvements to its bikeway system to increase the connectivity and safety of the existing bikeway network. Several of these improvements are in the vicinity of the project site, according to the Long Beach Bicycle Master Plan, and are described below.

Near-Term Bikeway Improvements

These improvements are of highest priority to the City and are targeted for completion within the next five years. Four of the near-term bikeway projects are near the project site and would provide increased bicycle accessibility from areas to the west and southwest.

PacifiCenter Bikeway (Class II) – A new, dedicated bike lane that would connect the existing Class I facility on Carson Street to Cherry Avenue at Bixby Road by traveling through the project site. The bike lane would connect bikeways on the east and west sides of the site, bringing that portion of the network closer to the existing Orange Avenue Bike Lane and other bikeways to the west that are planned for near- or medium-term implementation.

In keeping with the intent of the Long Beach Bicycle Master Plan, the project will continue to provide a Class I bike lane within the Carson Street parkway adjacent to the site between First Street and Lakewood Boulevard, and will provide Class II bike lane improvements that extend south from Carson Street and west to the Paramount Boulevard/Cover Street intersection.

Orange Avenue–Alamitos Avenue Bikeway (Class III) – A new bike route that would start where the existing Class II bikeway on Orange Avenue ends, to extend south into downtown Long Beach.

Pacific Avenue-San Antonio Bikeway (Class II/III Mix) – A new facility west of the project that would provide an additional north-south bikeway from the Cerritos Circle area to downtown Long Beach.

Del Amo Boulevard Bikeway (Class II/III Mix) – A new bikeway northwest of the project site that would link the Los Angeles River Bike Path with the Orange Avenue Bike Lane and then continue its east-west alignment to the Lakewood city limit. This improvement would increase connectivity with the Del Amo bikeway in City of Lakewood, which extends east to the San Gabriel River Bike Path.

Medium-Term Bikeway Improvements

There are 15 bikeway improvements that are targeted by the City for implementation within the next six to 15 years. The proposed improvements that are closest to the project site and could thereby benefit the project with increased bicycle accessibility include:

Lakewood Boulevard Bikeway – Extending from the Lakewood city limit south towards the beach;

Cherry Avenue Bikeway – Extending from Spring Street north;

Bixby Road Bikeway – Extending from Cherry Avenue west; and

Spring Street Bikeway – Extending from the Los Angeles River Bike Path to the San Gabriel River Bike Path.

The specific designations of these medium priority bikeways (i.e., whether Class I, II or III) are not yet known. Finally, there are long-term bikeway projects on a 16- to 20-year time horizon. Although these improvements are generally farther from the project site than those described above, they will ultimately help to infill the City bicycle network.

MITIGATION MEASURES

Because its potential impacts are over a large area, and due to its site being within an area bounded by four regional freeways (San Diego Freeway, Long Beach Freeway, Artesia Freeway and San Gabriel River Freeway), the PacifiCenter project proposes to implement a subregional transportation mitigation program that addresses both project impacts and area-wide needs. Recognizing that increasing travel demand has caused the transportation system to reach the limits of its capacity, and that intersection and roadway improvements are becoming increasingly infeasible, more and more jurisdictions are pursuing other ways to ease this strain. This includes Intelligent Transportation Systems (ITS) through the application of modern information technology and communications. Thus, the major component of the PacifiCenter mitigation program utilizes selected ITS measures to improve traffic flow along arterials in the study area, and freeway ramp access and connectivity with the surface street system.

The project mitigation program also incorporates other mitigation measures. These include implementation of a project transportation demand management program; construction of physical improvements at a number of study intersections; and funding for the implementation of neighborhood traffic management programs to deter the use of local residential streets by non-residential traffic in the neighborhoods around the site.

Categorized and more fully described below are the various measures and components of the PacifiCenter traffic mitigation program. Figures 12(a) and 12(b) depict the With Project mitigated traffic volumes at the 109 study intersections.

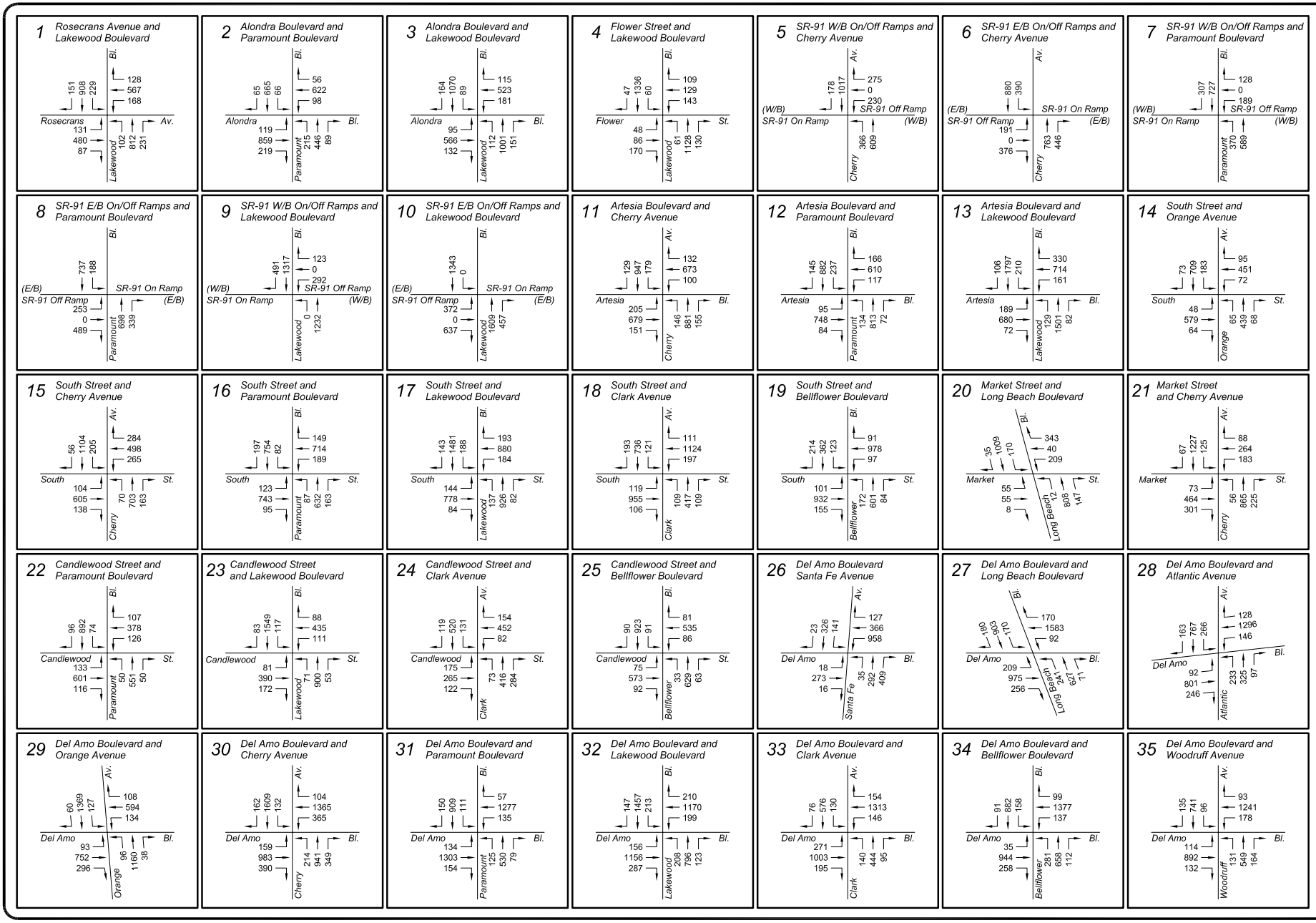

FIGURE 12(a)

9/2/2003

BOEING-LNGBCH\9-2-03\AM2020WPWM-G1

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110INTS-STICKFUT-GRID-1

FUTURE (2020) TRAFFIC VOLUMES WITH PROJECT + MITIGATION AM PEAK HOUR

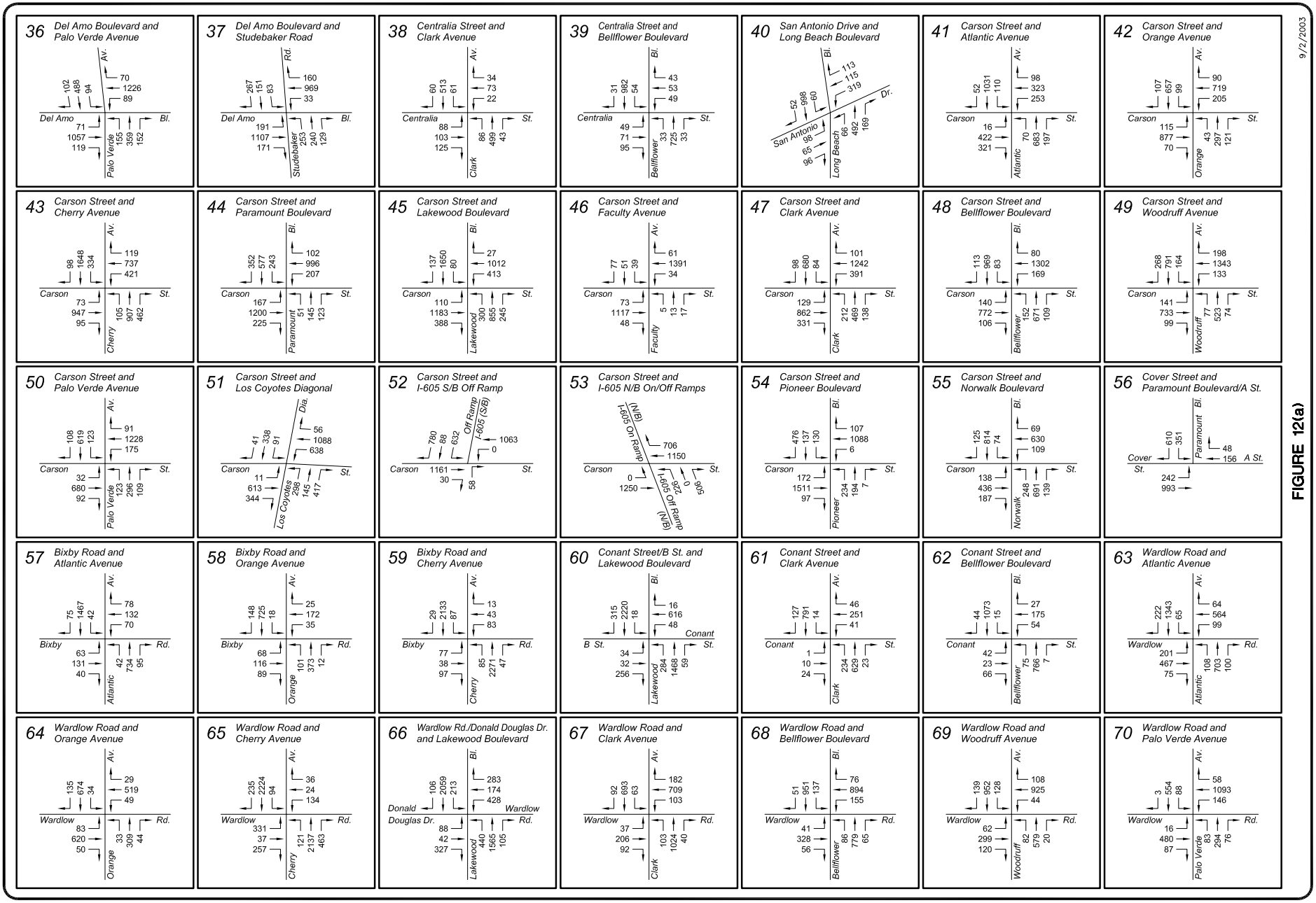

FIGURE 12(a)

9/2/2003

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110INTS-STCKFUT-GRID-2

FUTURE (2020) TRAFFIC VOLUMES WITH PROJECT + MITIGATION AM PEAK HOUR

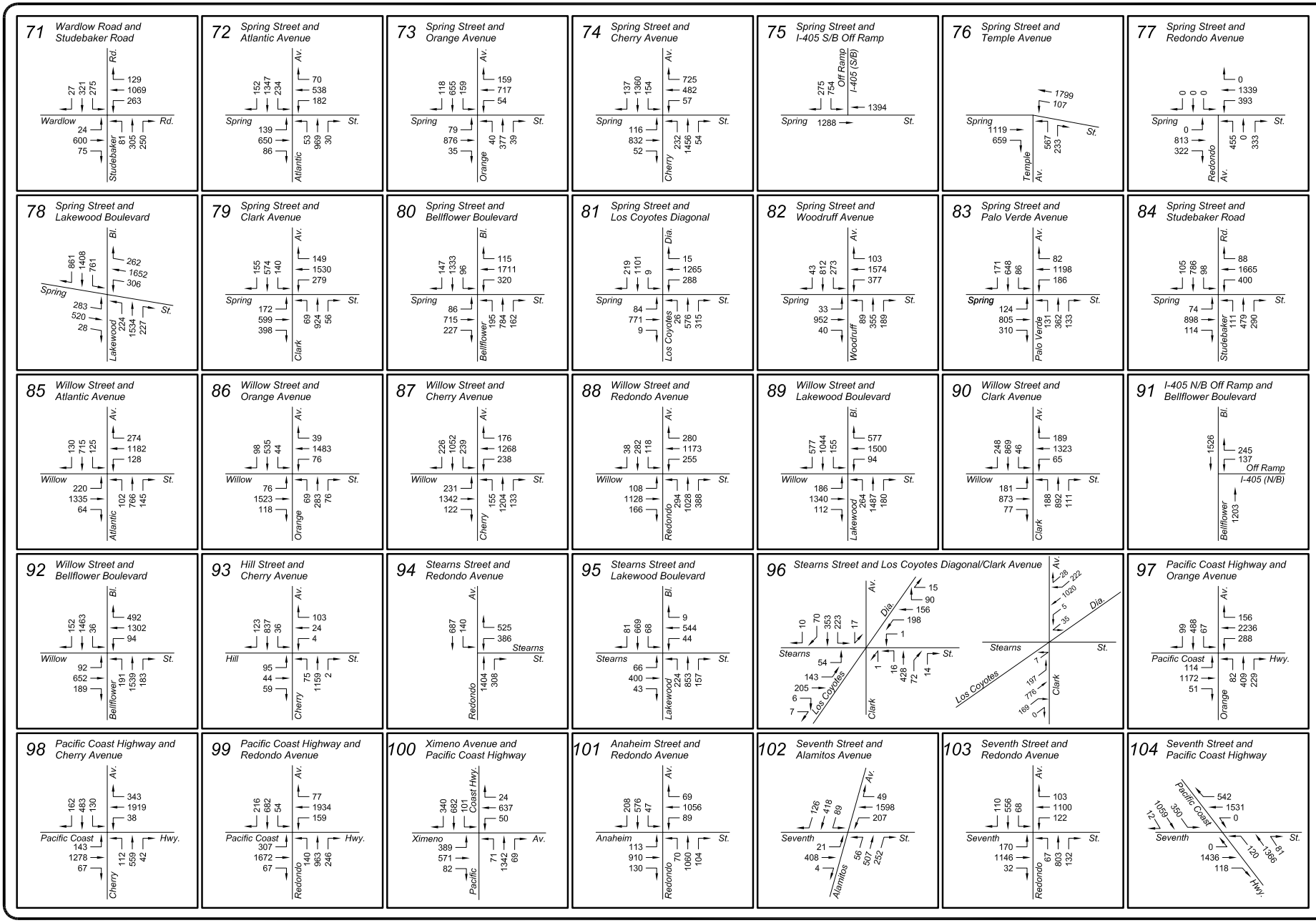

FIGURE 12(a)

9/2/2003

BOEING–LNGBCH\9–2–03\AM2020WPWM–G3

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FUTURE (2020) TRAFFIC VOLUMES WITH PROJECT + MITIGATION AM PEAK HOUR

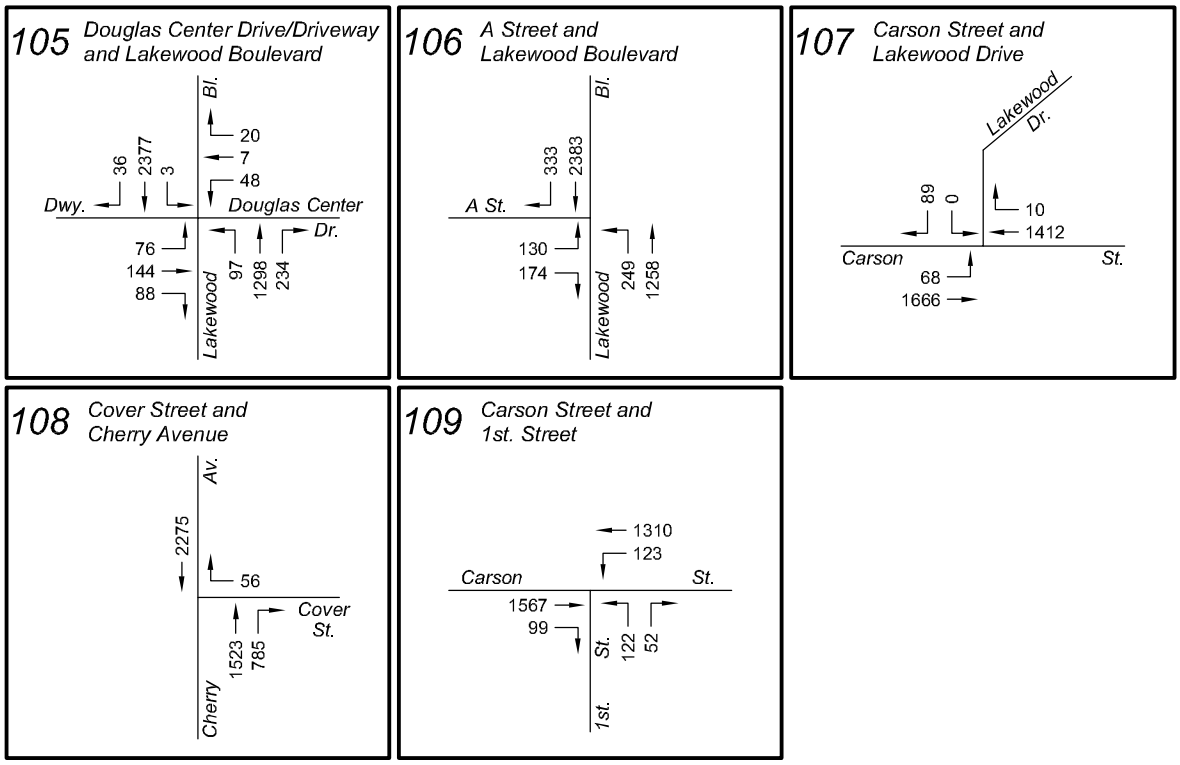

FIGURE 12(a)

9/2/2003

BOEING-LNGBCH\9-2-03\AM2020WPWM-G4

_110INTS-STICKFUT-GRID-4

FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT + MITIGATION
AM PEAK HOUR

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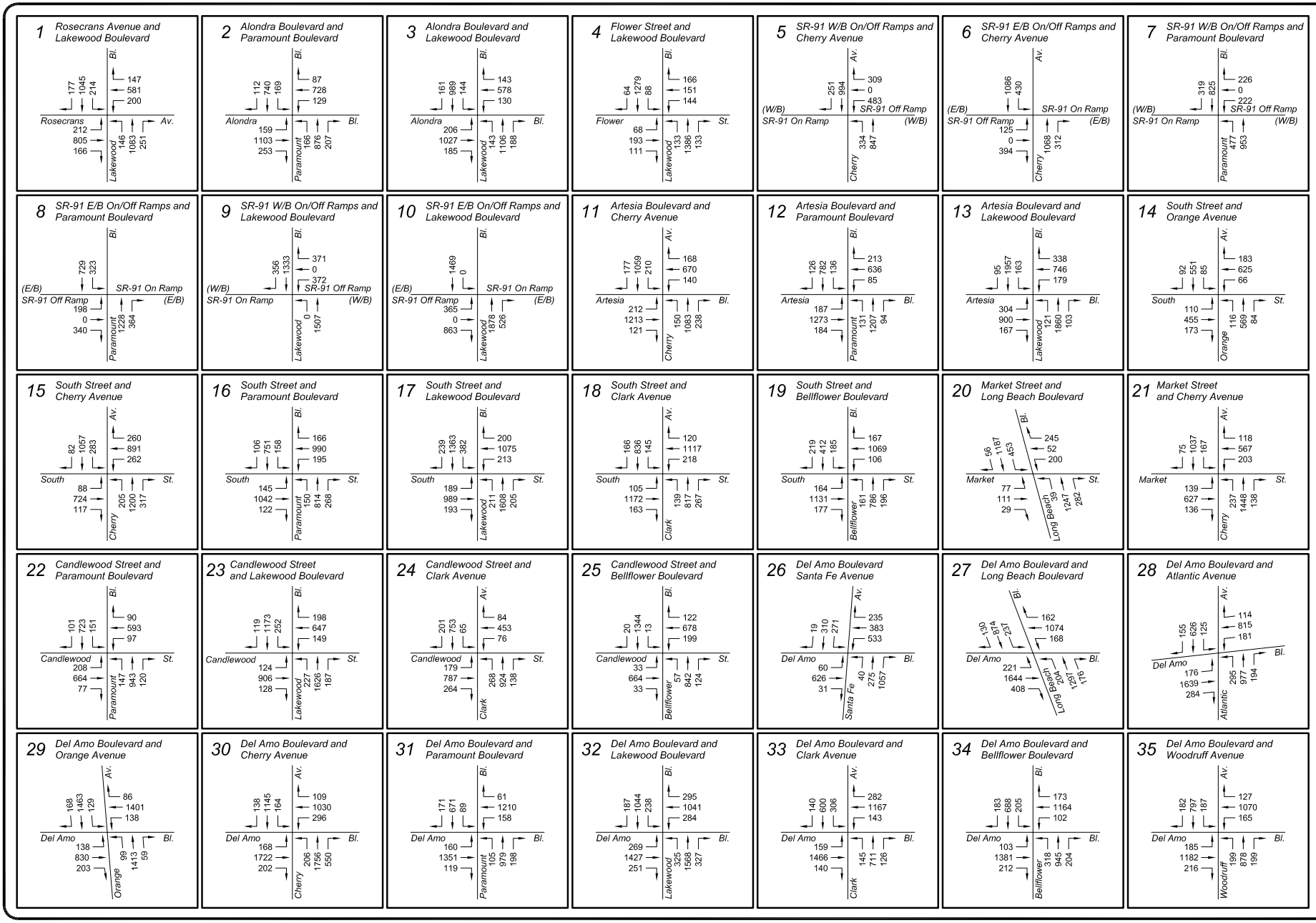

FIGURE 12(b)

9/2/2003

BCEINC-LNGBCH\9-2-03\PM2020WPWM-G1

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FUTURE (2020) TRAFFIC VOLUMES WITH PROJECT + MITIGATION PM PEAK HOUR

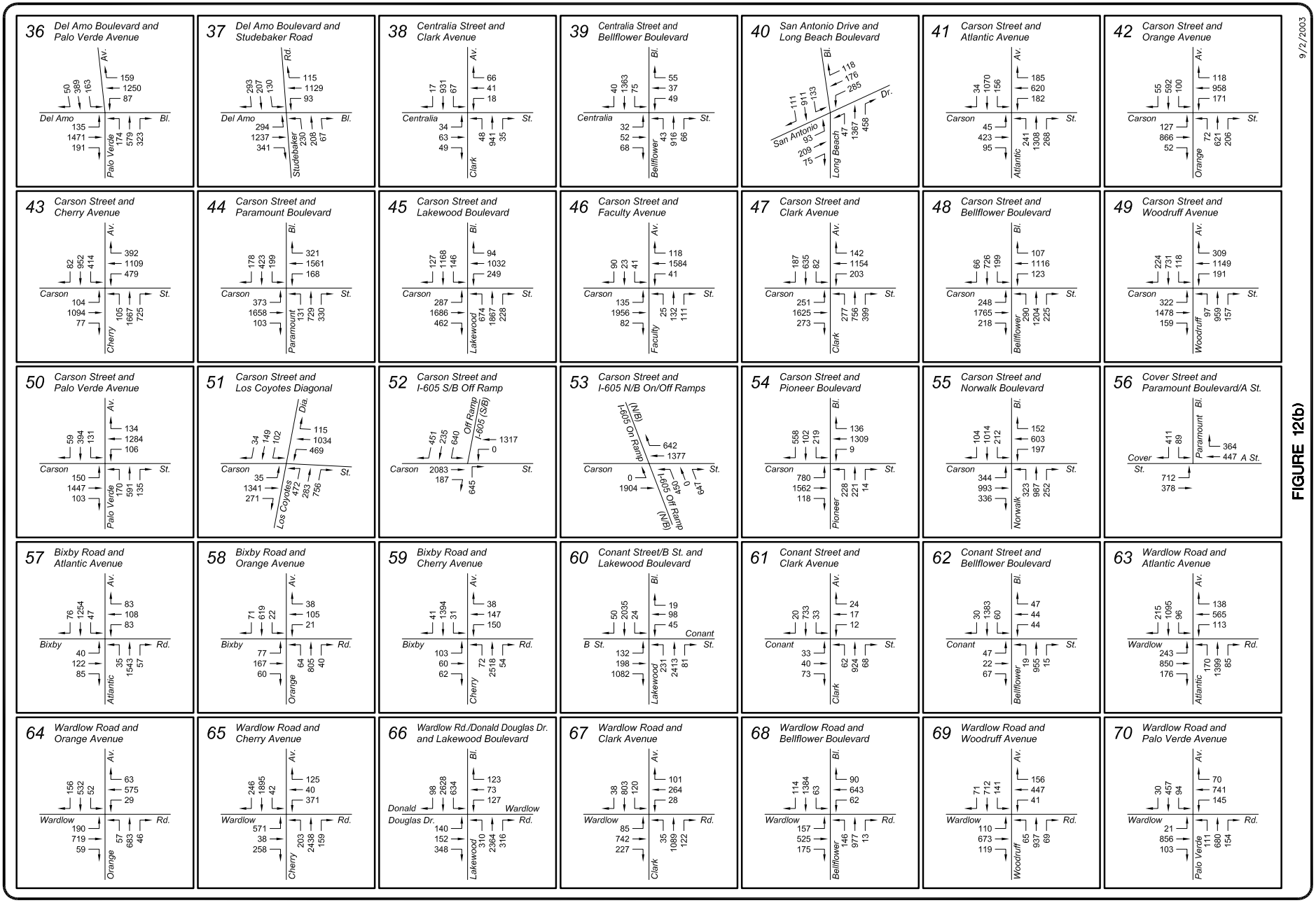

FIGURE 12(b)

9/2/2003

BOEING–LNGBCH\9–2–03\PM2020WPWM–G2

110INTS–STICKFUT–GRID–2

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FUTURE (2020) TRAFFIC VOLUMES WITH PROJECT + MITIGATION PM PEAK HOUR

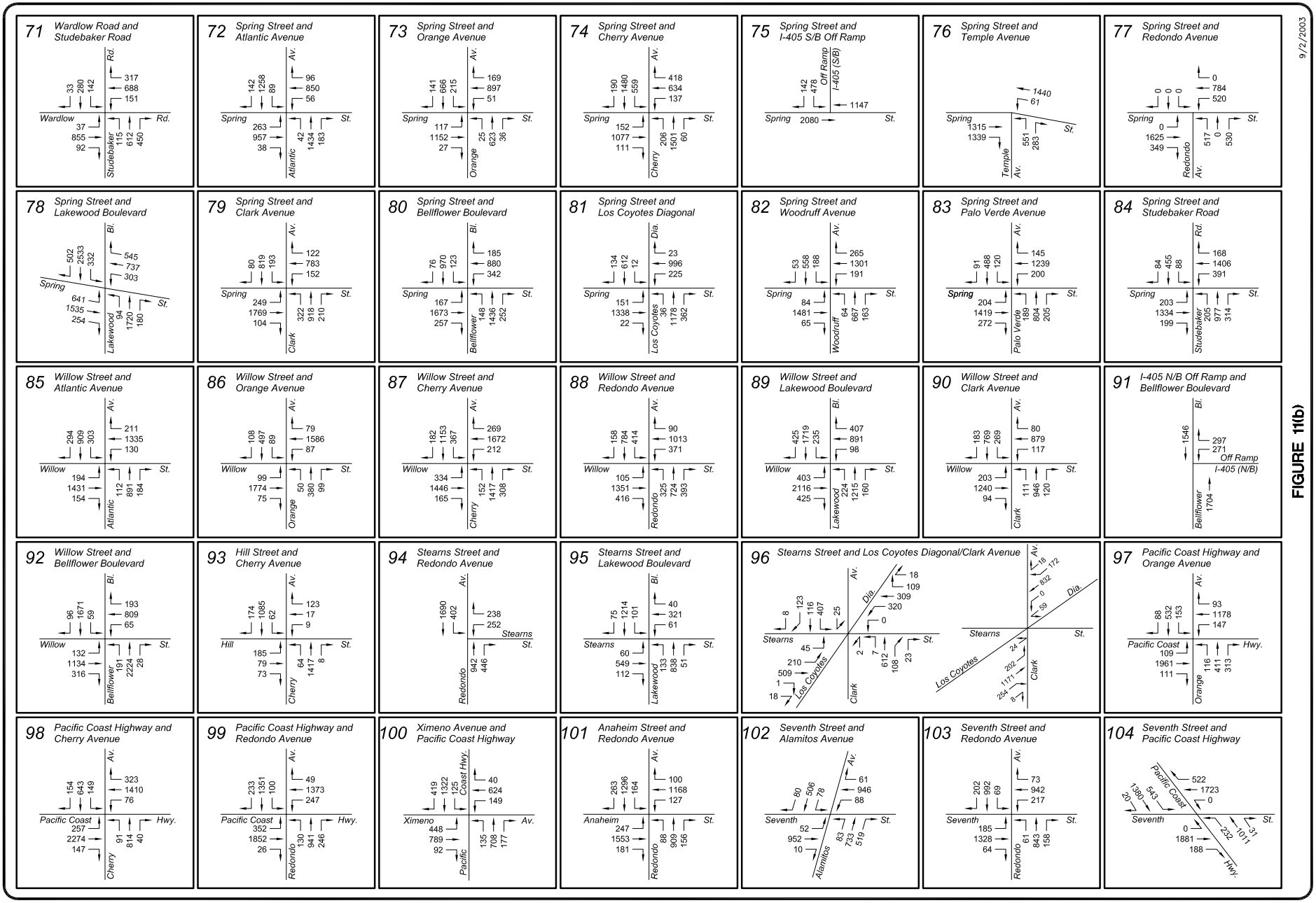

FIGURE 11(b)

9/2/2003

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FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT
PM PEAK HOUR

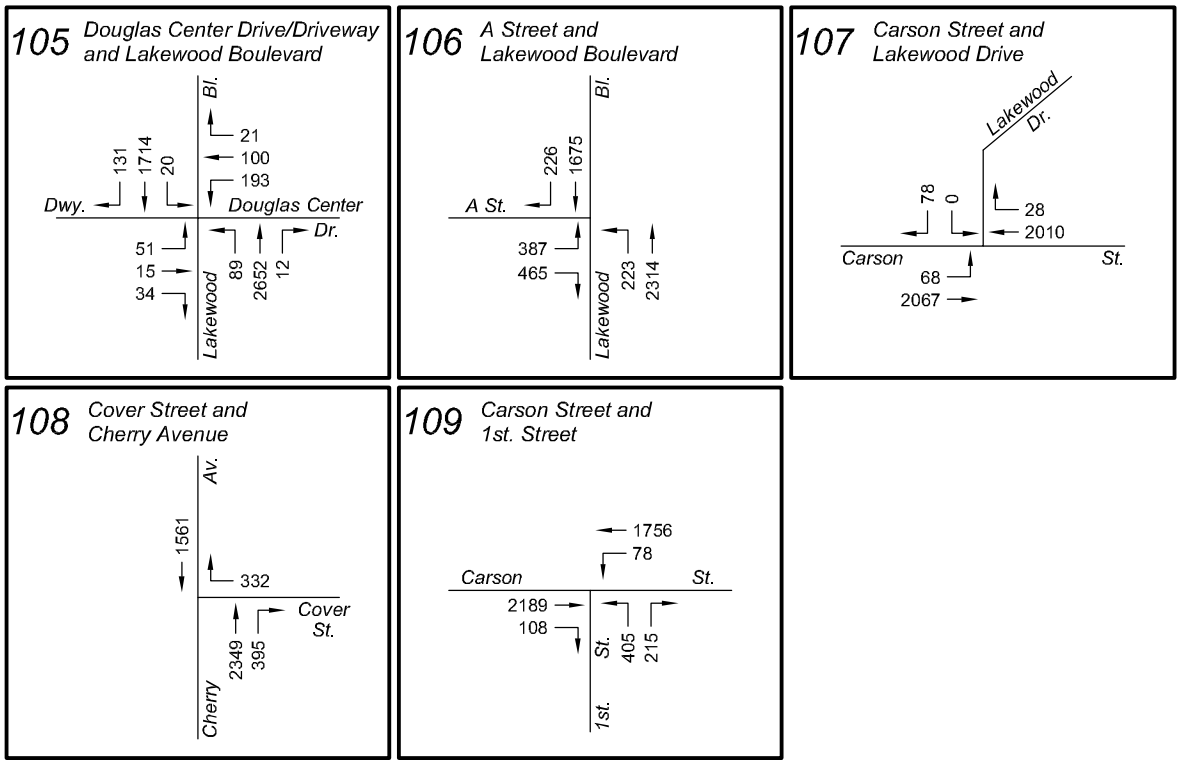

FIGURE 12(b)

9/2/2003

BOEING-LNGBCH\9-2-03\PM2020WPWM-G4

_110INTS-STICKFUT-GRID-4

FUTURE (2020) TRAFFIC VOLUMES
WITH PROJECT + MITIGATION
PM PEAK HOUR

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CATEGORY A - AREA-WIDE ATCS/ITS MEASURES

Adaptive Traffic Control System (ATCS) and ITS Connectivity with Freeway Ramps: Fund or cause the funding for the design and construction of a state-of-the-art traffic signal system, such as ATCS, along the following eight arterial routes: 1) Del Amo Boulevard, approximately from the Long Beach Freeway to the San Gabriel River Freeway; 2) Carson street, approximately from Long Beach Boulevard-San Antonio Drive to the San Gabriel River Freeway; 3) Spring Street, approximately from Atlantic Avenue to the San Gabriel River Freeway; 4) Willow Street, approximately from Atlantic Avenue to the San Gabriel River Freeway; 5) Atlantic Avenue, approximately from the Artesia Freeway to Willow Street; 6) Cherry Avenue, approximately from the Artesia Freeway to Pacific Coast Highway; 7) Lakewood Boulevard, approximately from the Artesia Freeway to Stearns Street; and 8) Bellflower Boulevard, approximately from the Artesia Freeway to the San Diego Freeway. The location of these eight arterial routes are illustrated in Figure 13.

Also, fund or cause the funding for the design and construction of interconnect, traffic detectors, surveillance cameras, message signs and other means that connect the arterial traffic signal system with adjacent freeway on- and off-ramps meters and signals. Such connectivity with the regional transportation system would allow motorists leaving the freeway and motorists getting on the freeway to be better informed more quickly as to which surface streets and on-ramps provide the best alternatives for accessing their destinations. This would result in better distribution of traffic loadings and more efficient use of available street and ramp capacity.

Also, fund or cause the funding for the design and construction of a centralized ATCS/ITS command center to operate and manage the area-wide ATCS and affiliated ITS measures.

The capacity of the signalized intersections along the eight arterials being implemented with the ATCS and supportive ITS measures is assumed to improve by 10 percent, which is consistent with that experienced in other jurisdictions with ATCS/ITS programs, such as the Cities of Los Angeles, Pasadena and Glendale. Signalized intersections in the study area not directly along the ATCS/ITS routes will also benefit and experience improved traffic flow overall due to ITS technology informing motorists of traffic conditions in the area. Motorists can use this information to seek better routes and thereby better balance traffic demand with capacity. It is assumed that this betterment is commensurate with an approximate three percent improvement in capacity at these other intersections.

CATEGORY B - INTERSECTION IMPROVEMENTS

1. Del Amo Boulevard and Lakewood Boulevard (Intersection 32, Cities of Lakewood and Long Beach): Widen on the east side of the north leg and the west side of the south leg of Lakewood Boulevard; remove the nose islands and modify the remaining raised islands on the north and south legs; and restripe the north and south legs to provide a second southbound left-turn and three through lanes in each direction on Lakewood Boulevard. No on-street parking removal is anticipated.

2. Carson Street and Paramount Boulevard (Intersection 44, City of Lakewood): Widen on the east side of the south leg of Paramount Boulevard; modify and shift the raised island on the north leg; remove the raised island on the south leg; and restripe the north and south legs to provide a northbound right-turn-only lane on Paramount Boulevard. No on-street parking removal is anticipated.

3. Carson Street and Lakewood Boulevard (Intersection 45, Cities of Long Beach and Lakewood): Widen on the west side of Lakewood Boulevard between Carson Street and the project access roadway opposite Douglas Center Drive; modify and shift the raised islands on the north and south legs; restripe the north leg to provide an additional southbound through lane; and restripe the departure lanes on the south leg to receive the added through lane traffic. No on-street parking removal is anticipated.

   (Note: This improvement would not fully mitigate the project impact to a level below significance.)

4. Carson Street and Bellflower Boulevard (Intersection 48, Cities of Long Beach and Lakewood): Prohibit parking during the AM peak period on the north side of Carson Street for a length of approximately three blocks east and west of Bellflower Boulevard; modify and lengthen the left-turn channelization along the raised islands on the east and west legs of Carson Street; and restripe this length of Carson Street to provide a third westbound through lane, including conversion of the right-turn lane at Bellflower Boulevard, for the A.M peak periods, and extended left-turn lanes approaching Bellflower Boulevard.

   On-street parking removal of up to approximately 75 spaces during the AM peak period on the north side of Carson Street would be necessary. The affected parking spaces are adjacent to residential and commercial uses that appear to have off-street parking facilities capable of satisfying parking requirements. Therefore, removal of the on-street parking is not expected to have a significant impact.

5. Cover Street and Paramount Boulevard (Intersection 56, City of Lakewood); Cover Street from Paramount Boulevard to West of Industry Avenue (Cities of Long Beach and Lakewood): Construct the project roadway approximately in a northwesterly alignment approaching Cover Street and Paramount Boulevard, and stripe to provide two through lanes and a right-turn-only lane westbound, and a bike lane in each direction. Reconstruct Cover Street approximately in a southeasterly alignment approaching the project roadway and Paramount Boulevard, and restripe to provide a left-turn lane and two through lanes eastbound, and a bike lane in each direction. Restripe Paramount Boulevard to provide a left-turn lane and a right-turn-only lane southbound. No on-street parking removal is anticipated.

Widen on the north side of Cover Street from approximately 100 feet west of to 340 feet east of Industry Avenue; modify and lengthen the left-turn channelization along the raised island on the east leg at Industry Avenue; and restripe to provide two through lanes, left-turn channelization and a bike lane in each direction, including an extended westbound left-turn lane at Industry Avenue, from Industry Avenue to the improvement at Paramount Boulevard. Restripe the west leg of Cover Street at Industry Avenue to provide two eastbound through lanes, including conversion of the right-turn-only lane, and two westbound right-turn-only lanes departing the intersection and approaching Cherry Avenue. On-street parking removal of up to approximately three spaces on Cover Street would be necessary.

Restripe Industry Avenue between Cover Street and Bixby Road to provide a left-turn lane and two right-turn-only lanes northbound, a southbound through lane, and a bike lane in each direction.

The affected parking spaces are adjacent to commercial and industrial uses. There appears to be sufficient off-street capability to satisfy parking requirements. Therefore, removal of the on-street parking is not expected to have a significant impact.

(Note: These improvements are designed to enhance project access via the Cover Street – Cherry Avenue route and should be implemented with Measures 5 and 11.)

6. Bixby Road and Cherry Avenue (Intersection 59, Cities of Long Beach and Lakewood): Restripe the east leg of Bixby Road to provide one left-turn lane, one left-turn/through shared lane and one right-turn-only lane. On-street parking removal of up to approximately 37 spaces, including nine commercial (yellow zone) spaces, on Bixby Road would be necessary.

   The affected parking spaces are adjacent to commercial uses. There appears to be sufficient off-street capability to satisfy parking requirements, with the possible exception of delivery/service needs. Therefore, removal of some of the on-street parking may have a significant unavoidable impact for which no feasible mitigation can be identified.

   (Note: This improvement is designed to enhance project access via the Cover Street - Cherry Avenue route and should be implemented with Measures 5 and 11.)

7. Conant/B Street and Lakewood Boulevard (Intersection 60, City of Long Beach): Construct and stripe B Street approaching Lakewood Boulevard to provide one left-turn lane, one through lane and two right-turn-only lanes eastbound. Restripe and convert the right-turn-only lane on the east leg of

Conant Street to a westbound through/right-turn shared lane. No on-street parking removal is anticipated.

(Note: This improvement would not fully mitigate the project impact to a level below significance.)

8. Wardlow Road and Cherry Avenue (Intersection 65, City of Long Beach): Widen on both sides of the south leg of Cherry Avenue; shorten the raised island on the north leg; and restripe the north and south legs to provide a third southbound through lane. Extensive on-street parking removal on Cherry Avenue, especially on the north leg, would be necessary.

The affected parking spaces are adjacent to commercial and residential uses. There appears to be sufficient off-street capability to satisfy parking requirements. Therefore, removal of the on-street parking is not expected to have a significant impact.

(Note: This improvement is designed to enhance project access via Cherry Avenue.)

9. Douglas Center Drive/Project Access Roadway (new) and Lakewood Boulevard (Intersection 105, City of Long Beach): Widen on the west side of Lakewood Boulevard between Carson Street and the project access roadway; modify the raised island on Lakewood Boulevard for left-turn channelization; and restripe to provide a fourth southbound through lane that becomes a right-turn-only lane at the project access roadway, and a northbound left-turn lane. No on-street parking removal is anticipated.

(Note: This improvement is designed to enhance project access capacity on Lakewood Boulevard.)

10. A Street (new) and Lakewood Boulevard (Intersection 106, City of Long Beach): Widen on the west side of the north leg of Lakewood Boulevard; open and modify the raised island on Lakewood Boulevard to provide left-turn channelization; and restripe to provide a southbound right-turn-only lane and northbound left-turn lane. Install a traffic signal to control this intersection.

(Note: This improvement is designed to enhance project access capacity on Lakewood Boulevard.)

11. Cover Street and Cherry Avenue (Intersection 108, Cities of Long Beach and Lakewood): Open and modify the raised island on Cherry Avenue between Roosevelt Road and Bixby Road, and restripe to provide a southbound left-turn lane accessing Cherry Avenue and a third northbound through lane. Restripe Cover Street to provide a second westbound right-turn-only lane and no westbound left-turn lane. Remove the Stop sign control on Cover Street and install a “half signal” that controls all movements except for the southbound through movement on Cherry Avenue.

On-street parking removal of up to approximately 12 spaces on Cherry Avenue and 24 spaces on Cover Street would be necessary. The affected parking spaces are adjacent to commercial and industrial uses. Some of these uses may not have sufficient off-street capability to satisfy parking requirements. Therefore, removal of the on-street parking may result in a shortage of parking in the area during times of peak demand.

(Note: This improvement is designed to enhance project access via the Cover Street – Cherry Avenue route and should be implemented with Measures 5 and 6.)

12. Carson Street and First Street (new) (Intersection 109, City of Long Beach): Restripe Carson Street to provide a westbound left-turn lane. Install a traffic signal to control this intersection. No on-street parking removal is anticipated.

The location of these 12 intersection improvements are depicted in Figure 13.

No suitable measure could be identified to mitigate the significant project impact at the intersection of Spring Street/Lakewood Boulevard.

CATEGORY C - PROJECT TRANSPORTATION DEMAND MANAGEMENT PROGRAM

The project Transportation Demand Management (TDM) program is expected to reduce inbound AM peak-hour and outbound PM peak-hour trips by 20 percent for the Commercial (Office Park) use. Although the project is taking trip-reduction credit for only this use, many of the TDM program measures would be available to a broader cross section of the site, and would likely attract participants outside of the targeted uses. The project TDM program is more fully described in Appendix C.

Should it become evident that the project TDM program is not on schedule to achieve and sustain the 20 percent trip reduction goal, the project, as mutually agreed to with the City of Long Beach, will accelerate the implementation of the physical mitigation measures and/or expand its TDM program to include other employers in the surrounding area.

CATEGORY D - REGIONAL TRANSPORTATION IMPROVEMENTS

As reflected in Tables 12, 13 and 14, the PacifiCenter project is expected to significantly impact the regional freeway system at several locations. These impacts

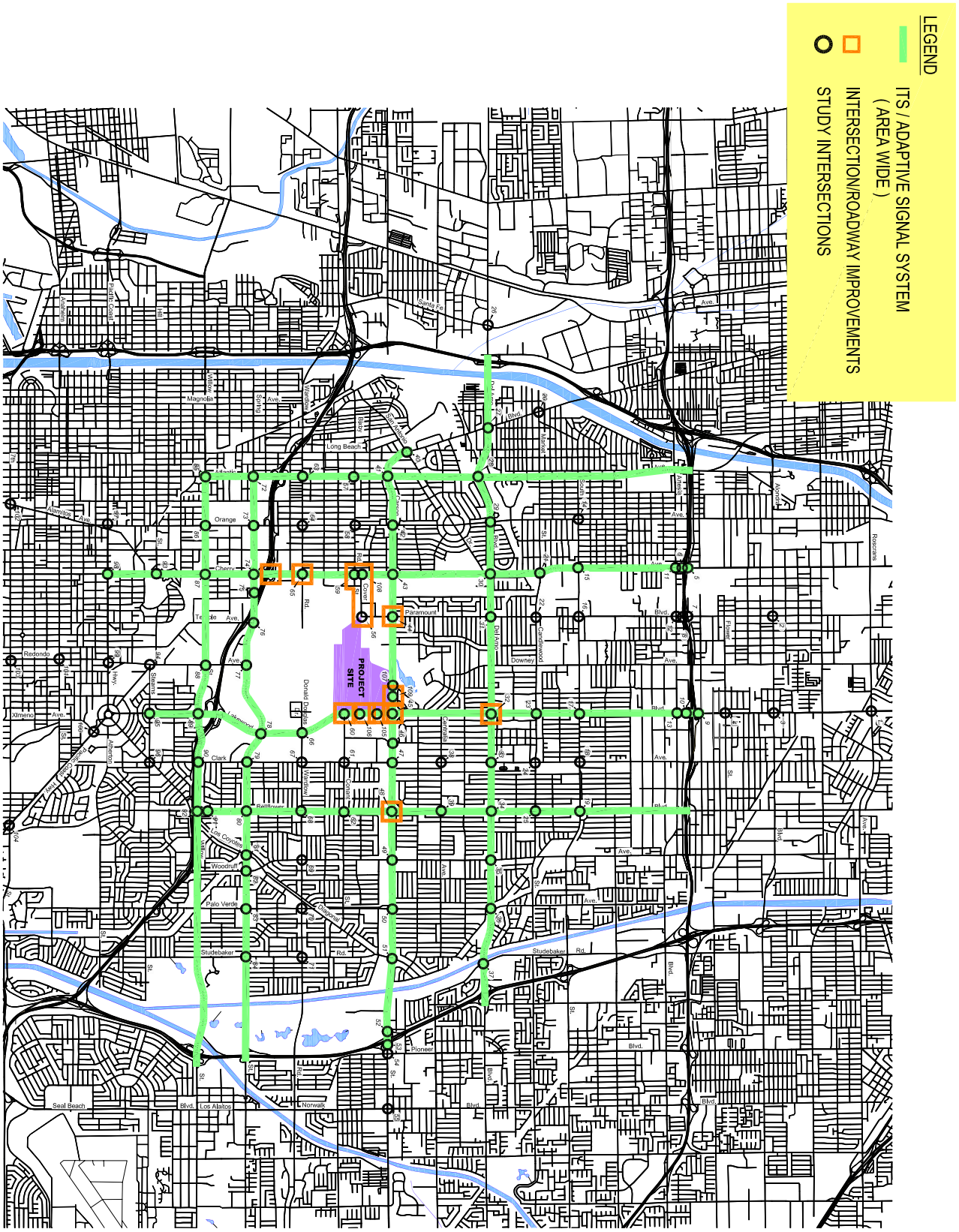

FIGURE 13

10/28/03

:FN BOEING-LNGBCH\MITIGATION MEASURES-ITS

LOCATION OF PROPOSED PROJECT MITIGATION MEASURES:
AREA-WIDE ITS/ADAPTIVE SIGNAL SYSTEM
AND INTERSECTION IMPROVEMENTS

C&A
CRAIN & ASSOCIATES
2007 Sawtelle Boulevard
Los Angeles, California 90025
(310) 473-6508
Transportation Planning • Traffic Engineering

include locations along the San Diego and Artesia Freeways. Measures to increase the capacity of these facilities are beyond the ability of the project. However, as shown in Tables 16(a), 16(b) and 16(c), the project's TDM measures would be sufficient to mitigate the project impacts on the mainline of the Artesia Freeway to a level below significance. In addition, the CMP provides for alternative methods to improve conditions in the sub-region. This traffic study indicates that by improving conditions on area-wide arterials, vehicles would be better able to circulate without further overloading the freeway system.

The CMP includes a worksheet analysis procedure by which it can be determined whether a project, with mitigation, would have a greater benefit or impact on the regional system. The impacts are calculated in terms of net CMP debits and the benefits in terms of net CMP credits. The debits and credits for the PacifiCenter project have been calculated and are contained in Appendix B. These calculations show that the project, with its funding (or causation of the funding) of the ATCS and affiliated ITS measures, would improve arterial corridor capacity and mobility area-wide, and further enhance freeway ramp access and connectivity. These combined sub-regional measures would provide approximately 164,688 credit points, well in excess of the estimated 38,270 debit points resulting from the development of the project. Therefore, the project can be considered to have a less than significant impact on the regional system as the project will fund, or cause to be funded, extensive area-wide mitigation measures that will result in greater benefit than impact on the regional system.

In addition to the above area-wide measures, the following voluntary improvement to the San Diego Freeway is also proposed by the project, which would benefit all cumulative traffic and enhance the usage of Cherry Avenue:

Table 16(a)
San Diego Freeway (I-405) Demand/Capacity (D/C) and Level of Service (LOS) Summary
Future (2020) With Project + TDM Mitigation Traffic Conditions

				Future (2020) With Project + TDM Mitigation				
Freeway Segment	Peak Hour	Direction	Freeway Capacity	Daily Demand	Peak Hour Demand	D/C Ratio	LOS	Project Impact
1 San Diego Freeway (I-405)	AM	N/B	9,600	273,400	10,851	1.130	F	0.007
s/o Route 110 at Carson Scales		S/B	9,600		8,456	0.881	D	0.020
(CMP Station)	PM	N/B	9,600		9,130	0.951	E	0.024
		S/B	9,600		10,655	1.110	F	0.009
2 San Diego Freeway (I-405)	AM	N/B	7,600	318,600	10,800	1.421	F	0.013
at Santa Fe Ave		S/B	7,600		10,014	1.318	F	0.038 *
(CMP Station)	PM	N/B	7,600		10,467	1.377	F	0.043 *
		S/B	7,600		10,876	1.431	F	0.017
3 San Diego Freeway (I-405)	AM	N/B	9,600	309,900	12,638	1.316	F	0.013
betw. I-710 and Atlantic Ave		S/B	9,600		10,326	1.076	F	0.033 *
	PM	N/B	9,600		11,919	1.242	F	0.049 *
		S/B	9,600		12,003	1.250	F	0.016
4 San Diego Freeway (I-405)	AM	N/B	9,600	314,500	10,276	1.070	F	0.010
betw. Atlantic Ave and Cherry Ave		S/B	9,600		10,831	1.128	F	0.034 *
	PM	N/B	9,600		10,468	1.090	F	0.040 *
		S/B	9,600		11,640	1.213	F	0.017
5 San Diego Freeway (I-405)	AM	N/B	9,600	300,400	10,771	1.122	F	0.011
betw. Cherry Ave and Lakewood Blvd		S/B	9,600		9,953	1.037	F	0.001
	PM	N/B	9,600		9,949	1.036	F	0.041 *
		S/B	9,600		11,891	1.239	F	0.000
6 San Diego Freeway (I-405)	AM	N/B	9,600	298,000	9,691	1.009	F	0.000
betw. Lakewood Blvd and Bellflower Blvd		S/B	9,600		8,538	0.889	D	0.008
	PM	N/B	9,600		8,540	0.890	D	0.000
		S/B	9,600		10,372	1.080	F	0.022 *
7 San Diego Freeway (I-405)	AM	N/B	9,600	290,100	10,665	1.111	F	0.029 *
betw. Bellflower Blvd and Woodruff Ave		S/B	9,600		8,586	0.894	D	0.015
	PM	N/B	9,600		9,927	1.034	F	0.019
		S/B	9,600		9,912	1.033	F	0.041 *
8 San Diego Freeway (I-405)	AM	N/B	9,600	290,400	10,228	1.065	F	0.037 *
betw. Woodruff Ave and Studebaker Rd		S/B	9,600		8,674	0.904	D	0.015
	PM	N/B	9,600		8,513	0.887	D	0.019
		S/B	9,600		10,908	1.136	F	0.040 *
9 San Diego Freeway (I-405)	AM	N/B	7,600	301,200	10,773	1.418	F	0.042 *
n/o Route 22		S/B	9,600		9,662	1.006	F	0.013
(CMP Station)	PM	N/B	7,600		9,567	1.259	F	0.022 *
		S/B	9,600		11,278	1.175	F	0.036 *

* Denotes a significant project impact prior to additional mitigation considerations.

Table 16(b)
Artesia Freeway (SR-91) Demand/Capacity (D/C) and Level of Service (LOS) Summary
Future (2020) With Project + TDM Mitigation Traffic Conditions

				Future (2020) With Project + TDM Mitigation				
Freeway Segment	Peak Hour	Direction	Freeway Capacity	Daily Demand	Peak Hour Demand	D/C Ratio	LOS	Project Impact
1 Artesia Freeway (SR-91)	AM	E/B	11,600	228,300	12,640	1.090	F	0.005
e/o Alameda St / Santa Fe Ave		W/B	11,600		6,558	0.565	C	0.000
(CMP Station)	PM	E/B	11,600		8,543	0.736	C	0.002
		W/B	11,600		10,667	0.920	D	0.004
2 Artesia Freeway (SR-91)	AM	E/B	9,600	281,000	12,344	1.286	F	0.019
betw. I-710 and Cherry Ave		W/B	9,600		11,818	1.231	F	0.003
	PM	E/B	9,600		10,701	1.115	F	0.009
		W/B	9,600		13,395	1.395	F	0.006
3 Artesia Freeway (SR-91)	AM	E/B	9,600	285,100	11,633	1.212	F	0.014
betw. Cherry Ave and Paramount Blvd		W/B	9,600		11,177	1.164	F	0.003
(CMP Station)	PM	E/B	9,600		10,111	1.053	F	0.007
		W/B	9,600		12,661	1.319	F	0.006
4 Artesia Freeway (SR-91)	AM	E/B	9,600	272,500	12,281	1.279	F	0.007
betw. Paramount Blvd and Lakewood Blvd		W/B	9,600		9,474	0.987	E	0.003
	PM	E/B	9,600		10,048	1.047	F	0.005
		W/B	9,600		11,704	1.219	F	0.004
5 Artesia Freeway (SR-91)	AM	E/B	9,600	276,500	10,557	1.100	F	0.007
betw. Lakewood Blvd and Bellflower Blvd		W/B	9,600		10,980	1.144	F	0.015
	PM	E/B	9,600		9,671	1.007	F	0.019
		W/B	9,600		11,921	1.242	F	0.008
6 Artesia Freeway (SR-91)	AM	E/B	7,600	290,900	9,824	1.293	F	0.004
betw. Norwalk Blvd and Pioneer Blvd		W/B	7,600		11,136	1.465	F	0.006
(CMP Station)	PM	E/B	7,600		9,606	1.264	F	0.007
		W/B	7,600		11,367	1.496	F	0.004

* Denotes a significant project impact prior to additional mitigation considerations.

Table 16(c)
Freeway On-Ramp Demand/Capacity (D/C) and Level of Service (LOS) Summary
Future (2020) With Project + TDM Mitigation Traffic Conditions

					Future(2020) With Project + TDM Mitigation															
					AM Peak Hour								PM Peak Hour							
			Capacity		Demand		Demand/Capacity		LOS		Impact		Demand		Demand/Capacity		LOS		Impact	
No.	Route	On-Ramp	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane	Metered Lane	HOV Lane
1	405	SB from NB Bellflower Bl.	900		367		0.408		A		0.009		371		0.412		A		0.067	
2	405	SB from SB Bellflower Bl.	900		251		0.279		A		0.009		346		0.384		A		0.067	
3	405	NB from SB Bellflower Bl.	900		499		0.555		A		0.000		279		0.310		A		0.000	
4	405	NB from NB Bellflower Bl.	1,600		567		0.354		A		0.000		513		0.321		A		0.000	
5	405	SB from EB Willow St.	900	1,600	451	93	0.501	0.058	A	A	0.052	0.006	553	114	0.614	0.071	B	A	0.067	0.008
6	405	SB from SB Lakewood Bl.	900	1,600	287	58	0.319	0.036	A	A	0.078	0.009	583	120	0.648	0.075	B	A	0.210	0.024
7	405	NB from NB Lakewood Bl.	900	1,600	795	163	0.883	0.102	D	A	0.000	0.000	534	109	0.594	0.068	A	A	0.000	0.000
8	405	NB from SB Lakewood Bl.	900	1,600	412	85	0.458	0.053	A	A	0.103	0.012	865	177	0.961	0.111	E	A	0.400	0.046
9	405	SB from Spring St.	900	1,600	283	58	0.315	0.036	A	A	0.000	0.000	372	76	0.413	0.048	A	A	0.000	0.000
10	405	SB from SB Cherry Av.	900		640		0.711		C		0.000		580		0.644		B		0.000	
11	405	NB from WB Spring St.	900	1,600	664	136	0.738	0.085	C	A	0.000	0.000	713	146	0.792	0.091	C	A	0.000	0.000
12	405	SB from Orange Av.	900	1,600	283	58	0.314	0.036	A	A	0.000	0.000	259	54	0.288	0.033	A	A	0.000	0.000
13	405	NB from NB Cherry Av.	900		858		0.953		E		0.000		548		0.609		B		0.000	
14	405	NB from SB Cherry Av.	900	1,600	371	76	0.412	0.047	A	A	0.044	0.005	480	98	0.534	0.061	A	A	0.115	0.013
15	405	NB from EB 32nd St.	900		388		0.431		A		0.000		381		0.423		A		0.000	
16	405	SB from NB Atlantic Av.	900		303		0.337		A		0.001		429		0.477		A		0.001	
17	405	SB from SB Atlantic Av.	900		250		0.278		A		0.000		285		0.317		A		0.000	
18	405	NB from NB Atlantic Av.	900		265		0.294		A		0.000		227		0.252		A		0.000	
19	91	EB from Atlantic Av.	1,600		527		0.329		A		0.009		563		0.352		A		0.004	
20	91	WB from Cherry Av.	900	1,600	435	89	0.484	0.056	A	A	0.001	0.000	467	96	0.519	0.060	A	A	0.005	0.001
21	91	EB from Cherry Av.	1,600		812		0.508		A		0.002		706		0.441		A		0.001	
22	91	WB from Paramount Bl.	1,600		574		0.359		A		0.004		736		0.460		A		0.012	
23	91	EB from Paramount Bl.	1,600		484		0.302		A		0.001		528		0.330		A		0.007	
24	91	WB from Downey Av.	900	1,600	764	157	0.848	0.098	D	A	0.000	0.000	542	110	0.602	0.069	B	A	0.001	0.000
25	91	EB from Downey Av.	1,600		538		0.336		A		0.000		400		0.250		A		0.000	
26	91	WB from SB Lakewood Bl.	1,600		813		0.508		A		0.000		807		0.504		A		0.000	
27	91	WB from NB Lakewood Bl.	900	1,600	681	140	0.757	0.087	C	A	0.022	0.002	632	130	0.703	0.081	C	A	0.041	0.005
28	91	EB from SB Lakewood Bl.	900	1,600	168	34	0.187	0.021	A	A	0.000	0.000	166	34	0.184	0.021	A	A	0.000	0.000
29	91	EB from NB Lakewood Bl.	900	1,600	370	76	0.411	0.048	A	A	0.066	0.008	458	94	0.509	0.058	A	A	0.165	0.019
30	91	EB from Clark Av.	900	1,600	455	93	0.506	0.058	A	A	0.000	0.000	402	82	0.446	0.051	A	A	0.015	0.002
31	91	WB from Bellflower Bl.	1,600		643		0.402		A		0.000		698		0.436		A		0.000	
32	91	EB from Bellflower Bl.	900	1,600	185	38	0.205	0.024	A	A	0.000	0.000	196	40	0.218	0.025	A	A	0.006	0.001

- San Diego Freeway Northbound On-Ramp from Southbound Cherry Avenue: This improvement involves a widening for the two northbound on-ramps from Cherry Avenue in the area where these ramps merge together. The existing merge is rather abrupt and can involve relatively high speeds. The widening on both sides of the ramp would provide an elongation of the merge section for a smoother and safer merge. Additionally, the ramp metering location for southbound traffic from Cherry Avenue could be relocated to provide added queuing length between the meter and Cherry Avenue.

CATEGORY E - RESIDENTIAL NEIGHBORHOOD STREET MEASURES

Of the five streets serving residential neighborhoods that were previously examined in Table 15, Conant Street between Clark Avenue and Bellflower Boulevard, Bixby Road between Orange Avenue and Cherry Avenue, and Clark Avenue between Arbor Road and Centralia Street would be significantly impacted by the project according to the City's guideline. As shown in Table 17, the project TDM program would not adequately reduce these impacts to a level below significance. Therefore, it is proposed that the project provide appropriate funding to the City of Long Beach to administer and allocate for the design and implementation of neighborhood traffic management measures to deter non-residential traffic intrusion into these residential areas. As part of this program, the City would include and coordinate with adjacent jurisdictions and neighborhood groups that may be significantly affected by such traffic intrusion.

CATEGORY F - PUBLIC TRANSIT MEASURES/IMPROVEMENTS

The project proposes to work with LBT and MTA to address the project's anticipated transit demand and needs. The combination of project transit

Table 17

Future (2020) Traffic Volumes on Residential Streets
With Project + TDM Mitigation

Segment	Period	Future (2020)				
		Without Project	With Project + TDM Mitigation	Project Volume (Net)		Project Percent
Conant St.	AM Peak Hour	173	404	231	*	57%
bet. Clark Av. &	PM Peak Hour	190	211	21		10%
Bellflower Bl.	Daily	2,330	3,570	1,240	*	35%
Bixby Rd.	AM Peak Hour	340	368	28		8%
bet. Orange Av. &	PM Peak Hour	395	493	98	*	20%
Cherry Av.	Daily	4,330	4,950	620	*	13%
Clark Av.	AM Peak Hour	1,205	1,252	47		4%
bet. Arbor Rd. &	PM Peak Hour	1,985	2,050	65	*	3%
Centralia St.	Daily	20,470	21,010	540	*	3%
Lakewood Dr.	AM Peak Hour	165	167	2		1%
bet. Ann Arbor Rd. &	PM Peak Hour	155	169	14		8%
Carson St.	Daily	1,440	1,530	90		6%
28th St.	AM Peak Hour	200	205	5		2%
bet. Clark Av. &	PM Peak Hour	190	197	7		4%
Bellflower Bl.	Daily	2,220	2,280	60		3%

* Denotes a significant project impact.

measures and the TDM measures (see Appendix C) are expected to reduce the project trip generation of the Commercial (Office Park) use by 20 percent.

CATEGORY G - BICYCLE FACILITY IMPROVEMENTS

In keeping with the intent of the Long Beach Bicycle Master Plan, the project will continue to provide a Class I bike lane within the Carson Street parkway adjacent to the site between First Street and Lakewood Boulevard, and will provide Class II bike lane improvements that extend south from Carson Street and west to the Paramount Boulevard/Cover Street intersection. These and other bicycle-related infrastructure and amenities are also discussed in the project TDM program, Appendix C.

PHASING OF MITIGATION MEASURES

As the PacifiCenter project is developed, the traffic mitigation measures described above will be implemented in a phased manner. These measures will be phased to mitigate off-site traffic impacts before they become significant. The various components of mitigation (i.e., off-site physical improvements; regional traffic signal system corridor upgrades; transportation demand management; neighborhood traffic management programs; and new roadway linkages) will be staged to anticipate the traffic consequences of project development as it is implemented.

SIGNIFICANCE AFTER MITIGATION

As previously noted, prior to mitigation, the project is expected to significantly impact 55 study intersections. Seventy-nine (79) study intersections would be operating at LOS E or F in one or both peak hours after project completion, prior to mitigation. Table 12, page 102, shows the results with the implementation of the total program of proposed mitigation measures. These measures would add capacity or reduce traffic volumes in the study area. As indicated, the combination of these measures is expected to reduce nearly all project intersection impacts to a level of below significance, except at three intersections. Also, with project mitigation, 49 of the 109 study intersections would be operating at LOS D or better, while 60 intersections would be at LOS E or F in one or both peak hours. Of course, mitigation of an otherwise significant impact is dependent upon timely implementation of the recommended mitigation measures by the agency or agencies having jurisdiction over the affected locations.

In terms of impacts to the regional transportation system, measures to increase the capacity of these facilities are beyond the ability of the project. However, as discussed previously regarding the credits/debits analysis, the project would be funding (or cause to be funded) extensive area-wide mitigation measures that would result in much

greater benefit than impact on the regional system. These measures would improve conditions on the area-wide arterial streets and freeway ramps, thereby allowing vehicles to better use these facilities without further overburdening the freeways. The project is also proposing a voluntary improvement to the Cherry Avenue on-ramp of the San Diego Freeway. Thus, the project can be deemed to have reduced its regional impacts to a level of insignificance by the in-lieu mitigation attributable to the project's area-wide measures, as promoted by the CMP and its credits/debits analysis. However, although the credits/debits analysis indicates that the project would provide an overall benefit to the regional transportation system and the proposed mitigation measures would further improve conditions, since project traffic volumes would result in a D/C ratio increase of 0.020 or more with a final LOS of F on eight mainline segments of the San Diego Freeway, the project's impact on these segments is considered significant.

Relative to its residential neighborhood street impacts, the project would be providing funding for the implementation of neighborhood traffic management measures to mitigate traffic intrusion conditions. However, should the jurisdiction(s) with authority fail or be unable to implement acceptable and adequate neighborhood management traffic measures, project impacts on possibly up to three residential street segments may not be reduced to a level below significance.

No significant project impact on public transit is anticipated. Long Beach Transit has indicated it has adequate capacity to absorb moderate increases in patronage demand from the project.

TRAFFIC IMPACT STUDY REPORT

FOR PACIFICENTER @ LONG BEACH PROJECT

APPENDICES
A, B, C, D, & E

TRAFFIC IMPACT STUDY REPORT
FOR PACIFICENTER @ LONG BEACH PROJECT

Appendix

A Related Projects Trip Generation Equations and Rates

B Congestion Management Program (CMP) Credits/Debits Analysis

C Preliminary Project Transportation Demand Management (TDM) Program

D Intersection, Residential Street and Freeway Traffic Counts

E Critical Movement Analysis (CMA) Worksheets

APPENDIX A

Related Projects
Trip Generation Equations and Rates

APPENDIX A
Related Projects Trip Generation Equations and Rates

Apartment - per unit

Daily:	T = 5.994 (D) + 134.114	
AM Peak Hour:	T = 0.497 (D) + 3.238	Inbound = 16%, Outbound = 84%
PM Peak Hour:	T = 0.541 (D) + 18.743	Inbound = 67%, Outbound = 33%

Church - per 1,000 square feet

Daily:	T = 9.11 (A)	
AM Peak Hour:	T = 0.72 (A)	Inbound = 54%, Outbound = 46%
PM Peak Hour:	T = 0.66 (A)	Inbound = 54%, Outbound = 46%

Commercial Airport - per flight

Daily:	T = 104.73 (F)	
AM Peak Hour:	T = 5.40 (F)	Inbound = 54%, Outbound = 46%
PM Peak Hour:	T = 5.75 (F)	Inbound = 56%, Outbound = 44%

Condominium - per unit

Daily:	Ln(T) = 0.85 Ln(D) + 2.564	
AM Peak Hour:	Ln(T) = 0.79 Ln(D) + 0.298	Inbound = 17%, Outbound = 83%
PM Peak Hour:	Ln(T) = 0.827 Ln(D) + 0.309	Inbound = 67%, Outbound = 33%

Elderly Housing (Detached) - per unit

Daily:	T = N/A	
AM Peak Hour:	T = 0.21 (D)	Inbound = 36%, Outbound = 64%
PM Peak Hour:	T = 0.23 (D)	Inbound = 64%, Outbound = 36%

Fast-Food Restaurant w/ Drive Through - per 1,000 square feet

Daily:	T = 496.12 (A)	
AM Peak Hour:	T = 49.86 (A)	Inbound = 51%, Outbound = 49%
PM Peak Hour:	T = 33.48 (A)	Inbound = 52%, Outbound = 48%

General Office - per 1,000 square feet

Daily:	Ln(T) = 0.768 Ln(A) + 3.654	
AM Peak Hour:	Ln(T) = 0.797 Ln(A) + 1.558	Inbound = 88%, Outbound = 12%
PM Peak Hour:	T = 1.121 (A) + 79.295	Inbound = 17%, Outbound = 83%

Government Office Building - per 1,000 square feet

Daily:	T = 68.93 (A)	
AM Peak Hour:	T = 5.88 (A)	Inbound = 84%, Outbound = 16%
PM Peak Hour:	T = 11.03 (A)	Inbound = 74%, Outbound = 26%

APPENDIX A (cont.)
Related Projects Trip Generation Equations and Rates

Hospital - per 1,000 square feet

Daily:	T = 10.411 (A) + 1915.686	
AM Peak Hour:	Ln(T) = 0.788 Ln(A) + 1.256	Inbound = 73%, Outbound = 27%
PM Peak Hour:	Ln(T) = 0.842 Ln(A) + 0.908	Inbound = 24%, Outbound = 76%

Hotel - per room

Daily:	T = 8.92 (R)	
AM Peak Hour:	T = 0.782 (R) - 29.797	Inbound = 58%, Outbound = 42%
PM Peak Hour:	Ln(T) = 1.15 Ln(R) - 1.255	Inbound = 49%, Outbound = 51%

Library - per 1,000 square feet

Daily:	Ln(T) = 0.681 Ln(A) + 5.043	
AM Peak Hour:	T = 1.317 (A) - 5.343	Inbound = 72%, Outbound = 28%
PM Peak Hour:	Ln(T) = 0.874 Ln(A) + 2.270	Inbound = 48%, Outbound = 52%

Light Industrial - per 1,000 square feet

Daily:	T = 6.97 (A)	
AM Peak Hour:	T = 0.92 (A)	Inbound = 88%, Outbound = 12%
PM Peak Hour:	T = 0.98 (A)	Inbound = 12%, Outbound = 88%

Medical Office - per 1,000 square feet

Daily:	T = 40.892 (A) - 214.970	
AM Peak Hour:	T = 2.43 (A)	Inbound = 80%, Outbound = 20%
PM Peak Hour:	Ln(T) = 0.921 Ln(A) + 1.476	Inbound = 27%, Outbound = 73%

Mini-Warehouse - per 1,000 square feet

Daily:	Ln(T) = 1.01 Ln(A) + 0.815	
AM Peak Hour:	T = 0.15 (A)	Inbound = 59%, Outbound = 41%
PM Peak Hour:	Ln(T) = 1.015 Ln(A) -1.487	Inbound = 64%, Outbound = 36%

Pharmacy - per 1,000 square feet

Daily:	Ln(T) = 0.994 Ln(A) + 4.51	
AM Peak Hour:	T = 9.495 (A) - 66.577	Inbound = 59%, Outbound = 41%
PM Peak Hour:	T = 7.63 (A)	Inbound = 49%, Outbound = 51%

Research and Development Center - per 1,000 square feet

Daily:	T = 8.11 (A)	
AM Peak Hour:	T = 1.24 (A)	Inbound = 83%, Outbound = 17%
PM Peak Hour:	T = 1.08 (A)	Inbound = 15%, Outbound = 85%

APPENDIX A (cont.)
Related Projects Trip Generation Equations and Rates

Restaurant - per 1,000 square feet

Daily:	T = 89.95 (A)		
AM Peak Hour:	T = 0.81 (A)	Inbound = 82%,	Outbound = 18%
PM Peak Hour:	T = 7.49 (A)	Inbound = 67%,	Outbound = 33%

Shopping Center - per 1,000 square feet

Daily:	Ln(T) = 0.643 Ln(A) + 5.866		
AM Peak Hour:	Ln(T) = 0.596 Ln(A) + 2.329	Inbound = 61%,	Outbound = 39%
PM Peak Hour:	Ln(T) = 0.660 Ln(A) + 3.403	Inbound = 48%,	Outbound = 52%

Single-Family Detached Housing - per unit

Daily:	Ln(T) = 0.92 Ln(D) + 2.707		
AM Peak Hour:	T = 0.704 (D) + 12.09	Inbound = 25%,	Outbound = 75%
PM Peak Hour:	Ln(T) = 0.887 Ln(D) + 0.605	Inbound = 64%,	Outbound = 36%

Specialty Retail - per 1,000 square feet

Daily:	T = 40.67 (A)		
AM Peak Hour:	T = 6.41 (A)	Inbound = 48%,	Outbound = 52%
PM Peak Hour:	T = 2.59 (A)	Inbound = 43%,	Outbound = 57%

Supermarket - per 1,000 square feet

Daily:	T = 111.51 (A)		
AM Peak Hour:	Ln(T) = 1.696 Ln(A) - 1.423	Inbound = 61%,	Outbound = 39%
PM Peak Hour:	Ln(T) = 0.87 Ln(A) + 2.902	Inbound = 51%,	Outbound = 49%

Where:

Ln = logarithmic function	D = dwelling units
T = trip ends	F = average flights
A = building area in 1,000's of square feet	R = rooms

APPENDIX B

Congestion Management Program (CMP)
Credits/Debits Analysis

APPENDIX B
PacifiCenter @ Long Beach
CMP Credits/Debits Analysis

Part 1: New Development Activity	**Size**	**Rate**	**(A) Debit Points**	**(B) Credit Points**
Single-Family Residential	255 du	6.80	1,734	
Multi-Family Residential	2,245 du	4.76	10,686	
Commercial	120 ksf	22.23	2,668	
Free-Standing Eating/Drinking (assumed)	30 ksf	66.69	2,010	
Lodging (assumed at 800 sf/rm)	320 ksf	7.21	2,307	
Office	3,150 ksf	7.35	23,153	
			42,558	
Part 2: New Development Adjustments				
Industrial	303 ksf	6.08	1,842	
Office	233 ksf	10.50	2,446	
			4,288	
Part 3: New Development Net Debit			38,270	
Part 4: Traffic Signal Survel. & Control				
Del Amo Boulevard				23,349
Carson Street				19,737
Spring Street				16,383
Willow Street				24,381
Atlantic Avenue				12,900
Cherry Avenue				19,350
Lakewood Boulevard				28,980
Bellflower Boulevard				19,608
				164,688
Part 5: Net CMP Credits (= 164,688 - 38,270)				**126,418**

APPENDIX C

Preliminary Transportation Demand Management (TDM) Program

Preliminary Transportation Demand Management Plan
PacifiCenter at Long Beach Project

Project TDM Program Measures

Outlined within this document is the preliminary Transportation Demand Management (TDM) Plan for the PacifiCenter at Long Beach project, a mixed-use redevelopment project that is proposed by Boeing Realty Corporation for its approximately 260-acre site. A TDM program is proposed to reduce the PacifiCenter project's inbound AM peak-hour and outbound PM peak-hour commute-related trips by 20 percent among the office uses. However, the TDM measures outlined herein would be available to a broader cross section of the site, and would also likely attract participants outside of the office uses.

This Plan incorporates the TDM requirements of Chapter 21.64 of the Long Beach City Municipal Code. It also provides a number of additional measures beyond those required by the Municipal Code to achieve and maintain the peak hour trip reduction objective.

The PacifiCenter project is not expected to reach completion until the year 2015, which means it would be several years before the project would begin approaching the trip generation levels assumed in the Traffic Impact Study, or even the reduced peak-hour level resulting from the 20 percent reduction described above. The project would therefore have the benefit of several years to develop and adjust the TDM program, as needed, to assure that the peak hour trip-limit objectives are achieved and maintained, and that the transportation needs of site employees are addressed. It would also give the project the flexibility to consider and/or work with less traditional TDM measures that can produce the same desired effect, such as leasing to tenants who employ an eclectic mix of work schedules which is a strategy that has proven successful elsewhere in the Los Angeles metropolitan area.

Detailed next are the measures that would comprise the project TDM Plan.

A. **Building & Site Design Amenities**

The following design amenities would be provided by the Applicant to facilitate and encourage employee use of alternative transportation modes. These design amenities would be available to site employees within three months after the initial final Certificate of Occupancy for the project has been issued.

A.1 Preferential Parking for Employee Carpools and Vanpools

This amenity would work in conjunction with the HOV lanes on nearby freeways, including the I-405, I-605 and SR91, to encourage employee carpooling and vanpooling. Designated “preferential parking” spaces for employee carpools and vanpools would be provided within the project. These parking spaces would be among the closest non-handicapped employee parking spaces available, to make carpool and/or vanpool parking more convenient than for employees who drive alone to the project. As such, the spaces would likely be distributed throughout the project to maximize the convenience of this parking among the different project buildings. In total, the preferred parking would be comprised of at least ten percent of the employee parking required of the project. Two of these parking spaces would be permanently identified through posted signs and/or pavement striping, and would be of standard dimensions suitable for both carpool and vanpool vehicles. As demand arises, more of the spaces within the preferred parking areas would be clearly identified (signed and/or striped) sufficient to meet the demand of project employees who carpool and/or vanpool with one another to work at least three days per week. Until marked and used for preferred parking, the spaces would be available for regular employee use. Restrictions on parking locations would be explained to employees through postings on the centralized transportation information board (see Item B.2).

A.2 Carpool/Vanpool Passenger Staging Area

A safe and convenient zone would be established within the project, to provide an area outside of vehicle parking spaces where employee carpools and vanpools may deliver and board their passengers.

A.3 Direct Pedestrian Access

To the extent feasible, sidewalks or clearly defined pedestrian pathways would be developed to provide safe and direct access from the external pedestrian circulation system to the main pedestrian entrances of the project buildings.

A.3.a Access to Public Transit Stops -- The design of pedestrian access would include attention to safe and efficient access to nearby public transit stops, specifically the stops at the intersection of Lakewood Boulevard and Carson Street. These stops are served by Long Beach Transit bus routes 111, and 101/103, which are the three existing bus routes that provide direct service to the project site.

A.4 Bicycle Facilities

Bicycle access and parking would be provided as outlined below, to work in conjunction with the growing network of local Class I, II and III bicycle routes and lanes and encourage bicycling as a viable alternative by which to reach the project.

A.4.a Bicycle Access – To the extent feasible, safe and convenient access from the external circulation system to the on-site bicycle parking facilities would be provided. This effort may include posting signs within the project, such as at the main entrances to on-site vehicle parking, indicating the availability and location

of the on-site bicycle parking. This effort would also be facilitated by the internal Class II bicycle lane described below.

A.4.b Internal Bicycle Lane – The project will continue to provide a Class I bike lane within the Carson Street parkway adjacent to the site between First Street and Lakewood Boulevard, and will provide Class II bike lane improvements that extend south from Carson Street and west to the Paramount Boulevard/Cover Street intersection.

