APPENDIX B

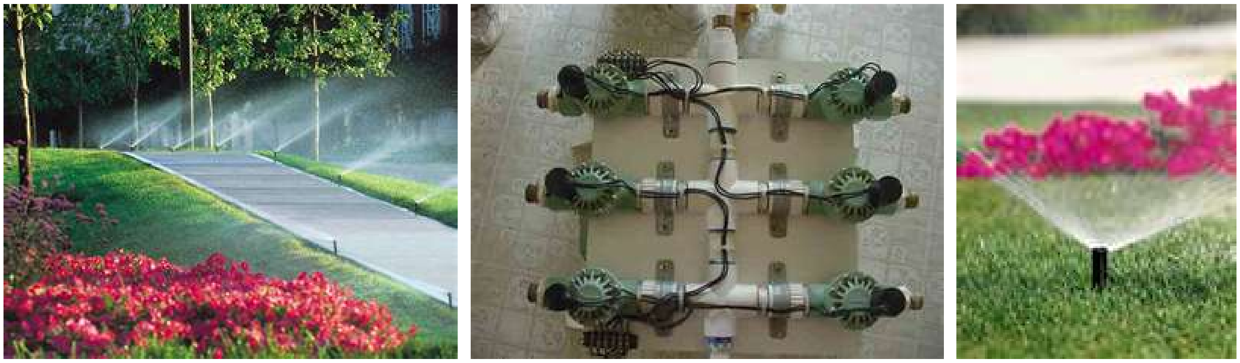
Citywide Smart Irrigation Control System

and Recycled Water Improvements

CITY of CALABASAS

Citywide Smart Irrigation Control System

Feasibility Study



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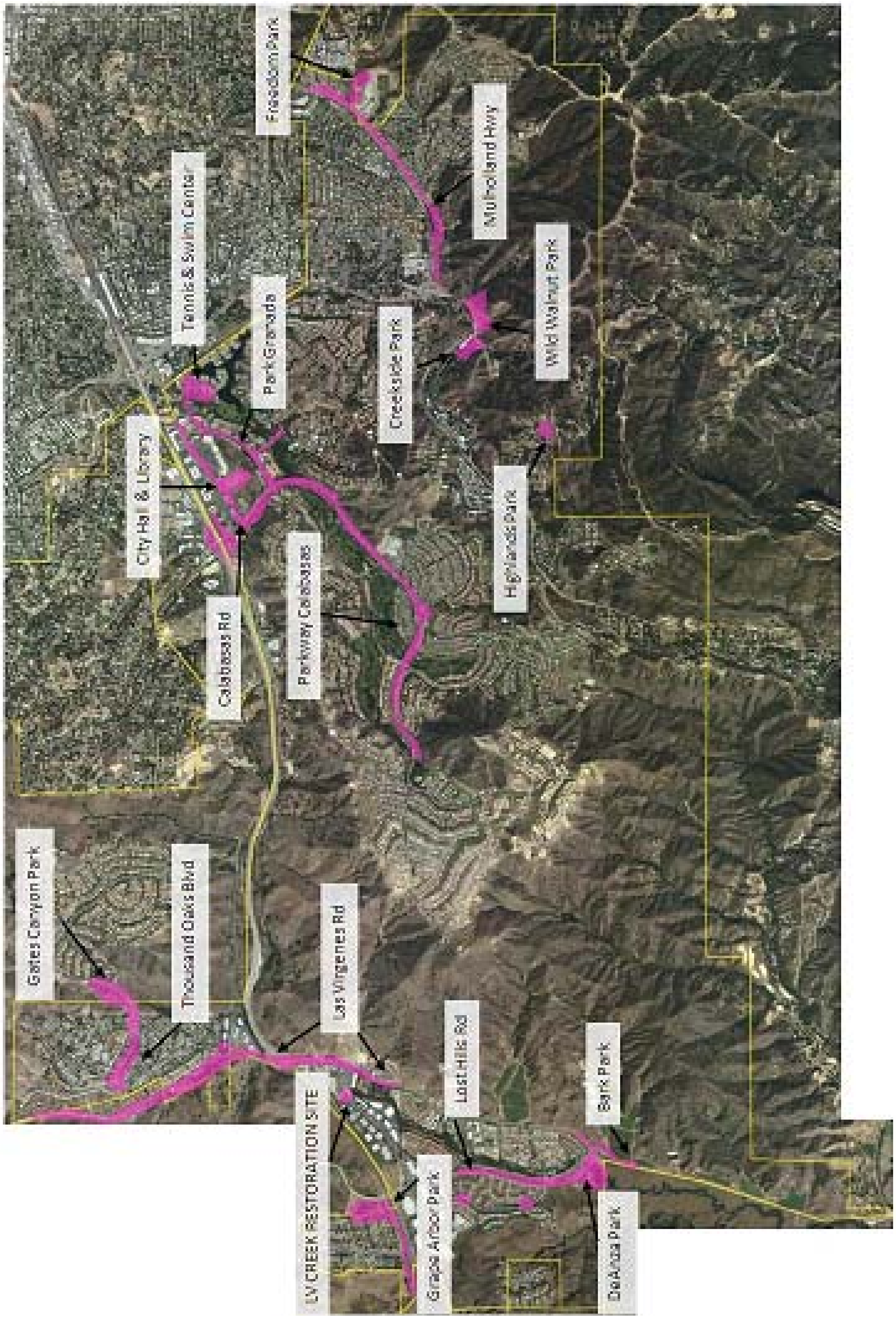
Map of City of Calabasas Parks, Medians and Parkways



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Executive Summary

What is Smart Irrigation Controller?

Smart irrigation controllers automatically adjust based on local real-time weather and site conditions like rainfall, wind temperature, humidity, solar radiation, and soil type to apply just the right amount of water needed at just the right time. This allows for an accurate and customized watering schedule for your landscape - which can save you water and money.

So called "smart" irrigation controllers have appeared on the market for use in residential and commercial applications since the early 2000's. The Irrigation Association (www.irrigation.org) defines "smart controllers" as (controllers that reduce outdoor water use by monitoring and using information about site conditions (such as soil moisture, rain, wind, slope, soil, plant type, and more), and applying the right amount of water based on those factors”. Essentially, these irrigation controllers receive feedback from the irrigated system and schedule or adjust irrigation duration and/or frequency accordingly. For example, they would reduce watering in the cooler months and increase watering in the hot and dry months. There are generally two types of smart controllers: climatologically-based controllers and soil moisture-based controllers.

Evapotranspiration Controllers

Climatologically based controllers are also known as evapotranspiration, or ET, controllers. Generally, ET is the process of transpiration by plants combined with evaporation that occurs from plant and soil surfaces. More information on the ET concept and definitions can be found in the publication, *Evapotranspiration: Potential or Reference*? http://edis.ifas.ufl.edu/AE256.

There are generally three types of ET controllers:

1. signal Based: Meteorological data are either collected from publicly available sources or from agreements with weather station networks. The ET value is calculated for a hypothetical grass surface for that site. Then, ET data are sent to surrounding controllers via wireless communication. In some cases, the ET values are adjusted to account for controllers that are not near the weather data collection site. The ET controller adjusts the irrigation run times or watering days according to climate throughout the year.

2. historical ET: This approach for ET controllers uses a pre-programmed crop water use curve for different regions. The curve may be modified by a sensor such as a temperature or solar radiation sensor that measures on-site weather conditions.

3. On-site Weather Measurement: This approach uses measured weather data at the controller to calculate ET continuously and adjust the irrigation times according to weather conditions.

Several bench scale studies have shown that ET controllers can adjust irrigation in response to plant needs, but few studies demonstrate the controllers in comparison to controls such as actual homeowner irrigation or non-irrigated test plots. Results from two demonstration studies with ET controllers in California indicate that some irrigation savings is possible with these controllers, but that more detailed comparisons are needed. Testing of ET controllers in Florida is ongoing at the plot and homeowner scale.

Soil Moisture Sensor Controllers

Two types of control strategies are employed with soil moisture sensor (SMS) controllers, "bypass" and "on-demand".

1. The bypass configuration is the most common for small sites including most residential sites. Typically, a bypass SMS controller has a soil moisture threshold adjustment from "dry” to “wet". This threshold can be used to lower and raise the point at which the irrigation system is allowed to water to suit specific plant, soil, and microclimate needs. This type of controller bypasses timed irrigation events if the current soil moisture content exceeds the adjustable threshold. The bypass mode of operation is very similar to that of a rain sensor (see EDIS publication *Residential Irrigation System Rainfall Shutoff Devices* http://edis.ifas.ufl.edu/ae221). Most of these types of SMS controller are added to an existing time clock (Fig. 2). Many of these systems only include one soil moisture sensor, in which case the sensor should be buried in the driest irrigation zone and the run times for the other zones should be adjusted to limit over-watering. Controllers that contain multiple sensors allow for the installation of a sensor in each irrigation zone.

2. An on-demand SMS controller initiates irrigation at a pre-programmed low soil moisture threshold and terminates irrigation at a high threshold. This type of controller is often used where a high level of customization or high level of control is needed such as commercial sites or other types of sites with many irrigation zones. Thus, this controller initiates and terminates irrigation events, whereas the bypass controller only allows irrigation events (i.e. day of the week, time of day, and run time) from a time clock. Therefore, it is critical to properly program a schedule into the time clock. Detailed information on soil moisture sensor controller programming and installation can be found at Smart Irrigation Controllers: *How do Soil Moisture Sensor Irrigation Controllers Work*? http://edis.ifas.ufl.edu/AE437.

In summary, a Smart Controller is "smart" due to the feedback received from the irrigated system whether it be climate measurements or soil moisture measurements. This feedback is then used to adjust irrigation application to match plant needs. In contrast a "dumb" irrigation time clock simply applies water at the pre-programmed date and time. Although the concept of Smart Controllers reducing inefficient water use while maintaining landscape quality seems to have potential, little information has been available until recently.

Smart Controller Water Conservation Potential

Since these Smart Controllers are relatively new to the irrigation industry, a group of researchers at the University of Florida have been testing various Smart Controller technologies under field plot conditions and on cooperating homes in Florida. To date, the water conservation potential of these technologies ranges depending on weather conditions and site conditions such as soil and microclimate to name a few. Generally, irrigation savings can be as high as 30-40% during dry conditions and up to 70-90% during normal Florida rainfall conditions for properly installed and programmed Smart Controllers.

Introduction

Smart Irrigation Highlights
A sprinkler system is one area of your home or business where a little knowledge can go a long way to conserve water while maintaining a healthy yard. The new generation of smart sprinkler systems can be viewed as sophisticated communications systems that happen to dispense water, rather than a network of underground valves, pipes and pop-ups controlled by a wall-mounted timer. Thanks to advances in electronics and communications, sprinkler systems can monitor data, such as climate, site conditions, or soil moisture, and automatically adjust your sprinkler's watering schedule. Smart systems keep your grass green while saving your green. The secret to smart systems is the controller. Smart controllers use weather and site data to automatically determine when and how long to water. Then your sprinklers apply just enough water at exactly the right time in each zone of your yard. Here are highlights of the substantial benefits that smart controllers offer:

1. **Saves Water**
   Environmentally friendly smart systems conserve water by watering only as much as needed. Smart sprinklers work with Mother Nature to automatically suspend watering during rain, freezing or high wind conditions or compensate for rainfall. Plus a smart system can keep your lawn and landscape healthier by avoiding the pitfalls of inadequate watering, too frequent watering, or the more common problem of overwatering, which often results in disease or poor root systems.

2. **Saves Money**
   Because smart systems water only when needed, time the applications to allow water to soak-in, and avoid application when water might evaporate or blow away, you may reduce your annual water bill as much as 30 percent. On top of that, you may qualify for rebates from your local water board or utility for the purchase of specific smart controllers.

3. **Saves Time**
   Once your irrigation installer has programmed the site data into the smart system, the controller adjusts the watering schedule based upon local conditions and/or soil moisture and by zone. This "set and forget" technology is perfect for frequent travelers and ideal for vacations or second homes used only part of the year.

4. **Adds Convenience**
   Smart controllers require little direct access, so they provide an excellent solution for sites where it is difficult to access the controller. There's no need to reprogram the controller due to seasonal weather changes. Upgrading your current controller may be an option. Some new components are designed as easy add-ons to an existing controller, eliminating the need to replace your system's brains.

The purpose of this feasibility study is to evaluate the City of Calabasas' needs to convert to a smart irrigation control system and introduce city officers to pros and cons of various products in the US market.

Background

Water agencies implementing water use efficiency programs have long struggled to achieve quantifiable and reliable water savings. Historically, programs targeting landscape savings have focused on education pertaining to irrigation system maintenance, irrigation scheduling and climate appropriate plantings. Although these efforts have garnered savings, much potential exists for further landscape irrigation efficiency improvements.

In 2008, a Smart Irrigation Controller (also referred to as "Smart Controller" or "ET Controller") Testing Facility was established by the Irrigation Technology Center at Texas A&M University in College Station, Texas. This testing program was initiated in order to evaluate smart controller testing methodology needed to determine controller performance and reliability under Texas Conditions from an "End-User" point of view.

The first year evaluation (2008) evaluated the performance (depth of irrigation applied) of 6 controllers over a 60 day period. The second year (2009) evaluated the performance of 10 controllers over a 91 day period. A third year evaluation (2010) is currently being conducted that will evaluate 10 Smart Controllers and 2 Conventional Controllers performance over a typical Texas Growing Season (9 months).

All smart controllers used in this program were donated by the manufacturers. Once programmed in accordance with a virtual landscape, the controller is connected to a data-logger through a set of relays (simulated valves). The data-logger records the start and stop time of each station (or zone) on the controller. These start and stop times are then entered into a database and an event runtime is calculated. Runtimes are then totaled for the testing period to determine the amount of irrigation applied by the controller.

In the late 1990's, the Irvine Ranch Water District, Municipal Water District of Orange County and Metropolitan Water District of Southern California learned of an emerging irrigation management technology using weather based irrigation scheduling devices. This technology removes the need to make manual scheduling adjustments because the "smart" device adjusts the schedule automatically as weather changes. A water savings evaluation of this technology was implemented which is known as the "Residential Weather-Based Irrigation Scheduling – The Irvine ET Controller Study". This evaluation identified an average single-family home savings rate of 37 gallons per day.

In an effort to address non-point source pollution, a second weather based irrigation scheduling study was performed to evaluate the linkage between improved residential irrigation management and reduced dry-weather runoff. The "Residential Runoff Reduction (R3) Study" reported comparable water savings of 42 gallons per day per single-family home. Savings at nonresidential sites were 545 gallons per day. The R3 Study also quantified a reduction in runoff ranging from 64 to 71 percent. With this change in runoff volume, concentrations of pollutants did not change therefore pollutants were reduced by a like amount.

Although soil moisture sensors have been used in agricultural and research applications for many years, this technology has only recently been applied successfully in the landscape irrigation field. Initial attempts to use soil moisture sensors to control landscape irrigation were unsuccessful due to the state of the technology, maintenance requirements and cost. Within the past several years, soil moisture sensor technology has advanced significantly with accurate and maintenance free systems being offered by several companies at competitive prices. Recent study findings indicate water savings resulting from soil moisture based smart systems are similar to those discussed above for weather based systems.

Water agencies throughout the country recognize smart irrigation control as an emerging tool to achieve landscape water savings and reduce non-point source pollution. When the first study began, the study team was aware of only a few Weather and Soil Moisture Based Landscape Scheduling Devices smart technologies. Today, nearly 30 smart irrigation control manufacturers exist and others are quickly emerging into the marketplace.

This report includes information on smart irrigation control products by 28 companies that were available as of December 2010. Three additional companies have been added and one companies' products are no longer available in the U.S.

City of Calabasas Existing Irrigation System

The following information represents the current irrigation system within the City of Calabasas parks, medians and parkways owned by the City.

	Location	Existing Controller	No. Valves
1	Firestation-LV Median-Clock B	Rain Bird ESP	11
2	Parkmore Battery Operated	Dig	2
3	Mont Calabasis	Rain Master Sentar	12
4	TO Center Median and South Median	Leit	6
5	TO North Parkway	IBOC	6
6	LV Clock for Gazania Beds	IBOC	5
7	LV Median-Clock A	Rain Bird ESP	5
8	LV Creek Park	Dig	2
9	Saratoga Clock	Irritrol MC	10
10	TO Turf Clock-near Gates Canyon Park	Leit	6
11	Mul. Hwy-below Eddingham	IBOC	7
12	Mul. Hwy-Daguerre	IBOC	7
13	Mul. Hwy-Eddingham N/S Turf	IBOC (qty. 2)	14
14	Mul. Hwy-Daguerre N/S Turf/Plant	IBOC (qty. 2)	18
15	Mul. Hwy-Center Median Near School	IBOC	12
16	Mul. Hwy-Median Across From Gelsons	IBOC	3
17	Freeway Controller A	Rain Master Eagle	23
18	Freeway Controller B	Rain Master Eagle	36
19	Freeway Controller C	Rain Master Eagle	13
20	Lost Hills-North of Cold Springs	Rain Master Sentar	31

21	Lost Hills-Meadow Creek Ln.	Irritrol MC	22
22	Lost Hills-Las Virgenes	Irritrol MC	42
23	Calabasis Hills Rd.	Irritrol MC	13
24	Calabasis Hills Rd.-S.of Cold Springs	Irritrol MC	15
25	Agoura Road-W. of Lost Hills Dr.	Irritrol MC	7
26	Lost Hills-Malibu Hills Dr.	Irritrol MC	7
27	Las Virgenes-Saddle Ridge	Irritrol MC	8
28	Las Virgenes-Meadow Creek	Irritrol MC	5
29	Grape Arbor Park	Irritrol MC	16
30	Juan Batista DeAnza Park	Irritrol MC	36
31	Juan Batista DeAnza Park-Tennis	Irritrol Rain Dial	3
32	Bark Park	Irritrol MC	6
33	Pocket Park	Irritrol RD	12
34	Gates Canyon Park	Rain Master Eagle	26
35	Calabasas Rd-Civic Center	Superior Sterling	5
36	Calabasas Rd-Commons Way	Irritrol MC	5
37	Calabasas Rd.-E. of Park Granada	Irritrol Total Control	16
38	Park Granada-Park Sorrento	IBOC	6
39	Park Granada-S. of Park Sorrento	Irritrol MC	7
40	Park Granada-N. of Pkwy Calabasas	Irritrol MC	6
41	City Hall	Calsense ET2000e	23
42	Pkwy Calabasas-Calabasas Rd.	Rain Master Eagle	7
43	Pkwy Calabasas-Park Granada	Rain Master Eagle	9
44	Pkwy Calabasas-S. of Park Granada	Superior Sterling	10
45	Pkwy Calabasas-Paseo Primario	Irritrol MC	7
46	Pkwy Calabasas-Camino Portal	Rain Master Eagle	33
47	Pkwy Calabasas-Palmilla Dr.	Irritrol MC	2
48	Pkwy Calabasas-Palmilla Dr. HOA+City	Irritrol MC	12
49	Pkwy Calabasas-Ariella Dr. Cont. 1	Irritrol Total Control	20
50	Pkwy Calabasas-Ariella Dr. Cont. 2	Irritrol MC	15

51	Pkwy Calabasas-Slope Irr. 24134 1/2	Irritrol MC	16
52	Pkwy Calabasas-Park Entrada	Irritrol MC	16
53	Pkwy Calabasas-N. of Park Entrada	Irritrol MC	9
54	Pkwy Calabasas-Medians	Rain Master Eagle	36
55	Pkwy Calabasas-Las Virgenes WD	Irritrol MC	8
56	Tennis & Swim Center-SW Pool Storage	Irritrol MC	12
57	Tennis & Swim Center-Tennis Courts	Irritrol MC	29
58	Tennis & Swim Center-Delivery Entrance	Irritrol MC	14
59	Park Capri	Irritrol MC	11
60	McCoy Creek-Park Capri-Park Sienna	Irritrol MC	4
61	Highlands Park	Leit	3
62	Creekside Park-E. Side of Kindergarden	Irritrol MC	9
63	Creekside Park-Ball Field	Irritrol MC	10
64	Freedom Park	Irritrol MC	12

Overview of Smart Irrigation Technology

Smart irrigation control systems typically include either a stand-alone controller or an add-on device which interfaces with a conventional clock-type controller. The weather or soil moisture based technologies incorporated into these devices allow them to function similar to a thermostat. Like a thermostat, the devices permit irrigation to occur when needed rather than on a preset schedule.

Regardless of the specific method or technology, the concept is for the appropriate irrigation quantity to be applied at the appropriate time. Most of these systems are available in a variety of sizes appropriate for small residential to large commercial applications. For this report, a device with more than a 12 station (zone) capacity is considered large residential or light Weather and Soil Moisture Based Landscape Scheduling Devices commercial. In most cases, light commercial products possess the same features as the residential products, but have greater station capacity.

Larger industrial type commercial products possess high station capacity and offer additional features such as flow sensing, surge and lightning protection, multiple master valve circuits, concurrent station operation, and other sophisticated features.

Computerized central control system type products are beyond the scope of this review. These consist of multiple “satellite” controllers that are controlled through a centralized computer system allowing for monitoring and control of multiple irrigation system parameters including flow rates, pressures, pumps, master valves, etc. from a single location. Several of these systems are mentioned since they are offered by the companies that sell stand-alone devices. Also, some of the stand-alone controllers reviewed possess central control system type features.

SWAT Testing

In an effort to set an industry conservation standard, the Irrigation Association® (IA) has organized the Smart Water Application Technologies TM (SWATTM) initiative. This initiative functions as a partnership with constituents from public entities and private companies from the landscape irrigation industry. The first products for which testing protocols have been developed are for climatologically based irrigation control products. The current climatologically based testing protocol (7th Draft) was approved in November 2006 and has been implemented for testing. The current draft soil moisture sensor based protocol (Phase 2, 1st Draft) was posted in April 2006 and implementation is pending further review and preliminary testing.

The Center for Irrigation Technology at California State University – Fresno (CIT) has been contracted by the IA to conduct SWAT bench mark testing. Climatologically based testing began in 2005. The testing is done in a laboratory environment using a “virtual landscape” that is subjected to a representative climate based on weather station data. The purpose of the testing is to evaluate the ability of a device to adequately and efficiently irrigate the virtual landscape.

Although actual irrigation does not occur, the test measures the irrigation quantities prescribed by the device for 6 different zones with varying site conditions (soil and plant types, ground slope, sun/shade, irrigation system, etc.) The test duration is for 30 consecutive days with total minimum rainfall and evapotranspiration (ET) of 0.4 and 2.5 inches, respectively.

Testing results are summarized in performance reports (performance summaries and technical reports) which are posted on the IA’s website (http://www.irrigation.org/SWAT/Industry/ia-tested.asp) as test results are released by manufacturers. The summaries include percentage scores in the categories of Irrigation Adequacy and Irrigation Excess. The technical reports include details associated with these scores.

At the time of this report, performance reports for 9 manufacturers had been posted. Since the IA does not disclose which products have been tested until a performance report is released, it is unknown how many of the other weather based products have been submitted for testing. Certain manufacturers have indicated concerns regarding the SWAT testing and reported they will not submit their products for testing unless certain protocol changes are made. Whether or not a device has been submitted for SWAT testing and the status of the testing, when a performance report is not posted, is discussed in this report only if this information was made available by the manufacturer.

EPA WaterSense Program

In 2006, the EPA introduced its voluntary public-private partnership WaterSense Program. The mission of the WaterSense Program is to protect the future of our nation’s water supply by promoting and enhancing the market for water-efficient products and services. It is being modeled after the EPA’s successful Energy Star Program.

The WaterSense logo will be displayed on the labels of certified products. EPA staff are evaluating the potential for adoption of the SWAT protocols discussed above for WaterSense certification of weather and sensor based landscape irrigation control devices.

Reported Water Savings

Most of the product descriptions in this report discuss water savings. In some cases, water savings associated with various studies and demonstration projects are discussed. In most cases the water savings discussed are as reported by the manufacturer. It is discussed if water savings related study reports were submitted as part of this review, and or if the reports are publicly available. It is significant to understand water savings can be calculated by numerous methods and verification can be difficult.