A.4.c Bicycle Parking – Chapter 21.64 of the City Municipal Code requires bicycle parking for non-residential development at the rate of four spaces for the first 50,000 square feet of development, plus one space for each additional 50,000 square feet of development. The project would install bicycle parking within the project to meet this requirement. The bicycle parking may take the form of a centralized and secured bicycle parking facility and/or dispersed bicycle parking areas throughout the project to maximize their convenience. The project may also supplement the required parking with additional bicycle racks, when warranted by demand.

B. TDM Information & Services

TDM measures that serve to disseminate rideshare information and increase the convenience of alternative commute methods combine to form the cornerstone of successful TDM programs. Described below are measures that would be performed by the Applicant to provide ridesharing information and services to employees working at the project. These measures would be initiated within six months after the initial final Certificate of Occupancy has been issued, and would be carried-out and maintained by the designated on-site Transportation Coordinator. A full-time Transportation Coordinator would be employed, with additional staffing in the future as needed. The

Transportation Coordinator would work out of the Transportation Management Office, as is described below.

B.1 On-Site Transportation Coordinator and Transportation Management Office

A Transportation Management Office would be established within the project, to house the project Transportation Coordinator. Both employees and residents would be able to call the Transportation Coordinator or visit the Transportation Management Office to obtain information and/or assistance with alternative commute methods. Project employees and residents would be informed of the Transportation Coordinator's hours via the centralized transportation information bulletin boards and the new employee commuter benefits flier/packet described herein.

B.2 Centralized Transportation Information Boards

The Applicant would establish a centralized information board to display information on alternative transportation both within the non-residential and the residential portions of the project. The information board within the non-residential portion would be placed in a location visible and/or accessible to most project employees. Likewise for the residential information board. The displays would market applicable on-site amenities, such as the availability of preferred employee carpool/vanpool parking and bicycle parking, and make access to information on public transit and other alternative transportation options convenient. The displays would be maintained regularly by the project Transportation Coordinator, and include:

- A statement that preferred parking for employee carpools and vanpools is available and a description of how employees may obtain permission to use such spaces;
- The location of the Transportation Management Office and the Transportation Coordinator's name, contact information and work hours;

- A listing of other TDM-related site amenities and services available to employees (or residents) who carpool, vanpool, bicycle or ride public transit;
- A stock of current schedules for the taking of public bus and rail routes that serve or increase the accessibility of the project. Such services include Long Beach Transit's (LBT) bus routes 111, and 101/103, and MTA's Metro Blue Line, which has a station within 4 miles of the project at Willow Street and Long Beach Boulevard that is connected to the project by LBT bus routes 101/103.
- A system map of local bicycle routes and bicycle safety tips, as available or supplied by the City of Long Beach and/or regional organizations such as the MTA; and
- A listing of telephone numbers and/or websites employees can contact to receive additional public transit and rideshare information, such as:
    - MTA's website on public bus and rail services at http://www.mta.net, where the regional bus and rail system map can be viewed, as well as timetables and maps for individual routes;
    - LBT's website at http://www.lbtransit.org, and
    - 1-800-COMMUTE, for transit and rideshare information.

B.3 Personalized Transit Information

The centralized transportation information boards would advertise two websites employees and residents can use for free automated transit trip planning. One service is "Metro Trip Planner," and is accessible through MTA's website at http://www.mta.net. The other service is "TranStar," and is accessible from either the SCAQMD's website or the Southern California Association of Governments at http://latranstar.tann.com.

These options are alternatives to calling 1-800-COMMUTE.

Additionally, upon request, the on-site Transportation Coordinator would answer questions and assist project employees or residents seeking to obtain public transit information useful to their commute.

B.4 On-Site Transit Pass Sales

Monthly LBT, joint LBT/MTA and MTA passes would be made available for purchase on-site, through the Transportation Management Office.

B.5 Carpool / Vanpool Matching

A ridematching service would be made available to help project employees seek carpool and/or vanpool partners. The Transportation Coordinator would facilitate employee ridematching using an in-house system (e.g., specialized spreadsheet), or a service such as “RideLinks” that is available for purchase through a private company. Special emphasis would be given to matching project employees with one another, given the project objective to limit the site’s vehicle trip generation during peak hours. The availability of this service would be advertised through the centralized transportation information boards. Vanpool formation would be further encouraged through the following action:

B.5.a Vanpool Start-Up Assistance -- The Transportation Coordinator would provide further assistance, as needed, to employers or employees attempting to initiate vanpool service at the project. Such assistance could include research of van leasing arrangements possible through companies such as VPSI, research of applicable tax credits available to sponsoring employers or participating employees, increased marketing activity, and assistance with route development.

B.6 Preferential Parking Management

The preferred employee carpool/vanpool parking program would be overseen by the Transportation Coordinator, who would be responsible for receiving and processing employee requests to use the parking, allocating the spaces to eligible employee carpools and vanpools, and monitoring the use of identified spaces to ensure they are not used by employees who drive alone to the worksite.

B.7 Weekday Metro Blue Line Connector Service & Internal Circulator

The project proposes to develop a shuttle system through a joint arrangement with the City of Long Beach and/or Long Beach Transit, whereby the project would supply the shuttle vehicles and other capital needed to operate the service, and the other agencies would operate the weekday service. The purpose of the shuttle service would be two-fold: (1) to provide limited-stop service to the Metro Blue Line LRT, and intersecting bus lines that are en route, during the morning and afternoon commute periods, and (2) to operate as a free project circulator at other times of the day.

As Metro Blue Line Connector Shuttle

Long Beach Transit Routes 101 and 103 provide connection service between the northeast boundary of the project site and the Metro Blue Line's Willow Station, which requires approximately 20 minutes of travel time once on the bus. However, direct connection service from other areas of the project and to the closer Wardlow Station at 3420 N. Pacific Avenue (approximately three miles west of the site) does not currently exist. Therefore, the Metro Blue Line Connector Shuttle is proposed. The shuttle would likely access the Metro's Wardlow Station by way of Cover Street to Cherry Avenue to Wardlow Road, or possibly Cover Street to Industry Avenue to Bixby Road to Cherry Avenue to Wardlow Road. The timing between shuttles would be shorter during the AM

and PM peak periods (e.g., 10 to 15 minutes), with the frequency then diminishing to keep pace with demand. This service would benefit both employees and residents of the project.

As Internal Project Circulator

During non-commute periods, the shuttle would primarily operate as a fare-free circulator within the project to provide an alternative to walking or short driving trips. The shuttle would thereby promote interaction between the project components, provide access to services and restaurants, and further reduce the need for a personal vehicle on-site. Stops for the circulator within the project could be attractively designed to not only provide passenger waiting areas complete with displays of the circulator route and schedule, but to serve also as general pedestrian gathering and resting places. The circulator should ideally operate on 15-minute headways throughout the day, possibly decreasing to 10-minute headways during lunch and the peak commute periods.

B.8 New Business/Employee Commuter Benefits Flier/Packet

The project Transportation Coordinator would prepare fliers and/or packets that outline the key TDM amenities and services made available by the project. The fliers/packets would be distributed to new employers within the project, for employers to post and/or disseminate to their employees working at the project.

B.9 Biennial Transportation Fair and Other Marketing

The Transportation Coordinator would sponsor an annual Transportation Fair for the first two years following the issuance of the first certificate of occupancy, adjusting to once every two years thereafter. The Transportation Fair would promote the alternative transportation opportunities available to project employees (and residents). Special prize drawings and awards may also accompany the Fair to make the event more

festive for participants. The Transportation Coordinator would also promote the annual state-level events of California Rideshare Week and the California Bike Commute.

C. Non-Residential Tenant and Property Owner TDM Provision

The Applicant, or its successor, would issue a TDM Provision with each lease or purchase agreement, to formally introduce tenants and property owners to the project TDM program. The TDM Provision would also encourage all tenants and property owners to consider alternative work hour schedules, if feasible, such as those outlined below.

C.1 Alternative Work Schedules

Examples of alternative work schedules include: 1) compressed work week schedules, such as the 9/80 work schedule that allows employees to compress their work schedules into nine days to receive one specified day off every-other week; 2) adjusting the typical start and end times of specific departments or offices to avoid the evening peak period; and/or 3) offering employees the flexibility to adjust their designated work schedules by up to half an hour, upon supervisor or management approval, if needed to participate in a carpool, vanpool or public transit arrangement.

D. Pursue Eclectic Tenant Mix

The trip-reduction objectives of the project could be facilitated by pursuing a mix of tenants for the non-residential portion of the development. Larger tenants (i.e., tenants with 250 or more site employees) can benefit the project TDM effort because they not only tend to provide a better foundation for viable carpool/vanpool opportunities, but larger tenants are also subject to SCAQMD's Rule 2202, which can lead to a mutually beneficial relationship between the project's and tenant's trip-reduction objectives. Tenants with less traditional and/or more varied work schedules can also benefit the

project TDM effort, because such schedules can shift a proportion of their employee's arrival and departure hours outside of the AM and PM peak hours of concern.

E. Monitoring

The Applicant acknowledges that the City of Long Beach may periodically inspect the project site to ensure the implementation and continued maintenance of the signed-off TDM Plan. Furthermore, to ensure the 20 percent trip-reduction goals are met, an annual monitoring program is proposed whereby traffic counts are conducted within the project during the AM and PM peak hours, at locations most likely to intercept project-related vehicle trips versus commuter cut-through trips.

TRAFFIC IMPACT STUDY REPORT

FOR PACIFICENTER @ LONG BEACH PROJECT

APPENDIX D

Intersection, Residential Street and Freeway Traffic Counts

This Appendix is on File and Available for Review at:

City of Long Beach
Planning and Building Department
333 West Ocean Boulevard, 7th Floor
Long Beach, CA 90802

TRAFFIC IMPACT STUDY REPORT

FOR PACIFICENTER @ LONG BEACH PROJECT

APPENDIX E

Critical Movement Analysis (CMA) Worksheets
Volume 1

This Appendix is on File and Available for Review at:

City of Long Beach
Planning and Building Department
333 West Ocean Boulevard, 7th Floor
Long Beach, CA 90802

TRAFFIC IMPACT STUDY REPORT

FOR PACIFICENTER @ LONG BEACH PROJECT

APPENDIX E

Critical Movement Analysis (CMA) Worksheets
Volume 2

This Appendix is on File and Available for Review at:

City of Long Beach
Planning and Building Department
333 West Ocean Boulevard, 7th Floor
Long Beach, CA 90802

TRAFFIC IMPACT STUDY REPORT

FOR PACIFICENTER @ LONG BEACH PROJECT

APPENDIX E

Critical Movement Analysis (CMA) Worksheets
Volume 3

This Appendix is on File and Available for Review at:

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Appendix R

Water Master Plan Study

Water Master Plan Study

PacifiCenter @ Long Beach

December, 2003

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Water Master Plan Study

PacifiCenter @
Long Beach

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1. INTRODUCTION

The Water System Master Plan Report provides the following information for the PacifiCenter @ Long Beach project:

- A description of the existing water system and related demand;
- An analysis of the proposed water and reclaimed water systems, and projected demands; and
- A description of the potential impacts relative to capacity and water supplies.

Kimley-Horn and Associates, Inc., prepared this report as a part of the Master Planning and preliminary design efforts for Boeing Realty Corporation.

1.1 Site Background

The PacifiCenter site is located approximately 5 miles northeast of downtown Long Beach and immediately north of the Long Beach Municipal Airport. A majority of the site (approximately 238 acres) is located within the City of Long Beach, while the remaining portion of the site (approximately 23 acres) is within the City of Lakewood. In general, the project site is bound by Carson Street on the north, the Long Beach Airport on the south and southwest, Lakewood Boulevard on the east, and the Lakewood Country Club and Airport on the west. **Figure W-1** presents an aerial map of the project site.

Prior to 1941, the PacifiCenter site was undeveloped and generally consisted of relatively flat, grassy areas. In 1923, the adjacent Airport (then known as Daugherty Field) began operations, which included an unpaved open airfield with hangars located to the southwest of the project site. In order to meet the aircraft production requirements of World War II, the United States of America War Assets Administration purchased the project site and adjacent properties in 1941 and began to construct an aircraft production facility that was known as the Long Beach C-1 facility, which was operated by the Douglas Aircraft Company.

By 1945, the Long Beach C-1 facility was fully operational. The Long Beach C-1 facility thereafter became Douglas Aircraft Company's largest production center. At its peak, the facility included approximately 1.4 million square feet of covered workspace, produced one plane every hour, and employed over 50,000 workers.

During the years following the end of World War II, employment at the C-1 facility declined to approximately 1,000 employees. As a result, in 1947, the Douglas Aircraft Company started to acquire portions of the C-1 facility from the United States government. The acquisition of the entire C-1 facility was completed in 1961. In 1967, Douglas Aircraft Company merged with McDonnell Aircraft Company to form the McDonnell Douglas Corporation, which was subsequently acquired in 1997 by the Boeing Company. Between the 1960's and early 1990's, growth in commercial aviation increased on-site employment to approximately 40,000 employees. To date, the types of on-site operations associated with aircraft production have included office, research and development (R&D), manufacturing and processing, assembly and subassembly, material storage, testing and laboratories, and ancillary aviation-related services.

1.2 Existing Conditions

Until recently, the existing Boeing facilities on the PacifiCenter site contained over five million square feet of total floor area. [1] The majority of the existing development consists of large corrugated metal industrial buildings and airplane hangars as indicated in the aerial photograph provided in Figure W-1. These low to mid-rise industrial and R&D buildings are located throughout the project site and generally range between 30 to 90 feet in height and from 2,000 up to approximately 500,000 square feet in floor area. In addition, the site includes a nine-story former executive office building along Lakewood Boulevard. The remainder of the project site is paved with asphalt or concrete. An engine run-up/aircraft testing area is located adjacent to the Airport in the southwest corner of the site.

Currently, most of the aviation-related uses and activities on the project site have been discontinued. However, approximately 379,500 square feet of existing on-site floor area is being used for production associated with Boeing's C-17 and 717 aircraft, including final aircraft preparation, ground support, receiving customer operations, aircraft testing and ancillary support functions. This area is known as the Boeing Enclave and is located within the southwestern portion of the project site as indicated in Figure W-1. The Enclave contains approximately 48 acres. The primary C-17 and 717 plants are located adjacent to the project site along the west side of the Airport and on the east side of Lakewood Boulevard, respectively.

Development of the PacifiCenter project will result in the replacement of existing buildings and structures with new R&D, light industrial, office, retail, hotel, residential, and potentially the continuation of some aviation-related uses. PacifiCenter is anticipated to be fully developed by the year 2020. [1]

1.3 Study Objective

The objective of this Water System Master Plan is to describe the proposed on-site water system, the reclaimed water system, and to identify potential environmental impacts that may result from the development of the PacifiCenter project. The study analyzes existing and future conditions on the site and presents the proposed water and reclaimed system improvements.

2. EXISTING CONDITIONS

Kimley-Horn has reviewed documents and files from the Cities of Long Beach and Lakewood and met with members of the respective agency staffs. The documents and files reviewed include basin-wide maps, conceptual plans of the proposed project, and plans of the proposed improvements. Section 5 of this report lists the agency staff contacts.

2.1 City of Long Beach Regional Water System

The City of Long Beach currently provides water services for domestic and fire protection to the portion of the site within the City of Long Beach. The City of Long Beach's water sources include 25 active groundwater wells that provide approximately 42 percent of the City's water supply and imported water purchased from the Metropolitan Water District of Southern California (MWD).

[1] Project description provided by PCR.

The MWD obtains its water supplies from the Colorado River Aqueduct and the State Water Project Aqueduct via the Sacramento River Delta. The MWD supplies 26 member agencies whose total population is approximately 17 million. The City of Long Beach is one of the 14 member cities of the MWD. The MWD treats and delivers an average of 1.7 billion gallons per day and more than 2 billion gallons on a hot day. The service area population is expected to grow by about 43 percent to about 22.3 million people by the year 2020. The MWD's Integrated Resources Plan has targeted increased conservation, recycling, storage, and water transfers to help ensure the region's future water supply and reduce dependence on imported water from the Colorado River and Northern California. The Southern California Association of Governments (SCAG) projects the population to increase over a 17 year period from 2003 to 2020 at an average annual growth rate of 0.6 percent for the City of Long Beach, 0.2 percent for the City of Lakewood and 0.9 percent for Los Angeles County.[2] The SCAG projected population growth is consistent with the MWD's growth projections.

The MWD's long-range water reliability program provides for storing water during wet periods for use during dry spells. The MWD has negotiated nearly 1 million acre-feet of underground storage in the San Joaquin Valley near the State Water Project and is negotiating for about 2.5 million acre-feet of aquifer space near the Colorado River Aqueduct. The MWD's Diamond Valley Lake, formerly the Eastside Reservoir Project near Hemet in southwestern Riverside County, was dedicated in March, 2000, and is now being filled. Filling the reservoir will be complete sometime in 2003. When the reservoir is filled, it will hold approximately 800,000 acre-feet and will nearly double the surface reservoir capacity in the region, providing a six-month emergency supply of drinking water.

The City of Long Beach Water Department (LBWD) manages a water system that includes 25 active groundwater wells, 2 active MWD connections (LB4 and LB8), 4 inactive MWD connections (LB1, LB5, LB6, and LB7), 2 water reservoirs (Alamitos and J. Will Johnson), a 62.5 million gallon water treatment plant, and a network of water mainlines and fire hydrants. **Figure W-2** illustrates the City of Long Beach Municipal distribution system.

The Long Beach Water Reclamation Plant, owned and operated by the County Sanitation Districts of Los Angeles (CSDLA) and located in El Dorado Park in the City of Long Beach, provides reclaimed water used for irrigation throughout the City and will be used to irrigate the landscaping of the PacifiCenter project.

The existing Boeing Company manufacturing facility at the PacifiCenter site is served by a LBWD 20 inch diameter cast iron water main that is located in the Carson Street right-of-way. **Figure W-3** illustrates the on-site private domestic water distribution system. The City of Long Beach Water distribution system is depicted on Figure W-2. Figure W-2 also depicts the regional water system that serves the project site.

2.2 City of Lakewood Regional Water System

The Lakewood Department of Water Resources provides service for the portion of the project site within the City of Lakewood. One 6 inch potable water line enters the site at the corner of Paramount Boulevard and Cover Street and runs to the airplane wash rack and fire suppression system within the Lakewood portion of the project site. The City of Lakewood does not currently provide reclaimed water service to the project site. The City of Lakewood maintains three sources of water supply to meet current customer demand: groundwater, surface water, and reclaimed water. The City of

[2] Section V.J.1, Population, of the Draft Environmental Impact Report.

Lakewood will not be furnishing reclaimed water to any portion of the proposed PacifiCenter development.[3]

The City currently relies on groundwater for 100 percent of its potable water supply. The City draws its supply from the Central Groundwater Basin. This source annually supplies approximately 238,000 acre-feet of potable water to the area. The City of Lakewood supplements the potable water supply with imported water from Central Basin Municipal Water District (CBMWD) through two connections. The capacity of each connection is 15 cubic feet per second. Figure W-2 illustrates the City of Lakewood's distribution system.

The City's Department of Water Resources anticipates a gradual rise in water use, which comes with the passage of time and an increase in the economic vitality in the region. The water use is expected to stay within the City's allowable pumping and carry-over rights[4] through 2020.[5] The City's production facilities can produce up to 22 million gallons per day to meet peak demand. The City's water facilities can maintain this volume of production for two days. The City's water wells can produce up to 16 MG of water on a daily basis The average daily demand is approximately 8.2 million gallons per day and the peak demand for a day during the fiscal year of 1999-2000 was 11 million gallons. A small portion of the total water production is un-metered. This water is used for fire fighting and street sweeping and includes lost water due to leaks in the system. Approximately 0.4 percent of the City's total water production is used to maintain the water quality in the system through annual flushing and valve exercising programs. The system's water loss remains low, approximately 2 percent of the annual water production.

The City of Lakewood does not anticipate a severe water supply shortage during the 20 year planning period. The 1995 purchase of 400 acre-feet of additional water rights from the CBMWD increases the reliability of the City's supply. Any disruption in water production would be short lived and connected to operational problems including, but not limited to, power outages or disasters.

2.3 Regional Reclaimed Water System

The City of Long Beach provides reclaimed water services for irrigation purposes within the City via the Long Beach Water Reclamation Plant. Figure W-2 illustrates the City of Long Beach's reclaimed water distribution system. A 20 inch diameter LBWD reclaimed water main is located in the Carson Street right-of-way adjacent to the site. The City of Lakewood does not currently provide reclaimed water service within the City. Presently, the Boeing facility does not utilize reclaimed water.

2.4 Existing Water Demand

The existing water consumption at the project site includes water utilized for drinking, kitchen, toilet, industrial, and irrigation purposes. A large portion of this water consumption is disposed of through the sewer system. Sewage generation is generally assumed to be related to the amount of water that goes into sinks, toilets, and other wastewater disposal systems. Water consumed that does not

[3] James Glancy, Director of Water Resources, City of Lakewood, Personal Communication, July 2001.
[4] Lakewood is allowed to carry over 20 percent of its allowable pumping rights to the next fiscal year or a maximum of 1,873 acre-feet of water.
[5] City of Lakewood Urban Water Management Plan Update 2000, dated December 12, 2000.

ultimately go into the sewer system includes water for landscape irrigation and other miscellaneous uses that would drain into the storm drain system or evaporate. At this time, the City of Lakewood serves the western portion of the project site within the City of Lakewood. The consumption of the Lakewood portion of the Boeing property was 356 GPD in 2000.[6] Figure W-3 illustrates the existing water system.

Land use at the existing facility, based on occupied floor area as of May 2003, is consistent with a general manufacturing category utilized by the LBWD for both sewage and water generation rates. The historical record of water usage by the existing manufacturing facilities has ranged from a high of 330 million gallons a year (MGY) in 1992 through 1993 to a current (2001-2002) low of 76 MGY. The 330 MGY is consistent with the Boyle Engineering water demand study completed in 1994 for the LBWD. The study incorporated the existing Boeing facility and water consumption from both the City of Long Beach and the City of Lakewood. The study, used for the evaluation of the City of Long Beach water system, assumed full utilization of the Boeing facility and was estimated at 341 MGY, which equates to an average daily flow of 935,000 GPD. This rate is consistent with the water demand coefficients used in this report, see Table 6. Based on these coefficients and the existing active floor area, the base line water demand is 75,900 GPD.

2.5 Existing Fire Flows

Aside from daily water demand, fire flow and pressure in the water system must be adequate for fire protection. In the California Fire Code, fire flow requirements are based on building type and floor area, which range from 1,250 to 5,000 gallons per minute (GPM) at a pressure of 20 pounds per square inch (PSI).

In order to determine the adequacy of the existing fire flows on the site, output data from a computer model for fire flow results were obtained on July 11, 2001 from the LBWD. The locations of the computer model tests are as follows:

- Node 8759, located at the intersection of Carson Street and Lakewood Boulevard;
- Node 41894, located mid-block of Lakewood Boulevard between Carson Street and Conant Street; and
- Node 8835, located at the intersection of Lakewood Boulevard and Conant Street.

The purpose of the analysis was to establish base pressures for fire flow during the maximum day demand. The results of the City's analysis are shown in **Table 1**.

Table 1: Hydraulic Analysis Computer Model Results-LBWD [1,3]

[6] James Glancy, Director of Water Resources, City of Lakewood, letter to Mr. Chuck Spinks, September 21, 2001.

Fire Flow 3000 GPM	Node 8759 EL 47 FT [2]	Node 41894 EL 40 FT	Node 8835 EL 34 FT
HGL (FT) [2]	174	165	158
Pressure (PSI)	55	54	54
Fire Flow 3500 GPM	Node 8759 EL 47 FT	Node 41894 EL 40 FT	Node 8835 EL 34 FT
HGL (FT)	173	162	153
Pressure (PSI)	55	53	52
Fire Flow 4000 GPM	Node 8759 EL 47 FT	Node 41894 EL 40 FT	Node 8835 EL 34 FT
HGL (FT)	172	158	147
Pressure (PSI)	54	51	49

Footnotes:
1 Table 1, excerpted from City of Long Beach data provided to Kimley-Horn via transmittal on July 16, 2001 (see appendix H of this report for complete data).
2 HGL is hydraulic grade line; EL is elevation; FT is feet.
[3] Final Design of water facilities will require current fire flow test.

Assumptions used by the LBWD in estimating pressure and flow from the computer model are described below:

- The Metropolitan Water District interconnect was assumed closed. This has been normal summertime operation over the last few years.
- The water level at J.W. Johnson and Alamitos reservoirs were assumed to have an elevation of 191 feet.
- Two 12 inch loops were introduced into the model on the proposed development's First Street and B Street towards Conant Street. The purpose of these loops was to try to estimate how much fire flow might come from Carson Street and how much might come from Lakewood Boulevard.
- The LBWD's Hydraulic model uses the H_2ONet engine developed by MW Soft.
- Fire flow was recorded at one node off of Carson Street and two nodes off of Lakewood Boulevard.

To supplement the computer model hydraulic analysis, field fire flow tests were performed at two fire hydrants on Carson Street near Lakewood Boulevard. Due to the construction occurring on Lakewood Boulevard and Carson Street at the time the tests were performed, these fire flow tests were performed at the closest fire hydrant due west of the proposed PacifiCenter site so that such tests would not impact the construction activity. The results of the City's field test are summarized in **Table 2**.

Table 2: Fire Flow Test Data- LBWD[1]

Date	Test No.	Hydrant Read	Hydrant Flow

		Static (PSI)	Residual (PSI)	Chart Reading	LBWD Calculated Flow (GPM)
7-11-2001	1044	58	50	28	2280
7-13-2001	1044	55	50	28	2280

Footnote:
[1] Table 2 Excerpted from City of Long Beach data provided to Kimley-Horn via transmittal on July 16, 2001 (see appendix H of this report for complete data).

Additional fire hydrant flow test data for this report was also obtained from the City of Lakewood. This data was dated January 13, 1999. The test was performed for a Wal-Mart site located on the East Side of Paramount Boulevard and Kessler Street. **Table 3** summarizes the fire flow test data from the City of Lakewood. The test was a simultaneous dual-hydrant flow test with a combined actual observed flow of 3,846 GPM and a combined calculated flow of 5,590 GPM at 20 PSI.

Table 3: Fire Flow Test City of Lakewood [1]

Hydrant No: 122-176	North Paramount	Hydrant No: 122-205	South Paramount
STATIC:	60 PSI	STATIC:	60 PSI
RESIDUAL:	40 PSI	RESIDUAL:	40 PSI
DIFFERENTIAL:	20 PSI	DIFFERENTIAL:	20 PSI
PITOT:	20 PSI	PITOT:	20 PSI
ORIFICE SIZE:	4 INCHES	ORIFICE SIZE:	4 INCHES
OBSERVED FLOW:	1,923 GPM	OBSERVED FLOW:	1,923 GPM
Flow @ 40 PSI:	1,923 GPM	Flow @ 40 PSI:	1,923 GPM
Flow @ 30 PSI:	2,393 GPM	Flow @ 30 PSI:	2,393 GPM
Flow @ 25 PSI:	2,601 GPM	Flow @ 25 PSI:	2,601 GPM
Flow @ 20 PSI:	2,795 GPM	Flow @ 20 PSI:	2,795 GPM

Footnote:
[1]Data received from Lakewood Department of Water Resources.

Based on the fire flow test and the hydraulic analysis provided by the City of Long Beach Water Department (Table 1); KHA has developed a computer model of the proposed and existing adjacent system to determine if the City's system can provide the site with the required flows.

2.6 Regulatory Framework

Several regulations and ordinances regarding water supply and water use apply to the PacifiCenter project site and the proposed development. These regulations and ordinances are briefly discussed below.

[1] City of Long Beach Water Department has not verified these findings using their complete water model of the City.

2.6.1 Fire Department Requirements

The County of Los Angeles Fire Department is contracted to provide fire protection to the City of Lakewood. Both the City of Long Beach Fire Department and the County of Los Angeles Fire Department require the provision of fire flows to serve individual development in accordance with the California Fire Code (CFC). The CFC allows a 75 percent reduction in required fire flows for buildings constructed with an approved sprinkler system; the corresponding fire departments will evaluate building plans at the time of permitting to ascertain if reductions apply. The reductions allowed with the use of fire sprinklers are based on land use, fire hazard, life safety, response time, type of building construction, and square footage. **Table 4** contains the design criteria as it pertains to fire protection design without the allowed reduction for fire sprinklers.

Table 4: Fire Flow Criteria by Land Use

Use	Fire Flow[1] Demand (GPM)	Duration (Hours)	Hydrant Spacing (FT)	Remarks:
Office	3,000	5	300	
Retail	3,000	5	300	
Hotel	5,000	5	300	
Research and Development	5,000	5	300	
Housing	3,000	2	500	High Density

Footnote:
1. All fire flow values to maintain 20 PSI residual pressure

The City of Long Beach and the County of Los Angeles require on-site hydrants when any portion of a proposed structure exceeds the allowable distance from a public hydrant located in the right-of-way. The on-site hydrants shall be spaced at 300 to 600 foot intervals depending upon the type of building construction. Only sprinklered buildings qualify for the maximum hydrant spacing of 600 feet. For non-sprinklered buildings, locations shall consider fire protection-access doors and outside storage; however, the distance between hydrants shall not exceed 400 feet. On-site flow may be greater depending upon the size of the structure and the distance from the public hydrants.

A summary of the fire stations located in the area of the proposed development is provided below:

Long Beach Fire Department

Station 17	2241 Argonne Avenue
Station 19	3550 Clark Avenue
Station 23	2300 East 27th Street

Los Angeles County Fire Department

Station 45	4020 Candlewood Street
Station 122	2600 Greenmeadow Road

2.6.2 California Regulatory and Statutory Requirements

Title 24 of the California Administrative Code contains the California Building Standards, including the California Plumbing Code, which promotes water conservation. Title 20 addresses Public Utilities and Energy including appliance efficiency standards that promote water conservation. In addition, several other State laws and regulations require water-efficient plumbing fixtures in structures and impose other requirements related to water supplies and conservation. These include the laws and regulations summarized below:

- Title 24, California Administrative Code Sections 25352(i) and (j) address pipe insulation requirements, which can reduce water used before hot water reaches equipment or fixtures. These requirements apply to steam and steam-condensate return piping and recirculating hot water piping in attics, garages, crawl spaces, or unheated spaces other than between floors or in interior walls. Insulation of water-heating systems is also required.

- Title 20, California Administrative Code Section 1604 (g) (Plumbing Fittings) establishes efficiency standards that give the maximum flow rate of all new showerheads, lavatory faucets, sink faucets, and tub spout diverters.

- Title 20, California Administrative Code Section 1606 (Appliance Efficiency Regulations-Certifications) prohibits the sale of fixtures that do not comply with regulations. No new appliance may be sold or offered for sale in California that is not certified by its manufacturer to be in compliance with the provisions of the regulations establishing applicable efficiency standards.

- Health and Safety Code Section 17921.3 requires low-flush toilets and urinals in virtually all buildings as follows:

  > "All new buildings constructed in this state shall use water closets and associated flushometer valves, if any, that use less than an average of 1.6 gallons per flush and which meet the performance standards established by the American Society of Mechanical Engineers standards A112.19.2-1990 and A112.19.6-1990 and urinals and associated flushometer valves, if any, which use no more than an average of 1 gallon per flush and which meet performance standards established by the American Society of Mechanical Engineers standards A112.19.2- 1990 and A112.19.601990…".

- Health and Safety Code Section 116785 prohibits installation of residential water softening or conditioning appliances unless certain conditions are satisfied. Included is the requirement that, in most instances, the installation of the appliance must be accompanied by water conservation devices on fixtures using softened or conditioned water.

- Government Code Section 65591 et seq. – Water Conservation in Landscaping Act states that the Department of Water Resources must prepare a model water efficient landscape ordinance for use by local agencies. The Act then calls for local agencies to adopt a water efficient landscape ordinance containing measures to reduce irrigation water usage. In accordance with the Act, the City of Long Beach has adopted a water conservation ordinance.

- California Water Code Section SB 221 prohibits a city or county from approving a residential subdivision of more than 500 units in non-urban areas unless there is written verification from the water service provider that sufficient water supplies are or will be available for the development. Government Code section 66473.7(i) states:

(i) This Section shall not apply to any residential project for a site that is within an urbanized area and has been previously developed for urban use, or where the immediate contiguous properties surrounding the residential project site are, or previously have been, developed for urban uses...

- California Water Code Section 10910 et seq. requires each public water system to determine that a new project's anticipated water demand is included as a part of the most recently adopted Urban Water Management Plan (UWMP). The Act adds consequences for water agencies that do not submit or update their UWMP and mandates that Water Supply Assessments be prepared for all projects subject to the California Environmental Quality Act.

  Under SB 610, Long Beach Water Department's UWMP must describe the water supply projects and programs that may be undertaken to meet the total project water use of the services area. In addition, if groundwater is identified as a source available to the supplier, SB 610 requires additional information such as: (1) a groundwater management plan; (2) a description of the groundwater basin(s) to be used and the water use adjudication rights, if any; (3) a description and analysis of groundwater use in the past five years; and (4) a discussion of the sufficiency of the groundwater that is projected to be pumped by the supplier. While the Long Beach portion of the project is subject to SB 610 the Lakewood portion of the PacifiCenter project does not meet the definition of a project per Section 10912 of the Water Code and the requirements of SB 610 do not apply as discussed in Section VM1 Sewer of the EIR.

  Assembly Bill 901, signed October 2001 into law, requires UWMPs to contain information specifically pertaining to the quality of water supply sources. In addition to requirements related to UWMPs, SB 610 recognizes the need to link water supply and land use planning as currently required by Section 10910 of the Water Code. Under certain circumstances, a city or county is required to request in conjunction with a development project a water supply assessment containing specific information from the water service provider to prepare a water supply assessment requested by a city or county for any "project" defined by Section 10912 of the Water Code that is subject to CEQA. The bill prescribes a timeframe within which a public water system is required to submit the assessment to the city or county and authorizes the city or county to seek a writ of mandamus to compel the public water system to comply with requirements relating to the submission of the assessment. If the provider determines that water supplies are, or will be, insufficient, plans must be submitted for acquiring additional water supplies. Additionally, the bill requires the city or county to include the water supply assessment and other pertinent information in any environmental document prepared (e.g., EIR) for the project pursuant to the act.

  Development of the PacifiCenter Project will result in a long-term increase in water consumption. In accordance with the requirements of SB 610, the Long Beach Water Department has prepared the Water Availability Assessment Report for PacifiCenter that analyzed water demands for the proposed project in the context of the Water Department's ability to provide adequate water supplies. Based on the uses proposed for the project site at buildout, an estimated total of 1.41 mgd (4.33 acre-feet) of potable water and 0.403 mgd (1.24 acre-feet) of reclaimed water would be consumed on an average day, and 2.42 mgd (7.43 acre-feet) of potable water and 0..94 mgd (8.65 acre-feet) of reclaimed water would be consumed on a maximum day.

  Based on the Long Beach Water Department 2000 Urban Water Management Plan, an estimated potable water use of 80,346 acre-feet per year and reclaimed water use of 13,025 acre-feet per year is projected. The water consumption associated with this project represents approximately

2.0 percent of LBWD's future water average domestic demand and 3.5 percent of LBWD's future reclaimed water average demand.

Based on this assessment and the Water Availability Assessment prepared for the PacifiCenter @ Long Beach on December 19, 2002, the Long Beach Water Department has provided assurances that there is sufficient capacity to supply the proposed project with potable water for the 20-year timeframe specified in the legislation during normal, single-dry and multiple-dry years. Therefore, the impacts associated with water supplies would be less than significant.

3. Proposed Improvements

3.1 Hydraulic Modeling

Kimley-Horn performed the analysis of the Boeing water system with the aid of the Haestad Methods, Inc., Cybernet and WaterCAD water modeling programs. Using the mathematical model of the existing water system, an evaluation of the existing steady-state flow conditions in the existing pressurized pipe system was performed. The model was calibrated to emulate the current flow regime of the hydrant fire flow tests as furnished by the City of Long Beach. The model output results are located in Appendices A, B, and C of this report.

The program uses pipe network equations that express mass continuity and energy conservation in terms of discharge in each pipe section. This set of simultaneous nonlinear algebraic equations is solved with a linear method algorithm that determines the flow rate in each line using gradient methods to handle the nonlinear flow rate in terms of the energy equation. Line losses are typically determined from the Hazen-Williams equation, and local losses are determined by multiplying a minor loss coefficient by a function of the flow velocity.

The pipe network is modeled as nodes and pipelines. Nodes are located at junction points where two or more pipes intersect, and at the end of a pipe. Each pipe is assigned a diameter, length, and coefficient of friction. The nodes are assigned an elevation and typically a water demand in GPM. The pipes are arranged in a series of loops so that one node can receive supplied water from different directions. The arrangement of the nodes and pipes represent the actual water system.

The proposed PacifiCenter site water distribution system was modeled using the calibrated existing Cybernet model. The proposed system model was added to the existing city system model and analyzed for impacts. The average daily peak flow demands were applied to the model with respect to development units. The simulation results of this modeling are located in Appendices E, F, and G of this report.

The capacity of the proposed system was analyzed based on its ability to provide the required domestic water and emergency fire flows for the proposed project. The proposed water system for the PacifiCenter project has been analyzed based on the system's fire flow capacity, since fire flow requirements are significantly higher than domestic water demand or peak demand for individual uses.

As part of the improvement program, when a full street improvement is constructed, the programmed utility improvements, including water system improvements, would be constructed at the same time. In addition, the utility improvements would be constructed to accommodate future development of the site and not just the specific development increment. This would ensure that the utility improvements would be constructed in a logical manner and would reduce the potential for additional

trenching and resurfacing of streets for subsequent utility improvements. The coordination of street and utility improvements is a conservative approach to accommodating the project's utility requirements, as sufficient utility capacity would not typically be provided in advance of the actual development-related demand. **Figure W-4** illustrates the proposed water system improvements**.** **Figure W-5** illustrates the proposed reclaimed water system improvements.

3.2 Domestic Water Demand

Based on conversations with Robert Villanueva, P.E., LBWD, the per capita demand is 140 gallons per person per day for residential uses in Long Beach, which includes water for irrigation. Since the PacifiCenter development will provide a reclaimed water distribution system for irrigation separate from the domestic water consumption via the City's reclaimed water system, the per capita demand coefficient used in the water system model for the PacifiCenter development is 110 gallons per person per day for residential development.[7] The model also assumed 2.5 persons per dwelling unit, which is the value used by the Long Beach Water Department for system planning and design.

Domestic water demand coefficients were used for the non-residential component of the planned development. The demands were evaluated for office, retail, light industrial, hotel, and R&D land uses. Since no current water demand coefficients were available for Planned Development zoning and land uses specifically for Long Beach, the sewer coefficients were used in modeling water demand within the non-residential component of the development. These coefficients exceed the values used in the 1994 Boyle Report, providing a more conservative estimate of water consumption. A factor of 1.72 was applied to average daily demand to determine the daily peak flow (maximum daily demand) in gallons per minute. Also a factor of 2.31 was applied to the average daily demand to determine the peak hour flow in gallons per minute.

The PacifiCenter project will be developed as a master-planned, mixed-use community. It will replace the existing uses with the following three primary land uses:

- Commercial (C) (research and development, office, hotel, retail, light industrial, and aviation related uses);
- Residential (R1-R8) (low to medium density); and
- Residential (R9-R12) (medium to high density).

Figure W-6 illustrates these land uses. **Table 5** tabulates the main development for each land use category.

To optimize the ability to respond to market conditions, the PacifiCenter project includes development flexibility allowing the project to be market-driven within approved limits. The proposed land use plan allows up to 3,300,000 SF of floor space for the commercial designated areas and 2500 housing units within the residential designated areas. In addition the commercial areas would allow up to 400 hotel rooms. A retail overlay zone would be allowed over the Residential Areas adjacent to A Street and East of 1st Street. This 150,000 SF is included in the 3,300,000 SF of commercial floor space.

[7] Data provided by, City of Long Beach Water Department. 110gpd is consistent with the 1994 Boyle Report.

Table 5: Development Intensities by Parcels

Planned Development Unit (a)	Commercial Building (SF) (d)	Retail / Hotel (rooms) (b)	Housing (DU)
R1			161
R2			150
R3			132
R4			207
R5			99
R6			137
R7			95
R8			95
R9(c)			356
R10(c)			356
R11(c)			356
R12(c)			356
C1	178,000		
C2	90,000		
C3	292,500		
C4	137,000		
C5	146,300		
C6	213,400		
C7	210,500		
C8	211,500		
C9	223,000		
C10	221,900		
C11	222,800		
C12	212,100		
C13	229,200		
C14	228,800		
C15	230,800		
C16	252,200		
Retail / Hotel		150,000 SF /400 rooms	
Total	3,300,000	150,000 / 400	2,500

(a) Areas for the Planned Development unit were established to determine water demands from areas based on anticipated land use and are not to be interpreted as specific parcelization for the site or ultimate development densities for a specific parcel.

(b) 400 hotel rooms and 150,000 SF of retail would be allowed within any of the commercial land use areas. Retail floor SF is include in the total Commercial SF of 3,300,000 SF.

(c) Residential units consisting of medium to high density are the worst case scenario in terms of water usage.

(d) Office, light industrial, R&D, retail, and hotel are allowed within the commercial land use area.

Table 6 contains the demand coefficients with respect to the land uses in determining the total demand of the project.

Table 6: Domestic Water Demand Coefficient [1]

Use:	Demand Coefficient	Remarks:
Office	200 gallons per 1,000 sf per day	
Retail	200 gallons per 1,000 sf per day	
Hotel	150 gallons per room per day	
Research and Development	200 gallon/per 1000 sf per day	
Light Industrial	200 gallon/per 1000 sf per day	
Housing	110 gallons per person/per day[2]	2.5 persons per DU

Footnote:

[1]Coefficients are based on the City of Long Beach Water Department Tables located in Appendix D of this report. They have been modified for use on this project. The same coefficients used for the Lakewood portion of the development.
[2]Housing demand coefficients typically range from 80-110 gallons per person per day. A conservative 110 gpd was used for water modeling purposes. This assumes the use of reclaimed water for irrigation.

Providing flexibility in developing several areas requires the land uses with the greatest water demand be used in analyzing the system. **Table 7** tabulates the domestic water demand based on the land uses that generate the greatest water demand.

Table 7: Domestic Water Demand Summary by User
(Average Daily Demand)

	Commercial [1] (SF)	Hotel Rooms	Housing Units
Project Totals:	3,300,000 SF	400	2,500
Demand (Long Beach):	565,900 GPD		
Demand (2) (Lakewood):	94,100 GPD		
TOTALS:	660,000 GPD	60,000 GPD	687,500 GPD
TOTAL USAGE	1,407,500 GPD		

Footnote:
(1) Retail square footage is included in commercial SF.
(2) Lakewood will be served by LBWD

Table 8 furnishes a demand total as it corresponds to the individual parcels. **Table 9** summarizes the domestic water demands for the project as it relates to the corresponding municipality. The total average daily demand of potable water for the PacifiCenter development at full buildout is

approximately 1,407,500 gallons per day (GPD) and the maximum daily demand is approximately 2,420,900 GPD.

Table 8: Domestic Water Demand Summary

Planned Development Unit	Average Daily Demand (GPD)	Maximum Daily Demand (GPD)	Peak Hour Demand (GPM)
R1	44,275	76,153	71
R2	41250	70,950	66
R3	36,300	62,436	58
R4	56,925	97,911	91
R5	27,225	46,827	44
R6	37,675	64,801	60
R7	26,125	44,935	42
R8	26,125	44,935	42
R9 (b)	97,900	168,388	157
R10 (b)	97,900	168,388	157
R11 (b)	97,900	168,388	157
R12 (b)	97,900	168,388	157
C1	36,600	61,232	57
C2	18,000	30,960	29
C3	58,500	100,620	94
C4	27,400	47,128	44
C5	29,260	50,327	47
C6	42,680	73,410	68
C7	42,100	72,412	68
C8	42,300	72,756	68
C9	44,600	76,712	72
C10	44,380	76,334	71
C11	44,560	76,643	71
C12	42,420	72,962	68
C13	45,840	78,844	74
C14	45,760	78,707	73
C15	46,160	79,395	74
C16	50,440	86,757	81
Hotel (a)	60,000	103,200	96
Total	1,407,500	2,420,900	2,258
(a) Commercial land uses include 400 hotel rooms and 150,000 SF of retail.			
(b) Medium to high density residential.			

Maximum Daily Demand = 1.72 * Average Daily Demand
Peak Hour Flows = 2.31 * Average Daily Demand

Table 9: Domestic Water and Reclaimed Water Project Totals

	DOMESTIC		RECLAIM	
Municipality	Average Daily Demand (GPD)	Maximum Daily Demand (GPD)	Average Daily Demand (GPD)	Maximum Daily Demand (GPD)
Long Beach	1,313,400	2,259,048	402,715	939,669
Lakewood	94,100	161,852	(1)	(1)
Total	1,407,500 GPD	2,420,900 GPD	402,715	939,669

(1) LBWD will supply reclaimed water to the Lakewood portion of the project

The existing City of Long Beach system was modeled assuming the 12 inch line, located in Lakewood Boulevard, flowed in a southerly direction only. Based upon a conversation with Robert Villanueva, P.E. with the LBWD, it was brought to our attention that the 12 inch line connects with a larger supply line located at Redondo Avenue and can flow in a northerly direction if the demand distribution of the City's system incurred such a load. This adds an additional level of redundancy to meet the water demands on the project site.[10]

3.3 Fire Flow Demand

Fire flow is defined as the quantity of water available for fire protection in a given area and is normally measured in gallons per minute (GPM). For modeling purposes, the average daily peak flow was applied to the PacifiCenter's respective planned units. This creates a "worst-case" scenario for applying a fire flow demand at any random location and at any random time within the proposed development timeline. The analysis of the proposed system's ability to deliver the required fire flow demand in GPM is based upon the land uses that were identified in Table 4 of this report.

Two independent domestic water system models were developed and tested with respect to the jurisdictions responsible for providing each portion of the development. At the request of Lakewood's Department of Water Resources, an emergency interconnect between the two systems is being proposed at the City of Long Beach and City of Lakewood City line. Inter-tie connections between the LBWD and other agencies can not be used for fire flow. The water system model did not include interconnections. Referencing **Figure W-8**, the City of Long Beach's portion of the system delivered more than 5,000 GPM in all areas of development (Appendix E). The City of Lakewood's portion of the system required a new 16 inch main parallel to the existing 12 inch main, which is in Paramount Boulevard from Carson Street to Cover Street (Appendix G). The new 16 inch main will connect to the existing City of Lakewood's 16 inch main at the intersection of Paramount Boulevard and Green Meadow Road. This new connection will allow the delivery of 5,000 GPM[11] to all areas of the development.

Table 10 summarizes the calculated on-site fire flows.

[10] October 22, 2001 conversation with Robert Villanueva, City of Long Beach Water Department.
[11]These flows are based on KHA's Water Model and have not been verified by LBWD.

Table 10: Available Fire Flow

Location	City	Available Fire Flow (GPM)	Residual Pressure (PSI)
First Street – Carson St, PSJ-1	LB	5,500.00	20.00
Carson St – Lakewood Blvd, EXJ-3	LB	5,500.00	20.00
Conant St – B St., EXJ-7	LB	5,500.00	20.00
Residential 1 – Residential 2, PPJ-1	LB	5,500.00	20.00
Residential 4 – Residential 5, PPJ-2	LB	5,500.00	20.00
Lakewood Blvd – A St, PSJ-2	LB	5,500.00	20.00
3rd St – A St, PSJ-4	LB	5,500.00	20.00
A St – 2nd St, PSJ-7	LB	5,500.00	20.00
Carson St – A St, PSJ-9	LB	5,500.00	20.00
3rd St – B St, PSJ-12	LB	5,500.00	20.00
B St – 2nd St, PSJ-16	LB	5,500.00	20.00
A St, J-46	LW	5,285.46	20.00
A St, J-47	LW	5,103.09	20.00
Abbreviations: LB = Long Beach LW = Lakewood			

3.4 Reclaimed Water Demand

The reclaimed water demand for the PacifiCenter site is assumed to supply reclaimed water for the proposed open space landscaping. As the City of Lakewood has no reclaimed water infrastructure, the City of Long Beach will provide reclaimed water the Lakewood portion of the project. This demand is also assumed to be the equivalent to 2 inches of irrigation per week in depth over the entire pervious area.

The Average Daily Demand equals the total irrigation demand for a 24 hour period in gallons per day for each planned development unit. The peak Maximum Daily Irrigation Demands were calculated from an 8 hour nighttime irrigation period and an irrigation schedule of 3 days per week. The peak demand was used for sizing the reclaimed water distribution system. The pervious area to be irrigated on the private parcels was determined from the Open Space Plan, illustrated in **Figure W-7,** and is assumed to be approximately 41 acres. Similarly, the pervious area for the common and right-of-way areas was determined from the typical roadway and parkway cross-section that was 20 percent, yielding approximately 10 acres of green landscape space. Therefore, a total of 51 open space acres across the PacifiCenter site were assumed in evaluating the reclaimed water demand for irrigation.

[1.] Matt Lyon of LBWD has confirmed that the City of Long Beach can supply reclaimed water to the City of Lakewood portion of the project.

Table 11 summarizes the total demand based on the 2 inches of irrigation per week criteria and is itemized by parcel.

Table 11: Reclaimed Water Demand Calculations

Planned Development Unit	Municipality	Area (acres)	Area (SF)	Green Space Area (SF) (a)	Average Daily Demand (GPD)	Maximum Daily Demand (GPM)
R1	Long Beach	10	436,907	87,381	15,873	77
R2	Long Beach	9.4	407,286	81,457	14,797	72
R3	Long Beach	8.2	357,628	71,526	12,993	63
R4	Long Beach	12.9	561,924	112,385	20,416	99
R5	Long Beach	6.2	268,330	53,666	9,749	47
R6	Long Beach	8.5	372,002	74,400	13,515	66
R7	Long Beach	5.9	257,440	51,488	9,353	45
R8	Long Beach	5.9	257,440	51,488	9,353	45
R9	Long Beach	7.7	336,283	67,257	12,218	59
R10	Long Beach	7.7	336,283	67,257	12,218	59
R11	Long Beach	7.7	336,283	67,257	12,218	59
R12	Long Beach	7.7	336,283	67,257	12,218	59
C1	Lakewood	7.6	331,492	49,724	9,033	44
C2	Lakewood	3.8	163,350	24,503	4,451	22
C3	Long Beach	13	567,587	85,138	15,466	75
C4	Long Beach	5.8	250,906	37,636	6,837	33
C5	Long Beach	6	262,231	39,335	7,145	35
C6	Long Beach	8.8	382,457	57,369	10,421	51
C7	Long Beach	8.7	377,230	56,584	10,279	50
C8	Long Beach	8.7	378,972	56,846	10,326	50
C9	Long Beach	9.4	410,335	61,550	11,181	54
C10	Long Beach	9.4	408,157	61,224	11,122	54
C11	Long Beach	9.4	409,900	61,485	11,169	54
C12	Long Beach	9.0	390,298	58,545	10,635	52
C13	Long Beach	10.4	452,153	67,823	12,321	60
C14	Long Beach	10.4	452,53	67,823	12,321	60
C15	Long Beach	10.5	455,202	68,280	12,404	60
C16	Long Beach	11.4	497,455	74,618	13,555	66
Landscape Parkways & perimeters	Entire Site	10 (b)	435,600	435,600	79,130	385
TOTALS		250 (c)	10,890,000 (c)	2,216,899	402,715	1,958

(a) 20% of the total area for residential areas and 15% of the total area for commercial areas are assumed as landscape.

(b) Includes parkways for all backbone Streets.

(c) Total site acreage and square footage includes landscape setback areas, but not backbone streets.

The total reclaimed water demand for the PacifiCenter development is approximately 402,715 gallons per day with a total peak reclaimed water demand over an 8 hour period of approximately 939,668 gallons per day. The existing reclaimed system has been extensively modified in 2003 and a specific model for this system has not been developed by either LBWD or KHA. The impact of the system improvements is designed to be positive, however, this has not been verified by operational results.

The actual amount of flow will not be affected but, actual delivery pressure may require onsite pumps for the irrigation facilities.

3.5 Phasing of Water Improvements

As the PacifiCenter is constructed it may be necessary to build areas within the site before other areas (i.e., commercial areas prior to the residential areas). This will require infrastructure for those areas being developed to be constructed prior to the other areas. However, because much of the water infrastructure is dependent on the total system to function properly, as each area is developed, it will be necessary to determine what specific water infrastructure outside of the proposed development area will need to be constructed to provide the required water service and fire flow.

4. Project Impacts

4.1 Thresholds of Significance

A project would normally have a significant impact on water services if after project related infrastructure improvements:

- The estimated water requirements for the proposed project exceed available water supplies or the estimated demand exceeds the capacity of the existing delivery system in conjunction with the planned improvements proposed for the project by a substantial magnitude.
- Any alterations to the water system made necessary by the proposed project reduce or inhibit the capacity of the water system serving the project area.

Neither of these significant thresholds will be triggered by the development of the Pacific Center Project, which is summarized below.

4.2 Project Features and Benefits

The domestic, fire, and reclaimed water impacts that would result from the development of the PacifiCenter are analyzed below:

- The City of Long Beach potable water system has sufficient capacity to serve the project with no off-site improvements needed. In addition, the on-site water system would be designed and constructed to provide adequate water service and fire flows. No adverse impacts are anticipated.

- The water system capacity within the City of Long Beach is adequate to handle fire flow requirements. Fire flows create the highest demand for water at any one time. Implementation of the project would not require off-site water system improvements, as existing off-site infrastructure would provide adequate flows to the project site within the City of Long Beach.

- Implementation of the PacifiCenter project within the City of Lakewood would require a new 16 inch water line parallel to the existing 12 inch water line in Paramount Boulevard to handle fire flow requirements. The new 16 inch line would connect to the existing 16 inch line at the intersection of Paramount Boulevard and Green Meadow Road, and serve the portion of the site in the City of Lakewood.

- In addition to the on-site upgrades to the potable water system, a reclaimed water system would be installed in the new PacifiCenter streets to allow for future reclaimed water uses on the site. Reclaimed water laterals to individual developments for the commercial and multifamily areas and for the common open space areas for the single family areas within the PacifiCenter property. Each of these laterals would be sized according to demand for each area. Implementation of the project would not require off-site reclaimed water system improvements, as existing off-site infrastructure would provide adequate flows to the project site. Future development on the site would be required to tap into the reclaimed water system for landscape irrigation needs. The use of reclaimed water would reduce the demand for potable water from groundwater resources.

- The PacifiCenter project would replace the aging, existing private infrastructure onsite with a new public system that would follow the proposed roadways with connections to the individual building lots.

- A short-term demand for water may occur during the demolition, excavation, grading, and construction activities on site. The demolition, grading, and construction activities associated with implementation of the project would be incremental through time (from start of construction to buildout) and would be short term and temporary. Thus the demand for water supplies for use in soil watering (fugitive dust control), clean up, masonry, painting, and other activities would also be temporary. The demand for water during grading and excavation activities is expected to be 3,000 gallons per acre per day. Demolition and construction activities would require minimal water for cleaning activities and would not be expected to have any impact on the existing water system or available water supplies.

- All new development would be required to comply with the State law regarding water conservation measures, including pertinent provisions of Title 20 and Title 24 of the California Government Code regarding the use of water efficient appliances. Compliance with these measures would reduce the projected water consumption estimates for the project at full buildout and reduce the demand on City supplies.

- As part of the plan check review process, the City of Long Beach Fire Department and the County of Los Angeles Fire Prevention Division would determine the required fire flow for individual structures based on the type of construction, size of building, and occupancy.

- Water line abandonment and new water system connections needed for future developments would be made in coordination with the City of Long Beach Water Department, the City of Lakewood Water Department, and the County of Los Angeles Fire Prevention Division, Engineering and Building Plan Check Unit.

- Development of the PacifiCenter Project will result in a long-term increase in water consumption. Based on the uses proposed for the project site at buildout, an estimated total of 1.41 mgd (4.33 acre-feet) of potable water and 0.403 mgd (1.24 acre-feet) of reclaimed water would be consumed on an average day, and 2.42 mgd (7.43 acre-feet) of potable water and 0.94 mgd (8.65 acre-feet) of reclaimed water would be consumed on a maximum day.

  Based on the Long Beach Water Department 2000 Urban Water Management Plan, an estimated potable water use of 80,346 acre-feet per year and reclaimed water use of 13,025 acre-feet per year is projected. The water consumption associated with this project represents approximately

2.0 percent of LBWD's future water average domestic demand and 3.5 percent of LBWD's future reclaimed water average demand.

Based on this assessment and the Water Availability Assessment prepared for the PacifiCenter @ Long Beach on December 19, 2002, the Long Beach Water Department has provided assurances that there is sufficient capacity to supply the proposed project with potable water for the 20-year timeframe specified in the legislation during normal, single-dry and multiple-dry years. Therefore, the impacts associated with water supplies would be less than significant.

- The total water demand from the PacifiCenter project would be approximately 1,407,500 GPD by project buildout or approximately 1,331,600 GPD more than the existing demand. As noted above, the Long Beach Water Department has provided assurances that the City has sufficient available water supplies to serve the fully developed condition of the project including the portion of the project located within the City of Lakewood.

4.3 Conclusions

- The proposed development of the PacifiCenter project will increase the demand for water over the current site's water demand. However, both the LBWD and the City of Lakewood Water Department have sufficient available water supplies to meet this increased demand. It should be noted that historically the site's water demand has been substantially higher. At the time when the site was at full production of commercial and military aircrafts, the water demand was in excess of one million gallons per day, which is comparable to the proposed project's estimated water demand. As the production of aircraft has declined over the last fifteen years, the water demand has declined accordingly to its current levels. It is clear from the historic record that the existing water system and supply, which have served this site over the years, are adequate to supply the proposed development.

- The proposed alterations of the existing systems for the proposed project will not adversely affect the adjacent areas. The water improvements proposed for Paramount Boulevard will have the net affect of providing better fire flow capacity to the existing properties within the immediate areas adjacent to Paramount Boulevard.

- The City of Long Beach's water sources include 58 percent of imported water purchased from the Metropolitan Water District of Southern California (MWD). MWD strongly defends their water availability predictions in a July 17, 2003 response letter to San Diego County Water Authority Review of the Metropolitan's Report on Water Supplies (March 25, 2003) (Appendix J). In summary, MWD defends the effectiveness of conservation and local projects in reducing demands; water supply reliability and availability; and increased capabilities to make available replenishment deliveries to its member agencies and to refill its system storage.

- The proposed alterations of the existing systems for the proposed project will not adversely affect the adjacent areas.

5. Contacts

Long Beach Water Department
Robert Villanueva, P.E.
1800 E. Wardlow Road
Long Beach, CA 90807-4994
(562) 570-2499

Long Beach Water Department
Matt Lyon
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Long Beach Bureau of Fire Prevention
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Los Angles County Fire Prevention Division
Wally Collins, Land Development Unit
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Commerce, CA 90040
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Los Angles County Fire Prevention Division
Andy Wells, Engineering and Building Plan Check Unit
5823 Rickenbacker Road
Commerce, CA 90040
(323) 890-4125

Metropolitan Water District of Southern California
700 N. Alameda Street
Los Angeles, CA 90012
(213) 217-6000

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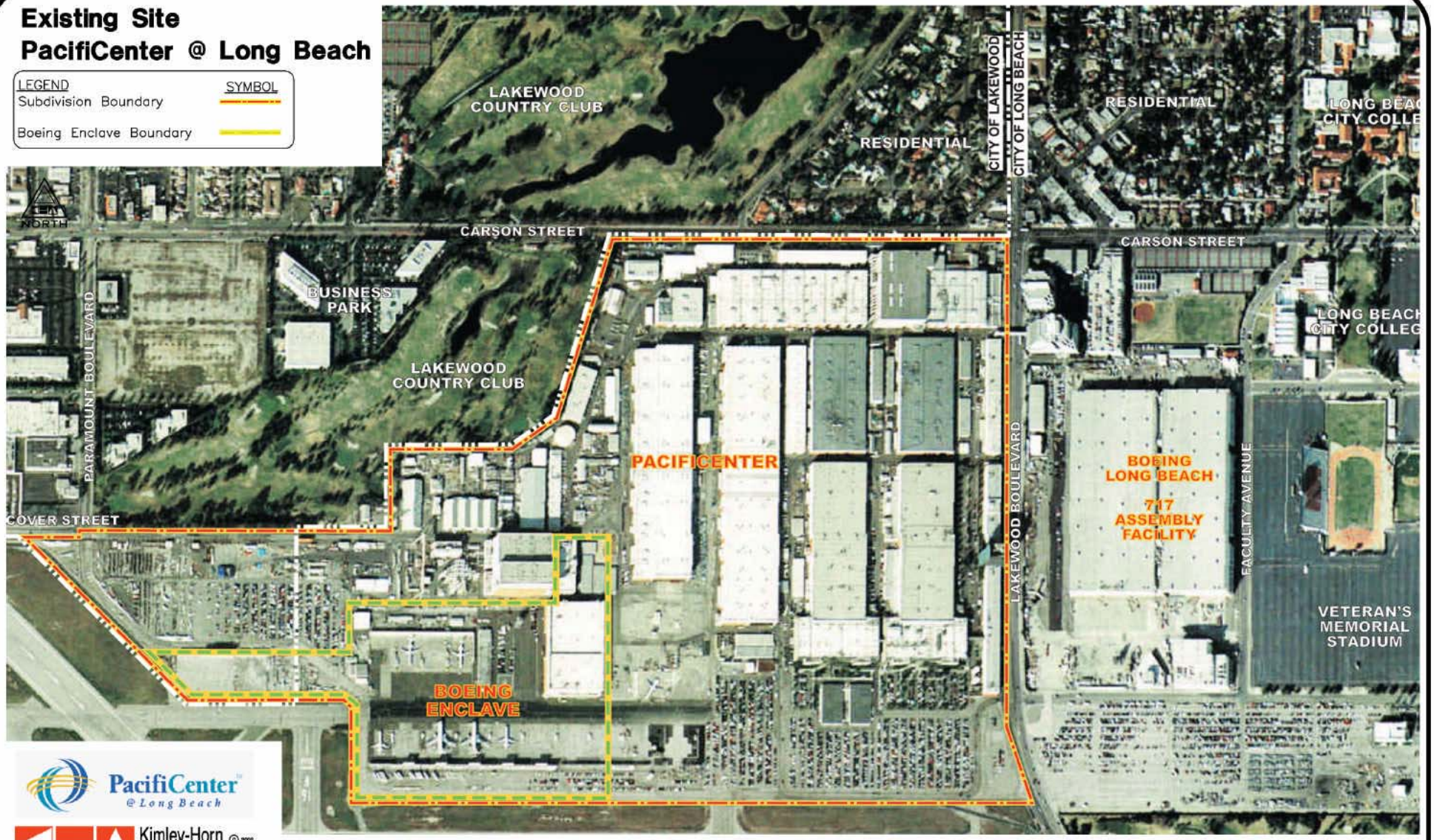
Existing Site
PacifiCenter @ Long Beach

LEGEND	SYMBOL
Subdivision Boundary	
Boeing Enclave Boundary	



PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc.

Figure W-1

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The original oversized exhibit is available on file and available for Review at:
City of Long Beach-Planning and Building Department
333 West Ocean Boulevard, 7th Floor, Long Beach, CA 90802

LEGEND	SYMBOL
260 ACRE BOEING SITE	
MUNICIPALITY BOUNDARIES	
MWD TRANSMISSION LINE	
CITY OF LONG BEACH DOMESTIC WATER	
CITY OF LAKEWOOD DOMESTIC WATER	
CITY OF LONG BEACH RECLAIMED WATER	

Not to Scale
DECEMBER 2003

PacifiCenter @ Long Beach

KIMLEY-HORN AND ASSOCIATES

Regional Distribution Systems
PacifiCenter • Long Beach
Figure W-2

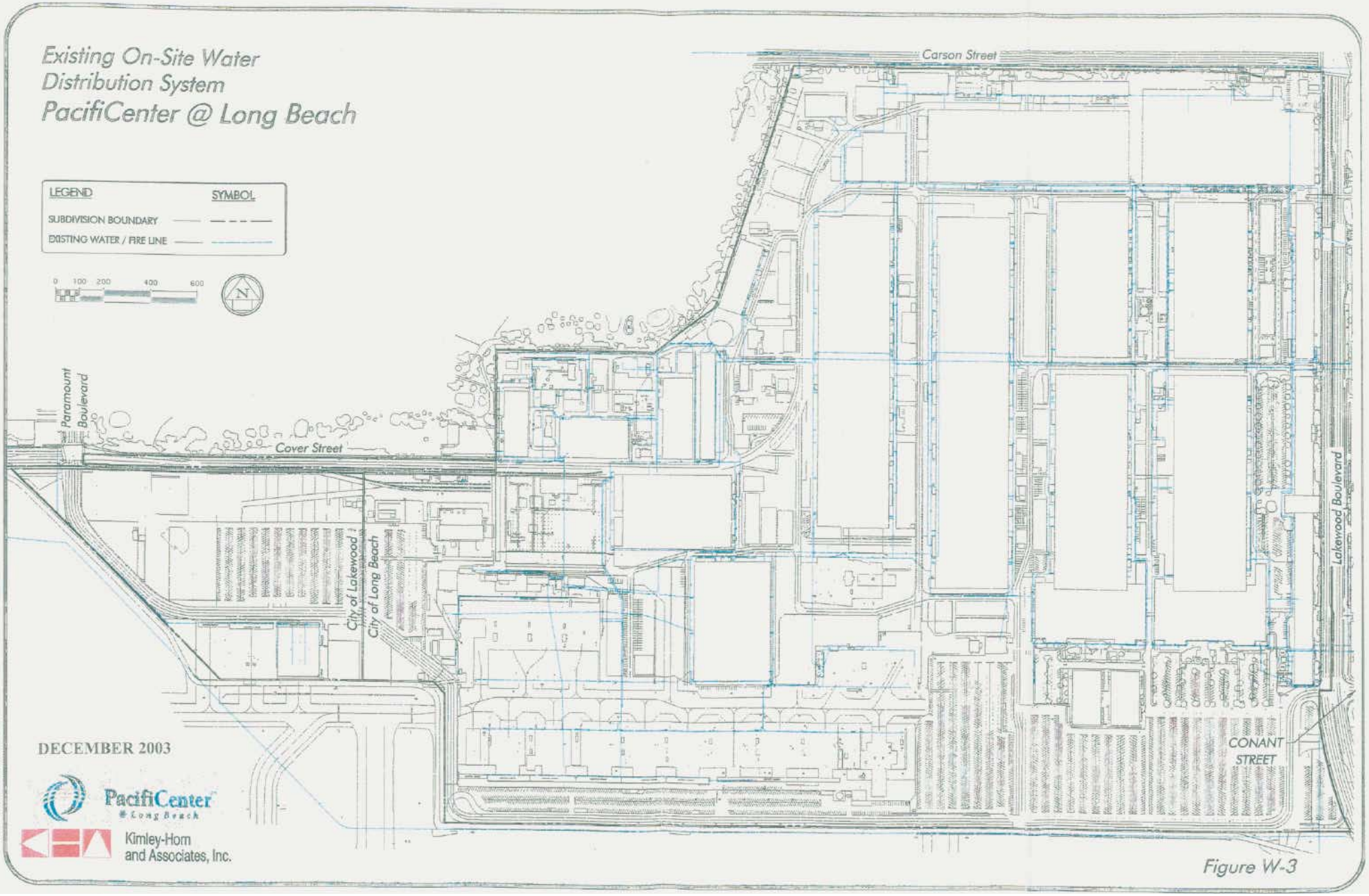
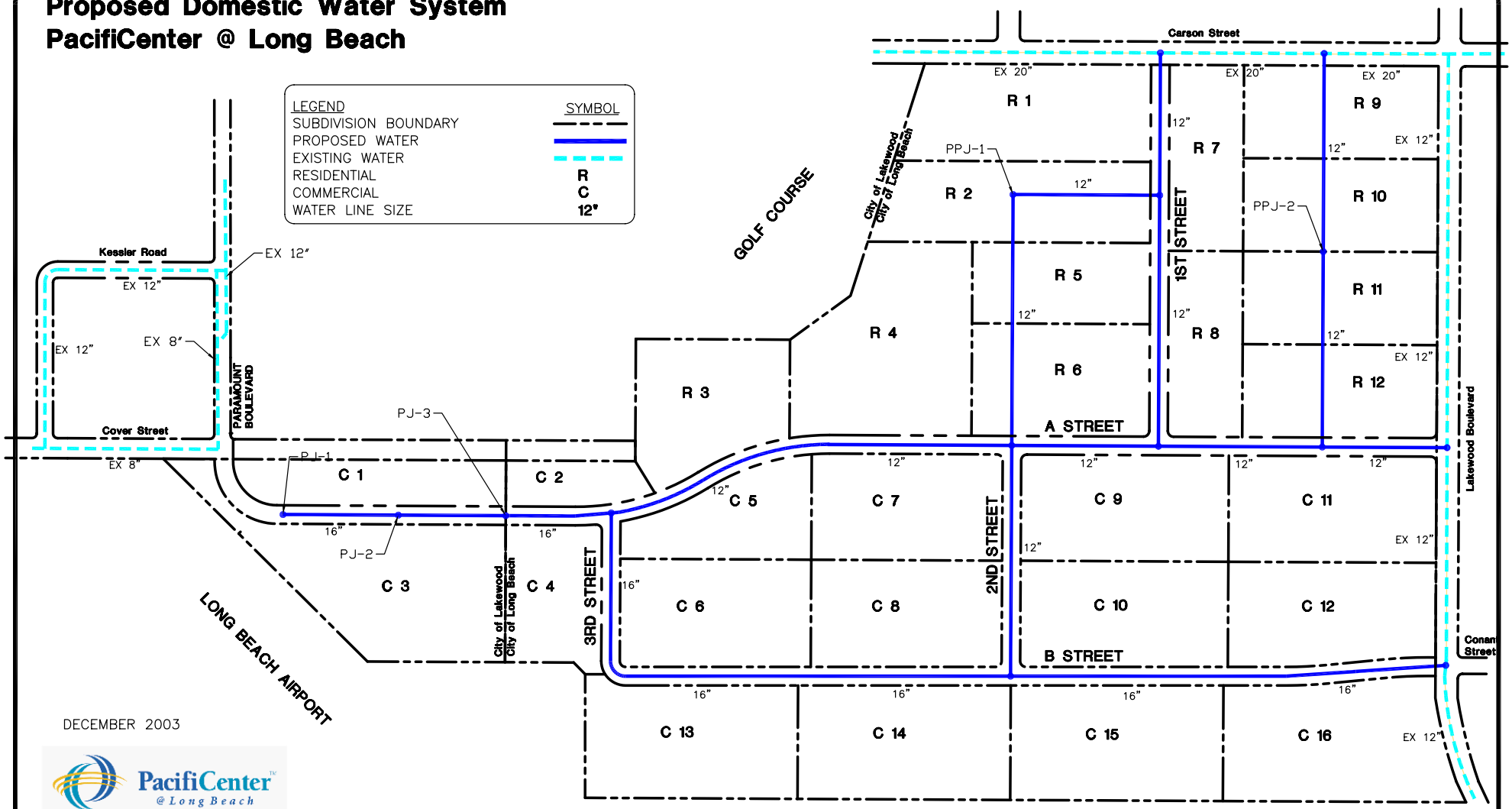

Existing On-Site Water
Distribution System
PacifiCenter @ Long Beach
LEGEND
SYMBOL
SUBDIVISION BOUNDARY
EXISTING WATER / FIRE LINE
0 100 200 400 600
N
Carson Street
Paramount Boulevard
Cover Street
City of Lakewood
City of Long Beach
Lakewood Boulevard
CONANT STREET
DECEMBER 2003
PacifiCenter
Long Beach
Kimley-Horn
and Associates, Inc.

Figure W-3

Proposed Domestic Water System
PacifiCenter @ Long Beach



DECEMBER 2003

PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc. © 2002

Figure W-4

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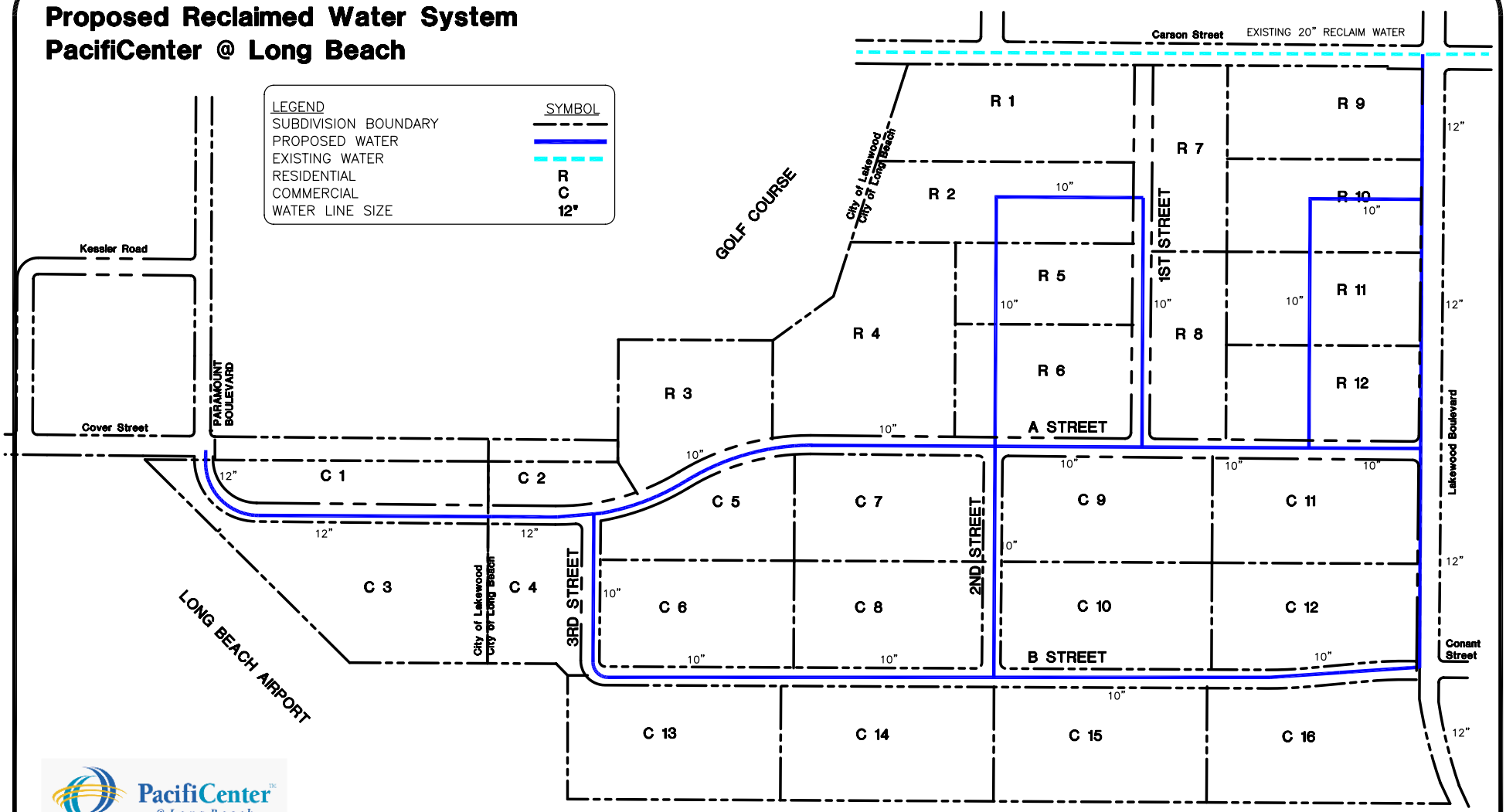
Proposed Reclaimed Water System
PacifiCenter @ Long Beach



LONG BEACH AIRPORT

Figure W-5

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Land Use Diagram
PacifiCenter @ Long Beach

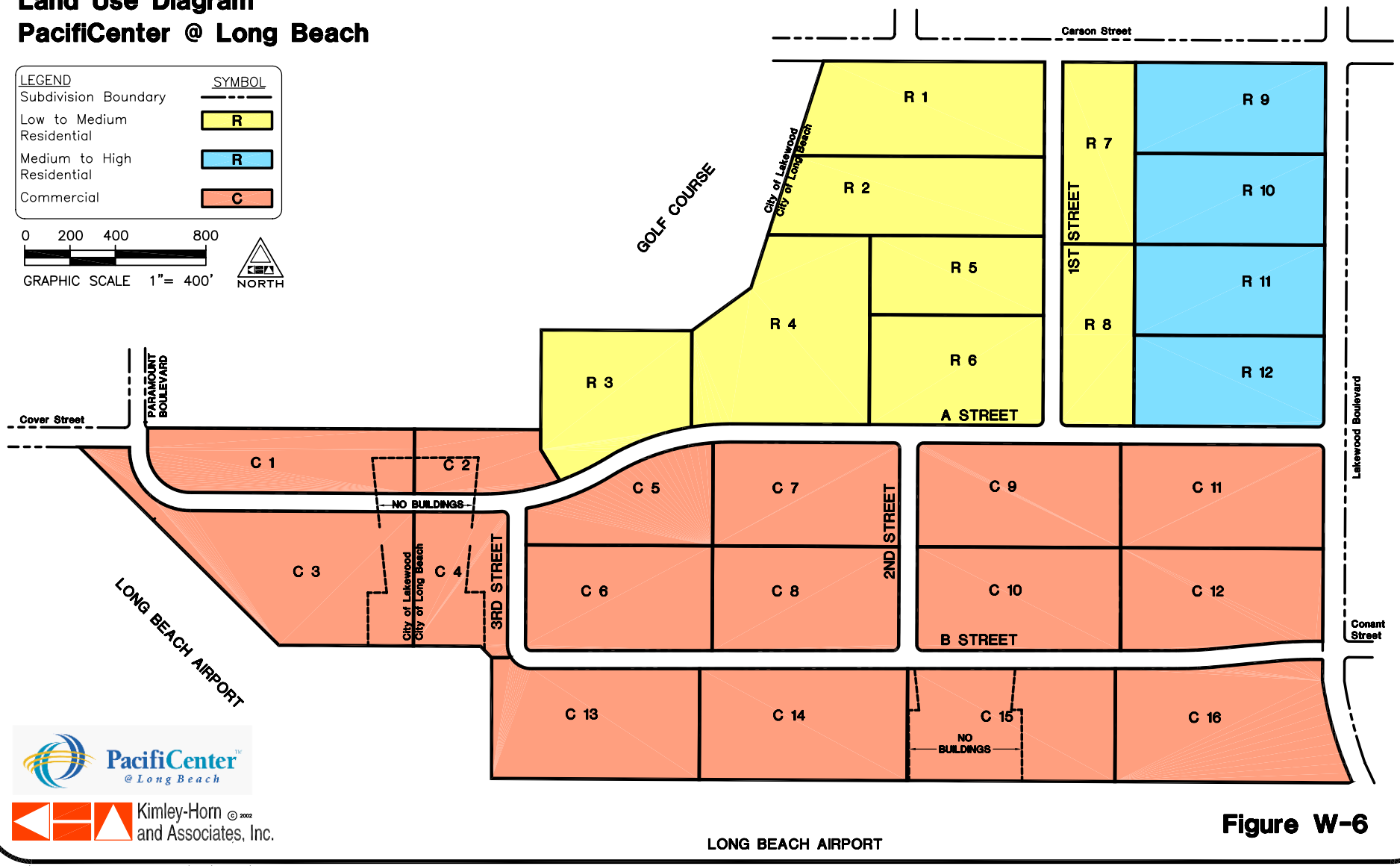

Figure W-6

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Proposed Open Space
PacifiCenter @ Long Beach

LEGEND	SYMBOL
SUBDIVISION BOUNDARY	
RESIDENTIAL	R
COMMERCIAL	C
PARKWAY AND SETBACK 10 Ac	
REQUIRED OPEN SPACE 41 Ac	

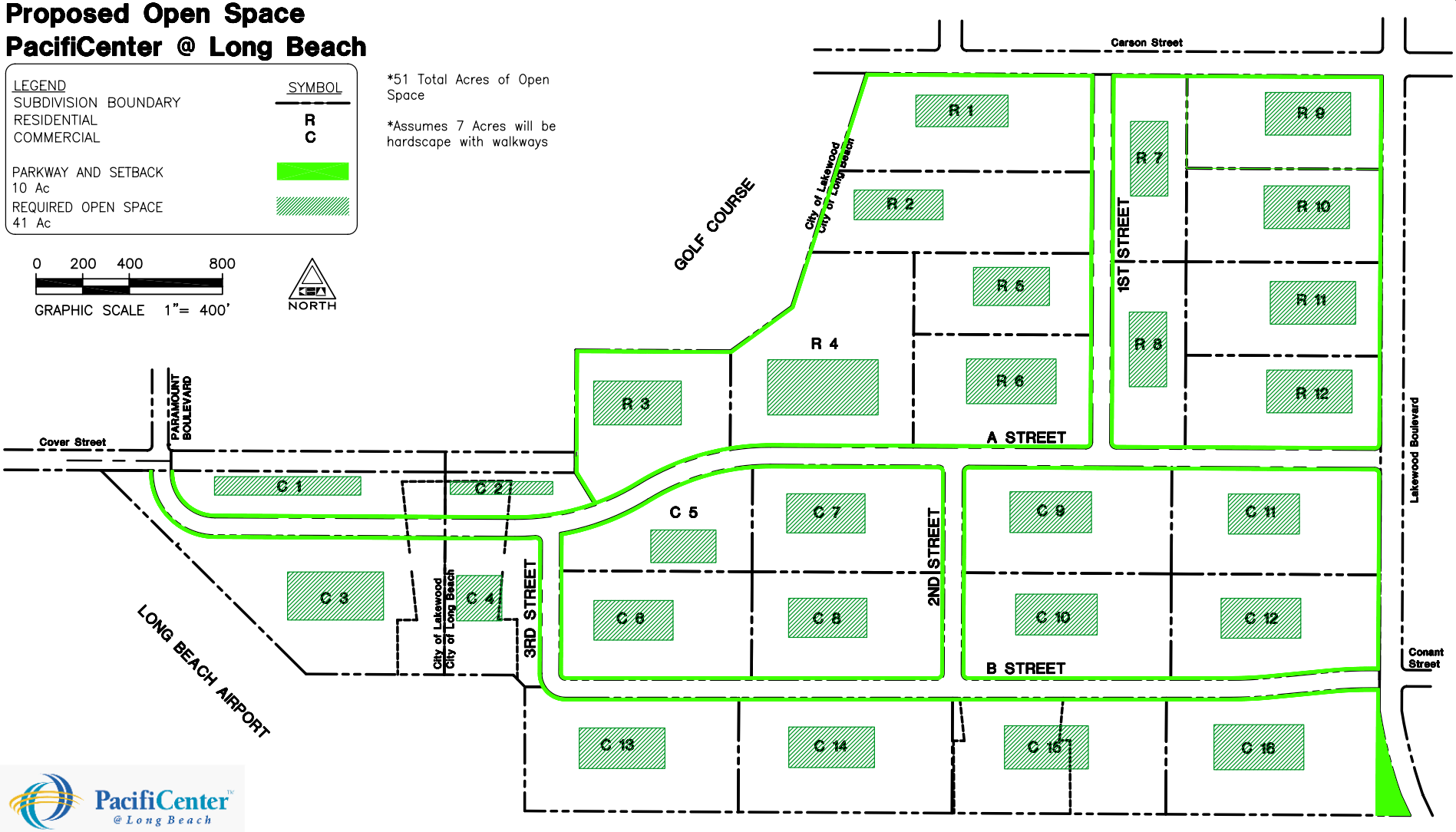
*51 Total Acres of Open Space

*Assumes 7 Acres will be hardscape with walkways

0 200 400 800

GRAPHIC SCALE 1"= 400'

NORTH



PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc. © 2002

LONG BEACH AIRPORT

Figure W-7

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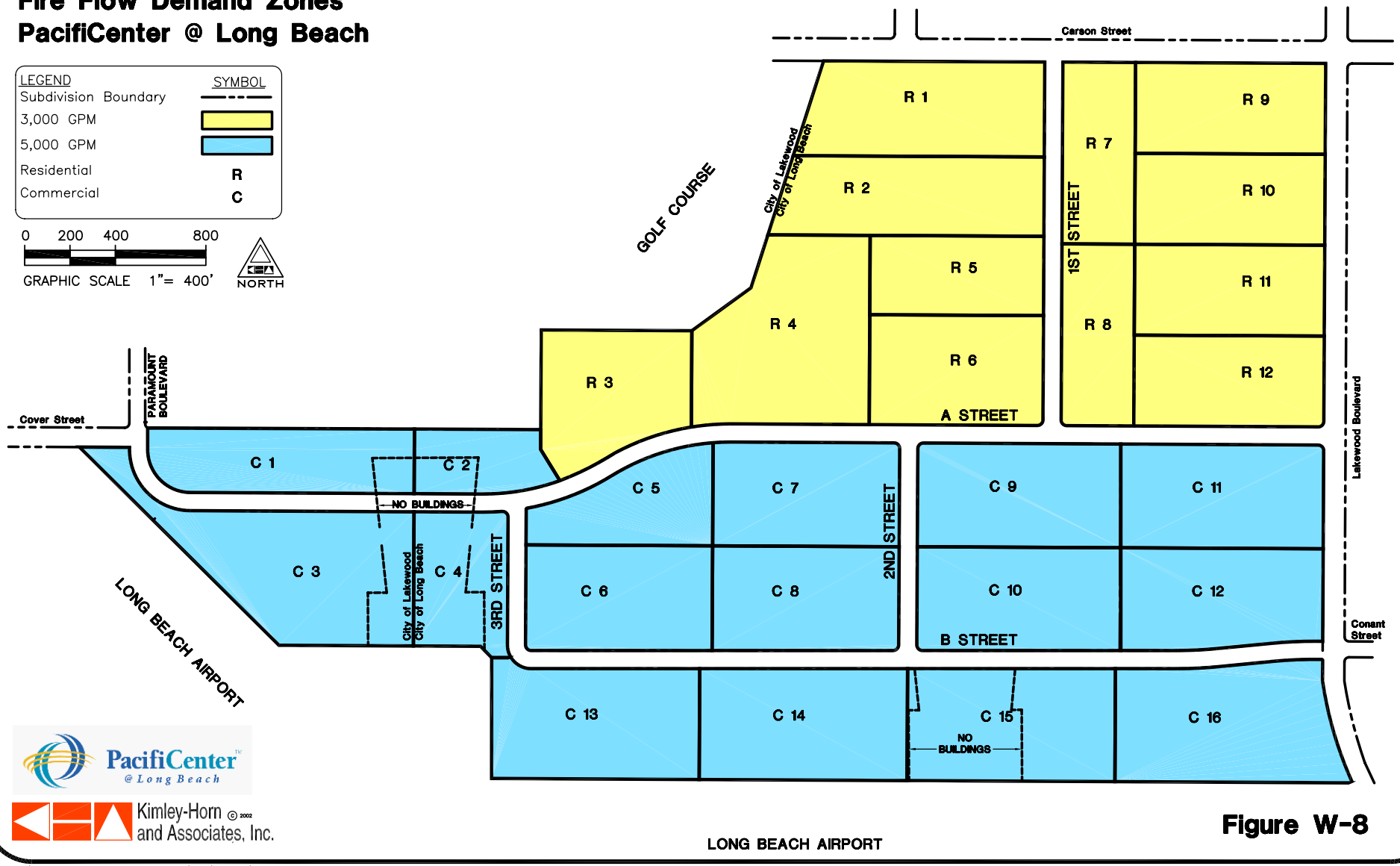
Fire Flow Demand Zones
PacifiCenter @ Long Beach



LONG BEACH AIRPORT

Figure W-8

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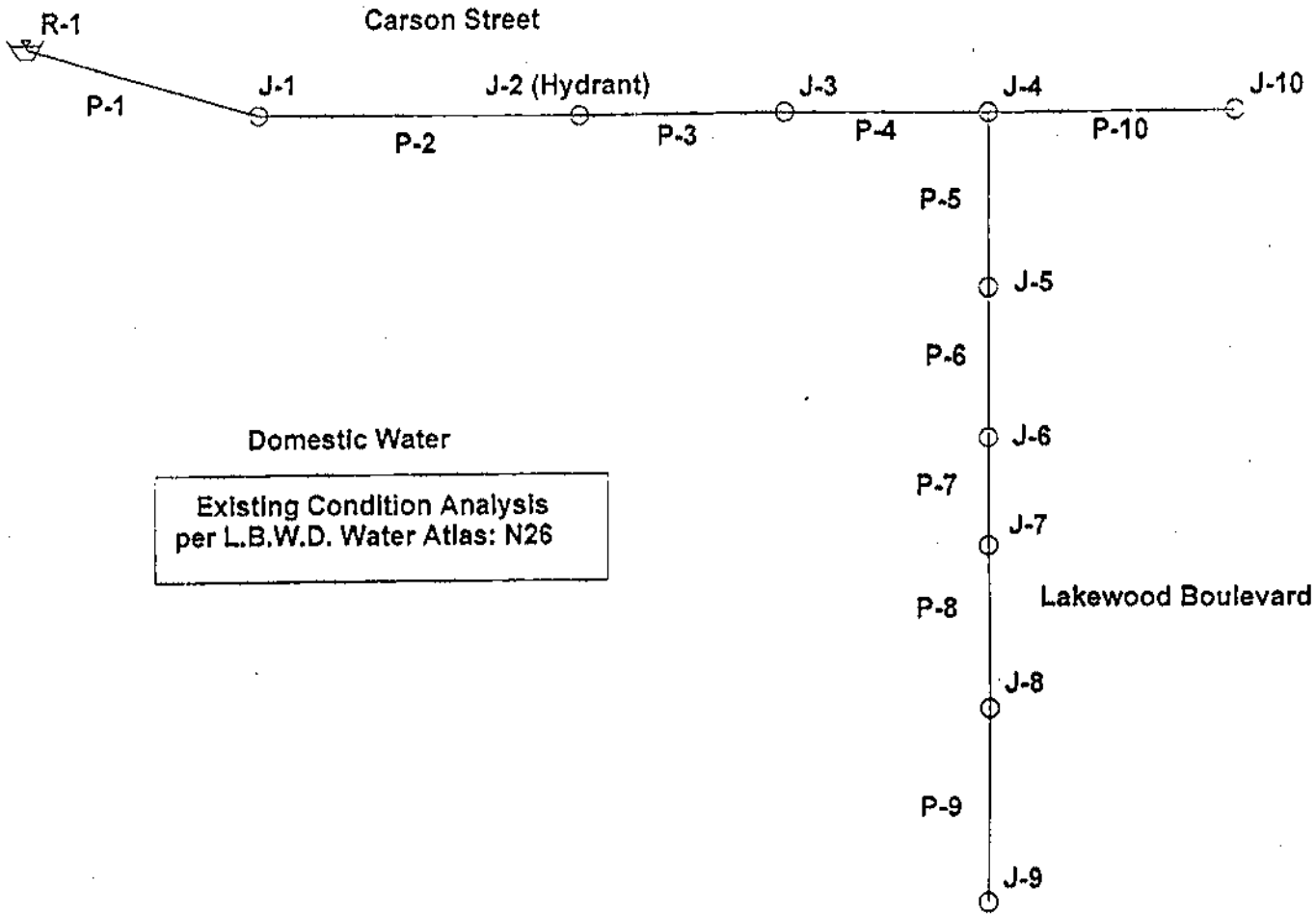
APPENDICES

APPENDIX A

- EXISTING DOMESTIC WATER SYSTEM MODEL LBWD

Steady State Analysis



Domestic Water

Existing Condition Analysis
per L.B.W.D. Water Atlas: N26

Analysis Results
Steady State Analysis

Project Title: PacifiCenter
Project Engineer: Jeffrey Hodgkinson
Project Date: 07/11/01
Comments:

Hydraulic Analysis Summary

Analysis	Steady State	Demand Scenario	Default-Average Daily
Friction Method	Hazen-Williams Formula	Accuracy	0.001000
Trials	40		

Liquid Characteristics

Liquid	Water at 20C(68F)	Specific Gravity	1.00
Kinematic Viscosity	0.108e-4 ft²/s		

Network Inventory

Number of Pipes	10	Number of Reservoirs	1
Number of Junctions	10	Number of Tanks	0
Number of Pumps	0	Number of Valves	0
- Constant Power:	0	- FCV's:	0
- One Point (Design Point):	0	- PBV's:	0
- Standard (3 Point):	0	- PRV's:	0
- Standard Extended:	0	- PSV's:	0
- Custom Extended:	0	- TCV's:	0

Junctions @ 0.00 hr

Label	Constituent (mg/l)	Hydraulic Grade (ft)	Pressure (psi)	Demand (gpm)	Pressure Head (ft)
J-1	0.0	185.22	59.34	0.00	137.22
J-2 (Hydrant)	0.0	180.87	57.89	3,000.00	133.87
J-3	0.0	180.82	58.30	0.00	134.82
J-4	0.0	180.77	58.71	0.00	135.77
J-5	0.0	180.77	59.23	0.00	136.96
J-6	0.0	180.77	59.79	0.00	138.27
J-7	0.0	180.77	60.11	0.00	139.01
J-8	0.0	180.77	61.23	0.00	141.59
J-9	0.0	180.77	63.47	14.00	146.77
J-10	0.0	180.77	58.71	1,148.00	135.77

Reservoirs @ 0.00 hr

Label	Constituent (mg/l)	Hydraulic Grade (ft)	Reservoir Inflow (gpm)	Reservoir Outflow (gpm)
R-1	0.0	191.00	N/A	4,162.00

Pipes @ 0.00 hr

Label	Status	Constituent (mg/l)	Flow (gpm)	Velocity (ft/s)	From Grade (ft)	To Grade (ft)	Friction Loss (ft)	Minor Loss (ft)	Total Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	Open	0.0	4,162.00	4.25	191.00	185.22	5.78	0.00	5.78	2.97
P-2	Open	0.0	4,162.00	4.25	185.22	180.87	4.34	0.00	4.34	2.97

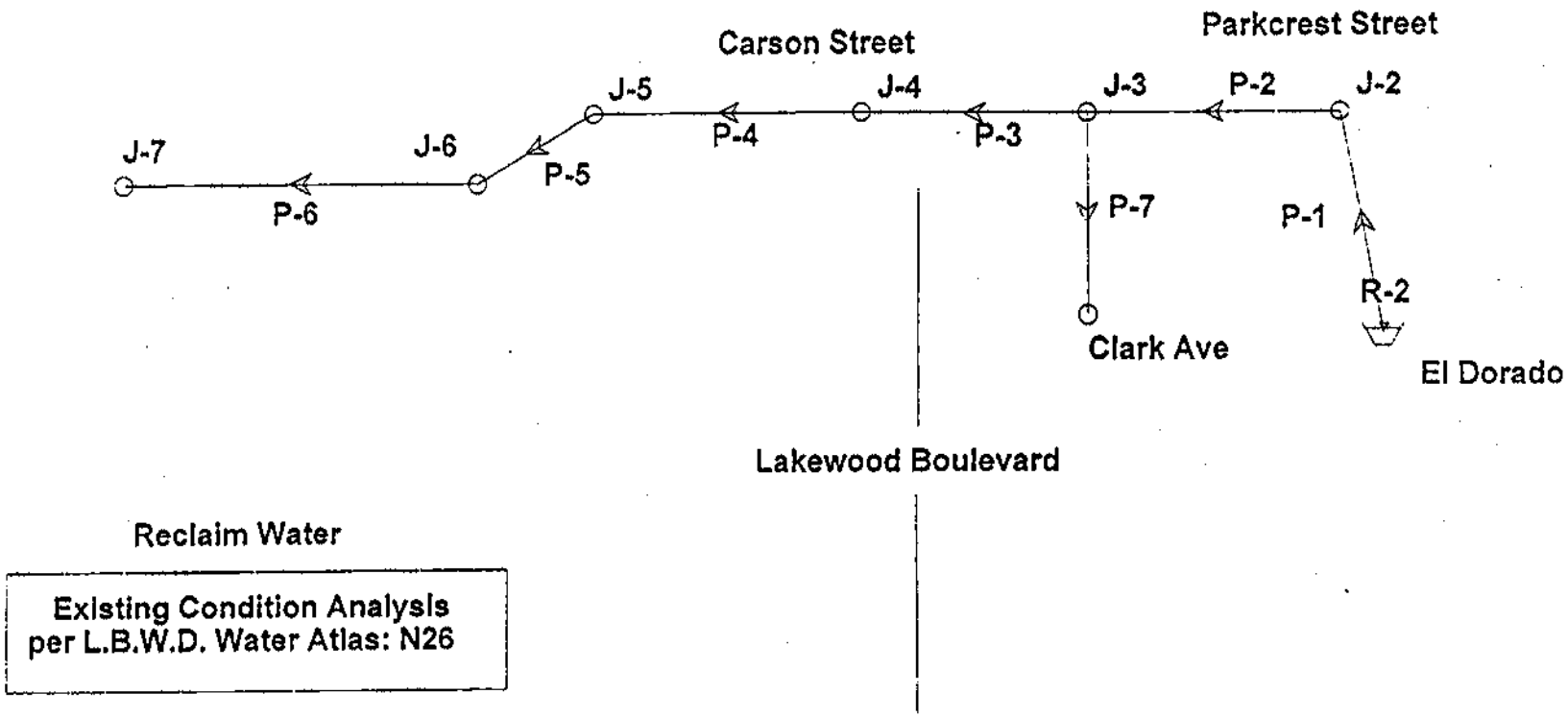
Analysis Results
Steady State Analysis

Pipes @ 0.00 hr										
Label	Status	Constituent (mg/l)	Flow (gpm)	Velocity (ft/s)	From Grade (ft)	To Grade (ft)	Friction Loss (ft)	Minor Loss (ft)	Total Headloss (ft)	Headloss Gradient (ft/1000ft)
P-3	Open	0.0	1,162.00	1.19	180.87	180.82	0.05	0.00	0.05	0.28
P-4	Open	0.0	1,162.00	1.19	180.82	180.77	0.04	0.00	0.04	0.28
P-5	Open	0.0	14.00	0.04	180.77	180.77	0.95e-3	0.00	0.95e-3	0.39e-2
P-6	Open	0.0	14.00	0.04	180.77	180.77	0.11e-2	0.00	0.11e-2	0.4e-2
P-7	Open	0.0	14.00	0.04	180.77	180.77	0.6e-3	0.00	0.6e-3	0.4e-2
P-8	Open	0.0	14.00	0.04	180.77	180.77	0.22e-2	0.00	0.22e-2	0.4e-2
P-9	Open	0.0	14.00	0.04	180.77	180.77	0.4e-2	0.00	0.4e-2	0.4e-2
P-10	Open	0.0	1,148.00	1.17	180.77	180.77	0.14e-2	0.00	0.14e-2	0.27

APPENDIX B

- EXISTING RECLAIMED WATER SYSTEM MODEL LBWD

Steady State Analysis



Analysis Results
Steady State Analysis

Project Title: PacifiCenter
Project Engineer: Jeffrey Hodgkinson
Project Date: 07/11/01
Comments:

Hydraulic Analysis Summary

Analysis	Steady State	Demand Scenario	Default-Average Daily
Friction Method	Hazen-Williams Formula	Accuracy	0.001000
Trials	40		

Liquid Characteristics

Liquid	Water at 20C(68F)	Specific Gravity	1.00
Kinematic Viscosity	0.108e-4 ft²/s		

Network Inventory

Number of Pipes	7	Number of Reservoirs	1
Number of Junctions	7	Number of Tanks	0
Number of Pumps	0	Number of Valves	0
- Constant Power:	0	- FCV's:	0
- One Point (Design Point):	0	- PBV's:	0
- Standard (3 Point):	0	- PRV's:	0
- Standard Extended:	0	- PSV's:	0
- Custom Extended:	0	- TCV's:	0

Junctions @ 0.00 hr

Label	Constituent (mg/l)	Hydraulic Grade (ft)	Pressure (psi)	Demand (gpm)	Pressure Head (ft)
Clark Ave	0.0	117.53	31.36	2,070.00	72.53
J-2	0.0	203.69	69.05	0.00	159.69
J-3	0.0	190.06	62.73	0.00	145.06
J-4	0.0	189.97	62.69	0.00	144.97
J-5	0.0	189.90	61.80	0.00	142.90
J-6	0.0	189.90	61.36	0.00	141.90
J-7	0.0	189.88	61.35	305.00	141.88

Reservoirs @ 0.00 hr

Label	Constituent (mg/l)	Hydraulic Grade (ft)	Reservoir Inflow (gpm)	Reservoir Outflow (gpm)
R-2	0.0	209.00	N/A	2,375.00

Pipes @ 0.00 hr

Label	Status	Constituent (mg/l)	Flow (gpm)	Velocity (ft/s)	From Grade (ft)	To Grade (ft)	Friction Loss (ft)	Minor Loss (ft)	Total Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	Open	0.0	2,375.00	2.43	209.00	203.69	5.31	0.00	5.31	1.05
P-2	Open	0.0	2,375.00	2.43	203.69	190.06	13.63	0.00	13.63	1.05
P-3	Open	0.0	305.00	0.31	190.06	189.97	0.09	0.00	0.09	0.02
P-4	Open	0.0	305.00	0.31	189.97	189.90	0.07	0.00	0.07	0.02
P-5	Open	0.0	305.00	0.31	189.90	189.90	0.35e-2	0.00	0.35e-2	0.02
P-6	Open	0.0	305.00	0.31	189.90	189.88	0.02	0.00	0.02	0.02

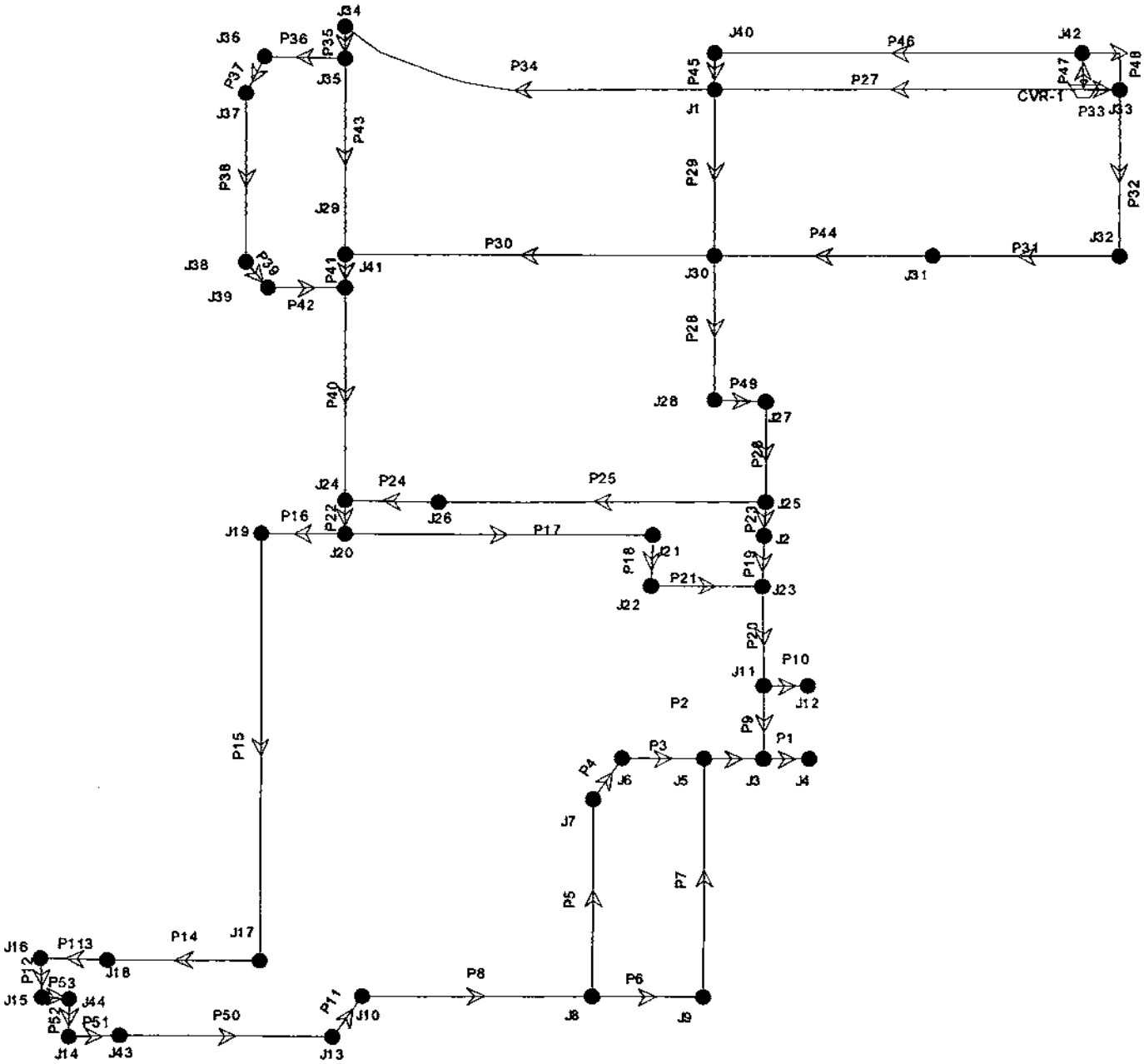
Analysis Results
Steady State Analysis

Pipes @ 0.00 hr										
Label	Status	Constituent (mg/l)	Flow (gpm)	Velocity (ft/s)	From Grade (ft)	To Grade (ft)	Friction Loss (ft)	Minor Loss (ft)	Total Headloss (ft)	Headloss Gradient (ft/1000ft)
P-7	Open	0.0	2,070.00	5.87	190.06	117.53	72.53	0.00	72.53	40.98

APPENDIX C

- EXISTING DOMESTIC WATER SYSTEM MODEL CITY OF LAKEWOOD

Scenario: Base



Scenario: Base
Fire Flow Analysis
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J3	62.00	Zone-1	Demand	0.00	Fixed	0.00	398.61	145.64
J4	63.00	Zone-1	Demand	1,923.00	Fixed	1,923.00	398.31	145.07
J5	62.00	Zone-1	Demand	0.00	Fixed	0.00	398.90	145.76
J6	65.00	Zone-1	Demand	0.00	Fixed	0.00	400.05	144.96
J7	65.00	Zone-1	Demand	0.00	Fixed	0.00	400.31	145.07
J8	65.00	Zone-1	Demand	0.00	Fixed	0.00	401.50	145.59
J9	58.00	Zone-1	Demand	0.00	Fixed	0.00	400.29	148.09
J10	63.00	Zone-1	Demand	0.00	Fixed	0.00	403.06	147.13
J11	63.00	Zone-1	Demand	0.00	Fixed	0.00	398.90	145.33
J12	64.00	Zone-1	Demand	1,923.00	Fixed	1,923.00	398.60	144.76
J13	62.00	Zone-1	Demand	0.00	Fixed	0.00	403.45	147.73
J14	66.00	Zone-1	Demand	0.00	Fixed	0.00	404.65	146.52
J15	65.00	Zone-1	Demand	0.00	Fixed	0.00	404.88	147.05
J16	65.00	Zone-1	Demand	0.00	Fixed	0.00	405.03	147.12
J17	63.00	Zone-1	Demand	0.00	Fixed	0.00	405.66	148.25
J18	64.00	Zone-1	Demand	0.00	Fixed	0.00	405.42	147.71
J19	65.00	Zone-1	Demand	0.00	Fixed	0.00	407.18	148.05
J20	65.00	Zone-1	Demand	0.00	Fixed	0.00	407.35	148.12
J21	65.00	Zone-1	Demand	0.00	Fixed	0.00	407.02	147.98
J22	65.00	Zone-1	Demand	0.00	Fixed	0.00	406.99	147.96
J23	64.00	Zone-1	Demand	0.00	Fixed	0.00	406.98	148.39
J24	65.00	Zone-1	Demand	0.00	Fixed	0.00	407.45	148.16
J25	65.00	Zone-1	Demand	0.00	Fixed	0.00	408.21	148.49
J26	65.00	Zone-1	Demand	0.00	Fixed	0.00	407.45	148.16
J27	62.00	Zone-1	Demand	0.00	Fixed	0.00	413.88	152.24
J28	62.00	Zone-1	Demand	0.00	Fixed	0.00	414.65	152.58
J1	55.00	Zone-1	Demand	0.00	Fixed	0.00	445.56	168.98
J2	65.00	Zone-1	Demand	0.00	Fixed	0.00	407.70	148.27
J29	52.00	Zone-1	Demand	0.00	Fixed	0.00	432.57	164.66
J30	52.00	Zone-1	Demand	0.00	Fixed	0.00	436.45	166.34
J31	52.00	Zone-1	Demand	0.00	Fixed	0.00	446.27	170.58
J32	52.00	Zone-1	Demand	0.00	Fixed	0.00	447.39	171.07
J33	50.00	Zone-1	Demand	0.00	Fixed	0.00	449.89	173.01
J34	55.00	Zone-1	Demand	0.00	Fixed	0.00	436.15	164.91
J35	55.00	Zone-1	Demand	0.00	Fixed	0.00	435.66	164.69
J36	55.00	Zone-1	Demand	0.00	Fixed	0.00	435.43	164.59
J37	54.00	Zone-1	Demand	0.00	Fixed	0.00	435.32	164.98
J38	52.50	Zone-1	Demand	0.00	Fixed	0.00	431.44	163.95
J39	52.00	Zone-1	Demand	0.00	Fixed	0.00	431.35	164.13
J41	52.00	Zone-1	Demand	0.00	Fixed	0.00	431.22	164.07
J40	55.00	Zone-1	Demand	0.00	Fixed	0.00	445.57	168.98
J42	49.00	Connectio	Demand	0.00	Fixed	0.00	449.89	173.45
J43	65.00	Zone-1	Demand	0.00	Fixed	0.00	404.52	146.90
J44	65.00	Zone-1	Demand	0.00	Fixed	0.00	404.72	146.98

Scenario: Base
Fire Flow Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P1	5.00	8	Cast iron	130.0	false	0.00	Open	1,923.00	398.61	398.31	0.31	61.32
P2	90.00	12	Asbestos C	140.0	false	0.00	Open	-1,216.54	398.61	398.90	0.29	3.18
P3	551.00	12	Cast iron	130.0	false	0.00	Open	-903.04	398.90	400.05	1.16	2.10
P4	140.00	12	Asbestos C	140.0	false	0.00	Open	-903.04	400.05	400.31	0.26	1.83
P5	650.00	12	Asbestos C	140.0	false	0.00	Open	-903.04	400.31	401.50	1.19	1.83
P6	650.00	8	Asbestos C	140.0	false	0.00	Open	-313.50	400.29	401.50	1.21	1.86
P7	750.00	8	Asbestos C	140.0	false	0.00	Open	313.50	400.29	398.90	1.39	1.86
P8	490.00	12	Asbestos C	140.0	false	0.00	Open	1,216.54	403.06	401.50	1.56	3.18
P9	250.00	12	Asbestos C	140.0	false	0.00	Open	706.46	398.90	398.61	0.29	1.16
P10	5.00	8	Cast iron	130.0	false	0.00	Open	1,923.00	398.90	398.60	0.31	61.32
P11	107.00	12	Cast iron	130.0	false	0.00	Open	-1,216.54	403.06	403.45	0.39	3.64
P12	50.00	12	Asbestos C	140.0	false	0.00	Open	-1,216.54	404.88	405.03	0.16	3.18
P113	120.00	12	Asbestos C	140.0	false	0.00	Open	-1,216.54	405.03	405.42	0.38	3.18
P14	310.00	16	Asbestos C	140.0	false	0.00	Open	-1,216.54	405.42	405.66	0.24	0.78
P15	1,700.00	16	Cast iron	130.0	false	0.00	Open	-1,216.54	405.66	407.18	1.53	0.90
P16	210.00	16	Asbestos C	140.0	false	0.00	Open	-1,216.54	407.18	407.35	0.16	0.78
P17	1,090.00	12	Asbestos C	140.0	false	0.00	Open	340.04	407.35	407.02	0.33	0.30
P18	90.00	12	Asbestos C	140.0	false	0.00	Open	340.04	407.02	406.99	0.03	0.30
P20	610.00	12	Asbestos C	140.0	false	0.00	Open	2,629.46	406.98	398.90	8.08	13.24
P21	50.00	12	Asbestos C	140.0	false	0.00	Open	340.04	406.99	406.98	0.01	0.30
P22	70.00	16	Cast iron	130.0	false	0.00	Open	-1,556.57	407.35	407.45	0.10	1.42
P24	190.00	16	Cast iron	130.0	false	0.00	Open	-184.25	407.45	407.45	0.01	0.03
P25	950.00	8	Cast iron	130.0	false	0.00	Open	-184.25	407.45	408.21	0.76	0.80
P26	480.00	12	Asbestos C	140.0	false	0.00	Open	2,473.68	413.88	408.21	5.68	11.82
P27	2,600.00	20	Concrete	110.0	false	0.00	Open	-2,619.06	445.56	450.00	4.44	1.71
P23	50.00	12	Asbestos C	140.0	false	0.00	Open	2,289.43	408.21	407.70	0.51	10.24
P19	70.00	12	Asbestos C	140.0	false	0.00	Open	2,289.43	407.70	406.98	0.72	10.25
P28	4,790.00	16	Concrete	110.0	false	0.00	Open	-2,473.68	414.65	436.45	21.80	4.55
P29	2,400.00	16	Concrete	110.0	false	0.00	Open	-2,242.53	436.45	445.56	9.11	3.80
P30	1,150.00	10	Cast iron	130.0	false	0.00	Open	-722.64	432.57	436.45	3.88	3.38
P31	1,020.00	14	Cast iron	130.0	false	0.00	Open	-953.79	446.27	447.39	1.12	1.10
P32	2,280.00	14	Cast iron	130.0	false	0.00	Open	-953.79	447.39	449.89	2.50	1.10
P33	120.00	14	Cast iron	130.0	false	0.00	Open	-863.63	449.89	450.00	0.11	0.91
P34	1,145.00	8	Cast iron	130.0	false	0.00	Open	649.68	445.56	436.15	9.41	8.22
P35	60.00	8	Cast iron	130.0	false	0.00	Open	649.68	436.15	435.66	0.49	8.22

Scenario: Base
Fire Flow Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P36	480.00	12	Cast iron	130.0	false	0.00	Open	410.97	435.66	435.43	0.23	0.49
P37	210.00	12	Cast iron	130.0	false	0.00	Open	410.97	435.43	435.32	0.10	0.49
P38	1,105.00	8	Cast iron	130.0	false	0.00	Open	410.97	435.32	431.44	3.89	3.52
P39	170.00	12	Cast iron	130.0	false	0.00	Open	410.97	431.44	431.35	0.08	0.49
P40	5,220.00	12	Ductile Iron	130.0	false	0.00	Open	-1,372.32	407.45	431.22	23.78	4.55
P41	145.00	10	Steel	100.0	false	0.00	Open	-961.35	431.22	432.57	1.35	9.31
P42	265.00	12	Cast iron	130.0	false	0.00	Open	410.97	431.35	431.22	0.13	0.49
P43	2,400.00	8	Cast iron	130.0	false	0.00	Open	-238.71	432.57	435.66	3.09	1.29
P44	1,740.00	10	Cast iron	130.0	false	0.00	Open	-953.79	436.45	446.27	9.82	5.64
P45	50.00	16	Concrete	110.0	false	0.00	Open	-273.15	445.56	445.57	3.85e-3	0.08
P46	2,620.00	8	Cast iron	130.0	false	0.00	Open	-273.15	445.57	449.89	4.33	1.65
P47	112.00	10	Cast iron	130.0	false	0.00	Open	-363.31	449.89	450.00	0.11	0.94
P48	500.00	16	Cast iron	130.0	false	0.00	Open	90.16	449.89	449.89	3.6e-3	0.01
P49	65.00	12	Asbestos C	140.0	false	0.00	Open	2,473.68	414.65	413.88	0.77	11.82
P50	339.00	12	Asbestos C	140.0	false	0.00	Open	-1,216.54	403.45	404.52	1.08	3.18
P51	41.00	12	Asbestos C	140.0	false	0.00	Open	-1,216.54	404.52	404.65	0.13	3.18
P52	20.00	12	Asbestos C	140.0	false	0.00	Open	-1,216.54	404.65	404.72	0.06	3.18
P53	50.00	12	Asbestos C	140.0	false	0.00	Open	-1,216.54	404.72	404.88	0.16	3.18

Scenario: Base
Fire Flow Analysis
Fire Flow Report

Label	Zone	Fire Flow Iterations	Fire Flow Balanced?	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Min Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Min System Pressure (psi)	Calculated Minimum System Pressure (psi)	Minimum System Junction
J3	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	50.70	20.00	50.14	J4	20.00	50.14	J4
J4	Zone-1	1	true	true	5,000.00	6,500.00	8,923.00	7,423.00	40.00	48.65	20.00	50.70	J3	20.00	50.70	J3
J5	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	50.69	20.00	50.53	J4	20.00	50.53	J4
J6	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	47.87	20.00	48.87	J7	20.00	48.87	J7
J7	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	47.92	20.00	48.59	J6	20.00	48.59	J6
J8	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	50.77	20.00	51.84	J7	20.00	51.84	J7
J9	Zone-1	14	true	true	5,000.00	5,008.27	5,000.00	5,008.27	40.00	40.00	20.00	63.22	J6	20.00	63.22	J6
J10	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	53.95	20.00	53.99	J8	20.00	53.99	J8
J11	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	52.89	20.00	52.12	J12	20.00	52.12	J12
J12	Zone-1	1	true	true	5,000.00	6,500.00	8,923.00	7,423.00	40.00	50.84	20.00	52.69	J11	20.00	52.69	J11
J13	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	55.16	20.00	54.83	J8	20.00	54.83	J8
J14	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	56.38	20.00	56.85	J43	20.00	56.85	J43
J15	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	57.48	20.00	57.08	J14	20.00	57.08	J14
J16	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	57.94	20.00	57.59	J14	20.00	57.59	J14
J17	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	60.90	20.00	59.70	J14	20.00	59.70	J14
J18	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	59.02	20.00	58.85	J14	20.00	58.85	J14
J19	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	67.08	20.00	68.35	J6	20.00	68.35	J6
J20	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	68.21	20.00	67.09	J6	20.00	67.09	J6
J21	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	68.10	20.00	66.87	J12	20.00	66.87	J12
J22	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	68.87	20.00	68.73	J12	20.00	68.73	J12
J23	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	69.50	20.00	68.84	J12	20.00	68.64	J12
J24	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	66.39	20.00	67.22	J8	20.00	67.22	J8
J25	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	71.62	20.00	68.80	J12	20.00	68.80	J12
J26	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	67.60	20.00	67.27	J8	20.00	67.27	J6
J27	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	81.97	20.00	77.41	J12	20.00	77.41	J12
J28	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	83.28	20.00	78.64	J12	20.00	78.64	J12
J1	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	168.87	20.00	136.05	J12	20.00	136.05	J12
J2	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	70.50	20.00	67.85	J12	20.00	67.85	J12
J29	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	113.33	20.00	105.76	J12	20.00	105.76	J12
J30	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	140.54	20.00	119.71	J12	20.00	119.71	J12
J31	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	147.05	20.00	133.29	J12	20.00	133.29	J12
J32	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	151.94	20.00	135.39	J12	20.00	135.39	J12
J33	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	171.91	20.00	144.42	J12	20.00	144.42	J12
J34	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	97.27	20.00	100.14	J35	20.00	100.14	J35
J35	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	97.70	20.00	98.92	J36	20.00	98.92	J36
J36	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	94.14	20.00	95.20	J37	20.00	95.20	J37
J37	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	93.18	20.00	95.37	J38	20.00	95.37	J36
J38	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	104.46	20.00	103.00	J12	20.00	103.00	J12
J39	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	108.80	20.00	102.68	J12	20.00	102.68	J12
J41	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	109.83	20.00	102.12	J12	20.00	102.12	J12
J40	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	158.57	20.00	136.08	J12	20.00	136.08	J12
J42	Connectio	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	171.70	20.00	171.70	J42	20.00	144.41	J12
J43	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	58.45	20.00	56.65	J14	20.00	56.65	J14
J44	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	40.00	58.99	20.00	56.58	J14	20.00	56.58	J14

APPENDIX D

- PROPOSED DEVELOPMENT DEMAND CALCULATIONS
  DOMESTIC & RECLAIMED

Domestic Water Demand Coefficient [1]

[illegible]	[illegible]	[illegible]
Office	200 gallons per 1,000 sf per day	
Retail	200 gallons per 1,000 sf per day	
Hotel	150 gallons per room per day	
Research and Development	200 gallon/per 1000 sf per day	
Light Industrial	200 gallon/per 1000 sf per day	
Housing	110 gallons per person/per day[2]	2.5 persons per DU

Footnote:

[1]Coefficients are based on the City of Long Beach Water Department Tables located in Appendix D of this report. They have been modified for use on this project. The same coefficients used for the Lakewood portion of the development.

[2]Housing demand coefficients typically range from 80-110 gallons per person per day. A conservative 110 gpd was used for water modeling purposes. This assumes the use of reclaimed water for irrigation.

Domestic Water Demand Summary by User
(Average Daily Demand)

[illegible]	[illegible]	[illegible]	[illegible]
Project Totals:	3,300,000 SF	400	2,500
Demand (Long Beach):	565,900 GPD		
Demand (2) (Lakewood):	94,100 GPD		
TOTALS:	660,000 GPD	60,000 GPD	687,500 GPD
TOTAL USAGE	1,407,500 GPD		

Footnote:
(1) Retail square footage is included in commercial SF.
(2) Lakewood will be served by LBWD

Domestic Water Demand Summary

Planned Development Unit	Average Daily Demand (GPD)	Maximum Daily Demand (GPD)	Peak Hour Demand (GPM)
R1	44,275	76,153	71
R2	41250	70,950	66
R3	36,300	62,436	58
R4	56,925	97,911	91
R5	27,225	46,827	44
R6	37,675	64,801	60
R7	26,125	44,935	42
R8	26,125	44,935	42
R9 (b)	97,900	168,388	157
R10 (b)	97,900	168,388	157
R11 (b)	97,900	168,388	157
R12 (b)	97,900	168,388	157
C1	36,600	61,232	57
C2	18,000	30,960	29
C3	58,500	100,620	94
C4	27,400	47,128	44
C5	29,260	50,327	47
C6	42,680	73,410	68
C7	42,100	72,412	68
C8	42,300	72,756	68
C9	44,600	76,712	72
C10	44,380	76,334	71
C11	44,560	76,643	71
C12	42,420	72,962	68
C13	45,840	78,844	74
C14	45,760	78,707	73
C15	46,160	79,395	74
C16	50,440	86,757	81
Hotel (a)	60,000	103,200	96
Total	1,407,500	2,420,900	2,258

(a) Commercial land uses include 400 hotel rooms and 150,000 SF of retail.

(b) Medium to high density residential.

Maximum Daily Demand = 1.72 * Average Daily Demand

Peak Hour Flows = 2.31 * Average Daily Demand

Table 2-4 Non-Residential Zoning Characteristics

Zoning Map Classification	Typical Development
CC	Commercial Corridor
CR	Retail Center
CB	Central Business
CO	Office Commercial
CP	Pedestrian Commercial
CH	Highway Commercial
CL	Limited Commercial
CN	Neighborhood Commercial
CT	Tourist and Entertainment Commercial
CS	Commercial Storage
CMR	Mixed Commercial/Residential
CU	Urban Commercial
CO (HR)	Office Commercial High Rise
CH (HR)	Highway Commercial High Rise
M	Manufacturing
MC	Mixed Manufacturing and Commercial
ML	Limited Manufacturing
MG	General Manufacturing
MR	Restricted Manufacturing
MP	Port District
I	Institutional
P	Park
PR	Public Right-of-Way
PR (H)	Public Right-of-Way (Horse)

Table 3-2 summarizes unit flow coefficients for the various City Residential Zoning Classifications. These values are based upon 85 gallons per person per day and 2.5 persons per dwelling unit(DU). Current census (1990) information for the City of Long Beach indicates the 2.5 person per DU figure. Analysis of the R4H zoning classification revealed a ceiling of 250 dwelling units per acre. Discussion with city planning staff and an examination of neighborhood population goals, however, indicate that this type of development is expected to maximize at no more than 110 dwelling units per acre, as shown below.

Table 3-2 Residential Unit Flow Coefficients *

Zoning Map Classification	Density (DU/Acre)	Flow Coefficient Average cfs/acre
R1S	18	.0059
R1N	7	.0023
R1L	4	.0013
R2S	18	.0059
R2N	15	.0049
R2I	15	.0049
R2L	11	.0036
R3S	21	.0069
R34	39	.0128
R3L	29	.0095
R3T	27	.0089
R4R	54	.0178
R4N	62	.0204
R4H	110	.0362
RM	9	.0029

* Based upon 85 gpcd & 2.5 persons per dwelling unit

See 2-25 for Definition of Zoning

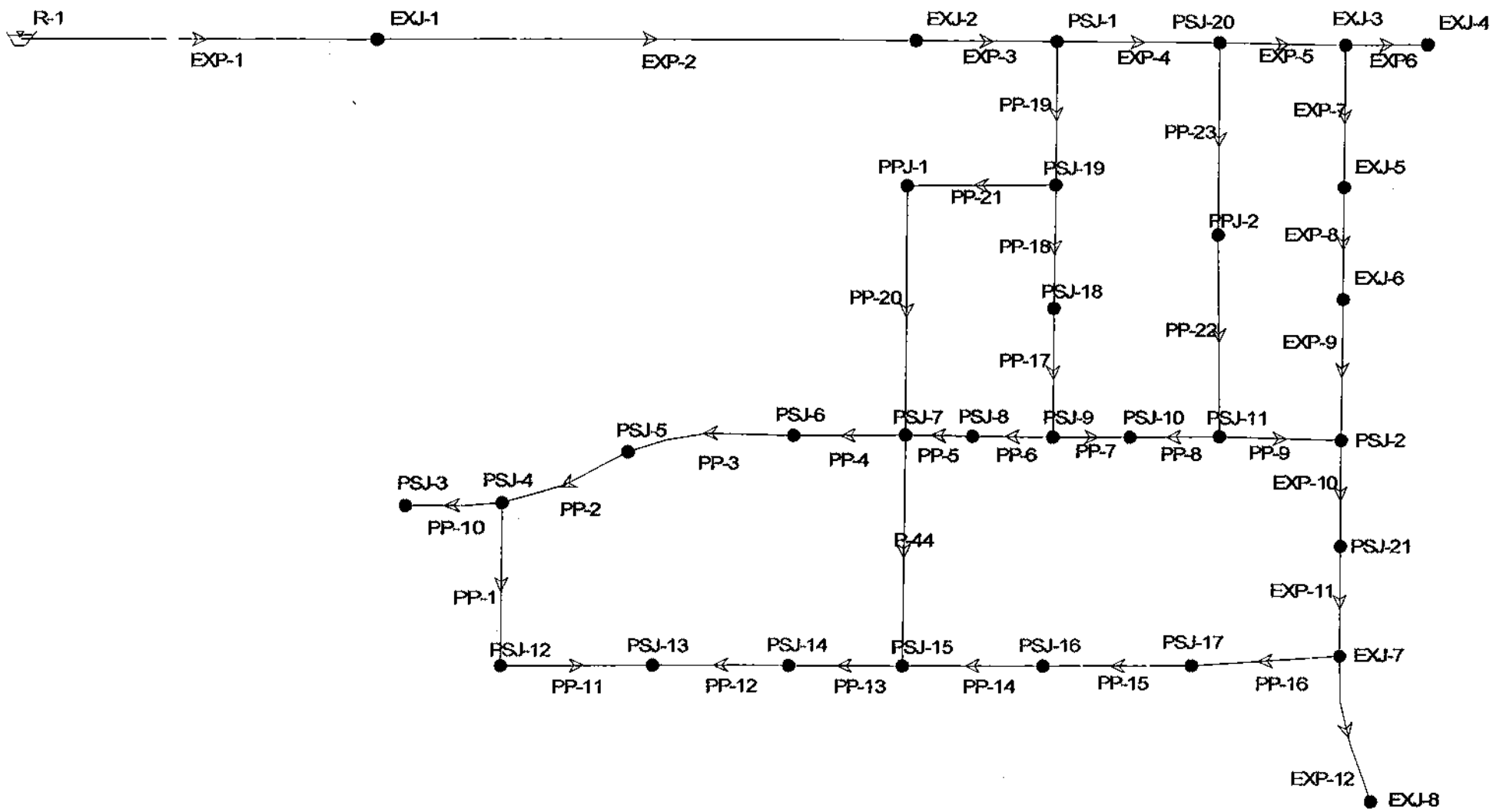
Table 3-3 Non-Residential Unit Flow Coefficients

Land Use Type		Flow Coefficient Average (cfs/acre)
CC	Commercial Corridor	0.006
CR	Retail Center	0.006
CB	Central Business	0.006
CO	Office Commercial	0.006
CP	Pedestrian Commercial	0.006
CH	Highway Commercial	0.006
CL	Limited Commercial	0.006
CN	Neighborhood Commercial	0.006
CT	Tourist and Entertainment Commercial	0.006
CS	Commercial Storage	0.003
CMR	Mixed Commercial/Residential	0.006
CU	Urban Commercial	0.006
CO (HR)	Office Commercial (High Rise)	0.013
CH (HR)	Highway Commercial (High Rise)	0.013
M	Manufacturing	0.008
MC	Mixed Manufacturing and Commercial	0.008
ML	Limited Manufacturing	0.008
MG	General Manufacturing	0.010
MP	Port District	0.008
MR	Restricted Manufacturing	0.006
I	Institutional	0.006
P	Park	0.0003
PR	Public Right-of-Way	N/A
PR (H)	Public Right-of-Way (Horse)	N/A

APPENDIX E

- PROPOSED DOMESTIC WATER SYSTEM & FIRE FLOW MODEL LBWD

Scenario: Base



Title: Proposed Domestic Water System PacifiCenter @ LB
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11/21/03 08:01:07 AM

Kimley Horn & Associates Inc
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Project Engineer: Kimley-Horn and Associates, Inc.
WaterCAD v4.5 [4.5015a]
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Scenario: Base
Fire Flow Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
EXP-1	1,495.00	20.0	Cast iron	130.0	false	0.00	Open	2,491.00	191.00	189.29	1.71	1.14
EXP-2	2,286.00	20.0	Cast iron	130.0	false	0.00	Open	2,491.00	189.29	186.69	2.61	1.14
EXP-3	603.00	20.0	Cast iron	130.0	false	0.00	Open	2,491.00	186.69	186.00	0.69	1.14
EXP-4	704.00	20.0	Cast iron	130.0	false	0.00	Open	1,775.68	186.00	185.57	0.43	0.61
EXP-5	536.00	20.0	Cast iron	130.0	false	0.00	Open	1,337.79	185.57	185.37	0.19	0.36
EXP6	348.00	20.0	Cast iron	130.0	false	0.00	Open	1,148.00	185.37	185.28	0.09	0.27
EXP-7	610.00	12.0	Cast iron	130.0	false	0.00	Open	189.79	185.37	185.30	0.07	0.12
EXP-8	481.00	12.0	Cast iron	130.0	false	0.00	Open	189.79	185.30	185.25	0.06	0.12
EXP-9	608.00	12.0	Cast iron	130.0	false	0.00	Open	189.79	185.25	185.18	0.07	0.12
EXP-10	456.00	12.0	Cast iron	130.0	false	0.00	Open	290.66	185.18	185.06	0.12	0.26
EXP-11	475.00	12.0	Cast iron	130.0	false	0.00	Open	272.66	185.06	184.95	0.11	0.23
EXP-12	640.00	12.0	Cast iron	130.0	false	0.00	Open	14.00	184.95	184.95	5.95e-4	9.3e-4
PP-16	633.00	16.0	PVC	150.0	false	0.00	Open	258.66	184.95	184.93	0.02	0.04
PP-15	642.00	16.0	PVC	150.0	false	0.00	Open	184.66	184.93	184.91	0.01	0.02
PP-14	606.00	16.0	PVC	150.0	false	0.00	Open	110.66	184.91	184.91	4.93e-3	0.01
PP-13	491.00	16.0	PVC	150.0	false	0.00	Open	88.03	184.91	184.90	2.61e-3	0.01
PP-12	586.00	16.0	PVC	150.0	false	0.00	Open	18.03	184.90	184.90	1.68e-4	2.86e-4
PP-11	653.00	16.0	PVC	150.0	false	0.00	Open	-51.97	184.90	184.91	1.31e-3	2.01e-3
PP-1	701.00	16.0	PVC	150.0	false	0.00	Open	-86.97	184.91	184.91	3.65e-3	0.01
PP-10	400.00	16.0	PVC	150.0	false	0.00	Open	27.00	184.91	184.91	2.44e-4	6.1e-4
PP-9	521.00	12.0	PVC	150.0	false	0.00	Open	-100.88	185.18	185.19	0.01	0.03
PP-8	385.00	12.0	PVC	150.0	false	0.00	Open	83.02	185.19	185.18	0.01	0.02
PP-7	333.00	12.0	PVC	150.0	false	0.00	Open	-4.98	185.18	185.18	3.05e-5	9.16e-5
PP-6	345.00	12.0	PVC	150.0	false	0.00	Open	212.44	185.18	185.14	0.04	0.11
PP-5	291.00	12.0	PVC	150.0	false	0.00	Open	176.44	185.14	185.12	0.02	0.08
PP-4	480.00	12.0	PVC	150.0	false	0.00	Open	292.97	185.12	185.03	0.10	0.20
PP-3	719.00	12.0	PVC	150.0	false	0.00	Open	212.97	185.03	184.95	0.08	0.11
PP-2	589.00	12.0	PVC	150.0	false	0.00	Open	156.97	184.95	184.91	0.04	0.06
PP-17	551.00	12.0	PVC	150.0	false	0.00	Open	-243.42	185.18	185.26	0.08	0.14
PP-18	529.00	12.0	PVC	150.0	false	0.00	Open	-331.42	185.26	185.39	0.13	0.25
PP-19	614.00	12.0	PVC	150.0	false	0.00	Open	-691.32	185.39	186.00	0.60	0.98
P-44	994.00	6.0	PVC	150.0	false	0.00	Open	-49.36	184.91	185.12	0.22	0.22
PP-20	1,074.00	12.0	PVC	150.0	false	0.00	Open	-249.90	185.12	185.28	0.16	0.15
PP-21	634.00	12.0	PVC	150.0	false	0.00	Open	-273.90	185.28	185.39	0.11	0.18
PP-22	868.00	12.0	PVC	150.0	false	0.00	Open	-284.90	185.19	185.36	0.16	0.19

Scenario: Base
Fire Flow Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
PP-23	819.00	12.0	PVC	150.0	false	0.00	Open	-336.90	185.36	185.57	0.21	0.26

Scenario: Base
Fire Flow Analysis
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
EXJ-1	48.00	Zone-1	Demand	0.00	Fixed	0.00	189.29	61.13
EXJ-2	46.00	Zone-1	Demand	0.00	Fixed	0.00	186.69	60.87
PSJ-1	49.00	Zone-1	Demand	24.00	Fixed	24.00	186.00	59.27
PSJ-20	46.00	Zone-1	Demand	101.00	Fixed	101.00	185.57	60.38
EXJ-3	45.00	Zone-1	Demand	0.00	Fixed	0.00	185.37	60.73
EXJ-4	45.00	Zone-1	Demand	1,148.00	Fixed	1,148.00	185.28	60.69
EXJ-5	43.81	Zone-1	Demand	0.00	Fixed	0.00	185.30	61.22
EXJ-6	42.50	Zone-1	Demand	0.00	Fixed	0.00	185.25	61.76
PSJ-2	37.00	Zone-1	Demand	0.00	Fixed	0.00	185.18	64.11
PSJ-21	42.00	Zone-1	Demand	18.00	Fixed	18.00	185.06	61.89
EXJ-7	39.16	Zone-1	Demand	0.00	Fixed	0.00	184.95	63.07
EXJ-8	34.00	Zone-1	Demand	14.00	Fixed	14.00	184.95	65.31
PSJ-17	37.00	Zone-1	Demand	74.00	Fixed	74.00	184.93	64.00
PSJ-16	39.00	Zone-1	Demand	74.00	Fixed	74.00	184.91	63.13
PSJ-15	40.00	Zone-1	Demand	72.00	Fixed	72.00	184.91	62.69
PSJ-14	42.00	Zone-1	Demand	70.00	Fixed	70.00	184.90	61.83
PSJ-13	42.00	Zone-1	Demand	70.00	Fixed	70.00	184.90	61.83
PSJ-12	45.00	Zone-1	Demand	35.00	Fixed	35.00	184.91	60.53
PSJ-4	51.00	Zone-1	Demand	43.00	Fixed	43.00	184.91	57.94
PSJ-3	53.50	Zone-1	Demand	27.00	Fixed	27.00	184.91	56.85
PSJ-11	40.00	Zone-1	Demand	101.00	Fixed	101.00	185.19	62.82
PSJ-10	41.00	Zone-1	Demand	88.00	Fixed	88.00	185.18	62.38
PSJ-9	42.50	Zone-1	Demand	26.00	Fixed	26.00	185.18	61.73
PSJ-8	44.00	Zone-1	Demand	36.00	Fixed	36.00	185.14	61.07
PSJ-7	47.00	Zone-1	Demand	84.00	Fixed	84.00	185.12	59.76
PSJ-6	50.00	Zone-1	Demand	80.00	Fixed	80.00	185.03	58.42
PSJ-5	49.00	Zone-1	Demand	56.00	Fixed	56.00	184.95	58.82
PSJ-18	44.00	Zone-1	Demand	88.00	Fixed	88.00	185.26	61.12
PSJ-19	47.00	Zone-1	Demand	86.00	Fixed	86.00	185.39	59.88
PPJ-1	48.00	Zone-1	Demand	24.00	Fixed	24.00	185.28	59.40
PPJ-2	45.00	Zone-1	Demand	52.00	Fixed	52.00	185.36	60.73

Scenario: Base
Fire Flow Analysis
Fire Flow Report

Label	Zone	Fire Flow Iterations	Fire Flow Balanced?	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Min Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Min System Pressure (psi)	Calculated Minimum System Pressure (psi)	Minimum System Junction
EXJ-1	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	65.48	20.00	51.20	PSJ-3	20.00	51.20	PSJ-3
EXJ-2	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	48.57	20.00	42.55	PSJ-3	20.00	42.55	PSJ-3
PSJ-1	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	42.79	20.00	40.38	PSJ-3	20.00	40.38	PSJ-3
PSJ-20	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	42.48	20.00	39.25	PSJ-3	20.00	39.25	PSJ-3
EXJ-3	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	41.13	20.00	38.48	PSJ-3	20.00	38.48	PSJ-3
EXJ-4	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	45.98	20.00	43.65	PSJ-3	20.00	43.65	PSJ-3
EXJ-5	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	38.82	20.00	36.83	PSJ-3	20.00	36.83	PSJ-3
EXJ-6	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	35.19	20.00	35.41	PSJ-3	20.00	35.41	PSJ-3
PSJ-2	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	39.27	20.00	33.57	PSJ-3	20.00	33.57	PSJ-3
PSJ-21	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	32.13	20.00	30.51	PSJ-3	20.00	30.51	PSJ-3
EXJ-7	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	30.41	20.00	27.67	PSJ-3	20.00	27.67	PSJ-3
EXJ-8	Zone-1	13	true	true	5,000.00	5,244.08	5,000.00	5,244.08	20.00	20.00	20.00	29.81	PSJ-3	20.00	29.81	PSJ-3
PSJ-17	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	31.85	20.00	27.62	PSJ-3	20.00	27.62	PSJ-3
PSJ-16	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	30.54	20.00	26.95	PSJ-3	20.00	26.95	PSJ-3
PSJ-15	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	29.99	20.00	26.30	PSJ-3	20.00	26.30	PSJ-3
PSJ-14	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	28.73	20.00	25.64	PSJ-3	20.00	25.64	PSJ-3
PSJ-13	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	28.39	20.00	24.88	PSJ-3	20.00	24.88	PSJ-3
PSJ-12	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	26.53	20.00	23.70	PSJ-3	20.00	23.70	PSJ-3
PSJ-4	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	23.90	20.00	22.82	PSJ-3	20.00	22.82	PSJ-3
PSJ-3	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	20.72	20.00	23.75	PSJ-4	20.00	23.75	PSJ-4
PSJ-11	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	39.64	20.00	35.25	PSJ-3	20.00	35.25	PSJ-3
PSJ-10	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	38.14	20.00	34.98	PSJ-3	20.00	34.98	PSJ-3
PSJ-9	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	37.62	20.00	34.13	PSJ-3	20.00	34.13	PSJ-3
PSJ-8	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	35.41	20.00	33.00	PSJ-3	20.00	33.00	PSJ-3
PSJ-7	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	34.21	20.00	32.37	PSJ-3	20.00	32.37	PSJ-3
PSJ-6	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	28.52	20.00	29.61	PSJ-3	20.00	29.61	PSJ-3
PSJ-5	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	25.59	20.00	25.88	PSJ-3	20.00	25.88	PSJ-3
PSJ-18	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	36.29	20.00	35.27	PSJ-3	20.00	35.27	PSJ-3
PSJ-19	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	37.86	20.00	35.81	PSJ-3	20.00	35.81	PSJ-3
PPJ-1	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	32.38	20.00	34.14	PSJ-3	20.00	34.14	PSJ-3
PPJ-2	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	38.86	20.00	36.98	PSJ-3	20.00	36.98	PSJ-3

APPENDIX F

- PROPOSED RECLAIMED WATER SYSTEM MODEL LBWD

APPENDIX G

- CITY OF LONG BEACH SYNTHETIC MODELING DOMESTIC & RECLAIMED WATER

Scenario: Base
Fire Flow Analysis
Junction Report

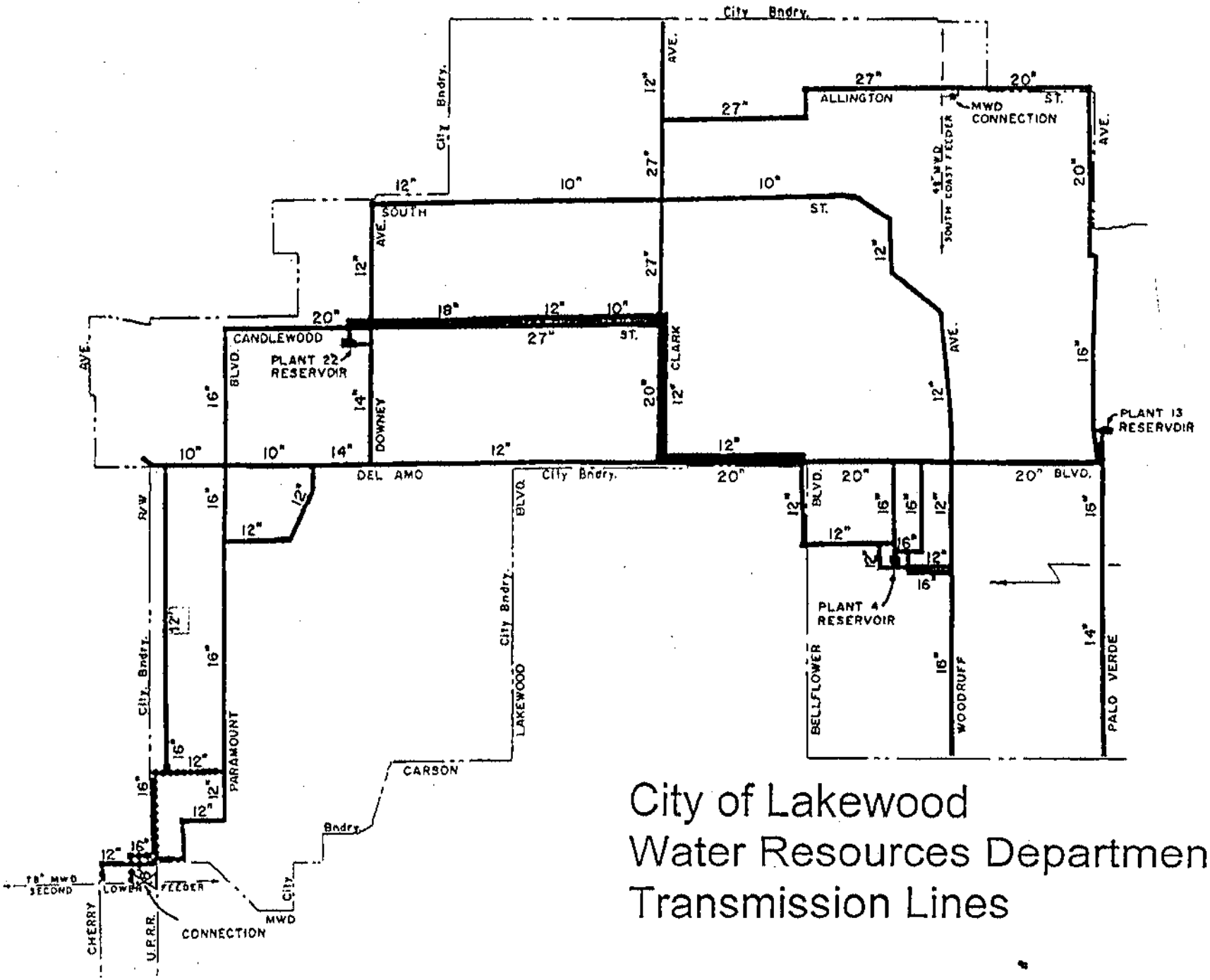
Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
EXJ2	48.00	Zone-1	Demand	0.00	Fixed	0.00	203.16	67.13
EXJ3	47.00	Zone-1	Demand	0.00	Fixed	0.00	203.17	67.57
C-1	44.00	Zone-1	Demand	0.00	Fixed	0.00	203.23	68.89
PJ1	43.50	Zone-1	Demand	77.00	Fixed	77.00	197.62	66.68
PJ2	42.50	Zone-1	Demand	61.00	Fixed	61.00	195.89	66.36
PJ4	42.00	Zone-1	Demand	53.00	Fixed	53.00	193.19	65.41
PJ5	39.00	Zone-1	Demand	109.00	Fixed	109.00	192.57	66.44
PJ6	38.00	Zone-1	Demand	165.00	Fixed	165.00	190.39	65.93
PJ7	40.00	Zone-1	Demand	220.00	Fixed	220.00	188.90	64.42
PJ8	45.00	Zone-1	Demand	167.00	Fixed	167.00	188.01	61.87
PJ9	51.00	Zone-1	Demand	142.00	Fixed	142.00	187.97	59.26
PJ10	55.00	Zone-1	Demand	142.00	Fixed	142.00	187.83	57.47
PJ14	40.00	Zone-1	Demand	138.00	Fixed	138.00	193.27	66.31
PJ13	42.50	Zone-1	Demand	173.00	Fixed	173.00	189.75	63.71
PJ12	47.00	Zone-1	Demand	243.00	Fixed	243.00	188.90	61.39
PJ11	49.00	Zone-1	Demand	230.00	Fixed	230.00	188.09	60.18
PJ16	47.00	Zone-1	Demand	180.00	Fixed	180.00	189.06	61.46
PJ15	48.00	Zone-1	Demand	60.00	Fixed	60.00	188.97	60.99
PJ17	45.00	Zone-1	Demand	154.00	Fixed	154.00	195.81	65.25
PJ18	56.00	Zone-1	Demand	0.00	Fixed	0.00	187.83	57.04
EXJ5	45.00	Zone-1	Demand	0.00	Fixed	0.00	206.10	69.70
EXJ7	45.00	Zone-1	Demand	2,070.00	Fixed	2,070.00	201.92	67.89
EXJ6	44.00	Zone-1	Demand	0.00	Fixed	0.00	207.36	70.68
EXJ1	48.00	Zone-1	Demand	305.00	Fixed	305.00	203.14	67.12
PJ3	37.00	Zone-1	Demand	0.00	Fixed	0.00	193.87	67.87

Scenario: Base
Fire Flow Analysis
Pipe Report

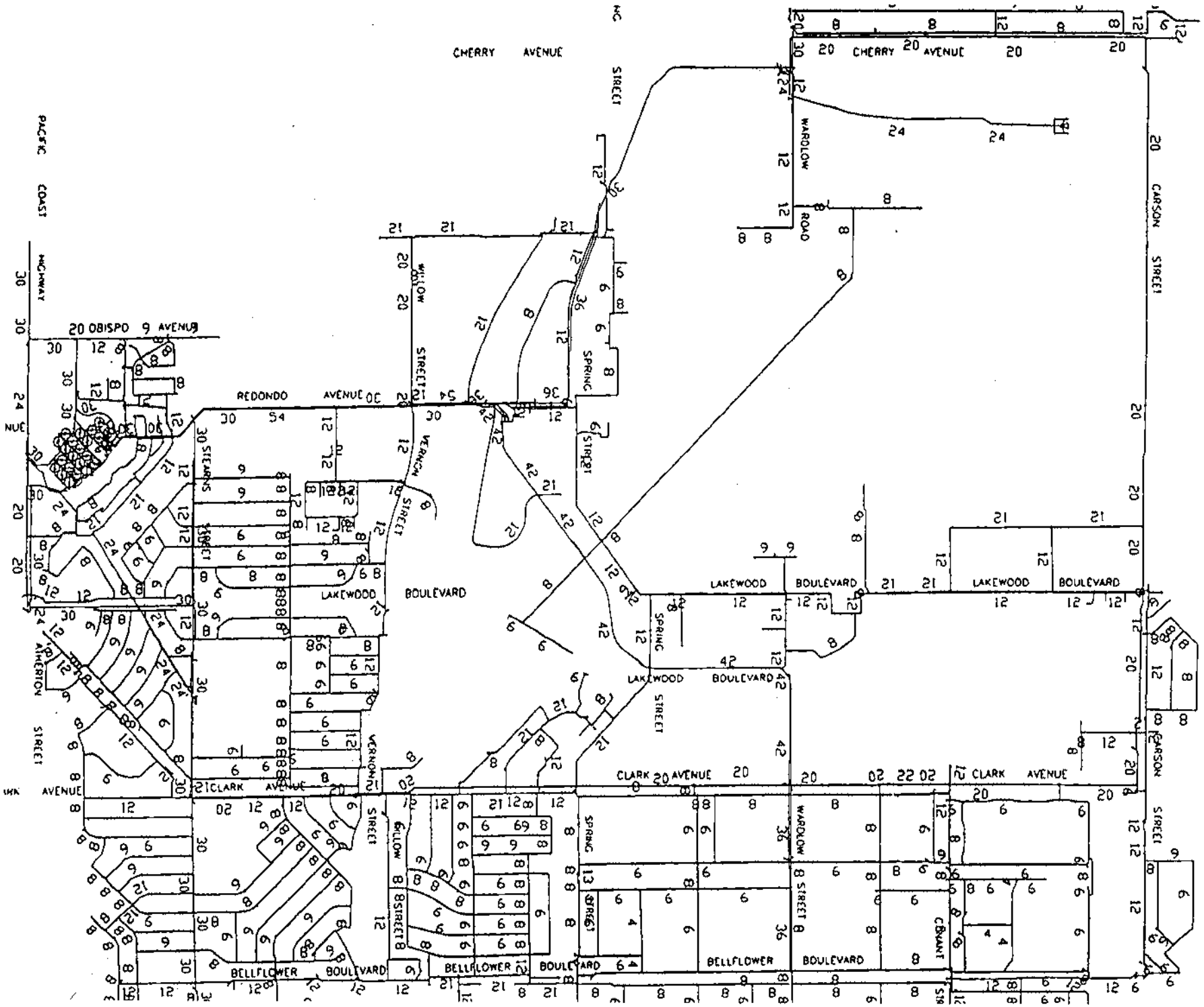
Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
EXP2	267.00	20.0	Cast iron	130.0	false	0.00	Open	-305.00	203.16	203.17	0.01	0.02
PP1	610.00	12.0	PVC	150.0	false	0.00	Open	2,314.00	203.23	197.62	5.61	9.20
PP2	481.00	12.0	PVC	150.0	false	0.00	Open	1,394.43	197.62	195.89	1.73	3.60
PP5	475.00	12.0	PVC	150.0	false	0.00	Open	811.70	193.19	192.57	0.63	1.32
PP6	886.00	10.0	PVC	150.0	false	0.00	Open	702.70	192.57	190.39	2.18	2.46
PP10	701.00	12.0	PVC	150.0	false	0.00	Open	134.95	188.01	187.97	0.03	0.05
PP9	1,096.00	10.0	PVC	150.0	false	0.00	Open	142.00	187.97	187.83	0.14	0.13
PP12	827.00	10.0	PVC	150.0	false	0.00	Open	149.05	188.09	187.97	0.12	0.14
PP22	994.00	10.0	PVC	150.0	false	0.00	Open	15.76	188.90	188.90	2.15e-3	2.16e-3
PP17	1,074.00	10.0	PVC	150.0	false	0.00	Open	-98.57	188.90	188.97	0.07	0.06
PP18	634.00	10.0	PVC	150.0	false	0.00	Open	-158.57	188.97	189.06	0.10	0.16
PP19	1,073.00	10.0	PVC	150.0	false	0.00	Open	-688.57	193.27	195.81	2.54	2.37
PP11	1,022.00	12.0	PVC	150.0	false	0.00	Open	0.00	187.83	187.83	0.00	0.00
EXP6	429.00	12.0	Cast iron	130.0	false	0.00	Open	2,070.00	206.10	201.92	4.18	9.75
EXP5	341.00	20.0	Cast iron	130.0	false	0.00	Open	-4,689.00	206.10	207.36	1.26	3.68
EXP7	446.00	20.0	Cast iron	130.0	false	0.00	Open	-4,689.00	207.36	209.00	1.64	3.68
EXP1	1,103.00	20.0	Cast iron	130.0	false	0.00	Open	305.00	203.16	203.14	0.03	0.02
PP20	526.00	10.0	PVC	150.0	false	0.00	Open	-842.57	195.81	197.62	1.81	3.44
EXP3	2,473.00	20.0	Cast iron	130.0	false	0.00	Open	-305.00	203.17	203.23	0.06	0.02
EXP4	2,296.00	20.0	Cast iron	130.0	false	0.00	Open	-2,619.00	203.23	206.10	2.88	1.25
PP3	608.00	12.0	PVC	150.0	false	0.00	Open	1,333.43	195.89	193.87	2.01	3.31
PP4	456.00	12.0	PVC	150.0	false	0.00	Open	864.70	193.87	193.19	0.68	1.49
PP16	521.00	10.0	PVC	150.0	false	0.00	Open	468.73	193.87	193.27	0.61	1.16
PP7	995.00	10.0	PVC	150.0	false	0.00	Open	537.70	190.39	188.90	1.49	1.50
PP8	1,731.00	10.0	PVC	150.0	false	0.00	Open	301.95	188.90	188.01	0.89	0.51
PP13	1,029.00	10.0	PVC	150.0	false	0.00	Open	-379.05	188.09	188.90	0.81	0.78
PP14	635.00	10.0	PVC	150.0	false	0.00	Open	-507.72	188.90	189.75	0.86	1.35
PP15	718.00	10.0	PVC	150.0	false	0.00	Open	-1,019.30	189.75	193.27	3.52	4.90
PP21	1,080.00	10.0	PVC	150.0	false	0.00	Open	-338.57	189.06	189.75	0.69	0.64

APPENDIX I

- LONG BEACH & LAKEWOOD WATER MAPS



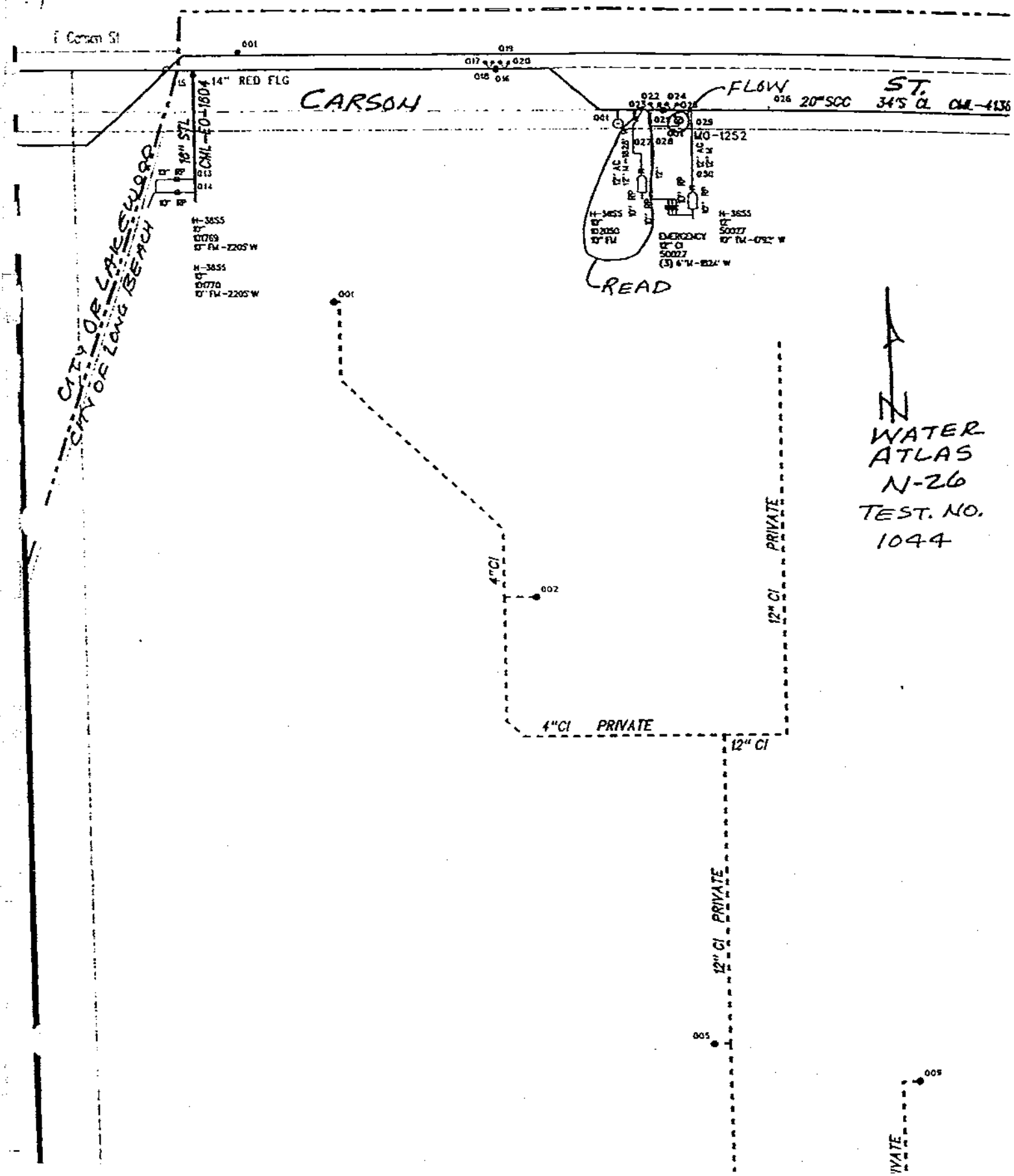
City of Lakewood
Water Resources Department
Transmission Lines


CHERRY AVENUE
CHERRY AVENUE
PACIFIC COAST HIGHWAY
OBISPO AVENUE
REDONDO AVENUE
STEARNS STREET
WILLOW STREET
VERMONT STREET
SPRING STREET
WARDLOW ROAD
CARSON STREET
LAKEWOOD BOULEVARD
LAKEWOOD BOULEVARD
LAKEWOOD BOULEVARD
LAKEWOOD BOULEVARD
ATHERTON STREET
CLARK AVENUE
CLARK AVENUE
CLARK AVENUE
BELLFLOWER BOULEVARD
BELLFLOWER BOULEVARD
BELLFLOWER BOULEVARD
BELLFLOWER BOULEVARD
CORNET STREET

APPENDIX J

- DOMESTIC & RECLAIMED WATER PLANS

WATER ATLAS: N26

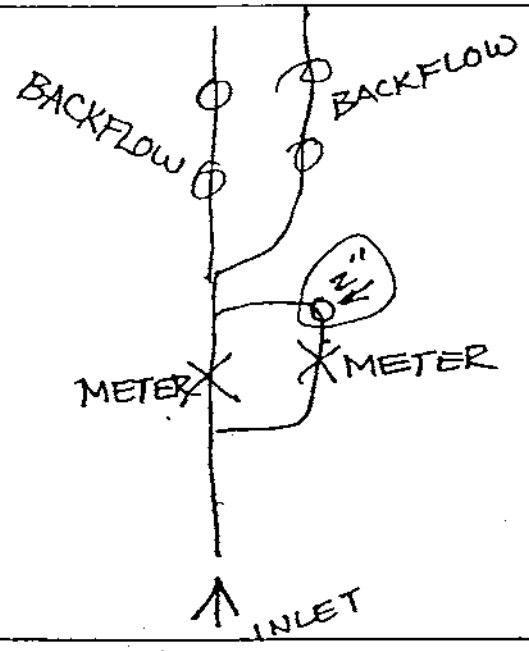


LONG BEACH WATER DEPARTMENT

TO _____

FROM Mel Logan DATE _____

- ☐ Information
- ☐ Per Request
- ☐ Please Handle
- ☐ For Typing
- ☐ Signature
- ☐ Approval
- ☐ Please See Me
- ☐ For Xeroxing
- ☐ Comments
- ☐ File Return
- ☐ Prepare Reply
- ☐ Mail/Send To



APPENDIX K

- RESPONSE TO SAN DIEGO COUNTY WATER AUTHORITY REVIEW

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Executive Office

July 17, 2003

Mrs. Maureen A. Stapleton
General Manager
San Diego County Water Authority
4677 Overland Avenue
San Diego, CA 92123-1233

Dear Mrs. Stapleton:

Response to San Diego County Water Authority Review of the "Report on Metropolitan's Water Supplies"

I am writing in response to San Diego County Water Authority's board letter, dated May 14, 2003, which reviewed Metropolitan's Report on Water Supplies (March 25, 2003). Provided below are our key comments to the Board letter. Water supply reliability for Southern California is dependent on the strong commitment of Metropolitan and its member agencies to integrated resources planning. This integrated resources planning calls for the development of a diverse water resource portfolio, which consists of conservation programs, local resource projects, and groundwater/reservoir storage in concert with imported water deliveries. The recent occurrences of hydrologic and political risks have made it very clear that the traditional approach of relying exclusively on direct annual deliveries from the Colorado River Aqueduct and State Water Project to meet the region's supplemental water needs are not well suited for the complex issues that the region faces today.