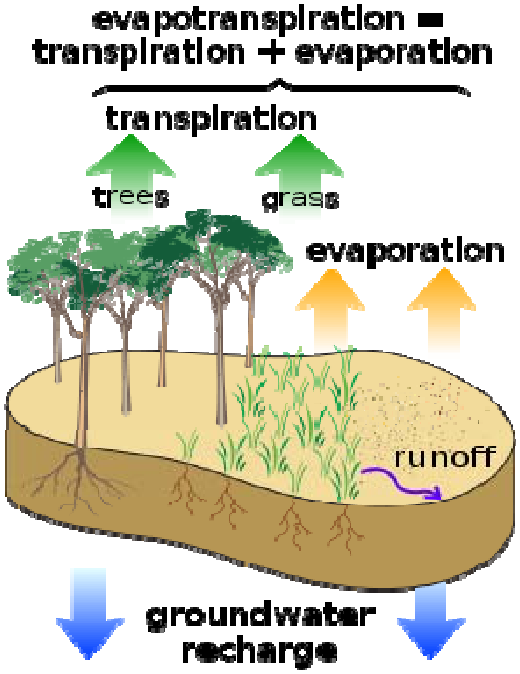
In some cases the reported water savings are average values for multiple installations, and in other cases savings for a selected site are reported. Regardless of a product's reported water savings potential, actual savings will vary significantly from user to user depending on weather, irrigation system and site conditions, and previous irrigation practices. A properly installed irrigation system (piping and sprinkler heads) with acceptable distribution uniformity is critical to realizing water savings and maintaining a healthy landscape.

No Rating of Products

No attempt has been made to rate the products relative to each other. Certain comparison criteria are discussed, and it is left to the reader to research further and determine which products may suit various applications most appropriately.

Weather Based Irrigation Control System Principles

All of the weather based products reviewed operate on the principle of scheduling irrigation as a function of weather conditions. Most of the products use real time or historic weather data to schedule irrigation based on evapotranspiration (ET), which is a function of weather conditions and plant type. ET is defined as the quantity of moisture that is both transpired by the plant and evaporated from the soil and plant surfaces.



The American Society of Civil Engineering's (ASCE) standardized reference ET equation parameters are maximum and minimum air temperature, net solar radiation, average vapor pressure and average wind speed. Vapor pressure can be calculated from humidity, dry and wet bulb, or dew point data and solar radiation can be derived from pyranometer or sunshine recorder data. The standardized reference ET equation is widely recognized as the best empirical method for estimating ET.

Other less accurate equations are also used which require only temperature and solar radiation parameters, and solar radiation is sometimes estimated as an average value based on historic data for a given site latitude. The problem with using estimated solar radiation values is the significant variability due to cloud cover is neglected, and solar radiation is the single most important parameter in ET calculation using the ASCE standardized equation. Some of the products evaluated use these empirical ET equations in their scheduling algorithms. It is significant to consider which equation is used with regard to ET estimation accuracy, or what parameters are measured if the equation used is not referenced.

Each of the weather based irrigation scheduling systems evaluated utilize micro-processing devices which calculate or adjust irrigation schedules based on one or more of the following parameter sets: weather conditions (temperature, rainfall, humidity, wind and solar radiation), plant types (low versus high water use and root depth), and site conditions (latitude, soils, ground slope and shade). Some of the systems are fully automatic, and others are semi-automatic. The semiautomatic systems typically require the user to enter a base daily irrigation schedule, and then the device determines the frequency (which days) irrigations occur or adjusts run times. Some of the semi-automatic system manufacturers provide guidelines for establishing the base schedule and others do not.

A significant factor in comparing the products that use real time weather data is the quality of the data used. The cost to install and maintain a complete weather station onsite in order to collect the data necessary to use the standardized reference ET equation is prohibitive in most cases. Two techniques are used to collect current weather data as alternatives to onsite weather stations.

Specifically, irrigation demand is calculated either using a limited set of on-site measurements, or using a full set of weather station data from a remote site. There are trade-offs associated with both methods. If only a limited set of data are used to calculate ET with onsite sensors, the accuracy of the calculated ET may be poorer than ET calculated with a full set of weather station data. Conversely, if the remote weather station data used are not representative of the irrigator's site, the calculated ET value and or rainfall sensing or measurement may not be accurate. Some of the weather station data being used may not be adequate for ET calculation. Specifically, some weather stations being used do not measure radiation, but calculate it from other parameters, and some stations are not properly located for ET parameters data collection.

Certain products reviewed use on-site temperature measurements combined with historic monthly ET or solar radiation data in the daily ET calculation. The historic data used are a function of the site location. An obvious consideration with this technique is the accuracy of the historic data relative to a specific site. In one case only five sets of data are available for the entire U.S. Several of the products reviewed calculate ET using a full set of remotely collected data from local weather stations or a network of weather sensors. The weather station data are collected from public and or private weather stations.

The weather station and sensor network data are processed by a centralized computer server, and transmitted to the irrigation sites. There are ongoing service provider costs associated with the operation of the weather stations, sensor networks, computers, and information transmission systems associated with these products. These costs are either absorbed by water entities or are paid by the users.

In some cases, compelling study results were submitted by the manufacturers showing accurate ET calculation and or significant water savings associated with their product as discussed under the product descriptions. In addition to the SWAT testing discussed above, a science-based evaluation of 4 of the weather based products reviewed was conducted by the University of California Cooperative Extension. Most studies to date have evaluated individual products rather than comparing the performance of multiple products. Given the general lack of data, it is difficult to draw conclusions about the overall performance of one product or technique versus another.

Weather Based Control Products Features and Comparison Criteria

Significant weather based controller product components and features are discussed below. The discussion also identifies different methods used to achieve similar results by the various products, and associated advantages and disadvantages.

Installation
Although most of the manufacturers recommend professional installation and programming of their products, several indicate installation and programming of its residential models can be done by “do-it-yourself” type homeowners. Most of the individuals associated with residential product demonstration programs and pilot studies who were interviewed during this review expressed concerns about homeowner installation and programming.

Based on the review of installation and programming instruction materials only, it appears some devices could be more difficult to install and program than others. The degree of difficulty to install any of the products can vary significantly depending on site-specific conditions. It appears that all of the commercial products should be professionally installed. Installation and programming instructions are available for many of the products at their websites. All potential customers should review this information when shopping for a device regardless of whether they plan to do their own installation and programming.

In the development of Smart irrigation device promotion programs, water agencies should consider requiring professional installation or requiring users to attend workshops to receive training before performing self-installation.

Stand-Alone Controller Versus Add-on Device
The primary component of most of the products reviewed is an automatic irrigation controller in place of a traditional clock type controller. Alternatively, several of the products include a receiver or scheduler that is connected to an existing controller. In some cases, the lower cost of the add-on device is a significant attraction. Regardless of cost, the quality of an existing controller should be a factor when considering replacement. If the existing controller is a high quality unit with adequate features, an add-on receiver may be an attractive alternative. The level of automation is limited with some of these units relative to some of the stand-alone

controller systems. Specifically, some devices only prescribe irrigation frequency or adjust preset run times and do not automatically calculate run times.

Irrigation Schedules and Run Time Calculation and Adjustment
Some of the products reviewed will automatically generate irrigation schedules and run times for various zones as a function of sprinkler application rate, plant and soil types, slope and sun/shade conditions, and distribution uniformity. The ability of the automatic controllers to accurately generate an efficient schedule is dependent on the controller, the user's knowledge of the landscape parameters and proper programming.

Other devices require a base irrigation schedule with specific run times which are entered by the user. In which case, the user must manually calculate run times based on experience and or guidelines provided by the manufacturer. Some of these controllers adjust the preset run times based on weather conditions, and others only control the irrigation run frequency. The product descriptions identify the manufacturers that provide guidelines for determining appropriate run times for the devices that require a base schedule.

Automatic run time calculation can be a significant advantage if the required programming inputs are known and the controller calculates accurately. Regardless of automatic or manual run times, many of the products have a fine-tune feature which allows adjustment of station run times by a percentage factor or by minutes giving the user the ability to compensate for inadequate run times.

Application Rates and Distribution Uniformity
Some of the products reviewed allow the user to enter actual sprinkler application rates versus preprogrammed rates based on irrigation type (spray, rotor, drip, etc.). Application rates can be measured by the user if not provided by the sprinkler manufacturer. The irrigation system's distribution uniformity or efficiency factor (typically a percentage) describes the effectiveness of the sprinkler head coverage, and reflects the quality and layout of the sprinklers. This setting allows the controller to compensate for low uniformity. The majority of a system with low distribution uniformity must be over irrigated in order for all areas to receive adequate water.

Irrigation Run and Soak Cycles
All of the stand-alone controllers reviewed provide for multiple run and soak times to limit runoff. Some calculate them automatically by zone based on soil and ground slope conditions, and others require manual programming. Of those that require manual programming and for the add-on devices, certain manufacturers provide guidelines or computer programs for calculating the times. Regardless of automatic or manual calculation, by zone multiple run/soak cycles ability is a very advantageous feature.

Landscape Establishment/Fertilizer and Syringe Programs
Some stand alone controllers provide landscape establishment or fertilizer programs which allow for programming high irrigation quantities for a certain time frame before reverting to

the weather based programming. Plant establishment programs can preclude over-irrigation and runoff occurring for extended periods due to a landscape contractor programming for establishment of a new landscape. Syringe programs are designed for installation and system testing purposes. The program provides a convenient means of executing a short run time for each station.

Crop Coefficients
All of the controllers that automatically calculate run times can utilize preprogrammed crop coefficients set by the manufacturer by plant type. Some provide the user the option of programming custom crop coefficients. This can be advantageous since crop coefficients typically vary geographically.

Rain Sensors and Gauges and Rain Interrupt or Delay
Most of the products reviewed include a rain sensor or gauge with the system, or as an optional add-on accessory. These have a rain interrupt and or delay feature triggered by the sensor or gauge, or irrigation schedule adjust feature. Some of the products' only interrupt ongoing irrigation when significant rainfall is detected and others initiate an adjustable irrigation delay period. Some systems adjust the irrigation schedule based on the amount of rainfall measured.

Although no documentation was reviewed for this report on the measurement accuracy of different types of rain gauges and sensors, it is assumed the tipping bucket type gauges are more accurate than hygroscopic type rain sensors (sensors that absorb rainfall). Some of the receiver type systems have the ability to initiate a rain interrupt/delay or adjust the irrigation schedule based on rainfall detected or measured at a nearby weather station. Other receiver type systems use an on-site rain sensor or gauge that has the advantage of detecting or measuring rainfall that actually occurs at the site.

Other Sensors
Some of the products reviewed include standard or optional solar radiation, humidity, wind, temperature and flow sensors. In addition to calculating irrigation demand using temperature data, some of the devices interrupt or delay irrigation when wind and or temperature conditions are adverse to irrigation.

Alternatively, some of the systems delay irrigation based on wind and temperature conditions measured at a local weather station. Most of the commercial products include flow sensor input terminals. In addition to monitoring to detect for high and low flows indicative of irrigation system problems, some of the controllers factor flow conditions into automatic scheduling decisions.

Power Supply and Surge and Lightning Protection
With one exception, all of the stand-alone controllers include a power transformer that converts 110-120 volts of alternating current (VAC) to 24 VAC. The transformers are either hardwired inside the controller cabinet (internal), or plugged into a power outlet (external). The

Alex-Tronix controller operates on a pulsed 9 volts of direct current (VDC) using battery power. The add-on scheduling devices operate on either 24 VAC, 9 VDC or 12 VDC and either receive power from the existing controller or from an external transformer. Most of the transformer devices include some type of current overload protection such as a fuse or breaker switch. Some controllers include lightning and or surge protection, or offer these as an optional feature. Surge and lightning protection limits damage to the controller's circuitry from transient voltage and current from the power source (surge) and from the valve circuits (lightning).

Station Circuit Rating, Wiring and Terminal Wire Sizes

The compatibility of the existing electrical circuits (wiring from the controller to the station valves) should be considered in the selection of a replacement irrigation controller. If the station wire terminals on the controller will not accept the existing wire, adapters must be used. Also, the circuit current capacity required for an existing system should be checked prior to installing a new unit.

Reports from demonstration studies indicate installation problems associated with insufficient circuit capacity to operate some irrigation valves with high circuit resistance. The traditional wiring system (circuitry) used for most controllers consists of a common and a dedicated wire from the controller to each valve and sensor. Some controllers utilize "2-wire" circuitry that consists of a single pair of wires connected to all of the valves and sensors in the system. These systems require the installation of a decoder device for each valve and sensor. Applications include large systems and linear systems (e.g., highway corridors) with large quantities of wiring required for traditional circuitry.

Clock Mode Operation

Most of the controllers reviewed will operate in a standard clock mode. Some of them can be programmed for clock mode operation by station. One of the controllers that receives a scheduling signal does not have clock mode capability. Therefore, if the signal subscription is cancelled the controller must be replaced.

Display and Data Review

It is advantageous for a device to have a large easy-to-read display which displays settings and data. Ideally, the data review control should be backlit and easy to use. It should display information by zone for run times, soak times, irrigation amounts, percent adjustments, ET and other weather information, watering window and irrigation history.

Non-volatile Memory and Batteries

All of the products reviewed have non-volatile memory to protect their programming during power outages. Some of the products also include a backup battery for maintenance of the date and time during power failures, and those that do not provide this back-up protection within the non-volatile memory.

Warranty and Reliability

All of the products reviewed come with a warranty. Warranty periods are discussed separately in the review of each product. In some cases, the manufacturers' warranty periods vary for its different products. Although the warranty periods may or may not be indicative of the life expectancy of the products, in some cases there appears to be a correlation between the cost and overall quality of the product to the warranty period. It is assumed the cost of a product somewhat reflects the quality of the construction materials and electronic components. Hence the less expensive residential devices should not be expected to last as long and function as reliably as the more expensive residential and commercial products. Since most of the devices are relatively new products, it is difficult to speculate on how long they should last. Depending on site conditions and maintenance, the weather sensors and other outdoor components may be vulnerable to degradation due to exposure to the elements. The availability of replacement sensors and their costs should be considered for those systems with on-site weather sensors.

Weather Based Product Descriptions

The following product descriptions address operational characteristics and features, and include discussions of available information from demonstration and pilot studies relative to documented water savings and operation. Each of the manufacturers was provided with copies of the product descriptions for their input prior to being incorporated into this report.

Accurate WeatherSet

Accurate WeatherSet is located in Winnetka, California. WeatherSet has manufactured commercial weather based irrigation controllers for landscapes, golf courses and greenhouses since 1979. The company started development of its first residential controller prototypes in 2000, and began marketing the residential controllers in September 2001. All WeatherSet controllers utilize a solar sensor and rain sensor to automatically adjust irrigation schedules. The solar sensor, designed and fabricated by WeatherSet, measures solar radiation which is the major factor affecting the controller's ET calculation.

The WeatherSet controller is called the Smart Timer™, and it comes in 8, 12, 16, 24, 32, 40 and 48 station models. The Smart Timer is a stand-alone controller and does not require communication with remote servers to obtain weather data or irrigation schedules, and there are no ongoing service costs. The controller calculates ET with input from an onsite solar radiation sensor. WeatherSet reports the solar sensor has functioned reliably in demanding environmental conditions to control greenhouse and outdoor misting systems since the early 1990's.

Operational Features

The WeatherSet controller calculates a daily ET estimate based on solar sensor SunFall™ measurements that are logged by the controller on a 2-minute frequency. The sensor must be installed in a mostly sunny location in order to function accurately. Adaptive control logic allows the controller to function with some shading. From their work with commercial controllers, WeatherSet reports that SunFall reduces by about two-thirds from a clear day in summer to a clear day in winter, and that their 5 self-adjusting programs follow these changes.

The calculated ET information is combined with rain sensor data and user programmed information to schedule irrigation. To program the controller for automatic adjustments, the user assigns each station to one of three programs, which are labeled Flowers™, Lawns™ and Shrubs™. The Flowers, Lawn, and Shrubs programs are for shallow, medium and deep-rooted plants, respectively.

A fourth program called LWU (low water use) will deliver water to California native plants that expect no rain from May through September and winter rains from October through April. A runoff limit, in minutes per hour, may also be entered for each station to stop runoff. The user enters a MAX Runtime for each station and the Smart Timer automatically adjusts the watering days and runtimes for each valve. The controller has a manual start function, and an optional irrigation history review function. With the H-option, the controller keeps a running tab of total run time for each station.

The controller's rain sensor is an Ecologic RainBrainTM. The sensor signals the controller to interrupt irrigation in its rain shut-off mode, and the rain sensor signals are also used by the controller for irrigation scheduling. The WeatherSet controller is preprogrammed to account for the duration that the rain shut-off circuit has been interrupted when scheduling irrigations. The WeatherSet irrigation controller provides 7 different runoff limits that are set for each station. A maximum cycle run time of 2, 4, 6, 8, 11, 15, 20 and unlimited number of minutes per hour may be set for each valve. The default cycle limit factor is four minutes per hour. As an example, if the controller calculates a total 12-minute run time for a station, this station will be irrigated in three 4-minute increments over a 3-hour period, with the default setting.

For stations that generate runoff, WeatherSet recommends the user measure the time required to cause runoff (using the manual run mode), divide the time by two and use that time to choose the runoff factor for the station. The runoff factor may be shut off to allow continuous watering when required. For example, valves controlling drip systems in LWU programs may best be watered with the runoff limit shut off.

Descriptions, Prices and Warranty

Two Smart Timer indoor residential controller models and seven outdoor commercial models are available. The indoor controller cabinets are constructed of aluminum with dimensions of 5.5" x 7.5" x 1.5", and the indoor power transformer is an external plug-in type unit. The lockable outdoor cabinets are constructed of zinc plated steel with powder coating and stainless steel hinges, and they come in three sizes. The respective dimensions for 8-12, 16-24 and 32- 48 station models are 9" x 10.5" x 4", 10.5" x 9.5" x 4.5" and 14" x 12" x 4.5".

The outdoor models include internal power transformers. The 16-station and larger models include flow sensor connectivity, station circuit testing and surge/lightning protection features. The station circuit current rating for the indoor units is 0.75 amperes and it is 1.5 amperes for the outdoor units. All models' station circuit terminals will accommodate wiring sizes from 12 to 20 gauge. The controller's program memory is non-volatile, and the time-keeping microprocessor chip uses a 3.3-volt coin-type battery that has a reported life of ten years. The prices include the solar and rain sensors.

The controllers are available directly from WeatherSet by telephone (818-993-1449) or e-mail (www.weatherset.com). The company plans to also distribute the product through select specialty irrigation contractors. The Smart Timer controllers come with a 3-year warranty.

Installation

WeatherSet reports that 95 percent of homeowners included in the Municipal Water District of Orange County rebate program using the Smart Timer installed the controller themselves. Based on this, it appears that the typical homeowner can understand and program the WeatherSet Smart Timer. Technical support is available by telephone and through the company's internet site. Service by factory-trained contractors is limited to California, Oregon, Washington, and Colorado at this time. WeatherSet reports this area will grow as their market expands. The installation and programming instructions, which include directions for locating the solar sensor, appear to be adequate and easy to follow.

Track Record, Water Savings and SWAT Testing

WeatherSet has provided data showing close correlation between ET estimate calculation by their controller and that calculated by an AZMET (Phoenix, Arizona ET network) weather station. WeatherSet controllers have not been included in any formal demonstration studies and no water savings data were evaluated for this report. A SWAT test performance report for the Smart Timer controller was not available for this report. The WeatherSet controller appears to be a simple and relatively economical stand-alone weather based irrigation controller which comes with onsite rain and solar sensors.

AccuWater

AccuWater, Inc. was incorporated in October 2002 and is based in Austin, Texas. The company has developed a centralized, weather-based irrigation management system for residential and commercial property applications. The AccuWater system has been in development since mid-2000 and pilot testing was performed from October 2002 through July 2004. The company has been actively marketing their system within Texas since July 2004. Sales outside of Texas began in July 2005.

AccuWater™ is a network-centric irrigation control system that is based on the latest Internet hardware and software technologies. AccuWater controllers are designed to irrigation industry standards and connect directly to all 24 VAC valves, replacing any existing "clock."

The AccuWater data center is located in Austin, Texas in a professionally managed Internet co-location facility. Communication and data transfer between the controllers and the data center is accomplished through an Internet connection.

Currently supported configurations include: wireless (802.11b/g), wired (Cat5 Ethernet), GPRS (digital cellular) radio. The AccuWater system schedules irrigation based on calculated soil moisture in each irrigation zone. Soil moisture is updated hourly for each zone taking into account local weather (rainfall and ET) and actual irrigation (as reported by the AccuWater controller).

To ensure the accuracy and timeliness of the weather data, AccuWater utilizes a combination of attached weather sensors and publicly available weather sources including the National Oceanic and Atmospheric Administration (NOAA), the California Irrigation Management Information System (CIMIS), and the Missouri Agricultural Bulletin Board (AgBB). A backup schedule, based on recent ET, allows the controller to irrigate for up to 21 days without network connectivity. This schedule can be modified through an ethernet computer connection to the controller.

One of the unique attributes of the AccuWater system is that it can share weather data between nearby units via the AccuWater data center. The AccuWater controllers send weather data to the data center, and the data center fills in missing data elements from nearby sites by searching a pre-defined hierarchy.

The server then sends each controller a complete weather context for that location including temperature, humidity, barometric pressure, wind speed and rainfall. As a result, AccuWater controllers can receive current weather conditions and make decisions (adjust, delay or abandon) without the benefit of on-site weather sensors.

Operational Features

AccuWater controllers are configured and managed by the end user on the company's website. Configuration information for each controller includes:

- Location (latitude, longitude and elevation)
- Environmental limits (temperature and wind speed)
- Watering window (including "no water" days)

Configuration information for each zone includes:

- Plant type
- Soil type and depth
- Precipitation rate
- Flow rate
- Distribution efficiency
- Sun and rain exposure
- Cycle-and-soak
- Soil moisture depletion limit
- Minimum and maximum irrigation limits

Controllers can be grouped into "locations" and any location can be delegated to another user (free accounts) or to one of AccuWater's landscape maintenance partners. This allows owners to maintain control and monitor water usage while simultaneously allowing authorized third parties to manage AccuWater systems remotely. AccuWater provides a free, cell phone remote control program. This program enables the end user (or their authorized delegate) to access and control his/her AccuWater controller from anywhere.

At 6:30 pm local time each day, the AccuWater data center calculates a one-time use irrigation event for each irrigation zone based on calculated soil moisture and the National Weather Service (NOAA) local rain forecast. If the forecast includes a high probability of rain and soil moisture levels allow, irrigation may be deferred for 24 hours. Irrigation events are sent to and stored on the controller for execution during the watering window. If weather conditions are not appropriate for irrigation, the controller will wait for conditions to improve. If conditions do not improve before the watering window closes, no irrigation will occur. In the event data are not available, a 21-day back-up schedule is calculated based on recent ET.

Descriptions, Prices and Warranty

The model R116 AccuWater controller is an indoor unit with a 16-station capacity, including one station terminal that may run concurrently with all the other stations to control a master valve or pump start relay. The controller housing is constructed of injection-molded ABS plastic, and the transformer is external to the controller. The station circuit terminals will accept 14 gauge and smaller wire sizes and the station circuit current rating is 0.75 amperes. All AccuWater controllers include percent adjust, syringe cycle, distribution setting features and surge and lightning protection. The retail price for the R116 controller is $549. Up to three R116 controllers can be interconnected to create 32 or 48 station units.

AccuWater also sells commercial grade 16, 32 and 48 station models in ventilated outdoor steel enclosures priced at $1099, $1699 and $2499, respectively. The outdoor unit has an internal transformer with 2.0 ampere circuit capacity. The optional GPRS radio is priced at $495 and requires an Internet wireless plan from T-Mobile or Cingular.

Annual service fees start at $149 for 16 stations. Fees are based on the number of equipped stations at a "location" and the cost per station declines as the number of stations increases. A location is defined as a contiguous property under a single owner/operator.