The March 25, 2003 "Report on Metropolitan's Water Supplies" (Report) demonstrates that the current strategy of diversifying water supplies allows Metropolitan and its member agencies to adjust to changes in demands and supplies and to maintain a high degree of reliability for the region. First, the success of this strategy is based on investing in cost-effective conservation and local projects, supply contracts, and significant increases in storage capabilities while continuing efforts to resolve the long-standing issues of the Bay-Delta and Colorado River. Second, these investments have already proven to be effective as they have been instrumental in meeting the region's water needs even during the record-breaking droughts of 2002 and the supply uncertainties of 2003. Third, these investments are long-term and will continue to provide reliability into the foreseeable future. Finally, the most important element of this strategy is that the region's water supply reliability will not be placed at risk due to the uncertainties of individual resource investments, including the Colorado River Quantification Settlement Agreement (QSA).

700 N. Alameda Street, Los Angeles, California 90012 • Mailing address: Box 54153, Los Angeles, California 90054-0153 • Telephone (213) 217-6000

Despite the region's commitment to a diversified resource investment, the San Diego County Water Authority (SDCWA) has made assertions (Board Letter, dated May 14, 2003) viewed from a perspective of outdated resource management strategies. SDCWA has challenged the "Report" with its assertion that water supply reliability for the region should be assessed according to only direct annual Colorado River Aqueduct (CRA) and State Water Project (SWP) Table A deliveries and not take into account the regional approach to meeting the needs. SDCWA did not account for the full benefit of the region's investments in conservation, local resources, water storage and transfers. This approach is calculated to support their assertion that urban Southern California water reliability rests on the Imperial Irrigation District (IID)/SDCWA transfer. With this premise, they then shamelessly assert that state taxpayers and Metropolitan ratepayers should be prepared to subsidize the transfer. The not so subtle threat being that if the subsidies are not received, the transfer won't proceed and Southern California's and Northern California's water reliability cannot be assured.

Looking beyond the transparent tactics to justify public subsidies for the transfer, it is important to correctly identify all resources that have been overlooked by SDCWA and to counter misleading conclusions that incorrectly call into question the region's supply reliability. General responses to the SDCWA's assertions are as follows:

- SDCWA overlooked the effectiveness of conservation and local projects in reducing expected demands on Metropolitan; thereby overestimating demands. Based on actual trends, water demands on Metropolitan for 2003 are expected to be 2.2 million acre-feet. This demand includes M&I, agricultural and replenishment deliveries. In the last 10 years, demands on Metropolitan have ranged from 1.5 to 2.44 million acre-feet during wet to record high dry-year in Southern California. However, SDCWA has overestimated 2003 projected water demands (2.4 million acre-feet) and has not accounted for the demand reductions that have occurred due to actual conservation and local projects.

- SDCWA unnecessarily limited water supply reliability to only CRA and SWP Table A deliveries; thereby underestimating the available supplies. In its assessment of water supply reliability for 2003, SDCWA unnecessarily limits Metropolitan's available supplies to only core supplies that include direct deliveries from the CRA and SWP Table A allocation. In addition, annual supplies available to Metropolitan under existing long-term contracts for transfers/exchanges, and current storage capabilities have also been omitted.

- SDCWA failed to disclose full deliveries of water available to Metropolitan under its existing SWP contract, existing core supply contracts, and current storage capabilities,

thereby underestimating available supplies. In its water supply assessment for 2003, SDCWA has omitted up to 295,000 acre-feet of contracted annual deliveries and up to 1 million acre-feet of deliveries from existing storage.

- SDCWA excluded full deliveries of water available under the SWP contract. SDCWA's assessment omits the additional annual deliveries under Article 21 and turn-back pool provisions, and from Metropolitan's carryover account in the San Luis Reservoir. In 2003, the additional supplies available under these contract provisions total 169,377 acre-feet. Such supplies will continue to be available under Metropolitan's SWP contract that extends through 2035.

- SDCWA excluded annual deliveries available under existing contracts. SDCWA's assessment omits the additional annual supplies that can be delivered via the California Aqueduct under the 1967 Water Exchange Contract/1984 Advance Delivery Agreement with Desert Water Agency/Coachella Valley Water District and under the 2001 Coordinated Use Agreement with San Bernardino Valley Municipal Water District. In 2003, the additional supplies available under these contracts total 125,080 acre-feet. Such supplies will continue to be available under these agreements that extend to 2035.

- SDCWA failed to account for the full supply benefit of the ten-fold increase in Metropolitan's storage capabilities since 1990-1992. Metropolitan has put in place more than 2.6 million acre-feet of total storage capacity in the recent 10 years as shown on Figure 1. By the end of 2003, Metropolitan will have 2.45 million acre-feet of "wet" water already in storage available for use, which is equivalent to twice our full Colorado River Aqueduct annual delivery. With a fully operational Diamond Valley Lake, Metropolitan's current operational plan provides the option to deliver up to 1 million acre-feet per year from storage via the California Aqueduct and within the service area to meet annual seasonal and dry-year demands, as needed. This storage capability has been developed in groundwater basins and in surface reservoirs consistent with the current policies of Metropolitan's Board and current operating standards. Metropolitan's access to this storage is by ownership and contractual partnerships with other water agencies in Central Valley and Southern California. It does not include storage along the Colorado River Aqueduct. SDCWA conveniently underestimates Metropolitan's supply capabilities by limiting storage deliveries to the minimum storage capabilities specified in previous reports and by ignoring Metropolitan's current operational plan.

- ➢ SDCWA failed to account for Metropolitan's increased capabilities to make available replenishment deliveries to its member agencies and to refill its system storage. Based on historical record, normal and wet years have occurred 70 percent of the time in the SWP system and have provided available supplies that have far exceeded Metropolitan's delivery demands in the past. In fact, if SWP deliveries were not constrained by demands or limited by storage, Metropolitan would have received 100 percent of its SWP Table A allocation in 6 out of 10 years (1992-2001). Since Metropolitan had not yet developed its full storage capability during this 10 year period, Metropolitan only took 38 percent of its allocation, and left back a total of 8.94 million acre-feet of unused SWP supplies. With member agencies' improvements in groundwater basin operations and with a ten-fold increase in Metropolitan's storage capacity, Metropolitan can now take delivery of the majority of SWP water available to meet both consumptive demands and replenish storage in these hydrologic years to significantly enhance the region's dry-year supplies. This enhanced capability will be even greater upon the completion of the Inland Feeder Project. Examples of Metropolitan's increased capability to provide replenishment deliveries are:

  - Despite the 50 percent reduction of CRA deliveries in 2003, Metropolitan has met all consumptive demands, resumed replenishment deliveries, and increased its system storage by 200,000 acre-feet over last year's storage levels. With a 90 percent SWP allocation, Metropolitan expects to take full delivery of available deliveries through the California Aqueduct and maximize replenishment deliveries to the service area.

  - Metropolitan has continued to make replenishment deliveries available to the member agencies over the past 10 years. In fact, Metropolitan has made available supplies to SDCWA to replenish reservoirs (e.g., Lower Otay, El Capitan, San Vicente and Sweetwater) at a discount rate in each of the past 10 years. As shown on Figure 2, if SDCWA had taken full advantage of Metropolitan's available replenishment supplies, San Diego reservoir storage would have remained full since April 1998.

- SDCWA rejected a prudent approach of considering alternative resources that would ensure reliability for Southern California with or without the QSA. SDCWA's assertion advocated an "all or nothing" approach on the QSA that puts Southern California at risk by exclusively relying on CRA deliveries and does not consider competitive alternative supply options. Metropolitan's report on water supplies recognized the value of both a successful QSA that includes assured benefits as well as feasible supply alternatives.

Metropolitan's detailed evaluation of SDCWA's assertions is included in Attachment A.

In considering the full complement of conservation, local resources, contracted supplies and storage, Metropolitan and its member agencies have positioned themselves to maintain water supply reliability despite record droughts and supply uncertainties on the Colorado River. Given the successes of these conservation and supply programs, it is important that Southern Californians maintain a strong resolve to move forward with diverse resource investments that assure benefits and makes clear business sense. The state will also be best served by a competitive water market not subject to the disrupting influences of taxpayer subsidies. The precedent that the SDCWA seeks of subsidizing the transportation and environmental mitigation costs of a purported market transfer risks pushing the water transfer market off in a direction analogous to California's energy deregulation disaster. A viable competitive water market cannot be sustained if select individual transfers get subsidies based solely upon political considerations while others do not. We urge you to continue your strong support and commitment to sound resources management and conservation initiatives.

I am available to discuss these comments with you at your convenience.

Very truly yours,

Ronald R. Gastelum
Chief Executive Officer

DM:jm
p:\response to sdcwa review 6-28-03.doc

Attm.

cc: Mr. Bernie Rhinerson
Chairman of the Board
San Diego County Water Authority

MWD Board of Directors
MWD Member Agency Managers

Figure 1
Metropolitan's Storage Capacity

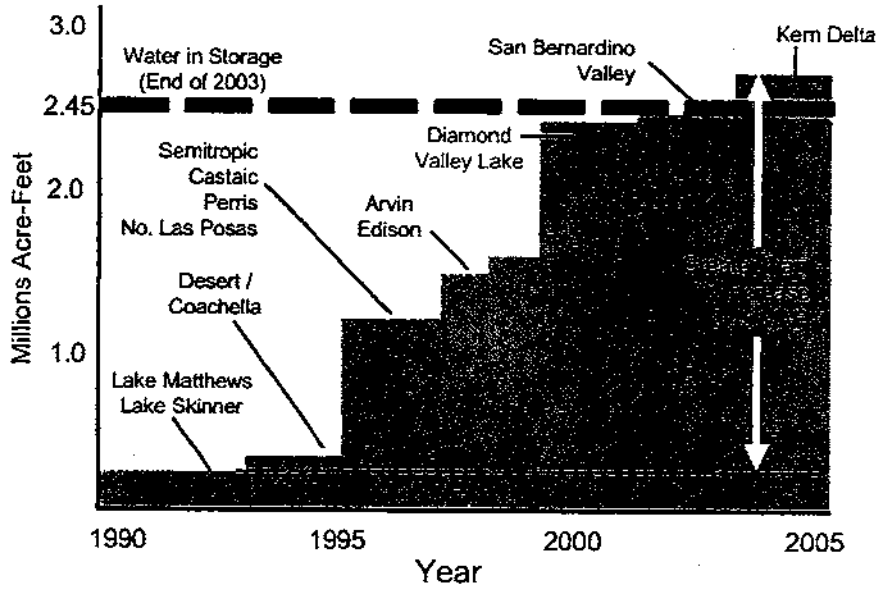


Figure 2
SDCWA Accumulated Reservoir Storage

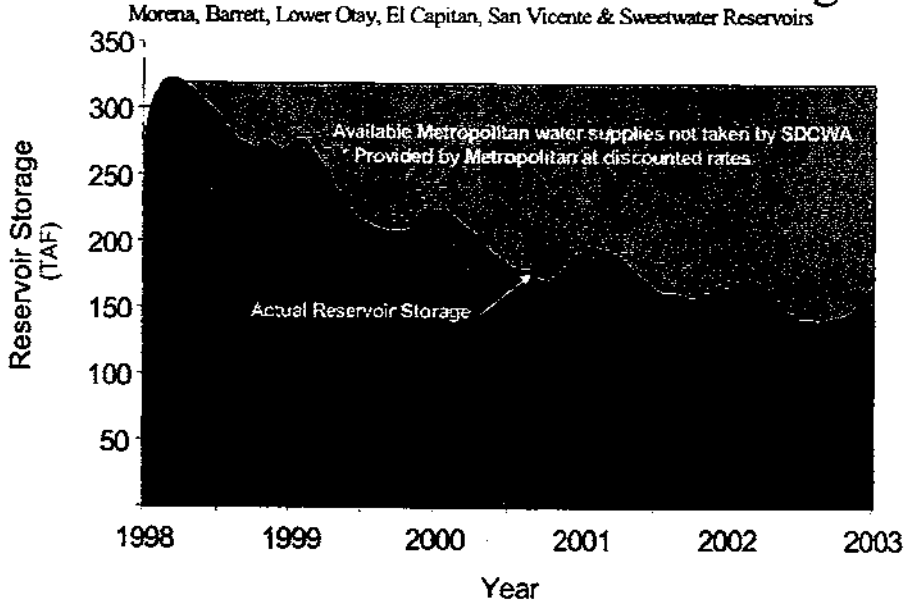
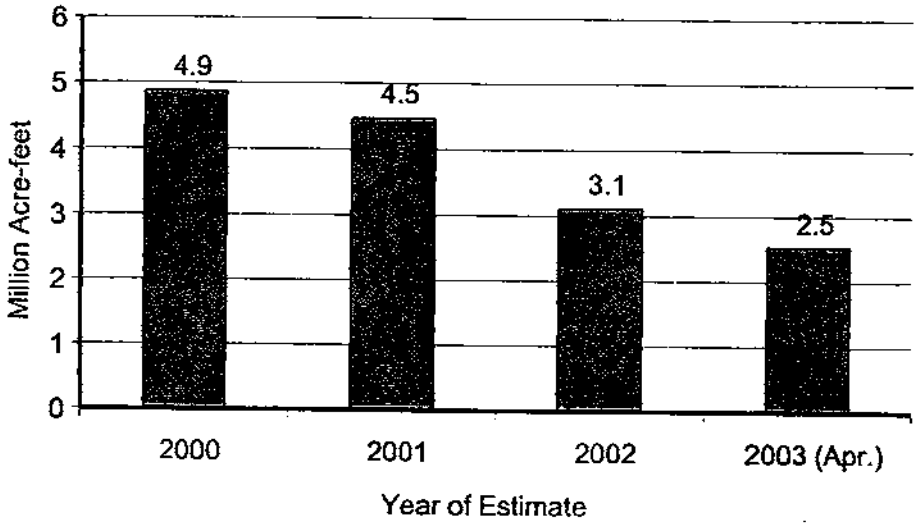


Figure 3
Total Surplus Available to MWD
(with QSA 2004 through 2016)



Attachment A
Responses to the SDCWA Board Letter
Concerning the "Report on Metropolitan's Water Supplies"

Responses to specific statements in the SDCWA Board Letter are presented as follows.

1. **Statement from SDCWA Board Letter, Report Overview Discussion:**
   (Page 2 of 8)

   The ability of Metropolitan to do this [meet projected demands, refill storage, and provide reserve supplies] over the next 10 to 15 years without executing the QSA is questionable. The loss of surplus Colorado River supply has shifted Metropolitan from a large surplus of net contracted core supply to a net contracted core supply deficit, as illustrated below. This constriction of the band between demand and core supply will reduce Metropolitan's reliability and place its member agencies at significant risk.

2002 Core Supply With QSA Surplus
MWD Actual Demand = 2.4 million acre-feet

Normal Year Supply	*Amount (acre-feet)*
Colorado River	*1,250,000*
State Water Project	*1,400,000*
Total contracted supply	*2,650,000*
Core supply surplus	*250,000*

2003 Core Supply Without QSA Surplus
Projected MWD Demand = 2.4 million acre-feet

Normal Year Supply	*Amount (acre-feet)*
Colorado River	*580,000*
State Water Project	*1,400,000*
Total contracted supply	*1,980,000*
Core supply surplus	*(420,000)*

Metropolitan Response 1:
There is no deficit in Metropolitan's core contracted supplies in meeting demands with or without surplus Colorado River water as shown in the following 2002 and 2003 examples. In fact, in both examples, core supplies exceed demands ensuring that consumptive, replenishment and agricultural demands are met and providing the opportunity for Metropolitan to further increase the amount of water stored in Metropolitan's reservoirs and banking programs.

The SDCWA board letter underestimates Metropolitan's core contracted supplies by 170,846 acre-feet in 2002 and between 451,622 and 717,307 acre-feet in 2003. The differences between SDCWA supply assessment and Metropolitan's actual supplies are significant because SDCWA has omitted the following:

- SWP contract deliveries under the provisions of Article 21, turn-back pool, and the carryover account in the San Luis Reservoir.

- Core supplies under the 1967 Water Exchange Contract/1984 Advance Delivery Agreement with Desert Water Agency/Coachella Valley Water District and under the 2001 Coordinated Use Agreement with San Bernardino Valley Municipal Water District (SBVMWD).
- Supply reserves that are put into Metropolitan's reservoirs and banking programs. By the end of 2003, it is expected that Metropolitan will have 2.45 million acre-feet of "wet" water already in storage available for use, which is equivalent to twice our full Colorado River Aqueduct annual delivery.

In addition to underestimating Metropolitan's core contracted supplies, the SDCWA board letter overestimates the projected demands on Metropolitan in 2003. SDCWA has assumed an above-normal demand of 2.4 million acre-feet in its 2003 example. However, Metropolitan estimates that its demands will be 2.152 million acre-feet in 2003 based on the actual demands that have already occurred in January through May and the normal weather conditions in Southern California.

2002 Water Supplies and Demands
Metropolitan's Actual Supplies vs SDCWA Assertion

	SDCWA Assertion (acre-feet)	**Metropolitan Actual** (acre-feet)	**Comments**
Demands (Dry-year)	2,400,000	**2,439,000**	**Actual demands on Metropolitan in 2002 (record drought) are 2.439 maf.**
Colorado River	1,250,000	**1,199,842**	
- Basic Apportionment		**= 550,000**	
- HD 1 Program		**= 104,940**	
- Surplus Water		**= 583,054**	
- Deliveries to DWA/CVWD		**= (38,152)**	
California Aqueduct	1,400,000	**1,621,004**	**SDCWA underestimated California Aqueduct deliveries by 221,004 af.**
Metropolitan's SWP Contract			
- Table A Allocation	= 1,400,000	**= 1,408,050**	**SDCWA excluded the additional deliveries under Metropolitan SWP contract (Article 21, turn-back pool, and San Luis carryover.**
- Article 21 & turnback pool	-----	**= 21,809**	
- San Luis Carryover	-----	**= 97,640**	
Supply Contracts			
- DWA/CVWD Exchange	-----	**= 42,840**	**SDCWA excluded annual supplies under existing contracts. Metropolitan only utilized a portion of the total contract amounts.**
- SBVWD	-----	**= 20,000**	
- Other	-----	**= 30,665**	
Total Contracted Supplies	2,650,000	**2,820,846**	**SDWCA underestimated total contracted supplies by 170,846 af.**
Supply Reserves	250,000	**381,846**	**Supply reserves placed into storage.**

2003 Water Supplies and Demands
Metropolitan's Actual Supplies vs SDCWA Assertion

	SDCWA Assertion (acre-feet)	Water Supplies and Demands (acre-feet)		Comments
		Hypothetical Average Imported Supplies	Projected Actual	
Projected Demand - M&I - Agricultural - Replenishment	2,400,000	2,152,000 = 1,933,000 = 132,000 = 87,000	2,152,000 = 1,933,000 = 132,000 = 87,000	SDCWA overestimated demands on Metropolitan by 194,000 af.
Colorado River	580,000	592,500	592,500	DOI has allocated 592,500 af to Metropolitan for 2003.
California Aqueduct	1,400,000	1,839,122	2,104,807	SDCWA underestimated Ca. Aq. deliveries by 439,122 to 704,807 af.
Metropolitan's SWP Contract - Table A Allocation - Article 21/turnback - San Luis Carryover	=1,450,000 ----- ----	= 1,548,855 = 34,533 = 134,844	= 1,810,350 = 34,533 = 134,844	Historical avg. is 77%. SDCWA excluded deliveries under Article 21, turn-back pool, and San Luis carryover.
Supply Contracts - DWA/CVWD Exchange - SBVWD - Other	----- ----- -----	= 50,890 = 70,000 Not needed	= 55,080 = 70,000 Not needed	SDCWA excluded annual supplies under existing contracts. Metropolitan only utilized a portion of the total contract amounts.
Total Contracted Supplies	1,980,000	2,431,622	2,697,307	SDWCA underestimated total contracted supplies by 451,622 to 717,307 af.
Supply Reserves	(420,000)	279,622	545,307	No contracted core supply deficit. Supply reserves are placed into storage.

2. **Statement from the SDCWA Board Letter, Demand Discussion:**
(Page 2 of 8)
Projected water demand changed very little from Metropolitan's 2000 Urban Water Management Plan (UWMP). The Report states that Metropolitan's projections are 6 to 16 percent higher than the combined demand projections of its member agencies, leading to a conservative estimate. The following table shows demand projected by the 2003 Report and the 2000 UWMP.

Average Year Demand on Metropolitan
(million acre-feet)

	2005	2010	2015	2020
2003 Report	*1.99*	*1.94*	*2.13*	*2.34*
2000 UWMP	*1.96*	*2.02*	*2.14*	*2.36*

Metropolitan's Response 2:

SDCWA statement confirms that Metropolitan's demands in the 2003 Report and the 2002 UWMP are consistent. This is correct.

Metropolitan's demands projections in the 2003 Report and the 2002 UWMP are 6 to 16 percent higher than the combined demand projections stated in the individual urban water management plans of its member agencies. This difference indicates that Metropolitan's water supplies developed in accordance its reports would provide a "margin of safety" or measure of flexibility to accommodate some delays in local resources development.

3. **Statement from SDCWA Board Letter, Colorado River Aqueduct Deliveries:** *(Page 3 of 8)*
Metropolitan's analysis of Colorado River supplies is unclear, misidentifies as current supplies programs that do not currently exist and that require the execution of the QSA, and misrepresents the potential availability of QSA surplus water. For example, under a dry-year scenario in 2005, the Report shows that Metropolitan will have 721,330 acre-feet from the river. Although the report does not say so, this amount assumes supplies that will only be available with the execution of the QSA. The following chart compares "Current Programs" supplies form the Report with Authority analysis of supplies that are actually available and those that require the QSA:

Colorado River Supplies in 2005
Under Dry-year Scenario
(acre-feet)

Current Programs	*Metropolitan Report*	*Authority Assertion*	*SDCWA Comments*
Priority 4	***550,000***	*550,000*	
IID/MWD transfer	***105,130***	*50,000*	***CVWD has call on half of water***
ALL American and Coachella Canal Lining	***21,200***	*0*	***IID and CVWD have call on water***
Hayfield Storage	***45,000***	*0*	***Not a completed project***
Misc. PPR's	***0***	*(42,000)*	***MWD responsible for all present perfected rights without QSA***
Total	***721,330***	*558,000*	***Variance of 158,330 af***

Metropolitan's Response 3:

Estimates of the supplies that would be available to Metropolitan without a QSA in 2005 are been based on legal, funding and operational documentation as indicated in the following table. SDCWA's concern regarding supply variances highlights the continued differences amongst parties and uncertainties concerning the Colorado River. As a result, Metropolitan's Report maintains a prudent supply reserve that safeguards against potential demand and supply uncertainties.

Colorado River Supplies in 2005
Under Dry-year Scenario
(acre-feet)

Current Programs	Metropolitan Report	Authority Assertion	Comments
Priority 4	**550,000**	550,000	
IID/MWD transfer	**105,130**	50,000	**Minimum delivery is 55,000af per yr. More water could be available depending on CVWD demands and supplies.**
ALL American and Coachella Canal Lining	**21,200**	0	**Public Law 100-675 calls for the conservation of water from lining the canals and the delivery of this conserved water to the party who pays for the lining.**
Hayfield Storage	**45,000**	0	**Environmental review was completed in 1999. Funds were appropriated in 2001 for construction of facilities. Extraction capabilities will be on-line in 2005. 67,000 af of water already in storage as of 2003.**
Misc. PPR's	**0**	(42,000)	**Responsible for PPR's is not established under law**
Total	**721,330**	558,000	**Metropolitan's supply reserves cover potential variances.**

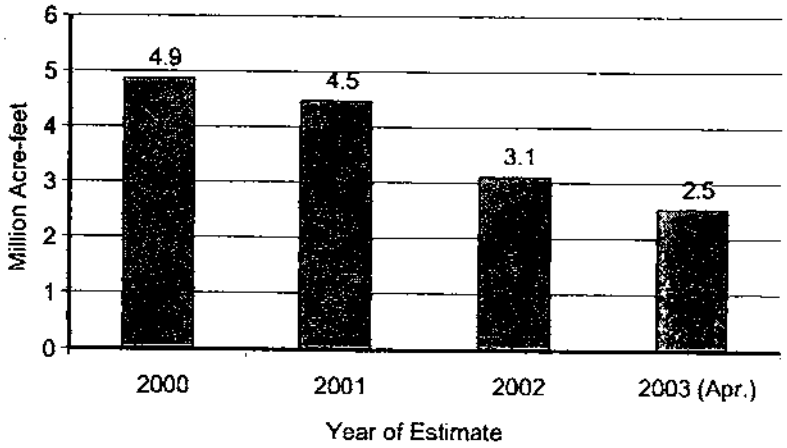
4. **Statement from the SDCWA Board Letter, Colorado River Aqueduct Deliveries:** *(Page 3 of 8)*

   The availability of net additional surplus water from the QSA has been a subject of much recent discussion at Metropolitan and its member agencies. The Report provides a limited look at the amount of surplus that Metropolitan expects to be available. During average years, the Report shows a net QSA surplus of 180,500 acre-feet in 2005, but none in 2010 or 2015. This conflicts with analysis of the QSA that Metropolitan provided to its Board April 22, 2003, which used computer modeling to show that over the 14-year QSA interim surplus period (through 2016), Metropolitan would receive 2.5 million acre-feet of total surplus with the QSA, or an average annual amount of more than 178,000 acre-feet. Authority review of the same computer modeling data shows that the surplus could be as high as 3.0 million acre-feet during the QSA interim period, or about 214,000 acre-feet per year. Metropolitan estimated in 2001 that the QSA surplus would be 4.5 million acre-feet and in 2002 that the surplus would be 3.1 million acre-feet. The reduced estimates are a result of drought conditions on the Colorado River. It is important to note that a series of wet years on the river could increase the available QSA surplus back to previously expected levels as quickly as the dry years reduced the projected levels.

Metropolitan's Response 4:

Metropolitan shares the concerns of SDCWA regarding the uncertainty of surplus water that is provided through the Interim Surplus Guidelines. The most important variable is hydrology. The sobering impact of that variable on surplus water is shown on Figure 3. Based on the Bureau of Reclamation estimates, our expectation for surplus water from 2003 to 2016 (before any shortage sharing with Arizona) has declined from almost 6.0 million acre-feet when we were in 2000 to about 2.5 million acre-feet today. The Bureau indicates that there are no assurances that we can count on full surplus deliveries.

Figure 3
Total Surplus Available to MWD
(with QSA 2004 through 2016)



The repeat of the 1922-98 hydrologic period is used to project the availability of State Project water and the availability of surplus Colorado River water. This approach provides the linked hydrology to evaluate the supply conditions on the two systems together. As the computer modeling studies were undertaken in February 2003 when runoff for the water year could still vary widely, end of 2002 storage in the Colorado River reservoirs was utilized as the initial conditions, and a repeat of each of the years from 1922-98 was considered as a possibility in 2003. An explanation of the hydrologic period used may be found on page 10 of the Report. As Central Arizona banking is included as a program under development in the Report, the simulation of such storage operations were included. As indicated on page 10 of the Report, an average-year represents the statistical average of the 77 historical hydrological conditions. This is the case for each level of demand in Metropolitan's service area for 2005, 2010, 2015, 2020, and 2025. As such, the calculation of an average amount of surplus water available per year from the total amount of surplus water available from 2004 to 2016 would not necessarily be representative of the average amount of surplus water available in one of the years between 2004 and 2016. This is because there may be no surplus water available in years such as 2010 and 2015, which is what the studies conducted for the Report determined.

5. **Statement from the SDCWA Board Letter, California Aqueduct Deliveries:** *(Page 4 of 8)*

The report assumes Metropolitan will have 1.549 million acre-feet of SWP supply available in average years through 2010, a 77 percent allocation of its SWP entitlement. This amount is based upon an August 2002 draft report from the California Department of Water Resources, "The State Water Project Delivery reliability Report," which produced results from three computer models showing a range of 72 to 76 percent of average entitlement available to SWP contractors.

Metropolitan's historic draw upon SWP supplies is not a measure of the availability of future supplies because Metropolitan has never historically demanded its full entitlement, as it must do now. However, the DWR report shows that over the 10-year period from 1992 to 2001, the SWP as a whole produced an average annual supply of about 2.255 million acre-feet, or about 54 percent of total project entitlement. If this supply yield repeated itself over the next 10 years, Metropolitan would have about 1.1 million acre-feet of annual SWP supply, or about 400,000 acre-feet per year less than stated as average Metropolitan supply in the Report.

Metropolitan's Response 5:

The average 2.55 million acre-feet per year reflects actual water deliveries (constrained by demands) not the water that was available on the SWP. If deliveries were not constrained by demands or limited by storage, then Metropolitan would have received 100 percent of its SWP Table A allocation in 6 out 10 years (1992-2001), and on average over this 10 year period, received approximately 82 percent of its full entitlement. Many of the years in the late 1990's were very wet and thus caused water demands to be substantially lower on the SWP, the lack of demand, not water supply caused the "lower" delivery levels for the SWP. Since Metropolitan has not yet developed its full storage capability during this 10 year period, Metropolitan only took 38 percent of its allocation and left back a total of 8.94 million acre-feet of unused SWP supplies.

Supply Year	Available SWP Supplies for Metropolitan		Actual SWP Deliveries to Metropolitan	
	SWP Allocation (%)	Supply Allocated (acre-feet)	SWP Taken (%)	Supply Taken (acre-feet)
1992	45	905,175	35	710,000
1993	100	2,011,500	32	652,000
1994	50	1,005,750	40	807,866
1995	100	2,011,500	22	436,042
1996	100	2,011,500	29	593,380
1997	100	2,011,500	36	721,810
1998	100	2,011,500	20	410,065
1999	100	2,011,500	42	852,617
2000	90	1,810,350	77	1,546,348
2001	39	784,485	45	904,909
Total		16,574,760		7,635,037
Total unused supply 8,939,723 acre-feet				

Fortunately with member agencies improvements in groundwater basin operations and with a 10-fold increase in Metropolitan's storage capacity, Metropolitan can now take delivery of SWP water available to meet both consumptive demands and replenishment storage.

6. **Statement from the SDCWA Board Letter, California Aqueduct Deliveries, Semitropic and Arvin-Edison Program Discussion:**
(Page 5 of 8)

The Report also includes Metropolitan's Semitropic and Arvin Edison groundwater conjunctive use programs in its assessment of Available California Aqueduct supplies. The projects are assumed to collectively produce 197,000 acre-feet (107,000 and 90,000 acre-feet, respectively), during drought years through 2025. The Report cites annual production of these dry-year supplies that is 91,000 to 137,000 acre-feet more than other recent Metropolitan reports.

Metropolitan's 2000 UWMP describes dry-year scenarios under which Semitropic would be limited to producing 31,500 acre-feet, and states that the maximum single-year yield from Arvin Edison is 75,000 acre-feet (106,500 acre-feet combined). Metropolitan January 2002 IRP Report Card indicated that under a 30 percent SWP allocation, the combined yield from these two projects would be 110,000 acre-feet, but only after the projects are "fully developed." The IRP Report Card noted that the projects could have delivered only 60,000 acre-feet in 2000 (when Metropolitan's SWP allocation was 100 percent.)

Metropolitan's Response 6:

In 2003, Metropolitan's operating plan has been updated to reflect a fully operational Diamond Valley Lake (DVL) and the ability to maximize the deliveries from existing banking/transfer programs that deliver supplies through the California Aqueduct. Metropolitan's Report reflects this updated plan.

DVL is now fully operational as the initial fill has been completed; the State Department of Water Resources Division of Safety of Dams provided its Certificate of Approval for full operations of DVL; and the conveyance capacity for refill has been increased through an intertie between the Foothill Pipeline and the constructed segment of the Inland Feeder.

With a fully operational DVL, the existing banking/transfer programs (Semitropic and Arvin-Edison) can now be coordinated with reservoir deliveries to make the most of the supply yields and water quality benefits. Prior to the full use of DVL, these banking/transfers programs were reserved as peak summer supplies during critical dry years and only operated at the minimum contracted amounts, if needed. DVL can now provide the summer peak supplies allowing the banking/transfer programs to be operated on a more frequent basis and at greater delivery amounts according existing contracts. The minimum and maximum operating deliveries under contract and Metropolitan's operating plan for the Semitropic and Arvin-Edison programs are shown below.

Program	Water in Storage End of 2003 (acre-feet)	Program Deliveries (acre-feet per year)		
		Minimum: 4-Mo. Peak	Maximum: 12-Mo.	2003 MWD Operating Plan: 10-Mo.
Semitropic Program	381,632	31,000	170,000	107,000
Arvin-Edison	248,873	40,000	110,000	90,000
Combined Program Capabilities	630,505	71,000	280,000	197,000

Based on expected replenishment and withdrawal requirements, Metropolitan's 2003 operating plan provides the Metropolitan the option to deliver up to 197,000 acre-feet per year from the Semitropic and Arvin-Edison programs. It should be noted that these programs represent 24 percent of Metropolitan's total water in storage. By the end of 2003, Metropolitan will have 2.45 million acre-feet of "wet" water already in storage available for immediate use.

7. **Statement from the SDCWA Board Letter, In-Basin Storage Deliveries Discussion:**
(Page 5 of 8)

One of the most significant changes between the 2002 Report on Metropolitan Water Supplies and this year's Report is the use if Diamond Valley Lake to meet single year dry-year demand. The 2002 Report showed that 150,000 acre-feet of DVL storage would be withdrawn in a dry-year, or about 20 percent of the reservoir's capacity. The 2003 Report shows that a total of up to 510,000 acre-feet would be withdrawn from combined storage in DVL, Lake Mathews, and Lake Skinner. This is a 340 percent increase in dependence upon surface storage to meet single-year demand.

Because Skinner and Mathews are regulating reservoirs with combined operational storage of about 75,000 acre-feet, about 435,000 acre-feet of the total projected storage use would come from DVL. This is more than 50 percent of DVL's capacity. This reflects Metropolitan written court testimony about the heightened risks that resulted from reduced Colorado River deliveries: "MWD anticipates that a total of approximately 400,000 acre-feet would need to be drawn from surface storage reserves in 2003 to avoid shortages. This represents approximately 45 percent of the region's total surface storage reserves that have been earmarked for drought protection and catastrophic emergencies." (From "Declaration of Stephen Arakawa in Support of MWD's Supplemental Memorandum on Preliminary Injunction Remedies," March 28, 2003.

Metropolitan's Response 7:

With a fully operational DVL and increased refill capacity in 2003, the operations of Southern California reservoirs have been coordinated to maximize the use of storage to meet emergency, regulatory, drought and water quality needs. The primary reservoirs available for use within Metropolitan's service area include Metropolitan's facilities (DVL, Lake Mathew, and Lake Skinner) and DWR facilities (Castaic Lake, Lake Perris, Pyramid Lake, Silverwood Lake and Elderberry Forebay). Metropolitan's Report documents the coordinated operations of these reservoirs

consistent with Metropolitan's operating policies as established in the October 1991 Final Environmental Impact Report for the Eastside Reservoir (DVL) Project and in the March 1996 Metropolitan Integrated Resources Plan.

The reservoir capacity available for emergency and dry-year usage is described below. The total reservoir capacity available to Metropolitan is 1,669,000 acre-feet. In the March 28, 2003 testimony, the maximum allowable withdrawal from DVL in a critical dry-year is 400,000 acre-feet, which is 45 to 50 percent of the total DVL capacity and 24 percent of the total capacity of Southern California reservoirs available for Metropolitan's use.

The first component, emergency storage, was based on the potential for a major earthquake to damage the Colorado River, California and Los Angeles aqueducts simultaneously. Emergency water reserves are essential within Metropolitan's service area to supplement local production during an this type of emergency, or severe water shortages will occur during the period the aqueducts are out of service. It was determine that, damage from such an event could render all import aqueducts out of service for six months. During this period, all interruptible service deliveries would be suspended, accompanied by a mandatory water supply reduction of 25 percent from normal-year demand levels. Also water stored in surface reservoirs and groundwater basins under Metropolitan's interruptible program would be made available, and it is anticipated that full local groundwater production would be sustained. This emergency storage also would be used during other situations, including unexpected disruptions of aqueduct deliveries due to environmental and water quality regulations. Storage reserved in system reservoirs for emergency purposes changes over the next 20 years in accordance with the projected demands.

Surface Storage Requirements
Average-year
(acre-feet)

	Average-year Storage Projection				
	2005	2010	2015	2020	2025
Surface Storage in MWD Service Area					

The second storage component, dry-year supply and seasonal storage, was also based on Board adopted criteria. As established in these criteria, dry-year supply storage within Metropolitan's service area is required to meet the additional water demands that occur during single-year and extended droughts. This criteria requires that Metropolitan have the capability to withdraw the drought storage in reservoirs within a two-year period. This storage requirement is the difference between normal-year demand and above-normal demand during dry years. Seasonal storage is required to meet seasonal peak demands during the year, and is the difference between normal

winter demands and normal summer demands. Dry-year supply and seasonal storage also provide sufficient reserves to permit about 5 percent downtime for rehabilitation, repair and maintenance of raw water transmission facilities. Full use of this storage capacity also is required to improve blends with SWP water and reduce the total organic carbons at the Weymouth, Diemer and Skinner treatment facilities.

Based on the these reservoir capabilities, Metropolitan can utilize deliveries from In-Basin Storage which includes DVL, Lake Skinner, Lake Mathews, the flexible storage accounts in Castaic Lake and Lake Perris, the long-term seasonal storage, and the North Las Posas Groundwater Storage Program. Based on expected replenishment and withdrawal requirements, Metropolitan's operating plan establishes the maximum deliveries from the In-Basin Storage that can be made to meet demands in single and multiple dry-year events. Metropolitan would not necessarily make the maximum deliveries unless warranted. The maximum deliveries from In-Basin Storage under Metropolitan's operating plan are clarified below.

In-Basin Storage Deliveries
2005 Single Dry-year
(acre-feet)

Current Programs	2002 Metropolitan Report	2003 Metropolitan Report	Comments
DVL only (under initial fill and DOI inspection)	150,000		In February 2002, the Safety of Dams Certificate of Approval for full operations of DVL to spillcrest was not yet issued. DVL withdrawals were operationally limited.
Fully operational DVL, Skinner, and Mathews		470,400	The Safety of Dams Certificate of Approval for full operations of DVL has been issued and is effective in 2003. Coordinated operations of DVL, Skinner and Mathews are consistent with Board approved operating criteria.
Castaic, Perris	70,000	110,000	Consistent with Metropolitan's SWP contract. 2003 Report is consistent with Board approved operating criteria.
Long-term seasonal storage	100,000	100,000	Based on historical record for replenishment deliveries.
North Las Posas	50,000	50,000	Extraction facilities are under construction and scheduled to be operational in December 2004.

8. Statement from the SDCWA Board Letter, Replenishment of Storage, Without QSA Discussion:
(Page 6 of 8)

The Report calculates large volumes of "potential reserve and system replenishment supply" by subtracting expected demand from the sum of both current supplies and supplies under development. These include supplies that will only be available if the QSA is executed, although this is not explicitly referenced in the Report. In 2005 during an average year, for example, the Report includes 434,700 acre-feet of supplies that will not be available unless the QSA is executed.

Metropolitan's Response 8:

In 2005 during an average year, supplies delivered from current Colorado River programs (without the QSA) and from the California Aqueduct are expected to be 2.476 million acre-feet. Projected demands are 1.969 million acre-feet. This means that the current supply capabilities exceed demands and can provide a supply reserve of 500,000 acre-feet that safeguards against supply uncertainties and assures the replenishment of storage. If the QSA is executed, then up to 321,500 acre-feet of potential supplies from the Interim Surplus Guidelines, IID/SDCWA transfer and PVID Land Management Program may not be realized in an average year in 2005. Although these additional Colorado River supplies provide an additional supply reserve, they may not necessarily be needed in this year to meet consumptive and replenishment needs in this year.

9. Statement from the SDCWA Board Letter, Replenishment of Storage, Exchange Program with Coachella and Desert Discussion:
(Page 6 of 8)

The Report's cited reserve and replenishment supply also includes carryover storage from the SWP (128,600 acre-feet), and a water exchange program with Coachella Valley WD and Desert WA (46,100 acre-feet). These represent a depletion of existing storage needed to offset dry-year demand, and not a water supply that is available to replenish storage.

Metropolitan's Response 9:

Article 56 of the our State Water Project Contract allows Metropolitan to store up to 200,000 acre-feet in SWP conservation facilities such as San Luis Reservoir on a space available basis. Because there is a high probability that Project conservation facilities will fill by spring, Metropolitan and other contractors use this storage as a means of carrying over water from the fall of one year into the winter of the next year. This can be particularly important if the water supply allocation in the latter year is low. Detailed analysis of expected deliveries from the SWP show that on average Metropolitan will be able to shift 128,600 acre-feet per year in 2005 decreasing to about 80,000 acre-feet per year by 2025.

Currently Metropolitan has about 220,000 acre-feet of water in storage in the Desert Water Agency/Coachella Valley Water District storage Program. Under dry conditions this is approximately 18 years of storage given no replenishment.

Metropolitan anticipates utilizing this storage account more interactively in the future to optimize the total amount of water in storage vs return capabilities.

10. Statement from the SDCWA Board Letter, Replenishment of Storage, Discussion:
(Page 7 of 8)

Metropolitan's current annual core supply deficit may be offset by depleting storage, reducing demand, developing additional local supply, or purchasing transfer or spot market water. For the next five to 10 years, Metropolitan is limited to depleting storage and purchasing transfer water to make up most of the supply gap. Even under the most aggressive practicable implementation program, additional local resources and water conservation programs take time to develop and would not, in the near term, be of sufficient magnitude to close the water supply gap.

Metropolitan's Response 10:

Based on historical record, normal and wet years have occurred 70 percent of the time in the SWP system and have provided available supplies that have far exceeded Metropolitan's delivery demands in the past. Fortunately, with the member agencies improvements in groundwater basin operations and with a 10-fold increase in Metropolitan's storage capacity, Metropolitan can now take delivery of the majority of SWP water available to meet both consumptive demands and replenish storage in these hydrologic years to significantly enhance the region's dry-year supplies. Examples of Metropolitan's increased capability to provide replenishment deliveries are:

- Despite the 50 percent reduction of CRA deliveries in 2003, Metropolitan has met all consumptive demands, resumed replenishment deliveries, and increased its system storage by 200,000 acre-feet over storage levels. With a 90 SWP allocation, Metropolitan expects to take full delivery of available deliveries through the California Aqueduct and maximize replenishment deliveries to the service area.
- Metropolitan has continued to make replenishment deliveries available to the member agencies over the recent ten years. In fact, Metropolitan has made available supplies to SDCWA to replenish reservoirs (Lower Otay, El Capitan, San Vicente and Sweetwater) at a discount rate in every year of the last ten. As shown on Figure 2, if SDCWA had taken full delivery of Metropolitan's available replenishment supplies, the San Diego reservoir storage would have remained full since April 1998.

11. Summary comments in SDCWA Board Letter:

SDCWA Summary Comment 1: *(Page 8 of 8) The Report overstates current supplies by including projects that have not been implemented, are not complete, or require execution of the QSA to be implemented. Some projects, such as Semitropic, Arvin Edison, and North Las Posas, show supply yields above current capacity.*

Metropolitan's Response to Summary Comment 1: The Report states the current supplies that are available to Metropolitan from Colorado River deliveries, California Aqueduct deliveries and In-Basin Storage deliveries based on legal, funding and operation documentation. Based on this substantial evidence, the Report has not overstated these supplies. See Metropolitan Responses 1, 3, 5 and 6.

SDCWA Summary Comment 2: *(Page 8 of 8) The Report assumes execution of the QSA by including QSA supplies in both current and future supplies. But the Report concludes that reduced Colorado River supplies will be managed through use of storage, "enhanced" conservation, and additional local supplies (groundwater, recycling, seawater desalination). The Report is silent on Metropolitan's water supply risk if the QSA is not executed.*

Metropolitan Response to Summary Comment 2: The Report recognizes the value of both a successful QSA with assured benefits as well as feasible supply alternatives. It includes Colorado River programs that have already been implemented without the QSA in the inventory of current supplies. The potential programs that would be implemented with the QSA are included in the inventory of supplies under development. In considering the full complement of conservation, local resources, contracted supplies and storage, Metropolitan and its member agencies have positioned themselves to maintain water supply reliability despite record droughts and the uncertainties on the Colorado River. The most important element of this strategy is that the region's water supply reliability will not be placed at risk due to the potential uncertainties of individual resource investments, including the Colorado River Quantification Settlement Agreement (QSA). See Metropolitan Responses 1, 3, and 10.

SDCWA Summary Comment 3: *(Page 8 of 8) Projected supplies from the State Water Project need further review. Metropolitan assumes that it will obtain an average of about 75 percent of its SWP entitlement in future years, based upon DWR studies. From 1992 –2001 the SWP delivered 54 percent of contractor entitlement. In its 2000 UWMP, Metropolitan concluded that, due to ESA take limits, DWR probably overstated expected SWP reliability for the current project status.*

Metropolitan's Response to Summary Comment 3: The SDCWA Board Letter has excluded the full deliveries of water available under the SWP contract. SDCWA's assessment omits the additional annual deliveries under Article 21 and turn-back pool provisions, and from Metropolitan's carryover account in the San Luis Reservoir. In 2003, the additional supplies available under these contract provisions total 169,377 acre-feet. Such supplies will continue to be available under Metropolitan's SWP contract that extends to 2035. See Responses 1, 5 and 9

SDCWA Summary Comment 4: *(Page 8 of 8) Metropolitan's plan for withdrawing DVL storage and consecutive dry years seriously increases risks of water shortage if QSA is not executed and consecutive dry years occur on the SWP. Prudent withdraws rates of 150,000 acre-feet per year have been revised to allow up to more than 400,000 acre-feet to be withdrawn in a single year. Metropolitan no longer has a full Colorado River Aqueduct as a backstop, as it did in the 1987-92 drought.*

Metropolitan's Response to Summary Comment 4: The SDCWA review fails to account for the full supply benefit of the ten-fold increase in Metropolitan's storage capabilities since 1990-1992. Metropolitan has put in place more than 2.6 million acre-feet of total storage capacity in the recent ten years as shown on Figure 1. By the end of 2003, Metropolitan will have 2.45 million acre-feet of "wet" water already in storage available for use, which is equivalent to twice our full Colorado River Aqueduct annual delivery. With a fully operational Diamond Valley Lake, Metropolitan's current operational plan provides the district the option to deliver up to 1.0 million acre-feet per year from storage via the California Aqueduct and within the service area to meet annual seasonal and dry-year demands, as needed. This storage capability has been developed in groundwater basins and in surface reservoirs consistent with the current policies of Metropolitan's Board and current operating standards. Metropolitan's access to this storage is by ownership and contractual partnerships with other water agencies in Central Valley and Southern California. It does not include storage along the Colorado River Aqueduct. Unfortunately, SDCWA underestimates Metropolitan's supply capabilities by limiting storage deliveries to the minimum storage capabilities specified in previous reports and by ignoring Metropolitan's current operational plan. See Metropolitan Responses 7, 8, 9 and 10.

SDCWA Summary Comment 5: *(Page 8 of 8) Metropolitan's Report includes a "Disclosure Statement" that raises serious questions about the Report's utility for member agency compliance with SB221 (Kuehl) and SB 610 (Costa). The statement notes that Metropolitan and other Wholesalers "do not have verification responsibilities" under the legislation, and asserts "Readers should make their own judgments to the extent on which they rely on information in the report."*

Metropolitan's Response to Summary Comment 5: The purpose of Metropolitan's Report is to provide the member public agencies, retail water utilities, cities and counties within Metropolitan's service area information on supplemental imported water supplies that may assist in their compliance with SB 221 and SB 610. The recently enacted laws require new development to provide "substantial evidence" of available water supplies in the event of drought. To meet the substantial evidence requirement, retail water utilities have the responsibility to develop and publish their water supply plans providing specific information on available and projected water supplies to assist local public agencies in making land use decisions on new development. The laws do not require that a public water system have a 20-year supply of water in place and immediately available nor provide a warranty for its water supply plans.

For many retail water utilities, primary water supplies consist of local groundwater, recycling, seawater desalination, and local surface water. Metropolitan's imported water deliveries supplement these local resources and provide a portion of the total retail supplies required to serve customers. As a result, Metropolitan's report focuses on the supplemental imported water supplies and does not address the availability and delivery of local supplies provided by other purveyors. Retail water utilities must exercise their own judgments to the extent on which they rely on the information in

Metropolitan's report. As such, it is not appropriate for Metropolitan to warrant the reliability of the information as it is used or represented by third parties regarding retail water supply reliability.

Scenario: Base
Fire Flow Analysis
Fire Flow Report

Label	Zone	Fire Flow Iterations	Fire Flow Balanced?	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Min Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Min System Pressure (psi)	Calculated Minimum System Pressure (psi)	Minimum System Junction
EXJ-3	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	39.64	20.00	39.21	EXJ-4	20.00	39.21	EXJ-4
EXJ-4	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	39.28	20.00	39.64	EXJ-3	20.00	39.64	EXJ-3
EXJ-5	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	38.31	20.00	38.93	EXJ-6	20.00	38.93	EXJ-6
EXJ-6	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	35.28	20.00	35.87	EXJ-7	20.00	35.87	EXJ-7
EXJ-7	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	35.29	20.00	35.88	EXJ-8	20.00	35.88	EXJ-8
EXJ-8	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	37.12	20.00	39.04	EXJ-7	20.00	39.04	EXJ-7
EXJ-9	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	36.45	20.00	34.64	PJ-2	20.00	34.64	PJ-2
EXJ-10	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	38.12	20.00	39.30	EXJ-8	20.00	39.30	EXJ-8
PJ-2	Zone-1	1	true	true	5,000.00	5,500.00	7,500.00	8,000.00	20.00	25.36	20.00	25.76	PJ-3	20.00	25.76	PJ-3
EXJ-11	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	40.57	20.00	40.13	EXJ-12	20.00	40.13	EXJ-12
EXJ-12	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	39.20	20.00	40.57	EXJ-11	20.00	40.57	EXJ-11
PJ-4	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	36.49	20.00	34.48	PJ-2	20.00	34.48	PJ-2
PJ-3	Zone-1	1	true	true	5,000.00	5,500.00	7,500.00	8,000.00	20.00	23.88	20.00	25.36	PJ-2	20.00	25.36	PJ-2
PJ-1	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	31.30	20.00	29.96	PJ-2	20.00	29.96	PJ-2
EXJ-14	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	38.82	20.00	38.85	EXJ-10	20.00	38.85	EXJ-10
EXJ-15	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	38.52	20.00	39.06	EXJ-44	20.00	39.06	EXJ-44
EXJ-16	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	39.34	20.00	39.07	EXJ-15	20.00	39.07	EXJ-15
EXJ-17	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	39.63	20.00	39.46	EXJ-15	20.00	39.46	EXJ-15
EXJ-18	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	41.98	20.00	41.03	EXJ-15	20.00	41.03	EXJ-15
EXJ-19	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	40.87	20.00	40.41	EXJ-15	20.00	40.41	EXJ-15
EXJ-20	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	46.42	20.00	45.99	EXJ-15	20.00	45.99	EXJ-15
EXJ-21	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	47.28	20.00	46.38	PJ-2	20.00	46.38	PJ-2
EXJ-22	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	45.66	20.00	45.11	PJ-2	20.00	45.11	PJ-2
EXJ-23	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	48.21	20.00	44.95	PJ-2	20.00	44.95	PJ-2
EXJ-24	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	47.01	20.00	44.85	PJ-2	20.00	44.85	PJ-2
EXJ-25	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	47.40	20.00	46.49	PJ-2	20.00	46.49	PJ-2
EXJ-26	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	48.52	20.00	46.08	PJ-2	20.00	46.08	PJ-2
EXJ-27	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	46.58	20.00	46.50	PJ-2	20.00	46.50	PJ-2
EXJ-28	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	61.29	20.00	56.40	PJ-2	20.00	56.40	PJ-2
EXJ-29	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	62.95	20.00	57.88	PJ-2	20.00	57.88	PJ-2
EXJ-1	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	158.19	20.00	124.04	PJ-2	20.00	124.04	PJ-2
EXJ-2	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	47.09	20.00	44.85	PJ-2	20.00	44.85	PJ-2
EXJ-30	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	100.89	20.00	91.34	PJ-2	20.00	91.34	PJ-2
EXJ-31	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	132.99	20.00	105.22	PJ-2	20.00	105.22	PJ-2
EXJ-32	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	143.84	20.00	120.32	PJ-2	20.00	120.32	PJ-2
EXJ-33	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	149.17	20.00	123.03	PJ-2	20.00	123.03	PJ-2
EXJ-34	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	171.79	20.00	133.53	PJ-2	20.00	133.53	PJ-2
EXJ-35	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	88.10	20.00	90.66	EXJ-36	20.00	90.66	EXJ-36
EXJ-36	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	88.21	20.00	89.28	EXJ-37	20.00	89.28	EXJ-37
EXJ-37	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	84.39	20.00	85.39	EXJ-38	20.00	85.39	EXJ-38
EXJ-38	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	83.32	20.00	85.65	EXJ-37	20.00	85.65	EXJ-37
EXJ-39	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	91.16	20.00	88.36	PJ-2	20.00	88.36	PJ-2
EXJ-40	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	93.18	20.00	88.04	PJ-2	20.00	88.04	PJ-2
EXJ-42	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	98.19	20.00	87.49	PJ-2	20.00	87.49	PJ-2
EXJ-41	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	155.90	20.00	124.06	PJ-2	20.00	124.06	PJ-2
EXJ-43	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	171.57	20.00	133.54	PJ-2	20.00	133.54	PJ-2
EXJ-44	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	38.75	20.00	38.78	EXJ-15	20.00	38.78	EXJ-15
EXJ-45	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	39.06	20.00	38.68	EXJ-15	20.00	38.68	EXJ-15
PJ-5	Zone-1	1	true	true	5,000.00	5,500.00	5,000.00	5,500.00	20.00	45.99	20.00	44.16	PJ-2	20.00	44.16	PJ-2

LONG BEACH WATER DEPARTMENT
A Class 1 Water Utility

TO: Kimley-Horn
517 Fourth Avenue, Suite 301
San Diego, CA 92101

DATE: July 5, 2001

ATTN: Chuck Spinks, P.E.

RE: Boeing Development – Transmittal of Data

JOB NO.

WE ARE SENDING YOU: **Mail** [ ] _____

[X] Attached [ ] Mailed Separately [ ] Plans

[ ] Tracing [ ] Specifications [ ] Copy of Letter

COPIES	DATE	DWG NO.	DESCRIPTION

THESE ARE TRANSMITTED AS CHECKED: [ ] _____

[X] As Requested [ ] For Recordation [ ] For Review & Comments

[X] For Your Use [ ] Approved As Noted [ ] Returned for Corrections

[ ] Resubmit _____ Copies For Approval [ ] Return _____ Corrected Prints [ ] Submit _____ Copies For Distribution

REMARKS: The attached data is transmitted at your request.

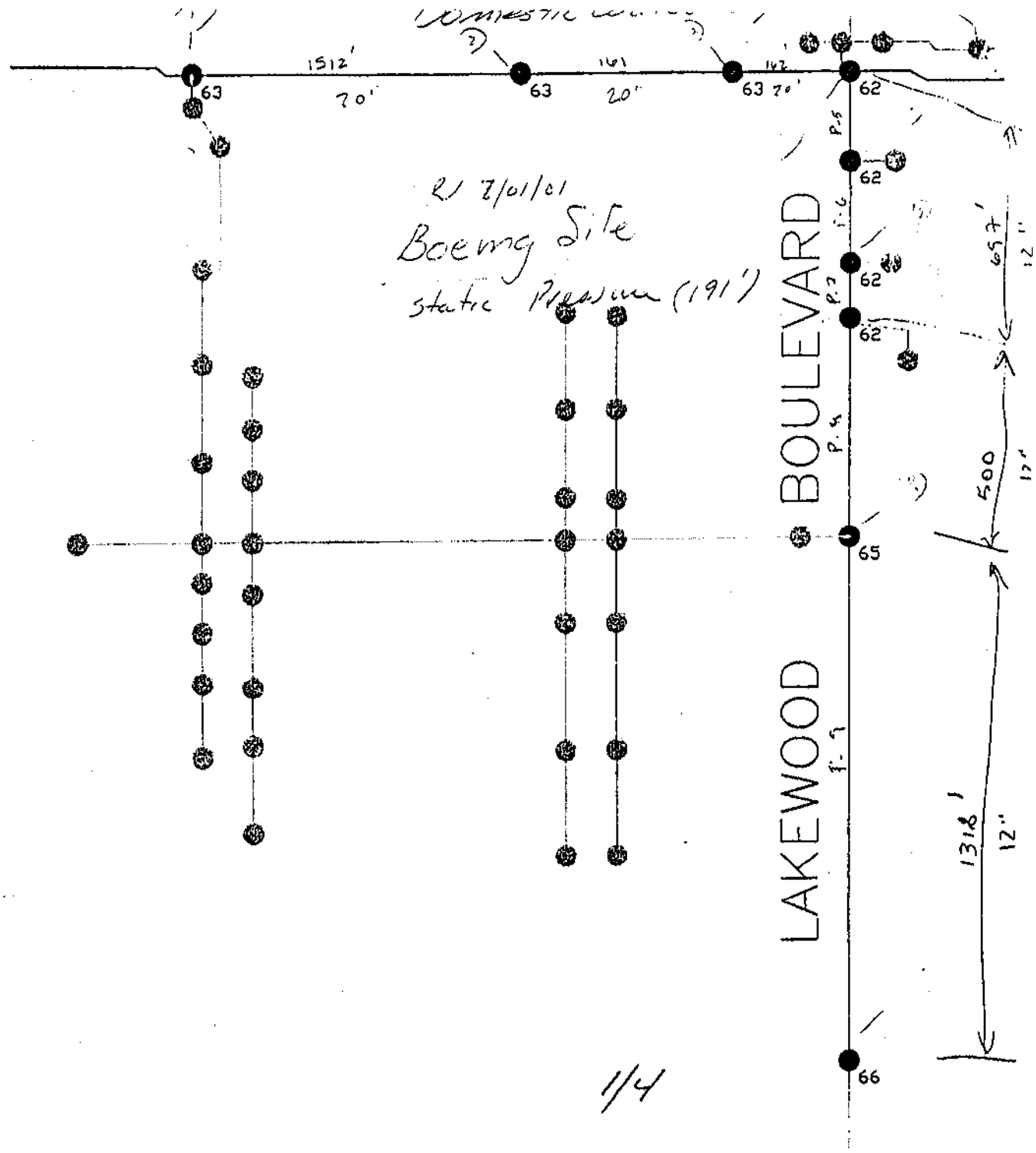
1. Hydraulics of existing and proposed reclaimed water system. Note that the data for each computer run is presented on several sheets for clarity.
2. Hydraulics of existing water system. Presented in the package is the static pressure based on the reservoir at 191 feet on sheet 1. The maximum water level in the reservoir is 205 feet (Not Part of the Analysis). A run with a fire flow of 3000 gpm on Carson Street is shown on sheet 2 and pressure and HGL are shown at the nodes. Sheets 3 shows the available flow at 20 psi at each node. The value of this run is to show the potential for each node. Sheet 4 shows the available pressure for a single 3000 fire flow at each node.
3. Comprehensive Sewer System Master Plan and Management Program excerpts. Also attached are sewer maps that define the nodes for the analysis.
4. Please note that I will send you the pressures for the water system as discussed in my office on 7/3/01 when I run the hydraulic model.

SIGNED: Robert Villanueva

Robert Villanueva, P.E., Senior Civil Engineer

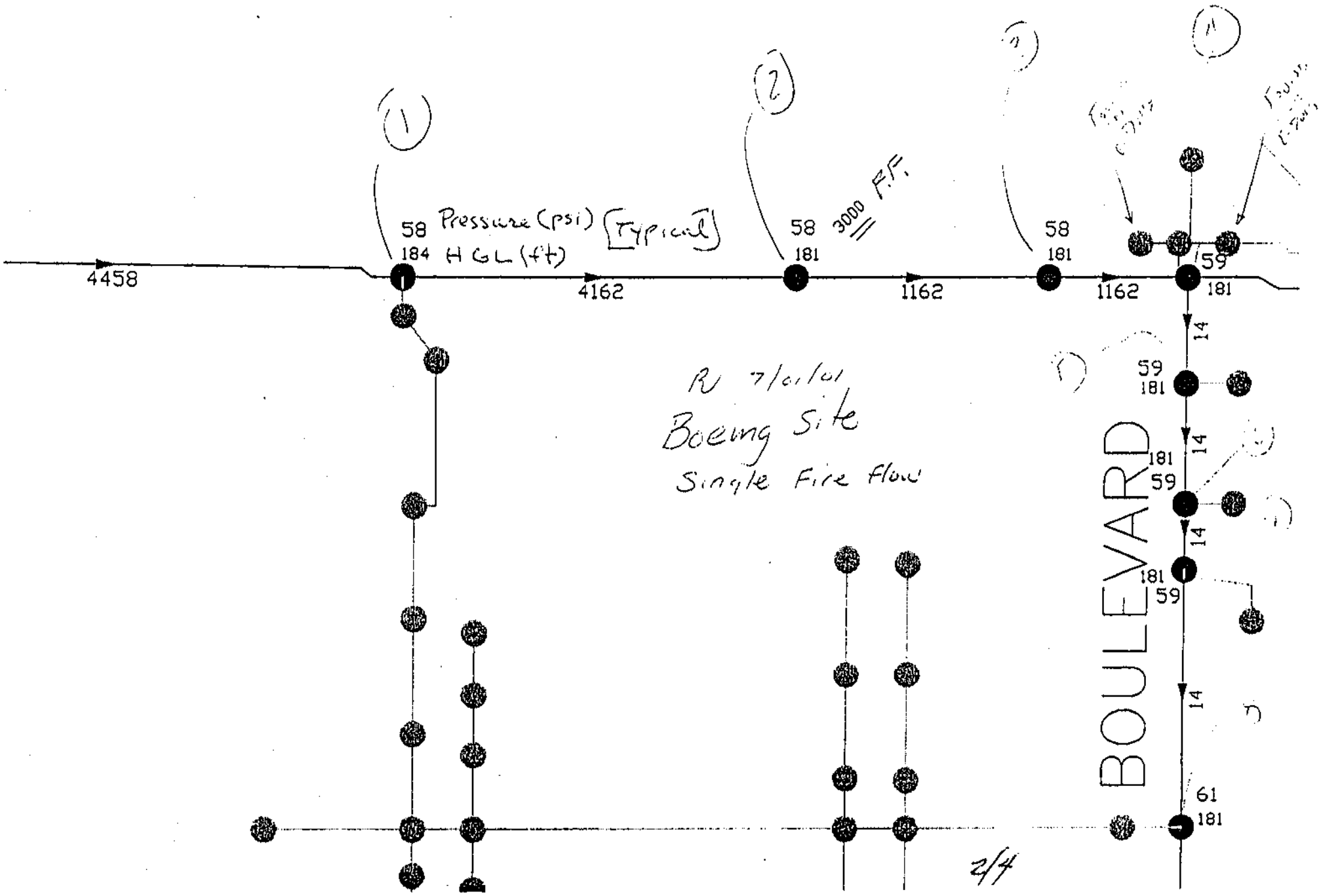
cc: Steve Myers

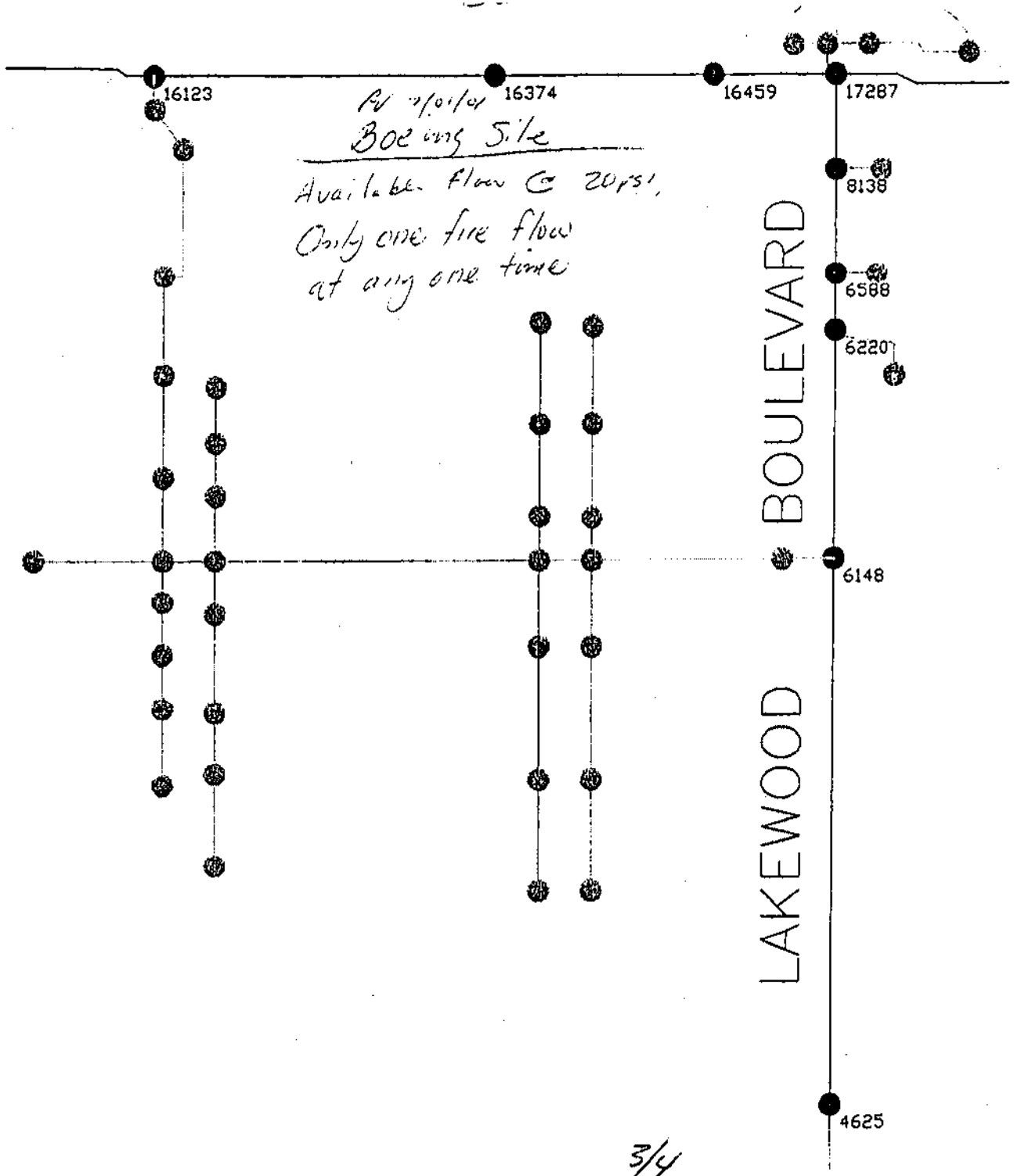
1800 EAST WARDLOW ROAD • LONG BEACH, CALIFORNIA 90807-4994 • Phone (562) 570-2300 • FAX (562) 492-9631


1512'
70'
161
20'
162
70'
63
63
63
62
62
62
62
65
66
LAKEWOOD BOULEVARD
657'
12"
500
12"
1318'
12"
R/ 7/01/01
Boeing Site
static Pressure (191')

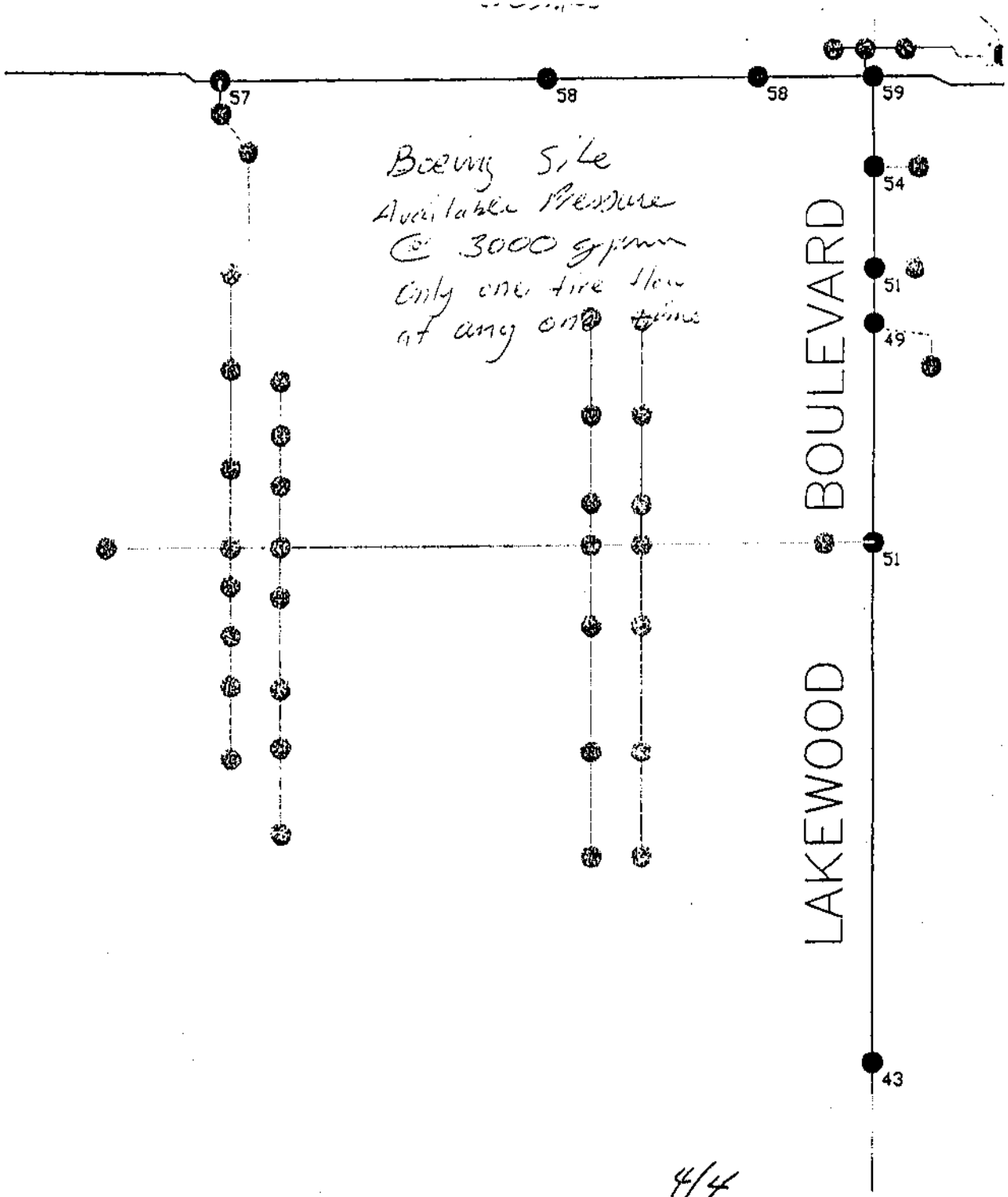
1/4

DOMESTIC WATER SYSTEM




16123
16374
16459
17287
8138
6588
6220
6148
4625
LAKEWOOD BOULEVARD
Boeing Site
Available flow @ 20psi,
Only one fire flow
at any one time

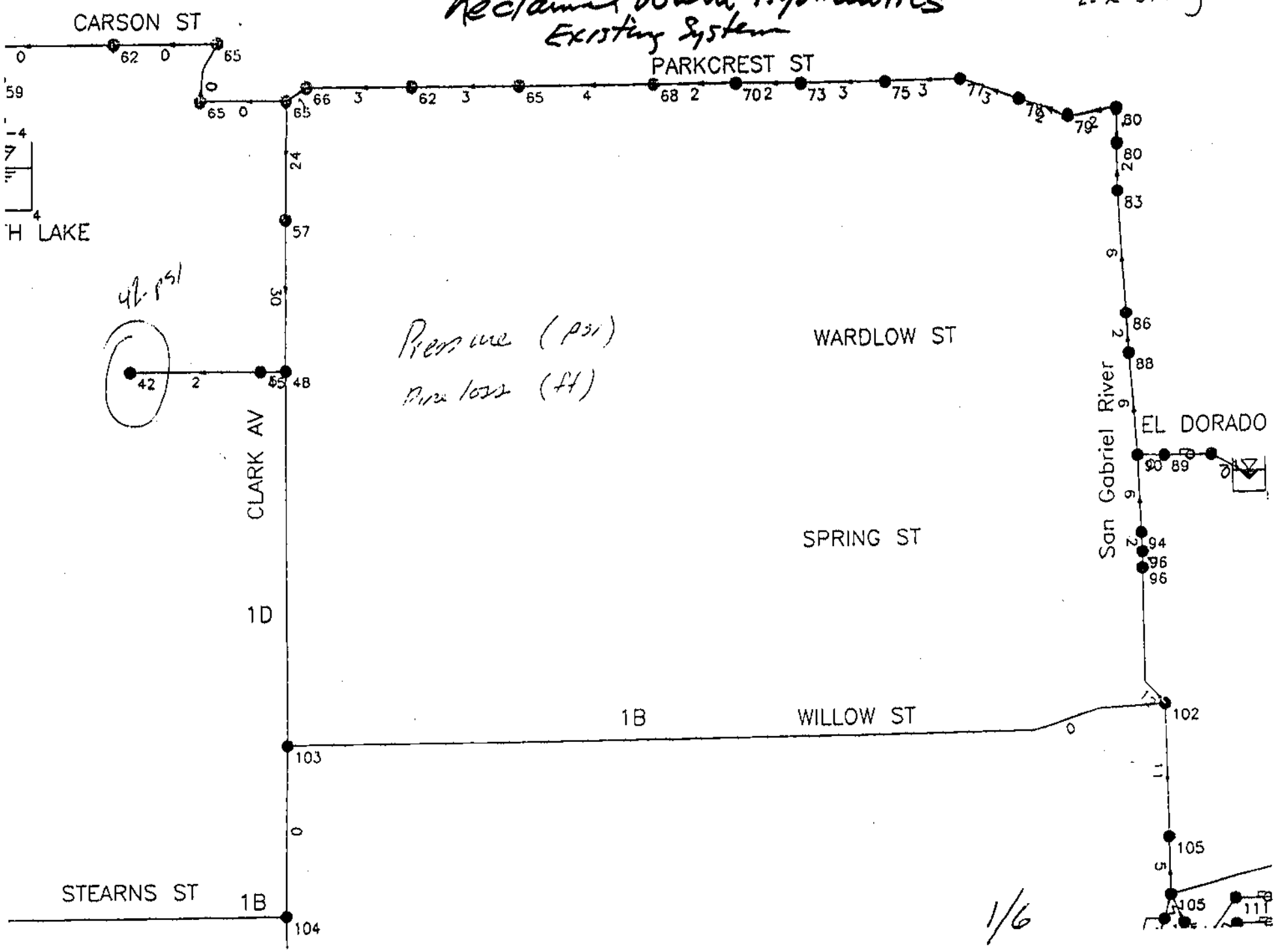
3/4


57
58
58
59
54
51
49
51
43
LAKEWOOD BOULEVARD
Boeing Site
Available Pressure
@ 3000 gpm
Only one fire flow
at any one time

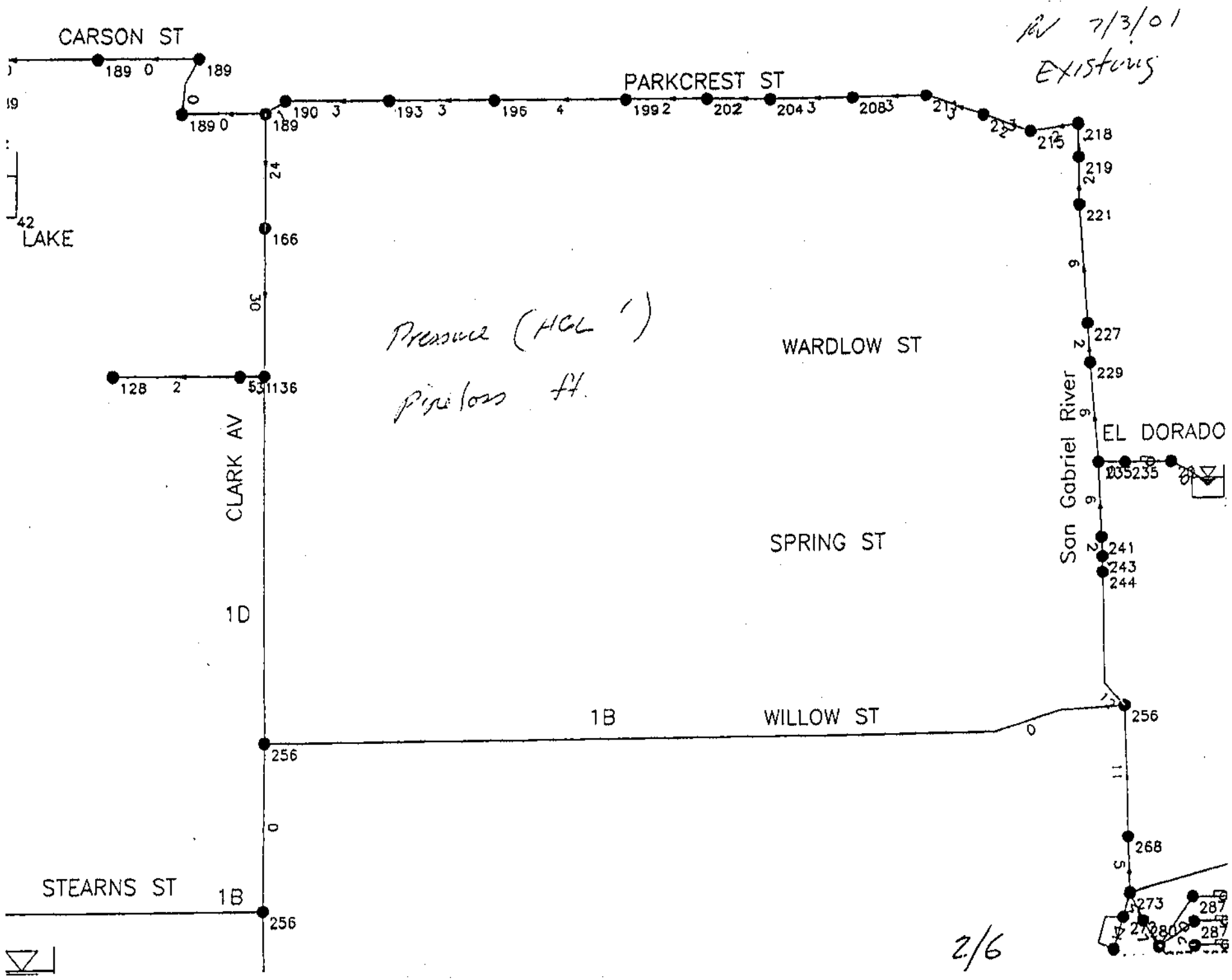
4/4

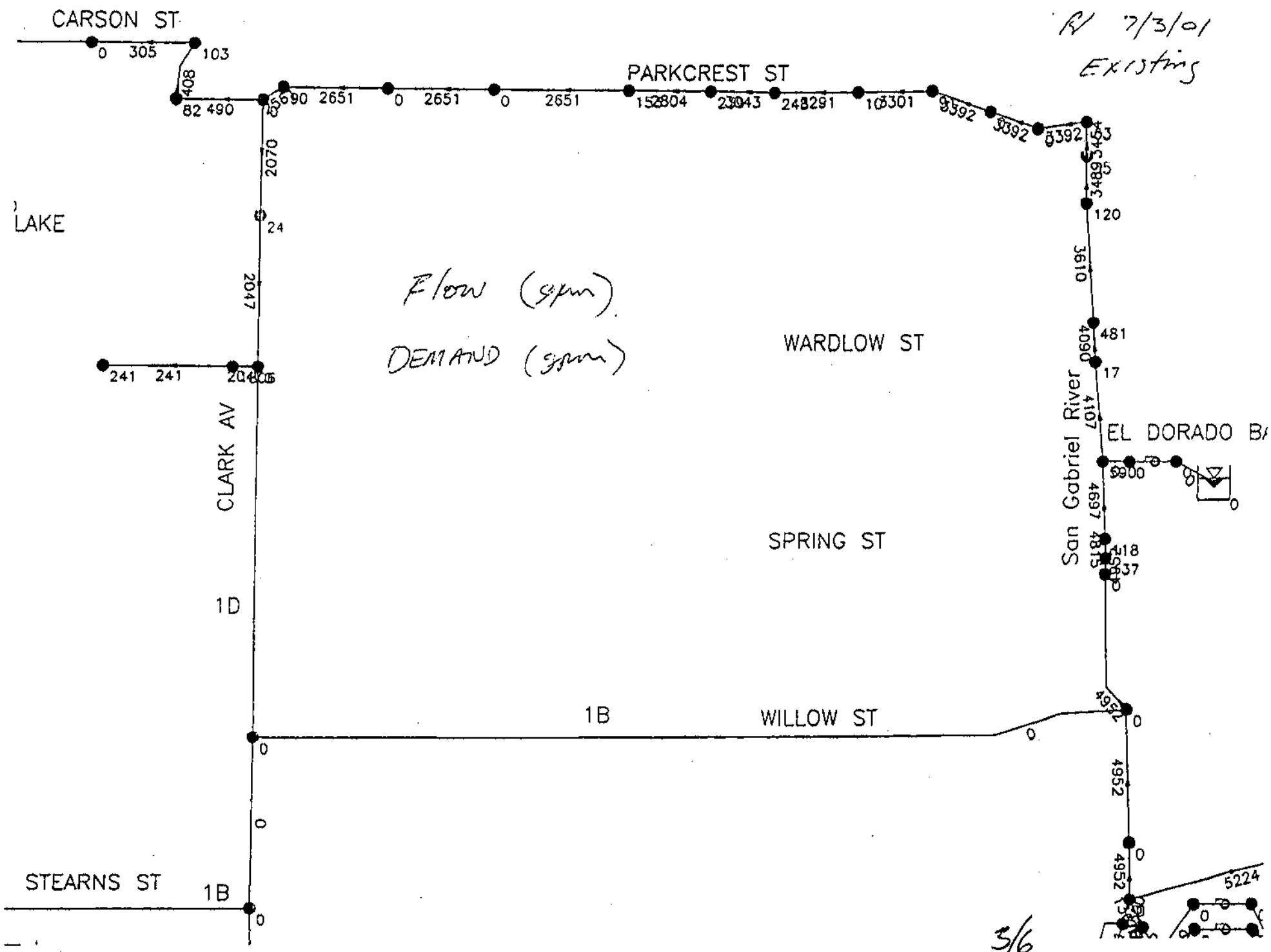
Reclaimed Water Hydraulics
Existing System

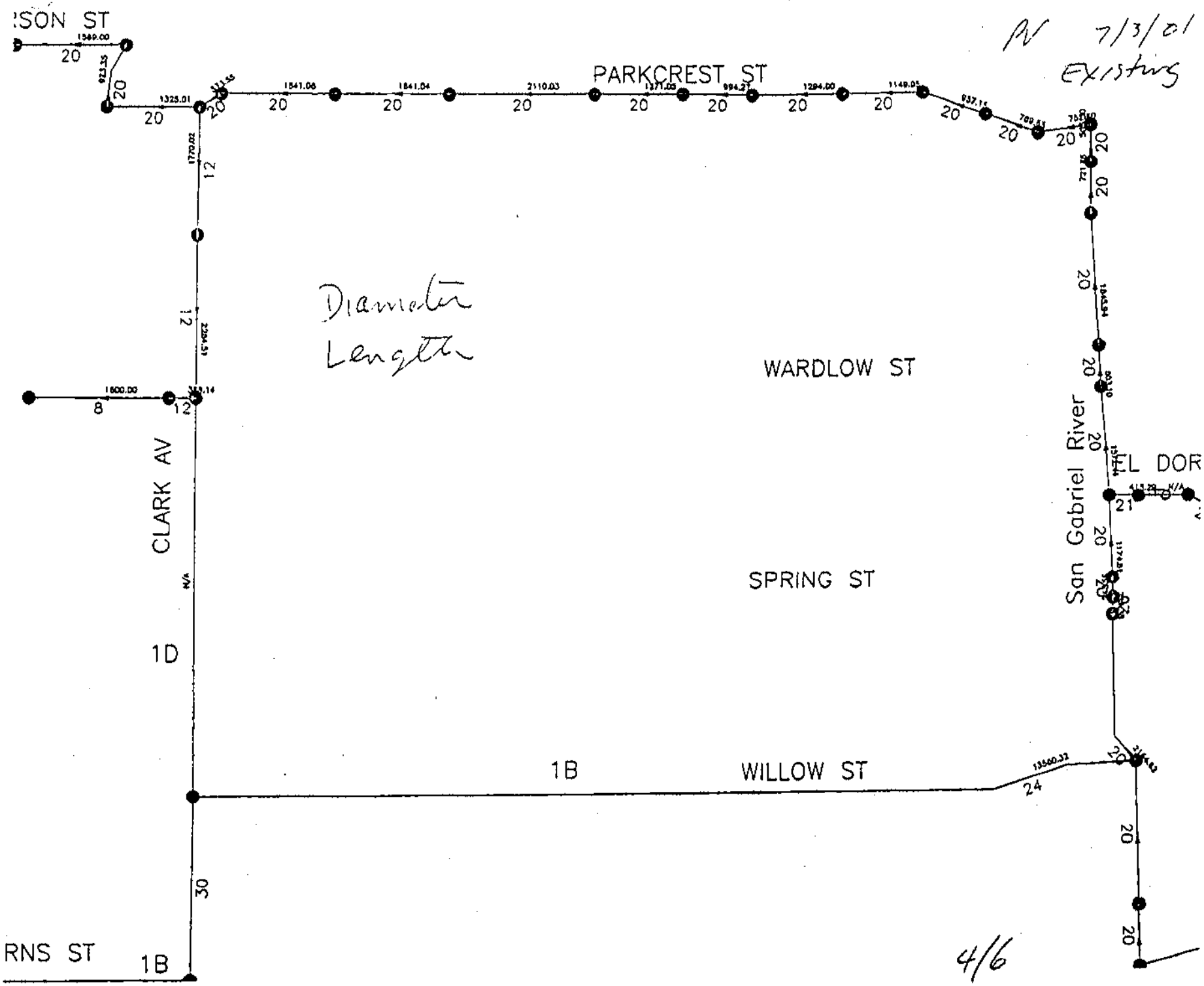
Existing



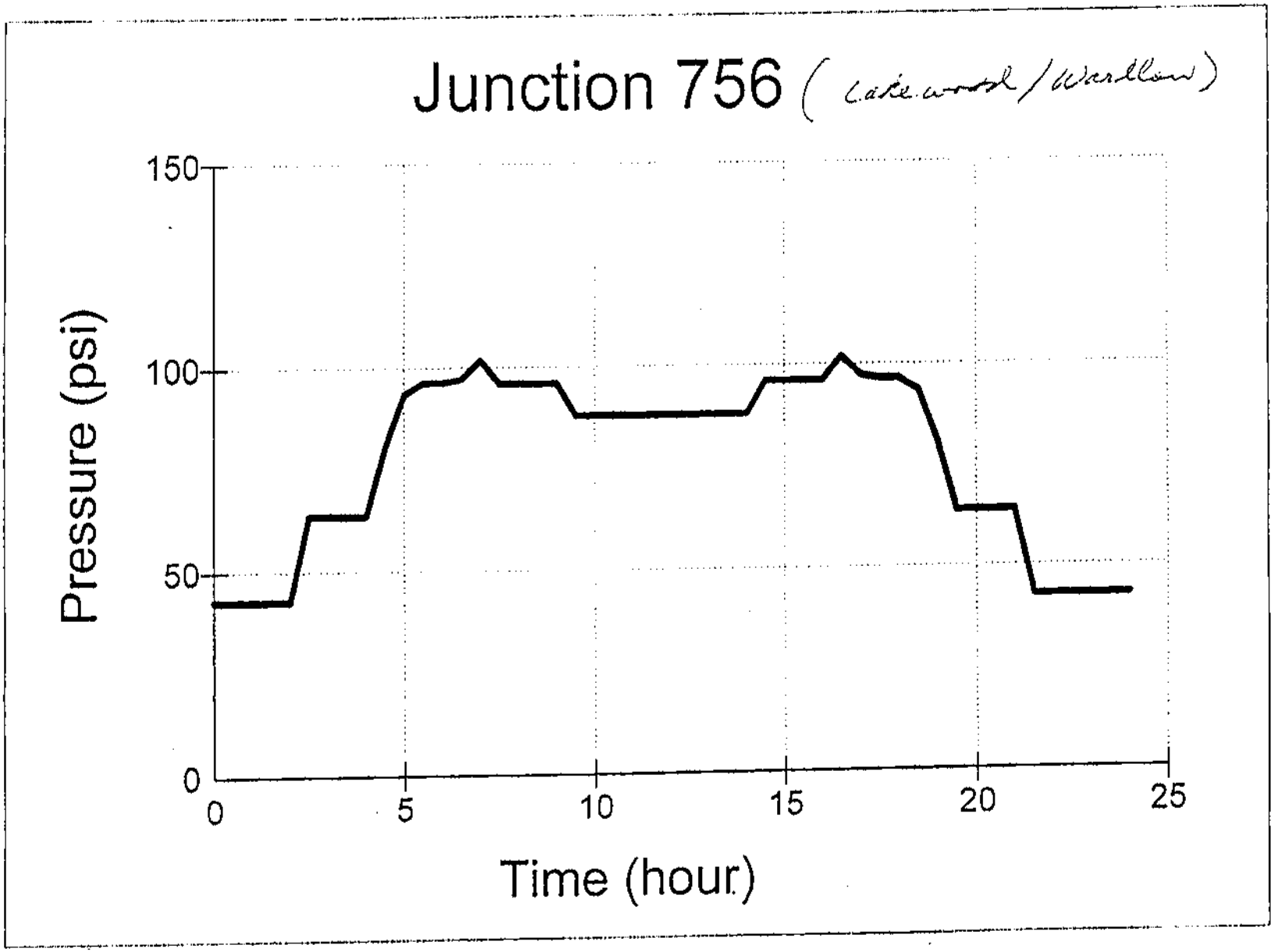
1/6


7/3/01
Existing
CARSON ST
PARKCREST ST
LAKE
WARDLOW ST
SPRING ST
WILLOW ST
CLARK AV
San Gabriel River
EL DORADO
STEARNS ST
1D
1B
1B
Pressure (HGL ')
pipe loss ft.
2/6

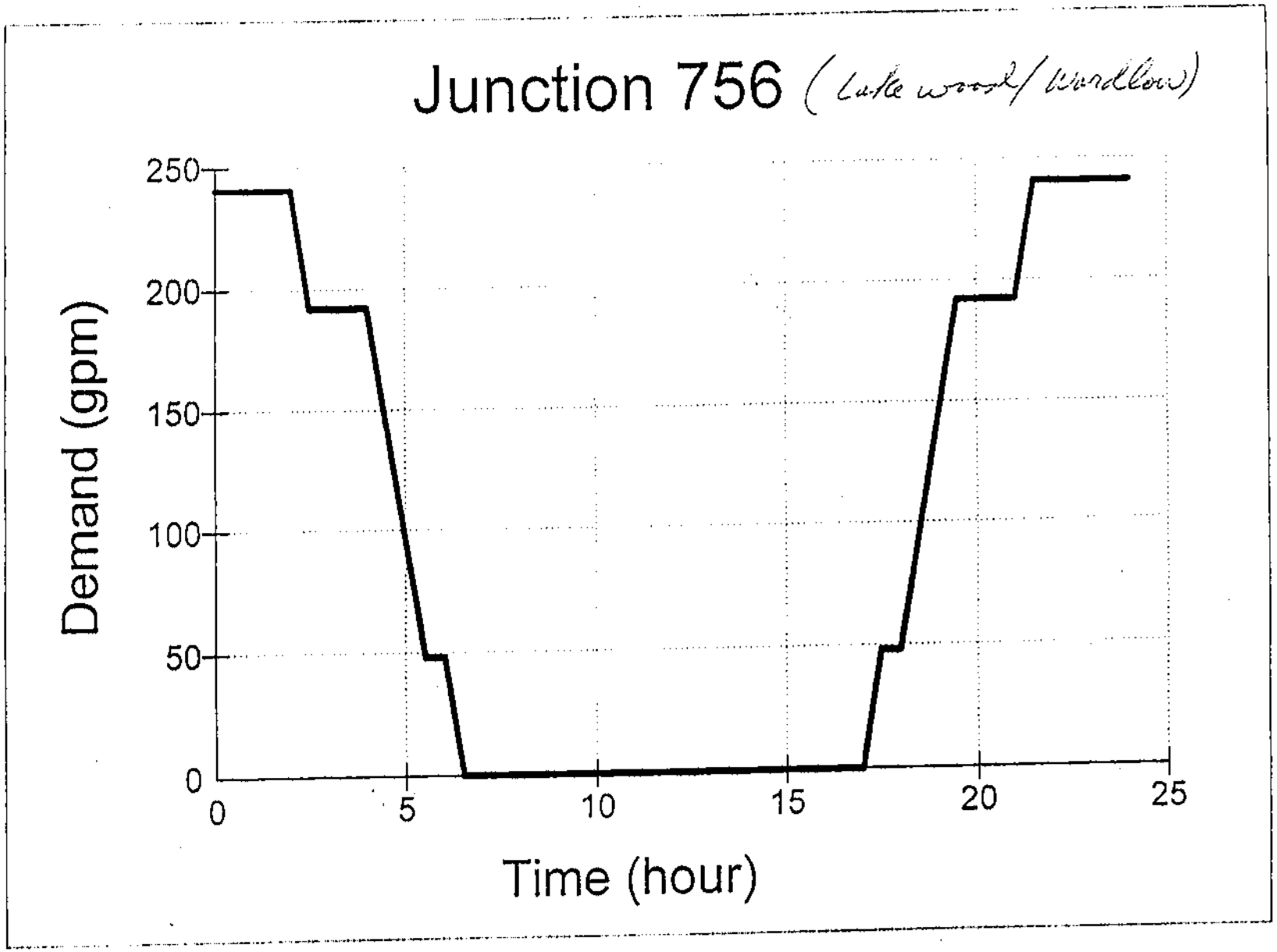

CARSON ST
PARKCREST ST
LAKE
Flow (gpm)
DEMAND (gpm)
WARDLOW ST
CLARK AV
SPRING ST
1D
1B
WILLOW ST
San Gabriel River
EL DORADO B
STEARNS ST
1B
5/6


ISON ST
PARKCREST ST
WARDLOW ST
SPRING ST
WILLOW ST
CLARK AV
San Gabriel River
EL DOR
RNS ST
1B
1D
Diameter
Length
N/A
7/3/01
Existing
4/6

RV 7/3/01
Existing



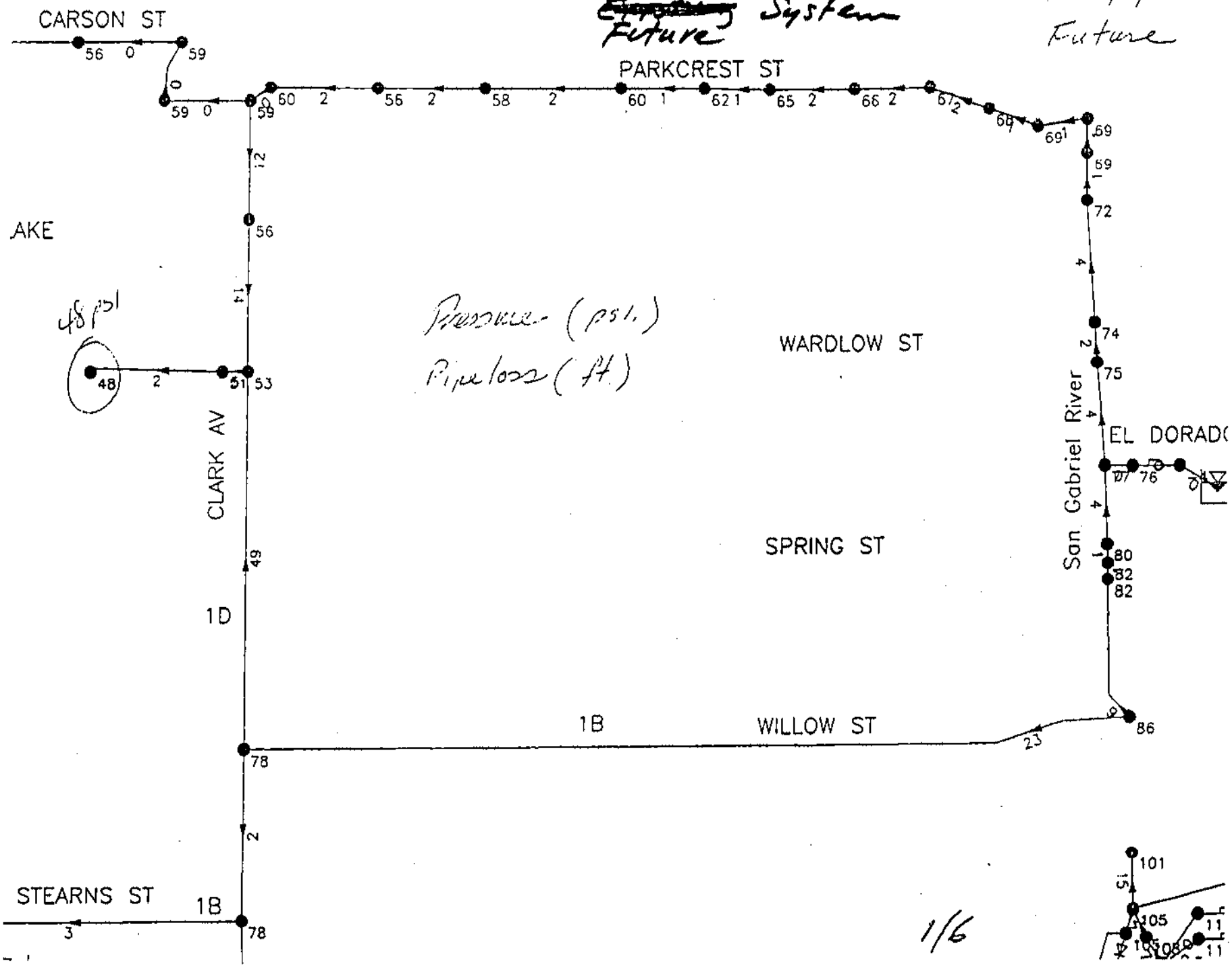
pv 7/3/01


Junction 756 (Lakewood/Windlow)
Demand (gpm)
250
200
150
100
50
0
0
5
10
15
20
25
Time (hour)

Reclaimed Water Hydraulics ~~Existing~~ Future System

RV 7/3/01

Future



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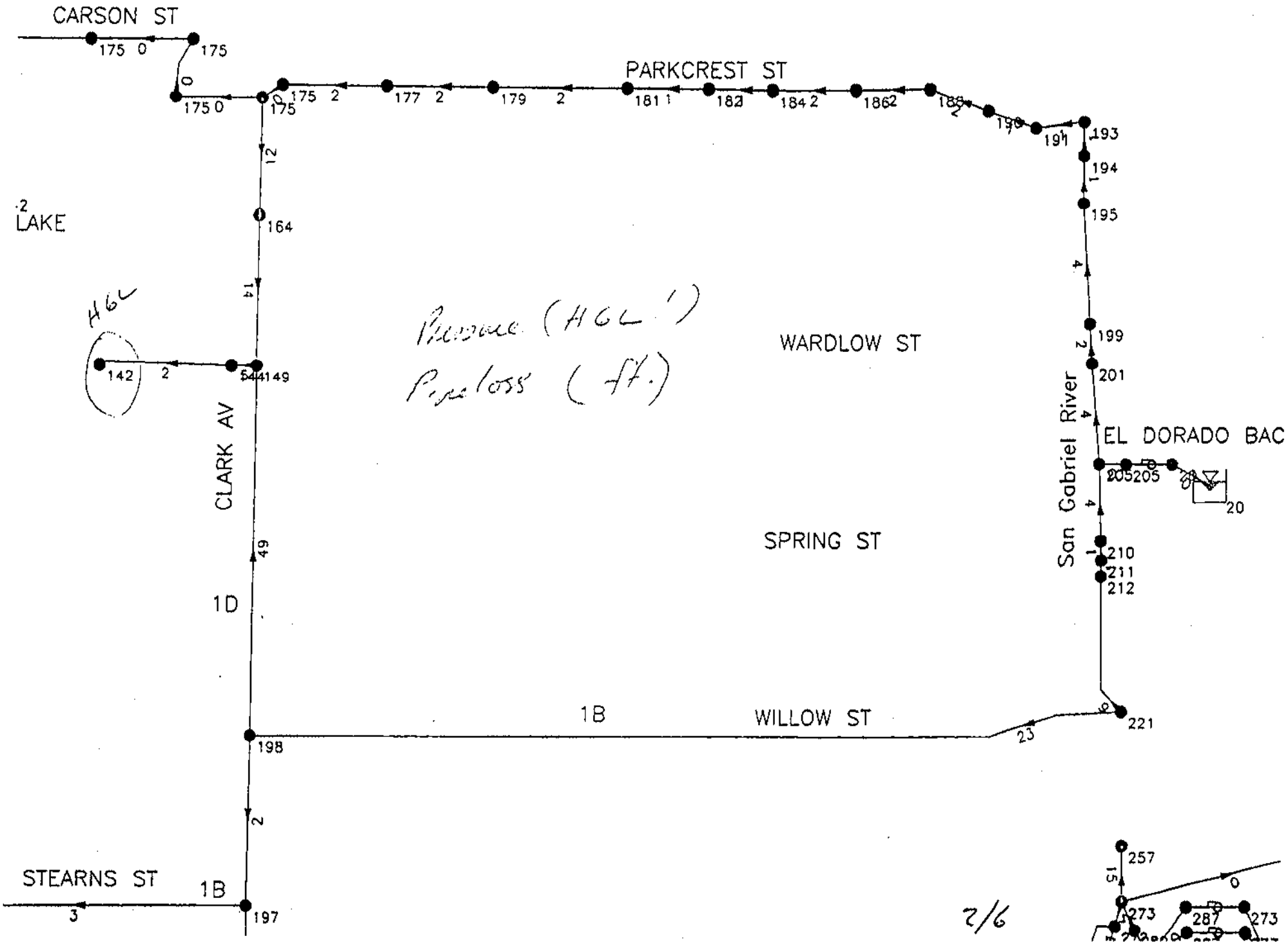
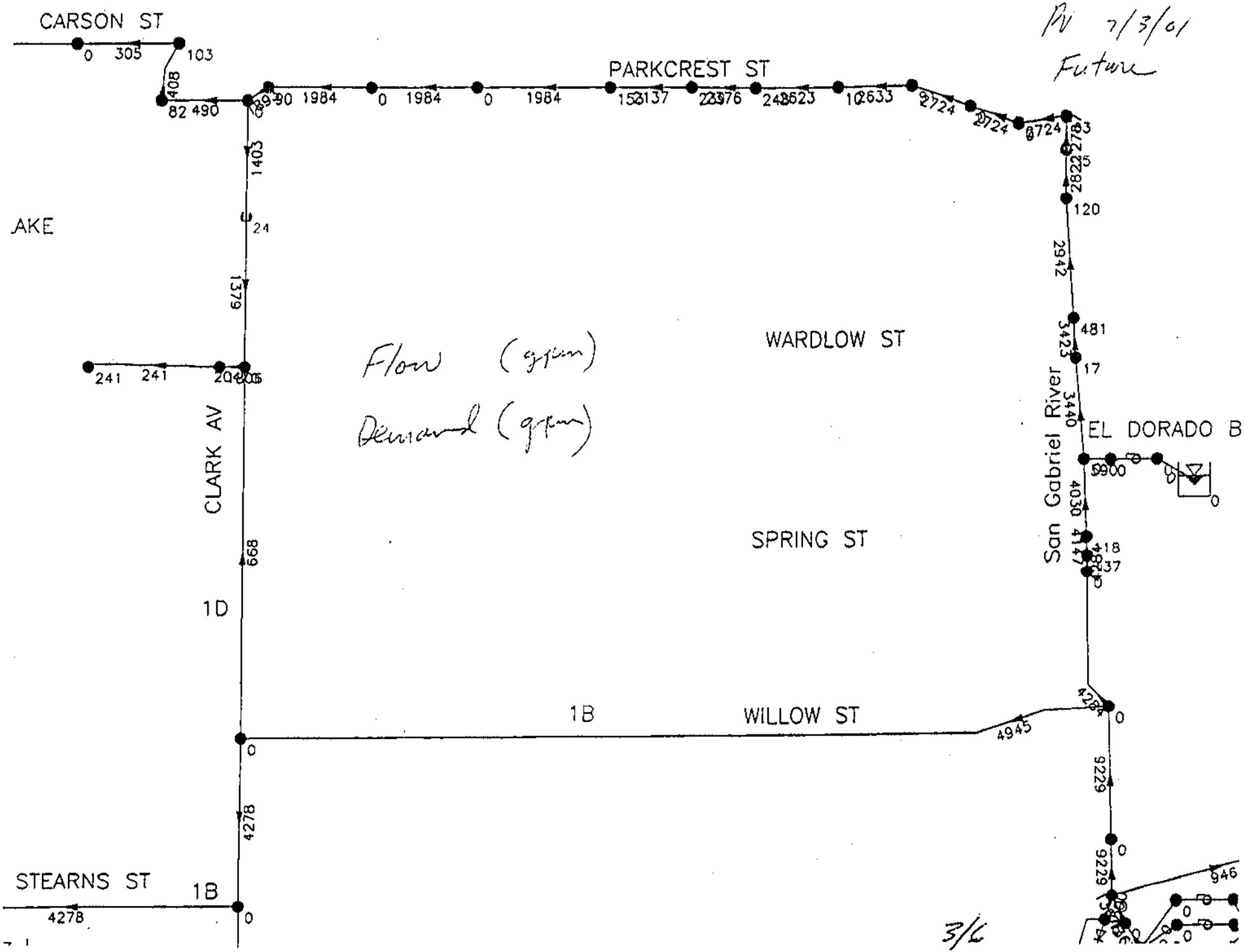
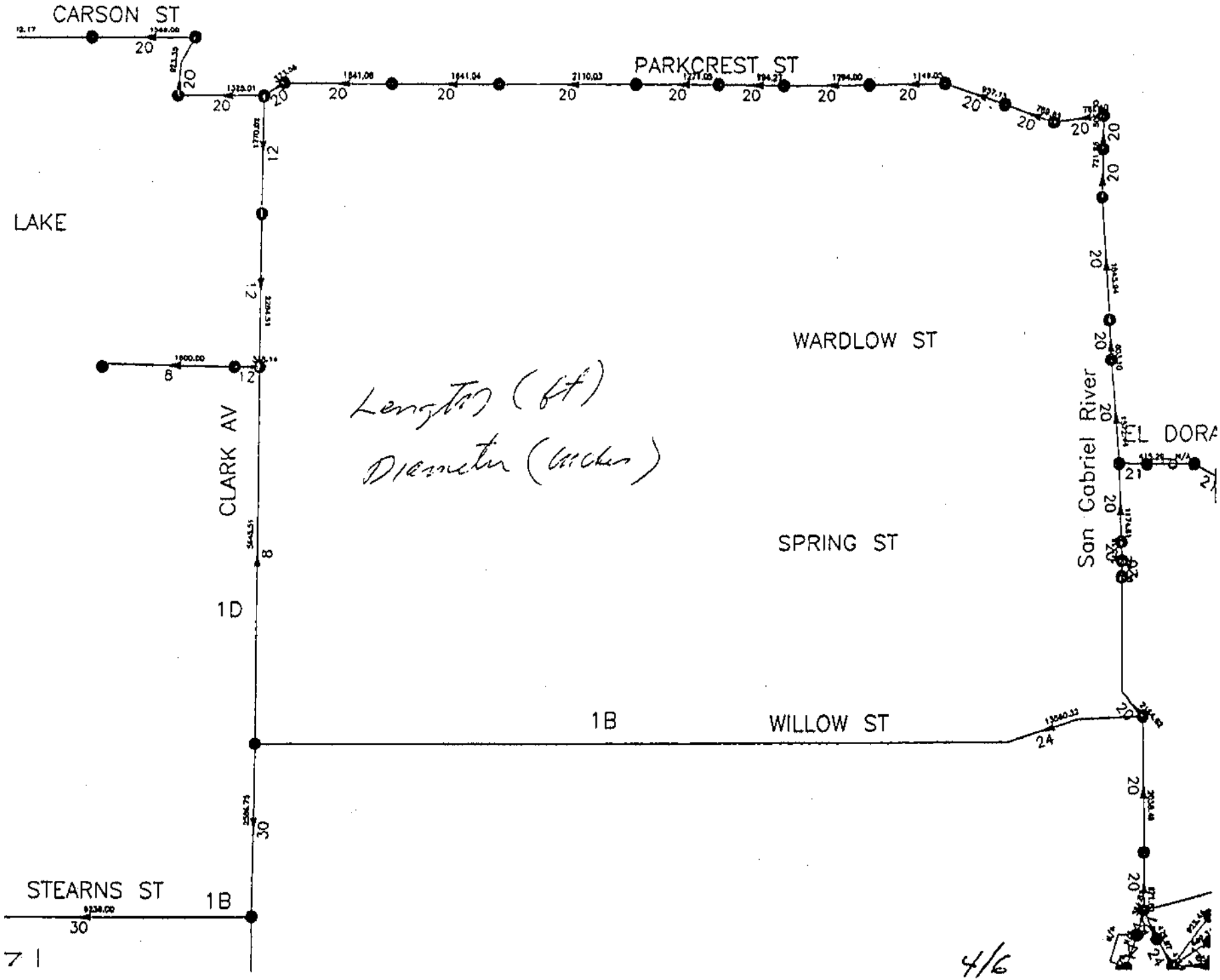

CARSON ST
PARKCREST ST
LAKE
WARDLOW ST
SPRING ST
WILLOW ST
CLARK AV
San Gabriel River
EL DORADO BAC
1D
1B
STEARNS ST
Pressure (HGL')
Pressure loss (ft.)
2/6


CARSON ST
PARKCREST ST
WARDLOW ST
SPRING ST
WILLOW ST
STEARNS ST
CLARK AV
San Gabriel River
EL DORADO B
1B
1D
Flow (gpm)
Demand (gpm)
Future
3/6

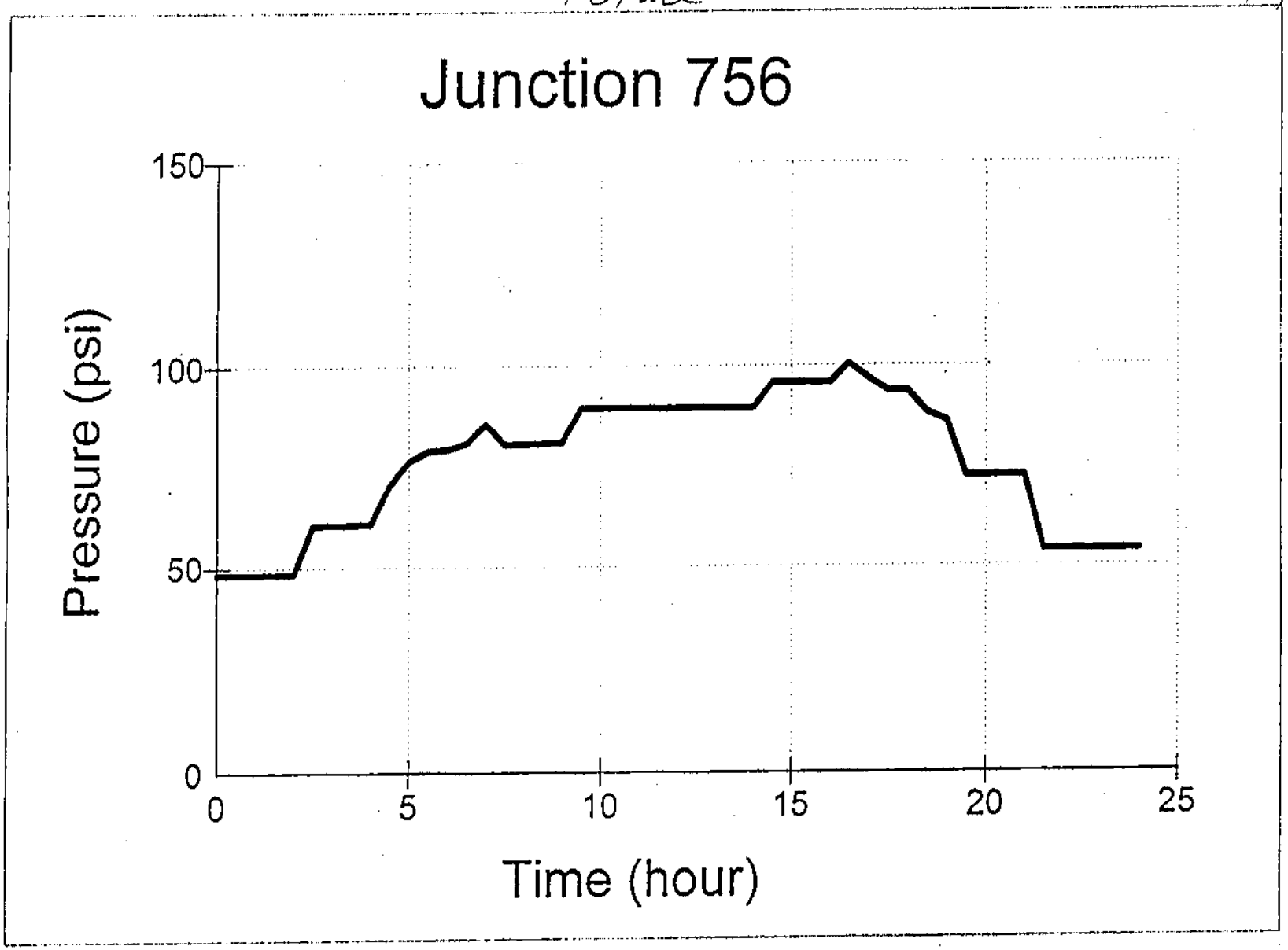

CARSON ST
PARKCREST ST
LAKE
WARDLOW ST
CLARK AV
Length (ft)
Diameter (inches)
SPRING ST
San Gabriel River
EL DORA
1D
1B
WILLOW ST
STEARNS ST
1B

7 |

4/6

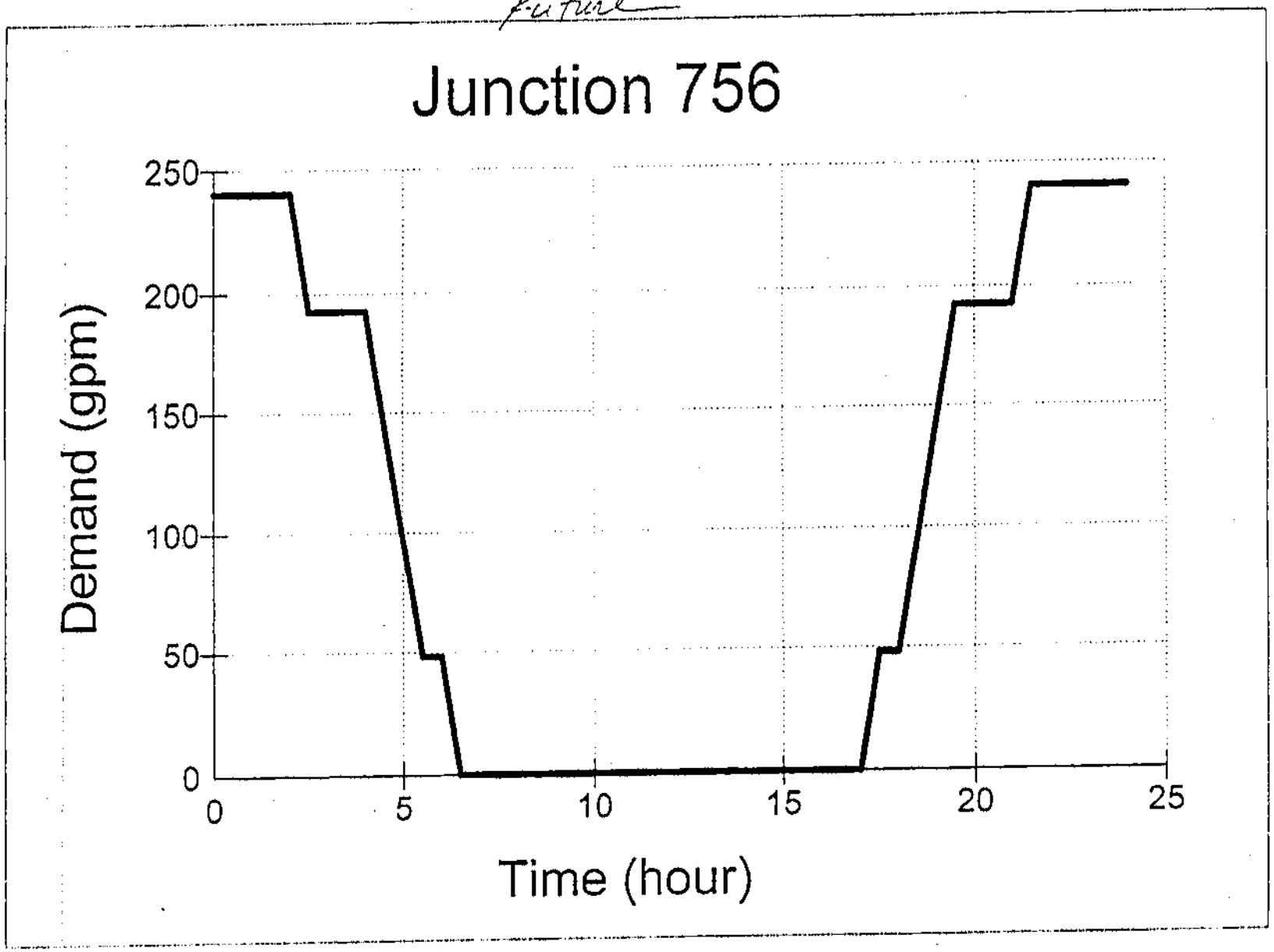
Future

RV 7/3/01



RW 7/3/01

Future



rec. 7/23/01

LONG BEACH WATER DEPARTMENT
A Class 1 Water Utility

TO: Kimley-Horn and Associates, Inc.
517 Fourth Avenue
Suite 301
San Diego, CA 92101

DATE: July 16, 2001

ATTN: Chuck Spinks

RE: Boeing Development Hydraulic Analysis Potable Water System Carson Street/Lakewood Blvd.

JOB NO.

WE ARE SENDING YOU: FAX [ ] _____

[X] Attached
[ ] Mailed Separately
[ ] Plans
[ ] Tracing
[ ] Specifications
[ ] Copy of Letter

COPIES	DATE	DWG NO.	DESCRIPTION
1	July 16, 2001		Boeing Development Hydraulic Analysis Potable Water System Carson Street/Lakewood Boulevard
1	July 13, 2001		Computer Run @ Zero, 3000, 3500 & 4000 gpm Fire Flow
1	See to Right		Fire Flow Test 1044 on 7/11/01 & 7/13/01

THESE ARE TRANSMITTED AS CHECKED: [ ] _____

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REMARKS: **Please call if you have any questions. I will fax material and follow-up with regular mail.**

SIGNED: Robert Villanueva
Robert Villanueva, P.E., Senior Civil Engineer

1800 EAST WARDLOW ROAD • LONG BEACH, CALIFORNIA 90807-4994 • Phone (562) 570-2300 • FAX (562) 492-9631

Boeing Development Hydraulic Analysis
Potable Water System
Carson Street/Lakewood Boulevard

Prepare by Robert Villanueva
July 16, 2001

Chuck Spinks of Kimley-Horn and Associates requested that the Long Beach Water Department (LBWD) perform a hydraulic analysis of their Water System near the Boeing Development at specific locations (Carson/First Street, Lakewood/B Street & Lakewood/Conant Street). The purpose of the analysis was to establish base pressures for fire flow during the maximum day demand. Kimley-Horn will use these base pressures and flows to size their water distribution system to meet fire flow. Since the exact fire flow is not know at this time, hydraulic gradients and pressures are provided at nodes noted below as computed for 3000, 3500 and 4000 fire flow. The computer sheets are attached for your review.

To supplement the hydraulic Analysis, two field fire flow tests (Attached) were performed at 3855 Carson Street. Because of construction on Lakewood Boulevard and Carson, these fire flow tests were taken at the closes fire hydrant west of the proposed Boeing site that would not impact the construction at Lakewood Boulevard and Carson Street.

Assumptions:

1. Fire Flow during Maximum Day Demand (1.72 ADD).
2. The turnout from the Metropolitan Water District of Southern California (LB-8) was assumed closed. This has been normal summertime operation over the last few years.
3. Reservoir Level at J.W. Johnson at 191 feet.
4. Two 12" loops were introduced into the model on First Street, B Street and Conant Street. The purpose of these loops was to try to estimate how much fire flow might come from Carson Street and how much might come from Lakewood Boulevard. As Boeing's engineer develops the Boeing water system, gradients might be refined
5. The Hydraulic model uses the H2ONET engine developed by MW Soft.
6. Fire flow was recorded at one node off Carson Street and two nodes off Lakewood Boulevard as shown on the computer run and noted above.

Fire Flow 3000 gpm	**Node 8759** EL. 47'	**Node 41894** EL. 40'	**Node 8835** EL. 34'
HGL (ft.)	174	165	158
Pressure (psi)	55	54	54

Fire Flow 3500 gpm	**Node 8759** EL. 47'	**Node 41894** EL. 40'	**Node 8835** EL. 34'
HGL (ft.)	173	162	153
Pressure (psi)	55	53	52

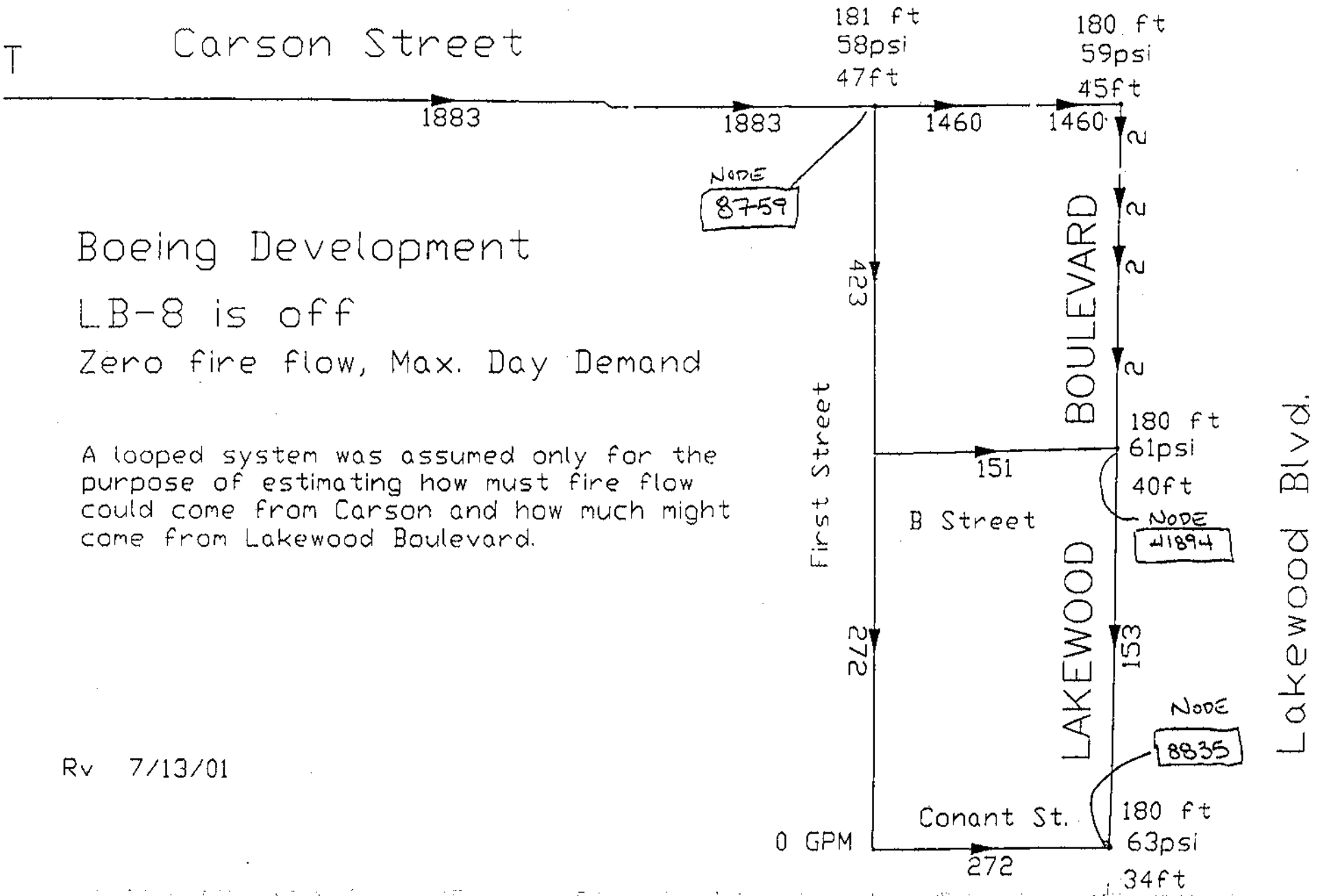
Fire Flow 4000 gpm	**Node 8759** EL. 47'	**Node 41894** EL. 40'	**Node 8835** EL. 34'
HGL (ft.)	172	158	147
Pressure (psi)	54	51	49

Boeing Development

LB-8 is off

Zero fire flow, Max. Day Demand

A looped system was assumed only for the purpose of estimating how must fire flow could come from Carson and how much might come from Lakewood Boulevard.



Rv 7/13/01

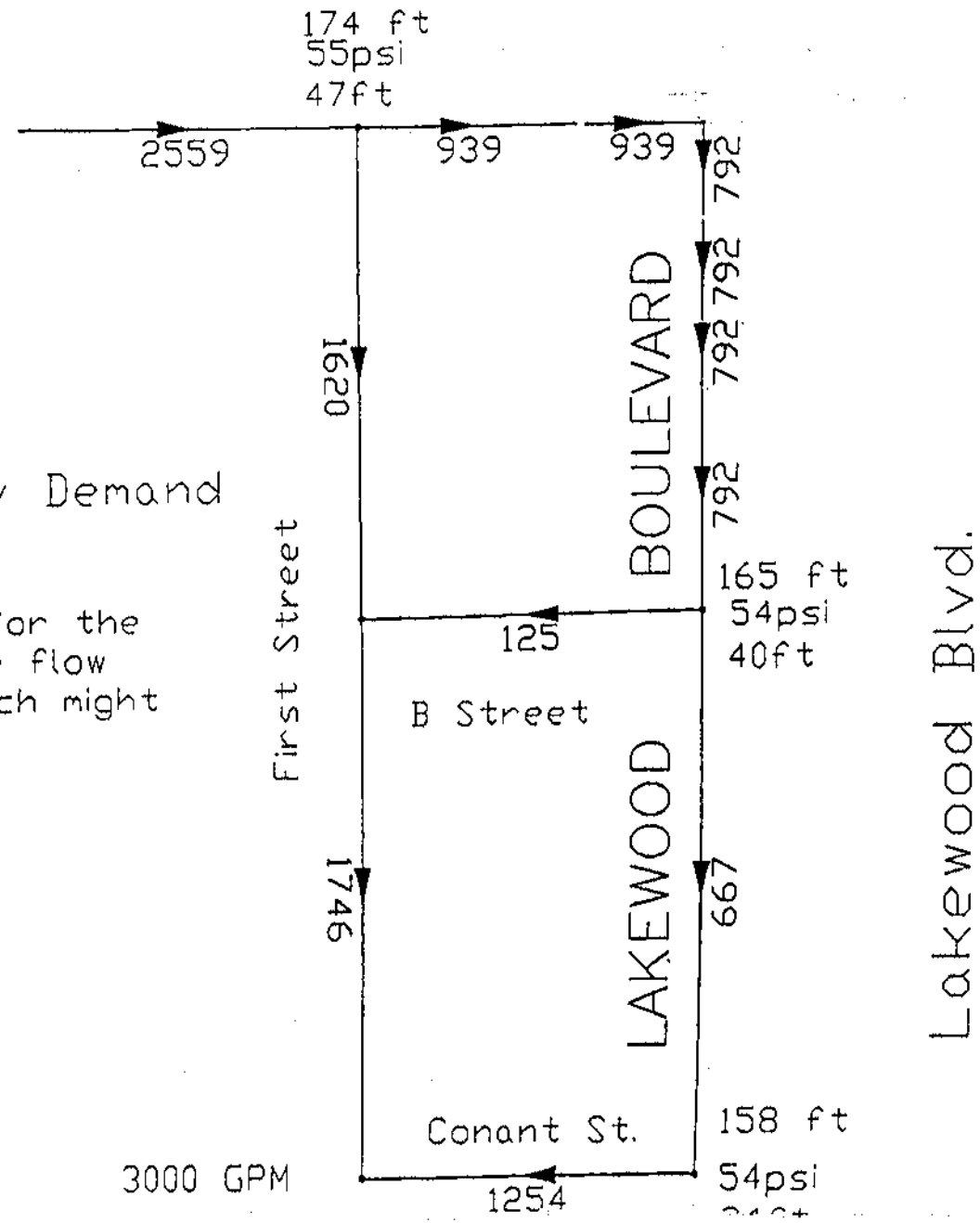
Carson Street

Boeing Development

LB-8 is off

3000 GPM fire flow, Max. Day Demand

A looped system was assumed only for the purpose of estimating how must fire flow could come from Carson and how much might come from Lakewood Boulevard.



Rv 7/13/01

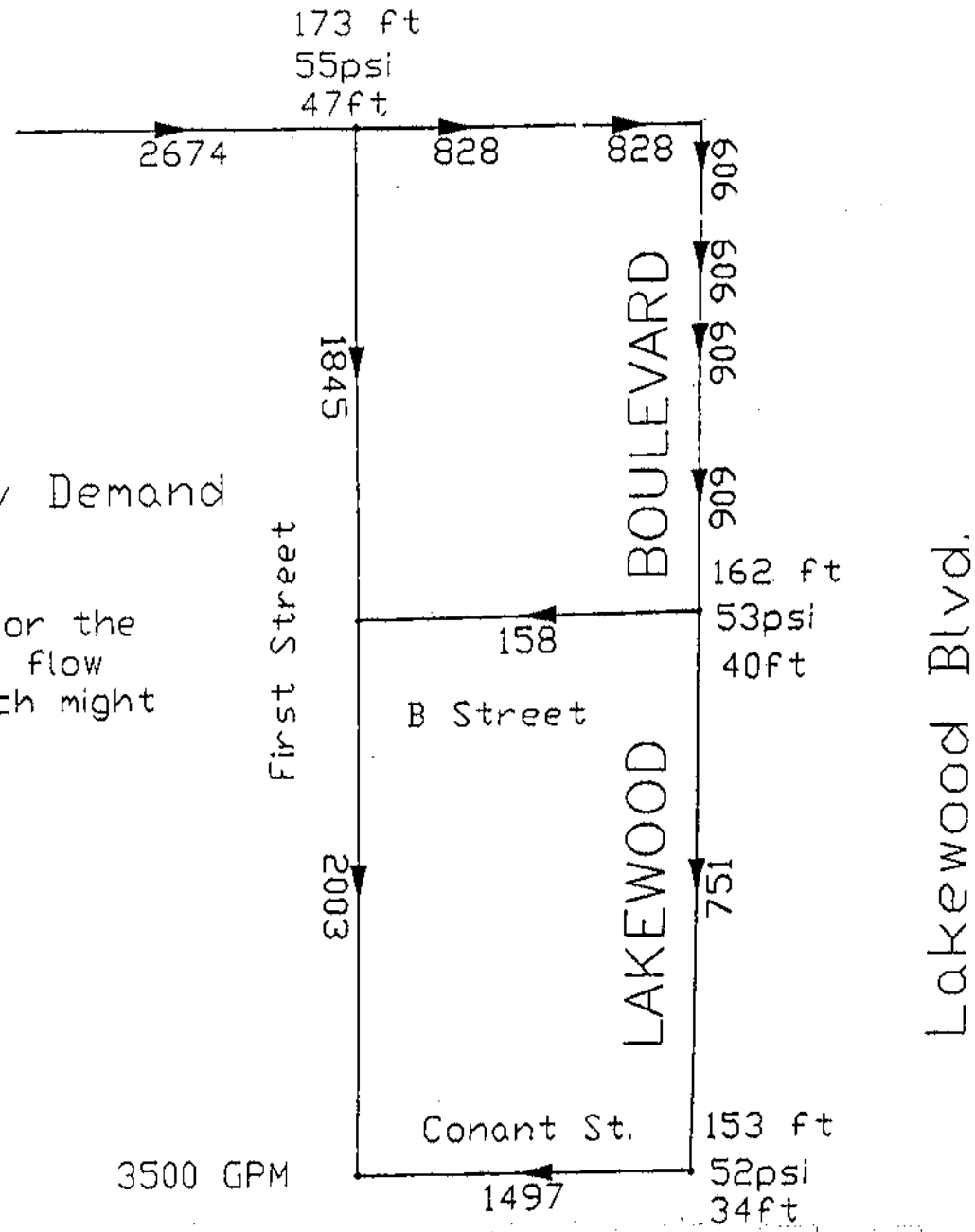
Carson Street

Boeing Development

LB-8 is off

3500 GPM fire flow, Max. Day Demand

A looped system was assumed only for the purpose of estimating how must fire flow could come from Carson and how much might come from Lakewood Boulevard.



Rv 7/13/01

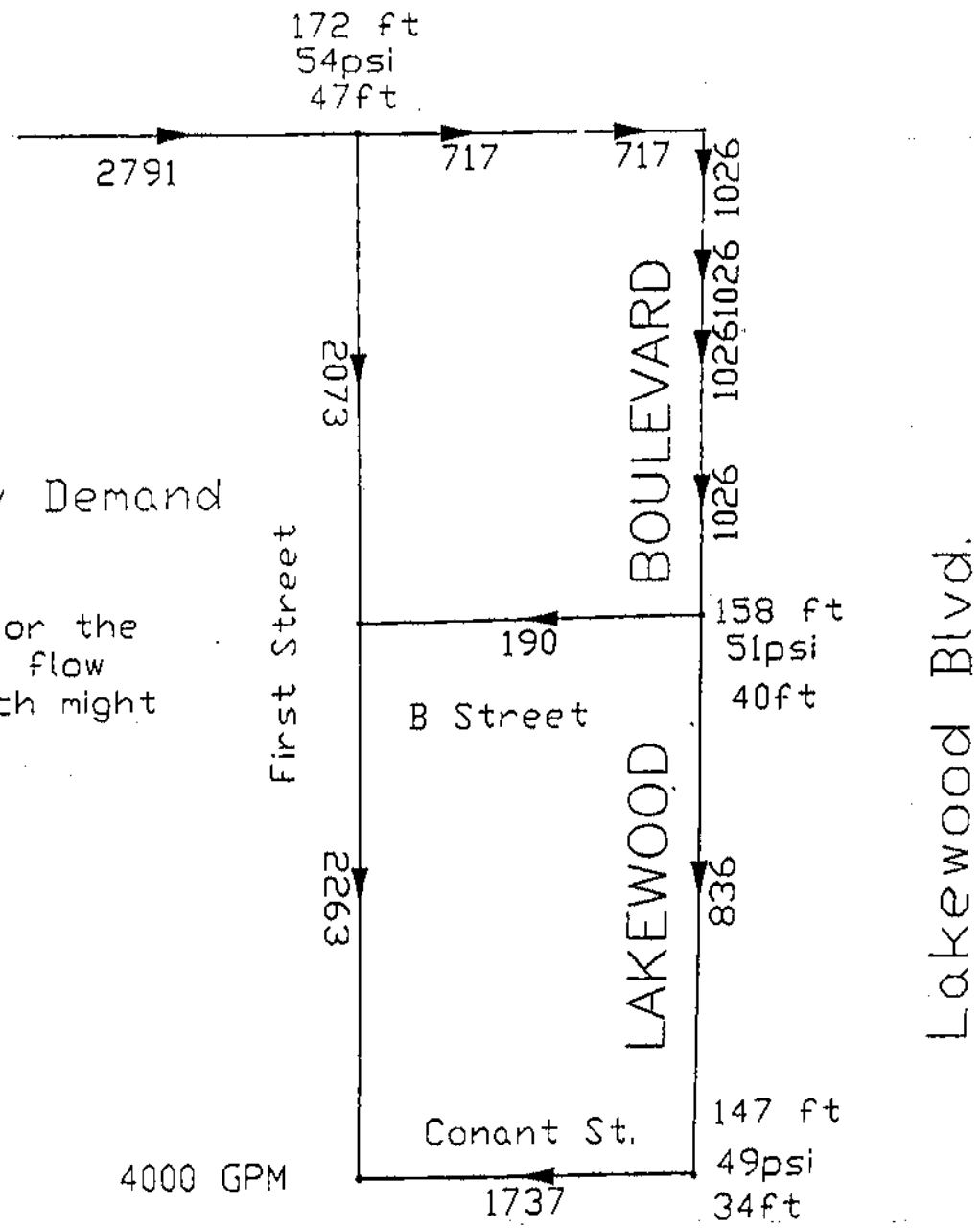
Carson Street

Boeing Development

LB-8 is off

4000 GPM fire flow, Max. Day Demand

A looped system was assumed only for the purpose of estimating how must fire flow could come from Carson and how much might come from Lakewood Boulevard.



Rv 7/13/01

FIRE FLOW TEST

TEST NO. 1044

DATE: 7-11-2001
TIME: 1320 PM
WEATHER: SUNNY 78°

FFT REQUESTED BY:
ATLAS:
LOCATION: 3855 CARSON ST
SIZE OF MAIN:
FLOW:
READ:

ATTENDING PERSONNEL:
1. M. HARRIS
2. E. GONZALEZ
3.
4.

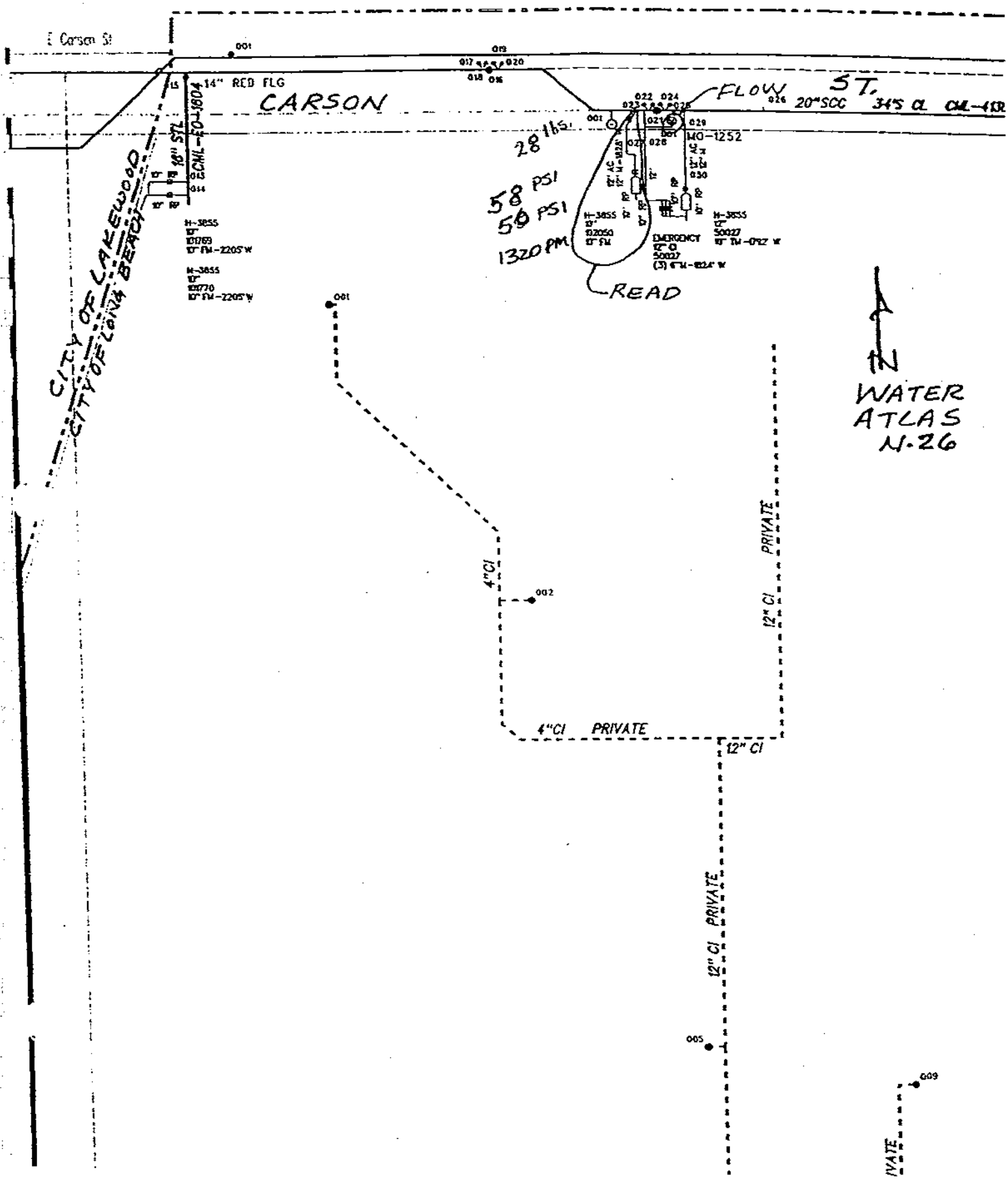
	HYDRANT READ		HYDRANT FLOWED
NOZZLE SIZE	2 1/2"	4"	2 1/2"
STATIC PRESSURE	58		
RESIDUAL PRESSURE	50		
MEASURED PITOT PRESSURE(psi)			
CHART READING (G.P.M.)			28
CALCULATED FLOW LBWD USE ONLY	#DIV/0!	#DIV/0!	2280
WATER COLOR LBWD USE ONLY			

NOTE: PLEASE NOTE ANY ADJUSTMENT OF FLOW OR READ LOCATIONS AS REQUIRED BY FIELD CONDITIONS LBW
COMMENTS:

404 569-8305
404-982-0401

WATER ATLAS: N26

Tus + ⊕
1644



SYSTEM HYDRAULIC INFORMATION

DATE: 7-11-2001 BY:

HIGH WATER RESERVOIR LEVEL:			MWD CONNECTION:		
ALAMITOS:	28.0	FEET	LB-8:		
			FLOW:	Ø	MGD
			PRESSURE:	–	PSI
J. WILL JOHNSON:	25.0	FEET	LB-4:		
			FLOW:	8.2	MGD
			PRESSURE:	75.0	PSI

CITIZEN PUMP STATION:			42-INCH WATER MAIN:			
FLOW:	4.7	MGD	[X]	OPEN 10%	2.4	MGD
PRESSURE:	60.0	PSI	[ ]	CLOSED		

INSTANTANEOUS SYSTEM FLOW AT TIME OF TEST: _____ MGD

REFERENCE FIRE FLOW TEST NUMBER: 1044

HYDMODL

TEST NO. **1044**

DATE: 7-13-2001
TIME: 1335
WEATHER: SUNNY 78°

FFT REQUESTED BY: Larry Oaks at 82330
ATLAS: N-26
LOCATION : 3855 Lakewood Blvd.
SIZE OF MAIN: 20" C.I..in Carson St.
FLOW: Fire Hydrant in Carson St.
at 400 feet E/City Boundary
READ: Existing 10" Water Service in Carson St.
for 3855 Lakewood Blvd.

ATTENDING PERSONNEL:
1. M. HARRIS
2. F. GONZALEZ
3.
4.

	HYDRANT READ		HYDRANT FLOWED	
NOZZLE SIZE	2 1/2"	4"	2 1/2"	4"
STATIC PRESSURE	55			
RESIDUAL PRESSURE	50			
MEASURED PITOT PRESSURE(psi)				28
CHART READING (G.P.M.)				2280
WATER COLOR LBWD USE ONLY				Clear

NOTE: PLEASE NOTE ANY ADJUSTMENT OF FLOW OR READ LOCATIONS AS REQUIRED BY FIELD CONDITIONS
COMMENTS: LBWD USE ONLY

SYSTEM HYDRAULIC INFORMATION

DATE: BY:

HIGH WATER RESERVOIR LEVEL:			MWD CONNECTION:		
ALAMITOS:	25.01	FEET	LB-8:		
			FLOW:	Ø	MGD
			PRESSURE:	–	PSI
J. WILL JOHNSON:	24.0	FEET	LB-4:		
			FLOW:	8.32	MGD
			PRESSURE:	74.2	PSI

CITIZEN PUMP STATION:			42-INCH WATER MAIN:			
FLOW:	3.07	MGD	[X]	OPEN 10%	1.6	MGD
PRESSURE:	67.1	PSI	[ ]	CLOSED		

INSTANTANEOUS SYSTEM FLOW AT TIME OF TEST: _____ MGD

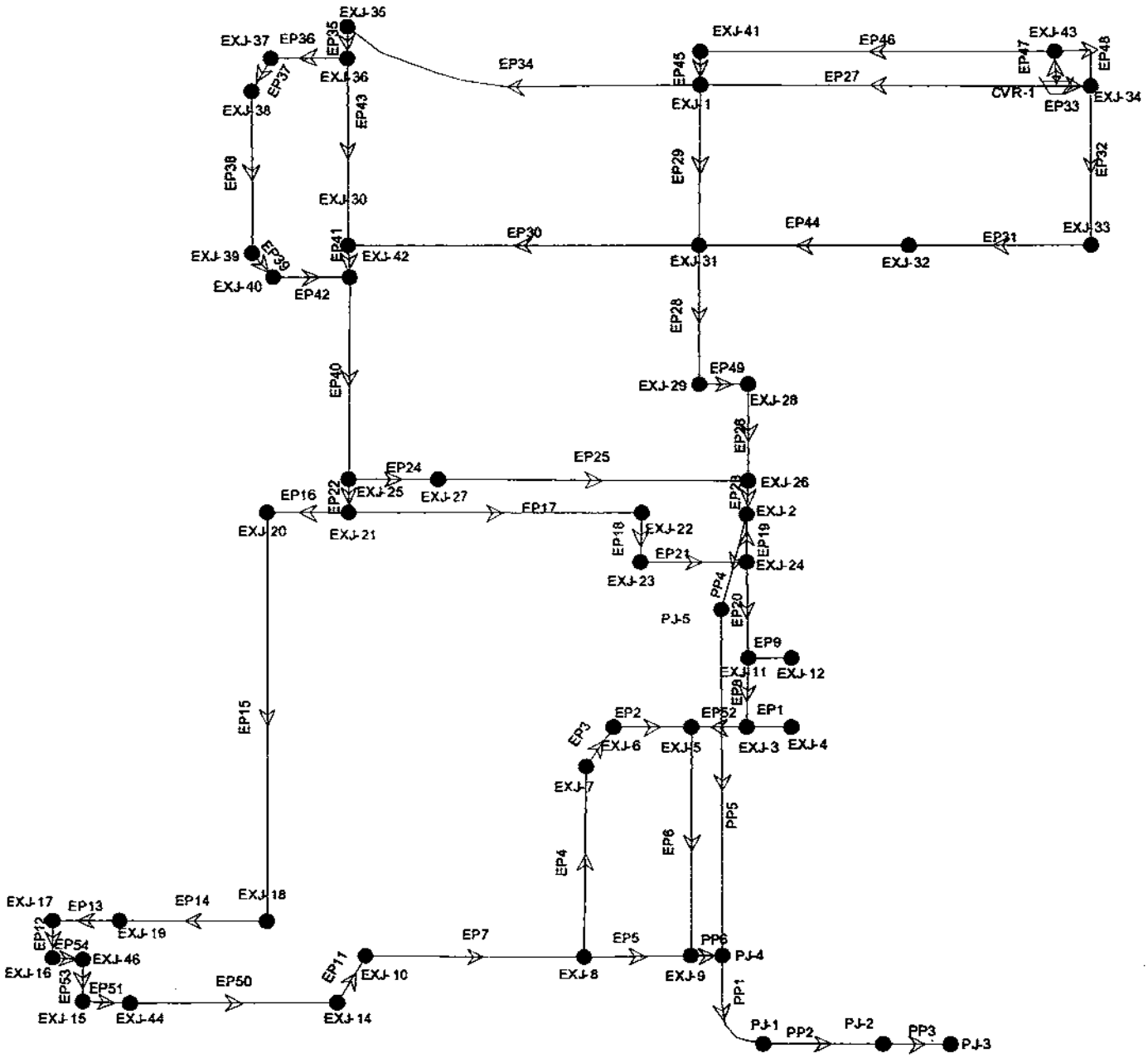
REFERENCE FIRE FLOW TEST NUMBER: 1044

HYDMODL

APPENDIX H

- PROPOSED DOMESTIC WATER SYSTEM & FIRE FLOW MODEL CITY OF LAKEWOOD

Scenario: Base



Scenario: Base
Fire Flow Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
EP1	5.00	8	Cast iron	130.0	false	0.00	Open	0.00	379.52	379.52	0.00	0.00
EP2	550.00	12	Cast iron	130.0	false	0.00	Open	-80.96	378.81	378.82	0.01	0.02
EP3	100.00	12	Asbestos C	140.0	false	0.00	Open	-80.96	378.82	378.82	2.08e-3	0.02
EP4	650.00	12	Asbestos C	140.0	false	0.00	Open	-80.96	378.82	378.84	0.01	0.02
EP5	650.00	8	Asbestos C	140.0	false	0.00	Open	-777.58	372.34	378.84	6.50	9.99
EP6	750.00	8	Asbestos C	140.0	false	0.00	Open	-718.02	372.34	378.81	6.47	8.62
EP7	490.00	12	Asbestos C	140.0	false	0.00	Open	858.53	379.65	378.84	0.82	1.67
EP8	250.00	12	Asbestos C	140.0	false	0.00	Open	637.06	379.76	379.52	0.24	0.96
EP9	5.00	8	Cast iron	130.0	false	0.00	Open	0.00	379.76	379.76	0.00	0.00
PP6	50.00	12	PVC	150.0	false	0.00	Open	1,495.59	372.34	372.14	0.20	4.10
PP3	218.00	16	PVC	150.0	false	0.00	Open	2,500.00	364.99	364.42	0.57	2.61
PP1	375.00	16	PVC	150.0	false	0.00	Open	5,000.00	372.14	368.60	3.54	9.43
PP2	382.00	16	PVC	150.0	false	0.00	Open	5,000.00	368.60	364.99	3.60	9.43
EP11	107.00	12	Cast iron	130.0	false	0.00	Open	-858.53	379.65	379.86	0.20	1.91
EP12	50.00	12	Asbestos C	140.0	false	0.00	Open	-858.53	380.61	380.69	0.08	1.67
EP13	120.00	12	Asbestos C	140.0	false	0.00	Open	-858.53	380.69	380.89	0.20	1.67
EP14	310.00	16	Asbestos C	140.0	false	0.00	Open	-858.53	380.89	381.02	0.13	0.41
EP15	1,700.00	16	Cast iron	130.0	false	0.00	Open	-858.53	381.02	381.82	0.80	0.47
EP16	210.00	16	Asbestos C	140.0	false	0.00	Open	-858.53	381.82	381.90	0.09	0.41
EP17	1,090.00	12	Asbestos C	140.0	false	0.00	Open	740.55	381.90	380.52	1.38	1.27
EP18	90.00	12	Asbestos C	140.0	false	0.00	Open	740.55	380.52	380.41	0.11	1.27
EP20	610.00	12	Asbestos C	140.0	false	0.00	Open	637.06	380.34	379.76	0.58	0.96
EP21	50.00	12	Asbestos C	140.0	false	0.00	Open	740.55	380.41	380.34	0.06	1.27
EP22	70.00	16	Cast iron	130.0	false	0.00	Open	-1,599.08	381.90	382.01	0.10	1.49
EP24	190.00	16	Cast iron	130.0	false	0.00	Open	161.76	382.01	382.00	4.06e-3	0.02
EP25	950.00	8	Cast iron	130.0	false	0.00	Open	161.76	382.00	381.41	0.59	0.63
EP26	480.00	12	Asbestos C	140.0	false	0.00	Open	3,239.16	390.76	381.41	9.35	19.48
EP27	2,600.00	20	Concrete	110.0	false	0.00	Open	-3,404.05	442.79	450.00	7.21	2.77
EP23	50.00	12	Asbestos C	140.0	false	0.00	Open	3,400.92	381.41	380.34	1.07	21.32
EP19	70.00	12	Asbestos C	140.0	false	0.00	Open	-103.48	380.34	380.34	2.32e-3	0.03
EP28	4,790.00	16	Concrete	110.0	false	0.00	Open	-3,239.16	392.03	427.95	35.92	7.50
EP29	2,400.00	16	Concrete	110.0	false	0.00	Open	-2,919.12	427.95	442.79	14.84	6.18
EP30	1,150.00	10	Cast iron	130.0	false	0.00	Open	-920.90	421.87	427.95	6.08	5.29
EP31	1,020.00	14	Cast iron	130.0	false	0.00	Open	-1,240.94	443.93	445.75	1.82	1.78
EP32	2,280.00	14	Cast iron	130.0	false	0.00	Open	-1,240.94	445.75	449.82	4.07	1.78

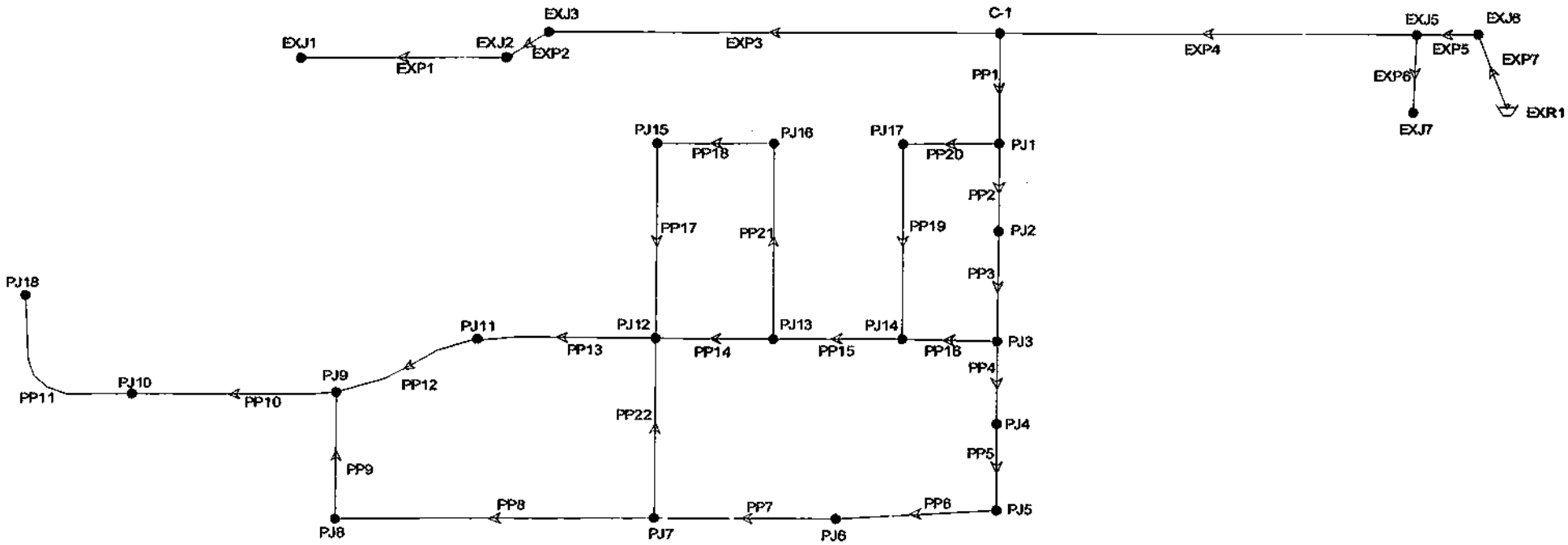
Scenario: Base
Fire Flow Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
EP33	120.00	14	Cast Iron	130.0	false	0.00	Open	-1,123.40	449.82	450.00	0.18	1.48
EP34	1,145.00	8	Cast iron	130.0	false	0.00	Open	839.94	442.79	427.65	15.14	13.22
EP35	60.00	8	Cast iron	130.0	false	0.00	Open	839.94	427.65	426.86	0.79	13.22
EP36	480.00	12	Cast iron	130.0	false	0.00	Open	530.58	426.86	426.48	0.38	0.78
EP37	210.00	12	Cast iron	130.0	false	0.00	Open	530.58	426.48	426.32	0.16	0.78
EP38	1,105.00	8	Cast Iron	130.0	false	0.00	Open	530.58	426.32	420.07	6.24	5.65
EP39	170.00	12	Cast iron	130.0	false	0.00	Open	530.58	420.07	419.94	0.13	0.78
EP40	5,220.00	12	Ductile Iron	130.0	false	0.00	Open	-1,760.84	382.01	419.73	37.73	7.23
EP41	145.00	10	Steel	100.0	false	0.00	Open	-1,230.26	419.73	421.87	2.13	14.70
EP42	265.00	12	Cast iron	130.0	false	0.00	Open	530.58	419.94	419.73	0.21	0.78
EP43	2,400.00	8	Cast iron	130.0	false	0.00	Open	-309.36	421.87	426.86	4.99	2.08
EP44	1,740.00	10	Cast iron	130.0	false	0.00	Open	-1,240.94	427.95	443.93	15.99	9.19
EP45	50.00	16	Concrete	110.0	false	0.00	Open	-355.01	442.79	442.80	0.01	0.13
EP46	2,620.00	8	Cast Iron	130.0	false	0.00	Open	-355.01	442.80	449.83	7.03	2.68
EP47	112.00	10	Cast iron	130.0	false	0.00	Open	-472.55	449.83	450.00	0.17	1.54
EP48	500.00	16	Cast iron	130.0	false	0.00	Open	117.64	449.83	449.82	0.01	0.01
EP49	65.00	12	Asbestos C	140.0	false	0.00	Open	3,239.16	392.03	390.76	1.27	19.48
EP50	339.00	12	Asbestos C	140.0	false	0.00	Open	-858.53	379.86	380.42	0.56	1.67
EP51	41.00	12	Asbestos C	140.0	false	0.00	Open	-858.53	380.42	380.49	0.07	1.67
EP53	20.00	12	Asbestos C	140.0	false	0.00	Open	-858.53	380.49	380.52	0.03	1.66
EP54	50.00	12	Asbestos C	140.0	false	0.00	Open	-858.53	380.52	380.61	0.08	1.67
PP4	100.00	16	PVC	150.0	false	0.00	Open	3,504.41	380.34	379.85	0.49	4.88
PP5	1,580.00	16	PVC	150.0	false	0.00	Open	3,504.41	379.85	372.14	7.72	4.88
EP52	90.00	8	Cast Iron	130.0	false	0.00	Open	-637.06	378.81	379.52	0.71	7.93

Scenario: Base
Fire Flow Analysis
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
EXJ-3	62.00	Zone-1	Demand	0.00	Fixed	0.00	379.52	137.38
EXJ-4	63.00	Zone-1	Demand	0.00	Fixed	0.00	379.52	136.94
EXJ-5	62.00	Zone-1	Demand	0.00	Fixed	0.00	378.81	137.07
EXJ-6	65.00	Zone-1	Demand	0.00	Fixed	0.00	378.82	135.78
EXJ-7	65.00	Zone-1	Demand	0.00	Fixed	0.00	378.82	135.78
EXJ-8	65.00	Zone-1	Demand	0.00	Fixed	0.00	378.84	135.78
EXJ-9	58.00	Zone-1	Demand	0.00	Fixed	0.00	372.34	136.00
EXJ-10	63.00	Zone-1	Demand	0.00	Fixed	0.00	379.65	137.00
PJ-2	55.50	Zone-1	Demand	2,500.00	Fixed	2,500.00	364.99	133.90
EXJ-11	63.00	Zone-1	Demand	0.00	Fixed	0.00	379.76	137.05
EXJ-12	64.00	Zone-1	Demand	0.00	Fixed	0.00	379.76	136.61
PJ-4	58.00	Zone-1	Demand	0.00	Fixed	0.00	372.14	135.91
PJ-3	54.00	Zone-1	Demand	2,500.00	Fixed	2,500.00	364.42	134.31
PJ-1	56.00	Zone-1	Demand	0.00	Fixed	0.00	368.60	135.25
EXJ-14	62.00	Zone-1	Demand	0.00	Fixed	0.00	379.86	137.52
EXJ-15	66.00	Zone-1	Demand	0.00	Fixed	0.00	380.49	136.06
EXJ-16	65.00	Zone-1	Demand	0.00	Fixed	0.00	380.61	136.55
EXJ-17	65.00	Zone-1	Demand	0.00	Fixed	0.00	380.69	136.58
EXJ-18	63.00	Zone-1	Demand	0.00	Fixed	0.00	381.02	137.59
EXJ-19	64.00	Zone-1	Demand	0.00	Fixed	0.00	380.89	137.10
EXJ-20	65.00	Zone-1	Demand	0.00	Fixed	0.00	381.82	137.07
EXJ-21	65.00	Zone-1	Demand	0.00	Fixed	0.00	381.90	137.11
EXJ-22	65.00	Zone-1	Demand	0.00	Fixed	0.00	380.52	136.51
EXJ-23	65.00	Zone-1	Demand	0.00	Fixed	0.00	380.41	136.46
EXJ-24	64.00	Zone-1	Demand	0.00	Fixed	0.00	380.34	136.87
EXJ-25	65.00	Zone-1	Demand	0.00	Fixed	0.00	382.01	137.15
EXJ-26	65.00	Zone-1	Demand	0.00	Fixed	0.00	381.41	136.90
EXJ-27	65.00	Zone-1	Demand	0.00	Fixed	0.00	382.00	137.15
EXJ-28	62.00	Zone-1	Demand	0.00	Fixed	0.00	390.76	142.24
EXJ-29	62.00	Zone-1	Demand	0.00	Fixed	0.00	392.03	142.79
EXJ-1	55.00	Zone-1	Demand	0.00	Fixed	0.00	442.79	167.78
EXJ-2	65.00	Zone-1	Demand	0.00	Fixed	0.00	380.34	136.43
EXJ-30	52.00	Zone-1	Demand	0.00	Fixed	0.00	421.87	160.02
EXJ-31	52.00	Zone-1	Demand	0.00	Fixed	0.00	427.95	162.65
EXJ-32	52.00	Zone-1	Demand	0.00	Fixed	0.00	443.93	169.57
EXJ-33	52.00	Zone-1	Demand	0.00	Fixed	0.00	445.75	170.36
EXJ-34	50.00	Zone-1	Demand	0.00	Fixed	0.00	449.82	172.98
EXJ-35	55.00	Zone-1	Demand	0.00	Fixed	0.00	427.65	161.23
EXJ-36	55.00	Zone-1	Demand	0.00	Fixed	0.00	426.86	160.88
EXJ-37	55.00	Zone-1	Demand	0.00	Fixed	0.00	426.48	160.72
EXJ-38	54.00	Zone-1	Demand	0.00	Fixed	0.00	426.32	161.08
EXJ-39	52.50	Zone-1	Demand	0.00	Fixed	0.00	420.07	159.03
EXJ-40	52.00	Zone-1	Demand	0.00	Fixed	0.00	419.94	159.19
EXJ-42	52.00	Zone-1	Demand	0.00	Fixed	0.00	419.73	159.10
EXJ-41	55.00	Zone-1	Demand	0.00	Fixed	0.00	442.80	167.78
EXJ-43	49.00	Zone-1	Demand	0.00	Fixed	0.00	449.83	173.42
EXJ-44	65.00	Zone-1	Demand	0.00	Fixed	0.00	380.42	136.47
EXJ-46	65.00	Zone-1	Demand	0.00	Fixed	0.00	380.52	136.51
PJ-5	65.00	Zone-1	Demand	0.00	Fixed	0.00	379.85	136.22

Scenario: Base



Scenario: Base
Fire Flow Analysis
Fire Flow Report

Label	Zone	Fire Flow Iterations	Fire Flow Balanced?	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Min Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Min System Pressure (psi)	Calculated Minimum System Pressure (psi)	Minimum System Junction
EXJ2	Zone-1	1	true	true	0.00	0.10	0.00	0.10	20.00	87.13	20.00	57.04	PJ18	20.00	57.04	PJ18
EXJ3	Zone-1	1	true	true	0.00	0.10	0.00	0.10	20.00	87.57	20.00	57.04	PJ18	20.00	57.04	PJ18
C-1	Zone-1	1	true	true	0.00	0.10	0.00	0.10	20.00	88.89	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ1	Zone-1	1	true	true	0.00	0.10	77.00	77.10	20.00	66.69	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ2	Zone-1	1	true	true	0.00	0.10	61.00	61.10	20.00	66.36	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ4	Zone-1	1	true	true	0.00	0.10	53.00	53.10	20.00	65.41	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ5	Zone-1	1	true	true	0.00	0.10	109.00	109.10	20.00	66.44	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ6	Zone-1	1	true	true	0.00	0.10	165.00	165.10	20.00	65.93	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ7	Zone-1	1	true	true	0.00	0.10	220.00	220.10	20.00	64.42	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ8	Zone-1	1	true	true	0.00	0.10	167.00	167.10	20.00	61.87	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ9	Zone-1	1	true	true	0.00	0.10	142.00	142.10	20.00	59.26	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ10	Zone-1	1	true	true	0.00	0.10	142.00	142.10	20.00	57.47	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ14	Zone-1	1	true	true	0.00	0.10	138.00	138.10	20.00	66.31	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ13	Zone-1	1	true	true	0.00	0.10	173.00	173.10	20.00	63.71	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ12	Zone-1	1	true	true	0.00	0.10	243.00	243.10	20.00	61.39	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ11	Zone-1	1	true	true	0.00	0.10	230.00	230.10	20.00	60.18	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ16	Zone-1	1	true	true	0.00	0.10	180.00	180.10	20.00	61.48	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ15	Zone-1	1	true	true	0.00	0.10	60.00	60.10	20.00	60.99	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ17	Zone-1	1	true	true	0.00	0.10	154.00	154.10	20.00	65.25	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ18	Zone-1	1	true	true	0.00	0.10	0.00	0.10	20.00	57.04	20.00	57.47	PJ10	20.00	57.47	PJ10
EXJ5	Zone-1	1	true	true	0.00	0.10	0.00	0.10	20.00	69.70	20.00	57.04	PJ18	20.00	57.04	PJ18
EXJ7	Zone-1	1	true	true	0.00	0.10	2,070.00	2,070.10	20.00	87.89	20.00	57.04	PJ18	20.00	57.04	PJ18
EXJ6	Zone-1	1	true	true	0.00	0.10	0.00	0.10	20.00	70.68	20.00	57.04	PJ18	20.00	57.04	PJ18
EXJ1	Zone-1	1	true	true	0.00	0.10	305.00	305.10	20.00	87.12	20.00	57.04	PJ18	20.00	57.04	PJ18
PJ3	Zone-1	1	true	true	0.00	0.10	0.00	0.10	20.00	87.87	20.00	57.04	PJ18	20.00	57.04	PJ18

Appendix S

Water Supply Assessment

8C.