AccuWater's circuitry is based on a 75 megahertz Java-based central processing unit. It has one megabyte of volatile storage and 4 megabytes of non-volatile memory, as well as a 10-year lithium ion battery just for the onboard clock. All configuration and operating data for AccuWater controllers are stored in the AccuWater data center. After a power or network interruption, the controller will synchronize itself with the data center. If a connection to the data center cannot be made, the controller will reload its operating program and configure data from non-volatile memory.

To ensure accurate rainfall data, AccuWater recommends the use of their wired, tipping bucket rainfall gauge ($150). The gauge is commercial grade and is constructed of UV-resistant, heavy-gauge, white nylon. AccuWater also offers temperature, humidity, barometric pressure, wind speed/direction and solar radiation sensors for direct connection to the controller. Additionally, AccuWater controllers can utilize real-time weather data from Campbell Scientific Turf Weather and WeatherHawk weather stations over an Internet connection.

In the absence of a local weather station on the AccuWater network, the system will automatically utilize data from NOAA, CIMIS or AgBB. Other state-wide weather networks will be integrated as needed. AccuWater provides a one-year limited warranty on their products. AccuWater products are currently available directly from the company or from AccuWatercertified irrigation contractors.

Installation
AccuWater reports that many homeowners are capable of installing and configuring the controller, but professional installation is recommended. The AccuWater website (www.accuwater.com) provides a step-by-step guide to installing and configuring the product. Technical support is available by telephone at 512-331-9283 and through the company's website, and local technical service representatives are available for service calls.

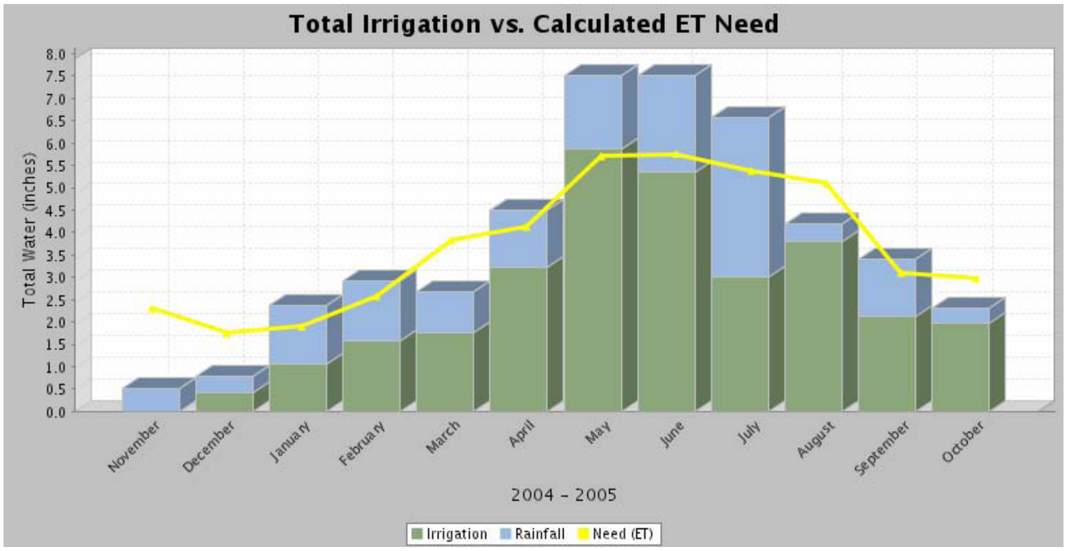
Installation of the AccuWater system involves

1. installing the AccuWater controller in place of the existing controller;
2. installing weather instrument(s) and connecting to the new controller;
3. performing an initial site survey to determine flow and precipitation rates; and
4. configuring the stations and performing a test run of all stations.

Because of its Internet-centric design and web-based controls, the AccuWater system integrates easily into most home automation systems. As of this writing, the following companies have committed to integrating AccuWater into their whole-home automation solutions: Crestron, AMX, Control4, Vantage Controls and Convergent Living.

Track Record, Water Savings and SWAT Testing

As of November 2005, AccuWater had accumulated over 700 controller-months of operating data. AccuWater reports its analysis of these data suggest that average water savings are in the 30 percent range, with individual controllers yielding savings as high as 55 percent. The chart shown in figure below is taken directly from the AccuWater web site for a residential property in Austin, Texas. It shows the AccuWater prescribed irrigation quantity relative to reference ET as reported by Texas A&M University.



The Accuwater System's computer interface provides an apparently easy and effective method for monitoring irrigation information and weather conditions. This system should satisfy the more demanding and affluent portions of the residential weather based irrigation controller market. Accuwater has not submitted its product for SWAT testing.

Alex-Tronix

Alex-Tronix® Controls is a division of GNA Industries, Inc. and is located in Fresno, California. This manufacturer of turf irrigation controllers was established in 1977 and specializes in battery operated controllers. The Alex-Tronix Smart Clock® and Enercon Plus are the industries' only battery operated weather based residential and commercial controllers, respectively.

The Smart Clock and Enercon Plus controllers entered the market in 2005 after 3 years of research and development. They are lithium battery powered controllers which operate using the temperature budgeting based Set It, Don't Sweat It® Program. The program incorporates a weather parameter estimation model developed at the University of Oregon known as PRISM (**P**arameter-elevation **R**egressions on **I**ndependent **S**lopes **M**odel). Daily irrigation schedules are calculated by the controller as a function of site latitude (radiation), real time temperature, and maximum annual high temperature.

An optional rain switch is available which stops and prevents irrigation when significant rainfall occurs. The "Set It, Don't Sweat" It program is based on a temperature budget theory. Once a schedule is programmed into the controller for peak summer irrigation, daily schedules are calculated as a function of the actual temperature for the day relative to the maximum annual temperature. Alex-Tronix believes this simple and logical programming concept is easy for the user to understand, thus encouraging proper utilization.

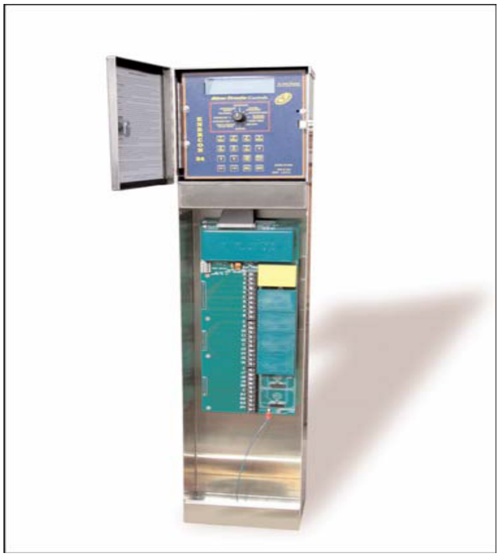
Operational Features
To program the Smart Clock, the site zip code is entered along with the peak summer irrigation schedule. A minimum irrigation temperature may be entered for cold regions to prevent irrigation during freezing weather. The schedule entered may be based on either days of the week or interval of days.

The key to optimizing this system is proper programming of the peak summer irrigation schedule. Appropriate station run times and soak cycles must be determined and entered manually. Once peak summer run times and the zip code are set; the temperature sensor is connected. The rain delay feature can be triggered manually or automatically, with an optional rain sensor, for an adjustable irrigation delay of up to 99 days.

Descriptions, Prices and Warranty
The Smart Clock controller is suitable for indoor or outdoor installation. It is powered by three 9- volt lithium batteries and is suited for residential applications with 6 stations plus a master valve terminal. Each station may be programmed for up to 4 cycles per day. This allows for the total station run times to be divided into multiple cycles in order to minimize run off. Specific days of the week or interval of days for irrigation may be programmed by the user.
The battery operation of the controller eliminates potential surge problems and burned out coils due to excessive voltage. The pulsed DC current eliminates capacitive problems associated with AC powered systems and galvanic copper wire deterioration caused by steady DC operation.

The standard Smart Clock is a locking powder coated 8.25" x 7.5" x 5.2" commercial grade metal enclosure. A stainless steel pedestal option for mounting the Smart Clock is available. The controller terminals will accept wire sizes up to 12 gauge. The station circuit capacity is 5 amperes. The controller includes a self-powered removable panel for programming at a convenient location. The controller's high temperature rated liquid crystal display is 2.4" x 0.7" and is easy to read. The controller possesses a unique valve test function that allows cycling through each station for a programmed amount of time without the need to return to the controller.

The Enercon Plus includes all of the features as the Smart Clock and more, and provides more capacity with 4, 8, 12, 16, 20 and 24 station models. It comes standard with a stainless steel pedestal and internal temperature sensor. An external rain and temperature sensor is also available. The overall dimensions are 35.6" x 7.5" x 5.1". This arrangement provides a large wiring area for ease of installation and service. Optional output board lightning protection is available for the Enercon Plus.



Alex-Tronix reports the current water and energy savings technologies used by the Smart Clock and Enercon Plus controllers are recognized and sponsored by the U.S. Department of Energy.

Alex-Tronix controllers may be purchased through the recognized turf and landscape irrigation distributors Ewing, John Deere and Hughes. The current list price for the standard Smart Clock (with integrated temperature sensor) is $995.

The optional stainless steel pedestal is listed at $995. The base Enercon Plus list price with stainless steel pedestal is $1,950 including a 4-station output module, and each additional 4-station module is $199. The optional rain and temperature sensor for pole mounting for either model is $149. Lightning protection for the Enercon Plus is $460. The Smart Clock and Enercon Plus controllers both come with a two-year warranty, including the batteries.

Installation

Alex-Tronix reports installation and setup are reported to be easy, and it is reported that installation of the residential controller may be accomplished by most homeowners. The time required for an inexperienced user for installation and setup is reported to be 2 hours. An experienced professional should be able to install and setup the Smart Clock in one hour or less. Detailed step-by-step installation and setup instructions are included in the owner's manual which is available with the controller and at www.alex-tronix.com.

The Alex-Tronix battery powered controllers are compatible with Hunter and Rain Bird latching solenoids as well as the Alex-Tronix latching solenoid. In general, they are compatible with nearly all currently manufactured valves.

Track Record, Water Savings and SWAT Testing

Alex-Tronix performed a five year analytical study comparing their Set It, Don't Sweat It temperature budget calculated irrigation demands at 25 locations to nearby CIMIS station reference ET. The Alex-Tronix Smart Clock and Enercon Plus controllers have completed SWAT testing and performance summary reports are posted at the Irrigation Association website. These are the first battery powered controllers to complete SWAT testing.

Aqua Conserve

Aqua Conserve, Inc., located in Riverside, California has been in business since 1996. The company manufactures 5 residential ET controller models, a large variety of commercial ET controllers, and controller replacement panels and accessories.

The Aqua Conserve® controller operation is based on adjusted historic ET data, with the adjustment made as a function of on-site temperature sensor readings. Combined rainfall/ temperature sensors are included with some controller models and are available as add-on components for the other models which include only a temperature sensor.

Aqua Conserve's residential and commercial controllers have been on the market for approximately 8 years. Three indoor residential models are available, which accommodate 6, 9 or 14 stations, and the two outdoor residential models accommodate 8 or 12 stations.

Aqua Conserve offers two types of commercial controllers, both of which come in wall mount and top entry models. The commercial controllers are outdoor units and will accommodate from 16 to 66 stations. Aqua Conserve's basic commercial models come in 16, 24 and 32 station models. The ULTIMO commercial controller series offer additional features and include 16, 26, 36, 46, 56 and 66 station models.

Operational Features

Aqua Conserve's ET controllers are preprogrammed with 16 individual historic ET curves, each representing geographic regions within the states of Arizona, California, Washington, Nevada, New Mexico, Utah, Colorado and Texas. The user enters one of the 16 regions into the controller. The controller then makes automatic seasonal changes to the run-times based on the historic ET curves, and daily changes based on the onsite temperature sensor. July run-times are entered into the controller for each station by the user.

Aqua Conserve provides suggested run-times that are specific for plant types and for either spray or rotor sprinkler heads. Suggested run-times for drip systems are not provided. The suggested run-times are available at Aqua Conserve's web site (www.aquaconserve.com) for each of the 16 geographic regions mentioned above. Refinements to the suggested run-times to compensate for soil, slope and shade conditions are also provided. Further refinement of run-times can be made based on visual observations.

The various Aqua Conserve controllers provide 4 programs that allow the user to specify different watering days for different stations. 4 to 8 start times are available for each program to allow for refinement of total run-times into multiple cycle and soak times to compensate for soil and slope conditions to limit run off.

The maximum station run time is 99 to 240 minutes for the various models. The minimum irrigation frequency is once per week for low water plants. A new plant/landscape establishment option (2 additional non-adjusting programs) allows added watering by station for a specified period (1-60 days) to establish new landscaping, and then automatically reverts to the ET based schedule.

The controllers include 1 to 4 station circuits that may run concurrently with all the other stations to control a master valve, drip system or other accessories. On residential and small commercial controllers, other stations may not run concurrently. On the ULTIMO controllers, up to 6 stations, on other programs, may run concurrently.

The actual irrigation run-times for a given day are dependent on the programming described above and an automatic adjustment made by the controller, which is based on the measured on-site average temperature and historic ET data. The controllers have an accumulation feature that eliminates short cool period runtimes. The short cool period run-times are accumulated until 50 percent of the July run time has been reached and then irrigation will occur.

Descriptions, Prices and Warranty

Aqua Conserve commercial models come with a wired temperature sensor. Combined rain and temperature sensors are included with residential models and are an optional add-on with the commercial models. The combined sensors signal the controller once every second, initiating the rain delay (shut-off) function when significant rainfall is detected. In the rain delay mode, the controller will not re-initiate irrigation for at least a 24-hour period after significant rainfall has ceased. Depending on the duration of the rain event, the rain delay can cause the controller to interrupt irrigation for up to 5 days. The user also has the capability to trigger the controller’s rain delay feature manually.

All controllers have non-volatile memory and a 9-volt back-up battery. The back-up battery powers the controller clock in the event of a power outage for the residential and basic commercial units. The ULTIMO controllers include a storage capacitor that maintains the clock in the event of a power outage. All of the controllers can be programmed when powered only by the backup battery. The controller terminals accept 12 to 18 gauge wiring.

The residential indoor controllers provide 4 programs and 4 start times, and the outdoor models provide 4 programs and 4 start times. Both have one station circuit that may run concurrently with all the other stations to control a master valve or drip system. The indoor models are constructed of plastic and the outdoor controllers are housed in lockable stainless steel cabinets. The indoor models' dimensions are 8.3" x 6" x 2" and the outdoor models' dimensions are 9" x 8.8" x 3.3". The controller panel features dial type controls and a 2-line LCD display.

The indoor controller models have a station circuit current capacity of 0.5 amperes, and the outdoor models' station circuit current capacity is 0.75 amperes. All residential indoor controllers are powered through an external transformer (included with purchase). Residential outdoor units are hardwired to the electrical system and supplied with an internal transformer. All commercial controller models are housed in lockable stainless steel wall mount or top entry cabinets. The top entry units are designed for placement on a concrete foundation and are vandal resistant. The ULTIMO commercial controllers include all of the features of the basic models, plus additional master circuits, flow meter monitoring and other features.

The basic wall mount commercial models are powered through an internal 24VAC transformer (included with purchase), and provide 4 programs and 4 start times. The basic top entry commercial models are powered through an internal transformer, and include 4 programs and 4 start times. The wall mount cabinet dimensions are 9.8" x 10.8" x 4.3", and the top entry dimensions are 34.5" x 17.5" x 11.5". All of the basic commercial models' panels feature dial type controls and a 2-line LCD display. The station circuit capacity for the basic commercial controllers is 0.75 amperes, and one station circuit may run concurrently with all the other stations to control a master valve or drip system.

All of the ULTIMO models are powered through an internal transformer, and provide 4 programs and 8 start times. The wall mount cabinet dimensions are 12" x 14.3" x 14.3", and the top entry dimensions are 34.5" x 17.5" x 11.5". The ULTIMO controllers provide for manual, semi-automatic and timed operations.

The ULTIMO controllers can also detect leaks and excessive flows, and notify the operator or shut down the affected zone or master valve. Other ULTIMO features include water meter connections, large 4-line LED display, current and historic programming information access, ATM type push button programming, and start time stacking for all programs. The station circuit capacity for the ULTIMO controllers is 1.0 amperes, and they have four station circuits that may run concurrently with all the other stations to control a master valve or drip system. In addition, up to 6 programs can run concurrently.

All products are available directly from Aqua Conserve by telephone and Internet order, and through a limited number of local distributors. The residential models come with combined rain/temperature sensors, which are available as on optional add-on for the commercial models. The additional cost for the wired rain/temperature sensor is $83.50. The commercial models come with wired temperature sensors. There is no ongoing service cost associated with these controllers, and All Aqua Conserve products come with a limited 3-year warranty.

Installation

The findings of a 2003 study by the University of California Cooperative Extension indicate installation and programming of an Aqua Conserve residential controller is relatively simple and that the controller performed well. Professional installation of commercial controllers is recommended.

Aqua Conserve provides toll free telephone technical support and provides technical information on their web site. Aqua Conserve will participate in training contract installers upon request. Aqua Conserve reports that their support system meets or exceeds industry standards and the installation and programming instructions reviewed for this report are complete and easy to understand.

Track Record, Water Savings and SWAT Testing

Reported outdoor water use savings for pilot studies with Aqua Conserve controllers, which were performed by the City of Denver, Colorado, Sonoma, California, and the Valley of the Moon Water District in Northern California were 21, 23 and 28 percent, respectively. SWAT test performance reports for Aqua Conserve controllers were not posted at the Irrigation Association's website at the time of this review.

Calsense

Calsense®, started in 1986, is a Carlsbad, California based company that manufactures water management systems for large commercial customers. Since its startup, the company has specialized exclusively in water management systems using weather-based irrigation, real-time flow monitoring, moisture sensors and a wide variety of communication technologies.

Calsense markets its products to municipalities, school districts, universities, transportation departments, and other high volume landscape irrigators. Calsense provides free onsite training with its products, and emphasizes their commitment to customer service, support, and successful utilization of its products.

The Calsense ET2000e controller functions as either a stand-alone unit or as a field controller component for their water management central control system. The Calsense Command CENTER Software is the central component of the system.

Although the ET2000e is a new product for 2006, its basic design is unchanged from its predecessor, the ET2000 and favorably improved from the ET1, originally introduced in 1993.

Operational Features

The ET2000e can automatically adjust daily irrigation schedules with onsite reference ET measurements from the optional Calsense ET Gauge, a Campbell Scientific Weather Station, California Irrigation Management Information System (CIMIS) real-time data, or with historic average monthly ET. (Use of weather station or CIMIS data require computer interface to calculate ET and communicate it to the controller.)

CIMIS based historic monthly average values are preprogrammed into the controller, or the user can enter monthly values to serve as a back-up ET source. Measurements from an optional tipping rain bucket are incorporated into the irrigation schedule calculation to account for effective precipitation. Irrigation can be interrupted in the event of rain, and high winds with the use of optional switch type sensors. A soil moisture sensor can be used with the ET2000e also and override the decision determined through on-site ET. (See Calsense discussion under Soil Moisture Sensor Products section.)

In the ET scheduling mode, the user programs the controller's run times based on field knowledge for the time of year and soil moisture content. This base schedule is adjusted daily as a function of weather conditions. Monthly ET adjustment percentage factors are fine tuned for each station depending on plant types, sun/shade conditions, and soil moisture content. Crop coefficients can be entered as well, for each month for seven different kinds of plant material. Cycleand- soak times are manually programmed into the base schedule to minimize runoff.

The Calsense ET Gauge is an automated atmometer for estimating reference ET for turf (tall fescue). The covered ceramic evaporator at the top mimics solar energy absorption and vapor diffusion resistance of irrigated plants. A reservoir below the evaporator holds distilled water. The evaporator draws water from the reservoir at approximately the same rate that grass removes water from soil by ET.

Water drawn from the reservoir passes through a calibrated measuring vial and corresponds to 0.01 inch of ET. Electronic circuitry components sense when the vial is empty. It is then immediately refilled and the 0.01 inch event is marked by a switch-closure type pulse which is transmitted to the controller. The controller uses a 28-day ET table to calculate runtimes based on station precipitation rates. The ET Gauge operates on 24 VAC supplied from the controller. An optional stainless steel vandal proof enclosure is available for the ET Gauge.

Descriptions, Prices and Warranty

The ET2000e is available in 8, 12, 16, 24, 32, 40 and 48 station models. The controllers have two additional outputs for master valve and pump circuits. In addition, the controllers may be ordered with hardware and software for 4 additional 24 VAC outputs for the operation of lights, gates, water features, etc. at no additional cost. These outputs are controlled independently from the irrigation programs.

The controller has 7 regular programs and several syringe/propagation programs. A maximum number of start times or repeats per station is determined by station total minutes (programmed or ET calculated) and by a fixed set run time per cycle and a fixed set soak time between cycles.

The cycle-and-soak times are set manually. The user selects 7, 14, 21 or 28-day watering schedules to accommodate watering requirements, and no-water days can be designated by program. Programs can operate simultaneously based on the system capacity of the mainline and flow management. The ET2000e is typically installed by a landscape contractor and then Calsense provides assistance programming assistance to the user following the landscape establishment period.

A Calsense Model FM flow meter can be connected to the controller to continuously monitor flow through the irrigation mainline and learn each station’s flow rate automatically when irrigation occurs. This feature detects and alerts the user to mainline breaks, no flows, high flows (due to broken risers and pipe) for each individual station, and low flows due to pressure drops, malfunctioning valves, and or clogged heads.

An optional remote control receiver board is integrated into the ET2000e allowing the user to activate valves and view operational details without going to the controller. The Calsense Remote SENSE remote control transceiver allows the user to view valve-on, area description, flow rate, electrical use and remaining time.

A water volume budget feature determines when monthly use, with projected usage, will exceed the programmed monthly budget and alerts the user before the month ends. This capability helps maintain water rates and keep staff accountable to a water management program.

The controller also possesses a laptop computer interface for field uploads and downloads so that detailed reports can be produced and potential expansion to a central system can be evaluated. Extensive current and historic irrigation information can be viewed at the display or downloaded from the controller. The controller monitors and keeps a record of all site water usage by month for up to 2 years. Scheduled irrigation usage is recorded on a station-by-station basis and on a total controller basis for the current month and the previous month.

Unscheduled water usage (pressing the manual water or test key), and non-controller water usage (e.g. quick-couplers, manually bleeding valves, etc.) is recorded separately showing how the water is being applied.

The ET2000e is a weatherproof wall mount unit and the cabinet is powder coated rolled steel. The front panel includes an ergonomic key layout and a large16-line by 40-character LCD display (English or Spanish). The cabinet dimensions are 11.4” x 11.1” x 7.3”. The controller has non-volatile memory and the clock maintains time during power outages without the need for a backup battery. It is powered through an internal transformer. The controller accepts up to 14 gauge wire size, and the station current capacity is 1.5 amperes.

Optional AC power line overload protection consists of a sealed unit suitable for outdoor installation and carries full UL approval. Optional transient (lightning and surge) protection is provided with the TP-1 board. The transient protection board can be purchased either with or without an outdoor cabinet. The ET2000e will detect, alert and identify open and shorted circuits in field wires and solenoids. The affected station is skipped until repaired. Calsense products are available from many distributors located throughout the U.S. A list of these distributors is available from Calsense upon request (1-800-572-8608 or www.calsense.com). All Calsense products come with a 5-year warranty.

Installation

Calsense recommends professional installation of the ET2000e and installation time varies significantly depending on site conditions.

Track Record, Water Savings and SWAT Testing

Although Calsense has not participated in any outside studies or demonstration projects, its track record speaks for itself. During Calsense’s 20 years of existence, they have developed a large data base on its products’ performance and customer success.

Calsense submitted data for this report prepared by their in-house research and development department showing average water savings of 22 and 33 percent for two typical installations. Calsense reports an overall average water savings rate of approximately 20-40 percent depending on past water usage and project history.

Although the controller models have evolved, the Calsense ET scheduling technology has been in place since 1992. Many of the Calsense systems installed since that time continue to function today. Several articles written by end users in Calsense’s niche market testifying to the successful operation of their Calsense systems were submitted for this report. The ET2000e has completed SWAT testing and a performance summary report is posted on the Irrigation Association website.