LONG BEACH WATER DEPARTMENT
A Class 1 Water Utility

KEVIN L. WATTIER, General Manager

Date: December 18, 2002

To: BOARD OF WATER COMMISSIONERS

From: Kevin L. Wattier
General Manager
(Matthew P. Lyons, Manager of Planning)

Reviewed by: Diem X. Vuong
Assistant General Manager

John Kruse
Deputy General Manager

Subject: **Approve The Water Availability Assessment Prepared For The PacifiCenter @ Long Beach Project Pursuant To California Water Code Section 10910(g)(1)**

ACTIONS REQUESTED:

Approve the Water Availability Assessment prepared for the PacifiCenter @ Long Beach project pursuant to California Water Code Section 10910(g)(1).

EXECUTIVE SUMMARY:

California Senate Bill 221 and Senate Bill 610 amended state law, effective January 1, 2002, to improve the link between information on water supply availability and certain land use decisions made by cities and counties. SB 221 and SB 610 are companion measures which seek to promote more collaborative planning between local water suppliers and cities and counties. Both statutes require detailed information regarding water availability to be provided to the city and county decision-makers prior to approval of specified large development projects. Both statutes also require this detailed information be included in the administrative record that serves as the evidentiary basis for an approval action by the City on such projects.

Under SB 221, approval by a city or county of certain residential subdivisions requires an affirmative written verification of sufficient water supply. Under SB 610, water assessments must be furnished to local governments for inclusion in any environmental documentation for certain projects (as defined in Water Code 10912(a)) subject to the California Environmental Quality Act.

APPROVED 12-18-2002
BOARD OF WATER COMMISSIONERS

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1800 EAST WARDLOW ROAD • LONG BEACH, CALIFORNIA 90807-4994 • Phone (562) 570-2300 • FAX (562) 427-7061

The Long Beach Water Department (LBWD) has prepared a water availability assessment for the proposed PacifiCenter @ Long Beach (Project) at the request of the Department of Planning and Building, City of Long Beach, a request made on November 13, 2002. The LBWD is the public water agency that will service the Project.

If the assessment concludes that the supply is sufficient, the water supply governing body (i.e, the Board of Water Commissioners) must approve the assessment and deliver it to the lead agency, per Water Code section 10910(g)(1):

> *(g)(1) ...the governing body of each public water system shall submit the assessment to the city or county no later than 90 days from the date on which the request was received. The governing body of each public water system...shall approve the assessment prepared pursuant to this section at a regular or special meeting.*

Staff has determined that the Project is exempt from SB 221 requirement of an affirmative written verification of sufficient water supply (Government Code 66473.7) because the project will be sited within an urbanized areas that has been previously developed for urban uses. The Project is further exempt from SB 221 requirements because the immediate contiguous properties surrounding the proposed Project site are, or previously have been, developed for urban uses.

Staff has determined that the Project is subject to the water assessment required by SB 610. The projected water demand of the Project is within the 20-year water demand growth projected by LBWD's 2000 Urban Water Management Plan (UWMP). Staff anticipates that LBWD can provide sufficient domestic water supply to accommodate full implementation of the Project, given that LBWD's projected water supplies available during normal, single-dry, and multiple-dry water years, as included in the 20-year projection contained in this assessment, will meet the projected water demand associated with the Project in addition to the existing and other planned future uses, including agricultural and manufacturing uses.

Attached: Water Availability Assessment prepared for the PacifiCenter @ Long Beach.

LONG BEACH WATER DEPARTMENT
A Class 1 Water Utility

Water Availability Assessment prepared for the PacifiCenter @ Long Beach

Prepared by the
Long Beach Water Department

December 19, 2002

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I. Background and Findings

A. Background

California Senate Bill 610 and Senate Bill 221 amended state law, effective January 1, 2002, to improve the link between information on water supply availability and certain land use decisions made by cities and counties. SB 610 and SB 221 are companion measures which seek to promote more collaborative planning between local water suppliers and cities and counties. Both statutes require detailed information regarding water availability to be provided to the city and county decision-makers prior to approval of specified large development projects. Both statutes also require this detailed information be included in the administrative record that serves as the evidentiary basis for an approval action by the city or county on such projects. Both measures recognize local control and decision making regarding the availability of water for projects and the approval of projects.

Under SB 610, water assessments must be furnished to local governments for inclusion in any environmental documentation for certain projects (as defined in Water Code 10912(a)) subject to the California Environmental Quality Act. Under SB 221, approval by a city or county of certain residential subdivisions requires an affirmative written verification of sufficient water supply.

The Long Beach Water Department (LBWD) has prepared this water availability assessment for the proposed PacifiCenter @ Long Beach (Project) at the request of Mr. Gerhardt H. Felgemaker, Environmental Officer, Department of Planning and Building, City of Long Beach, a request made on November 13, 2002 (see Appendix). The LBWD is the public water agency that will service the Project.

B. Findings

The Project is exempt from SB 221 requirement of an affirmative written verification of sufficient water supply (Government Code 66473.7) because it will be sited within an urbanized areas that has been previously developed for urban uses. The Project is further exempt from SB 221 requirements because the immediate contiguous properties surrounding the proposed Project site are, or previously have been, developed for urban uses.

The Project is subject to the water assessment required by SB 610. LBWD anticipates that it can provide sufficient domestic water supply to accommodate the Project. The projected water demand of the Project is

within the 20-year water demand growth projected by LBWD's 2000 Urban Water Management Plan (UWMP).

LBWD anticipates that its projected water supplies available during normal, single-dry, and multiple-dry water years as included in the 20-year projection contained in this assessment will meet the projected water demand associated with the Project, in addition to the existing and other planned future uses of LBWD's system.

LBWD anticipates that it will be capable of meeting the demand associated with full implementation of the Project.

II. PacifiCenter is defined as a subject "project" by SB 610

Because the Project is both subject to CEQA and is defined as a subject project by Water Code 10912(a) and (b) (see table below), the Project is considered a subject project by SB 610.

X	More than 500 dwelling units.
	Shopping center or business establishment employing more than 1,000 persons or having more than 250,000 square feet of floor space.
X	Commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space.
	Hotel or motel, or both, having more than 500 rooms.
	Industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area.
X	Mixed-use project that includes one or more of the projects specified in this subdivision.
X	Would demand an amount of water equivalent to or greater than the amount of water required by a 500 dwelling unit project (typical water use for 500 dwelling unit ~ one acre-foot per 2 to 3 units).

With respect to SB 221, the Project is a "subdivision" as defined by SB221's Government Code 66473.7(a)(1), having more than 500 dwelling units when the public water system (LBWD) has more than 5,000 services.

III. LBWD is the responsible agency for preparing SB 610 assessment

Because LBWD will be providing domestic water to the proposed site and because LBWD is a public water system of over 3,000 service connection, LBWD is responsible for performing the SB 610 assessment.

IV. An SB 610 water supply assessment has not previously been performed for the Project

Because a SB 610 assessment has not previously been performed on the Project, one must be prepared within 90 days of a request for an assessment.

V. LBWD has a current adopted UWMP

If the public water system has a current adopted Urban Water Management Plan (UWMP), it may rely on data in the plan for much of the information required in the SB 610 assessment. UWMP's are completed every five years, the last plan being completed in 2000. LBWD has a current adopted 2000 UWMP and used the data from that plan in this assessment.

A. Project's projected demand for water

The following table provides two estimates of the Project's water use, 1,492 and 1,458 acre-feet/year; this water use excludes landscape irrigation of the non-residential areas. These estimates are based on average water use for the types of development planned for the Project. These estimates reflect two scenarios: one of greater residential development and the other of greater commercial space, Scenarios I and II, respectively. These estimates may be on the high side because they assumeall the housing will be single family residential when in fact some housing will be apartments; the former using about 21-percent more water than the latter.

Estimate of Project's Annual Water Demand

	Gallons/ Day/ Unit	AF/ Unit/ Yr		Scenario I No. of Units	Scenario I Total AF/Yr Used	Scenario II No. of Units	Scenario II Total AF/Yr Used
Single- family	268	0.301	*	2,500	751.45	2,200	661.27
Multi-family	222	0.249	*	-	-	-	-
Hotel	128	0.143	^	400	57.23	400	57.23
	Gallons/ Day/ 1,000 sf	**AF/ 1 mil SF/ Yr**		**Square Feet (millions)**	**Total AF/Yr Used**	**Square Feet (millions)**	**Total AF/Yr Used**
Non-irrigation, Commercial Space	200	224	~	3.05	683.27	3.30	739.28
Total Acre-feet per Year					1,492		1,458

** Based on average use in Long Beach.*
^ Based on average use of large hotels in Long Beach.
~ Based on LBWD Compreshensive Sewer System Master Plan and Management Program.

The non-residential landscape irrigation is expected to require approximately 453 acre-feet of water per year. Although the Project plan anticipates using recycled water, if recycled water is not used it will increase the domestic water needs of the project accordingly.

A third estimate was made available to the LBWD from Kimley-Horn and Associates, in a letter dated November 12, 2002.[1] This estimate was for an average daily water use of 1,270,640 gallons per day or 1,424 acre-feet per year.

Assuming a worse case scenario of no use of reclaimed water, the estimates of annual domestic water use range from:

	Base (af/yr)	w/o Reclaimed for non-Residential Landscape Irrigation (af/yr)	Total (af/yr)
Low	1,424	453	1,877
Medium	1,458	453	1,911
High	1,492	453	1,945

[1] See Appendix for a copy of the letter.

B. Projected water demand for the Project was accounted for in the most recent UWMP

If the projected water demand from the Project is accounted for in the current adopted UWMP, than the UWMP may be used in the water supply assessment.

The projected water demand for the Project was accounted for in LBWD's current adopted UWMP. The LBWD 2000 UWMP assumed the demand for water in the City would increase with time as additional development took place.[2]

The 2000 UWMP projected an increase in water use with time as development slowly took place within the City. The 2000 UWMP estimated a demand for water in the City of 77,722 acre-feet[3] for the fiscal year ending September 30, 2002 (including both potable and recycled water); yet the actual demand for water was 75,232; for a difference of 2,490 acre-feet of demand yet to materialize.

The 2,490 acre-feet of demand yet to materialize represents a portion of the demand related to growth, of which the Project can be considered a part. The amount of water consumed by the Project, as shown above, will likely range from a low of 1,424 to a high of 1,945 acre-feet/year. This range is within the unrealized yet anticipated increase in demand for water.

VI. Twenty-year water supply assessment in normal, single-dry, and multiple dry-years

The issue is whether the water supplier's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection meet the projected water demand of the proposed Project, in addition to the water supplier's existing and planned future uses, including agricultural and manufacturing uses.

---

[2] See Appendix for a copy of the UWMP.

[3] An acre-foot of water equals the amount of water required to cover an acre of land one foot deep. This is roughly 326,000 gallons of water, or the annual amount of water used by three single family homes in Long Beach.

A. Water supplies

1. *General information*

The demand for domestic water in Long Beach is met with a combination of groundwater and of surface water imported and treated by the Metropolitan Water District of Southern California (MWD). LBWD has a right to both these sources of water.

LBWD has a right to extract 32,684 acre-feet of groundwater each year. A discussion of this right and of the groundwater basin follows this *General Information* section.

LBWD also has a right to the imported drinking water it expects to purchase wholesale from the MWD. This entitlement is embedded in State law and comes in the form of a preferential right to MWD supplies except during times of extreme emergencies. Section 135 of the Metropolitan Water District Act states:

> ***Sec. 135. [Preferential Right to Purchase Water]***
>
> *Each member public agency shall have a preferential right to purchase from the district for distribution by such agency, or any public utility therein empowered by such agency for the purposes, for domestic and municipal uses within the agency a portion of the water served by the district which shall, from time to time, bear the same ratio to all of the water supply of the district as the total accumulation of amounts paid by such agency to the district on tax assessments and otherwise, excepting purchase of water, toward the capital cost and operating expense of the district's works shall bear to the total payments received by the district on account of tax assessments and otherwise, excepting purchase of water, toward such capital cost and operating expense.*

The MWD recalculates each of its member agency's preferential rights on an annual basis. According to this calculation Long Beach has a right to 2.69-percent of MWD's water supply. Experts in the water industry believe that MWD, through a combination of imported water and stored water, will be able to deliver at least 1.5 million acre-feet of water per year to its customers even under the most severe hydrologic conditions. LBWD would have a preferential right to 40,350 acre-feet of this water. Because MWD has made a commitment to be 100-percent reliable for the next 20 years, LBWD does not anticipate a need to invoke its preferential rights during this period of time.

MWD projects that it will have sufficient water supplies to meet the supplemental needs of southern California for the next twenty years.

Supplemental demands are those demands for which a retail agency relies on wholesale water to meet. In the case of the City of Long Beach, "supplemental demands" are demands in excess of our groundwater supplies and feasible use of recycled water. In a comprehensive report titled **Report on Metropolitan's Water Supplies**[4], dated February 11, 2002, MWD reports that:

> *"...there are sufficient supplies that can be reasonably relied upon to meet projected supplemental demands and that there are additional reserve supplies that could provide a "margin of safety" to mitigate against uncertainties in demand projection and risks in fully implementing all supply programs under development." (page 13)*

Over the last 20 years Long Beach has not pumped all its annual pumping rights because it participates in a voluntary program in which it "retires" some of its pumping rights on an annual basis for the sake of replenishing the groundwater basin and, in exchange, is allowed to purchase additional MWD water at a discounted rate and with further financial contributions from the Water Replenishment District of Southern California (WRD). The following table shows that LBWD has pumped from about 28,000 acre-feet to as little as 16,625 in a single year; while purchasing from over 49,000 to as little as 38,729 acre-feet. LBWD expects to continue to participate in this worthwhile and cost effective program in the future.

Water demand & supply, actual and projected (af)

Fiscal Year	1985	1990	1995	2000	2005*	2010*	2015*	2020*	2025^
Groundwater	25,749	28,090	16,625	24,582	25,727	26,770	27,812	27,812	27,812
Wholesale - MWD	48,951	47,028	49,997	46,475	44,839	45,681	48,478	52,534	56,551
Potable	74,700	75,118	66,622	71,057	70,566	72,451	76,290	80,346	84,363
Reclaimed	2,471	3,992	2,992	5,190	10,648	11,478	12,328	13,025	13,676
Grand Total	77,171	79,110	69,614	76,247	81,214	83,929	88,618	93,371	98,039

* *From the adopted 2000 Urban Water Management Plan.*
^ *Extrapolated from estimates of 2000 through 2020.*

2. *Groundwater Location, Amount, and Sufficiency*

A portion of the LBWD water supply to the Project will be treated groundwater. The location of the groundwater pumped by the LBWD is the Central Basin aquifer. A description of the Central Basin is included in the Watermaster Services annual report, a copy of which is in the

[4] See Appendix for a copy of the report's introduction and findings. The entire report is available from the MWD (and was located on the MWD web site http://www.mwd.dst.ca.us/mwdh2o/pdf/sb221/sb221.pdf as of December 19, 2002.)

Appendix. This basin was adjudicated in 1965. The adjudication limited the amount of water allowable to be extracted in any given year from the basin and assigned the right, or "Allowable Pumping Allocation" or APA, to extract that water to specified parties. The specified parties have the right to sell and to lease some or all of their APA. LBWD was awarded certain APA rights at the time of the adjudication and has purchased additional APA since that time, accumulating 32,684 acre-feet APA per year as of the date of this assessment.

Because the sum total of all the water that can be legally extracted from the Central Basin in a given year (i.e., the total APA) exceeds the basin's natural yield, the adjudication specified that the Water Replenishment District of Southern California (WRD) (known at the time of the adjudication as the *West and Central Basin Replenishment District*) would be the responsible agency for replenishment of the Central Basin. WRD replenishes the groundwater basin in several ways, including a spreading operation and through in-lieu replenishment. The adjudication provided WRD a means to finance the replenishment operations by allowing it to levy a tax on water extracted from the basin.

The Central Basin had been in an overdraft condition prior to 1965; since the imposition of adjudication's extraction limitations and the replenishment operations of the WRD, the groundwater basin has recovered significantly from its pre-1965 levels. Additional information about the replenishment operations and condition of the groundwater basin can be found in the Appendix'ed **Watermaster Service**. This document includes a description of the groundwater basin, the water demands for the cities overlaying the basin, a list of the owners of water rights, a discussion of the replenishment operations, the active wells and their locations, as well as information concerning the current and historic water levels.

Because LBWD relies on the Central Basin for its groundwater extractions, because the adjudication has limited extraction of groundwater from the basin, because the adjudication has imposed upon WRD the mandate to provide for the replenishment of the basin, and because WRD has performed that function sufficiently since the time of the adjudication to the date of this assessment, and because WRD is expected to continue to maintain the groundwater level in the basin in the future, given its mandate and access to resources, it is reasonable to assume that LBWD will encounter no difficulties extracting the groundwater it anticipates extracting over the next 20 years.

The following table shows the amount of water extracted from the Central Basin by the LBWD for each of the last five years:

Fiscal Year Ending Sept 30...	2002	2001	2000	1999	1998
Acre-feet Extracted	25,802.5	24,326.4	24,581.9	23,397.0	23,452.9

3. *Documenting Supplies if Supplies Never Before Used*

The supplies expected to be used by the Project have been used in the past with the exception of, potentially, some water from projects the MWD anticipates implementing in the future to meet additional future demands on it. MWD in its *Report on Metropolitan Supplies* provides the requisite documentation. Additionally, because LBWD has a preferential right to a potion of MWD supplies, even if MWD were no longer able to meet all the region's supplemental supplies, it would be able to supply enough preferential rights to LBWD to meet the City's needs.

B. Water demand

As stated above, because the proposed development was included as part of the projected water demand of the current adopted 2000 UWMP, the water demand for the proposed development need not be separately analyzed.

The LBWD 2000 UWMP demand estimates were based, in part, on estimates of population growth. The following table showed these UWMP estimates in 5-year increments. These estimates were based on historical trends and data from the City of Long Beach and the Southern California Association of Governments.

FY Ending	2000	2005	2010	2015	2020
Population	459,500	474,751	490,509	506,880	527,776

Long Beach is an urban coastal community within the southern California coastal plan. As such it has a temperate "Mediterranean" climate distinguished by wet winters and dry, warm summers. The average annual rainfall for the region is approximately 15 inch but fluctuates between less than 4 inches and greater than 35.

By water industry standards Long Beach is considered a "built out city;" meaning there is little undeveloped land and that new development will almost always be in the form of in-fill or replacement of existing development. Therefore, some or all of the water demanded by the new development tends to simply replace the previous demand at the site, for little or no net increase in overall water demand to the City.

Based on the population estimates and other factors, the LBWD 2000 UWMP made the following estimates of water use by sector. The sectors shown are the only sectors for which information was available.

Estimated and projected demand by sector (in acre-feet)

Fiscal Year	1990	1995	2000	2005*	2010*	2015*	2020*	2025^
SFR	52,494	45,814	46,833	48,071	49,356	51,971	54,734	57,468
MFR	15,683	14,627	16,353	15,511	15,926	16,770	17,661	18,543
Misc./ Agg.	624	578	1,496	910	934	984	1,036	1,088
Comm/ Ind	6,317	5,603	6,376	6,073	6,236	6,566	6,915	7,261
Total	75,118	66,622	71,057	70,566	72,451	76,290	80,346	84,360

* Based on the 2000 UWMP.

^ Based on trends established in the 2000 UWMP.

C. Dry year supplies

LBWD has two sources of domestic water: groundwater and imported MWD supplies; and expects to be desalinating seawater in less than ten years. The desalinated seawater is not factored into this assessment.

Both the groundwater and the MWD supplies are reliable in normal and in multiple dry years as the following discussion makes clear.

1. Groundwater Reliability

The groundwater supplies are extremely reliable because the amount of water stored in the basin is very significant, because the basin is adjudicated (limited extractions), and because the WRD is charged with replenishing the basin in a timely manner. Therefore, the groundwater supplies are not expected to be limited by single nor multiple dry-year events.

The average annual rainfall in the LA basin over the last 125 years is 14.97 inches per year. If a "dry year" is considered 13 inches or less, a fairly conservative number, there have been only three events of 4 or more dry years in a row during this period: the four years including 1928 through 1931; the seven years including 1945 through 1951; and the five years including 1987 through 1991.[5]

For the purposes of the assessment of the impact of four consecutive dry years, the most useful period was the most recent, from 1987 through 1991. The two previous dry-year periods took place before the groundwater basin was adjudicated, before there was a systematic means of replenishing the groundwater basin, and before good records of the water table elevations were available.

[5] These "years" began on July 1 and ended June 30th of the year noted. For example, the year "1928" began July 1, 1927 and ended June 30, 1928.

The five-year 1987 through 1991 drought was more severe than the 4-year analysis required in the assessment, yet a reduction in groundwater production was not required and the water table remained above the pre-adjudication level in each of the four monitoring wells tracked by the Watermaster (see the Appendix'ed *Watermaster Service*, page 26).

2. *MWD Water Reliability*

In a comprehensive report titled **Report on Metropolitan's Water Supplies**, dated February 11, 2002, MWD reports that:

> *"...there are sufficient supplies that can be reasonably relied upon to meet projected supplemental demands and that there are additional reserve supplies that could provide a "margin of safety" to mitigate against uncertainties in demand projection and risks in fully implementing all supply programs under development." (page 13)*

This report anticipates multiple dry year events. The report's introduction and findings are attached. The entire report is available from the MWD (and was located on the MWD web site http://www.mwd.dst.ca.us/mwdh2o/pdf/sb221/sb221.pdf as of December 4, 2002.)

3. *Additional Water Reliability*

In addition to groundwater and MWD supplemental supplies, LBWD is seeking to increase its recycled water distribution system in order to switch more users from potable water to recycled water, to aggressively expand its water conservation program to limit domestic water demands, and to meet the drinking water needs of about 1of 7 LBWD customers with desalinated seawater in less than 10 years.

D. Dry year demand

The average annual rainfall over a 125-year period in the greater Long Beach area is 14.97 inches. Using the years 1978 through 2000 as a benchmark, it appears that local hydrology impacts water use. For the sake of this analysis a "dry year" was a year of 13 inches of rain or less.

Water demand increased over this 22-year period an average of 1.3% per year. The increase was due, in part, to growth in population and economic activity. In *non-dry years* the average is only about 0.7%; this is lower than the long-term average because some of these years were very wet, significantly reducing water demands and pulling down the average for years classified as non-dry.

The *first consecutive dry year* demand jumps 5% but levels off to about 1% per year as the number of consecutive dry years increases. But this 1% increase is still less than the expected long-term average annual increase of 1.3%.

Subtracting the annual average increase irrespective of hydrology, we see that demand in a *first consecutive dry year* causes a jump in demand of about 3.7%; but demand actually decreased from what it would have been as the number of consecutive dry years increases (see the bottom row on the following table). The fact that demand is less than expected in multiple dry-years is probably attributable to an increase in the "loudness" of the conservation messages and the community's awareness of and concern over water supply reliability and the environment.

Averagae annual increase in water demand -- depending on hydrology
For the years 1978 through 2000.

	For 22 Year Period	In Non-dry Years	In Consecutive Dry Years				
			1st Yr	2nd Yr	3rd Yr*	4th yr*	5th Yr*
Increase from Previous Year	1.3%	0.7%	5.0%	1.1%	0.8%	1.3%	-14.0%
Increase due to Hydrology (subtract average for 22-yr period)			3.7%	-0.3%	-0.5%	0.0%	-15.4%

** Only one data point in this time period.*

Applying these factors to estimate the demand for water in multiple dry-years, when the annual demand would have been 70,000 acre-feet if the hydrology were *Normal*, demand would jump about 2,579 acre-feet if it were a *1st Dry Year*. If it were a *2nd Dry Year* demand would be about 0.3%) less than the *1st Dry Year* that proceeded it, or about 72,384 acre-feet. And if it were a *3rd Dry Year* it would be about (-0.5%) less than the *2nd Dry Year* that proceeded it, or about 71,987 acre-feet.

Impact on water demand due to less than average rainfall.

	"Normal"	1st Dry Yr	2nd Dry Yr	3rd Dry Yr
% Increase due to hydrology		3.7%	-0.3%	-0.5%
SFR	46,324	48,031	47,902	47,640
MFR	16,510	17,118	17,072	16,978
Misc./Agg.	1,190	1,234	1,231	1,224
Comm/Ind	5,976	6,196	6,179	6,145
Total	70,000	72,579	72,384	71,987

These increases above *Normal* are accommodated in several ways. First, per the Central Basin judgement LBWD has storage rights in the

groundwater basin in excess of 6,000 af, or more than twice as much as the increase demand from a *1st Dry Year*. Second, as stated above, MWD has assured its member agencies (such as Long Beach) that it can meet projected water demands for the next twenty years. Third, in the unlikely event that MWD would not be able to meet the water needs of all of its service area, LBWD would be in a position to invoke its preferential right to the available MWD supplies.

VII. The Water Supply is sufficient for the proposed Project

A. Determination

As shown above and in the 2000 UWMP, LBWD will have the resources to meet the demand of the Project in normal hydrological events. The following table shows that the current supply of water will increase to accommodate the demands of the Project in dry year events as well. The increase in supply reflects LBWD's preferential right to MWD's supplies and MWD's commitment to regional water reliability. Not shown but available are is LBWD's right to pump its carryover storage and to access other groundwater supplies in case of emergency per the adjudication of the basin.

In most years what essentially takes place is LBWD pumps its groundwater APA (an essentially fixed amount of water) and makes up the difference between that amount and water demands by purchasing more or less water from MWD.

Current Supply and Demand: Hydrology and the impact of the Project

	Normal Year	1st Dry Yr	2nd Dry Yr	3rd Dry Yr	4th Dry Yr
Without Project					
Groundwater Supplies	32,684	32,684	32,684	32,684	32,684
Wholesale - MWD	37,316	39,895	39,700	39,303	39,303
Less non-Project Demand	(70,000)	(72,579)	(72,384)	(71,987)	(71,987)
Balance	-	-	-	-	-
With Project					
Groundwater Supplies	32,684	32,684	32,684	32,684	32,684
Wholesale - MWD	39,261	41,912	41,711	41,303	41,303
Less Project Demand*	(1,945)	(2,017)	(2,011)	(2,000)	(2,000)
Less non-Project Demand	(70,000)	(72,579)	(72,384)	(71,987)	(71,987)
Balance	-	-	-	-	-

* Assumes worse-case scenario of high water use and no use of recycled water.

- It should be noted that the 2000 UWMP was based, in part, on historical water demands at the site of the proposed Project. Because this had been a fully developed industrial site significant water use had been taking place there, water use assumed by the 2000 UWMP. Therefore, the above table over estimates the impact of the Project in the sense that it shows the high estimate of the Project's potential water use while not discounting the curtailment of water used by the previous tenants of the site.

The Project will not have an impact on the supply and demand for water in the fiscal year 2025 as the Project's demand has been anticipated in the 2000 UWMP:

FY 2025 Supply and Demand: Hydrology and the Impact of the Project

	Normal Year	1st Dry Yr	2nd Dry Yr	3rd Dry Yr	4th Dry Yr
With out Project					
Supply	84,360	87,481	87,219	86,783	86,783
Less non-Project Demand	(84,360)	(87,481)	(87,219)	(86,783)	(86,783)
Balance	-	-	-	-	-
With Project					
Supply	84,360	87,481	87,219	86,783	86,783
Less Project Demand	(250)	(259)	(258)	(257)	(257)
Less non-Project Demand*	(84,110)	(87,222)	(86,960)	(86,526)	(86,526)
Balance	-	-	-	-	-

* Because Project demand is accounted for in the UWMP, this value is adusted accordingly.

B. Governing body approval

If the assessment concludes that the supply is sufficient, the water supply governing body must approve assessment and deliver to the lead agency (per Water Code section 10910(g)(1):

> *(g)(1) ...the governing body of each public water system shall submit the assessment to the city or county no later than 90 days from the date on which the request was received. The governing body of each public water system...shall approve the assessment prepared pursuant to this section at a regular or special meeting.*

LBWD received the request for an assessment of the Project on November 13, 2002; and must provide the approved assessment within 90 days, or by February 11, 2003.

VIII. The Project is a "subdivision" under SB 221

This Project is considered a subdivision by SB 221, Government Code section 66473.7 (a)(1) if:

> *(a)(1) "Subdivision" means a proposed residential development of more than 500 dwelling units, except that for a public water system that has fewer than 5,000 service connection…*

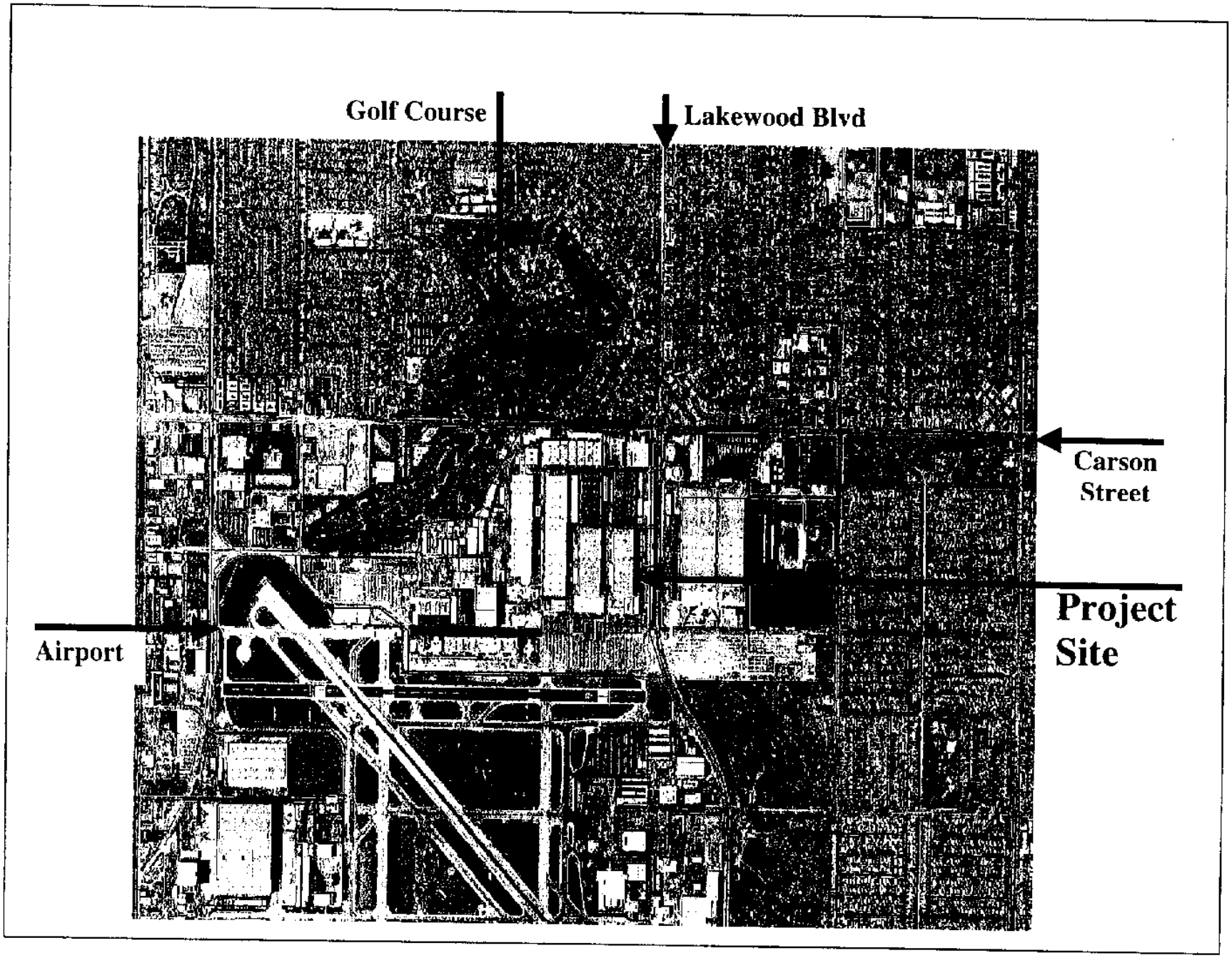
The Project is a "subdivision" as defined by SB221's Government Code 66473.7(a)(1), having more than 500 dwelling units when the public water system (LBWD) has more than 5,000 services.

IX. The Project is exempt from SB 221

The Project, although a "subdivision" under SB 221, is exempt from SB 221 because it will be developed at a site within an urbanized area that had been previously developed for urban use. It is further exempted because the immediate contiguous properties surrounding the proposed Project site are, or previously have been, developed for urban uses. Government Code section 66473.7(i) states:

> *(i) This Section shall not apply to any residential project for a site that is within an urbanized area and has been previously developed for urban use, or where the immediate contiguous properties surrounding the residential project site are, or previously have been, developed for urban uses….*

As depicted in the following photograph, the current site of the proposed Project is within an urbanized area and is currently developed and that the immediate contiguous properties surrounding the Project are developed for urban uses.


Golf Course
Lakewood Blvd
Carson Street
Project Site
Airport

X. Appendix

A. Request for SB 221 & SB610 Assessment and Certification.

B. Kimley-Horn and Associates letter dated November 12, 2002.

C. Central Groundwater Basin Adjudication

D. Watermaster Service in the Central Basin, Los Angeles County, July 1, 2001 - June 30, 2002

E. Report on Metropolitan's Water Supplies; Introduction and findings only.

F. Long Beach Water Department 2000 Urban Water Management Plan

Appendices A-F of the Water Supply Assessment are on file at the City of Long Beach

Appendix T

Sewer Master Plan Study

Sewer Master Plan Study

PacifiCenter @ Long Beach

December, 2003

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1. Introduction

This Sewer Master Plan Report provides the following information for the PacifiCenter project:

- A description of the existing sewer environment;
- An analysis of the existing and proposed wastewater collection system and treatment capacity; and
- A description of the project's impacts relative to the sewer system and treatment capacity.

Kimley-Horn and Associates, Inc. prepared this report as a part of the Master Planning and preliminary design efforts for Boeing Realty Corporation.

1.1 Site Background

The PacifiCenter site is located approximately 5 miles northeast of downtown Long Beach and immediately north of the Long Beach Municipal Airport. A majority of the site (approximately 238 acres) is located within the City of Long Beach, while the remaining portion of the site (approximately 23 acres) is within the City of Lakewood. In general, the project site is bound by Carson Street to the north, the airport to the south and southwest, Lakewood Boulevard to the east, and the Lakewood Country Club and Airport to the west.[1] Figure SS-1 identifies the project site and the current City of Lakewood and City of Long Beach boundary.

Prior to 1941, the PacifiCenter site was undeveloped and generally consisted of relatively flat, grassy areas. In 1923, the adjacent Long Beach Airport (then known as Daugherty Field) began operations that included an unpaved open airfield with hangars located to the southwest of the project site. In order to meet the aircraft production requirements of World War II, the United States of America War Assets Administration purchased the project site and adjacent properties in 1941 and began constructing an aircraft production facility that was known as the Long Beach C-1 facility, which was operated by the Douglas Aircraft Company.

By 1945, the Long Beach C-1 facility was fully operational. The Long Beach C-1 facility thereafter became Douglas Aircraft Company's largest production center. At its peak, the facility included approximately 1.4 million square feet of covered workspace, produced one plane every hour, and employed over 50,000 workers.

During the years following the end of World War II, employment at the C-1 facility declined to approximately 1,000 employees. As a result, in 1947, the Douglas Aircraft Company started to acquire portions of the C-1 facility from the United States government. The acquisition of the entire C-1 facility was completed in 1961. In 1967, the Douglas Aircraft Company merged with the McDonnell Aircraft Company to form the McDonnell Douglas Corporation, which was subsequently acquired in 1997 by the Boeing Company. Between the 1960s and early 1990s, growth in commercial aviation increased on-site employment to approximately 40,000 employees. To date, the types of on-site operations associated with aircraft production have included office, research and

[1] Although analyzed as part of the project, a small portion (less than one acre) of the PacifiCenter site on the southwest corner of Lakewood Boulevard and Carson Street is not currently under Boeing ownership.

development (R&D), manufacturing and processing, assembly and subassembly, material storage, testing and laboratories, and ancillary aviation-related services.

1.2 Existing Conditions

The existing Boeing facilities on the PacifiCenter site until recently included over five million square feet of total floor area. [2] The majority of the existing development consists of large corrugated metal industrial buildings and airplane hangars as indicated in the aerial photograph provided in Figure SS-1. These low-rise to mid-rise industrial and R&D buildings are located throughout the project site and generally range between 30 to 90 feet in height and from 2,000 up to approximately 500,000 square feet in floor area. In addition, the site includes a nine-story former executive office building along Lakewood Boulevard. The remainder of the project site is paved with asphalt or concrete. An engine run-up and aircraft testing area is located adjacent to the Airport in the southwest corner of the site.

Currently, most of the aviation-related uses and activities on the project site have been discontinued. However, the remaining 379,500 square feet of existing on-site floor area is being used for production associated with Boeing's C-17 and 717 aircraft, including final aircraft preparation, ground support, receiving and/or customer operations, aircraft testing, and ancillary support functions. This area, known as the Boeing Enclave, is located within the western portion of the project site as indicated in Figure SS-1 and consists of approximately 48 acres. The primary C-17 and 717 plants are located adjacent to the project site along the west side of the Airport and on the east side of Lakewood Boulevard, respectively.

Development of the PacifiCenter project on this site will result in the replacement of existing buildings and structures with new R&D, light industrial, office, retail, hotel, residential, and potentially the continuation of a small amount of aviation-related uses. The PacifiCenter is anticipated to be fully developed by the year 2020. [3]

1.3 Study Objective

The objective of this study is to define a preliminary plan for the proposed on-site sewage collection system and to identify potential environmental impacts to the citywide and countywide systems that may result from the development of the PacifiCenter Project. The study analyzes existing conditions and future development on the site and presents the proposed on-site sewer improvements.

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[3] Project Description Provided by PCR..

2. Existing Conditions

Kimley-Horn has reviewed documents and files from the City of Long Beach, the City of Lakewood, and the County of Los Angeles Sanitation District (CSDLA) Number 3. The documents and files reviewed included basin-wide maps, conceptual plans of the proposed project, and plans of the proposed improvements. Section 5 of this report lists the references used. The aerial photo illustrated in Figure SS-1 identifies the project site and the current City of Lakewood and City of Long Beach Boundary.

2.1 Topography

The PacifiCenter site is topographically flat with a 24 foot elevation difference across the site from west to east, which is a distance of 5,800 feet.[4] The resultant grade is approximately 0.4 percent.

2.2 Regional Sewer System

The site sewer system, which includes both public and private lines, generally runs north to south and west to east. The public sewer system flows west to east. The on-site sewer point of discharge is located at the southeast corner of the site where it discharges into the public system owned by the City of Long Beach.

The City of Long Beach Water Department (LBWD) provides sewer services for the 238 acre project site located in the City of Long Beach. The 23 acres of the project located in the City of Lakewood is provided sewer service directly by CSDLA. However the CSDLA line that provides sewer service to the Lakewood portion of the site drains directly into the LBWD sewer line that provides sewer service to the Long Beach portion of the site. The City system consists of collection pipelines and pump stations. The City maintains over 760 miles of sewer mains and collects approximately 40 million gallons per day (MGD) of raw sewage from residential and industrial sources. The City sewer system includes pipelines varying from 4 inches to 30 inches in diameter and 29 pump stations throughout the City. These pipelines collect wastewater from individual developments and convey the wastewater to trunk lines and into regional interceptors for treatment at the Long Beach Water Reclamation Plant (LBWRP) located in El Dorado Park in the City of Long Beach or the Joint Water Pollution Control Plant (JWPCP). A stop valve located at the intersection of Clark Avenue and East Atherton Street is electronically controlled, allowing sewage to be conveyed to either facility. The reclaimed water from the LBWRP is used for landscape irrigation throughout the City and will be used to irrigate the landscaping in areas of the PacifiCenter project. The sewage that is not intercepted and treated at the LBWRP continues in the CSDLA'S system to the JWPCP in the City of Carson. Both the LBWRP and the JWPCP are owned and operated by the CSDLA.

The CSDLA also provides sewer services for the City of Lakewood, which includes the 23 acre portion of the project site located in Lakewood. The sewer lines in the Lakewood portion of the project site convey the wastewater to the trunk lines and into regional interceptors for treatment at the LBWRP or the JWPCP.

[4] PSOMAS Survey performed October 20, 1999.

Figure SS-2 depicts the regional system receiving sewage flow generated from the Boeing site. The figure shows the sewer mains owned by the CSDLA and the direction of flow. Also shown are sewer lines owned by the CSDLA that serve the City of Lakewood and flow into the City of Long Beach system on the Boeing site approximately 3,300 feet easterly of old Lakewood Boulevard. The LBWD sewer extends from the CSDLA's sewer to join the CSDLA's trunk sewer located in Clark Avenue. The wastewater flow originating from the project site ultimately discharges to the CSDLA's Joint Outfall "A" Unit 1A, North Long Beach Interceptor Trunk Sewer (NLBITS) located in Clark Avenue at Conant Street. This 30 inch diameter sewer has a capacity of 9 MGD (14 cubic feet per second (CFS)) and conveyed a peak flow of 3.9 MGD (6 CFS) when last measured in 1998.

Under existing conditions, wastewater that would be generated by the PacifiCenter project will be treated at the JWPCP or LBWRP. The JWPCP has a design capacity of 385 MGD (596 CFS) and currently processes an average flow of 326.5 MGD (505 CFS). The LBWRP has a design capacity of 25 MGD (38.7 CFS) and currently processes an average flow of 18 MGD (27.8 CFS).[5] Both facilities have sufficient remaining capacity available for treating flows discharged from the project.

In a May 23, 2001 letter from James Stahl, Chief Engineer and General Manager of the County Sanitation Districts of Los Angeles County, to Gerry Felgemaker, Environmental Manager of the City of Long Beach, Mr. Stahl confirmed that adequate treatment capacity was available at the two plants.[5] He stated:

> "The wastewater generated by the proposed project will be treated at the JWPCP located in the City of Carson or the LBWRP. The JWPCP has a design capacity of 385 MGD and currently processes an average flow of 334.4 MGD. The LBWRP has a design capacity of 25 MGD and currently processes an average flow of 19.1 MGD."[5]

The available capacity of the Districts' treatment facilities is limited to the levels associated with the forecasted growth identified by the Southern California Association of Governments (SCAG). The PacifiCenter project growth as described in Section 3 is consistent with the forecasted growth identified by SCAG for the County.

2.3 Local Sewer System

The existing sewage flows generated on the PacifiCenter site are discharged into one of two pipelines. The first pipeline is a private 15 inch sewer that belongs to Boeing and extends from its connection with the NLBITS at the intersection of Conant Street and Clark Avenue to private internal Boeing systems running east and west upstream of the street intersection along Lakewood Boulevard. This 15 inch sewer carries only flows from the Boeing property. No flows from outside Boeing enter this pipeline.

The second pipeline is a public line that extends from the NLBITS at Conant Street and Clark Avenue beyond the project to the west, where it intercepts flow from areas of Long Beach and Lakewood. At its downstream point, the pipeline is 21 inches in diameter between Clark Avenue and

[5] May 23, 2001 letter from Ruth Frazen, County Sanitation District. Appendix D.
Updated on June 3, 2003 telephone conversation with Ruth Frazen of CSDLA. Updated flows as of March 2003.

Lakewood Boulevard; it continues west upstream where it changes from 21 inches to 18 inches and then joins the 15 inch CSDLA's pipeline. The project site connects to this line at five locations, including a line that is pumped from the area to the south of the Conant Street extension. The public sewer line is owned by the CSDLA to a point approximately 3,300 feet west of Lakewood Boulevard where it becomes a City of Long Beach sewer line. The upstream portion of this sewer line is owned by the CSDLA because it serves the Cities of Lakewood and Long Beach, and Lakewood's sewer service is provided exclusively by the CSDLA.

Figure SS-3 depicts the existing trunk sewer system in the project area and the system's connection to the CSDLA NLBITS. The City of Long Beach's portion of the PacifiCenter site is in the LBWD's Sewer Service Area 9. Figure SS-3 also illustrates the service area's boundary. The manhole numbers on the Figure correspond to the pipe segment capacities summarized in Table 1 and were compiled from the LBWD's records.

Table 1: Existing Sewer System Capacity

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
Clark to Lakewood Blvd	253	21 inch	0.0012	5.00	5.49
Lakewood to 400' upstream	255	18 inch	0.0040	6.05	6.64
400' to 1300'	256	18 inch	0.0018	4.06	4.46
1300' to 1700'	257	18 inch	0.0020	4.28	4.69
1700' to 2150'	258	18 inch	0.0014	3.58	3.93
2150' to 2300'	259	18 inch	0.0019	4.17	4.58
2300' to 3300'	260	18 inch	0.0010	3.02	3.32
(a) 3300' to property line	261	15 inch	0.0048	4.08	4.47
[illegible]					
Clark to Lakewood Blvd	270	15 inch	0.0012	2.04	2.24
(a) This is owned by CSDLA.					

Several of the existing Boeing connections to these two sewer lines have meters to measure flow into the public system. The data from these meters are combined into annual reports that are included in the Appendix of this document. Table 2 on the following page summarizes the last ten years of data obtained from the Boeing facilities group. Figure SS-4 illustrates the meter locations.

Meter No. 807 measures flows from the 23 acre portion of the Boeing site that is in the City of Lakewood. Meter No. 805 measures flows from the north central portion of the site. Three other sewer lines that serve the central portion of the project site discharge directly into the 21 inch CSDLA/Long Beach sewer without meters. The flows from Meter No. 807, Meter No. 805, and from the three other un-metered lines discharge to the 21 inch CSDLA/Long Beach sewer line that connects to the CSDLA'S system at Clark Avenue. Meter No. 804 measures flows from the sewer system that serves most of the large manufacturing buildings in the eastern portion of the project site. The flows through Meter No. 804 discharge into the 15 inch private Boeing sewer line that connects to the CSDLA'S system at Clark Avenue. The 21 inch and the 15 inch sewer lines are independent

and do not connect until they reach the CSDLA'S system at Conant Street and Clark Avenue (Figures SS-3 and SS-4).

Table 2: Boeing Metered Sewage Flow Summary
(All flows are based on actual measurements)

Meter Number	Annual Flow (MG)	Peak Flow (GPM)	Meter Number	Annual Flow (MG)	Peak Flow (GPM)
Years 1990/1991			Years 1995 / 1996		
804	279.72	1183	804	219.10	874
805	21.95	217	805	8.54	198
807	16.39	41	807	0.52	90
Years 1991 / 1992			Years 1996 / 1997		
804	215.27	1201	804	219.82	692
805	33.04	33	805	10.07	69
807	8.40	45	807	0.38	45
Years 1992 / 1993			Years 1997 / 1998		
804	288.13	1546	804	215.53	702
805	28.69	289	805	12.90	85
807	11.79	6	807	0.65	53
Years 1993 / 1994			Years 1998 / 1999		
804	267.50	1404	804	200.60	666
805	8.19	57	805	11.81	74
807	3.00	205	807	0.27	63
Years 1994 / 1995			Years 1999 / 2000		
804	217.32	1137	804	206.67	680
805	8.08	66	805	5.47	68
807	1.96	150	807	0.35	75
			Years 2000/2001		
			804	67.79	580
			805	6.81	121
			807	0.55	98

2.4 Regulatory Framework

Wastewater from the Cities of Long Beach and Lakewood is treated at the CSDLA's JWPCP or the LBWRP. The CSDLA is empowered by the California Health and Safety Code to charge a fee for connecting, directly or indirectly, to the CSDLA's sewage system, or to increase the existing strength and/or quantity of wastewater attributed to a particular parcel or operation already connected. The sewage system proposed as part of the PacifiCenter project will be designed according to the City of Long Beach Design Standards for all pipelines within the City of Long Beach. For the area of the site located within the City of Lakewood, CSDLA'S design standards will be used.

The LBWD's Rules and Regulations specify standards for industrial wastewater discharge. No discharge of industrial wastewater into a main line sewer is allowed unless it conforms to the following requirements:

- The content of total oil and grease shall not exceed six hundred milligrams per liter;
- The content of floatable oil and grease shall not exceed twenty-five milligrams per liter;
- The content of floatable hydrocarbon oil shall not exceed ten milligrams per liter;
- The standard five day biochemical oxygen demand shall not exceed one thousand milligrams per liter;
- The suspended solids content shall not exceed one thousand milligrams per liter;
- The dissolved sulfide content shall not exceed one tenth of a milligram per liter; and
- The pH shall not be below six (6.0).

The proposed PacifiCenter project will meet all of these requirements. The residential wastewater discharges would also be subject to these standards; however, the typical residential wastewater contains only human waste and food products.

3. Proposed Improvements

The on-site sewage system proposed as part of the PacifiCenter development will replace most of the existing aging system. The sewage expected to be generated from the PacifiCenter project has been estimated using the City of Long Beach's average wastewater generation factors for both the City of Lakewood's portion and the City of Long Beach's area.

As specified in the LBWD Rules and Regulations, the smallest size sewer line allowed is 8 inches. Main line sewers, up to 15 inches in diameter, will be designed to flow one-half full and 18 inch diameter or larger sewers will be designed to flow three quarters full. All main line sewers will be designed to provide a minimum velocity of two feet per second unless the gradient required to meet the two feet per second velocity is unfeasible. In such cases, the LBWD approval will be obtained. Currently, all proposed sewer lines within the PacifiCenter meet these criteria. In October 1991, Boyle Engineering completed a Sewer Master Plan Study for the LBWD that included the PacifiCenter site. The proposed sewer flows calculated from the PacifiCenter site are consistent with the methodology presented in the Boyle study. [6]

The proposed sewer system was analyzed using Manning's equation for pipe flow to determine the capacity of the main sewer network serving the proposed land use areas. The City of Long Beach's criteria (as derived from the County of Los Angeles Sewer Design Manual), the calculations to determine sewer pipe capacity and size utilizes a depth-to-diameter (D/d) design criteria of 0.75 (assume ¾ full for pipe capacity) for pipe sizes 18 inches in diameter or larger, and a D/d of 0.50 for pipes less than 18 inches in diameter were used. However, in determining the capacity of the existing 15 inch diameter sewer line, the CSDLA allows D/d to be equal to 0.75. New 15 inch lines need to be designed for D/d equal to 0.50. The sizing of sewer pipelines is based on the calculated peak flow. The peak sewage flows were calculated using the following equation:

$$Q_{peak}=2.04 * (Q_{Average})^{0.983}$$

Where,

Q is sewage flow in CFS.

[6] Long Beach Water Department, Sewer System Master Plan, Boyle Engineering.

The average sewage flow represents the typical expected flow at buildout using average flow factors for the type of development being proposed. It is the total flow past a specific point over a period of time divided by the number of days in that period of time. The average flow is used for assessing the capacity of systems, such as treatment plants, which are sized based on total volume of flow. The peak sewage flow represents the maximum momentary load placed on sewage facilities. Peak sewage flows are used for sizing sewer pipelines, pump stations, and other sewage facilities.

The calculations for the average and peak sewage flows were based on the proposed land uses for the project site. Figure SS-5 illustrates the land uses. The proposed project development incorporates the following primary land uses:

- Commercial (C) (R&D, office, hotel, retail, and light industrial uses);
- Residential (R1-R8) (low to medium density units); and
- Residential (R9-R12) (medium to high density units).

In determining the maximum impact the development plan would have on the proposed and existing systems, a number of development scenarios were examined. It was determined that the scenario presented in this report is a potential alternative. To optimize the ability to respond to market conditions, the PacifiCenter project includes development flexibility that allows the project to be market-driven within approved limits. The proposed land use plan allows up to approximately 3,300,000 SF of floor space for the areas designated commercial and 2,500 housing units within the housing designated areas. In addition to commercial and residential use for this site, up to 400 hotel rooms would be allowed within the commercial areas. Furthermore, a retail overlay zone allowing up to 150,000 SF of retail uses will be established along a portion of the interface between the commercial and housing areas adjacent to A Street and east of 1st Street. This retail space is included in the 3,300,000 SF of designated commercial floor space. Retail floor space is also allowed within any of the commercial areas as a part of the allowed commercial square footage. Table 3 identifies the maximum development for each land use category.

The land use types and either the square footage or the number of dwelling units (DU) were used to determine flow for the area's tributary to the proposed sewer collection system, utilizing the specific land-use based flow generation factors shown in Table 4. Table 5 summarizes the calculated peak flows for the proposed sewer system. A detailed spreadsheet showing the flow calculations is included in the Appendix.

In determining sizes of the proposed sewer lines as well as the impact on the existing sewer lines that extend to the east from Lakewood Boulevard, the inclusion of a 400-room hotel within one of the commercial areas needed to be considered. The 400-room hotel will have the maximum impact on the proposed sewer system if they are located within the most westerly commercial parcel along A Street. To accommodate the potential hotel location, the sewer line C within A and B Street was sized so that all 400 hotel rooms would drain into the 21 inch sewer line. There is also the potential for the hotel to be located on the northeastern most commercial parcel. Therefore, the proposed sewer line south of A Street along Lakewood Boulevard was also sized to allow the 400 hotel rooms to drain into the existing 15 inch sewer line. (See Figure SS-6)

Table 3: Development Intensities by Parcels

Parcel Development Unit	Commercial SF	Rooms	Housing DU
R1			161
R2			150
R3			132
R4			207
R5			99
R6			137
R7			95
R8			95
R9			356
R10			356
R11			356
R12			356
C1	178,000		
C2	90,000		
C3	292,500	400 (b)	
C4	137,000		
C5	146,300		
C6	213,400		
C7	210,500		
C8	211,500		
C9	223,000		
C10	221,900		
C11	222,800		
C12	212,100		
C13	229,200		
C14	228,800		
C15	230,800		
C16	252,200		
Total	3,300,000	400	2500

(a) Areas for the Planned Development Unit were used to determine sewer flows from areas based on anticipated land use and are not to be interpreted as specific parcels for the site or ultimate development intent of a specific parcel.

(b) Hotel rooms would be allowed within any of the commercial designated areas. It is assumed that locating the hotel in the most westerly commercial parcel will provide the maximum impact to the proposed sewer system.

(c) 150,000 SF of retail floor space is included within the commercial parcels but is allowed along north side of A street adjacent to the High density residential areas

Table 4: Sewer Discharge Coefficients [1]

[illegible]	[illegible]	[illegible]
Office	200 gallons per 1,000 sf per day	
Retail	200 gallons per 1,000 sf per day	
Hotel	150 gallons per room per day	
Research and Development	200 gallons per 1,000 sf per day	
Light Industrial	223 gallons per 1,000 sf per day (a)	Assume 50% of commercial is Light Industrial
Housing	85 gallons per person per day	2.5 persons per DU
(a) Equivalent to 0.008 CFS/Acre.		

Footnote:

[1]Coefficients excerpted from City of Long Beach Water Department Tables located in Appendix I of this report and modified for this project. Same coefficients used for the Lakewood portion of the development.

Table 5: Proposed Sewage Flow

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tributary to 15 inch sewer	Lakewood Blvd.	MH44	40	0.78	1.21	1.21
Tributary to 21 inch sewer	1st Street south to A Street to 2nd Street south	MH7	81.4	0.71	1.10	
	A Street to 3rd Street 3rd to B St. B Street from 3rd Street to 2nd B Street to Lakewood	MH18 MH31 MH7 MH13	221	3.18	4.92	4.92 (a)
Total						6.13

(a) Flows shown are accumulated in-line flows at the manholes, including trunk lines running south on 1st Street to A Street to 2nd Street. Flows include existing offsite flows of 1.91 CFS entering PacifiCenter project and proposed discharge from the 400-room hotel. Subtracting the existing offsite flow of 1.91 CFS, the proposed project discharges 4.92 CFS – 1.91 CFS = 3.01 CFS into the 21 inch sewer.

Table 6 is a summary of average and peak flows from this site. The peak Boeing measured flow is from the flow data previously summarized in Table 2. The baseline peak flow is based upon the current square footage of occupied industrial space on the project site and the flow factors from the

LBWD. The baseline peak flow of 0.28 CFS for the existing Boeing manufacturing facilities was calculated using 379,500 square feet of floor area and a flow rate from the City of Long Beach standards of 223 gallons per 1,000 square feet per day. The total proposed peak flow into the existing 15 inch sewer along Conant Street is 1.21 CFS. The total peak flow into the existing 21 inch sewer along Conant Street is 4.92 CFS, with 3.01 CFS coming from the proposed development. Therefore, the total proposed peak flow calculated for the proposed PacifiCenter project at full development was determined to be 4.22 CFS. The baseline peak flow of 0.28 CFS is 3.94 CFS less than the estimated future PacifiCenter peak flow of 4.22 CFS.

Table 6: Average & Peak Sewage Flows Summary
(Project Site Only)

Sewer	Avg. Daily Flow (CFS)	Avg. Daily Flow (MGD)	Peak Flow (CFS)	Peak Flow (MGD)	Notes
Boyle Master Plan (calculated)	1.90	1.23	3.84	2.48	At Future Buildout
Boeing (measured)	2.03	1.31	4.10	2.65	1992/1993 Peak
Baseline (calculated)	0.13	0.08	0.28	0.18	Boeing Facility 0.379 MSF
PacifiCenter (calculated)	2.05	1.32	4.22	2.73	At Project Buildout

The remaining capacity of the local sewer system was analyzed to determine if the downstream system could handle the projected sewage volume from the planned development. The capacity of the 15 inch line is 2.04 CFS and of the 21 inch is 5.04 CFS, for a total of 7.04 CFS (based on both pipes being 75 percent full). The estimated sewage peak flow generated from the project into the existing 15 inch and 21 inch sewers at buildout is 2.73 MGD or 4.22 CFS. The off-site flow into the CSDLA'S sewer line at the westerly site Boundary is 1.91 CFS for a total of 6.13 CFS sewage generation at the site boundary. The total peak discharge from the project plus the off-site area (6.13 CFS) is less than the available capacity (7.04 CFS) of the existing sewer system serving the project area; there is adequate capacity in the downstream system for the project flows. This requires splitting the flow between the private 15 inch line and the public 21 inch line. The split will be an interconnect at strategic manholes in the upper region of the two lines, which will help equalize the flow between the private 15 inch line and the public 21 inch line. To be able to split the flows between the two lines, the private 15 inch line will need to be dedicated to the City of Long Beach as a public facility. The LBWD has considered this to be achievable, but the existing 15 inch sewer utility will need to be video inspected in the presence of the City of Long Beach's engineering staff. Any deficiencies from the City of Long Beach's standards for sewer lines will have to be corrected before the 15 inch line would be accepted as a public facility.

The sewer system improvements on-site shall be constructed concurrently with the street improvements to accommodate future buildout of the site and not at a specific development increment or threshold. This ensures that the sewer system improvements will be constructed in a logical manner and will reduce the potential for additional trenching and resurfacing of streets for subsequent sewer system improvements. Figure SS-6 depicts the proposed sewer line sizes and locations. Table 7 on the following page identifies the corresponding size and slopes of the network of sewers that drain to the sewers in B Street.

Table 7: Proposed Sewer System

Lakewood Blvd.-LINE A			
Reach 1A	8	350	.0040
Reach 2A	8	350	.0040
Reach 3A	10	350	.0032
Reach 4A	12	350	.0024
Reach 5A	12	350	.0024
Reach 6A	15	230	.0016
Reach 7A	15	230	.0016
1st Street to A St.–LINE B			
Reach 1B	8	350	.0040
Reach 2B	8	350	.0040
Reach 3B	8	350	.0040
Reach 4B	10	350	.0032
Reach 5B	10	635	.0032
A Street to 2nd St.-LINE B			
Reach 6B	8	350	.0040
Reach 7B	8	350	.0040
Reach 8B	10	350	.0032
Reach 9B	12	350	.0024
Reach 10B	12	320	.0024
A Street to 3rd St. LINE C			
Reach 1C	10	350	.0032
Reach 2C	10	700	.0032
Reach 3C	10	350	.0033
Reach 4C	10	250	.0032
Reach 5C	10	250	.0032
Reach 6C	12	164	.0024
Reach 7C	15	171	.0020
Reach 8C	18	82	.0020
Reach 9C	18	700	.0020
Reach 10C	18	250	.0025
Reach 11C	21	400	.0020
Reach 12C	21	350	.0020
Reach 13C	21	600	.0022
Reach 14C	21	500	.0024

4. Project Impacts

4.1 Thresholds of Significance

A project would normally have a significant impact on wastewater services if, after completion and construction of project related infrastructure:

- The increase in project-generated wastewater would exceed the existing or planned capacity of the wastewater collection system and/or wastewater treatment plants serving the site by a substantial magnitude; or
- Alteration to existing infrastructure would substantially reduce or inhibit the ability of the sewer system to serve the project and area surrounding the project site.

Neither of these significant thresholds will be triggered by the PacifiCenter development, which is summarized below.

4.2 Project Design Features and Benefits

The sanitary sewer features and impacts resulting from the PacifiCenter project include:

- The proposed project would implement project features that include sewer system improvements designed to provide adequate sewer service to all future development on site. This new infrastructure will not impose significant impacts on the existing municipal facilities. The downstream pipelines and treatment plants have adequate capacity for the additional discharge from the project. There will be no construction related impacts resulting from public sewer replacement or upgrades outside of the project site. The private 15 inch sewer being dedicated to the City of Long Beach may require minor improvements as a condition of acceptance to the City.
- The North Long Beach Interceptor Trunk Sewer has adequate capacity for the additional flow generated by the project. The 30 inch sewer has a capacity of 14 CFS and measured peak flow of 6 CFS. The remaining 8 CFS of capacity is much greater than the maximum demand flow from the proposed project.
- The Long Beach Water Reclamation Plant has adequate capacity to treat the flow generated by the project. The design capacity of the plant is 25 MGD (38.7 CFS) and the plant currently treats 18 MGD (27.8 CFS), leaving an available treatment capacity of 7.0 MGD (10.8 CFS).
- The Joint Water Pollution Control Plant has adequate capacity to treat the flow generated by the project. The design capacity of the plant is 385 MGD (596 CFS) and the current plant flow is 326.5 MGD (505 CFS), leaving an available treatment capacity of 58.5 MGD (91 CFS).
- The project will comply with applicable County and City requirements for design and construction of new sewer facilities.
- The proposed project will replace the aging existing infrastructure within the PacifiCenter site with a new system that is in the proposed roadway right-of-way with connections to the individual building lots. The new sewer infrastructure will be durable and reliable with little possibility of sewer line breaks, infiltration, or leaks resulting from material failures.

Kimley-Horn and Associates, Inc.

5. References

- City of Long Beach, Department of Public Works, Handbook of Design Standards, June, 1995.
- City of Long Beach, Water Department; Rules, Regulations and Charges Governing Potable Water, Reclaimed Water, Sewer Service, and the Emergency Water Conservation Plan.
- "Long Beach Water Department Sewer Calculations and Improvement Map".
- Los Angeles County Sanitation District Sewage Design Manual.
- Watson, Montgomery, "Long Beach C1 Facility Spill Containment Plan", McDonnell Douglas Corporation, September, 1994.

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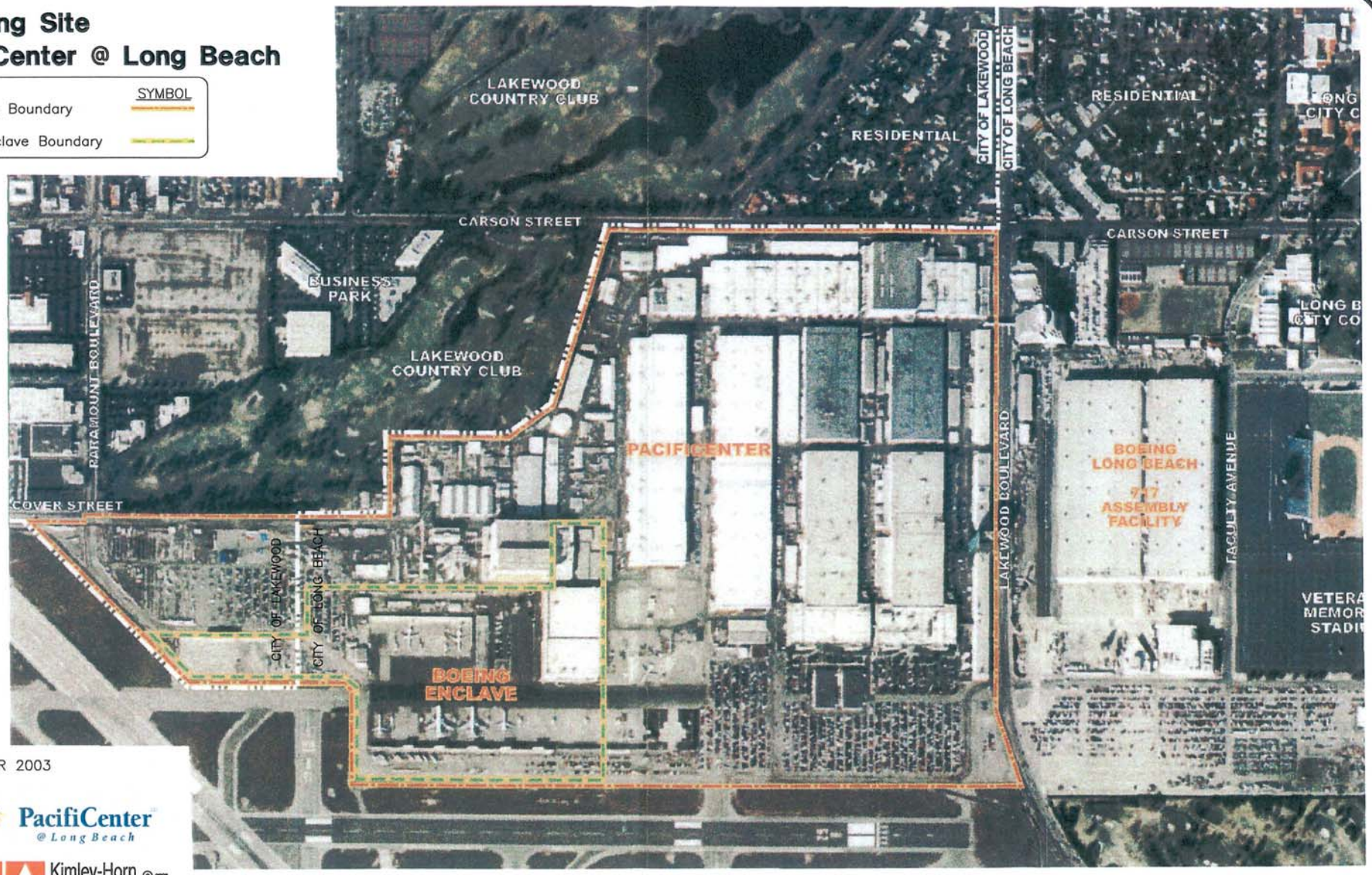
Existing Site
PacfiCenter @ Long Beach

LEGEND	SYMBOL
Subdivision Boundary	
Boeing Enclave Boundary	

NORTH



DECEMBER 2003

PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc.