Calsense provides potential clients with a reference list of all past and current users so that they can learn of their personal and professional experiences. In some cases, Calsense loans controllers to potential clients to demonstrate its system. The ET2000e provides a complete water management system as a standalone field controller, which can easily be expanded into a central control system.

Cyber-Rain

Cyber-Rain, Inc. came into existence in 2006 and is based in Oak Park, California. The Cyber-Rain XCI is a weather-based wireless stand-alone controller that works with the user's personal computer (PC) and adjusts irrigation scheduling based on weather forecasts downloaded from the Internet. Development of the Cyber-Rain XCI began in 2005 and the company received venture funding and began marketing the XCI in January 2007.

Cyber-Rain has incorporated several new technologies into its 8-station XCI controller. It uses a modern wireless mesh networking system (IEEE 802.15.4 ZigBee) to maintain two-way wireless communication between the controller and the user's PC located anywhere within 300 feet of the controller.

Wire-free expansion of the system can occur by adding more controllers (for more zones) and devices such as wireless sensors (moisture, rain, temperature, humidity) and flow meters. The company plans to introduce these complimentary wireless products in 2007. The system adjusts a base irrigation schedule using information from a variety of Internet sources such as the Weather Channel and NOAA websites. Cyber-Rain is currently developing interfaces for local weather stations. The Cyber-Rain system concept is to use state-of-the-art technologies to conserve water and provide broad functionality while hiding the complexities of these technologies from the user.

The Cyber-Rain system allows full control of irrigation scheduling and offers water usage reports using a Windows® graphical user interface. The system monitors weather forecasts and wirelessly transmits irrigation schedule adjustments to the controller. Two-way communication allows each controller's activities, such as manual or scheduled activation of valves, to be centrally reported to the PC and logged.

Operational Features

The Cyber-Rain XCI can be installed as a new controller or one that replaces an existing clock type controller. The XCI controller comes with a small wireless device called an Access Point that is connected to an internet-accessible PC's USB port to let the Cyber-Rain software wirelessly communicate with one or more XCIs. The XCI is programmed using the PC and all scheduling operations can be performed through the PC user interface. In addition, users have the option to operate the XCI using the buttons on the controller.

Cyber-Rain reports that after the initial setup and schedule entry, no further user intervention should be required. The system is designed to run "in the background" without interfering with any other PC operations.

The system does not require that the PC is turned-on to operate, but the PC must be turned-on and connected to the internet for access to weather forecasts. The weather forecast is checked automatically via the PC's internet access and irrigation schedule adjustments are calculated based on temperature and humidity and transmitted to the controller. If rain is forecasted, irrigation is suspended until it stops raining.

The suspension may continue to compensate for the duration of the rain. The XCI includes a cycle and soak feature to eliminate or reduce run-off. Individual zones can be put on a temporary hold for a user-defined number of days. A fertilizer watering feature allows the temporary increase of watering for a user-defined number of days, and then the system returns to its normal schedule.

An anti-freeze feature will automatically suspend all watering when the forecast temperature approaches freezing point. Cyber-Rain maintains a log of all water usage and displays a variety of water usage and saving statistics.

During normal usage, Cyber-Rain receives weather forecasts then schedules irrigation accordingly; however, if the PC is offline for many days (e.g., when the homeowner is away on vacation) the system reverts to irrigation schedule adjustments based on a built-in Watering Index. The Watering Index is based on historical temperature, precipitation and other weather patterns for a given geographical area. A graphical example of Watering Index settings are shown below.

Custom zone names are entered by the user as text such as "Rose Bushes" or "Front Grass" and can be in any language. When the controller operates, the names are displayed. A base irrigation schedule is entered by the user consisting of irrigation days, total run times and cycle and soak times for each zone.

Information on determining the base schedule is included in the Cyber-Rain user manual and there are shortcut keys to make the initial entry easier. Cyber-Rain is designed with remote policy functions that can ensure automatic compliance with city or water district regulations such as limiting watering to certain hours of the day or blocking watering certain days. The system can “lookup” changes in these regulations and apply them immediately. Cyber-Rain can also aggregate individual watering and report, via a central internet reporting site, the percentage of water savings in a given geographical area.

Watering Index Settings

Watering Index is used as a schedule setback when your sprinkler controller is offline

Description, Prices, and Warranties

The Cyber-Rain system consists of one or more 8-station XCI controllers, a wireless USB Access Point device that connects to the user’s PC, and Cyber-Rain computer software. Additional controllers can be added at any time that will integrate through the original Access Control and are all controlled from the same Cyber-Rain XCI software. In this way any size property can be managed from a single PC’s user interface.

The XCI is constructed of fire-retardant ABS plastic and is suitable for indoor installation only. Its dimensions are 8.5” x 4.25” x 1.75” and it includes a 2-line by 24 character LED display panel. The XCI is powered by an external 24VAC transformer. Station circuit capacity is 1A and the controller accepts wire sizes up to 14 gauge solid or 16 gauge stranded. The XCI has non-volatile memory to retain programming during power outages and its clock is maintained during power outages with a super capacitor and real-time clock chip. Surge and lightning protection is provided with metal oxide varistors (MOV) and extra inductors on each circuit.

A single-controller system is priced at $295 and includes one Cyber-Rain XCI 8-zone controller, wireless USB Access Point, 24VAC transformer, USB cable, software, and user manual. Additional 8-zone controllers (including transformers) may be purchased for $245. Cyber-Rain has a 30-day “satisfaction or money back” guarantee, plus a 1-year limited manufacturer’s warranty. There are no monthly fees or additional charges. Software and firmware updates are free and can be downloaded from the Cyber-Rain web site.

Installation

Cyber-Rain reports a typical single-XCI controller system can be installed in less than one hour by anyone who knows how to use a PC. Cyber-Rain does not recommend professional installation.

Track Record, Water Savings and SWAT Testing

Cyber-Rain reports systems installed during January through June 2007 reported an average water savings of 36%. No study data are available on the Cyber-Rain XCI, which is understandable since it is such a new product. A SWAT test performance report was not posted for Cyber-Rain at the time of this review.

ECO Research

ECO Research LLC, located in Nampa, Idaho, began work on the weather based ECO 100TM Sprinkler Optimizer in January 2003.

The first prototypes were tested during April to October of 2003. In 2004, production units were distributed for testing at additional locations. In 2005, the ECO 100 was introduced to the general market.

The ECO 100 works with any existing clock/timer controller to irrigate based on calculated ET. The device calculates ET from on-site temperature measurements and site location average solar radiation. No remote or historical data are used, and any industry standard rain sensor can be connected to the system to improve performance. The ECO 100's ET calculation algorithm is based on the Hargreaves equation for estimating ET. The device is connected to an existing controller and interrupts the controller from irrigating until calculated ET accumulates to the appropriate level.

Operational Features

Hourly temperature sensor readings are logged by the ECO 100, and solar radiation is calculated as a function of minimum and maximum temperatures and site latitude. Latitude is entered during system setup as one of 5 zones covering all of the U.S. These data are used to calculate daily ET, and daily ET is accumulated to determine when irrigation should occur. When rain is detected by an optional sensor, the system will stop or prevent watering and adjust ET accumulation.

ET accumulation adjustment is based on the amount of time the rain sensor is tripped, and an adjustable delay switch setting. The delay switch is set by the user during setup to delay ET accumulation from 0 to 7 days when the rain sensor is tripped. If no rain sensor is installed, the user can also manually enter a rain delay and cause ET accumulation adjustment.

The ECO 100 Sprinkler Optimizer is an add-on product that can be used with any existing electrical clock/timer type controller. The intent of this design is to minimize product installation and setup costs. It also simplifies operation since the existing controller is not replaced and it is not necessary for the user to learn a totally new system.

The ECO 100 manages watering by controlling watering frequency. This is accomplished by controlling the electrical connection from the common valve circuit to the controller. The controller is typically set to water every day, but watering will only occur when the ECO 100 has determined that the ET accumulation (soil moisture deficit) is equal to the last amount watered. The controller will water the same amount every time, but the frequency of irrigation is controlled by the ECO 100. The user adjusts the individual station times on the controller during setup, as recommended in the installation manual.

The recommended station run times are based on the sprinkler head application rate and irrigation of either 0.5 or 0.75 inches per watering. The manual provides instructions for measuring application rates, and discusses division of total run times to reduce run off. The method discussed for dividing total run times requires the user to observe the irrigation time which induces runoff and adjust accordingly. Specific adjustments based on soil, slope and shade conditions are not included in the manual. Consideration of soak cycles is also discussed. The Wetter/Dryer control is used to make minor frequency adjustments. This allows the user to slightly increase or decrease irrigation frequency as conditions warrant.

The ECO 100 may be programmed to only control certain stations of the controller. This allows the user to have stations irrigate at high frequency for plant germination, or for long run times to accommodate drip irrigation. The clock controller can be set to skip a day of the week and irrigation will occur the following day, if needed. The unit has a low temperature shut off which prevents irrigation at temperatures below 38o F. Watering history is displayed on the ECO 100, showing irrigation activity for the past two weeks.

The ECO 100 has no specific number of zones that it can control. The only limit is that the zones all have to be set to water in a single 24-hour period. This is because when the ECO 100 determines that watering is needed, it enables the connection from the station valves common circuit to the controller for 24 hours.

There are existing installations with 36 station controllers. The ECO 100B Sprinkler Optimizer, planned for later in 2007, will enable watering for up to 48 hours. This will allow additional watering options such as the use of two programs watering on alternate days.

Description, Pricing and Warranty

The ECO 100 cabinet is a 4" x 6" x 1.5" extruded plastic unit and the panel includes a 2.6" x 0.6" two-line LED information display. The panel controls are touch pad type. A lockable steel weatherproof enclosure is available for outdoor installations. The ECO 100 has non-volatile memory and battery backup to retain all settings in the event of a power failure. A 24 VAC power supply must be provided by the controller to which the ECO 100 is connected.

The retail price for the ECO 100 is $198, as is the planned price for its upcoming replacement, the ECO 150. The weatherproof enclosure is priced at $79. The ECO 100 and accessories may be purchased from ECO Research or from its distributors which are listed at www.ecoresearch.com.

Installation

Installation and setup are reported to be easy, and may be accomplished by most homeowners. The time required for an inexperienced homeowner for installation and setup is reported to be 2-3 hours. An experienced professional should be able to install and setup the ECO 100 in one hour or less. Detailed step-by-step installation and setup instructions are included in the owner's manual which is available at the ECO Research website (www.ecoresearch.com). Additional setup time (1-2 hours) is required to measure station flow rates if sprinkler head flow rates are not known. This procedure is covered in the owner's manual.

Track Record, Water Savings and SWAT Testing

During the development of the ECO 100, the ET algorithm was tested by comparing simulated EC100 ET to reference ET for an Orange County, California CIMIS station using the temperature data from the CIMIS station.

ECO Research reports water savings of 20 to 40 percent with the ECO 100, based on its own pilot testing. The ECO 100 is included in an ongoing study being conducted at Lake City Community College, Lake City, Florida. This study is comparing the performance of several ET and soil moisture based controllers and preliminary results are anticipated late in 2006. The ECO 100 is also included in an ongoing study being conducted by the Salt Lake City, Utah Department of Public Utilities.

This study includes ease of installation, landscape appearance and water savings evaluations. Results from the Salt Lake City study will also be available late in 2007. A SWAT test performance report for the ECO 100 was not available for this report. The ECO 100 provides a relatively economical weather based irrigation system control option, using real time onsite sensors.

ET Water Systems

ET Water Systems LLC, based out of Corte Madera, California, is a manufacturer of weather based irrigation controllers for the residential and commercial markets. ET WaterTM controllers operate under its centralized weather-based irrigation management system. ET Water was incorporated in 2002 and began manufacturing controllers in March 2005. The company sells its system in California, Nevada, Colorado, Texas, Oregon, Washington and Idaho and plans to expand sales to other states.

The ET Water system schedules irrigation based on ET and precipitation data received from existing weather stations and user programmed information associated with specific landscape features. Currently, the ET Water system uses a data network of approximately 8,500 public and private weather stations, most of which are located in populous areas. ET Water controllers are sold in single station increments from 6 to 48 stations, thus the customer only pays for what it uses. Additional stations (up to 48) may later be activated by paying a per station fee.

The ET Water commercial controller models begin at 12 stations, and the 2-way communication service offered with the commercial controllers provides features similar to a central control system.

With the ET Water System, ET and precipitation data are automatically retrieved daily from the weather station network by the ET Water's host server. The data are obtained from existing weather stations that provide localized weather, most often available at the town or even the suburb level in most metro areas. A WeatherBug® weather station can be installed on-site and the on-site data is utilized via the ET Water server as discussed below.

Operational Features

The ET Water server automatically processes the ET and rainfall data in combination with the user-programmed landscape information to develop irrigation schedules. The user enters the landscape information from any computer with an Internet connection via the ET Water website (www.etwater.com); however, a personal computer is not required at the installation site for the system to function. In commercial applications, the user may access special screens that enable selection of multiple accounts and thereafter select any controller or zone for each account. Scores of accounts may be accessed remotely from any computer at any time.

Communication between the user's controller and the ET Water server may be by wireless connection or land-based telephone link. Broadband access is planned for late 2007. The ET Water central server communicates with each field controller on a daily basis to send any required watering adjustments. In addition, all ET Water controllers send a 30-day log of all watering activity so users can review their watering history on the ET Water website. ET Water controllers can operate independently if communication to the server is temporarily interrupted.

In such a case, the controller continues to operate using the latest schedule stored in memory, and then revises the schedule once communication is re-established with the server. The ET Water controller can accommodate schedules of any duration and frequency, including schedules that require watering on a very infrequent basis (e.g., every 30 days).

To enter landscape information, users go to the ET Water website and log into their account using a user name and password. The program interface to enter the site-specific landscape information is set up with a choice of either Windows® based pull-down menus or click-on picture options (e.g., plant type pictures) and it is intuitive and easy to use. The program is well organized and covers a comprehensive set of landscape factors including; plant type, irrigation type or optional application rate, soil type, slope, root depth, sun exposure and distribution uniformity.

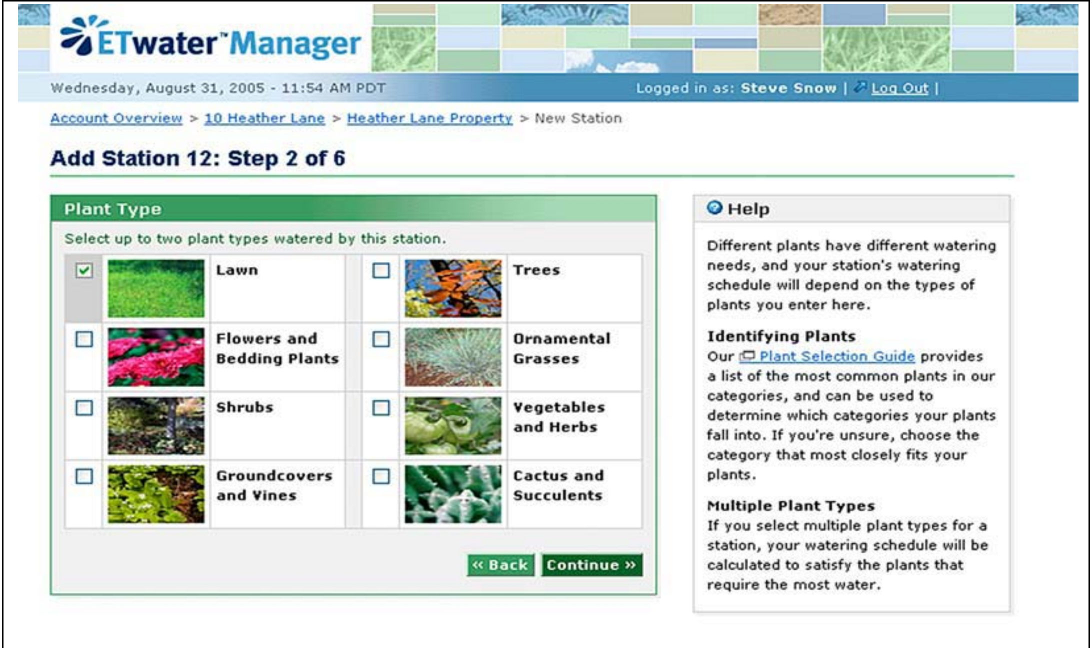
User-defined sprinkler precipitation rate (PR) and distribution uniformity (DU) may be entered or default measures may be selected in the absence of precise PR and DU information. A wide selection of plant types is available. Multiple plant types may be selected for one station and the program will automatically set the watering schedule based on the plants with the highest water requirement. Irrigation types available include spray, rotor, high efficiency matched precipitation rate rotors, impact, stream spray, drip emitter, bubbler and sub-surface inline tubing. The default distribution uniformity factor is 55 percent for pop-up spray heads. The user may specify customized distribution uniformity for any zone. All default settings can be changed at any time by ET Water.

The user may also enter non-irrigation days, adjust the total station run times by a percentage factor, and initiate manual irrigations by station. The user may review system and irrigation history information on the website. The ET Water setup program includes help screens to answer questions common to first time users.

Once the user becomes familiar with the program, an advanced setup mode may be used which offers a more efficient means of programming. Adjustments to specific site factors may be made at any time via the ET Water website. Site factor changes will generate new irrigation schedules.

The ET Water controller also has an offline programming feature that allows users to manually set a watering schedule for each station. This feature is intended for use during periods when phone service is temporarily unavailable (e.g., a newly constructed home prior to sale). Offline programming may be performed at the controller using the keypad and the 2-line LCD display. The manual start mode may also be initiated at the controller. ET Water's objective is for the system to automatically generate and execute irrigation schedules. The need for program modification in the field is typically limited.

ET Water provides email alerts when there is a failure of communication between the field controller and central server. It also provides email alerts when manual adjustments are made on the field controller – the user may review such changes and override them remotely from any PC if desired.



Wednesday, August 31, 2005 - 11:54 AM PDT

Logged in as: Steve Snow | Log Out |

Account Overview > 10 Heather Lane > Heather Lane Property > New Station

Add Station 12: Step 2 of 6

Plant Type

Select up to two plant types watered by this station.

☑	Lawn	☐	Trees
☐	Flowers and Bedding Plants	☐	Ornamental Grasses
☐	Shrubs	☐	Vegetables and Herbs
☐	Groundcovers and Vines	☐	Cactus and Succulents

Help

Different plants have different watering needs, and your station's watering schedule will depend on the types of plants you enter here.

Identifying Plants
Our Plant Selection Guide provides a list of the most common plants in our categories, and can be used to determine which categories your plants fall into. If you're unsure, choose the category that most closely fits your plants.

Multiple Plant Types
If you select multiple plant types for a station, your watering schedule will be calculated to satisfy the plants that require the most water.

ET Water Systems reports the irrigation scheduling algorithms it uses are based on current state-of-the-art horticultural science. The program reportedly incorporates all landscape factors needed to accurately determine soil moisture depletion and irrigation scheduling. ET Water uses a different algorithm for scheduling sprinkler and drip irrigation stations.

The company's proprietary algorithms automatically generate daily schedules for each station with run and soak times based on a station's sprinkler application rate, soil intake rate, and slope conditions. The station run/soak cycles for each irrigation period remain constant, based on replenishment of a 50 percent plant root zone moisture depletion level. Irrigations are delayed until a soil moisture depletion level of 50 percent is calculated, based on the measured daily ET and rainfall. If the user desires more frequent watering, it may adjust the depletion level downward.

Descriptions, Prices and Warranty
All ET Water controllers are currently constructed of weatherproof fabricated aluminum enclosures with a key lock. Starting in 2008, ET Water will manufacture residential controllers with an injection molded plastic enclosure. In addition to the regular station circuits, the controllers provide a master valve/pump start circuit. The station circuit capacity is 1.1 amperes and the station terminals will accept 12-20 gauge wire.

The use of a standard rain sensor (approximately $59) will cause circuit interruption and suspend irrigations when significant rainfall occurs. In addition, ET Water enables online set-up and control of station-by-station fertilizer dispensing through the irrigation system. This is achieved by installing an EZFLO ® fertigation tank that is wired to a terminal on the controller.

Remote monitoring features for commercial applications include email notification of any adjustments to a controller; such as suspend, power interruption, failure to connect to the internet, increase in percent watering for any zone and flow monitoring. For response to these occurrences, the user may remotely re-set or adjust these features from its PC.

An ET Water residential controller sells for approximately $499 to $549, depending upon the number of stations and the communication method – a 6 station telephone connected unit costs about $499, while a 12 station “powerline” connected unit sells for $549. The ET Water controller will accommodate popular brands of rain sensors or rain gauges. The annual residential service fee is $75 per year, but multiple year service plans reduce this amount as discussed below.

An ET Water commercial controller sells for approximately $1,219 to $2,399, depending upon the number of stations and the communication method – a 12 station telephone connected unit costs about $1,219, while a 48 station wireless connected unit sells for $2,399. The ET Water Manager Service includes daily watering schedule updates, telecommunication and wireless access charges, ability to remotely monitor and adjust the controller from any PC, email alerts in case of on-site problems, and online and phone-based customer service. The annual service fee ranges from $139 per year for commercial telephone connect to $199 for wireless connectivity.

Five and ten year service plans are available for both residential and commercial controller service, providing 33 and 50 percent savings off of the annual rate, respectively. This can bring annual service costs down to approximately $40 for residential service, and as low as $70 for commercial service.

ET Water offers panel replacements for certain non-weather based models of popular brand controllers. These panels make installation very rapid and sell for less than a full ET Water controller, saving the customer up to 40 percent off of the price of a new controller. Since telephone or wireless communication allows two-way information transfer, ET Water can manage the information received from individual controllers. This may be beneficial to water agencies by allowing analysis of customer water use data.

Installation

ET Water Systems reports its controllers do not require professional installation, although the company recommends professional installation and will provide factory trained individuals or irrigation contractors to install all units. A typical professional commercial installation should take 1 to 3 hours, which includes a site assessment and discussion of the assessment with the user. Typical residential installations can be completed in less time. The professional installation/consultation cost is estimated to be $75 - $225 depending on location, size, and other site conditions. Technical support is available by toll free telephone (800-685-5505), in addition to the support provided on the company's website.

Track Record, Water Savings and SWAT Testing

The ET Water system has completed SWAT testing and a performance report is posted on the Irrigation Association website. ET Water submitted information from three of its large commercial customers documenting significant water savings. ET Water reports overall average water savings in the range of 20 to 50 percent.

The ET Water Manager Service includes daily watering schedule updates, telecommunication and wireless access charges, ability to remotely monitor and adjust the controller from any PC, email alerts in case of on-site problems, and online and phone-based customer service. The ET Water computer interface method of programming and monitoring the system is comprehensive and user friendly. The water use monitoring option should also be attractive to progressive water agencies interested in quantifying water savings.

Hunter

Hunter Industries was established in 1982 and is headquartered in San Marcos, California. Hunter® manufactures and distributes a full line of landscape irrigation products worldwide. Hunter introduced its ET SystemTM to the market early in 2006. The ET System consists of the ET Sensor (onsite weather station) and the ET Module (add-on irrigation scheduler).

It is compatible with most Hunter irrigation controllers less than ten years old, including any Hunter controller equipped with a SmartPortTM. The ET System is not compatible with other brands of controllers. Depending on the controller, the ET System is suitable for residential and commercial applications.

The ET System creates an irrigation program automatically based on weather conditions measured onsite. The programs are operated via the compatible irrigation controller and run automatically on water days and at start times set by the user. Compatible controllers include Hunter Models SRC/SRC Plus, Pro-C, ICC, and ACC with SmartPort® technology.

The irrigation schedule is based on the ET Sensor's calculated ET value and programmed plant, soil, slope, sun/shade and sprinkler type information provide the basis for calculation of the irrigation schedule. The result is a new revised irrigation program every water day, based on the weather conditions measured onsite. Once installed, each zone is scheduled from the ET Module, rather than the controller itself.

Operational Features

The ET Sensor calculates ET by its daily measurement of solar radiation, air temperature, and relative humidity. The accuracy of the ET calculation can be improved with the addition of an optional anemometer (ET Wind), along with an automatic wind shutdown capability. The ET System will also shutdown irrigation if the air temperature drops below 35o F.

The ET Sensor includes a tipping bucket type rain gauge, which measures rainfall to one-hundredth of an inch. The user programs the ET Sensor to stop irrigation in progress at a specific rainfall depth, and a percentage of the rainfall is accounted for in the irrigation schedule.

The ET Module calculates specific run times for each zone individually. The ET Module also possesses an optional wilt guard feature (Wiltgard™) that triggers irrigation when extreme temperatures occur if enabled by the installer. The user-selectable WiltGard triggers emergency irrigation (regardless of time of day) when the ET System determines that plants are threatened by monitored conditions.

To program the ET Module, the user first enters the type of controller used, date and time, water days and start times. Then the site condition settings are made for each station. These settings consist of plant type, soil type, sprinkler type, percent ground slope, sun/shade, and plant maturity. The rain sensor setting is programmed for the minimum amount of rainfall that will cause interruption of irrigation. The minimum shutoff setting is 0.02 inches and it is set in 0.01 inch increments.

Available plant type settings include numerous types of grasses, shrubs, ground covers, vines, trees, perennials and desert plants. Alternatively, a custom crop coefficient setting can be used in place of plant type. Available soil type settings consist of sand, sandy loam, loam, clay loam, silt, clay and silty clay. Soil type selection determines both infiltration rate (used for cycle-and-soak calculation, along with the slope setting) and water-holding capacity of the soil. Sprinkler type can be set to rotor, spray, drip, bubbler or custom.

The custom option allows for entering a sprinkler application rate (0.01 inches/hour or 0.254mm/hour increments). The ground slope setting is by percentage. Available sun/shade settings consist of full sun, part shade (75 percent sun), part sun (50 percent sun) and full shade. The maturity setting is set to either new or established. With maturity set to new, the irrigation quantity is doubled and then decreases linearly to the normal or established rate based on the plant type. The ET source setting can be set to manual to override automatic ET calculation. The wilt guard feature is programmed either on or off (default out of the box is Off).

The ET Module is plugged into the controller’s SmartPort, and once programmed; it uses the controller’s Program “A” to create and run irrigation on water days (except with the Hunter ACC controllers where it works independently of any programs). Each day, the ET System evaluates the current soil moisture depletion level, ET rate, plant type (crop coefficient and root zone), and whether the next day is an allowable watering day. Then the system performs a “look ahead” on the allowable watering days, to see if not watering at that time would deplete soil moisture critically by the time a watering day is scheduled. Irrigation will not occur, however, if the calculated quantity is below the minimum irrigation amount, to prevent shallow watering. The calculation for minimum sprinkler runtime is based upon the soil type and capacity.

Descriptions, Prices and Warranty
The ET Module is housed in a weatherproof extruded plastic cabinet and it dimensions are 6" x 4" x 1.8". The ET Sensor standard model dimensions are 10.5" x 7.3" x 12", and the ET Sensor with ET Wind standard model dimensions are 11.5” x 7.3" x 20". The ET Module operates on 24 VAC from the controller’s SmartPort and requires no additional AC wiring. It has non-volatile memory and a replaceable 10-year lithium battery.

The ET System is available from Hunter distributors worldwide and a distributor search engine can be accessed at Hunter’s website. The retail price for the ET System basic model is $429, and the optional ET Wind is an additional $429. The price range for the ET System compatible Hunter controllers is from $115 to $799. The ET System comes with a 2-year warranty.

Installation
Installation and programming of the ET System can be performed by the user or irrigation professional. First time installation and programming for a typical setup is reported to require 2 hours. The ET Module is wall mounted near the controller and the ET Sensor is installed within 100 feet of the ET Module. The ET Sensor can be wall mounted or attached to a pole or eave.

The ET System owner's manual is available at Hunter's website (hunterindustries.com). It contains detailed installation and programming information.

Track Record, Water Savings and SWAT Testing

The ET System's ET calculation algorithm uses the Modified Penman-Monteith equation. In creating the ET System's crop coefficients for the various plant type settings, Hunter has generally followed the principles of Water Use Classification of Landscape Species as prescribed on the State of California Office of Water Use Efficiency website (www.owue.water.ca.gov/index.cfm). Use in other states may require some adjustment for crop coefficients, which can be customized in the ET System.

The ET System has completed SWAT testing and a performance report is posted on the Irrigation Association website. The ET System was two years in development and beta testing. Hunter has had 10-15 years experience with ETbased irrigation, but this is its first ET System aimed at stand-alone residential applications.

Although Hunter did not provide water savings data for this report, it reports an approximate water savings of 30 percent, which is similar to the study results for other weather based irrigation control products discussed in this report.

HydroPoint

WeatherTRAK® ET is the line of residential and commercial weather based irrigation controller products by HydroPoint Data Systems Inc. of Petaluma, California. WeatherTRAK ET provides a wireless, real-time ET data service combined with the controller's Scheduling EngineTM software that updates irrigation schedules daily for each valve in a landscape.

Network Services, which developed patents on the broadcasting of ET data used by HydroPoint, began business in 1997. HydroPoint was incorporated in 2002 and entered into a partnership with The Toro Company in 2003. Toro manufactures irrigation controllers under its name and under its subsidiary, Irritrol, which also use the WeatherTRAK system (see Toro and Irritrol sections).

HydroPoint's WeatherTRAK ET plus residential controller comes in 9, 12, 18 and 24 station models, and its WeatherTRAK ET pro commercial controller comes in 24 station models. The new WeatherTRAK ET Pro2 commercial controller series provides 12 to 48 station capacity and integrated flow management. The irrigation scheduling features are similar for all models, but the commercial controllers offer optional 2-way communication ability and other features.

The WeatherTRAK system uses data from over 14,000 weather stations across the U.S., including the National Oceanic and Atmospheric Administration's (NOAA) network, state and county networks and private weather stations.

The WeatherTRAK system uses advanced climatologic modeling techniques developed at Penn State University. This proprietary system is called ET EverywhereTM*,* and has proven accuracy to a standard deviation of .01 inch of daily ET down to one square kilometer.

The WeatherTRAK ET Everywhere service provides local ET (microzone) without the need for any additional weather stations or single sensors on a site. The WeatherTRAK system calculates ET using the standardized Penman-Monteith equation.

The HydroPoint Data Center validates the weather data and transmits calculated ET through three satellite servers to each controller every day. The three satellite servers provide overlapping coverage of the U.S. to ensure signal reception to WeatherTRAK controllers located anywhere.

Operational Features

The WeatherTRAK ET controller calculates irrigation schedules for each independent valve on a site. The controller does not use pre-set irrigation schedules input by the user. Instead, it asks a series of questions to define the site variables that influence water need. The controller is programmed by entering the following station specific information: sprinkler type or precipitation rate, plant type, root depth, soil type, microclimate (sun or shade), slope (including if the valve is at the top, middle or bottom of the slope, and system efficiency (percentage). The schedule for each station is adjusted daily according to the local weather data received via the ET Everywhere service.

With these inputs, the WeatherTRAK ET calculates an irrigation schedule for each irrigation valve. Soil moisture depletion tracking, triggered at a 50% depletion level, along with daily ET updates allow the controller to adjust schedules as the weather changes. The number of water days, minutes and cycles (with appropriate soak times between cycles) are generated automatically and change as weather and water need fluctuates. The WeatherTRAK ET has an eight-week scheduling window. This allows for infrequent watering of low water use or native plants.

Programming options for all WeatherTRAK ET controllers include sequential stacking of overlapping start times, or the ability to run two programs simultaneously. The WeatherTRAK ET controllers have a manual feature providing any amount of time setting for plant establishment or to check the irrigation system on a valve by valve basis. An adjust feature provides percentage adjustments (in 5 percent increments) to increase or decrease the run time for any station.

The controller accepts rain, wind, freeze and flow sensors and possesses a master valve circuit. A rain pause mode allows the user to shut-off irrigation for up to 14 days during or after rain. HydroPoint can also be contacted to automatically "rain pause" controllers and groups of controllers using the wireless data service. Non-waterering days can be selected. A "help" mode alerts the user to the WeatherTRAK customer service center toll free telephone number (800-362-8774) to answer questions and walk users through any situation occurring on the site.

Other features include inputs for crop coefficient values, community water restrictions (odd/even or selected watering days) and unlimited programs. The independent station adjust feature allows for individual station adjustments from -50 to +25 percent in 5 percent increments. All WeatherTRAK ET controllers have heavy duty surge protection on the 24 VAC output board.

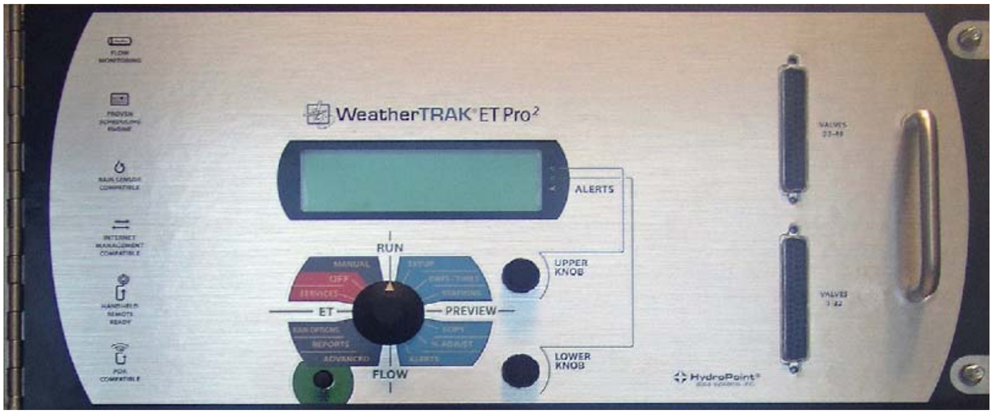
The WeatherTRAK ET controllers have non-volatile memory and do not require a back-up battery to maintain date and time information. The controller terminals will accept 12 to 20 gauge size wiring. In some cases, an optional antenna is required to receive the scheduling signal.

Descriptions, Prices and Warranty
The WeatherTRAK ET plus is an indoor/outdoor residential controller. Its cabinet is of extruded plastic with dimensions of 8.6" x 11" x 4.7". Programming is done with the programming dial, copy button, two selector knobs and three-line LCD display. The internal power transformer for the 9 and 12 station models includes a 2.0 ampere fuse, has a maximum total circuit capacity of 1.0 amperes and the individual station circuit current capacity is 0.375 amperes. The 18 and 24 station models include the same fuse and individual circuit capacity, but the total circuit capacity is 2.0 amperes. The 18 and 24 station models also include a manual valve test program to identify open valves and short circuits. A 2 year subscription to the ET Everywhere service is included with the purchase of 9 and 12 station models, and a 1 year subscription is included with the 18 and 24 station models.

The WeatherTRAK ET pro commercial controller comes in an indoor chassis model with dimensions 14.5" x 27" x 4" and two indoor/outdoor lockable stainless steel cabinet models. The wall mount cabinet dimensions are 8.5" x 18.5" x 8" and the front access pedestal cabinet dimensions are 16.8" x 30" x 8.3".

The ET pro does not include a typical front panel with programming access, but programming is done from a remote location using the WeatherTRAK.net service, as discussed below.

Additional features included with the ET pro include automatic short circuit detection and alarm, programming conflict alarm, ability to run two stations concurrently, and additional circuit capacity. The ET pro comes with a vandal resistant antenna. The internal power transformer includes a 2.4 ampere fuse, has a maximum total circuit capacity of 2.4 amperes and individual station circuit current capacity of 0.5 amperes.



The ET pro is compatible with the WeatherTRAK.net service that allows Internet based irrigation control 24/7 with a secure web-hosted service. With WeatherTRAK.net, the user can manage single or multiple controllers from any location with access to the Internet. WeatherTRAK.net delivers instant notifications of adjustments made in the field and enables fast, one-click synchronization.

Through wireless, two-way communication, WeatherTRAK.net transmits real-time updates and system alerts to the user's personal computer, mobile phone or PDA (personal data assistant). HydroPoint sells a Hewlett Packard® iPAQ PDA with all necessary hardware and software to utilize Weather TRAK.net. A 3-month subscription to WeatherTRAK.net and ET Everywhere is included with the purchase of a WeatherTRAK ET pro.

WeatherTRAK ET controllers are available directly from HydroPoint or local distributors. A distributor search engine can be accessed at HydroPoint's website. WeatherTRAK ET controllers come with a 3 year warranty, and toll-free telephone customer service is available Monday through Saturday during business hours, and on-line customer service is available 24/7.

Installation

Hydropoint reports the WeatherTRAK ET controllers do not require professional installation, although it is recommended. Typical installation times, as seen in public agency studies and distribution programs, range from 1 hour to 2.5 hours, depending upon the size of the landscape covered and mounting issues.

Installation should include a site assessment, and discussion with the user about the site irrigation system and how the controller operates with the user. Technical support is available by a toll free number, at HydroPoint's website (www.weathertrak.com) or through field-certified contractors.

Track Record, Water Savings and SWAT Testing
WeatherTRAK ET has completed SWAT testing and a performance report is posted on the Irrigation Association's website. The WeatherTRAK ET controllers have been tested in 20 public agency settings since 1998. WeatherTRAK reports the overall results from these tests indicate significant water savings (16 to 58 percent) and reductions in runoff (64 to 71 percent).

Hydrosaver

Water Conservation Services (WCS) HydrosaverTM, of Signal Hill, California, has been a manufacturer of water conservation based commercial landscape irrigation technologies for over 20 years. Hydrosaver entered the Smart controller market in 1992 with a soil moisture based controller. Its current ET controller, the ETIC, was introduced in 1994.

The Hydrosaver ETIC functions as either a stand-alone controller, or as a satellite controller of a centralized control system, managed by WCS' partner HydroEarth Solutions. WCS developed its own electronic tensiometer soil moisture sensor, electronic rain sensor and ET sensor. It reports over 2,500 of their commercial weather based controllers have been installed, mostly in Southern California.

The ETIC controller comes in standard sizes from 12 to 56 stations and can be customized with the WCS Hydromaster to handle up to 164 stations.

The ETIC adjusts irrigation schedules based on ET data received from the WCS Hydrosaver ET sensor. The controller comes with the ET sensor and the Hydrosaver Rain GuardTM rain sensor. Optional soil moisture and flow sensors may also be connected to the ETIC.

Operational Features
As a stand-alone controller, the user programs the ETIC with a base irrigation schedule. The base schedule includes irrigation days and run times. Total run times are entered for July and the controller automatically decreases the run times based on the accumulated ET sensor inputs since the last irrigation. The controller includes an ET percent feature that allows the user to vary the ET adjustment rate by program up to 300 percent, in 10 percent increments. The ET schedule adjustment function can be switched ON or OFF. The controller's ET scheduling

feature is based on real time ET utilizing historical ET as a baseline. Historical ET data are programmed into the controller by the user.

The Hydrosaver ET sensor measures temperature, humidity and solar radiation. The controller calculates ET using these measurements. (The ET calculation assumes a 3 mph wind speed.) The ET sensor is in a vandal resistant housing and is maintenance-free. ET is calculated to within 100th of an inch using the Penman-Monteith equation. When the Rain Guard detects one-quarter of an inch of rain, irrigation is interrupted and the controller can be programmed for a rain delay up to 99 days. The Rain Guard includes a built-in bypass switch for controller testing during periods of extended rain.

The controller accepts Data Industrial or Fluidyne flow sensors. Once the user programs flow limits, the flow-sensing feature will trigger an alarm and shut off irrigation when flow limits are exceeded in the event of line breaks and valve failure. A shut off delay feature is provided and the flow sensing capability can also be used for fertigation purposes. The controller also possesses a faulty circuit feature that senses valve and wiring problems.

The ETIC includes 6 regular programs with up to 12 start times each. The controller has a valve test program and up to 4 stations may run concurrently. In addition to the regular station circuits, the controller has 3 independently programmable master valve outputs. There is also a pump start output that goes on with all irrigation. The controller automatically divides total run times into appropriate cycle-and-soak times to minimize runoff based on soil and slope conditions entered by the user for each zone. The irrigation schedule calendar options include 7, 14 and 28 day and even or odd day. Irrigation days can be specified and the controller has a watering window feature.

Descriptions, Prices and Warranty

The ETIC comes in standard wall mount models and complete stainless steel (CSS) top entry enclosure models The standard wall mount cabinet is constructed of rolled steel with dimensions of 12” x 16” x 6”. The CSS dimensions are 16” x 14” x 36” and the enclosure must be mounted to a concrete foundation. Both models are designed for outdoor installation and are lockable, weatherproof and vandal resistant. The controller’s 4-line by 48 character LCD display can be set to English or Spanish. Current and historic irrigation, ET, weather and flow information is displayed. All ETIC controllers include an internal transformer and the station circuit capacity is 2 amperes. The controller has non-volatile memory and the date and time information is protected without backup batteries.

Surge and lightning protection is provided through a relay system to create circuit isolation protection, separate power transformers for controller processing and valve circuitry, MOVs, and an isolation transformer. WCS Hydrosaver products are available directly from Hydrosaver and HydroEarth (949-636-7749 or hydroearth.com), or from commercial distributors.

The current retail price for a standard wall mount 24-station ETIC controller with the Rain Guard and ET sensor is $1,800. A 24-station CSS controller is currently priced at $2,800. Prices for other controller sizes and accessories can be obtained from Hydrosaver or HydroEarth. The CSS controllers come with a 5-year warranty and the standard controllers come with a 3-year warranty. The warranties include free field service, with a renewable option.

Installation

According to WCS Hydrosaver, the ETIC should be installed by an irrigation professional. Installation and programming time will vary depending on system size and site conditions. Toll-free telephone customer support is available during business hours at 800-821-1322.

Track Record, Water Savings and SWAT Testing

WCS Hydrosaver reports its controllers are being included in several current studies including research work on wireless valves and ET controllers. Hydrosaver reports significant variance in ET measurements by multiple ET sensors tested within close proximity to a CIMIS weather station. Specifically, hill top ET measurements were found to be significantly higher than those at the bottom of the hill and at the nearby CIMIS site. A SWAT test performance report for Hydrosaver controllers was not available at the time of this study.

Irrisoft

Irrisoft Inc. offers weather-based control to residential and commercial irrigation systems through the Weather Reach Water Management SystemTM. Established in 1999, IrrisoftTM became a subsidiary of Campbell Scientific Inc. in 2001 and has now partnered with Rain Bird Corporation to offer weather-based irrigation control solutions to both homeowners and commercial water users. Rain Bird® has a longstanding relationship with Irrisoft and Campbell Scientific, Inc. The Weather Reach Water Management System provides wireless, real-time ET data to any standard irrigation controller through a Weather Reach Receiver.

There are two “smart” receivers offered with this system; the WR-7 Weather Reach Receiver and the ET ManagerTM, which is offered through Rain Bird Corporation (see Rainbird Section).

The Weather Reach Water Management System uses Campbell Scientific weather stations with a full set of sensors to gather accurate weather data.

The Weather Reach Signal Providers maintain computer servers with an Irrisoft computer software program to communicate with the weather stations (often using existing stations in an area), and broadcast weather information hourly through a pager network to Weather Reach Receivers. Data includes temperature, wind speed, relative humidity, solar radiation and rainfall. Weather Reach Receivers use this information to calculate ET accumulation on an hourly cycle, and process it into a running ET balance.

The WR-7 and ET Manager are used in combination with a user's existing irrigation controller to schedule irrigation based on ET demand. These receivers are compatible with any standard irrigation controller and interrupt irrigation until it is needed.

Operational Features

Weather Reach manages the frequency of irrigation and does not adjust run times. To help a user create an irrigation schedule for a controller, Weather Reach provides a free program called InSite Irrigation SchedulingTM. InSite tailors the schedule to a specific sprinkler controller's capabilities as well as the capabilities of the sprinkler system and factors in the landscape dynamics such as plant type, soil type, root depth, slope and sprinkler precipitation rates.

Users enter the information through a series of questions that help to tailor the schedule to each station on the property. InSite performs all the calculations automatically but still allows a user to adjust any of the calculations for a custom schedule and gives users the opportunity to see how the calculations are made. InSite can also calculate accurate settings for programming the Weather Reach Receiver.

Once the schedule has been created, the user enters it into the sprinkler controller, and programs the Weather Reach Receiver with the proper settings. Weather Reach will then automatically manage the frequency of irrigation based on ET. Weather Reach Receivers can accommodate any available or non-available watering day requirement.

Most weather conditions are relatively constant over large areas, but rainfall can be very localized. A tipping bucket rain gauge is offered as an optional add-on component to a receiver to measure on-site rain as opposed to the rain measurement provided at the weather station. This allows the receiver to more accurately calculate the amount of water a landscape will need, and to interrupt irrigation when a user specified amount of rainfall occurs.

A growing network of Weather Reach Signal Providers exists throughout the U.S. For a covered area, data from multiple weather stations are received, processed, and then transmitted by a Signal Provider. The Weather Reach Receivers are programmed to receive data from the appropriate weather station based on a weather region code. The data are transmitted hourly by the provider using a Motorola® Flex® paging system. Potential ongoing costs are dependent on the signal provider for a given area.

Public providers typically absorb the cost of the weather stations, computer server and software, and paging system, and there is no ongoing user cost. Commercial providers pass on these costs to the end user. Private providers offer the service to a specific entity such as a Home Owners Association. A list of current Signal Providers is maintained at www.irrisoft.net. The typical price range for private providers surveyed for this report is $50 to $350 per year. Where a signal is not available, Irrisoft offers a variety of solutions to establish a public or private Weather Reach Signal. (Irrisoft should be contacted for details.)

The existing controller is programmed based on a plant root zone moisture depletion and ET threshold balance concept using the InSite software. This balance is maintained based on ET minus effective rainfall. This type of schedule will allow the root zone to dry out to a manageable level before irrigation occurs, and then irrigation is set to refill the root zone without over-watering.

The controller schedule is set to irrigate every day, unless certain days are to be excluded for a variety of reasons. The receiver then allows the controller to irrigate when the ET threshold is reached, and the prescribed irrigation amounts are applied to replenish the root zone depletion. The receiver includes two programs so that two ET thresholds and landscape adjustment percentages may be used. This provides for different stations to be scheduled separately to meet the needs associated with varying plant types and conditions.

Descriptions, Prices and Warranty

The WR-7 is a small (4.8” x 5.3” x 1.5”) plastic cabinet designed for indoor installation. A lockable fiberglass outdoor enclosure is available as an accessory for both receivers. In the event a power supply is not available from the existing controller, an optional power transformer is available. A 9-volt backup battery is included for operation during power outages. In some cases, an external antenna is required for the receivers.

Installation

Irrisoft recommends installation by a professional irrigation system specialist, and it markets its products through specialty irrigation product suppliers. The typical installation cost ranges from $100 to $400.

Track Record, Water Savings and SWAT Testing

Irrisoft reports that during recent years, numerous demonstration projects using the Irrisoft System have proven its ability to save water. Irrisoft reports the overall results from these projects indicate water savings of 20 to 50 percent.

Irritrol

IrritrolTM Systems is a brand of professional irrigation products manufactured by the ToroTM Irrigation Division, located in Riverside, California. The Toro Company was established in 1914, and acquired the Irritrol brand of products in the early 1990s. The Irritrol Smart DialTM series of residential and commercial weather based irrigation system controllers entered the market during 2005.

The Smart Dial controllers utilize the ET EverywhereTM subscription service and WeatherTrakTM scheduling engine to provide weather based irrigation control. Toro and Irritrol are partners with Hydropoint Data Services. Toro and Hydropoint controllers also utilize ET Everywhere and WeatherTrak, as discussed in the Toro and Hydropoint sections of this report. The Smart Dial series includes six residential controllers, comprised of indoor and outdoor models for 6, 9 or 12 zones (plus a pump/master valve circuit), and a 24 zone commercial model. The controllers' WeatherTrak-enabled software creates a scientifically calculated zone-specific baseline irrigation schedule. The schedule is updated daily using weather data delivered by the ET Everywhere subscription service.