Figure SS-1

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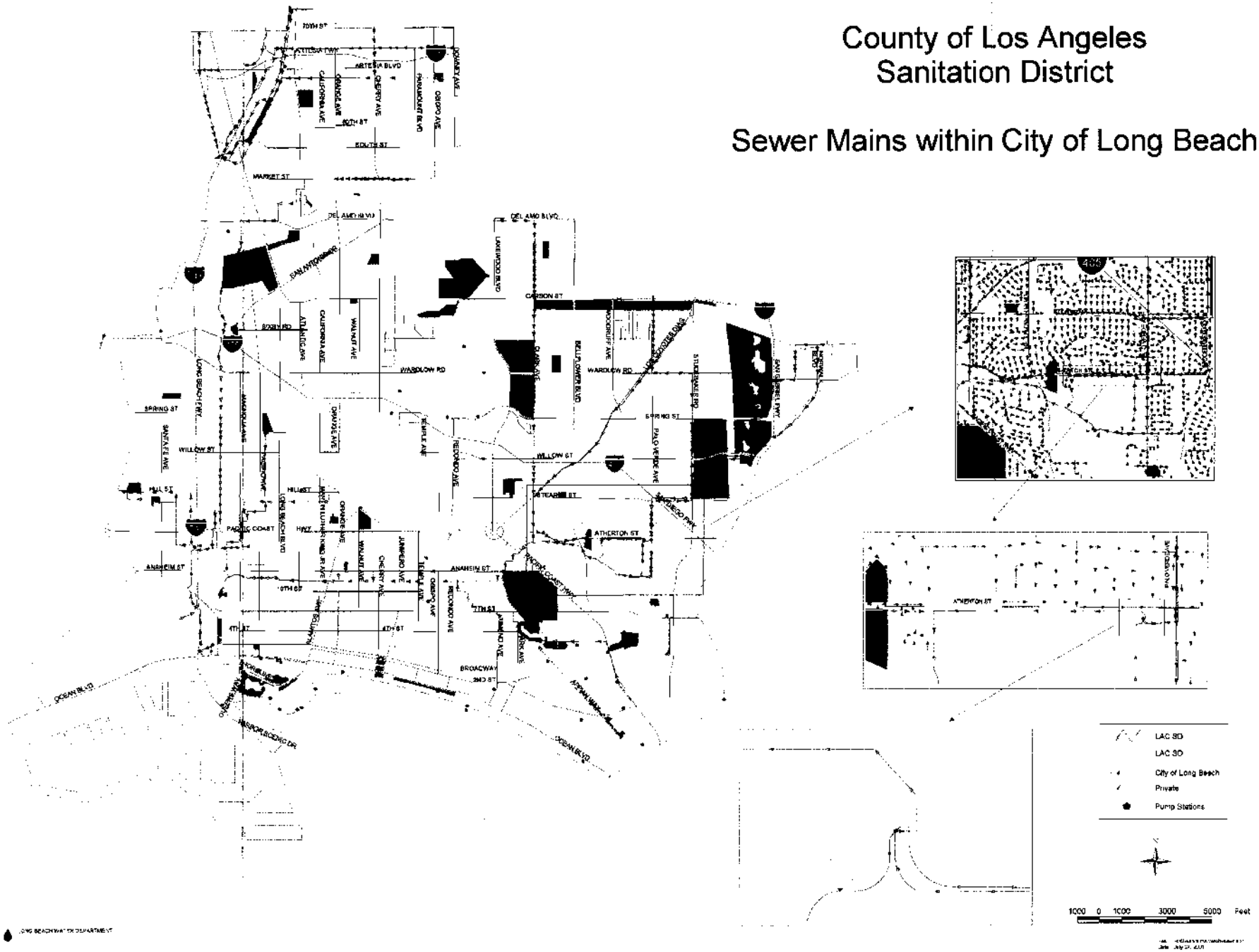
County of Los Angeles
Sanitation District

Sewer Mains within City of Long Beach



PacifiCenter

KIMLEY-HORN AND ASSOCIATES

Figure SS-2

DECEMBER 2003

Not to Scale

LEGEND	SYMBOL
260 ACRE BOEING SITE	
SERVICE AREA BOUNDARY	
LONG BEACH WATER DEPARTMENT TRUNK SEWER SYSTEM	
L.A. COUNTY SANITATION DISTRICT TRUNK SEWER SYSTEM	
PRIVATE SEWER SYSTEM	
EXISTING MANHOLE + IDENTIFICATION NUMBER	•254

Existing Trunk System
Sewer Service Area 9
PacifiCenter • Long Beach

Figure SS-3

PacifiCenter @ Long Beach

KIMLEY-HORN AND ASSOCIATES

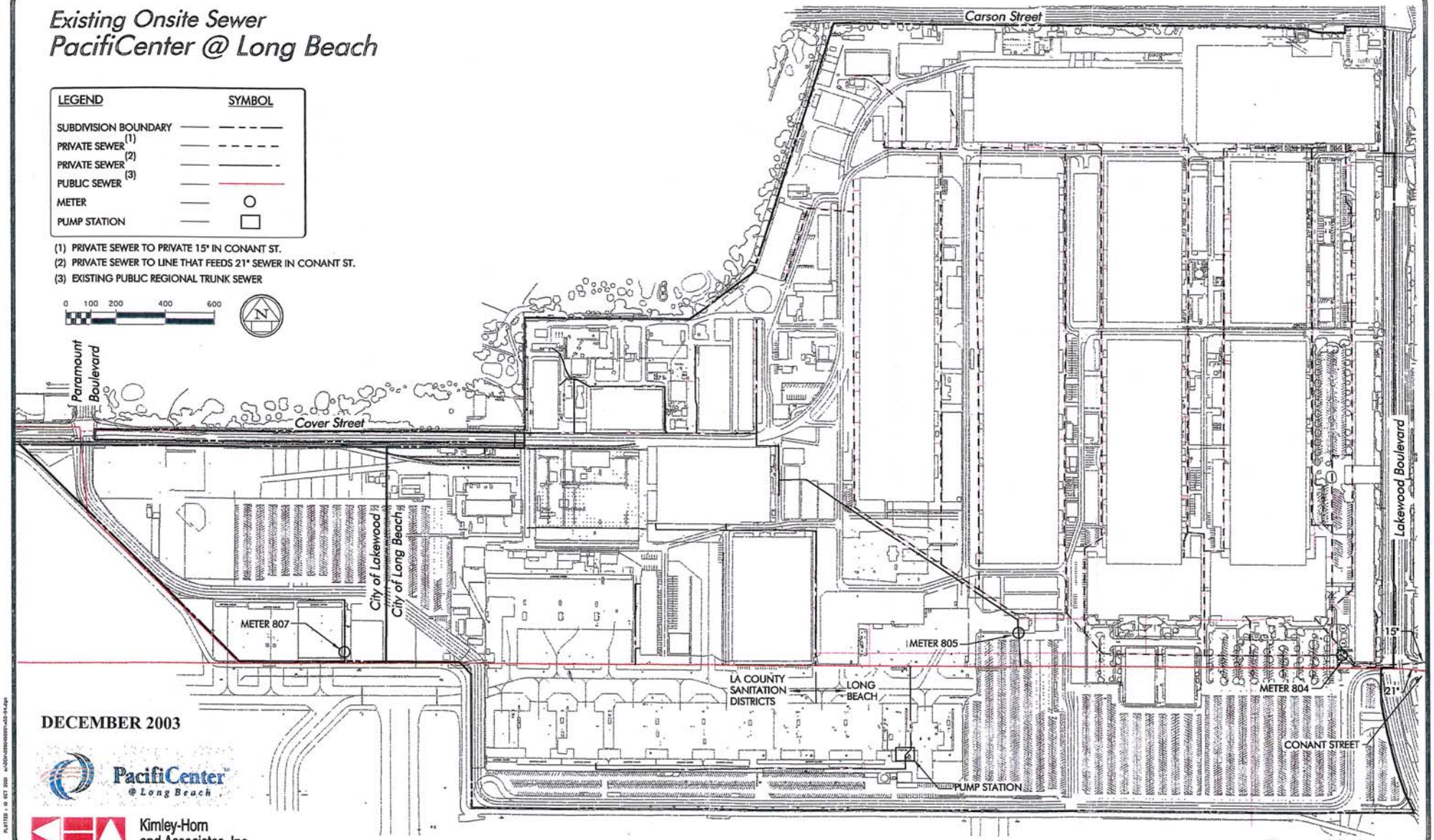
DECEMBER 2003

Existing Onsite Sewer
PacifiCenter @ Long Beach

LEGEND	SYMBOL
SUBDIVISION BOUNDARY	
PRIVATE SEWER (1)	
PRIVATE SEWER (2)	
PUBLIC SEWER (3)	
METER	○
PUMP STATION	□

(1) PRIVATE SEWER TO PRIVATE 15" IN CONANT ST.
(2) PRIVATE SEWER TO LINE THAT FEEDS 21" SEWER IN CONANT ST.
(3) EXISTING PUBLIC REGIONAL TRUNK SEWER

0 100 200 400 600



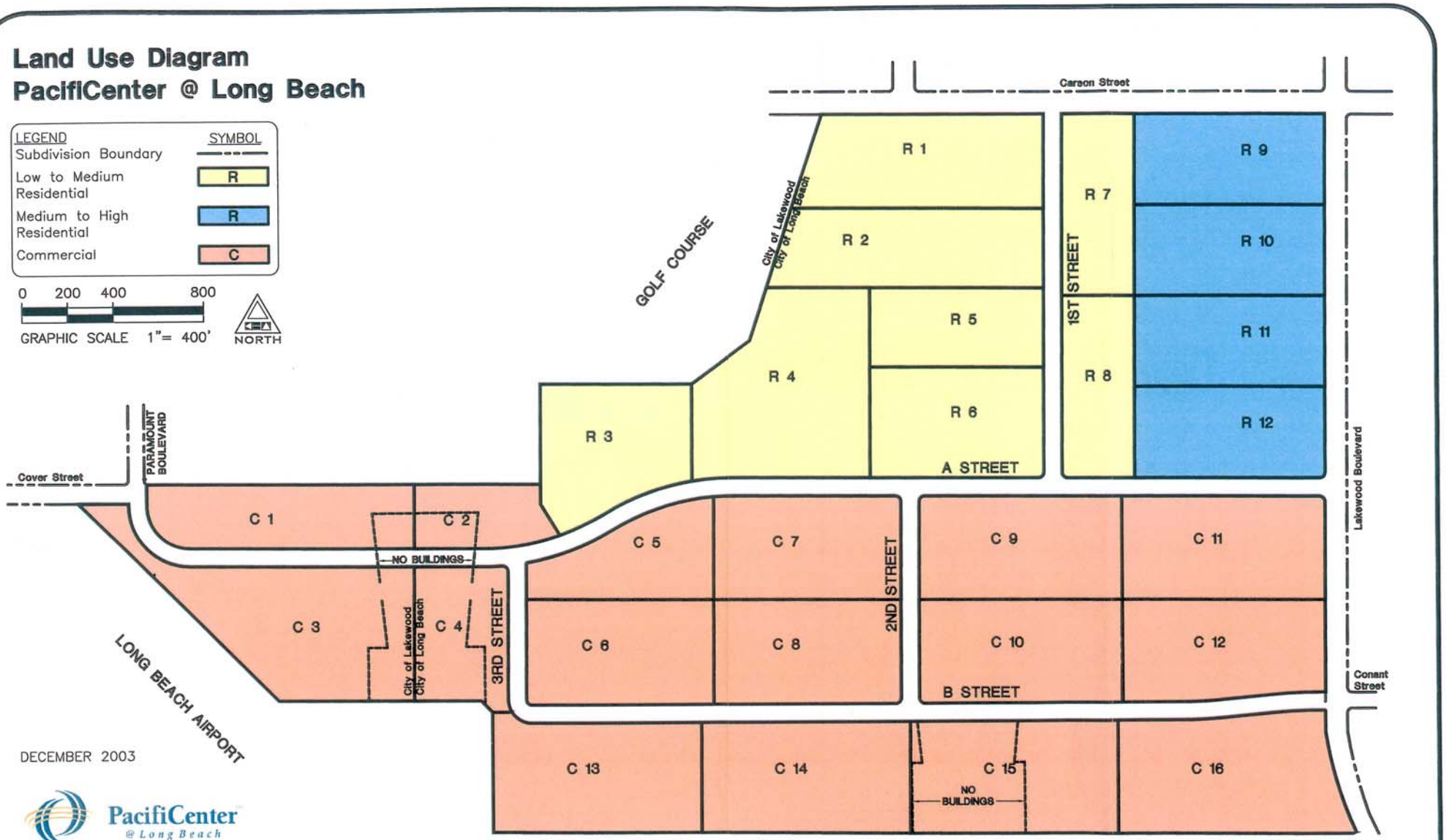
DECEMBER 2003

PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc.

Figure SS-4

Land Use Diagram
PacifiCenter @ Long Beach



LONG BEACH AIRPORT

Figure SS-5

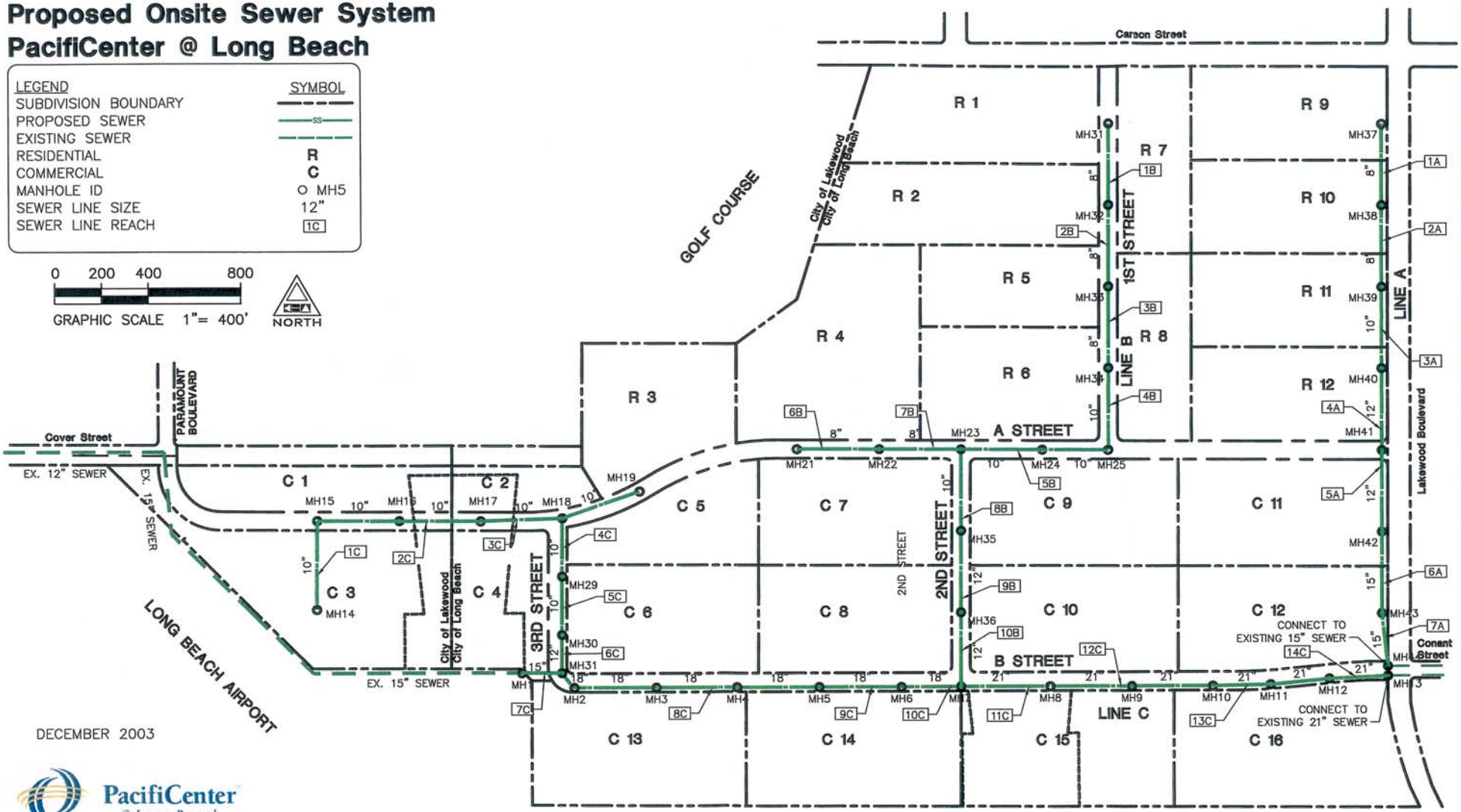
Proposed Onsite Sewer System
PacifiCenter @ Long Beach

LEGEND	SYMBOL
SUBDIVISION BOUNDARY	
PROPOSED SEWER	SS
EXISTING SEWER	
RESIDENTIAL	R
COMMERCIAL	C
MANHOLE ID	MH5
SEWER LINE SIZE	12"
SEWER LINE REACH	1C

0 200 400 800

GRAPHIC SCALE 1"= 400'

NORTH



DECEMBER 2003

PacifiCenter @ Long Beach

Kimley-Horn and Associates, Inc.

LONG BEACH AIRPORT

Figure SS-6

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EXISTING SEWER CAPACITY

CALCULATIONS

Type.... Chn-Circular
Name.... CHN-CIR 10

Existing

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 21" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001200 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.75 ft
Diameter = 1.7500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.040	.04	.00	.35	.0140	.52	.53	.03	0.38
10.080	.08	.02	.55	.0394	.73	.75	.05	0.42
10.120	.12	.05	.72	.0718	.88	.93	.08	0.45
10.160	.16	.09	.86	.1097	1.01	1.08	.11	0.46
10.200	.20	.15	1.00	.1522	1.11	1.21	.14	0.47
10.240	.24	.22	1.12	.1986	1.20	1.33	.16	0.48
10.280	.28	.30	1.23	.2484	1.28	1.44	.19	0.49
10.320	.32	.40	1.33	.3012	1.35	1.55	.22	0.50
10.360	.36	.51	1.43	.3565	1.41	1.65	.25	0.50
10.400	.40	.63	1.52	.4142	1.47	1.74	.28	0.50
10.440	.44	.76	1.60	.4740	1.52	1.84	.31	0.51
10.480	.48	.90	1.69	.5356	1.56	1.93	.34	0.51
10.520	.52	1.06	1.76	.5989	1.60	2.02	.37	0.51
10.560	.56	1.22	1.83	.6635	1.63	2.10	.41	0.51
10.600	.60	1.39	1.90	.7294	1.66	2.19	.44	0.51
10.640	.64	1.57	1.97	.7964	1.69	2.27	.47	0.50
10.680	.68	1.75	2.03	.8642	1.71	2.36	.51	0.50
10.720	.72	1.95	2.09	.9328	1.72	2.44	.54	0.50
10.760	.76	2.15	2.14	1.0020	1.73	2.52	.58	0.50
10.800	.80	2.35	2.19	1.0716	1.74	2.60	.61	0.49
10.840	.84	2.56	2.24	1.1414	1.75	2.68	.65	0.49
10.880	.88	2.77	2.29	1.2114	1.75	2.76	.69	0.48
10.920	.92	2.99	2.33	1.2814	1.75	2.84	.73	0.48
10.960	.96	3.20	2.37	1.3512	1.74	2.92	.78	0.47
11.000	1.00	3.42	2.41	1.4206	1.73	3.00	.82	0.47
11.040	1.04	3.63	2.44	1.4897	1.72	3.08	.87	0.46
11.080	1.08	3.85	2.47	1.5581	1.70	3.16	.92	0.45
11.120	1.12	4.06	2.50	1.6257	1.68	3.25	.97	0.45
11.160	1.16	4.27	2.52	1.6924	1.65	3.33	1.02	0.44
11.200	1.20	4.47	2.54	1.7580	1.62	3.41	1.08	0.43
11.240	1.24	4.67	2.56	1.8224	1.59	3.50	1.15	0.42
11.280	1.28 1.21	4.86	2.58	1.8852	1.55	3.59	1.22	0.41
11.320	1.32 756	5.04	2.59	1.9464	1.51	3.68	1.29	0.40
11.360	1.36	5.21	2.60	2.0057	1.46	3.78	1.38	0.39
11.400	1.40	5.36	2.60	2.0628	1.40	3.88	1.47	0.38

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 21" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001200 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.75 ft
Diameter = 1.7500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.440	1.44	5.51	2.60	2.1176	1.34	3.98	1.58	0.36
11.480	1.48	5.63	2.60	2.1696	1.26	4.08	1.72	0.35
11.520	1.52	5.74	2.59	2.2186	1.18	4.20	1.88	0.33
11.560	1.56	5.82	2.57	2.2641	1.09	4.32	2.08	0.31
11.600	1.60	5.88	2.55	2.3055	.98	4.46	2.35	0.29
11.640	1.64	5.90	2.52	2.3422	.85	4.61	2.76	0.27
11.680	1.68	5.88	2.48	2.3730	.69	4.79	3.46	0.23
11.720	1.72	5.78	2.41	2.3962	.45	5.04	5.27	0.19
11.750	1.75	5.49	2.28	2.4053	.00	5.50	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

Existing

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Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .004000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.53	.0084	.42	.43	.02	0.66
10.060	.06	.02	.83	.0237	.59	.60	.04	0.73
10.090	.09	.05	1.09	.0433	.71	.74	.06	0.78
10.120	.12	.09	1.31	.0662	.81	.86	.08	0.81
10.150	.15	.14	1.51	.0920	.90	.97	.10	0.83
10.180	.18	.20	1.69	.1201	.97	1.06	.12	0.85
10.210	.21	.28	1.86	.1504	1.04	1.15	.14	0.86
10.240	.24	.37	2.02	.1825	1.10	1.23	.17	0.87
10.270	.27	.47	2.17	.2163	1.15	1.31	.19	0.88
10.300	.30	.58	2.31	.2516	1.20	1.39	.21	0.89
10.330	.33	.71	2.45	.2883	1.24	1.46	.23	0.90
10.360	.36	.84	2.57	.3261	1.28	1.54	.25	0.90
10.390	.39	.98	2.69	.3651	1.32	1.61	.28	0.90
10.420	.42	1.14	2.81	.4050	1.35	1.67	.30	0.90
10.450	.45	1.30	2.92	.4459	1.37	1.74	.32	0.90
10.480	.48	1.47	3.02	.4875	1.40	1.80	.35	0.90
10.510	.51	1.65	3.12	.5298	1.42	1.87	.37	0.90
10.540	.54	1.84	3.22	.5727	1.44	1.93	.40	0.90
10.570	.57	2.04	3.31	.6162	1.46	1.99	.42	0.90
10.600	.60	2.24	3.39	.6601	1.47	2.05	.45	0.89
10.630	.63	2.45	3.47	.7043	1.48	2.12	.48	0.89
10.660	.66	2.66	3.55	.7489	1.49	2.18	.50	0.88
10.690	.69	2.88	3.62	.7937	1.50	2.24	.53	0.88
10.720	.72	3.10	3.69	.8386	1.50	2.30	.56	0.87
10.750	.75	3.32	3.76	.8836	1.50	2.36	.59	0.86
10.780	.78	3.55	3.82	.9286	1.50	2.42	.62	0.86
10.810	.81	3.78	3.88	.9735	1.50	2.48	.65	0.85
10.840	.84	4.01	3.93	1.0182	1.49	2.54	.68	0.84
10.870	.87	4.23	3.98	1.0628	1.48	2.60	.72	0.83
10.900	.90	4.46	4.03	1.1071	1.47	2.66	.75	0.82
10.930	.93	4.69	4.07	1.1510	1.46	2.72	.79	0.81
10.960	.96	4.91	4.11	1.1944	1.44	2.78	.83	0.80
10.990	.99	5.13	4.15	1.2373	1.42	2.84	.87	0.78
11.020	1.02	5.35	4.18	1.2796	1.40	2.91	.91	0.77
11.050	1.05	5.56	4.21	1.3213	1.37	2.97	.96	0.76

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .004000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	5.77	4.23	1.3621	1.35	3.04	1.01	0.74
11.110	1.11	5.96	4.25	1.4021	1.32	3.11	1.07	0.73
11.140	1.14	6.15	4.27	1.4410	1.28	3.18	1.12	0.71
11.170	1.17	6.33	4.28	1.4789	1.24	3.25	1.19	0.69
11.200	1.20	6.49	4.28	1.5155	1.20	3.32	1.26	0.67
11.230	1.23	6.65	4.29	1.5508	1.15	3.40	1.35	0.65
11.260	1.26	6.78	4.28	1.5846	1.10	3.48	1.44	0.63
11.290	1.29	6.90	4.27	1.6168	1.04	3.56	1.55	0.60
11.320	1.32	7.00	4.25	1.6470	.97	3.65	1.69	0.58
11.350	1.35	7.08	4.23	1.6752	.90	3.75	1.86	0.55
11.380	1.38	7.13	4.19	1.7009	.81	3.85	2.09	0.51
11.407	1.41	7.15	4.15	1.7219	.72	3.96	2.38	0.47
11.410	1.41	7.15	4.15	1.7239	.71	3.97	2.42	0.47
11.440	1.44	7.12	4.08	1.7434	.59	4.11	2.97	0.42
11.470	1.47	7.02	3.99	1.7587	.42	4.29	4.19	0.34
11.500	1.50	6.64	3.76	1.7671	.00	4.71	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

Existing

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001800 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.36	.0084	.42	.43	.02	0.44
10.060	.06	.01	.56	.0237	.59	.60	.04	0.49
10.090	.09	.03	.73	.0433	.71	.74	.06	0.52
10.120	.12	.06	.88	.0662	.81	.86	.08	0.54
10.150	.15	.09	1.01	.0920	.90	.97	.10	0.56
10.180	.18	.14	1.13	.1201	.97	1.06	.12	0.57
10.210	.21	.19	1.25	.1504	1.04	1.15	.14	0.58
10.240	.24	.25	1.36	.1825	1.10	1.23	.17	0.59
10.270	.27	.31	1.46	.2163	1.15	1.31	.19	0.59
10.300	.30	.39	1.55	.2516	1.20	1.39	.21	0.60
10.330	.33	.47	1.64	.2883	1.24	1.46	.23	0.60
10.360	.36	.56	1.73	.3261	1.28	1.54	.25	0.60
10.390	.39	.66	1.81	.3651	1.32	1.61	.28	0.60
10.420	.42	.76	1.88	.4050	1.35	1.67	.30	0.61
10.450	.45	.87	1.96	.4459	1.37	1.74	.32	0.61
10.480	.48	.99	2.03	.4875	1.40	1.80	.35	0.61
10.510	.51	1.11	2.09	.5298	1.42	1.87	.37	0.60
10.540	.54	1.24	2.16	.5727	1.44	1.93	.40	0.60
10.570	.57	1.37	2.22	.6162	1.46	1.99	.42	0.60
10.600	.60	1.50	2.28	.6601	1.47	2.05	.45	0.60
10.630	.63	1.64	2.33	.7043	1.48	2.12	.48	0.60
10.660	.66	1.78	2.38	.7489	1.49	2.18	.50	0.59
10.690	.69	1.93	2.43	.7937	1.50	2.24	.53	0.59
10.720	.72	2.08	2.48	.8386	1.50	2.30	.56	0.58
10.750	.75	2.23	2.52	.8836	1.50	2.36	.59	0.58
10.780	.78	2.38	2.56	.9286	1.50	2.42	.62	0.57
10.810	.81	2.53	2.60	.9735	1.50	2.48	.65	0.57
10.840	.84	2.69	2.64	1.0182	1.49	2.54	.68	0.56
10.870	.87	2.84	2.67	1.0628	1.48	2.60	.72	0.56
10.900	.90	2.99	2.70	1.1071	1.47	2.66	.75	0.55
10.930	.93	3.15	2.73	1.1510	1.46	2.72	.79	0.54
10.960	.96	3.30	2.76	1.1944	1.44	2.78	.83	0.53
10.990	.99	3.44	2.78	1.2373	1.42	2.84	.87	0.53
11.020	1.02	3.59	2.81	1.2796	1.40	2.91	.91	0.52
11.050	1.05	3.73	2.82	1.3213	1.37	2.97	.96	0.51

Type.... Chn-Circular
Name.... CHN-CIR 10

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001800 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	3.87	2.84	1.3621	1.35	3.04	1.01	0.50
11.110	1.11 1.13	4.00	2.85	1.4021	1.32	3.11	1.07	0.49
11.140	1.14	4.13	2.86	1.4410	1.28	3.18	1.12	0.48
11.170	1.17	4.24	2.87	1.4789	1.24	3.25	1.19	0.46
11.200	1.20	4.36	2.87	1.5155	1.20	3.32	1.26	0.45
11.230	1.23	4.46	2.87	1.5508	1.15	3.40	1.35	0.44
11.260	1.26	4.55	2.87	1.5846	1.10	3.48	1.44	0.42
11.290	1.29	4.63	2.86	1.6168	1.04	3.56	1.55	0.41
11.320	1.32	4.70	2.85	1.6470	.97	3.65	1.69	0.39
11.350	1.35	4.75	2.84	1.6752	.90	3.75	1.86	0.37
11.380	1.38	4.78	2.81	1.7009	.81	3.85	2.09	0.34
11.407	1.41	4.79	2.78	1.7219	.72	3.96	2.38	0.32
11.410	1.41	4.79	2.78	1.7239	.71	3.97	2.42	0.32
11.440	1.44	4.77	2.74	1.7434	.59	4.11	2.97	0.28
11.470	1.47	4.71	2.68	1.7587	.42	4.29	4.19	0.23
11.500	1.50	4.46	2.52	1.7671	.00	4.71	****	****

Existing

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.37	.0084	.42	.43	.02	0.47
10.060	.06	.01	.59	.0237	.59	.60	.04	0.52
10.090	.09	.03	.77	.0433	.71	.74	.06	0.55
10.120	.12	.06	.93	.0662	.81	.86	.08	0.57
10.150	.15	.10	1.07	.0920	.90	.97	.10	0.59
10.180	.18	.14	1.20	.1201	.97	1.06	.12	0.60
10.210	.21	.20	1.32	.1504	1.04	1.15	.14	0.61
10.240	.24	.26	1.43	.1825	1.10	1.23	.17	0.62
10.270	.27	.33	1.54	.2163	1.15	1.31	.19	0.62
10.300	.30	.41	1.63	.2516	1.20	1.39	.21	0.63
10.330	.33	.50	1.73	.2883	1.24	1.46	.23	0.63
10.360	.36	.59	1.82	.3261	1.28	1.54	.25	0.64
10.390	.39	.70	1.90	.3651	1.32	1.61	.28	0.64
10.420	.42	.80	1.99	.4050	1.35	1.67	.30	0.64
10.450	.45	.92	2.06	.4459	1.37	1.74	.32	0.64
10.480	.48	1.04	2.14	.4875	1.40	1.80	.35	0.64
10.510	.51	1.17	2.21	.5298	1.42	1.87	.37	0.64
10.540	.54	1.30	2.27	.5727	1.44	1.93	.40	0.64
10.570	.57	1.44	2.34	.6162	1.46	1.99	.42	0.63
10.600	.60	1.58	2.40	.6601	1.47	2.05	.45	0.63
10.630	.63	1.73	2.46	.7043	1.48	2.12	.48	0.63
10.660	.66	1.88	2.51	.7489	1.49	2.18	.50	0.62
10.690	.69	2.03	2.56	.7937	1.50	2.24	.53	0.62
10.720	.72	2.19	2.61	.8386	1.50	2.30	.56	0.62
10.750	.75	2.35	2.66	.8836	1.50	2.36	.59	0.61
10.780	.78	2.51	2.70	.9286	1.50	2.42	.62	0.61
10.810	.81	2.67	2.74	.9735	1.50	2.48	.65	0.60
10.840	.84	2.83	2.78	1.0182	1.49	2.54	.68	0.59
10.870	.87	2.99	2.82	1.0628	1.48	2.60	.72	0.59
10.900	.90	3.16	2.85	1.1071	1.47	2.66	.75	0.58
10.930	.93	3.32	2.88	1.1510	1.46	2.72	.79	0.57
10.960	.96	3.47	2.91	1.1944	1.44	2.78	.83	0.56
10.990	.99	3.63	2.93	1.2373	1.42	2.84	.87	0.55
11.020	1.02	3.78	2.96	1.2796	1.40	2.91	.91	0.55
11.050	1.05	3.93	2.98	1.3213	1.37	2.97	.96	0.54

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = ,002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	4.08	2.99	1.3621	1.35	3.04	1.01	0.52
11.110	1.11	4.22	3.01	1.4021	1.32	3.11	1.07	0.51
11.140	1.14	4.35	3.02	1.4410	1.28	3.18	1.12	0.50
11.170	1.17	4.47	3.03	1.4789	1.24	3.25	1.19	0.49
11.200	1.20	4.59	3.03	1.5155	1.20	3.32	1.26	0.48
11.230	1.23	4.70	3.03	1.5508	1.15	3.40	1.35	0.46
11.260	1.26	4.80	3.03	1.5846	1.10	3.48	1.44	0.44
11.290	1.29	4.88	3.02	1.6168	1.04	3.56	1.55	0.43
11.320	1.32	4.95	3.01	1.6470	.97	3.65	1.69	0.41
11.350	1.35	5.01	2.99	1.6752	.90	3.75	1.86	0.39
11.380	1.38	5.04	2.96	1.7009	.81	3.85	2.09	0.36
11.407	1.41	5.05	2.93	1.7219	.72	3.96	2.38	0.34
11.410	1.41	5.05	2.93	1.7239	.71	3.97	2.42	0.33
11.440	1.44	5.03	2.89	1.7434	.59	4.11	2.97	0.30
11.470	1.47	4.96	2.82	1.7587	.42	4.29	4.19	0.24
11.500	1.50	4.70	2.66	1.7671	.00	4.71	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

Existing

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001400 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.31	.0084	.42	.43	.02	0.39
10.060	.06	.01	.49	.0237	.59	.60	.04	0.43
10.090	.09	.03	.64	.0433	.71	.74	.06	0.46
10.120	.12	.05	.77	.0662	.81	.86	.08	0.48
10.150	.15	.08	.89	.0920	.90	.97	.10	0.49
10.180	.18	.12	1.00	.1201	.97	1.06	.12	0.50
10.210	.21	.17	1.10	.1504	1.04	1.15	.14	0.51
10.240	.24	.22	1.20	.1825	1.10	1.23	.17	0.52
10.270	.27	.28	1.28	.2163	1.15	1.31	.19	0.52
10.300	.30	.34	1.37	.2516	1.20	1.39	.21	0.53
10.330	.33	.42	1.45	.2883	1.24	1.46	.23	0.53
10.360	.36	.50	1.52	.3261	1.28	1.54	.25	0.53
10.390	.39	.58	1.59	.3651	1.32	1.61	.28	0.53
10.420	.42	.67	1.66	.4050	1.35	1.67	.30	0.53
10.450	.45	.77	1.73	.4459	1.37	1.74	.32	0.53
10.480	.48	.87	1.79	.4875	1.40	1.80	.35	0.53
10.510	.51	.98	1.85	.5298	1.42	1.87	.37	0.53
10.540	.54	1.09	1.90	.5727	1.44	1.93	.40	0.53
10.570	.57	1.21	1.96	.6162	1.46	1.99	.42	0.53
10.600	.60	1.32	2.01	.6601	1.47	2.05	.45	0.53
10.630	.63	1.45	2.05	.7043	1.48	2.12	.48	0.53
10.660	.66	1.57	2.10	.7489	1.49	2.18	.50	0.52
10.690	.69	1.70	2.14	.7937	1.50	2.24	.53	0.52
10.720	.72	1.83	2.19	.8386	1.50	2.30	.56	0.52
10.750	.75	1.97	2.22	.8836	1.50	2.36	.59	0.51
10.780	.78	2.10	2.26	.9286	1.50	2.42	.62	0.51
10.810	.81	2.23	2.30	.9735	1.50	2.48	.65	0.50
10.840	.84	2.37	2.33	1.0182	1.49	2.54	.68	0.50
10.870	.87	2.51	2.36	1.0628	1.48	2.60	.72	0.49
10.900	.90	2.64	2.39	1.1071	1.47	2.66	.75	0.48
10.930	.93	2.77	2.41	1.1510	1.46	2.72	.79	0.48
10.960	.96	2.91	2.43	1.1944	1.44	2.78	.83	0.47
10.990	.99	3.04	2.46	1.2373	1.42	2.84	.87	0.46
11.020	1.02	3.17	2.47	1.2796	1.40	2.91	.91	0.46
11.050	1.05	3.29	2.49	1.3213	1.37	2.97	.96	0.45

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001400 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	3.41	2.50	1.3621	1.35	3.04	1.01	0.44
11.110	1.11	3.53	2.52	1.4021	1.32	3.11	1.07	0.43
11.140	1.14	3.64	2.53	1.4410	1.28	3.18	1.12	0.42
11.170	1.17	3.74	2.53	1.4789	1.24	3.25	1.19	0.41
11.200	1.20	3.84	2.53	1.5155	1.20	3.32	1.26	0.40
11.230	1.23	3.93	2.54	1.5508	1.15	3.40	1.35	0.39
11.260	1.26	4.01	2.53	1.5846	1.10	3.48	1.44	0.37
11.290	1.29	4.08	2.53	1.6168	1.04	3.56	1.55	0.36
11.320	1.32	4.14	2.52	1.6470	.97	3.65	1.69	0.34
11.350	1.35	4.19	2.50	1.6752	.90	3.75	1.86	0.32
11.380	1.38	4.22	2.48	1.7009	.81	3.85	2.09	0.30
11.407	1.41	4.23	2.46	1.7219	.72	3.96	2.38	0.28
11.410	1.41	4.23	2.45	1.7239	.71	3.97	2.42	0.28
11.440	1.44	4.21	2.42	1.7434	.59	4.11	2.97	0.25
11.470	1.47	4.15	2.36	1.7587	.42	4.29	4.19	0.20
11.500	1.50	3.93	2.22	1.7671	.00	4.71	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

Existing

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001900 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.36	.0084	.42	.43	.02	0.45
10.060	.06	.01	.58	.0237	.59	.60	.04	0.51
10.090	.09	.03	.75	.0433	.71	.74	.06	0.54
10.120	.12	.06	.90	.0662	.81	.86	.08	0.56
10.150	.15	.10	1.04	.0920	.90	.97	.10	0.57
10.180	.18	.14	1.17	.1201	.97	1.06	.12	0.59
10.210	.21	.19	1.28	.1504	1.04	1.15	.14	0.60
10.240	.24	.25	1.39	.1825	1.10	1.23	.17	0.60
10.270	.27	.32	1.50	.2163	1.15	1.31	.19	0.61
10.300	.30	.40	1.59	.2516	1.20	1.39	.21	0.61
10.330	.33	.49	1.69	.2883	1.24	1.46	.23	0.62
10.360	.36	.58	1.77	.3261	1.28	1.54	.25	0.62
10.390	.39	.68	1.86	.3651	1.32	1.61	.28	0.62
10.420	.42	.78	1.94	.4050	1.35	1.67	.30	0.62
10.450	.45	.90	2.01	.4459	1.37	1.74	.32	0.62
10.480	.48	1.02	2.08	.4875	1.40	1.80	.35	0.62
10.510	.51	1.14	2.15	.5298	1.42	1.87	.37	0.62
10.540	.54	1.27	2.22	.5727	1.44	1.93	.40	0.62
10.570	.57	1.40	2.28	.6162	1.46	1.99	.42	0.62
10.600	.60	1.54	2.34	.6601	1.47	2.05	.45	0.61
10.630	.63	1.69	2.39	.7043	1.48	2.12	.48	0.61
10.660	.66	1.83	2.45	.7489	1.49	2.18	.50	0.61
10.690	.69	1.98	2.50	.7937	1.50	2.24	.53	0.60
10.720	.72	2.13	2.55	.8386	1.50	2.30	.56	0.60
10.750	.75	2.29	2.59	.8836	1.50	2.36	.59	0.60
10.780	.78	2.45	2.63	.9286	1.50	2.42	.62	0.59
10.810	.81	2.60	2.67	.9735	1.50	2.48	.65	0.58
10.840	.84	2.76	2.71	1.0182	1.49	2.54	.68	0.58
10.870	.87	2.92	2.75	1.0628	1.48	2.60	.72	0.57
10.900	.90	3.08	2.78	1.1071	1.47	2.66	.75	0.56
10.930	.93	3.23	2.81	1.1510	1.46	2.72	.79	0.56
10.960	.96	3.39	2.84	1.1944	1.44	2.78	.83	0.55
10.990	.99	3.54	2.86	1.2373	1.42	2.84	.87	0.54
11.020	1.02	3.69	2.88	1.2796	1.40	2.91	.91	0.53
11.050	1.05	3.83	2.90	1.3213	1.37	2.97	.96	0.52

Type.... Chn-Circular
Name.... CHN-CIR 10

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001900 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	3.97	2.92	1.3621	1.35	3.04	1.01	0.51
11.110	1.11	4.11	2.93	1.4021	1.32	3.11	1.07	0.50
11.140	1.14	4.24	2.94	1.4410	1.28	3.18	1.12	0.49
11.170	1.17	4.36	2.95	1.4789	1.24	3.25	1.19	0.48
11.200	1.20	4.48	2.95	1.5155	1.20	3.32	1.26	0.46
11.230	1.23	4.58	2.95	1.5508	1.15	3.40	1.35	0.45
11.260	1.26	4.67	2.95	1.5846	1.10	3.48	1.44	0.43
11.290	1.29	4.76	2.94	1.6168	1.04	3.56	1.55	0.42
11.320	1.32	4.83	2.93	1.6470	.97	3.65	1.69	0.40
11.350	1.35	4.88	2.91	1.6752	.90	3.75	1.86	0.38
11.380	1.38	4.91	2.89	1.7009	.81	3.85	2.09	0.35
11.407	1.41	4.93	2.86	1.7219	.72	3.96	2.38	0.33
11.410	1.41	4.92	2.86	1.7239	.71	3.97	2.42	0.32
11.440	1.44	4.91	2.81	1.7434	.59	4.11	2.97	0.29
11.470	1.47	4.84	2.75	1.7587	.42	4.29	4.19	0.24
11.500	1.50	4.58	2.59	1.7671	.00	4.71	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

Existing

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.26	.0084	.42	.43	.02	0.33
10.060	.06	.01	.42	.0237	.59	.60	.04	0.37
10.090	.09	.02	.54	.0433	.71	.74	.06	0.39
10.120	.12	.04	.65	.0662	.81	.86	.08	0.40
10.150	.15	.07	.75	.0920	.90	.97	.10	0.42
10.180	.18	.10	.85	.1201	.97	1.06	.12	0.42
10.210	.21	.14	.93	.1504	1.04	1.15	.14	0.43
10.240	.24	.18	1.01	.1825	1.10	1.23	.17	0.44
10.270	.27	.23	1.09	.2163	1.15	1.31	.19	0.44
10.300	.30	.29	1.16	.2516	1.20	1.39	.21	0.45
10.330	.33	.35	1.22	.2883	1.24	1.46	.23	0.45
10.360	.36	.42	1.29	.3261	1.28	1.54	.25	0.45
10.390	.39	.49	1.35	.3651	1.32	1.61	.28	0.45
10.420	.42	.57	1.40	.4050	1.35	1.67	.30	0.45
10.450	.45	.65	1.46	.4459	1.37	1.74	.32	0.45
10.480	.48	.74	1.51	.4875	1.40	1.80	.35	0.45
10.510	.51	.83	1.56	.5298	1.42	1.87	.37	0.45
10.540	.54	.92	1.61	.5727	1.44	1.93	.40	0.45
10.570	.57	1.02	1.65	.6162	1.46	1.99	.42	0.45
10.600	.60	1.12	1.70	.6601	1.47	2.05	.45	0.45
10.630	.63	1.22	1.74	.7043	1.48	2.12	.48	0.44
10.660	.66	1.33	1.78	.7489	1.49	2.18	.50	0.44
10.690	.69	1.44	1.81	.7937	1.50	2.24	.53	0.44
10.720	.72	1.55	1.85	.8386	1.50	2.30	.56	0.44
10.750	.75	1.66	1.88	.8836	1.50	2.36	.59	0.43
10.780	.78	1.77	1.91	.9286	1.50	2.42	.62	0.43
10.810	.81	1.89	1.94	.9735	1.50	2.48	.65	0.42
10.840	.84	2.00	1.97	1.0182	1.49	2.54	.68	0.42
10.870	.87	2.12	1.99	1.0628	1.48	2.60	.72	0.41
10.900	.90	2.23	2.02	1.1071	1.47	2.66	.75	0.41
10.930	.93	2.34	2.04	1.1510	1.46	2.72	.79	0.40
10.960	.96	2.46	2.06	1.1944	1.44	2.78	.83	0.40
10.990	.99	2.57	2.07	1.2373	1.42	2.84	.87	0.39
11.020	1.02	2.68	2.09	1.2796	1.40	2.91	.91	0.39
11.050	1.05	2.78	2.10	1.3213	1.37	2.97	.96	0.38

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 18" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	2.88	2.12	1.3621	1.35	3.04	1.01	0.37
11.110	1.11	2.98	2.13	1.4021	1.32	3.11	1.07	0.36
11.140	1.14	3.08	2.13	1.4410	1.28	3.18	1.12	0.35
11.170	1.17	3.16	2.14	1.4789	1.24	3.25	1.19	0.35
11.200	1.20	3.25	2.14	1.5155	1.20	3.32	1.26	0.34
11.230	1.23	3.32	2.14	1.5508	1.15	3.40	1.35	0.33
11.260	1.26	3.39	2.14	1.5846	1.10	3.48	1.44	0.31
11.290	1.29	3.45	2.13	1.6168	1.04	3.56	1.55	0.30
11.320	1.32	3.50	2.13	1.6470	.97	3.65	1.69	0.29
11.350	1.35	3.54	2.11	1.6752	.90	3.75	1.86	0.27
11.380	1.38	3.56	2.10	1.7009	.81	3.85	2.09	0.26
11.407	1.41	3.57	2.08	1.7219	.72	3.96	2.38	0.24
11.410	1.41	3.57	2.07	1.7239	.71	3.97	2.42	0.23
11.440	1.44	3.56	2.04	1.7434	.59	4.11	2.97	0.21
11.470	1.47	3.51	2.00	1.7587	.42	4.29	4.19	0.17
11.500	1.50	3.32	1.88	1.7671	.00	4.71	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

Exith

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 15" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .004800 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.25 ft
Diameter = 1.2500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.58	.0077	.38	.39	.02	0.72
10.060	.06	.02	.91	.0216	.53	.55	.04	0.80
10.090	.09	.05	1.19	.0394	.65	.68	.06	0.85
10.120	.12	.09	1.43	.0602	.74	.79	.08	0.88
10.150	.15	.14	1.64	.0834	.81	.88	.10	0.90
10.180	.18	.20	1.84	.1088	.88	.97	.12	0.92
10.210	.21	.27	2.02	.1360	.93	1.06	.15	0.93
10.240	.24	.36	2.19	.1648	.98	1.13	.17	0.94
10.270	.27	.46	2.35	.1950	1.03	1.21	.19	0.95
10.300	.30	.57	2.50	.2265	1.07	1.28	.21	0.96
10.330	.33	.68	2.64	.2590	1.10	1.35	.24	0.96
10.360	.36	.81	2.77	.2926	1.13	1.42	.26	0.96
10.390	.39	.95	2.89	.3269	1.16	1.48	.28	0.96
10.420	.42	1.09	3.01	.3620	1.18	1.55	.31	0.96
10.450	.45	1.24	3.12	.3977	1.20	1.61	.33	0.96
10.480	.48	1.40	3.22	.4340	1.22	1.67	.36	0.95
10.510	.51	1.56	3.32	.4707	1.23	1.73	.38	0.95
10.540	.54	1.73	3.41	.5077	1.24	1.79	.41	0.94
10.570	.57	1.91	3.50	.5449	1.25	1.85	.44	0.93
10.600	.60	2.09	3.58	.5824	1.25	1.91	.47	0.93
10.630	.63	2.27	3.66	.6198	1.25	1.97	.50	0.92
10.660	.66	2.45	3.73	.6573	1.25	2.03	.53	0.91
10.690	.69	2.64	3.80	.6947	1.24	2.09	.56	0.90
10.720	.72	2.82	3.86	.7319	1.24	2.15	.59	0.88
10.750	.75	3.01	3.91	.7688	1.22	2.22	.63	0.87
10.780	.78	3.19	3.96	.8053	1.21	2.28	.67	0.86
10.810	.81	3.37	4.01	.8414	1.19	2.34	.70	0.84
10.840	.84	3.55	4.04	.8769	1.17	2.40	.75	0.82
10.870	.87	3.72	4.08	.9118	1.15	2.47	.79	0.81
10.900	.90	3.88	4.11	.9459	1.12	2.53	.84	0.79
10.930	.93	4.04	4.13	.9791	1.09	2.60	.90	0.77
10.960	.96 .94	4.19	4.15	1.0113	1.06	2.67	.96	0.75
10.990	.99	4.33	4.15	1.0424	1.01	2.74	1.03	0.72
11.020	1.02	4.46	4.16	1.0722	.97	2.82	1.11	0.70
11.050	1.05	4.57	4.15	1.1004	.92	2.90	1.20	0.67

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... 15" VCP Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .004800 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.25 ft
Diameter = 1.2500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	4.66	4.14	1.1271	.86	2.98	1.32	0.64
11.110	1.11	4.74	4.12	1.1518	.79	3.07	1.46	0.60
11.140	1.14	4.79	4.08	1.1743	.71	3.17	1.66	0.56
11.170	1.17	4.81	4.03	1.1941	.61	3.29	1.95	0.51
11.200	1.20	4.79	3.96	1.2107	.49	3.42	2.47	0.44
11.230	1.23	4.71	3.85	1.2230	.31	3.61	3.90	0.34
11.250	1.25	4.48	3.65	1.2272	.00	3.93	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

Existing

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Old 15" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001200 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.25 ft
Diameter = 1.2500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.29	.0077	.38	.39	.02	0.36
10.060	.06	.01	.46	.0216	.53	.55	.04	0.40
10.090	.09	.02	.59	.0394	.65	.68	.06	0.42
10.120	.12	.04	.71	.0602	.74	.79	.08	0.44
10.150	.15	.07	.82	.0834	.81	.88	.10	0.45
10.180	.18	.10	.92	.1088	.88	.97	.12	0.46
10.210	.21	.14	1.01	.1360	.93	1.06	.15	0.47
10.240	.24	.18	1.09	.1648	.98	1.13	.17	0.47
10.270	.27	.23	1.17	.1950	1.03	1.21	.19	0.48
10.300	.30	.28	1.25	.2265	1.07	1.28	.21	0.48
10.330	.33	.34	1.32	.2590	1.10	1.35	.24	0.48
10.360	.36	.40	1.38	.2926	1.13	1.42	.26	0.48
10.390	.39	.47	1.45	.3269	1.16	1.48	.28	0.48
10.420	.42	.54	1.50	.3620	1.18	1.55	.31	0.48
10.450	.45	.62	1.56	.3977	1.20	1.61	.33	0.48
10.480	.48	.70	1.61	.4340	1.22	1.67	.36	0.48
10.510	.51	.78	1.66	.4707	1.23	1.73	.38	0.47
10.540	.54	.87	1.71	.5077	1.24	1.79	.41	0.47
10.570	.57	.95	1.75	.5449	1.25	1.85	.44	0.47
10.600	.60	1.04	1.79	.5824	1.25	1.91	.47	0.46
10.630	.63	1.13	1.83	.6198	1.25	1.97	.50	0.46
10.660	.66	1.23	1.86	.6573	1.25	2.03	.53	0.45
10.690	.69	1.32	1.90	.6947	1.24	2.09	.56	0.45
10.720	.72	1.41	1.93	.7319	1.24	2.15	.59	0.44
10.750	.75	1.50	1.96	.7688	1.22	2.22	.63	0.44
10.780	.78	1.59	1.98	.8053	1.21	2.28	.67	0.43
10.810	.81	1.69	2.00	.8414	1.19	2.34	.70	0.42
10.840	.84	1.77	2.02	.8769	1.17	2.40	.75	0.41
10.870	.87	1.86	2.04	.9118	1.15	2.47	.79	0.40
10.900	.90	1.94	2.05	.9459	1.12	2.53	.84	0.39
10.930	.93	2.02	2.06	.9791	1.09	2.60	.90	0.38
10.960	.96 .94	2.10	2.07	1.0113	1.06	2.67	.96	0.37
10.990	.99	2.17	2.08	1.0424	1.01	2.74	1.03	0.36
11.020	1.02	2.23	2.08	1.0722	.97	2.82	1.11	0.35
11.050	1.05	2.28	2.08	1.1004	.92	2.90	1.20	0.33

Type.... Chn-Circular
Name.... CHN-CIR 10

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Old 15" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .001200 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.25 ft
Diameter = 1.2500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	2.33	2.07	1.1271	.86	2.98	1.32	0.32
11.110	1.11	2.37	2.06	1.1518	.79	3.07	1.46	0.30
11.140	1.14	2.40	2.04	1.1743	.71	3.17	1.66	0.28
11.170	1.17	2.41	2.02	1.1941	.61	3.29	1.95	0.25
11.200	1.20	2.40	1.98	1.2107	.49	3.42	2.47	0.22
11.230	1.23	2.35	1.92	1.2230	.31	3.61	3.90	0.17
11.250	1.25	2.24	1.82	1.2272	.00	3.93	****	****

peak flow 92/93 = 1546 gpm
= 3.44 cfs

Type.... Chn-Circular
Name.... CHN-CIR 10

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 21" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.75 ft
Diameter = 1.7500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.040	.04	.01	.45	.0140	.52	.53	.03	0.49
10.080	.08	.03	.71	.0394	.73	.75	.05	0.54
10.120	.12	.07	.93	.0718	.88	.93	.08	0.57
10.160	.16	.12	1.12	.1097	1.01	1.08	.11	0.60
10.200	.20	.20	1.29	.1522	1.11	1.21	.14	0.61
10.240	.24	.29	1.44	.1986	1.20	1.33	.16	0.63
10.280	.28	.39	1.58	.2484	1.28	1.44	.19	0.63
10.320	.32	.52	1.72	.3012	1.35	1.55	.22	0.64
10.360	.36	.66	1.84	.3565	1.41	1.65	.25	0.65
10.400	.40	.81	1.96	.4142	1.47	1.74	.28	0.65
10.440	.44	.98	2.07	.4740	1.52	1.84	.31	0.65
10.480	.48	1.17	2.18	.5356	1.56	1.93	.34	0.65
10.520	.52	1.36	2.27	.5989	1.60	2.02	.37	0.66
10.560	.56	1.57	2.37	.6635	1.63	2.10	.41	0.65
10.600	.60	1.79	2.46	.7294	1.66	2.19	.44	0.65
10.640	.64	2.02	2.54	.7964	1.69	2.27	.47	0.65
10.680	.68	2.26	2.62	.8642	1.71	2.36	.51	0.65
10.720	.72	2.51	2.69	.9328	1.72	2.44	.54	0.65
10.760	.76	2.77	2.77	1.0020	1.73	2.52	.58	0.64
10.800	.80	3.03	2.83	1.0716	1.74	2.60	.61	0.64
10.840	.84	3.30	2.89	1.1414	1.75	2.68	.65	0.63
10.880	.88	3.58	2.95	1.2114	1.75	2.76	.69	0.63
10.920	.92	3.85	3.01	1.2814	1.75	2.84	.73	0.62
10.960	.96	4.13	3.06	1.3512	1.74	2.92	.78	0.61
11.000	1.00	4.41	3.11	1.4206	1.73	3.00	.82	0.60
11.040	1.04	4.69	3.15	1.4897	1.72	3.08	.87	0.60
11.080	1.08	4.97	3.19	1.5581	1.70	3.16	.92	0.59
11.120	1.12	5.24	3.22	1.6257	1.68	3.25	.97	0.58
11.160	1.16	5.51	3.26	1.6924	1.65	3.33	1.02	0.57
11.200	1.20	5.77	3.28	1.7580	1.62	3.41	1.08	0.56
11.240	1.24	6.03	3.31	1.8224	1.59	3.50	1.15	0.54
11.280	1.28	6.27	3.33	1.8852	1.55	3.59	1.22	0.53
11.320	1.32	6.50	3.34	1.9464	1.51	3.68	1.29	0.52
11.360	1.36	6.72	3.35	2.0057	1.46	3.78	1.38	0.50
11.400	1.40	6.93	3.36	2.0628	1.40	3.88	1.47	0.49

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 21" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.75 ft
Diameter = 1.7500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.440	1.44	7.11	3.36	2.1176	1.34	3.98	1.58	0.47
11.480	1.48	7.27	3.35	2.1696	1.26	4.08	1.72	0.45
11.520	1.52	7.41	3.34	2.2186	1.18	4.20	1.88	0.43
11.560	1.56	7.52	3.32	2.2641	1.09	4.32	2.08	0.41
11.600	1.60	7.59	3.29	2.3055	.98	4.46	2.35	0.38
11.640	1.64	7.62	3.25	2.3422	.85	4.61	2.76	0.35
11.680	1.68	7.59	3.20	2.3730	.69	4.79	3.46	0.30
11.720	1.72	7.46	3:11	2.3962	.45	5.04	5.27	0.24
11.750	1.75	7.09	2.95	2.4053	.00	5.50	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 18" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.37	.0084	.42	.43	.02	0.47
10.060	.06	.01	.59	.0237	.59	.60	.04	0.52
10.090	.09	.03	.77	.0433	.71	.74	.06	0.55
10.120	.12	.06	.93	.0662	.81	.86	.08	0.57
10.150	.15	.10	1.07	.0920	.90	.97	.10	0.59
10.180	.18	.14	1.20	.1201	.97	1.06	.12	0.60
10.210	.21	.20	1.32	.1504	1.04	1.15	.14	0.61
10.240	.24	.26	1.43	.1825	1.10	1.23	.17	0.62
10.270	.27	.33	1.54	.2163	1.15	1.31	.19	0.62
10.300	.30	.41	1.63	.2516	1.20	1.39	.21	0.63
10.330	.33	.50	1.73	.2883	1.24	1.46	.23	0.63
10.360	.36	.59	1.82	.3261	1.28	1.54	.25	0.64
10.390	.39	.70	1.90	.3651	1.32	1.61	.28	0.64
10.420	.42	.80	1.99	.4050	1.35	1.67	.30	0.64
10.450	.45	.92	2.06	.4459	1.37	1.74	.32	0.64
10.480	.48	1.04	2.14	.4875	1.40	1.80	.35	0.64
10.510	.51	1.17	2.21	.5298	1.42	1.87	.37	0.64
10.540	.54	1.30	2.27	.5727	1.44	1.93	.40	0.64
10.570	.57	1.44	2.34	.6162	1.46	1.99	.42	0.63
10.600	.60	1.58	2.40	.6601	1.47	2.05	.45	0.63
10.630	.63	1.73	2.46	.7043	1.48	2.12	.48	0.63
10.660	.66	1.88	2.51	.7489	1.49	2.18	.50	0.62
10.690	.69	2.03	2.56	.7937	1.50	2.24	.53	0.62
10.720	.72	2.19	2.61	.8386	1.50	2.30	.56	0.62
10.750	.75	2.35	2.66	.8836	1.50	2.36	.59	0.61
10.780	.78	2.51	2.70	.9286	1.50	2.42	.62	0.61
10.810	.81	2.67	2.74	.9735	1.50	2.48	.65	0.60
10.840	.84	2.83	2.78	1.0182	1.49	2.54	.68	0.59
10.870	.87	2.99	2.82	1.0628	1.48	2.60	.72	0.59
10.900	.90	3.16	2.85	1.1071	1.47	2.66	.75	0.58
10.930	.93	3.32	2.88	1.1510	1.46	2.72	.79	0.57
10.960	.96	3.47	2.91	1.1944	1.44	2.78	.83	0.56
10.990	.99	3.63	2.93	1.2373	1.42	2.84	.87	0.55
11.020	1.02	3.78	2.96	1.2796	1.40	2.91	.91	0.55
11.050	1.05	3.93	2.98	1.3213	1.37	2.97	.96	0.54

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 18" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.50 ft
Diameter = 1.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	4.08	2.99	1.3621	1.35	3.04	1.01	0.52
11.110	1.11	4.22	3.01	1.4021	1.32	3.11	1.07	0.51
11.140	1.14	4.35	3.02	1.4410	1.28	3.18	1.12	0.50
11.170	1.17	4.47	3.03	1.4789	1.24	3.25	1.19	0.49
11.200	1.20	4.59	3.03	1.5155	1.20	3.32	1.26	0.48
11.230	1.23	4.70	3.03	1.5508	1.15	3.40	1.35	0.46
11.260	1.26	4.80	3.03	1.5846	1.10	3.48	1.44	0.44
11.290	1.29	4.88	3.02	1.6168	1.04	3.56	1.55	0.43
11.320	1.32	4.95	3.01	1.6470	.97	3.65	1.69	0.41
11.350	1.35	5.01	2.99	1.6752	.90	3.75	1.86	0.39
11.380	1.38	5.04	2.96	1.7009	.81	3.85	2.09	0.36
11.407	1.41	5.05	2.93	1.7219	.72	3.96	2.38	0.34
11.410	1.41	5.05	2.93	1.7239	.71	3.97	2.42	0.33
11.440	1.44	5.03	2.89	1.7434	.59	4.11	2.97	0.30
11.470	1.47	4.96	2.82	1.7587	.42	4.29	4.19	0.24
11.500	1.50	4.70	2.66	1.7671	.00	4.71	****	****

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 15" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.25 ft
Diameter = 1.2500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.030	.03	.00	.37	.0077	.38	.39	.02	0.46
10.060	.06	.01	.59	.0216	.53	.55	.04	0.52
10.090	.09	.03	.77	.0394	.65	.68	.06	0.55
10.120	.12	.06	.92	.0602	.74	.79	.08	0.57
10.150	.15	.09	1.06	.0834	.81	.88	.10	0.58
10.180	.18	.13	1.19	.1088	.88	.97	.12	0.59
10.210	.21	.18	1.30	.1360	.93	1.06	.15	0.60
10.240	.24	.23	1.41	.1648	.98	1.13	.17	0.61
10.270	.27	.30	1.52	.1950	1.03	1.21	.19	0.61
10.300	.30	.36	1.61	.2265	1.07	1.28	.21	0.62
10.330	.33	.44	1.70	.2590	1.10	1.35	.24	0.62
10.360	.36	.52	1.79	.2926	1.13	1.42	.26	0.62
10.390	.39	.61	1.87	.3269	1.16	1.48	.28	0.62
10.420	.42	.70	1.94	.3620	1.18	1.55	.31	0.62
10.450	.45	.80	2.01	.3977	1.20	1.61	.33	0.62
10.480	.48	.90	2.08	.4340	1.22	1.67	.36	0.61
10.510	.51	1.01	2.14	.4707	1.23	1.73	.38	0.61
10.540	.54	1.12	2.20	.5077	1.24	1.79	.41	0.61
10.570	.57	1.23	2.26	.5449	1.25	1.85	.44	0.60
10.600	.60	1.35	2.31	.5824	1.25	1.91	.47	0.60
10.630	.63	1.46	2.36	.6198	1.25	1.97	.50	0.59
10.660	.66	1.58	2.41	.6573	1.25	2.03	.53	0.58
10.690	.69	1.70	2.45	.6947	1.24	2.09	.56	0.58
10.720	.72	1.82	2.49	.7319	1.24	2.15	.59	0.57
10.750	.75	1.94	2.52	.7688	1.22	2.22	.63	0.56
10.780	.78	2.06	2.56	.8053	1.21	2.28	.67	0.55
10.810	.81	2.18	2.59	.8414	1.19	2.34	.70	0.54
10.840	.84	2.29	2.61	.8769	1.17	2.40	.75	0.53
10.870	.87	2.40	2.63	.9118	1.15	2.47	.79	0.52
10.900	.90	2.51	2.65	.9459	1.12	2.53	.84	0.51
10.930	.93	2.61	2.67	.9791	1.09	2.60	.90	0.50
10.960	.96	2.71	2.68	1.0113	1.06	2.67	.96	0.48
10.990	.99	2.80	2.68	1.0424	1.01	2.74	1.03	0.47
11.020	1.02	2.88	2.68	1.0722	.97	2.82	1.11	0.45
11.050	1.05	2.95	2.68	1.1004	.92	2.90	1.20	0.43

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 15" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.25 ft
Diameter = 1.2500 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
11.080	1.08	3.01	2.67	1.1271	.86	2.98	1.32	0.41
11.110	1.11	3.06	2.66	1.1518	.79	3.07	1.46	0.39
11.140	1.14	3.09	2.63	1.1743	.71	3.17	1.66	0.36
11.170	1.17	3.11	2.60	1.1941	.61	3.29	1.95	0.33
11.200	1.20	3.09	2.56	1.2107	.49	3.42	2.47	0.29
11.230	1.23	3.04	2.48	1.2230	.31	3.61	3.90	0.22
11.250	1.25	2.89	2.35	1.2272	.00	3.93	****	****

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 12" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.00 ft
Diameter = 1.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.020	.02	.00	.29	.0037	.28	.28	.01	0.44
10.040	.04	.00	.45	.0105	.39	.40	.03	0.48
10.060	.06	.01	.59	.0192	.47	.49	.04	0.51
10.080	.08	.02	.71	.0294	.54	.57	.05	0.53
10.100	.10	.03	.81	.0409	.60	.64	.07	0.55
10.120	.12	.05	.91	.0534	.65	.71	.08	0.56
10.140	.14	.07	1.00	.0668	.69	.77	.10	0.57
10.160	.16	.09	1.09	.0811	.73	.82	.11	0.58
10.180	.18	.11	1.17	.0961	.77	.88	.13	0.58
10.200	.20	.14	1.25	.1118	.80	.93	.14	0.59
10.220	.22	.17	1.32	.1281	.83	.98	.15	0.59
10.240	.24	.20	1.39	.1449	.85	1.02	.17	0.59
10.260	.26	.24	1.45	.1623	.88	1.07	.18	0.60
10.280	.28	.27	1.52	.1800	.90	1.12	.20	0.60
10.300	.30	.31	1.57	.1982	.92	1.16	.22	0.60
10.320	.32	.35	1.63	.2167	.93	1.20	.23	0.60
10.340	.34	.40	1.68	.2355	.95	1.25	.25	0.60
10.360	.36	.44	1.74	.2546	.96	1.29	.27	0.59
10.380	.38	.49	1.78	.2739	.97	1.33	.28	0.59
10.400	.40	.54	1.83	.2934	.98	1.37	.30	0.59
10.420	.42	.59	1.87	.3130	.99	1.41	.32	0.59
10.440	.44	.64	1.92	.3328	.99	1.45	.34	0.58
10.460	.46	.69	1.96	.3527	1.00	1.49	.35	0.58
10.480	.48	.74	1.99	.3727	1.00	1.53	.37	0.58
10.500	.50	.80	2.03	.3927	1.00	1.57	.39	0.57
10.520	.52	.85	2.06	.4127	1.00	1.61	.41	0.57
10.540	.54	.91	2.09	.4327	1.00	1.65	.43	0.56
10.560	.56	.96	2.12	.4526	.99	1.69	.46	0.55
10.580	.58	1.02	2.15	.4724	.99	1.73	.48	0.55
10.600	.60	1.07	2.18	.4920	.98	1.77	.50	0.54
10.620	.62	1.12	2.20	.5115	.97	1.81	.53	0.53
10.640	.64	1.18	2.22	.5308	.96	1.85	.55	0.53
10.660	.66	1.23	2.24	.5499	.95	1.90	.58	0.52
10.680	.68	1.28	2.26	.5687	.93	1.94	.61	0.51
10.700	.70	1.33	2.27	.5872	.92	1.98	.64	0.50

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 12" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 11.00 ft
Diameter = 1.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.720	.72	1.38	2.28	.6054	.90	2.03	.67	0.49
10.740	.74	1.43	2.29	.6231	.88	2.07	.71	0.48
10.760	.76	1.48	2.30	.6405	.85	2.12	.75	0.47
10.780	.78	1.52	2.31	.6573	.83	2.17	.79	0.46
10.800	.80	1.56	2.31	.6736	.80	2.21	.84	0.44
10.820	.82	1.59	2.31	.6893	.77	2.27	.90	0.43
10.840	.84	1.63	2.31	.7043	.73	2.32	.96	0.42
10.860	.86	1.66	2.30	.7186	.69	2.37	1.04	0.40
10.880	.88	1.68	2.29	.7320	.65	2.43	1.13	0.38
10.900	.90	1.70	2.28	.7445	.60	2.50	1.24	0.36
10.920	.92	1.71	2.26	.7560	.54	2.57	1.39	0.34
10.938	.94	1.71	2.24	.7653	.48	2.64	1.59	0.31
10.940	.94	1.71	2.24	.7662	.47	2.65	1.61	0.31
10.960	.96	1.71	2.20	.7749	.39	2.74	1.98	0.28
10.980	.98	1.68	2.15	.7816	.28	2.86	2.79	0.23
11.000	1.00	1.59	2.03	.7854	.00	3.14	****	****

Type.... Chn-Circular
Name.... CHN-CIR 10

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 10" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 10.83 ft
Diameter = .8333 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.020	.02	.00	.29	.0034	.26	.26	.01	0.43
10.040	.04	.00	.45	.0096	.36	.37	.03	0.48
10.060	.06	.01	.58	.0175	.43	.45	.04	0.51
10.080	.08	.02	.70	.0267	.49	.53	.05	0.53
10.100	.10	.03	.81	.0371	.54	.59	.07	0.54
10.120	.12	.04	.91	.0483	.59	.65	.08	0.56
10.140	.14	.06	.99	.0604	.62	.70	.10	0.56
10.160	.16	.08	1.08	.0732	.66	.76	.11	0.57
10.180	.18	.10	1.16	.0867	.69	.81	.13	0.57
10.200	.20	.12	1.23	.1007	.71	.85	.14	0.58
10.220	.22	.15	1.30	.1151	.73	.90	.16	0.58
10.240	.24	.18	1.36	.1300	.75	.94	.17	0.58
10.260	.26	.21	1.42	.1453	.77	.99	.19	0.58
10.280	.28	.24	1.48	.1609	.79	1.03	.20	0.58
10.300	.30	.27	1.54	.1768	.80	1.07	.22	0.58
10.320	.32	.31	1.59	.1929	.81	1.11	.24	0.57
10.340	.34	.34	1.64	.2092	.82	1.15	.26	0.57
10.360	.36	.38	1.68	.2256	.83	1.20	.27	0.57
10.380	.38	.42	1.72	.2422	.83	1.24	.29	0.56
10.400	.40	.46	1.76	.2588	.83	1.28	.31	0.56
10.420	.42	.50	1.80	.2755	.83	1.32	.33	0.55
10.440	.44	.54	1.84	.2921	.83	1.36	.35	0.55
10.460	.46	.58	1.87	.3087	.83	1.40	.37	0.54
10.480	.48	.62	1.90	.3253	.82	1.44	.39	0.53
10.500	.50	.66	1.93	.3417	.82	1.48	.42	0.53
10.520	.52	.70	1.95	.3579	.81	1.52	.44	0.52
10.540	.54	.74	1.97	.3740	.80	1.56	.47	0.51
10.560	.56	.78	1.99	.3897	.78	1.60	.50	0.50
10.580	.58	.81	2.01	.4052	.77	1.64	.53	0.49
10.600	.60	.85	2.02	.4204	.75	1.69	.56	0.48
10.620	.62	.89	2.03	.4351	.73	1.73	.60	0.46
10.640	.64	.92	2.04	.4495	.70	1.78	.64	0.45
10.660	.66	.95	2.05	.4633	.68	1.83	.68	0.44
10.680	.68	.98	2.05	.4765	.65	1.88	.74	0.42
10.700	.70	1.00	2.05	.4891	.61	1.93	.80	0.40

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 10" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 10.83 ft
Diameter = .8333 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.720	.72	1.02	2.04	.5009	.57	1.99	.88	0.38
10.740	.74	1.04	2.03	.5119	.53	2.05	.97	0.36
10.760	.76	1.05	2.01	.5219	.47	2.12	1.11	0.34
10.780	.78	1.05	1.99	.5307	.41	2.19	1.30	0.31
10.800	.80	1.05	1.95	.5381	.33	2.28	1.65	0.27
10.820	.82	1.03	1.90	.5435	.21	2.41	2.60	0.21
10.833	.83	.98	1.80	.5454	.00	2.62	499.51	0.01

Type.... Chn-Circular
Name.... CHN-CIR 10

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 8" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 10.67 ft
Diameter = .6667 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.000	.00	.00	.00	.0000	.00	.00	.00	0.00
10.010	.01	.00	.18	.0011	.16	.16	.01	0.39
10.020	.02	.00	.28	.0031	.23	.23	.01	0.43
10.030	.03	.00	.37	.0056	.28	.29	.02	0.46
10.040	.04	.00	.45	.0086	.32	.33	.03	0.48
10.050	.05	.01	.52	.0119	.35	.37	.03	0.50
10.060	.06	.01	.58	.0156	.38	.41	.04	0.51
10.070	.07	.01	.64	.0195	.41	.44	.05	0.52
10.080	.08	.02	.70	.0237	.43	.47	.05	0.52
10.090	.09	.02	.75	.0282	.46	.50	.06	0.53
10.100	.10	.03	.80	.0328	.48	.53	.07	0.54
10.110	.11	.03	.85	.0377	.49	.56	.08	0.54
10.120	.12	.04	.89	.0427	.51	.58	.08	0.55
10.130	.13	.04	.94	.0479	.53	.61	.09	0.55
10.140	.14	.05	.98	.0533	.54	.63	.10	0.55
10.150	.15	.06	1.02	.0588	.56	.66	.11	0.55
10.160	.16	.07	1.06	.0644	.57	.68	.11	0.56
10.170	.17	.08	1.10	.0702	.58	.71	.12	0.56
10.180	.18	.09	1.13	.0760	.59	.73	.13	0.56
10.190	.19	.10	1.17	.0820	.60	.75	.14	0.56
10.200	.20	.11	1.20	.0881	.61	.77	.14	0.56
10.210	.21	.12	1.23	.0942	.62	.79	.15	0.56
10.220	.22	.13	1.27	.1005	.63	.82	.16	0.56
10.230	.23	.14	1.30	.1068	.63	.84	.17	0.56
10.240	.24	.15	1.32	.1131	.64	.86	.18	0.56
10.250	.25	.16	1.35	.1196	.65	.88	.19	0.55
10.260	.26	.17	1.38	.1260	.65	.90	.19	0.55
10.270	.27	.19	1.41	.1326	.65	.92	.20	0.55
10.280	.28	.20	1.43	.1391	.66	.94	.21	0.55
10.290	.29	.21	1.45	.1457	.66	.96	.22	0.55
10.300	.30	.23	1.48	.1524	.66	.98	.23	0.54
10.310	.31	.24	1.50	.1590	.67	1.00	.24	0.54
10.320	.32	.25	1.52	.1657	.67	1.02	.25	0.54
10.330	.33	.27	1.54	.1723	.67	1.04	.26	0.53
10.340	.34	.28	1.56	.1790	.67	1.06	.27	0.53
10.350	.35	.29	1.58	.1856	.67	1.08	.28	0.53

Type.... Chn-Circular
Name.... CHN-CIR 10

File.... C:\HAESTAD\PPKW\SAMPLE\PROJECT1.PPW
Title... Proposed 8" Sewer

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .002000 ft/ft
Mannings n = 0.01300
Invert Elev. = 10.00 ft
Top of Channel = 10.67 ft
Diameter = .6667 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
10.360	.36	.31	1.60	.1923	.66	1.10	.29	0.52
10.370	.37	.32	1.61	.1989	.66	1.12	.30	0.52
10.380	.38	.34	1.63	.2056	.66	1.14	.31	0.52
10.390	.39	.35	1.65	.2121	.66	1.16	.32	0.51
10.400	.40	.36	1.66	.2187	.65	1.18	.33	0.51
10.410	.41	.38	1.67	.2252	.65	1.20	.35	0.50
10.420	.42	.39	1.69	.2317	.64	1.22	.36	0.50
10.430	.43	.40	1.70	.2381	.64	1.24	.37	0.49
10.440	.44	.42	1.71	.2444	.63	1.26	.39	0.48
10.450	.45	.43	1.72	.2507	.62	1.29	.40	0.48
10.460	.46	.44	1.73	.2569	.62	1.31	.42	0.47
10.470	.47	.46	1.74	.2630	.61	1.33	.43	0.47
10.480	.48	.47	1.74	.2691	.60	1.35	.45	0.46
10.490	.49	.48	1.75	.2750	.59	1.37	.47	0.45
10.500	.50	.49	1.75	.2808	.58	1.40	.49	0.44
10.510	.51	.50	1.76	.2866	.57	1.42	.51	0.44
10.520	.52	.51	1.76	.2921	.55	1.44	.53	0.43
10.530	.53	.52	1.76	.2976	.54	1.47	.55	0.42
10.540	.54	.53	1.76	.3029	.52	1.49	.58	0.41
10.550	.55	.54	1.76	.3081	.51	1.52	.61	0.40
10.560	.56	.55	1.76	.3130	.49	1.55	.64	0.39
10.570	.57	.56	1.76	.3178	.47	1.57	.68	0.38
10.580	.58	.57	1.76	.3224	.45	1.60	.72	0.36
10.590	.59	.57	1.75	.3268	.43	1.63	.77	0.35
10.600	.60	.58	1.74	.3309	.40	1.67	.83	0.34
10.610	.61	.58	1.73	.3348	.37	1.70	.90	0.32
10.620	.62	.58	1.72	.3383	.34	1.74	.99	0.30
10.626	.63	.58	1.71	.3402	.32	1.76	1.06	0.29
10.630	.63	.58	1.70	.3416	.30	1.78	1.12	0.28
10.640	.64	.58	1.68	.3444	.26	1.83	1.32	0.26
10.650	.65	.57	1.65	.3468	.21	1.88	1.66	0.23
10.660	.66	.56	1.62	.3485	.13	1.96	2.62	0.18
10.667	.67	.54	1.55	.3491	.00	2.09	****	****

APPENDIX B

- PROPOSED SEWER SYSTEM FLOW CALCULATIONS

PROPOSED
SEWER SYSTEM

FLOW CALCULATIONS

PACIFICENTER SEWER LINE CAPACITY CALCULATIONS DATE: AUGUST 2003

Pipe Reach	AREA ID	units/build SF	Area Q	Q	Qp	Pipe Size	So	K'	D/d	Dn
Line A										
1A	R9	356	0.12	0.12	0.25	0.67	0.004	0.148033	0.39	0.26
2A	R10	356	0.12	0.24	0.50	0.67	0.004	0.299972	0.58	0.39
3A	R11	356	0.12	0.36	0.75	0.83	0.0032	0.282248	0.57	0.47
4A	R12	356	0.12	0.48	0.99	1	0.0024	0.263104	0.54	0.54
5A				0.48	0.99	1	0.0024	0.263104	0.54	0.54
6A	C11	222800 sf	0.08	0.56	1.15	1.25	0.0016	0.206806	0.47	0.59
7A	C12	106050 sf (1/2)	0.03	0.59	1.21	1.25	0.0016	0.217691	0.49	0.61
Line B										
1B	R1	161	0.05	0.05	0.11	0.67	0.004	0.066706	0.26	0.17
2B	R2+R7	245	0.08	0.13	0.28	0.67	0.004	0.16667	0.42	0.28
3B	R5	99	0.03	0.16	0.34	0.67	0.004	0.203838	0.46	0.31
4B	(1/2)R6+ R8	164	0.06	0.22	0.46	0.83	0.0032	0.175489	0.43	0.36
5B	(1/2)R6	68	0.03	0.25	0.53	0.83	0.0032	0.198775	0.38	0.32
6B	R4	207	0.07	0.32	0.67	0.83	0.004	0.226231	0.49	0.41
7B				0.32	0.67	0.83	0.004	0.22485	0.49	0.41
8B				0.32	0.67	0.83	0.0032	0.25139	0.53	0.44
9B	C7+C9	433,500 sf	0.15	0.47	0.97	1	0.0024	0.257715	0.53	0.53
10B	(1/2)C8+(1/2)C10	216,700	0.08	0.55	1.13	1	0.0024	0.300777	0.59	0.59
Line C										
1C	C3+hotel	292,500 sf +400rooms	0.2	0.20	0.42	0.83	0.0032	0.158379	0.4	0.33
2C	C1	178,00 sf	0.06	0.26	0.54	0.83	0.0032	0.204976	0.47	0.39
3C	C2	90,000 sf	0.04	0.30	0.62	0.83	0.0032	0.235936	0.5	0.42
4C	R3	132	0.04	0.34	0.71	0.83	0.0032	0.266826	0.55	0.46
5C	C5	146,500 sf	0.05	0.39	0.81	0.83	0.0032	0.305352	0.59	0.49
6C	C4+(1/2)C6	243,700 sf	0.09	0.48	0.99	1	0.0024	0.263104	0.54	0.54
7C			1.91	2.39	2.37	1.25	0.002	0.379976	0.68	0.85
8C	C13	229100 sf	0.08	2.47	3.06	1.5	0.002	0.302073	0.59	0.89
9C	C14+(1/2)C6+(1/2)C8	441,250 sf	0.14	2.61	3.35	1.5	0.002	0.329973	0.62	0.93
10C				2.61	3.35	1.5	0.0025	0.295137	0.58	0.87
11C			0.55	3.16	4.45	1.75	0.002	0.290895	0.58	1.02
12C	C15+(1/2)C10	341,750 sf	0.11	3.27	4.67	1.75	0.002	0.305249	0.59	1.03
13C				3.27	4.47	1.75	0.0022	0.278583	0.56	0.98
14C	(1/2)C12+C16	358,250 sf	0.12	3.39	4.91	1.75	0.0024	0.292926	0.55	0.96
Totals				3.98	6.12					

APPENDIX C

- LONG BEACH SEWER SYSTEM MASTER PLAN EXCERPTS

SEWER SYSTEM MASTER PLAN

LONG BEACH

1.