ET Everywhere uses data from the NOAA's system of 14,000 nation-wide weather stations to deliver ET to any area in the US. ET Everywhere has a proven accuracy to a standard deviation of .01 inch of daily ET at a resolution of one square kilometer. The ET Everywhere data service provides local ET (microzone) without the need for a weather station on site. The ET Everywhere Data Center validates the weather data and transmits calculated ET through three satellite servers to each controller everyday. The three satellites provide overlapping coverage of the U.S. to ensure signal reception anywhere.

Operational Features

The Smart Dial controllers calculate schedules for each irrigation zone. The controller does not use pre-set irrigation schedules input by the user. Instead, a series of questions are answered by the user to define the site variables that influence water need. The controller is programmed by entering the following station specific information: sprinkler type or precipitation rate, plant type, soil type, microclimate (sun or shade), slope (including if the zone is at the top, middle or bottom of the slope), and system efficiency (percentage). The schedule for each station is adjusted daily according to the local weather data received via the ET Everywhere service.

With these inputs, the controller calculates an irrigation schedule for each zone. Soil moisture depletion tracking, triggered at a 50 percent depletion level, along with daily ET updates allows the controller to adjust schedules as the weather changes. The number of water days, minutes and cycles (with appropriate soak times between cycles) are generated automatically and change as weather and water need fluctuates. The controllers have an eight-week scheduling window.

This allows for infrequent watering of low water use plants. The controllers can initiate irrigation even if the daily ET page is not received by using the last download and loop-up table included in the WeatherTrak software. Non-watering days can be specified in the controllers' schedule programming. The controllers are compatible with Irritrol's Wireless RainSensorTM series (rain and rain/freeze), which eliminate irrigation during rainfall and freezing weather if added as an optional accessory.

Descriptions, Prices and Waranties

Both the indoor controller models' cabinet is constructed of ABS plastic while the outdoor units are comprised of Lexan. The dimensions of the indoor models are 7.8" x 7" x 3.8" and the dimensions of the outdoor models are 7.8" x 10.8" x 4". The controllers have a large (3.5" x 0.8") LED information display, dial type controls, and a copy button for simplifying setup. All controllers include internal UL/CSA listed transformers. The current capacity for each zone circuit is 0.5 amperes, and the current capacity for pump/master valve circuit is 0.375 amperes. The controllers will accept wire sizes from 12 to 18 gauge. The non-volatile memory maintains programming, and the back-up battery maintains the date and time during power outages.

Other controller features include surge protection up to 6 kilovolts and valve malfunction detection. The irrigation schedule, irrigation history and program review can be viewed with the LED information display. In addition to the wireless rain and rain/freeze sensors, an external bow tie antenna kit, pump starter relay and wired rain sensor are available as optional accessories.

A snap-in Smart Dial Module is also available which directly interchanges with a users existing Rain Dial™ Plus controller panel to convert it to a WeatherTRAK enabled controller. A converted controller possesses all of the same features as the Smart Dial controllers. The Smart Dial controllers, modules and accessories may be purchased from authorized Irritrol distributors and retailers. Purchase of a Smart Dial controller requires a paid subscription to the ET Everywhere service. The ET Everywhere annual service fee is $48 for the 6 to 12 station controllers and $84 for the 24
station controller, as discussed in the Hydropoint section of this report. The Smart
Dial products come with a 5-year warranty.

Installation

The Smart Dial controllers and modules do not require professional installation, although trained installation is recommended. Typical installation times range from 1 hour to 2.5 hours, depending upon the size of the landscape covered and mounting issues. Installation should include a site assessment and discussion with the user about the irrigation system and how the controller operates. Installation and setup instructions are included in the owner's manual. Technical support is available from Irritrol at its website (www.irritrolsystems.com), by toll free telephone (800-634-8873) and through field certified contractors.

Track Record, Water Savings and SWAT Testing
Irritrol reports the technology behind the Smart Dial controller and module series is proven by several multi-year independent studies showing water savings. These studies were performed using Hydropoint's WeatherTrak controller and the ET Everywhere service. The studies are discussed in the Hydropoint section of this report. A Smart Dial controller SWAT test performance report is posted at the Irrigation Association's website.

Rain Bird

Rain Bird Corporation, based in Glendora, California, began business in 1933. Over 4,000 Rain Bird® products are sold domestically and in more than 120 countries. Rain Bird owns more than 130 patents and 30 additional trademarks. For more than two decades Rainbird has used weather technology in the golf and commercial irrigation markets with their central control products, including the MaxicomTM, SiteControlTM and NimbusTM II systems.

Rain Bird recently joined forces with Irrisoft Inc., a Campbell Scientific company, to offer a weather-based solution for homeowners and commercial water users. The ET Manager™, or ETMi, is an add-on scheduler that works with an existing controller to manage irrigation frequency based on weather conditions. Rain Bird began field testing the ET Manager in the Fall of 2005 and it entered the market in June 2006. Its predecessor, Irrisoft's WR7 Weather Reach Receiver, has been in use since 2001.

Rain Bird has used private-labeled Campbell Scientific weather stations for nearly 20 years with its central control systems. The Rain Bird ET Manager uses weather information, typically from fully instrumented Rain Bird and or Campbell Scientific weather stations.

The ET Manager receives the weather data in the form of an hourly broadcast through a paging network provided by a local Weather Reach Signal Provider. This approach enables thousands of users to benefit from accurate, reliable weather data from a single or network of weather stations depending on the size of the region covered. The weather data broadcast includes temperature, wind speed, relative humidity, solar radiation, and rain.

An optional rain gauge is available for on-site rainfall measurement, and to interrupt irrigation when a user specified amount of rainfall occurs. A growing network of Weather Reach Signal Providers exists throughout the U.S. Potential ongoing costs are dependent on the Signal Provider for a given area.

Public providers typically absorb the cost of the weather stations, computer server and paging system, and there is no ongoing user cost. Commercial providers pass on these costs to the end user. Private providers offer the service to a specific entity such as a Home Owners Association. A list of current Signal Providers is maintained at Irrosoft's website (www.irrisoft.net). The typical price range for private providers surveyed for this report is $50 to $350 per year.

Operational Features

The ET Manager uses the ASCE standardized ET equation to calculate ET on an hourly basis and maintain a user specified soil moisture balance. Typically, controllers irrigate on time-based (day, time, and minutes to water) schedules regardless of changing weather and landscape needs, whereas the Rain Bird ET Manager interrupts the controller only allowing it to irrigate when calculated soil moisture levels reach user set levels. Historical ET is programmed into the ET Manager and used as back-up in the event the Weather Reach Signal is not received.

The ET Manager is compatible with nearly any existing standard irrigation controller by interrupting the common wire thus managing the frequency of irrigation. The Rain Bird ET Manager schedules the irrigation frequency (how often watering occurs), but not controller run times. Additionally, the ET Manager provides pulse output of ET and rainfall to compatible controllers (0.01- inch per pulse). This feature allows for automatic scheduling by the clock controller based on ET accumulation and rainfall amounts as reported by the ET Manager.

To help users create an irrigation schedule for an irrigation controller and program settings in the ET Manager, Rain Bird offers the ETMi Scheduler. This computer program tailors an irrigation schedule to a specific irrigation controller's capabilities, and the characteristics of the irrigation system. The user enters information for each station and landscape characteristics including plant type, soil type, root depth, ground slope, and sprinkler precipitation rates to create the schedule. All calculations are done automatically and the user has the ability to adjust any of the results for a custom schedule. Once a schedule has been created with ETMi Scheduler, it can be printed out and entered into the irrigation controller. The ETMi Scheduler program can be downloaded at no charge from Rain Bird's website (www.rainbird.com).

The optional ETMi Programming Software allows settings for the ET Manager to be programmed quickly and easily. Users select the appropriate local weather station, site elevation, and available watering days (the ET Manager can accommodate any available or non-available watering day requirement). When the required parameters have been entered, the user can transfer the settings automatically into the ET Manager through the cable supplied with the optional ETMi Programming Software kit. This kit is very convenient for professionals performing higher volumes of ET Manager installations.

The controller schedule is set to irrigate every day, unless certain days are to be excluded for a variety of reasons. The ETMi then allows the controller to irrigate when the Irrigation Amount is reached. The Irrigation Amount is the amount of water that is allowed to evaporate and be used by the plants before irrigation will occur. The ET Manager "enables" watering cycles to refill the plant root zone by applying the Irrigation Amount. The irrigation controller is programmed to apply the Irrigation Amount. By applying the Irrigation Amount, the root zone is refilled without over-watering.

The ET Manager includes two programs so that two Irrigation Amounts may be used. This provides for different stations to be scheduled separately to meet the needs associated with varying plant types and conditions.

Descriptions, Prices and Warranty

The Rain Bird ET Manager has a large graphic display and is designed for indoor installations for convenient viewing of hourly weather conditions, ET and irrigation amounts. Its dimensions are 5.6" x 6.5" x 2". A lockable outdoor enclosure is available as an accessory. In the event power is not available from the existing irrigation controller, an optional external power transformer is available. A 9-volt backup battery is included for operation during power outages. In some cases, an external antenna is required for the receiver.

Rain Bird products are available from irrigation supply distributors throughout the U.S. A distributor search engine can be accessed at Rainbird's website. All Rain Bird controller products come with a 3-year warranty.

Installation

Although installation by a Rain Bird trained professional is preferred, Rain Bird reports installation may be performed by some homeowners.

Track Record, Water Savings and SWAT Testing

Rain Bird has field tested 150 ET Managers throughout the U.S. and a SWAT test performance report is posted at the Irrigation Association's website for the ET Manager. Water savings information for the ET Manager's predecessor, the Weather Reach WR-7, is included in the Irrisoft section of this report. The ET Manager combined with any standard irrigation controller should provide users with accurate real-time weather based irrigation scheduling and help maintain healthy landscapes.

Rain Master

For the past 25 years, Rain Master Irrigation Systems has specialized in the design and manufacture of commercial irrigation controllers, handheld remote controls, and central computerized irrigation control systems. Located in Simi Valley, California, Rain Master introduced its first ET based water management system in 1990.

In 2002, Rain Master introduced the RME EagleTM, weather based commercial irrigation controller that functions either as a stand-alone unit, or as a satellite controller component of the Rain Master iCentralTM Internet-based system. The RME Eagle /iCentral system (Patent No.

6,823,239) was designed to address the single controller as well as low to mid-sized control system markets.

Rain Master provides several ET source options for the Eagle. ET may be manually entered into the controller; alternatively the controller may be directly connected to a Rain Master Weather Center II weather station, or receive CIMIS data. When configured with Rain Master's iCentral 2-way wireless card, ET may be disseminated over the Internet using Rain Master's ZipET national dissemination weather service, or California users may obtain their daily ET from CIMIS.

Operational Features

When the Eagle's programs are enabled for ET operation, station runtimes are automatically adjusted on a daily basis when connected to the Internet or a Weather Center II weather station. If daily ET is unavailable, the controller will intelligently utilize average monthly historic ET entered by the user to adjust its daily schedules. Historic ET data by zip code are available at Rain Master's website (www.rainmaster.com). The controller computes ET adjustment granularity to the nearest second, which eliminates rounding errors commonly found in controllers that round on incremental minute basis (i.e., a 5 percent programming error can occur based on just a 10 minute run time).

Rain Master's ZipET is an ET data collection and dissemination service for Rain Master iCentral Internet customers. Rain Master collects raw weather information on a daily basis from thousands of Federal Aviation Administration and NOAA weather stations throughout the U.S. The weather information is validated, and converted as necessary to generate industry accepted ET values. The ET values are interpolated by zip code using a three-dimensional surface regression model. Site-specific ET information is then automatically delivered to each controller via the 2-way wireless communications card (iCard). Rain Master's iCentral website provides daily reports on all ET weather information which was successfully delivered to each controller (2-way confirmation).

An alternative to the ZipET service is available for users who require the accuracy of an on-site weather station. Rain Master's commercial grade, computer controlled, Weather Center II measures wind, rain, temperature, solar radiation and relative humidity and calculates ET at a frequency of ten seconds. A contact closure signal is transmitted from the weather station to the controller by wired connection to signal accumulation of 0.01 inch of ET. The electrical signals are counted and stored in the memory of the controller, which uses the ET data to adjust the irrigation schedule. The Weather Center II measuring devices are permanently mounted on a 10-foot tall, vandal-resistant tower with all connections made within the tower's terminal block. The controller supplies power to the system.

The Eagle user also has the ability to manually enter daily ET information at any time. When used in conjunction with historic ET, manually input ET can mitigate for extreme conditions.

Utilization of manually entered ET data in conjunction with historical ET data can significantly improve irrigation efficiency. The controller will utilize the manually entered ET value for a period of one week, and then automatically revert back to the use of the selected ET data source. Manual ET data can be entered at any time; each time it is entered it will over-write the last data value stored and supersede all other ET data sources.

When the RME Eagle controller is coupled with the optional 2-way wireless iCentral plug-in card, irrigation control and monitoring may be performed via the Internet. Activation of the wireless service to the controller is performed directly from the Rain Master website. Because it is wireless, installation is reportedly simple for either new or retrofit applications. A knock-out at the bottom of the controller enclosure is provided for mounting the 3-inch antenna.

The iCentral website automatically informs the user anytime a field change has occurred, including controller alarms (sensors and wiring fault detection) which are also e-mailed to the user. The website allows the user to command a rain shutdown, modify controller setup information, and manually turn on/off any station or program.

The website also provides an automatic schedule generator so that users may generate representative irrigation schedules taking into consideration plant type, irrigation system design, and climatic conditions. Once the user enters all the *scheduling constraints and station attributes* for a controller, as described below, suitable programs are downloaded throughout the year in addition to the daily ET adjustments that are sent to the controller. The scheduler algorithms utilize the Irrigation Association "Landscape Irrigation Scheduling and Water Management" equations dated March 2005.

The *scheduling constraints* define the irrigation season, the controller water window, the stations, programs, and the allowable water days that are available for the scheduler, and any hydraulic constraints the system may have. The *station attributes* include plant type, precipitation rate, soil type, root zone depth, slope, station efficiency, allowable soil moisture depletion, distribution uniformity, and seasonal plant crop coefficients. In the absence of the iCentral scheduler, the user must program the controller with a base schedule. The base schedule's total run times and soak/cycle times are adjusted automatically each day by the controller based on ET.

Descriptions, Prices and Warranty

The RME Eagle controller is available in 6, 12, 18, 24, 30, and 36 station configurations. It has four independent programs each with five start times. Water days may be programmed on a weekly basis or by skip-by-day water day cycles with skip days ranging from 1 to 30 days.

Station runtimes may be programmed up to 10 hours in one-minute increments, and may be increased/decreased using the program percent feature from 0 to 300 percent in 1 percent increments. Programmable overlap protection provides for programs to be stacked or run concurrently, and provision is made for a separate master valve and or pump. The controller has non-volatile memory and the time and date are updated without backup batteries. Electronic overload protection is provided, with automatic reset (no fuses or circuit breakers). The Eagle's standard water savings features are summarized in the bullets below:

- Programmable rain shut off in order to delay the start of irrigation after a rain event (1 to 7 days)
- Manual Rain Switch (Automatic Watering – No Watering) provides a means of quickly turning off all irrigation programs without disturbing the stored program(s)
- Connectivity for any one of the following options: rain, moisture, or freeze sensor devices on a per program basis - when the sensor is "active" irrigation will stop and the display will indicate that the sensor is active
- The ability to select either ODD or EVEN day watering on a per program basis
- Selectable cycle-and-soak irrigation programming or conventional programming on a per-program basis
- Programmable cycle runtime, Max Cycle Time, and Soak time on a per station basis
- Automatic minimization of the water window by intelligently scheduling station starts when other stations are satisfying their SOAK TIMES
- The controller provides the ability to display total program duration, real time flow in GPM, alarm information related to flow and station field wiring conditions, daily ET values, sensor status and total water usage When connected to an optional Rain Master Flow sensor, the RME Eagle controller will suspend irrigation in the event of a station break, catastrophic main line failure, or unscheduled flow. Station limits may be automatically "learned" by the controller and irrigation will be suspended for any station that fails its limit checks while it irrigates. The controller display shows real-time flow measured in GPM as well as flow and station field wiring fault conditions.

The standard size RME Eagle controller dimensions are 13.1” x 10.4” x 4.4”, and the extended size cabinet is approximately 7 inches taller. The enclosures are constructed of rolled steel with jet coat®, and are suitable for outdoor installation.

An optional stainless steel pedestal mount is available. The controller is UL approved and includes an internal 24 VAC transformer and the current capacity is 1.0 ampere per station or master valve circuit. The controller has terminal screw connections and will accept 12 gauge wire. Optional heavy duty lightning and surge protection is available.

Rain Master’s products are available throughout the U.S. at all major irrigation distributors. A distributor search engine can be accessed at Rain Master’s website. The MSRP for the standard RME Eagle 6 station controller starts at $640. A 36 station price of $4,264 includes a full year of on-line technical support, internet service and ZipET. Individual internet service plans for wireless 2-way communications range from $9.95 to $14.95 per month. The MSRP for the Weather Center II is $3,500. All Rain Master Controllers come with a 5-year warranty. Nationwide product support is available by a network of Rain Master sales representatives. Toll free factory phone support is available from 8:00 AM thru 5:00 PM PST at (800) 777-1477.

Installation

Rain Master reports installation of the controller is straightforward. The AC power however has to be hard-wired, and a contractor is recommended. Installation time and cost varies depending on site-specific conditions.

Track Record, Water Savings and SWAT Testing

Rain Master reports that thousands of Eagle controllers have been installed throughout the U.S. and that the Rain Master RME Eagle controller has been recognized and accepted by more than 40 water purveyors/agencies across the nation. A list of water agencies that accept Rain Master’s products in their water saving incentive programs can be accessed at Rain Master’s website. Although water savings data were not available for this report, Rain Master reports average water savings of 25 to 40 percent. Rain Master’s reputation and the controller’s 5-year warranty are significant factors when considering the reliability and overall performance of their products. A SWAT performance report for the RME Eagle was not posted at the time of this report.

Toro

The Toro Company, which was established in 1914, is a Fortune 1000 internationally recognized supplier of irrigation and landscape products. Toro’s corporate headquarters is located in Bloomington, Minnesota and its Irrigation Division resides in Riverside, California.

Toro’s Intelli-Sense series of residential and commercial controllers utilize the ET EverywhereTM subscription service and WeatherTrakTM scheduling engine to provide weather based irrigation system control. Toro also manufactures Irritrol products and is a partner with HydroPoint Data Services. Irritrol and HydroPoint controllers also utilize ET Everywhere and WeatherTrak, as discussed in the HydroPoint and Irritrol sections of this report.

The Intelli-Sense series entered the market in 2005 and includes seven controllers, comprised of indoor and outdoor models for 6, 9, 12 and 24 zones (plus a pump/master valve circuit). The WeatherTrak-enabled software creates a scientifically calculated zone-specific baseline irrigation schedule. The schedule is updated daily using weather data delivered by the ET Everywhere subscription service.

ET Everywhere uses data from the NOAA system of 14,000 nation-wide weather stations to deliver ET to any area in the U.S. ET Everywhere has a proven accuracy to a standard deviation of .01 inch of daily ET at a resolution of one square kilometer.

The ET Everywhere data service provides local ET (microzone) without the need for a weather station on site. The ET Everywhere Data Center validates the weather data and transmits calculated ET through three satellite servers to each controller every day. The three satellites provide overlapping coverage of the U.S. to ensure signal reception anywhere.

Operational Features

The Intelli-Sense controllers calculate irrigation schedules for each zone. The controller does not use pre-set irrigation schedules input by the user. Instead, a series of questions are answered by the user to define the site variables that influence water need. The controller is programmed by entering the following station specific information: sprinkler type or precipitation rate, plant type, soil type, microclimate (sun or shade), slope (including if the zone is at the top, middle or bottom of the slope, and system efficiency (percentage). The schedule for each station is adjusted daily according to the local weather data received via the ET Everywhere service.

With these inputs, the controller calculates an irrigation schedule for each zone. Soil moisture depletion tracking, triggered at a 50 percent depletion level, along with daily ET updates allows the controller to adjust schedules as the weather changes. The number of water days, minutes and cycles (with appropriate soak times between cycles) are generated automatically and change as weather and water need fluctuates. The controllers have an eight- week scheduling window.

This allows for infrequent watering of low water use plants. The controllers can initiate irrigation even if the daily ET page is not received by using the last download and loop-up table included in the WeatherTrak software. Non-watering days can be specified in the controllers' schedule programming. The controllers are compatible with Toro's wired & wireless rain and rain/freeze sensors, which eliminate irrigation during rainfall and freezing weather if added as an optional accessory.

Descriptions, Prices and Warranty

The indoor controller models' cabinet is constructed of ABS plastic while the outdoor units are comprised of Lexan. The dimensions of the indoor models are 7.5" x 6.5" x 3.3", and the dimensions of the outdoor models are 7.5" x 9.5" x 5.8". The controllers have a large (3.5" x 0.8") LED information display, dial type controls, and a copy button for simplifying setup. All controllers include internal UL/CSA listed transformers.

The current capacity for each zone circuit is 0.5 amperes, and the current capacity for pump/master valve circuit is 0.375 amperes. The controllers will accept wire sizes from 12 to 18 gauge. The nonvolatile memory maintains programming, and the back-up battery maintains the date and time, during power outages.

Other controller features include surge protection up to 6 kilovolts and valve malfunction detection. The irrigation schedule, irrigation history and program review can be viewed with the LED information display. In addition to the rain and rain/freeze sensors, pancake and bow tie antennas are available for sites with poor reception.

The Intelli-Sense controllers may be purchased from authorized Toro distributors and retailers. The Intelli-Sense controllers come with a 5-year warranty. The purchase of an Intelli-Sense controller requires a paid subscription to the ET Everywhere service through WeatherTrak. The ET Everywhere annual service fee is $48 for the 6 to 12 station controllers and $84 for the 24 station controller, as discussed in the HydroPoint section of this report.

Installation

The Intelli-Sense controllers do not require professional installation, although trained installation is recommended. Typical installation times range from 1 hour to 2.5 hours, depending upon the size of the landscape covered and mounting issues. Installation should include a site assessment and discussion with the user about the site's irrigation system and how the controller operates. Installation and setup instructions are included in the owner's manual. Technical support is available from Toro by a toll free number (800-664-4740), or www.Toro.com, and through field certified contractors.

Track Record, Water Savings and SWAT Testing

Toro reports the technology behind the Intelli-Sense controller series is proven by several multi-year independent studies showing water savings. These studies were performed using Hydropoint's WeatherTrak controller and the ET Everywhere service. The studies are discussed in the Hydropoint section of this report. An Intelli-Sense controller SWAT test performance report is posted at the Irrigation Association's website.

Tucor

Tucor, Inc. is headquarted in Wexford, Pennsylvania and has been in business since 1995. Tucor®, along with their Danish partner, SRC, manufactures commercial irrigation controllers which use decoder-based two-wire technology. Two-wire technology carries both power and signal to each irrigation valve, eliminating the need to run individual wires by instead using decoders at each valve, sensor or pump. Two-wire systems are easily extended without the need to install additional wires back to the controller.

The Tucor PROCOM© is a stand-alone controller with weather-based irrigation scheduling capability. The PROCOM is a modular, commercial grade controller that comes in its base form as a 50 valve (station) model. The controller's capacity can be increased through simple software registrations to 100, 200, 300, 400 or 500 valves.

The controller connects to a PC (via wired or wireless) using software supplied with the controller, which provides a Windows®-based interface for programming and monitoring. The Tucor ProCom ET-100 Weather Station is connected to the PROCOM controller to provide automatic weather-based irrigation scheduling. The controller calculates ET from the weather station sensor inputs and develops a daily irrigation schedule that provides efficient landscape watering. Housed in a sealed enclosure, the weather station is powered by a rechargeable (AC or solar panel) battery.

Weather station standard sensor inputs include solar radiation, air temperature, relative humidity, rainfall and wind speed and direction. Optional sensor inputs include soil temperature and moisture content. The station's battery charger is powered by either a 10 watt solar panel or AC power. The weather station data are transmitted to the controller by telephone modem, and ET is calculated using the FAO-56 Penman Monteith equation. The irrigation schedule is calculated based on station application rates entered by the user.

Other parameters that can be used in calculating the irrigation schedule include vegetation type, growing degree days, wet bulb temperature, dew point, and wind chill. The ET-100 comes with software and modem, a two or three meter pole mount, battery charger with solar panel or AC transformer and optional sensor inputs.

Operational Features

The PROCOM can run up to 40 stations simultaneously, manage up to 16 pumps and monitor up to 10 flow sensors. It can execute up to 30 schedules with up to 12 start times per schedule. Schedules can be executed sequentially as programmed, in priority as programmed with automatic execution based on flow data, or fully automatic based on a flow optimization protocol.

Scheduling is based on a 14 day cycle. The controller includes a rain sensor input for utilizing the automatic rain delay feature. The rain delay feature can be independent of the weather station. An auxiliary sensor input can be used for non irrigation related alarms. These are typically pump related. Additionally, the controller will actuate an alarm on wind speed, rain limits and temperature.

The PROCOM can monitor and react to flow conditions for up to 10 flow points. The controller can distinguish between multiple flow meters that are used for water sources and those flow meters that are used for monitoring main and sub main failures within a large system. Select flow meters can be identified for inclusion in the water consumption reports.

In the event of a high flow condition during irrigation, the controller can shut down that sequence, continue to the next sequence, send an alarm to a pager, and report to an Excel® file. In the event of an unscheduled flow event (main line failure), the user has the option to activate or deactivate a valve or device. The controller can then alarm to a pager and report to an Excel file.

While considered to be a stand-alone controller, the PROCOM must be programmed through the RMS management software that is included with the controller. The RMS software allows for the management of up to 25 individual controllers. All data logged by the controller can be exported to the Tucor Logviewer program, which is a series of Excel-based reports. This format allows for the customization of usage reports, unique to each application.

The controller can perform a dry run prior to the actual running of a schedule, to project total run times and water usage. The dry run can be displayed as a flow graph to help manage the efficient use of water and time. The controller allows for the option to apply water based on time, application rate, or ET. Communication to the controller can be a choice of a direct serial connection, phone line, cellular, or GSM/GPRS. Internet connectivity is also available utilizing an existing LAN/WAN or WIFI broadband. A WIFI network, featuring mesh technology, can be created in the event of the existence of multiple controllers on a single site.

Descriptions, Pricing and Warranty

The PROCOM is designed for indoor installation, but several optional outdoor cabinets are available. The controller's dimensions are 11.5" x 13" x 3". The outdoor cabinets come in wall mount or top entry models. The PROCOM has automated diagnostics capabilities. The controller detects wiring faults and turns off power and sends an alarm to the user when detection occurs. Diagnostics can be performed with the controller, to trace short circuits, line current and solenoid ground faults. Optional lightning protection is available for protection against lightning on the two-wire path. Tucor products are available through certified distributors. Tucor products come with a 3-year warranty that can be extended to 5 years through an installation certification process.

Installation

Tucor controller systems require professional installation.

Track Record, Water Savings and SWAT Testing

Although Tucor did not provide water savings data for this report, it appears proper use of the PROCOM controller may potentially result in water savings and runoff reductions similar to the other weather based irrigation control products discussed in this report. A SWAT test performance report is not posted for the Tucor PROCOM.

Water2Save

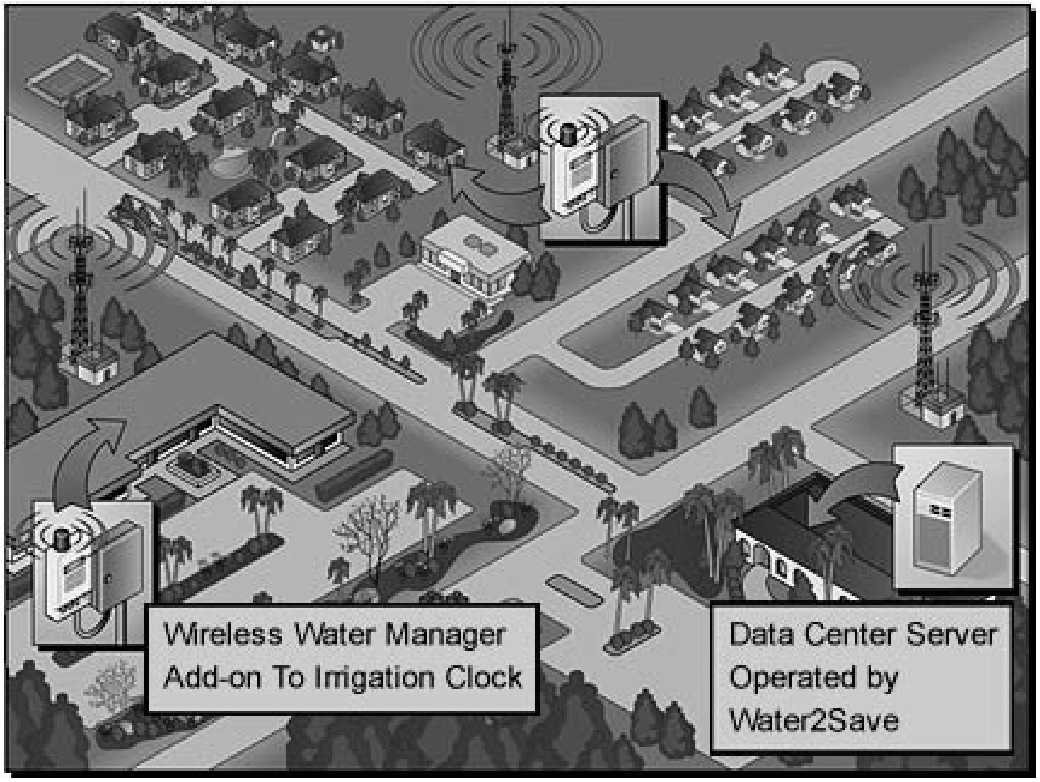
Water2Save, LLC is located in San Diego, California, and is a subsidiary of WaterLink Systems, Inc. WaterLink specializes in weather-based irrigation control and conservation management. In 1992, WaterLink began research and development, patent applications, and beta testing of a weather based irrigation control and feedback monitoring system using wired and wireless data telecommunications. WaterLink obtained two patents in 1997 and 1999 for a method of using forecasted weather and ET data to adjust irrigation schedules.

Water2Save was formed in 2000 under a technology license from WaterLink to market and sell the patented technology along with its patented forecasted weather based ET adjustment service to optimize irrigation water use for large residential and commercial irrigation systems. Both Look-Ahead ET ™ and WaterLink System® are trademarks or registered trademarks of WaterLink Systems, Inc.

Property owners contract with Water2Save to be their remote irrigation water manager on a performance guarantee basis. Water2Save offers a multiple controller add-on hardware package, fully automatic Look-Ahead ET irrigation scheduling, landscape audits, historic and real time irrigation runtime monitoring, savings tracking/reporting, and guaranteed savings.

Two patents, Evapotranspiration Remote Irrigation Control System and Evapotranspiration Forecasting Irrigation Control System, cover methods of using forecasted ET, called Look-Ahead

ET, with any type of wired or wireless communications to provide weather-based irrigation system control. According to patent claims, approximately 15% more water savings can be achieved when predictive data are used with the ET equations versus when only real-time or historic weather data are used. Water2Save is the only ET irrigation control service provider that can offer its patented forecasted weather based irrigation control.



In 1993, Water2Save began testing its first prototype ET controller. The initial technology replaced the existing controller and required site-specific data for each irrigation zone (plant type, soil type, root depth, irrigated area, flow rate, precipitation rate, and distribution uniformity). The programmed site information and Look-Ahead ET weather data were used to automatically calculate the irrigation schedule.

After years of testing, the company concluded that obtaining and entering site specific data for each landscape zone was impractical and too labor intensive for most users. In addition, the company determined that many users did not want to learn how to install and operate a new high-tech controller. Therefore, in 1996, the company developed a 2-way (send and receive) add-on technology using its patented method which factors down runtimes set in the controller in accordance with forecasted and measured weather data. Further, the technology monitors watering schedule changes made by the user for each zone and sends such information to Water2Save's Data Center for analysis. This technology has now been in operation with customers for over 12 years.

Operational Features
Water2Save's add-on technology is fully transparent and independent of the irrigation controller and is not operated by the user. Hardware is operated remotely by Water2Save and no training is required for the user. The user continues to use the familiar irrigation controller to set and "fine tune" baseline watering schedules. Water2Save is developing a commercial controller that will function similar to the add-on unit for those customers that wish to replace their existing controller with an integrated wireless ET based controller using Water2Save's Look-Ahead ET, valve runtime monitoring service and water usage/savings reporting.

With Water2Save, the user is responsible for setting a baseline schedule that is consistent with recommended summertime irrigation schedules and runoff guidelines established by Water2Save. Baseline schedules are set to the maximum peak ET or 100 percent that remain set at the summertime level the entire year. However, the user may "tune" specific valve schedules as needed.

These changes are remotely monitored by Water2Save. The installed technology will interrupt runtimes and reduce irrigation based on normalized weather data (ratio of Look-Ahead ET to the peak summer ET). Normalizing the data reduces the need to obtain site-specific absolute values for ET. Such percent adjustments are not a straight percentage per cycle. The technology considers both daily and weekly runtime minutes. This allows the technology to "store-up" minutes so as to drop cycles and or drop days from the irrigation schedule as appropriate. Water2Save monitors all start-times for daytime irrigation runs and records all manual valve activations that are made by the landscaper using the existing controller.

Although the user can manually run one or more stations during a daytime window of time with no interrupt, Water2Save can prevent all daytime manual watering from the controller if over-watering occurs from excessive runtime programs. Water2Save remotely monitors and manages each valve independently (e.g., color, turf, shrubs, ground cover, drip, slopes, etc.). Measured weather data and weather forecasts are reviewed daily from numerous sources including the National Weather Service and other government operated weather stations such as CIMIS and AZMET in California and Arizona.

Weather data review is done by qualified technical staff knowledgeable in meteorology and evapo-transpiration, as well as weather forecasting. Water2Save retrieves forecasts and weather changes for numerous climate zones where its systems are installed. Once the climate zone adjustments are determined, sending weather adjustment factors to the technology installed at customer sites is done via the Internet and wireless networks with confirmation of receipt of the adjustment update.

Water2Save operates a dual redundant server Data Center that retrieves data from properties installed with the company's equipment and monitors both the runtimes programmed by the landscaper and those adjusted by Look-Ahead ET factors. These factors (updated with both forecasts and corrections from measured weather data) are sent and then "receipt" is confirmed by Water2Save staff at its Data Center every day. Water2Save staff review the meteorological measurements for bad data, out of range data, calibration problems with weather instrumentation, and rainfall errors. This allows Water2Save staff to troubleshoot and then correct problems before processing, thus preventing incorrect adjustments from occurring.

Using 2-way wireless cellular data communications, Water2Save's Data Center retrieves irrigation runtime minutes (those programmed by the user into the controllers and those actually watered after the daily weather adjustments were made). Irrigation history is compiled into a database for analysis by Water2Save and is also made available to the user via the Internet. Servers automatically scan data to find baseline schedule changes that have been made by the user, which are flagged for investigation by Water2Save staff.

Water2Save's staff also obtains monthly or bi-monthly utility billing information to track water meter consumption. A baseline is established using water consumption history prior to installation and the monthly or bi-monthly use after install allows Water2Save to track and calculate achieved savings for "like periods" of the year. Utility meter read data are correlated with watering minutes to identify potential discrepancies. Water2Save mails or e-mails utility meter specific savings reports to its customers to document if and how much savings is being achieved.

The company's Wireless Water Manager (WWM) is designed to enable Look-Ahead ET control for up to 64 irrigation valves on up to 4 separate existing or new irrigation controllers (any type of electronic controller with low voltage solenoid operated valves). Each WWM receives weather-based adjustments via wireless data communications from the Data Center over a national cellular data network and optimizes irrigation. WWM adjusts runtimes using an electronic relay to turn-off water when a daily allowance is reached.

Modular multi-valve sensing monitoring cards are used with the WWM. Each electronic card measures activation time for 12 or 16 separate irrigation valves and records the number of seconds-on of all watering cycles. Up to 4 sensing monitoring cards (maximum of 64 valves) can be connected to one WWM via direct cable or wireless link. Each multi-valve sensing monitoring card is connected between the existing irrigation controller and solenoid driven valves.

Also, the common wire is connected between the card and controller to turn-off water to each valve according to the Look-Ahead ET requirement. Each valve is programmed to run a specific schedule at the controller and the sensing monitoring card interrupts the run time specific for each valve in accordance with the adjustments.

Descriptions, Pricing and Warranty

The WWM panel, wireless cell modem (activated on Cingular's network) and antenna are shipped inside a steel housing (10.8" x 6.5" x 2.5") that is to be mounted next to the existing irrigation controller. The valve sensing monitoring cards are usually mounted below each of the existing controllers to be enabled with Look-Ahead ET. The wireless modem is a completely separate module (not designed into the electronic circuit board) and is easily upgradeable should wireless technology infrastructure change over time. A standard rain sensor or rain gauge can be connected to the WWM to enhance the system's scheduling capability by triggering rain delays and or accounting for effective precipitation.

The WMM power supply is an external 9 VDC transformer that is fused for power line surges, and the multi-valve sensing monitoring cards have optoisolation type surge protection. The price for a basic add-on WWM model, with the capacity to schedule up to 16 valves on a single controller is $1,598. This price includes the main panel and CPU, a 5-year lithium ion battery, housing, power supply, wireless 2-way cell modem, antenna, a 16-valve sensor card, and all necessary cables. When connected to 4 controllers with three additional valve sensing cards for up to 64 valves, the price is $ $2,108 (or about $527 per controller).

The basic service fee for wireless airtime and Look Ahead ET daily adjustments is $39 per month ($468 per year total or $117 per year per controller- $9.75 per month assuming that all 4 controllers are connected to one WWM) and includes feedback confirmation that schedule data were received. Equipment rental plans are also available directly from Water2Save. Water2Save provides a 3-year parts and labor warranty with equipment purchase.

Planned pricing on Water2Save's forthcoming commercial ET controller was not available at the time of this report. Additional services include tracking runtimes, number of cycles, start times, time of day watering, and manual watering time. The Data Center also checks to confirm that each valve's runtime does not exceed a range of weekly watering minutes established by Water2Save for specific head type and plant type. The Data Center checks if the number of cycles set for slopes have been modified in the existing controller. If so, user follow-ups are conducted until such issues are resolved.

Additional data monitoring includes power outages, future day factors, daytime irrigation, start-time of each valve, end time, number of cycles, and the default factors (based on long-term meteorological conditions). Should wireless communications be interrupted, the WWM will use a set of specific climate zone default factors (provided that updated factors are not received over a several day period).

Installation

Water2Save reports the typical installation time for a WWM system with one controller is 2 hours and that professional installation is usually required.

Track Record, Water Savings and SWAT Testing

Water2Save reports its systems have proven to deliver maximum achievable savings reliably year after year with a guarantee. In-house savings reports show typical savings of over 2,000 gallons per day from installation of Water2Save on a one-acre site.

The City of Los Angeles, California Department of Water and Power recently performed a pilot study of Water2Save over a one-year period. Water2Save reports the average percentage water savings achieved for the properties installed with its system was over 28 percent.
A SWAT test performance report for the WWM was not available for this report. Water2Save offers a complete turn-key water manager package which includes hardware, patented Look-Ahead ET adjustments with receipt confirmation, runtime monitoring, flagging of problems, on-site field support, full reporting via the Internet, consumption tracking and guaranteed performance savings agreements.

This system appears to provide significant water savings and requires minimal onsite monitoring and adjustment. The Data Center interface appears to provide an easy and effective method for remotely monitoring an extensive set of irrigation related information.

Weathermatic

Weathermatic®, established in 1945, is a worldwide manufacturing company of a full line of irrigation products. The company, headquartered in Dallas, Texas, began developing water conserving products in the 1950's when it used soil moisture sensors which were later followed by its innovation of the industry's first rain sensor shut off device in the 1970's. Weathermatic's SmartLineTM residential and commercial irrigation controllers operate based on weather conditions using onsite sensors.

Operational Features

The Weathermatic SmartLine controller technology patent was filed in 1998 and granted in 2000. SmartLine controllers accept user inputs by zone for sprinkler type, plant type, soil type, slope, and a zone fine-tune adjustment factor. The units then incorporate a ZIP code input (for solar radiation) and an on-site weather monitor (sensing temperature and rainfall) to calculate real time ET estimates that are used with user inputs to calculate proper zone run times, including cycle/soak, at user selected start times and watering days.

The Weathermatic SmartLine controller/weather monitor package operates stand-alone and does not require communication with remote servers to obtain weather data or irrigation schedules and no ongoing service costs are associated with the unit. After 8 years of development, testing, and field trials, the SmartLine controller line entered the market in November of 2004. As of July 2005, Weathmatic reports shipment of tens of thousands of SmartLine controllers with less than 60 units returned.

The Weathermatic controller platform is built around zone modules that allow expandability from 4 to 8 zones for their SL800 model and 4 to16 zones for the SL1600 to accommodate various size residential and commercial landscapes. The SL1620 and SL1624 have fixed zone capacities 20 and 24. A larger commercial model, the SL4800 (scheduled for release in June

2007) will provide module and wiring space for up to 48 zones. The SL1600, SL 1620, SL1624 and the SL4800 are all suitable for indoor or outdoor installation. The SL800 is an indoor model.

Descriptions, Prices and Warranty

The SL800 is a fixed 4-zone unit that can be expanded to 6 or 8 zones with 2-zone modules. The SL1600 controller is shipped standard with a 4-zone module and can be expanded to 8, 12 or 16 zone with additional 4-zone modules. The SL1620 and SL1624 controllers are fixed 20-zone and 24-zone units. The SL4800 will be shipped with 12 zones included. The controller housing dimensions are: SL800 – 7” x 7.8” x 1.8”; SL1600 series – 9.1” x 10.1 x 4 and SL4800 – 15” x 16.5” x 5.8”.

The SL800 has an external transformer power supply with a barrel connector that plugs in to the side of the controller for fast installation. The SL1600 Series controllers have internal transformers with a prewired plug-in cord that will accept 120V or 240V. The SL4800 will also have a 120/240V internal transformer but without a pre-wired plug-in cord (professional installation required).

For the SL800 controller, either a 120V power supply or a 240V power supply with connectors for the EU or Australia can be specified when ordering. The controller output circuit capacities are 1.0A for the SL800 and 1.2A for the SL1600 series and the SL4800. Weathermatic reports these capacities are adequate for running 3 zone valves concurrently with a master/pump valve for the SL800 and SL1600 series, and 5 zone valves concurrently plus a master/pump valve for the SL4800. Accepted wire sizes range from 14 to 18 gauge.

The SmartLine controllers have advanced functions including zone-to-zone and master valve timing delays, a built-in valve locator, as well as a unique diagnostic function that displays the electrical current by zone for troubleshooting. Additionally, the user can omit specific calendar event dates, days of the week, and times of the day when no watering is allowed. A remote control option planned for 2008 will feature a handheld remote nested in the back of the programming module. The handheld will have a 600 foot line-of-sight range.

Units with the remote capable operating panel will also enable a second remote capable operating panel to be mounted independent of the base. Weathermatic offers a 2-wire option with the SL1600 series controllers. The SmartWireTM decoder module for 2-wire systems (model SLM48DM) can be integrated into these controllers and is considered cost effective for 18 zones and larger systems.

The SLM48DM includes connections for up to 3 different 2-wire paths and includes an LED display and status lights for programming, operation status and troubleshooting. The valve decoders used to decode the signals from the SLM48DM come in 1-, 2- and 4-valve capacity (models SLDEC-1, SLDEC-2 AND SLDEC-4). Additional valve decoder features include: shock and freeze/heat resistant, 14-guage wiring, surge protection and functional distance up to 100-feet from the valve.

The on-site weather monitor includes a temperature sensor and rain sensor. The unit has a microprocessor to record and process measurements. The temperature sensing unit is encased in a solar shield. The hygroscopic disc type rain sensor can be set to trigger rain delay at rainfall depths from 1/8" to 1". A wired weather monitor is currently available and a wireless unit is planned for 2008.

SmartLine controllers are distributed through Weathermatic's established wholesale suppliers (specialty irrigation suppliers) and installation professionals. Programming of the "Auto Adjust" ET portion of the controller requires inputs by zone for sprinkler type, plant type, soil type, and slope. Sprinkler type can be entered on a basic level by the user by selecting the type of sprinkler in a zone –SPRAY, ROTOR, or DRIP.

A more advanced user can scroll past these basic inputs with default precipitation rates and prescribe an exact numerical precipitation rate for the zone from 0.2"/hour to 3.0"/hr. Plant type works similarly to the sprinkler type input in that the user can simply select the type of plant life in the zone – COOL TURF, WARM TURF, ANNUALS, SHRUBS, NATIVE, or TREES. Again, a more advanced user can scroll past these basic inputs with default percentages and prescribe an exact numerical percentage for the zone from 10 to 300% based on the plant life in the zone and sun/shade consideration. The soil type – CLAY, SAND, LOAM - and slope (numerical degree of slope 1 – 25+ degrees) are used to automatically calculate the cycle/soak function by zone.

In addition to these inputs by zone, the user programs the ZIP CODE of the site, or primarily for locations outside the United States, the latitude of the site. This input and the calendar day of the year is used to determine the solar radiation at the site, which is a variable in ET calculation. These static inputs are combined with the dynamic on-site weather monitor inputs to perform the overall equation that determines proper zone run times.

The SmartLine user has the ability to fine tune the zone run times by zone through a MORE/LESS function. This allows the user to increase watering by zone up to 25 percent or decrease watering by up to 50 percent.

Weather Monitor required for weather-based irrigation scheduling not included in price The controller's irrigation schedule is based on the user prescribed irrigation days, start times, and omit times (dates, days, and times of day) so as to conform to local watering restrictions and also accommodate site-specific hydraulic issues, which vary by time of day. Once programmed, the controller calculates ET for the period beginning at the end of the last irrigation cycle, or measurable rainfall, and ending at the next prescribed irrigation day. Irrigation will occur if the calculated run time is sufficient for an effective irrigation watering. If sufficient demand has not been reached, irrigation will not occur and the controller will carryover the accumulated ET to the next prescribed irrigation day and time. This accumulation threshold, which prevents ineffective irrigation, is calculated based on a default accumulation factor.

Installation

Installation and programming of SmartLine controllers are designed to be simple and intuitive for both the novice homeowner and the advanced professional who are familiar with the unit's industry standard programming dial. Advanced user functions are located in an "Advanced Functions" position on the programming dial so as to not complicate the set up for novice users. While programming the unit is simple, Weathermatic recommends installation by a professional who will give the site the highest rate of success not only for controller programming, but also for complete system operations with an emphasis on water conservation.

Based on Weathermatic's solid reputation and well-established support network, it appears the SmartLine controllers' technical support system is outstanding. Installation and programming instructions are available on Weathermatic's internet site (weathermatic.com), and a programming video and DVD are available to supplement the standard user manual.

Track Record, Water Savings and SWAT Testing

Weathermatic tested its Hargreaves equation based ET calculation algorithm and controller functionality extensively for 8 years. For comparing ET calculations, CIMIS weather station reference ET values were compared to those using the Weathermatic controller/weather monitor methodology at 10 geographically diverse sites over a seven-year period for 70 years of combined data. Weathermatic reports good correlation between the CIMIS and Weathermatic ET data at all sites.

In addition to comparing the ET calculation, the Weathermatic SmartLine controllers were included in a field study performed by a Rocky Mountain Region Water Conservancy District. This three-year study analyzed the Weathermatic controller's accumulated water output in comparison to actual ET (as measured by lysimeter), reference ET (ETo calculated with on-site weather station data), and net plant watering requirements (PWR). The study results shows the Weathermatic unit watered consistent with plant demand.

The Weathermatic SmartLine controllers were also part of a field pilot program conducted by the Marin Municipal Water District. In this study, 13 controllers were installed at 7 sites to compare water usage in 2002 and 2003 to the base year usage in 2001. Weathermatic reports that in 2002, sites installed with the Weathermatic ET controller saved 26%. In 2003, the water savings climbed to 32%. Based on documentation from this program submitted by

Weathermatic, it appears the Weathermatic controller performs well and yields significant water savings.