LONG BEACH WATER DEPARTMENT

Comprehensive Sewer System Master Plan and Management Program

BOYLE ENGINEERING CORPORATION

Master Plan

Table 2-3 Residential Zoning Characteristics

Zoning Map Classification Residential	Typical Development	Density (DU/Acre)
R1S	Single Family Residential, Small Lot	18
R1N	Single Family Residential, Standard Lot	7
R1L	Single Family Residential, Large Lot	4
R2S	Two Family Residential, Small Lot	18
R2N	Two Family Residential, Standard Lot	15
R2I	Two Family Residential, Intensified	15
R2L	Two Family Residential, Large Lot	11
R3S	Three Family Residential, Small Lot	21
R34	Four Family Residential	39
R3L	Multi-Family Residential, Large Lot	29
R3T	Townhouse, Shallow Lot	27
R4R	Dense Multiple Residential, Restricted Height and Bulk	54
R4N	Dense Multiple Residential, High Rise	62
R4H	Dense Multiple Residential, High Rise	110
RM	Mobile, Modular Housing	9

Table 2-4 Non-Residential Zoning Characteristics

Zoning Map Classification	Typical Development
CC	Commercial Corridor
CR	Retail Center
CB	Central Business
CO	Office Commercial
CP	Pedestrian Commercial
CH	Highway Commercial
CL	Limited Commercial
CN	Neighborhood Commercial
CT	Tourist and Entertainment Commercial
CS	Commercial Storage
CMR	Mixed Commercial/Residential
CU	Urban Commercial
CO (HR)	Office Commercial High Rise
CH (HR)	Highway Commercial High Rise
M	Manufacturing
MC	Mixed Manufacturing and Commercial
ML	Limited Manufacturing
MG	General Manufacturing
MR	Restricted Manufacturing
MP	Port District
I	Institutional
P	Park
PR	Public Right-of-Way
PR (H)	Public Right-of-Way (Horse)

3. BASIS OF ANALYSIS AND DESIGN

This chapter presents the criteria used for evaluation of existing gravity and pumped sewer facilities and for sizing of improvements needed to provide master plan capacities.

GRAVITY SYSTEM

Hydraulic Analysis

Hydraulic analysis of the gravity sewer system was performed by use of Boyle's computerized BSWAN (Sewer Analysis) program which has been integrated into the Facilities Management System developed as part of the overall master plan effort.

The program simulates normal-depth open channel flow in each pipe within the system based upon the Manning's equation. Manning's friction factor "n" values used are as prescribed by the LBWD Sewer Design Standards as follows:

Manning's "n"	Pipe material/diameter
.013	VCP 15-inches & smaller
.012	VCP 18-inches & larger
.014	Unlined RCP-all sizes

Capacity Definition

Evaluation of pipeline capacity of existing lines and sizing of proposed trunk is determined by limiting the peak flow depth to pipe diameter (D/d ratio) as follows:

Pipe Size (inches)	D/d Existing	D/d New
8 to 15	.90	.50
$\geq$ 18	.90	.75

Based upon the discussion with LBWD staff the 90% depth to diameter represents the maximum hydraulic open channel flow desirable within a circular conduit. Although new facilities are not sized to operate at this level of fullness, it is used for the analysis of existing facilities to optimize the use of existing capacity before calling for new facility construction. The depth to diameter ratios for sizing of replacement or parallel facilities is as defined by the LBWD Standard Design criteria as shown above.

Peaking Factor

A least squares method of analysis of the peak and average flows measured during the flow monitoring of five sites within the downtown area at the onset of the study indicates a Peak to Average flow relationship as follows:

$$Q_{peak} = 2.04\ Q_{avg}^{.963}$$

As discussed in the Facilities Management Software documentation, peak flows are determined by summing all average flows tributary to the pipe reach in question and applying the peak to average flow relationship (equation) above.

Flow Coefficients

Estimates of average flow quantities from specific development projects have been based upon the following:

Table 3-1 Specific Development

Sewage Flow Generation Criteria

Commercial Development--	200 Gallons/1000 SF/day
Hotels	150 Gallons/Room/day
High Rise Residential	213 Gallons/Dwelling/day
Hospitals	
Surgical	500 Gallons/Bed/day
Convalescent	85 Gallons/Bed/day
Schools	
Elem. & Jr. High	10 Gallons/Student/day
Sr. High	15 Gallons/Student/day
College/Univ.	20 Gallons/Student/day

Estimates of average flow quantities from non-specific typical zoned development have been based upon unit flow coefficients applied to gross land acreages by type.

Table 3-2 summarizes unit flow coefficients for the various City Residential Zoning Classifications. These values are based upon 85 gallons per person per day and 2.5 persons per dwelling unit(DU). Current census (1990) information for the City of Long Beach indicates the 2.5 person per DU figure. Analysis of the R4H zoning classification revealed a ceiling of 250 dwelling units per acre. Discussion with city planning staff and an examination of neighborhood population goals, however, indicate that this type of development is expected to maximize at no more than 110 dwelling units per acre, as shown below.

Table 3-2 Residential Unit Flow Coefficients *

Zoning Map Classification	Density (DU/Acre)	Flow Coefficient Average cfs/acre
R1S	18	.0059
R1N	7	.0023
R1L	4	.0013
R2S	18	.0059
R2N	15	.0049
R2I	15	.0049
R2L	11	.0036
R3S	21	.0069
R34	39	.0128
R3L	29	.0095
R3T	27	.0089
R4R	54	.0178
R4N	62	.0204
R4H	110	.0362
RM	9	.0029

* Based upon 85 gpcd & 2.5 persons per dwelling unit

See 2-25 for Definition of Zoning

Table 3-3 summarizes unit flow coefficients used for the various Non-Residential Zoning Classifications. These coefficients are also used by the County Sanitation Districts of Los Angeles County. High rise (HR) land uses are expected to generate a little more than double non-high rise land uses. Depending on their size, schools may be measured either by land use or number of students.

Table 3-3 Non-Residential Unit Flow Coefficients

Land Use Type		Flow Coefficient Average (cfs/acre)
CC	Commercial Corridor	0.006
CR	Retail Center	0.006
CB	Central Business	0.006
CO	Office Commercial	0.006
CP	Pedestrian Commercial	0.006
CH	Highway Commercial	0.006
CL	Limited Commercial	0.006
CN	Neighborhood Commercial	0.006
CT	Tourist and Entertainment Commercial	0.006
CS	Commercial Storage	0.003
CMR	Mixed Commercial/Residential	0.006
CU	Urban Commercial	0.006
CO (HR)	Office Commercial (High Rise)	0.013
CH (HR)	Highway Commercial (High Rise)	0.013
M	Manufacturing	0.008
MC	Mixed Manufacturing and Commercial	0.008
ML	Limited Manufacturing	0.008
MG	General Manufacturing	0.010
MP	Port District	0.008
MR	Restricted Manufacturing	0.006
I	Institutional	0.006
P	Park	0.0003
PR	Public Right-of-Way	N/A
PR (H)	Public Right-of-Way (Horse)	N/A

PUMPED SYSTEM

Pump Station Capacity

Standards for design and operation of a sewage pump station call for installation of enough pumping units to enable pumping of the expected maximum peak sewage inflow while keeping a pumping unit of the largest single-unit capacity on standby for use when one of the main pump units is out of service for maintenance or repair. Therefore, evaluations of existing pump station capacity need to account for the number and relative capacity rating of each of the pumping units within each station.

Capacity of a pump station is determined by a study of the operation of the pumps at the station individually and in combination with the appropriate number of the other pumps which pump through the same force main. This study is performed graphically by superimposing single and multiple (parallel) pump performance curves on the system head curve for the force main. Intersection of these curves indicate the flow rate and head operation point which can be achieved by the pumping equipment.

Figure 3-1 shows two typical system head curves for a particular force main. The upper curve represents the highest static head condition (lowest wetwell level) at the highest force main friction condition–which represents the worst operation case. The lower curve represents the lowest static head condition (highest wetwell level) at a low friction factor–which would be the best operation case. The system head curve includes only those portions of the piping system and force main common to all the pumping units.

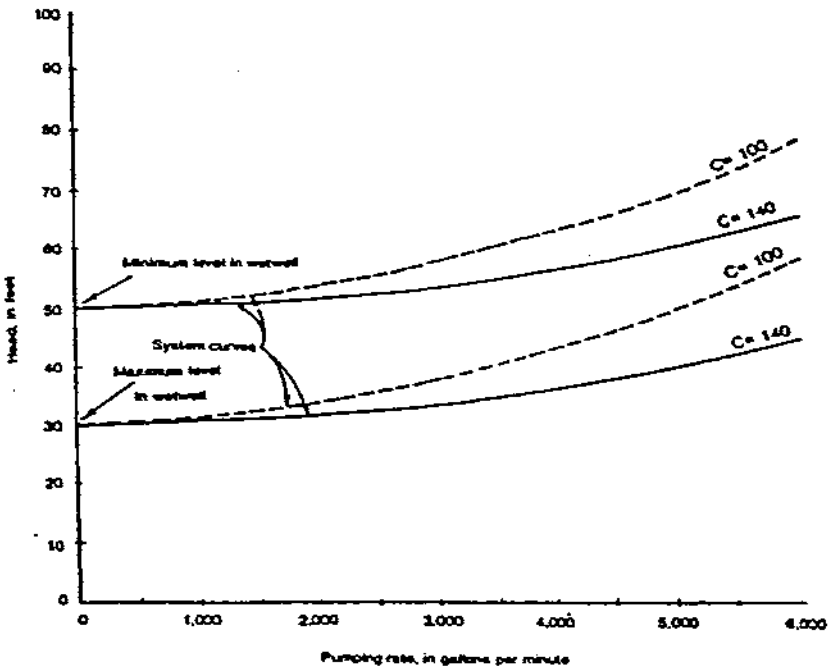

Figure 3-1 Typical System Head Curve

Pump curves for individual pumps superimposed on the system head curves are modified manufacturers published pump performance curves which account for minor losses through suction and discharge piping. Combined curves represent the addition of individual pump capacities at points of equal head and are used to determine the output of multiple pumps operating in parallel.

Figure 3-2 shows a typical example of individual, modified, and combined characteristic pump curves superimposed on the system head curves in Figure 3-1. The intersection of the modified combined pump curve with the worst case system head curve indicates the pump station's rated capacity and is the basis for determination of a deficiency when compared to the peak inflow estimated in the gravity system hydraulic model analysis.

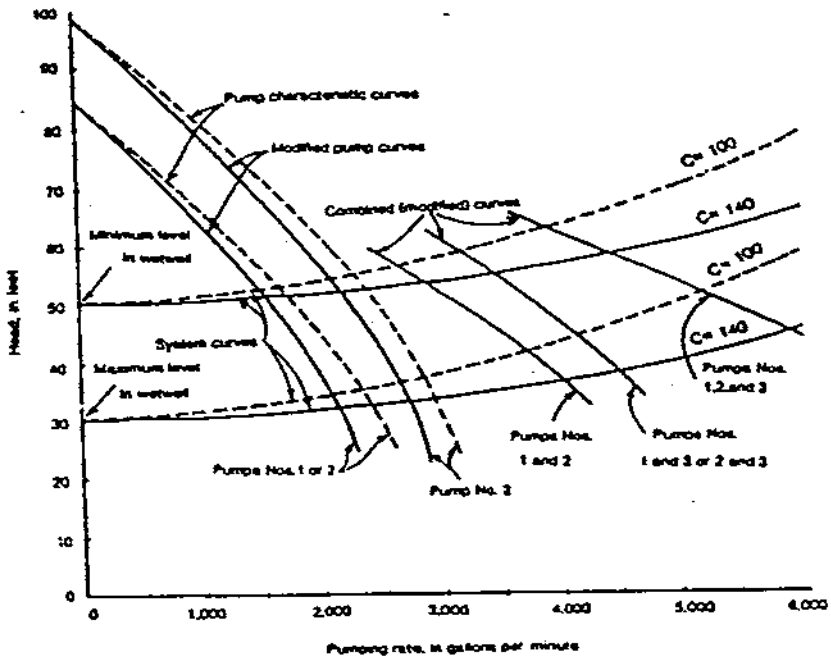

Figure 3-2 Typical Head/Capacity Analysis

Wetwell Volume

Wetwell operational volume need also be evaluated in relation to the current installed capacity and estimated peak capacity. For constant speed pumps, the wetwell volume must be large enough to provide minimum on-off cycle times of 10 minutes for 15 horsepower and smaller motors and 15 minutes for 20 to 50 horsepower motors. Alternation of the lead and lag pump units may be considered, if necessary, to achieve cycle time limitations.

Piping Velocities

Based upon current pumping capacity and the required peak capacity, existing force mains need to be checked for velocity less than 10 feet per second (fps) to prevent scour. New force mains should be sized for flow at approximately 6 fps to limit headloss and energy consumption. Desirable velocities in suction and discharge piping range from 4 to 6 fps and 6 to 8 fps, respectively.

FACILITY UPGRADE COST BASE

For the purposes of developing a capital improvement program and for comparing alternatives, basic unit pipe costs and associated appurtenant costs were established. These same costs were also tied to the latest published Environmental Protection Agency/Los Angeles (EPA/LA) "Complete Sewer System" construction cost index and to the January 1991 Engineering News Record Construction Cost index (CCI) for Los Angeles for future use in updating estimated project costs for budgeting purposes.

A data base consisting of construction bids for over 15 sewer projects within the Southern California area was assimilated from bid tabulations by local public agencies and the Daily Construction Service Newspaper for Los Angeles published by Construction Market Data, Inc. All bids for individual projects were included in the data base, to avoid an artificially low unit cost base from award or low-bid data.

The average contractors' bid cost was calculated for the bid items representing the various sizes of piping in each job. Shoring, dewatering, and traffic control costs, (where shown as separate bid items), were distributed on a weighted average cost basis to the line items for piping of the various sizes. In addition, costs for all bid items which did not represent furnishing and installing sewer piping, dewatering, shoring, or traffic control were tabulated to calculate the "appurtenant" costs on a percent basis for the individual projects. Appurtenant costs

typically include items such as manholes, frames, covers, concrete collars, laterals, etc. and averaged 20 percent of the pipeline construction costs for all projects surveyed. Costs were escalated from the various times of bid to the latest published EPA/LA index of 294 (January 1990). The U. S. EPA since informed us that the service of providing the sewer cost index would be discontinued indefinitely due to funding restrictions. Therefore, further escalations in this study have been made based upon the ENR/CCI for Los Angeles. The ENR/CCI/LA index was 5790 and 5994 in January 1990 and January 1991, respectively. This would be the same as an EPA/LA Index of 304.

Due to a wide variation in pipe cost per foot in the 36-to 42-inch-diameter size range, a linear regression "best fit" line of the data was developed. Figure 3-3 illustrates this line. Table 3-4 presents costs per foot and cost per pipe-diameter-inch per foot, based upon the best fit line, at the EPA/LA index of 294. Figure 3-4 illustrates the cost per inch diameter-which is found to increase at a decreasing rate as would be expected for the very large diameter sewers.

Long Beach Water Department
SEWER ANALYSIS RESULTS SUMMARY

at buildout

(resrep1)

ID	Slope (f/f)	Pipe Size (in)	Peak Capacity (cfs)	Average Capacity (cfs)	Area (acres)	Flow Input (cfs)	Point Source (cfs)	Average Flow (cfs)	Peak Flow (cfs)	Velocity (ft/sec)	Depth Ratio	Excess Avg Capacity (cfs)	UNDER CAPACITY Replace (in)	Relief (in)	Street Name/Label
090245-090244	0.00200	10	0.51	0.24				0.28	0.57	1.9	.55		12	6	
090246-090245	0.00700	10	0.95	0.46	62.3	0.14		0.28	0.57	3.0	.39	0.18			
090248-090246	0.00200	10	0.51	0.24	57.4	0.13		0.13	0.28	1.5	.36	0.11			
090250-090132	0.00400	10	0.72	0.34	173.2	0.05		0.44	0.91	2.7	.60		12	8	CONANT/BELLFLOW
090250-090132								0.44	U						CLARK
090251-090250	0.00240	10	0.55	0.27				0.39	0.81	2.2	.65		12	8	
090252-090251	0.00240	10	0.55	0.27	48.7	0.39		0.39	0.81	2.2	.65		12	8	LAKEWOOD/WARLOW
090253-090115	0.00200	21	6.46	3.23				2.62	5.26	3.2	.64	0.61			CLARK
090253-090115								2.62	U						
090254-090253	0.00120	21	5.01	2.49	34.8	0.28		2.62	5.26	2.6	.78		24	10	
090255-090254	0.00120	21	5.01	2.49				2.34	4.71	2.6	.72	0.15			
090256-090255	0.00460	18	6.50	3.25				2.34	4.71	4.3	.59	0.91			
090257-090256	0.00760	18	8.35	4.19				2.34	4.71	5.2	.51	1.85			
090258-090257	0.00180	18	4.06	2.02	133.6	1.07		2.34	4.71	2.8	.89		21	12	
090259-090258	0.00180	18	4.06	2.02				1.27	2.59	2.6	.55	0.74			
090260-090259	0.00220	18	4.49	2.23	42.3	0.34		1.27	2.59	2.8	.51	0.96			
090261-090260	0.00480	15	2.31	1.14				0.93	1.91	3.5	.45	0.20			
090262-090261	0.00480	15	2.31	1.14				0.49	1.02	3.0	.32	0.64			
090263-090262	0.00600	15	2.59	1.27				0.49	1.02	3.2	.31	0.78			
090264-090263	0.00240	15	1.64	0.80	88.6	0.49		0.49	1.02	2.3	.39	0.31			UNION PACIFIC R.
090265-090261	0.00320	15	1.89	0.92				0.44	0.91	2.5	.34	0.48			
090265-090261								0.44	U						
090266-090265	0.00200	15	1.49	0.73				0.44	0.91	2.1	.39	0.29			
090267-090266	0.00240	15	1.64	0.80	55.1	0.44		0.44	0.91	2.2	.37	0.36			
090268-090115	0.00120	15	1.16	0.56	56.4	0.45	0.17	1.13	2.30	2.1	.84		18	15	PARAMOUNT/COVER
090268-090115								1.13	U						CLARK
090270-090268	0.00120	15	1.16	0.56	63.1	0.50		0.50	1.04	1.8	.48	0.06			
090272-090120	0.00100	15	1.06	0.51	61.3	0.23		1.44	2.93	2.4	>1.0		18	18	LAKEWOOD/CONANT
090272-090120								1.44	U						CLARK
090274-090272	0.00100	15	1.06	0.51				1.21	2.47	2.0	>1.0		18	18	

Boyle Engineering Corporation

DESIGN CRITERIA: d/D 0.51 0.75 0.94
Dia 15 57 99

ANALYSIS CRITERIA: d/D 0.51 0.75 0.93
Dia 15 57 99

PEAKING FACTORS: K = 2.040
Ro = 0.983

APPENDIX D

- COUNTY SANITATION DISTRICT OF LOS ANGELES: COMMENT LETTER

COMMENT LETTER

LOS ANGELES COUNTY SANITATION DISTRICT

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

1955 Workman Mill Road, Whittier, CA 90601-1400
Mailing Address: P.O. Box 4998, Whittier, CA 90607-4998
Telephone: (562) 699-7411, FAX: (562) 699-5422
www.lacsd.org

JAMES F. STA
Chief Engineer and General Manag

May 23, 2001

File No: 03-00.04-00

Mr. Gerhardt H. Felgemaker
Environmental Manager
City of Long Beach
333 W. Ocean Boulevard, 5th Floor
Long Beach, CA 90802

RECEIVED
MAY 24 2001
Planning and Building Dept.
Community Planning

Dear Mr. Felgemaker:

PacifiCenter at Long Beach

The County Sanitation Districts of Los Angeles County (Districts) received a Notice of Preparation of a Draft Environmental Impact Report for the subject project on May 9, 2001. The proposed development is located within the jurisdictional boundaries of District No. 3. We offer the following comments regarding sewerage service:

1. The wastewater flow originating from the proposed project will discharge to a local sewer line, which is not maintained by the Districts, for conveyance to the Districts' Joint Outfall "A" Unit 1A North Long Beach Interceptor Trunk Sewer, located in Clark Avenue at Conant Street. This 30-inch diameter trunk sewer has a design capacity of 9 million gallons per day (mgd) and conveyed a peak flow of 3.9 mgd when last measured in 1998.

2. The wastewater generated by the proposed project will be treated at the Joint Water Pollution Control Plant (JWPCP) located in the City of Carson or the Long Beach Water Reclamation Plant (WRP). The JWPCP has a design capacity of 385 mgd and currently processes an average flow of 334.4 mgd. The Long Beach WRP has a design capacity of 25 mgd and currently processes an average flow of 19.1 mgd.

3. A copy of the Districts' average wastewater generation factors is enclosed to allow you to estimate the volume of wastewater the project will generate.

4. Individual developments associated with the proposed project may require a Districts' permit for Industrial Wastewater Discharge. Project developers should contact the Districts' Industrial Waste Section at extension 2900, in order to reach a determination on this matter. If this permit is necessary, project developers will be required to forward a copy of final plans for the proposed development(s) to the Districts for review and approval before beginning project construction.

5. Hazardous or toxic wastes are sometimes generated in research facilities. If such is the case for the research and development facilities of the subject project, please note that California law requires that any person producing hazardous or toxic wastes notify the State Department of Health Services of his intent to dispose of such waste. The producer of hazardous or toxic waste must provide the

hauler with a listing of the type(s) and amount of waste being hauled, the general chemical and mineral composition of the waste, and the origin and destination of the waste. Any person subject to a schedule of compliance who does not comply with that schedule shall be subject to a civil penalty of not more than $25,000 for each day of noncompliance. In addition, any person who intentionally or negligently makes any false statements or representations, or violates the laws and regulations regarding hazardous waste shall be liable for continuing violations, for each day that violation continues. If any hazardous waste is knowingly disposed of at an unauthorized site, the law provides for a fine of up to $50,000 for each day of violation and/or one year imprisonment. Repeat offenders will be fined up to $50,000 and/or two years imprisonment for each violation. If you have any questions regarding these laws and regulations, contact the State and County Departments of Health Services.

6. The Districts are empowered by the California Health and Safety Code to charge a fee for the privilege of connecting (directly or indirectly) to the Districts' Sewerage System or increasing the existing strength and/or quantity of wastewater attributable to a particular parcel or operation already connected. This connection fee is required to construct an incremental expansion of the Sewerage System to accommodate the proposed project which will mitigate the impact of this project on the present Sewerage System. Payment of a connection fee will be required before a permit to connect to the sewer is issued. For specific information regarding the connection fee application procedure and fees, please contact the Connection Fee Counter at extension 2727.

7. In order for the Districts to conform with the requirements of the Federal Clean Air Act (CAA), the design capacities of the Districts' wastewater treatment facilities are based on the regional growth forecast adopted by the Southern California Association of Governments (SCAG). Specific policies included in the development of the SCAG regional growth forecast are incorporated into the Air Quality Management Plan, which is prepared by the South Coast Air Quality Management District in order to improve air quality in the South Coast Air Basin as mandated by the CAA. All expansions of Districts' facilities must be sized and service phased in a manner which will be consistent with the SCAG regional growth forecast for the counties of Los Angeles, Orange, San Bernardino, Riverside, Ventura, and Imperial. The available capacity of the Districts' treatment facilities will, therefore, be limited to levels associated with the approved growth identified by SCAG. As such, this letter does not constitute a guarantee of wastewater service, but is to advise you that the Districts intend to provide this service up to the levels which are legally permitted and to inform you of the currently existing capacity and any proposed expansion of the Districts' facilities.

If you have any questions, please contact the undersigned at (562) 699-7411, extension 2717.

Very truly yours,

James F. Stahl

Ruth L. Frazen

Ruth L. Frazen
Engineering Technician
Planning & Property Management Section

RIF:eg
Enclosure

TABLE 1

LOADINGS FOR EACH CLASS OF LAND USE

DESCRIPTION	UNIT OF MEASURE	FLOW (Gallons per Day)	COD (Pounds per Day)	SUSPENDED SOLIDS (Pounds per Day)
RESIDENTIAL				
Single Family Home	Parcel	260	1.22	0.59
Duplex	Parcel	312	1.46	0.70
Triplex	Parcel	468	2.19	1.05
Fourplex	Parcel	624	2.92	1.40
Condominiums	Parcel	195	0.92	0.44
Single Family Home (reduced rate)	Parcel	156	0.73	0.35
Five Units or More	No. of Dwlg. Units	156	0.73	0.35
Mobile Home Parks	No. of Spaces	156	0.73	0.35
COMMERCIAL				
Hotel/Motel/Rooming House	Room	125	0.54	0.28
Store	1000 ft^2	100	0.43	0.23
Supermarket	1000 ft^2	150	2.00	1.00
Shopping Center	1000 ft^2	325	3.00	1.17
Regional Mall	1000 ft^2	150	2.10	0.77
Office Building	1000 ft^2	200	0.86	0.45
Professional Building	1000 ft^2	300	1.29	0.68
Restaurant	1000 ft^2	1,000	16.68	5.00
Indoor Theatre	1000 ft^2	125	0.54	0.28
Car Wash				
Tunnel - No Recycling	1000 ft^2	3,700	15.86	8.33
Tunnel - Recycling	1000 ft^2	2,700	11.74	6.16
Wand	1000 ft^2	700	3.00	1.58
Financial Institution	1000 ft^2	100	0.43	0.23
Service Shop	1000 ft^2	100	0.43	0.23
Animal Kennels	1000 ft^2	100	0.43	0.23
Service Station	1000 ft^2	100	0.43	0.23
Auto Sales/Repair	1000 ft^2	100	0.43	0.23
Wholesale Outlet	1000 ft^2	100	0.43	0.23
Nursery/Greenhouse	1000 ft^2	25	0.11	0.06
Manufacturing	1000 ft^2	200	1.86	0.70
Dry Manufacturing	1000 ft^2	25	0.23	0.09
Lumber Yard	1000 ft^2	25	0.23	0.09
Warehousing	1000 ft^2	25	0.23	0.09
Open Storage	1000 ft^2	25	0.23	0.09
Drive-in Theatre	1000 ft^2	20	0.09	0.05

APPENDIX E

- BOEING SEWAGE FLOW METER INFORMATION

SEWAGE FLOW METER INFORMATION

BOEING

PacifiCenter
@ Long Beach

PacifiCenter @ Long Beach
3855 Lakewood Boulevard
Building 1A MC D001-0097
Long Beach, CA. 90846

Jon Conk
Phone (562) 593-6543
Fax (562) 593-8140

Fax

To: NIKKI KERRY

From: Jon Conk

Fax: 818 609 9091 **Pages:** ~~14~~ 1, including cover sheet

Phone: **Date:** 7-12-01

Re: SEWER FLOW METER INFORMATION

Cc: MIKE RUSSELL

☐ Urgent X For Review ☐ Please Comment Please Reply

Comments:

CORRECTION WEST

NIKKI,

ATTACHED IS THE SEWER FLOW METER INFORMATION WE DISCUSSED TODAY. BOEING HAS 3 SEWER METERS ON THE WEST SIDE OF LAKEWOOD BLVD AND BOEING PREPARES A FLOW METER REPORT EACH YEAR. ATTACHED ARE 10 YEARS OF REPORTS FROM 1990 / 1991 THROUGH 1999 / 2000. THE 3 METERS ON THE ~~EAST~~ SIDE ARE NUMBERED, 804, 805 AND 807. I HAVE LOCATED THEM ON THE ATTACHED MAPS. IN 1998, AFTER THE MERGER WITH BOEING AND MD, THE PERMIT NUMBERS CHANGED AS FOLLOWS, 804 BECAME 14950 - 805 BECAME 14949 - 807 BECAME 14948. YOU WILL NOTICE THE HISTORIC PEAK WAS IN 1992 / 1993 @ 328.61 (MILLION GALLONS) AND THE LOW WAS IN 1999 / 2000 @ 212.49 (MILLION GALLONS).

If copy received incomplete or illegible
please contact Debra Booth @ (562) 593-8256

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PacifiCenter
@ Long Beach

PacifiCenter @ Long Beach
3855 Lakewood Boulevard
Building 1A MC D001-0097
Long Beach, CA. 90846

Jon Conk
Phone (562) 593-6543
Fax (562) 593-8140

Fax

To: NIKKI KERRY

From: Jon Conk

Fax: 818 609 9091 **Pages:** 14 , including cover sheet

Phone: **Date:** 7-12-01

Re: SEWER FLOW METER INFORMATION

Cc: MIKE RUSSELL

☐ Urgent x For Review ☐ Please Comment Please Reply

Comments:

NIKKI,

ATTACHED IS THE SEWER FLOW METER INFORMATION WE DISCUSSED TODAY. BOEING HAS 3 SEWER METERS ON THE WEST SIDE OF LAKEWOOD BLVD AND BOEING PREPARES A FLOW METER REPORT EACH YEAR. ATTACHED ARE 10 YEARS OF REPORTS FROM 1990 / 1991 THROUGH 1999 / 2000. THE 3 METERS ON THE EAST SIDE ARE NUMBERED, 804, 805 AND 807. I HAVE LOCATED THEM ON THE ATTACHED MAPS. IN 1998, AFTER THE MERGER WITH BOEING AND MD, THE PERMIT NUMBERS CHANGED AS FOLLOWS, 804 BECAME 14950 - 805 BECAME 14949 - 807 BECAME 14948. YOU WILL NOTICE THE HISTORIC PEAK WAS IN 1992 / 1993 @ 328.61 (MILLION GALLONS) AND THE LOW WAS IN 1999 / 2000 @ 212.49 (MILLION GALLONS).

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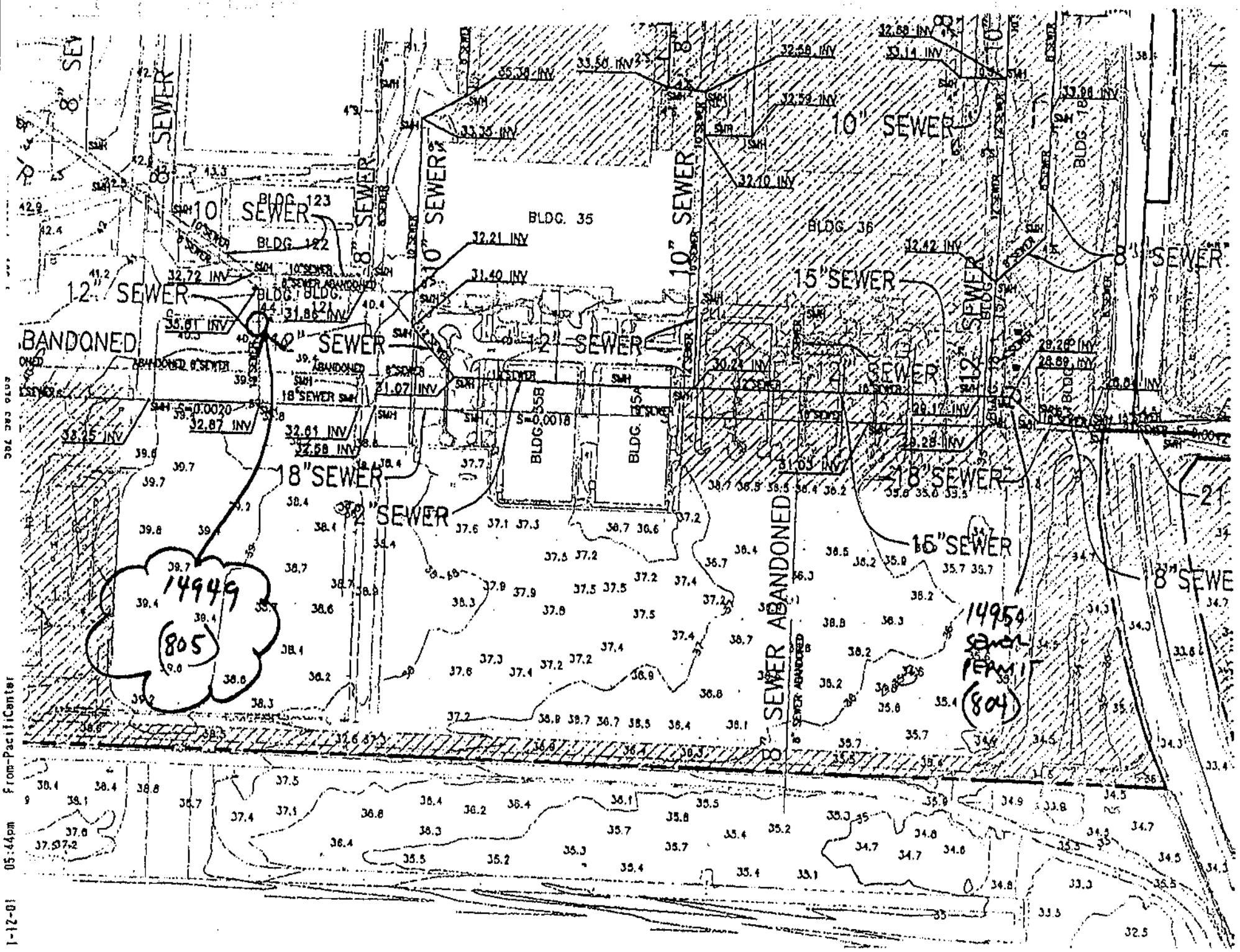

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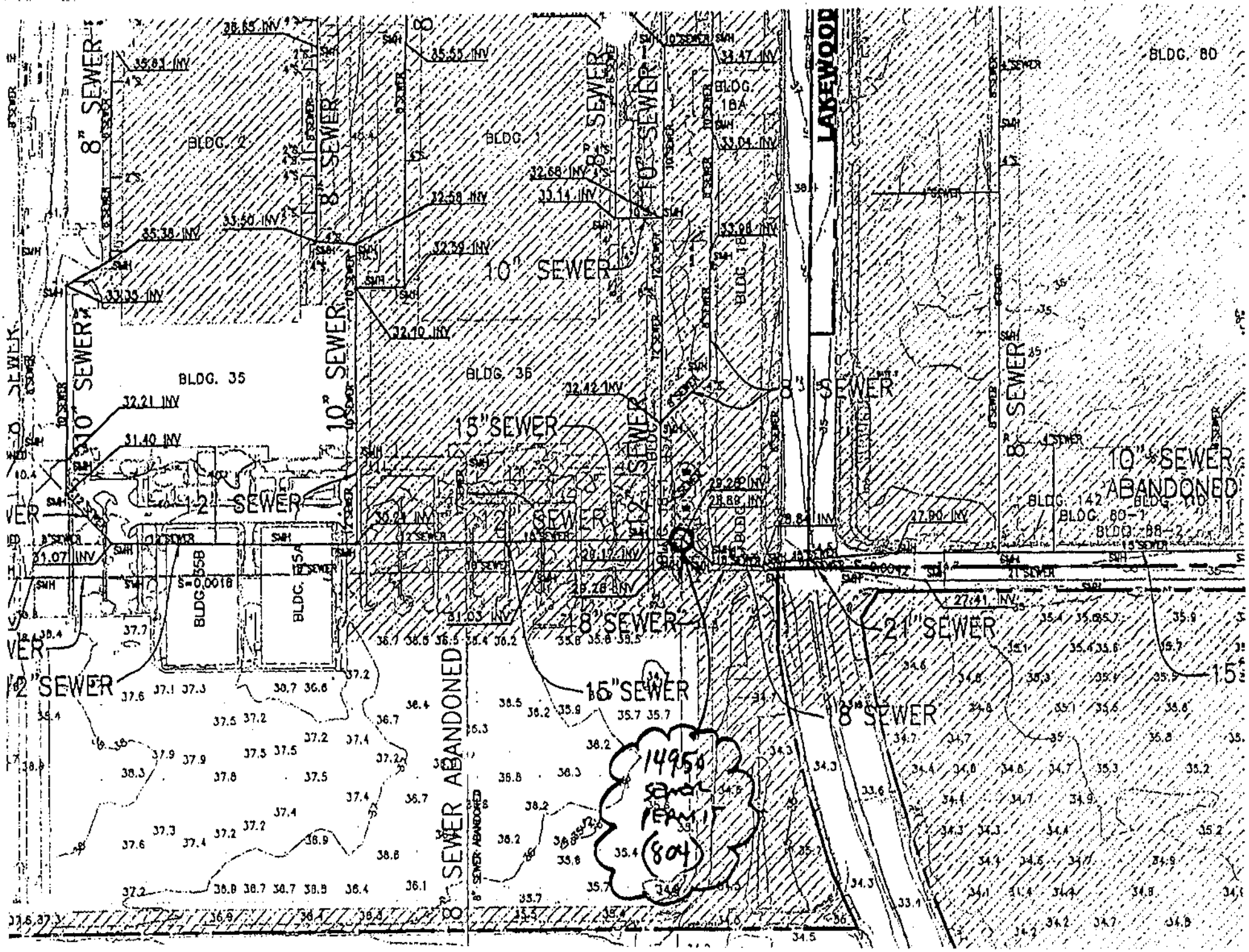
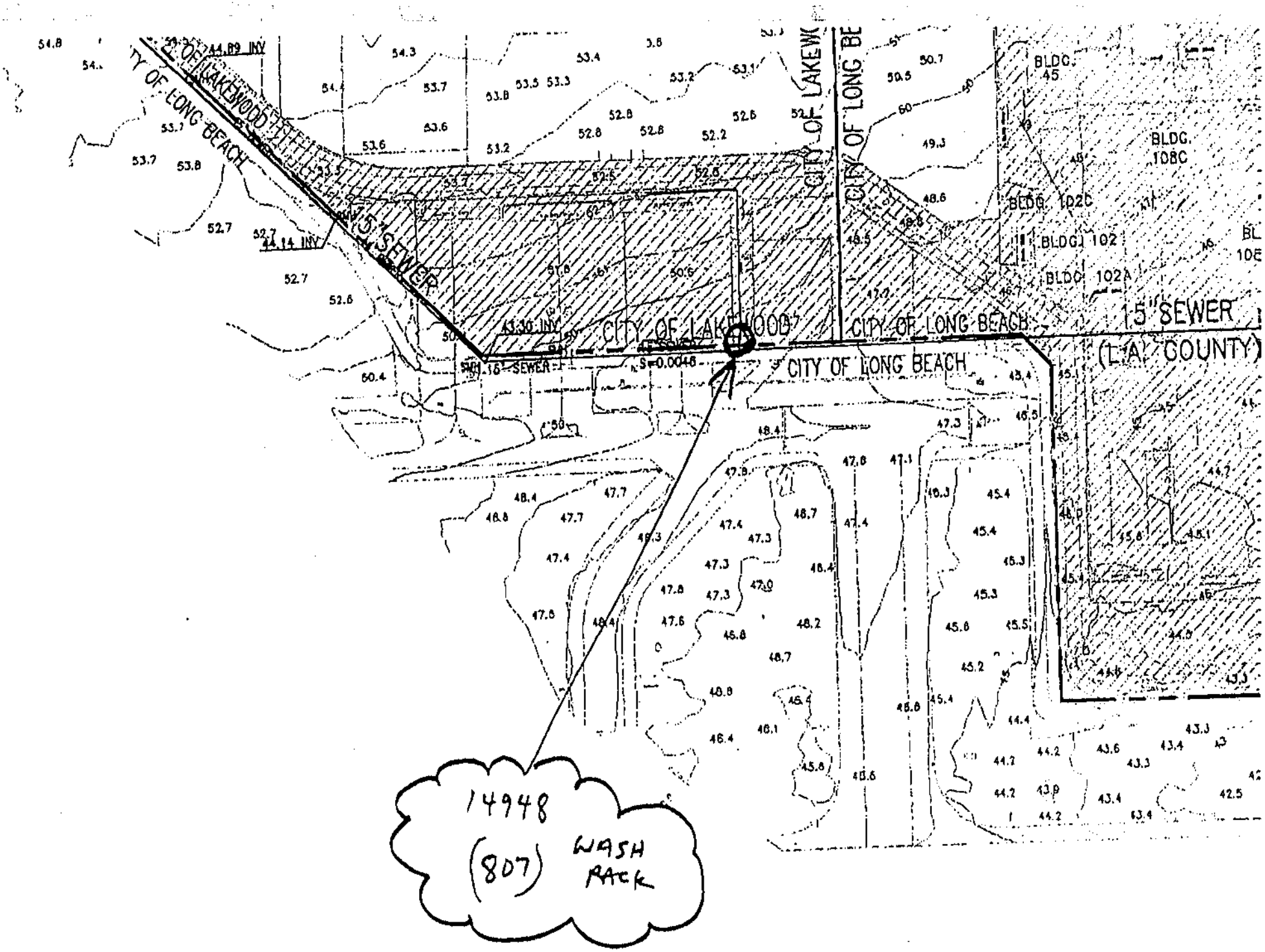

LAKEWOOD
BLDG. 2
BLDG. 1
BLDG. 18A
BLDG. 80
BLDG. 35
BLDG. 35B
BLDG. 35A
BLDG. 142
BLDG. 80-1
BLDG. 88-2
8" SEWER
10" SEWER
12" SEWER
15" SEWER
18" SEWER
21" SEWER
10" SEWER ABANDONED
8" SEWER ABANDONED
S=0.0016
14954 SEWER PERMIT (804)



1-12-01 05:46pm From-PacifiCenter 562 593 8269 T-581 P.004/014 F-883

tlet summary

al Year 199 0/1

.dditional Sheets If Necessary)

.npany Name

count No

Discharge Outlet to Sewer 2/ Districts' Permit No.	Yearly Flow Volume (in millions of gallons to two decimal places)	Yearly Chemical 1/ Oxygen Demand (COD) (in thousands of pounds to two decimal places)	Yearly Suspended 1/ Solids (SS) (in thousands of pounds to two decimal places)	Peak Flow Rate 3/ (in gallons per minute. Round off to whole numbers)
1. 804	279.72	301.13	189.01	1183
2. 805	21.95	50.14	19.40	217
3. ~~806~~	0.72	8.14	0.93	17
4. 807	16.39	248.51	6.13	41
5. 11982	1.70	4.62	4.30	52
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.	318.06			
14.				
TOTALS	320.48	613.14	219.77	
HIGHEST VALUE LISTED 3/				1183

NOTES:

1/ Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyzed for either COD or SS concentrations.

2/ For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report discharge quantities for all outlets and report only totals on the Surcharge Statement.

3/ Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

TABLE 1

outlet summary

F cal Year 199 1/2

Attach Additional Sheets If Necessary)

Company Name Douglas Aircraft Co.

Account No

Discharge Outlet to Sewer 2/ No.	Districts' Permit No.	Yearly Flow Volume (in millions of gallons to two decimal places)	Yearly Chemical 1/ Oxygen Demand (COD) (in thousands of pounds to two decimal places)	Yearly Suspended 1/ Solids (SS) (in thousands of pounds to two decimal places)	Peak Flow Rate 3/ (in gallons per minute. Round off to whole numbers)
1.	804	215.27	352.62	203.64	1201
2.	805	33.04	81.63	35.87	33
3.	~~806~~	~~10.48~~	~~90.37~~	~~23.10~~	~~5~~ EAST SIDE
4.	807	8.40	146.96	4.74	45
~~5.~~	~~11482~~	~~1.54~~	~~5.91~~	~~0.29~~	~~8~~
6.					
7.					
8.					
9.					
10.					
11.					
12.		256.71			
13.					
14.					
TOTALS		269.23	682.49	270.64	
HIGHEST VALUE LISTED 3/					1201

NOTES:

1/ Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyzed for either COD or SS concentrations.

2/ For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report discharge quantities for all outlets and report only totals on the Surcharge Statement.

3/ Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

TABLE 1

multiple discharge outlet summary

Fiscal Year 199 2 / 3

(Attach Additional Sheets If Necessary)

Company Name Douglas Aircraft Company

Account No 1350743

Discharge Outlet to Sewer 2 / No.	Districts' Permit No.	Yearly Flow Volume (in millions of gallons to two decimal places)	Yearly Chemical 1 / Oxygen Demand (COD) (in thousands of pounds to two decimal places)	Yearly Suspended 1 / Solids (SS) (in thousands of pounds to two decimal places)	Peak Flow Rate 3 / (in gallons per minute. Round off to whole numbers)
1.	804	288.13	326.73	117.94	1546
2.	805	28.69	59.07	21.04	289
3.	~~806R-1~~	~~2.22~~	~~13.56~~	~~2.46~~	~~12~~
4.	807	11.79	310.06	14.19	6
5.	~~11482~~	~~0.35~~	~~2.42~~	~~0.37~~	
6.					
7.					
8.					
9.					
10.					
11.					
12.		328.61			
13.					
14.					
TOTALS		331.18	711.84	156.00	
				HIGHEST VALUE LISTED 3 /	1546

NOTES:

1 / Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyzed for either COD or SS concentrations.

2 / For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report discharge quantities for all outlets and report only totals on the Surcharge Statement.

3 / Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

TABLE 1

TABLE 1

multiple discharge outlet summary

Fiscal Year 1993 / 4

(Attach Additional Sheets If Necessary)

Company Name _____

Account No 1350743

Discharge Outlet to Sewer 2 /		Yearly Flow Volume (in millions of gallons to two decimal places)	Yearly Chemical 1 / Oxygen Demand (COD) (in thousands of pounds to two decimal places)	Yearly Suspended 1 / Solids (SS) (in thousands of pounds to two decimal places)	Peak Flow Rate 3 / (in gallons per minute. Round off to whole numbers)
No.	Districts' Permit No.				
1.	804	267.50	198.59	114.56	1404
2.	805	8.19	54.68	10.42	57
3.	~~806R-1~~	~~1.21~~	~~5.73~~	~~1.34~~	~~70~~
4.	807	3.00	15.50	1.44	208
5.	~~11482~~	~~1.10~~	~~9.16~~	~~0.28~~	~~2~~
6.					
7.					
8.					
9.					
10.					
11.					
12.		278.69			
13.					
14.					
TOTALS		281.00	283.66	128.04	
				HIGHEST VALUE LISTED 3 /	1404

EAST SIDE

NOTES:

1 / Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyzed for either COD or SS concentrations.

For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report discharge quantities for all outlets and report only totals on the Surcharge Statement.

3 / Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

TABLE 1

ultiple discharg
utlet summary

scal Year 199 4 / 5

tach Additional Sheets If Necessary)

ompany Name Douglas Aircraft Company

ccount No 1350743

Discharge Outlet to Sewer 2 / No.	Districts' Permit No.	Yearly Flow Volume (in millions of gallons to two decimal places)	Yearly Chemical 1 / Oxygen Demand (COD) (in thousands of pounds to two decimal places)	Yearly Suspended 1 / Solids (SS) (in thousands of pounds to two decimal places)	Peak Flow Rate 2 / (in gallons per minute. Round off to whole numbers)
1.	804	217 32	110 61	42 [illegible]	1,137
2.	805	8 08	5 [illegible]	6 [illegible]	66
3.	806	80	15 [illegible]	2 [illegible]	48
4.	807	1 96	10 [illegible]	2 [illegible]	150
5.	11482	5 22	8 [illegible]	[illegible]	25
6.					
7.					
8.					
9.					
10.					
11.					
12.		227.36			
13.					
14.					
TOTALS		233 38	150 26	53	1,137
				HIGHEST VALUE LISTED 3 /	

EXCEPT SIDE

NOTES:

1 / Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyzed for either COD or SS concentrations.

2 / For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report discharge quantities for all outlets and report only totals on the Surcharge Statement.

3 / Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

TABLE 1

ıtlet summary

Year 199 5 / 6

n Additional Sheets If Necessary)

mpany Name Douglas Aircraft Company

count No 1350743

Discharge Outlet to Sewer 2 / District Permit No.	Yearly Flow Volume (in millions of gallons to two decimal places)	Yearly Chemical 1 / Oxygen Demand (COD) (in thousands of pounds to two decimal places)	Yearly Suspended 1 / Solids (SS) (in thousands of pounds to two decimal places)	Peak Flow Rate 3 / (in gallons per minute. Round off to whole numbers)
804	219.10	113.82	32.81	874
805	8.54	31.28	7.80	198
806	1.10	22.38	1.89	26
807	.52	2.35	.47	90
11,482	2.02	3.85	.31	25
TOTALS	231.28	173.68	43.28	874

EAST SIDE

228.16

HIGHEST VALUE LISTED 3 / 874

NOTES:

1 / Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyzed for either COD or SS concentrations.

2 / For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report discharge quantities for all outlets and report only totals on the Surcharge Statement.

3 / Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

multiple discharge outlet summary

Fiscal Year 199 6 / 7

(Attach Additional Sheets If Necessary)

Company Name Douglas Aircraft Company

Account No 1350743

Discharge Outlet to Sewer 2 / No.	Districts' Permit No.	Yearly Flow Volume (in millions of gallons to two decimal places)	Yearly Chemical 1 / Oxygen Demand (COD) (in thousands of pounds to two decimal places)	Yearly Suspended 1 / Solids (SS) (in thousands of pounds to two decimal places)	Peak Flow Rate 3 / (in gallons per minute. Round off to whole numbers)
1.	804	219.82	133.61	37.98	692
2.	805	10.07	6.41	2.21	69
3.	806	.90	82.30	.61	37
4.	807	.38	5.67	.46	45
5.	11482	4.59	4.68	.62	25
6.		.	.	.	
7.		.	.	.	
8.		.	.	.	
9.		.	.	.	
10.		.	.	.	
11.		.	.	.	
12.		230.27	.	.	
13.		.	.	.	
14.		.	.	.	
TOTALS		235.76	232.67	41.88	
				HIGHEST VALUE LISTED 3 /	692

NOTES:

1 / Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyzed for either COD or SS concentrations.

2 / For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report discharge quantities for all outlets and report only totals on the Surcharge Statement.

3 / Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

TABLE 1

TABLE 1

multiple discharge outlet summary

Fiscal Year 199 7 / 8

(Attach Additional Sheets If Necessary)

Company Name Douglas Aircraft Company

Account No 1350743

Discharge Outlet to Sewer 2/ No.	Districts' Permit No.	Yearly Flow Volume (In millions of gallons to two decimal places)	Yearly Chemical 1/ Oxygen Demand (COD) (In thousands of pounds to two decimal places)	Yearly Suspended 1/ Solids (SS) (In thousands of pounds to two decimal places)	Peak Flow Rate 3/ (In gallons per minute Round off to whole numbers)
1.	804	215 53	134 23	41 70	702
2.	805	12 90	23 02	5 65	85
~~3.~~	~~806~~	~~79~~	~~16 53~~	~~1 22~~	~~42~~
4.	807	65	9 97	76	53
~~5.~~	~~11482~~	~~5 54~~	~~30 79~~	~~1 67~~	~~28~~
~~6.~~	~~14278~~	~~14~~	~~0 00~~	~~0 00~~	~~5~~
7.					
8.					
9.					
10.					
11.					
12.		229.08			
13.					
14.					
	TOTALS	235 55	214 54	51 00	
				HIGHEST VALUE LISTED 3/	702

NOTES:

1/ Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyzed for al COD or SS concentrations.

2/ For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report disc quantities for all outlets and report only totals on the Surcharge Statement.

3/ Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

TABLE 1

multiple discharge outlet summary

Fiscal Year 1998/99

(Attach Additional Sheets If Necessary)

Company Name McDonnell Douglas Corporation / BOEING

Account No 2024962

Discharge Outlet to Sewer 2/ No.	Districts' Permit No.	Yearly Flow Volume (In millions of gallons to two decimal places)	Yearly Chemical 1/ Oxygen Demand (COD) (In thousands of pounds to two decimal places)	Yearly Suspended 1/ Solids (SS) (In thousands of pounds to two decimal places)	Peak Flow Rate 3/ (In gallons per minut Round off to whole numbers)
1.	14950	200.60	140.79	37.78	666
2.	~~14952~~	~~0.53~~	~~7.01~~	~~0.93~~	~~39~~
3.	14949	11.81	20	13.[illegible]	74
4.	14948	0.27	4.01	0.33	63
~~5.~~	~~14951~~	~~0.08~~	~~0.12~~	~~0.00~~	~~0.2~~
~~6.~~	~~14953~~	~~5.18~~	~~5.10~~	~~0.63~~	~~15~~
~~7.~~	~~14954~~	~~0.08~~	~~0.08~~	~~0.00~~	~~1~~
8.					
9.					
10.					
11.					
12.		212.68			
13.					
14.					
	TOTALS	218.55	177.[illegible]	52.[illegible]	
				HIGHEST VALUE LISTED 3/	666

NOTES:

1/ Copies of laboratory analysis sheets must be submitted for all composite samples taken during the fiscal year which were analyz for either COD or SS concentrations.

2/ For four or less outlets, use the Surcharge Statement to report quantities discharged. For over four outlets use this Table 1 to report disc quantities for all outlets and report only totals on the Surcharge Statement.

3/ Enter only the highest individual value listed for any outlet. Enter this value on Line 40a of the "Long Form" Surcharge Statement.

TABLE 1:

Appendix U

Research of Solid Waste Impact Thresholds

APPENDIX U
RESEARCH OF SOLID WASTE IMPACT THRESHOLDS

PCR has contacted several public agencies in an effort to obtain quantitative impact thresholds utilized to assess potential significance related to solid waste consumption and facilities capacity that may be applied in Los Angeles County, in accordance with CEQA. In addition, PCR contacted other jurisdictions to gather information as to how they address this issue. Through its research, PCR has determined the following information:

County Sanitation Districts of Los Angeles County. PCR staff spoke with Grace Chan, Planning and Permitting Section Head of the Solid Waste Management Department in December 2001. She indicated the Sanitation Districts do not maintain quantitative thresholds used to determine potential impact significance of generated solid waste.

California Integrated Waste Management Board. PCR staff spoke with Sue O'Leary, Supervisor of the Environmental Overview Section of the Permitting and Inspection Branch in January 2002. She indicated that while the Board identifies typical solid waste generation rates that can be used in providing a general level of information for planning purposes, it does not maintain specific quantitative thresholds to be used in determining potential impact significance of generated solid waste.

City of Los Angeles. The Draft Los Angeles CEQA Threshold Guide provides a screening criterion and discusses significance threshold for solid waste analysis. The screening criterion is used to determine whether further study in an expanded Initial Study, Negative Declaration, Mitigated Negative Declaration or EIR may be required, and is stated as follows: Would implementation of the proposed project result in solid waste generation of five tons or more per week? A "no" response to the preceding question indicates that there would normally be no significant impact on solid waste from the proposed project and therefore, impacts would be less than significant. A "yes" response to the preceding question would require further study in an expanded Initial Study, Negative Declaration, Mitigated Negative Declaration, or EIR. However, with regard to CEQA analyses, the City of Los Angeles does not quantitatively define its significance threshold for solid waste, but rather, the determination of significance is made on a case-by-case basis, considering an array of factors. No formal guidance has been provided as to how the factors can be applied.

County of Santa Barbara. Solid waste threshold criteria utilized by the County of Santa Barbara are based upon current and expected average solid waste generation for Santa Barbara County from 1990-2005. A project is considered to result in significant impacts to landfill capacity if it would generate 5 percent or more of the expected annual average increase in waste generation, thereby using a significant portion of the remaining landfill capacity. Based upon the analysis conducted (from County of Santa Barbara Waste Generation Study, February 1991), the numerical value associated with this 5 percent increase is 196 tons per year. Source reduction, recycling, and composting can reduce a project's waste stream by as much as 50 percent. If a proposed project generates 196 or more tons per year after reduction and recycling efforts, impacts would be considered significant and unavoidable.

Regarding thresholds for cumulative impacts, an increase in solid waste of 1 percent or more of the estimated annual increase as identified in the SRRE would be considered an adverse addition to regional cumulative solid waste impacts. One percent of the SRRE projected increase in solid waste equates to 40 tons per year. To reduce adverse cumulative impacts and to be consistent with the SRRE, mitigation should be recommended for projects which generate between 40 and 195 tons of solid waste. Projects that generate less than 40 tons per year of solid waste would not be identified as contributing to a significant cumulative adverse effect, due to the small amount of waste generated by these projects and the existing waste reduction provisions in the SRRE.

County of Ventura. PCR staff spoke with Gerard Kapuscik, Manager of the Planning and Recycling Division of the Ventura County Solid Waste Management Department in February 2002. According to Mr. Kapuscik, Ventura County previously maintained solid waste threshold criteria similar to that described above for Santa Barbara County (i.e., quantitative project-specific significance threshold of 5 percent of the expected annual increase of generated solid waste and cumulative significance threshold of 1 percent of expected annual solid waste increase). Last year they began utilizing a different threshold criterion, as they felt the previous threshold was outdated and did not reflect the current landfill capacity situation in Ventura County. The latest threshold states that, in general, a proposed project would not result in a significant impact related to solid waste if it complies with the recycling ordinance and if the landfills used by the County of Ventura have a 15-year capacity. If either of these criteria is not met, then determination of significance is made on a case-by-case basis.

Given the extensive research conducted, PCR was not successful in obtaining precise quantitative solid waste impact thresholds specifically applicable to development within the County of Los Angeles. While quantitative thresholds from neighboring

jurisdictions in southern California were identified, given that these thresholds have been specifically formulated based on the current situation and trends of the particular jurisdiction, they do not account for the realities of Los Angeles County. That is, applying a numerical value derived in one jurisdiction directly to another jurisdiction would be inappropriate due to vast differences in daily waste generation, permitted landfill capacity, alternative disposal options, etc.

In view of the issue of available capacity in Los Angeles County landfills associated with the proposed continued operation of the Puente Hills Landfill, PCR believes that the logic of relating potential project impacts to a County-wide forecasted cumulative increase in waste generation does offer a logical solution in quantifying the significance of solid waste generation. PCR recommends the following quantitative threshold for the PacifiCenter project:

> "A significant adverse impact on solid waste disposal capacity would occur if solid waste disposal generated by implementation of the proposed project or cumulative projects is determined to represent more than one percent of the forecasted cumulative Countywide increase in the solid waste stream flowing into major County solid waste facilities between 2003 and 2020."

It is believed that this threshold is particularly appropriate while the Puente Hills Landfill extension remains uncertain.

Appendix V

Energy Technical Report

PacifiCenter @ Long Beach

Energy Technical Report

Prepared for: Boeing Realty Corporation

Prepared by: Butsko Utility Design, Inc.

January 2004

1.0 INTRODUCTION

The PacifiCenter @ Long Beach project proposed by Boeing Realty Corporation would result in the redevelopment of 260 acres of the Boeing Company's C-1 aircraft production facility located within the Cities of Long Beach and Lakewood. Project implementation would provide for the replacement of existing research and development (R&D), office, warehousing, manufacturing, and other aviation-related uses with new R&D, light industrial, office, retail, hotel, residential, and ancillary uses, and potentially the continuation of a small amount of aviation-related uses. Open space and landscaped areas would also be provided throughout the PacifiCenter site. The PacifiCenter is anticipated to be fully developed by the year 2020. [1]

The project site is located approximately 5 miles northeast of downtown Long Beach and immediately north of the Long Beach Municipal Airport. A majority of the site (approximately 238 acres) is located within the City of Long Beach, while the remaining portion of the site (approximately 22 acres) is within the City of Lakewood. In general, the project site is bounded by Carson Street on the north, the Airport on the south and southwest, Lakewood Boulevard on the east, and the Lakewood Country Club and Airport on the west. [2]

2.0 EXISTING CONDITIONS

2.1 Regional Conditions

The following four utility companies have electricity and/or natural gas distribution and/or transmission facilities in close proximity to the PacifiCenter site: Southern California Edison (SCE), Southern California Gas Company (SCG), Los Angeles Department of Water and Power (LADWP), and Long Beach Energy (LBE). Currently, SCE supplies electricity to Boeing's private electric distribution system and LBE provides natural gas service. SCE provides electric service to the area through its network of 66kV transmission and 12kV distribution lines that already exist on the project site and along adjacent streets. SCE's network of transmission lines are fed from SCE's Del Amo and Lucas substations. Natural gas service within the City of Long Beach is provided by Long Beach Energy, a municipal utility. SCG provides natural gas service outside the City of Long Beach and provides transmission access for LBE.

2.2 California Electric Restructuring

In August 1996, the California Legislature passed Assembly Bill 1890 which launched electric industry restructuring in California. The restructuring plan required California's Investor Owned Utilities (IOU's) to de-couple generation, transmission, and distribution operations and assets. The plan also established California's new Power Exchange (PX) to create a wholesale energy market and the Independent System Operator (ISO) to manage operation of California's transmission grid.

Under restructuring, California initially experienced energy shortages as a result of insufficient electric generation capacity within California and a flawed wholesale energy market place established by California's new PX. During 2000 and early 2001, California's ISO declared several Stage One power alerts that required the IOU's to initiate limited rolling power outages within the state, including the Southern California region and Long Beach.

California has since corrected the flaws in its restructuring plan by closing the Power Exchange, establishing long term energy contracts with wholesale energy providers, expediting the construction of new electric generators within the state, and holding regulatory proceedings to determine the extent of wholesale electricity market manipulation. The California state legislature expanded the Department of Water Resources by adding responsibility for securing California's electric energy portfolio and created the California Consumer Power and Financing Authority. In addition, energy conservation measures and public awareness programs were instituted that effectively resulted in 8% peak load decrease in 2001 and a 5.4% decrease in 2002.

According to the California Energy Commission (CEC), the CEC has approved 18 power plants greater than 300 MW with a combined total capacity of 11,497 MW since 1999. As of October 2002, California has completed 6 of the 18 plants adding 3,587 MW of capacity. Seven additional plants are currently under construction that will add an additional 4,724 MW of capacity, and the remaining 5 power plants have placed construction on hold for an additional 3,186 MW of capacity. An additional 14 power plant applications are under review by the CEC as of December 2002, representing 8,827 MW of additional capacity. (CEC Website, Electricity in California, Power Plants & Infrastructure Section)

2.3 Local Conditions

Off-Site Electricity

Two existing SCE 66kV transmission lines are located on Carson Street (northerly boundary of PacifiCenter) and provide service to the "Boost" substation (located on the east side of Lakewood Blvd). The "Boost" substation provides electricity to Boeing's private electric distribution system for the manufacturing facilities on the east side of Lakewood Blvd. and Boeing's Enclave area on the west side of Lakewood Blvd. SCE's two 66kV transmission lines also previously served the "Turbo" and "Stress" substations located at Boeing's manufacturing facilities on the west side of Lakewood Blvd. The "Turbo" and "Stress" substations are being removed from service in conjunction with the on-site demolition for PacifiCenter.

SCE has confirmed that its existing 66kV transmission lines have the necessary capacity to serve the PacifiCenter Project, as these lines were built with the capacity to serve the high energy needs of Boeing's manufacturing facilities on both sides of Lakewood. SCE also operates a 12kV distribution circuit along Carson Street that provides a back up feed to Boeing's manufacturing facilities on the east side of Lakewood Blvd. and serves SCE customers in the area surrounding PacifiCenter. SCE has also confirmed that its 12kV

circuit has approximately 6-7 MW of capacity currently available that can be utilized to serve the initial development of PacifiCenter.

On-Site Electricity

The project site has a long history as an industrial aircraft manufacturing facility with high energy needs. Because of these energy requirements, Boeing Aircraft Company owns and operates its own private electric underground distribution system across the entire site. Boeing's distribution system was previously fed from the SCE's "Boost," "Turbo," and "Stress" substations mentioned earlier. Recent modifications to accommodate demolition work on the west side of Lakewood Blvd. upgraded Boeings electrical system which now only is through SCE's "Boost" substation. Boeing's private distribution system has the capacity to distribute over 80 MW of electric demand across the project site. In 1992, Boeing's private electrical system distributed 330,160 Megawatt Hours (MWH) of electricity with a peak demand of 59 MW. This compares with a peak demand 34.6 MW and 188,932 MWH of total consumption for 2000. These demand loads were served by SCE through its existing transmission and distribution facilities.

Off-Site Natural Gas

Long Beach Energy (LBE), a municipal utility, currently provides natural gas delivery services to the project site. LBE takes delivery of natural gas supplies at five interconnection points from SCG's intrastate pipeline system. The LBE gas distribution system has the capacity to deliver more than 155 million cubic feet per day. The highest peak daily delivery on the LBE system was approximately 73 million cubic feet on December 23, 1998. This peak delivery represents only 47 percent of LBE's delivery capacity.

The existing natural gas transmission infrastructure is adequate to transport gas to the area and site. Gas transmission expansion projects in construction and currently planned for the future by the energy companies will continue to ensure adequate supplies to California and the Southern California Region. LBE receives its natural gas through the transmission network of SCG. Since 2000, SCG has increased it gas receiving capability by 10.7% and has plans to continuing increasing this excess capacity to 22% by 2012. In addition SCG has plans underway to increase use of its Aliso Canyon and La Goleta storage facilities. (California Energy Commission, Natural Gas Supply and Infrastructure Assessment, December 2002, page 43).

On-Site Natural Gas

The PacifiCenter site, as previously discussed, is located on a site currently occupied by a Boeing manufacturing facility. The project site has a long history as an industrial aircraft manufacturing facility with high energy needs. Because of these high energy requirements, Boeing Aircraft Company owns and operates its own private natural gas distribution system across the entire site, which is fed directly from LBE. A portion of the PacifiCenter site, approximately 22-acres, is located within the City of Lakewood. Although SoCal Gas typically supplies natural gas to the City of Lakewood, any future

gas service for the Lakewood portion of the project site will be provided by either SoCal Gas or LBE, based upon mutual agreement between the two utilities.

In 2002, LBE completed the extension of an 8" gas main into the Boeing Enclave area along future "B" Street (at Conant Street west of Lakewood Blvd) as part of Boeing's rearrangement of its natural gas facilities to accommodate the on-site demolition work. This line was designed by LBE with the capacity to serve the PacifiCenter project. LBE has additional distribution gas mains along Carson Street that will also be connected with the new on-site distribution system.

3.0 REGULATORY

All buildings constructed at PacifiCenter, as all other buildings in the state, must comply with the California Building Energy Efficiency Standards, commonly known as Title 24. The Title 24 energy standards are among the strictest in the United States. The California Energy Commission, the responsible agency, typically updates the standards every three years. The most recent edition of Title 24 became effective June 15, 2001, ahead of the usual timeframe because of the state's on-going energy crisis. Buildings at PacifiCenter will be required to meet the standards in effect at the time a building permit is issued.

Title 24 may be met in one of two ways: by meeting performance criteria (measured in BTUs per square foot per year) or by installing a prescriptive list of specific measures. Either way, topics addressed include the building envelope, space conditioning (heating and cooling), lighting, and water heating.

4.0 THRESHOLD FOR DETERMINING SIGNIFICANCE

The CEQA Environmental Checklist, Appendix G outlines the thresholds for determining significance for energy.

Would the project:

1. Result in substantial adverse physical impacts associated with the provision of new or physically altered energy and communications transmission facilities, need for new or physically altered energy and communications transmission facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable levels of service?

2. Result in the use of substantial amounts of fuel and/or energy?

4.1 Methodology

The demand for and consumption of energy as a result of implementing the PacifiCenter project has been calculated using consumption factors derived from the SCAQMD CEQA Handbook, typical utility demand estimating and design criteria, and standard

energy consumption guidelines published by the U.S. Energy Information Administration (EIA) for the various uses existing and contemplated at the project site.

Existing consumption was calculated based on the approximately 379,503 square feet of manufacturing, research and development, and office floor area currently in use within the Boeing Enclave area on-site. It should be noted that the "Existing Occupancy Allocation Electric Demand and Consumption" calculations used in the report do not represent the higher historic energy usage and demand of the site. Electricity and gas needs for the project were independently calculated based on the development scenario and land use mix that would respectively generate the highest, or worst-case, demand and consumption. It should be noted that the land use mix identified as generating worst-case demand does not necessarily represent a realistic project development scenario, and actual energy demands will likely be less than those projected. Tables 1-4 show this existing energy usage along with the proposed build-out usage in the year 2020. The uses for this energy include standard industrial and office processes including heating, cooling, and lighting.

Table 1 – Existing Occupancy Allocation Electric Demand and Consumption

Land Use Type	Quantity Floor Area (sq. ft.) or Units	Demand Factor / (sq. ft.) or (unit)	Electric Demand (KW)	Electric Consumption (KWH/Yr)
Office (sq. ft.)	144,835	.0047	681	4,041,735
R&D, Tech (sq. ft.)	25,000	.0047	118	700,330
Manufacturing (sq. ft.)	160,670	.0114	1,832	10,872,920
Warehouse (sq. ft.)	11,048	.0007	8	47,480
Mechanical	37,950	.0114	433	2,569,855
TOTAL	**379,503**		**3,072**	**18,232,320**

Table 2 – Buildout Occupancy Allocation Electric Demand and Consumption
(Worst-case energy scenario)

Land Use Type	Quantity Floor Area (sq. ft) or Units	Demand Factor / (sq. ft.) or (unit)	Electric Demand (KW)	Electric Consumption (KWH/Yr)
Light Industrial*	3,150,000	.008	25,200	149,562,000
Office, R&D, Tech (sq ft.)		.0047		
Retail (sq. ft.)	150,000	.0042	630	3,739,050
SUB-TOTAL	**3,300,000**		**25,830**	

Hotel (Rooms)	400	4.8	1,920	11,395,200
Residential (Units)	2,500	1.4 – 2.8	4,875	28,933,125
TOTAL			**32,625**	**193,629,375**

**Light Industrial Load Factor includes 70% Industrial (.0114 demand factor) and 30% Warehouse (.0007 demand factor).*

Table 3 – Existing Occupancy Allocation Gas Consumption

Land Use Type	Quantity Floor Area (sq. ft.) or Units	Consumption Factor / (cu. ft./sq. ft./mo.) or (cu. ft./unit/mo.)	Gas Consumption (cu. ft./mo.)
Office (sq. ft.)	144,835	2.0	289,670
R&D, Tech (sq. ft.)	25,000	2.9396	73,490
Manufacturing (sq. ft.)	160,670	6.62	1,063,635
Warehouse (sq. ft.)	11,048	1.0	11,048
Mechanical (sq. ft.)	37,950	2.9396	111,558
TOTAL	**379,503**		**1,549,401**

Table 4 – Buildout Occupancy Allocation Gas Consumption
(Worst-case energy scenario)

Land Use Type	Quantity Floor Area (sq. ft.) or Units	Consumption Factor / (cu.ft./sq. ft./mo.) or (cu. ft./unit/mo.)	Gas Consumption (cu.ft./mo.)
Light Industrial*	3,150,000	6.62	20,853,000
Office, R&D, Tech (sq. ft.)		2.9	
Retail (sq. ft.)	150,000	2.9	435,000
SUB-TOTAL	**3,300,000**		**21,288,000**
Hotel (Rooms)	400	3,840	1,536,000
Residential (Units)	2,500	4,011.5	10,028,750
TOTAL			**32,852,750**

** Based upon SCAQMD CEQA Handbook industrial customer average consumption of 241,611 (cu./ft./mo.) / 36,500 (sq.ft)*

4.2 Environmental Impact - Electric Usage

As defined by the thresholds for determining significance, impacts related to the provision of energy are described below:

Threshold 1: Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered energy and communication transmission facilities, need for new or physically altered energy and communications transmission facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable levels of service?

As shown in Tables 1 & 2, there is an increase with regard to energy demand between the Existing Occupancy Allocation and the Buildout Occupancy Allocation (worst-case energy scenario). However, the existing utility infrastructure transporting electricity to the site is adequate to meet the needs of the PacifiCenter Project. This is due to the site previously having a much higher energy demand than would be experienced by the Project as proposed. SCE has confirmed that its existing 66kV transmission facilities already to the site have the capacity to service the PacifiCenter Project. As mentioned previously, SCE's historic peak demands to the site utilizing its existing transmission facilities were 59 MW in 1992 and 34.6 MW in 2000. Under the worst case scenario, the maximum electric peak demand load is 32.6 MW. Since the existing SCE transmission lines have adequate capacity, there will be no significant impact to energy transmission facilities.

The new on-site electric infrastructure will comply with modern design methods, performance standards and specifications. The new system will be installed to coincide with the routing of new streets circulating throughout the project. Electrical lines will be required to be undergrounded pursuant to City and utility requirements.

Threshold 2: Result in the use of substantial amounts of fuel and/or energy?

Using the worse case scenario of "Buildout Occupancy Allocation" the Project would consume 193,629,375 kWh per year (Table 2). Using the Electricity consumption from the "Existing Occupancy Allocation" (Table 1) the project would consume 18,232,320 kWh per year. To determine incremental or net electricity consumption we subtracted the "Buildout Occupancy Allocation" from the "Existing Occupancy Allocation". Total incremental electricity consumption would be approximately 175,397,055 kWh. In contrast, this compares with Boeing's historical peak consumption of 330,160,000 kWh for 1992 and 188,932,000 kWh for 2000.

To place the "Buildout Occupancy Allocation" electricity consumption and demand in perspective, the total new energy load in the SCE transmission service area in 2000 was 98,269 million kWh and SCE area peak demand was 18,724,000 kW (California Energy Commission (CEC), California Energy Demand 2002-2012 Forecast, Table B-3 and Table D-3). The CEC is also predicting that net energy for load will grow annually at 2 percent and that the area peak demand will grow at 2.4 percent (CEC, California Energy Demand 2002-2012 Forecast, Table B-3 and D-3). For the year 2012, the CEC forecasts net energy for load and area peak demand in SCE's service area to be 125,224 million kWh and 24,960,000 kW respectively (CEC, California Energy Demand 2002-2012 Forecast, Table B-3 and D-3). Using the worst case scenario of "Buildout Occupancy

Allocation Electric Demand and Consumption," the project's consumption of electricity is only .17 percent and peak demand is only .13 percent of CEC's forecast for SCE in 2012.

Based on the CEC's most likely estimate for generation, it projected a range of the state-wide peak load surpluses from 584 MW (8.0 percent reserve margin) to 3,961 MW (14.3 percent reserve margin). Generation includes existing generation sources, net new generation additions, net firm imports, and demand responsive programs. (Draft Report dated December 12, 2002, Energy Analysis Office, California Energy Commission.)

SCE has confirmed its ability to serve the project, in accordance with all applicable tariff schedules which are the effective rates and rules of the Southern California Edison Company on file with and approved by the Public Utilities Commission, State of California, and subject to the receipt of such permits or authorization from public agencies may be required for such installation. As indicated previously, project-related electricity demand and consumption will not significantly impact SCE's current level of service.

4.3 Environmental Impact - Natural Gas Usage

Threshold 1: Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered energy and communication transmission facilities, need for new or physically altered energy and communications transmission facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable levels of service?

As shown in Tables 3 & 4, there is an increase with regard to energy demand and consumption between the Existing Occupancy Allocation and the Buildout Occupancy Allocation (worst-case energy scenario). However, the existing utility infrastructure transporting natural gas to the site is adequate to meet the needs of the PacifiCenter Project. This is due to the site previously having a much higher energy demand than would be experienced by the Project as proposed. LBE has confirmed that its existing distribution facilities already to the site have the capacity to service the PacifiCenter Project. The LBE gas distribution system has the capacity to deliver more than 155 million cubic feet per day. PacifiCenter's maximum estimated delivery under the "Buildout Occupancy Allocation" (worst-case energy scenario) is 1,095,092 cubic feet per day (monthly gas consumption divided by 30 days). PacifiCenter's maximum delivery under the "Buildout Occupancy Allocation" represents approximately .7 percent of LBE's delivery capacity. The highest peak daily delivery on the LBE system was approximately 73 million cubic feet on December 23, 1998. LBE's historical peak delivery represents only 47 percent of its delivery capacity.

The new on-site gas infrastructure will comply with modern design methods, performance standards and specifications. The new system will be installed to coincide

with the routing of new streets circulating throughout the project. Gas lines will be installed pursuant to City and utility requirements.

Threshold 2: Result in the use of substantial amounts of fuel and/or energy?

Using the worse case scenario of "Buildout Occupancy Allocation," the project would consume 32,852,750 cubic feet of natural gas per month (Table 4). Using the gas consumption from the "Existing Occupancy Allocation" (Table 3), the project would consume 1,549,401 cubic feet per month. To determine incremental or net gas consumption, we subtracted the "Buildout Occupancy Allocation" from the "Existing Occupancy Allocation." Total incremental gas consumption would be approximately 31,303,349 cubic feet per month.

Natural gas supplies are sufficient to serve the PacifiCenter project at buildout. Even with the forecasted 41% increase in natural gas demand in California from 1997–2012, the CEC anticipates natural gas supplies will be adequate to meet the demand requirements for the state. (California Energy Commission, Natural Gas Supply and Infrastructure Assessment, December 2002). According to the Energy Information Administration of the U.S. Department of Energy, U.S. technically recoverable natural gas resources are estimated to be 1,614 trillion cubic feet. This is approximately 82 times the 2001 natural gas production level. (Energy Information Administration, U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 2001 Annual Report, November 2002, page 128.)

LBE has confirmed its ability to serve the project in accordance with all applicable tariff schedules, which are the effective rates and rules of the Long Beach Energy on file with City of Long Beach, and subject to the receipt of such permits or authorization from public agencies may be required for such installation. As indicated previously, project-related gas demand and consumption will not significantly impact LBE's current level of service.

5.0 PROJECT FEATURES

A network of new electric and natural gas distribution systems will be built to serve the entire PacifiCenter development. The new distribution systems will typically be installed in the new streets and will be located to efficiently meet the needs of the project. The new electric and gas distribution systems will utilize current design, construction, and operating standards to meet the energy distribution needs of the PacifiCenter Project. These facilities will be installed in accordance with each of the utilities construction standards and tariffs.

The new on-site electric distribution system will initially be connected to SCE's existing 12kV distribution facilities already available at the site. As load growth continues at PacifiCenter, SCE will construct a new 66kV / 12kV substation on-site to replace the "Turbo" and "Stress" substations being removed as part of the on-going site demolition work. SCE anticipates that the new substation will be required by approximately 2009.

SCE's substation will likely be fed underground to meet the aesthetical needs of PacifiCenter. While SCE's actual substation design will not begin until approximately 2006, SCE was able to provide the some general information on its size and ultimate capacity. Two possible locations for the substation under consideration include: the southerly commercial area of the project and an area near the southwest corner of Lakewood Blvd. and Carson Street within the residential area of the project.

SCE's substation could be sized to ultimately have up to four 28 MVA transformer banks with a maximum footprint of approximately 230' by 305'. The ultimate capacity of the substation with four 28MVA transformer bands is 128 MVA. SCE anticipates at full buildout that less than 25% of this substation's capacity will be needed for PacifiCenter. The additional substation capacity will be available for future load growth on SCE's distribution system. The new SCE substation will be connected to SCE's two 66kV transmission lines already located at the site. SCE will route its two existing 66kV circuits to the new substation and the new 12kV circuits leaving the substation in new underground substructures. The new underground substructures will be installed in coordination with PacifiCenter's development and installation of other utility infrastructure.

The new on-site gas distribution system will have its main connection and feed point from a recently completed 8" gas main located on "B" Street from Lakewood Boulevard. This line was designed with the capacity to serve as the main feed for the PacifiCenter Project. In addition, the new on-site gas distribution infrastructure will be sized and constructed to interconnect with LBE's existing distribution facilities along Carson Street.

6.0 MITIGATION MEASURES

As no significant energy impacts would occur as a result of implementation of the project, no mitigation measures would be required.

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[1] Project Description, Draft Environmental Impact Report.
[2] Although analyzed as part of the project, a small portion (less than one acre) of the PacifiCenter site on the southwest corner of Lakewood Boulevard and Carson Street is not currently under Boeing ownership.