Weathermatic's test center has conducted testing on the controllers and weather monitors in the following areas affecting reliability: mechanical stress testing, environmental testing, software testing, and functional/characterization testing. The Weathermatic SmartLine has completed SWAT testing and a performance report is posted on the Irrigation Association website The SmartLine controllers are relatively economical and appear to offer effective real time onsite ET measurements and inputs by zone for key programming parameters.

Weathermiser

The Weathermiser Company, based in Albuquerque, New Mexico manufactures a patented add-on controller device that works with any clock-type irrigation controller to schedule irrigation based on weather conditions. Weathermiser has been in business since 1997 and its first controller models entered the market in 2003. The Weathermiser devices include integrated temperature and humidity sensors, and these sensor inputs provide the basis for scheduling irrigation. Weathermiser reports the ability to forecast precipitation and as a result, the ability to interrupt irrigation cycles before precipitation occurs.

The Weathermiser monitors humidity in real-time to determine the need to irrigate. Irrigation may be delayed when humidity readings are high, since ET is lower and since humidity is high before, during and after rainfall. Irrigation frequency increases as a function of high temperatures and low humidity. The temperature sensor is factory set to interrupt irrigation at temperatures below 37 degrees F and an optional high-wind interrupt is also available.

Operational Features

The relative humidity sensor setting is adjustable and the controller interrupts irrigation when the ambient relative humidity exceeds the variable dial set point. The dial is set just above the highest average relative humidity for a given geographical area, at a specific time of day. Two relative humidity settings for all major cities are included in the Weathermiser instructions. The user programs the higher setting for morning irrigation and the lower setting for irrigation after dusk.

The controller is designed to track dew point, evaporation rate and solar radiation based on temperature, humidity and optional wind sensor readings. The Weathermiser device interrupts the common valve circuit from the clock-type controller until it determines irrigation is needed. The clock controller is set to irrigate every day and then irrigation occurs on the days the Weathermiser initiates it. A base schedule is programmed into the clock-type controller by the user.

Descriptions, Prices and Warranty

The Weathermiser controller models include the basic model (RSFI), basic steel enclosure model (RSFIS), wireless model (WLRSFI) and steel enclosure wireless model (WLRSFIS). Each of the Weathermiser controllers includes a dial-type humidity sensor setting control and a bypass dial position. Setting the dial to the bypass position deactivates irrigation interruption by the device. The RSFI and RSFIS have no power requirement; and the clock controller common valve circuit is interrupted by the action of the spring operated humidity and temperature sensors.

The RSFI is housed in a polycarbonate enclosure and its dimensions are 7” x 2” x 1.5”. The RSFIS is simply a RSFI mounted in a 7” x 5” x 3.5” vented steel security enclosure, and includes lock and key. The wireless WLRSFI is a 2-component system consisting of a combined controller and radio frequency transmitter and a receiver.

The controller/transmitter is housed in a polycarbonate enclosure (7” x 2” x 2”) and is powered by two 3V lithium batteries. The controller/transmitter communicates an on/off signal to the receiver that is connected to a clock controller (not included). The receiver is housed in a polycarbonate enclosure (2” x 4” x 1”) that is mounted in or near the clock controller and is powered by the controller 24VAC supply. The WLRSFIS includes the same controller/transmitter electrical components as the WLRSFI, housed in a lockable and vented steel security enclosure (7” x 7” x 4”), and the same receiver.

An optional wind sensor can be connected in series between the RSFI or RSFIS and the clock controller. The wind sensor is a Hunter® Wind-CLIC with a variable setting control, which is set to interrupt irrigation at high wind speeds. Weathermiser also sells a freeze sensor that interupts irrigation when the temperature falls below 37 degrees. Products can be ordered directly from Weathermiser by telephone (505-235-6999). Weathermiser provides a 5-year warranty on all controller devices (including batteries) and a 1-year warranty on the transmitter, receiver and wind sensor.

Installation

The Weathermiser controller devices are mounted on a shady outside surface, free from the influence of irrigation spray, and machinery exhaust. Relative humidity dial settings for major cities are included in the instructions and may require a seasonal adjustment depending on the user's mini-climate and preferences for determining landscape needs. Monthly and yearly settings are available.

Weathermiser reports its systems can be installed by most "do-it-yourselfers" or any landscape professional. The typical first-time installation is estimated to be 1-2 hours, depending on site conditions. Weathermiser product service is offered through a hotline and an internet troubleshooting guide. Field consultations are offered for large commercial and residential installations.

Track Record, Water Savings and SWAT Testing

The maximum relative humidity (RH) and average temperature information is actual weather data from a Western Regional Climate Center weather station. The graph illustrates the Albuquerque, New Mexico daily interrelationship between relative humidity, temperature and precipitation for the month of April.

The rise in relative humidity that precedes precipitation and/or drop in temperature are evident except during the gusty windy period that occurred on the 6th and 10th and the steady windy period that occurred between the 15th and 22st of the month. The relative humidity limit setting is 70 percent and the freeze limit is also shown. The Weathermiser interrupted irrigation on the days the relative humidity and temperature were outside these limits (19 days) and irrigation occurred on the days when the readings were within the limits (11 days).

Track Record, Water Savings and SWAT Testing

Weathermiser reports that over two thousand Weathermiser controllers were installed and water savings were evaluated in the Denver, Colorado and Albuquerque, New Mexico areas. Weathermiser reports the results of these studies indicated an average savings between 34 and 52 percent after four years of formal testing between 2000 and 2004. The water savings for the Denver area were calculated by comparing the water savings of 100 Weathermiser users to that of a 800 control group of typical Denver Water customers having no weather sensing devices applied.

An adjustment factor based on the past 5 year rolling average usage for each of the participants was applied to the water meter readings taken by the Denver Water Company. Based on the results of the Denver Water Board study, which included 12 other products, Weathermiser received a water conservation award by the Denver Water Board. Weathermiser and the Albuquerque Academy won the 2003 New Mexico Green Zia award for its cooperative water conservation efforts.

Weathermiser began developing its weather based controller over nine years ago. Weathermiser's inventor, Alphonse E. Caprio holds a patent for applying differential relative humidity and temperature to control irrigation. Weathermiser reports its product is currently in the SWAT testing process, but a performance report was not available for this report.

Soil Moisture Based Irrigation Control System Principles

All of the soil moisture based products reviewed operate on the principal of scheduling irrigation as a function of soil moisture conditions measured onsite with one or more soil moisture sensors. The concept is for an appropriate amount of irrigation to occur when needed to maintain adequate soil moisture levels.

Landscape soil moisture conditions should be maintained such that root zone moisture levels are between field capacity and the wilting point. Field capacity conditions occur following irrigation or precipitation when the maximum amount of water is retained in the soil after seepage and surface drainage ceases. The wilting point occurs when soil moisture is depleted to the point at which plants wilt without recovery during the night. The soil moisture levels at which field capacity and wilting point occur are a function of soil characteristics.

Soil moisture is typically reported in terms of volumetric soil water content, or as soil tension. Soil moisture content is the ratio of the volume of water in the soil to the volume of void spaces between the soil particles, and is reported as a percentage value. Soil tension is a measure of the negative pore pressure that occurs in the void spaces (increasingly negative as the moisture level drops), and is reported as a negative pressure reading.

Most of the soil moisture based products reviewed function such that a preset irrigation quantity is applied when the measured soil moisture level drops to a threshold point set by the user. Ideally, the irrigation quantity applied replenishes the soil moisture to field capacity with minimal surface runoff and seepage below the root zone (over-watering). Some of the products reviewed begin and end irrigation based on two preset thresholds; the first is set at a moisture level well above the wilting point and the second is set at near field capacity. One product adjusts run times based on soil moisture data. Most of the devices, however, do not automatically calculate total run times or cycle and soak times.

As with the weather based products, some of the soil moisture based systems include a stand-alone controller and others include an add-on device that works with an existing clock-type controller. Regardless of stand-alone versus add-on controller type, some of the devices control the irrigation of all zones based on measurements from one soil moisture sensor. Others control individual zones or groups of zones based on measurements from multiple sensors placed in representative zones.

In general, all of the soil moisture based systems' operate similarly and comparison is more straight-forward relative to that of the weather based systems. Most of the products possess similar components and features. All of the systems reviewed provide potentially effective methods for scheduling irrigation based on soil moisture sensing, which should result in water savings.

Several different types of soil moisture sensors are used with the systems reviewed. In recent years, significant technological advances have been made in the field of soil moisture sensors. In general, the accuracy of all types of sensors has improved and costs have gone down significantly for some types of sensors.

However, all types of soil moisture sensors possess one or more inherent deficiencies that should be considered. Several types of sensors function based on the dielectric properties of the soil, which vary depending on the soil type.

Hence, calibration of these devices is soil specific to varying degrees depending on the specific type of device. Specifically, a factory calibrated sensor may not function accurately for certain soil types and should be field calibrated. Salinity or fertilizer content, as well as temperature, affect the measurement accuracy of some sensors. Certain tensiometer type sensors will not tolerate freezing temperatures and or require maintenance anytime the soil becomes exceedingly dry.

Soil Moisture Based Control Products
Features and Comparison Criteria

Significant product components and features are discussed below. The discussion identifies different methods used to achieve similar results by the various products, and associated advantages and disadvantages.

Soil Moisture Sensor Types
Soil moisture sensors have been used for laboratory and outdoor testing purposes and for agricultural applications for over 50 years. There are many types of sensors, but only those used in the present generation of landscape irrigation scheduling systems are discussed.

Electrical Resistance Granular Matrix – This type of sensor consists of two electrodes embedded in a reference matrix material which is confined within a corrosion-proof and highly permeable case. The matrix material includes gypsum to buffer against the effects of salts and fertilizer, but these sensors do not dissolve like gypsum block sensors. Soil moisture is constantly absorbed or released from the sensor as the surrounding soil moisture conditions change. As the soil moisture changes, the sensor moisture reacts as reflected by the change in electrical resistance between the electrodes.

Reaction time, however, is relatively slow compared to some other types of sensors. As the moisture level increases, conductivity increases and the sensor is calibrated to output the moisture level in terms of soil tension. Calibration is temperature and soil type dependant. This type of sensor has been used in agricultural and landscape applications for approximately 20 years, and their performance is well documented. They are relatively inexpensive and their manufacturer reports a minimum useable life of 5 to 7 years.

Electrical Conductivity Probes – This type of sensor measures soil moisture by how well a current of electricity is passed between two probes (electrodes) that are inserted directly into the soil. As the soil moisture changes, the sensor moisture reacts as reflected by the change in electrical resistance between the electrodes. Reaction time is relatively fast. As the moisture level increases, conductivity increases and the sensor is calibrated to output the moisture level in terms of volumetric soil water content by percentage. Since the probes have direct contact with the soil there is no buffer against salt and fertilizer affects on the measured conductivity. These devices are very sensitive to the spacing of the probes as well as being influenced by soil type, salts and fertilizers. Specifically, bent probes and improper calibration for soil type can result in poor performance. Also, fluctuations in salt and fertilizer levels can affect measurement accuracy/consistency.

Time Domain Transmissometry (TDT) – This type of sensor measures the time required for an electromagnetic pulse to travel a finite distance along steel rods or length of wire (wave guide), and the travel time is dependent of the dielectric properties of the soil surrounding the wave guide. As moisture increases in the soil, the pulse travel time decreases and the sensor's time signal is converted into a volumetric soil water content measurement by percentage.

This technology, which evolved from and is similar to time domain reflectometry, provides high accuracy which is independent of low and moderate salt and fertilizer levels in the soil. The original time domain reflectometry type sensors were expensive and difficult to use. The recently developed time domain transmission devices are less expensive, and more suitable for landscape irrigation applications. The manner in which a TDT signal is processed is unique to its manufacturer and at least one manufacturer has a patented its digital signal analysis process. The significance of the signal processing method, with regard to accuracy and consistency, is beyond the scope of this review and it is recommended the reader research this matter as warranted.

Frequency Domain Reflectometry (FDR or Capacitance) – This type of sensor contains a pair of electrodes (either an array of parallel spikes or circular metal rings) which form a capacitor with the soil acting as the dielectric in between. The electrodes are inserted into the soil or in an access tube in the soil. An oscillating frequency is applied to the electrodes, which results in a resonant frequency, the value of which depends upon the dielectric constant of the soil.

The moisture content changes the dielectric constant of the soil, thereby changing the resonant frequency. The change in frequency is then converted to a soil moisture measurement. FDR sensors which operate at high frequency (greater than 20 mega hertz) are relatively independent of soil salt and fertilizer levels. This type of sensor is especially sensitive to undisturbed soil contact. (See discussion of undisturbed soil contact under the Installation heading below.)

Tensiometers – This type of sensor measures the soil moisture tension, or negative pore pressure, as it changes with soil moisture content. Tensiometers operate by allowing the soil solution to come to equilibrium with a reference pressure indicator through a permeable ceramic piece that is in contact with the soil. A vacuum gauge measures the soil moisture tension and high tension reflects low soil moisture. Tensiometers accurately measure wet soil moisture levels independent of salt and fertilizer levels, but are less accurate for dry soils. They can require maintenance to refill the tensiometer with liquid and maintain the integrity of the soil/ceramic tip interface. (This typically occurs only when the soil dries beyond the wilting point.) Some tensiometers must be removed from the soil during winter months in northern climates where the soil freezes.

Installation

All of the soil moisture system manufacturers recommend professional installation and programming of their commercial products, and report that installation and programming of their residential models can be done by a nonprofessional.

Based on discussions with third party individuals with experience installing most of the reviewed residential models, it appears homeowner installation may not be a realistic option with certain products. The degree of difficulty to install any of the products can vary significantly depending on site specific conditions. A significant factor is the soil moisture sensor wiring configuration.

Some sensors are connected to the existing nearby valve wiring, and some must be connected to the controller with potentially long runs of new wiring. Wiring the sensors to the irrigation valves should be easy in most cases, but the ease of connecting to the controller depends on site specific conditions (distance, obstacles, etc.). It is difficult to determine what percentage of homeowners successfully install and program the various residential products.

Installation and programming instructions are available for some of the products at their websites. All potential customers should review this information when shopping for a device regardless of whether they plan to do their own installation and programming.

Additional installation issues to be considered are associated with the placement of the soil moisture sensor(s) in the root zone. A soil moisture sensor should be in contact with relatively undisturbed soil that is representative of the irrigated landscape. Contact with disturbed soil with a higher void space ratio may result in soil moisture readings that are not representative of the landscape.

Some sensor types are more sensitive to this than others. Therefore, the sensor shape and method of placing the sensor with regard to undisturbed soil contact should be considered when comparing systems. Installation of the sensor may also result in disturbance of the turf root system and affect the health of the turf for a period following installation. This may cause the soil moisture in the vicinity of the sensor to be higher than typical due to reduced ET by the disturbed turf until it “heals”.

Stand-alone Versus Add-on Controller

The controller component for most of the soil moisture products reviewed is an add-on device which works with an existing clock type controller. The other products include a stand-alone controller with many of the features of typical clock type controllers. In some cases, the cost of the add-on device is a significant attraction. Regardless of cost, the quality of an existing controller should be a factor when considering replacement with a stand-alone control device. If the existing controller is a high quality unit with adequate features, an add-on device may be an attractive alternative.

The primary stand-alone controller features which should be considered include: automatic scheduling, number of programs and start times, cycle and soak, master valve circuits, compatibility with other sensors (rain, flow, temperature, wind, etc.), remote control, and system testing capabilities.

Irrigation Schedules and Run Time Calculation and Adjustment
Most of the devices reviewed do not automatically calculate irrigation run times, although some adjust user-entered run times based on soil moisture measurement data or control run times with on and off soil moisture thresholds. None of the soil moisture sensor devices automatically calculate cycle and soak times. Some manufacturers (stand-alone and add-on) provide guidelines or computer programs to assist the user in calculating total run times and cycle and soak times. The product descriptions identify the manufacturers that provide guidelines or computer programs for determining appropriate run times and cycle and soak times.

Single Versus Multiple Soil Moisture Sensors
Most of the residential systems reviewed use one soil moisture sensor to control operation of the entire system, and varying zone conditions are accommodated for by adjustment of run times. For complex residential landscapes and commercial systems, some systems have the capacity to use multiple sensors to control a single valve or groups of valves. For complex systems, the user should consider the sensor capacity of the controller. In some cases, multiple controllers with single sensor capacity can be used to build a multiple sensor system. Some of the multiple sensor controllers allow for bypassing the soil moisture control mode and running in clock mode by station. All of the products reviewed will allow for system-wide clock mode operation.

Soil Temperature and Conductivity Measurement and Display
Some of the sensors included with the products reviewed measure soil temperature and conductivity in addition to soil moisture. Soil temperature is necessary for calibration of the soil moisture measurement by certain types of sensors. Some of the controllers allow for display of the temperature and conductivity measurements. Display of the conductivity measurements is a significant feature for users irrigating with wastewater effluent or water that contains high levels of salts in order to know when to flush the soil. When the user is informed that the salt levels in the soil have reached a critical point based on the conductivity readings, the landscape should be irrigated heavily to leach (flush) the salts to below the root zone.

Soil Moisture Sensor Accuracy and Calibration
As previously discussed, the measurement of soil moisture by some sensors is affected by soil type, temperature and salinity. All of the sensor products reviewed are factory calibrated to measure moisture content for a spectrum of soil types. The manufacturers typically report a level of accuracy that is good for a range of soil types. In some cases, the accuracy may vary

significantly for the different soil types. Also, the accuracy may be inconsistent for different moisture, temperature and salinity levels.

For the purpose of landscape irrigation scheduling, the consistency of a sensor is as important as, or more so, as its accuracy. For practical purposes, the user of a sensor based landscape irrigation control system typically performs a quasi-calibration of the sensor during set-up. This is accomplished when the user observes the moisture level reading that occurs with the soil at field capacity.

Regardless of the accuracy of the reading, the user typically sets the irrigation trigger moisture level as a percentage of the field capacity reading. If the sensor does not read consistently, the percentage relationship between field capacity and the irrigation trigger will be affected. As an example, if a sensor reads 36 percent at field capacity and the user wants to set the irrigation trigger at 50 percent of field capacity the controller would be set to irrigate at a reading of 18 percent if the sensor reads consistently. If the sensor does not read consistently, the controller would need to be set to irrigate at a reading higher or lower than 18 percent.

Power Supply and Surge and Lightning Protection

Most of the controllers and devices operate on 24 VAC and few are battery powered. The stand-alone devices typically include a power transformer that converts 110-120 VAC to 24 VAC. The transformers are either hardwired inside the controller cabinet (internal), or plugged into a power outlet (external). The add-on scheduling devices that operate on 24 VAC either receive power from the existing clock/controller or from an external transformer. Most of the transformer devices include some type of current overload protection such as a fuse or breaker switch. Some of the controllers include lightning and or surge protection, or offer these as an optional feature. Surge and lightning protection limits damage to the controller's circuitry from transient voltage and current from the power source (surge) and from the valve circuits (lightning).

Station Circuit Rating, Wiring and Terminal Wire Sizes

The compatibility of the existing electrical circuits (wiring from the controller to the station valves) should be considered in the selection of a stand-alone controller. If the station wire terminals on the controller will not accept the existing wire, adapters must be used. Also, the circuit current capacity required for an existing system should be checked prior to installing a new unit.

Installation problems associated with insufficient circuit capacity to operate some irrigation valves with high circuit resistance are a possibility. The traditional wiring system (circuitry) used for most controllers consists of a common and a dedicated wire from the controller to each valve and sensor. Some controllers utilize "2-wire" circuitry that consists of a single pair of wires connected to all of the valves and sensors in the system. These systems require the installation of a decoder device for each valve and sensor. Applications include large systems and linear systems (e.g., highway corridors) with large quantities of wiring required for traditional circuitry.

Warranties and Reliability

All of the products reviewed include a warranty. Warranty details are discussed in the product descriptions section. In some cases, the manufacturers' warranty periods vary for its different products. Although the warranty periods may or may not be indicative of the life expectancy of the products, in some cases there appears to be a correlation between the cost and overall quality of the product to the warranty period. It is assumed the cost of a product somewhat reflects the quality of the construction materials and electronic components. Hence the less expensive residential devices should not be expected to last as long and function as reliably as the more expensive residential and commercial products. Since most of the devices are relatively new products, it is difficult to speculate on how long they should last.

Soil Moisture Based Product Descriptions

The following product descriptions address operational characteristics and features, and include discussions of available information from demonstration and pilot studies relative to documented water savings and operation. Each of the manufacturers were provided copies of the product descriptions for input prior to being incorporated into this report.

Acclima

Acclima, Inc., of Meridian, Idaho, manufactures soil moisture sensor based landscape irrigation control systems. Acclima began development of its system components in 1997, and Acclima products entered the market in 2003.

Acclima's sensor technology is sold throughout the U.S., Europe, South Africa, Asia and Australia. Acclima Closed Loop Irrigation® systems are governed by real-time root zone soil moisture content as measured by its patented Digital TDT® absolute soil moisture sensor. The Acclima sensor is the industry's only digital process time domain transmissometry soil moisture sensor.

Acclima reports its digital process sensors measure the absolute soil moisture content regardless of changing soil types, electrical conductivity and temperature. All systems accommodate one or more soil moisture sensors and either an add-on or stand-alone controller. Controllers suitable for all residential and commercial applications are available.

Sensor Description and Operation

The heart of all Acclima irrigation systems is the sensor. The sensor dimensions are 8" x 2" x 0.5", and the sensor is constructed of Type 316 stainless steel rods and electronic components embedded in moisture-resistant epoxy resin molded in heavy duty plastic. Sensor rods are electrically isolated from the circuit board to prevent galvanic corrosion and each sensor includes lightning protection. Sensors are buried in the soil among the active rootlets of turf, trees and shrubs. The sensor reports the moisture content to the controller via the same wiring used for valve control in resolution of tenths of one percent. A typical residential installation employs one sensor. Commercial systems typically use multiple sensors, one for each microclimate or landscape vegetation type. Various zones may be programmed to track any sensor.

Acclima reports its patented Digital TDT sensor is unique because it provides *absolute* percentage volumetric water content whereas other sensors provide only *relative* moisture data.

The sensor generates a unique high frequency pulse along the sensor rods with a sampling interval of 5 picoseconds -- the time required for light to travel 1.5 millimeters. This high speed sampling minimizes the dielectric relaxation properties found in clay soils. Acclima reports this characteristic, combined with its patented digital analysis process, produces superior stability and accuracy in all soil types. The Acclima sensor can detect the addition of 0.002 inches of water to 4 inches of soil, yielding maximum water savings.

Upon installation, the soil surrounding the sensor is doused to saturation and then allowed to percolate to field capacity. A sensor reading is taken at this time to determine the unique field capacity of the microclimate and the irrigation threshold is calculated. All Acclima irrigation controllers use the Digital TDT sensor as a “closed loop” feedback mechanism in controlling the irrigation process. The controller polls the sensor for accurate soil moisture readings; if the sensor returns a reading below the irrigation threshold, the system will intelligently replace only the amount of moisture lost through ET since the last irrigation cycle. Thus, root zone moisture levels are perpetually maintained at user-specified levels, resulting in optimized economy and healthier landscapes.

Controller Description, Prices and Warranty

Acclima offers a variety of control devices suitable for any application. All standalone Acclima controllers allow multiple sensors with highly flexible programming. On all models, volumetric soil moisture content is displayed from 0 to 100 percent. Soil temperature is displayed in degrees Fahrenheit or Celsius and soil conductivity in dS/m (10-1 Siemens per meter).

Acclima’s Suspended Cycle® systems are programmed just as a standard irrigation clock. When the programmed time arrives, the system polls the sensor to see if irrigation is allowed. If not, the cycle is suspended; if water is required, irrigation takes place. Acclima’s Water on Demand® systems require no programming whatever. The user enters the irrigation threshold, specifies times when irrigation is *not* allowed, and the system irrigates only as needed, without any programming.

The Acclima RS500 is an add-on controller that supports most existing clock type controllers. It sets, maintains and monitors any desired moisture level by suspending an irrigation cycle when there is sufficient moisture in the soil. The sensor is linked to the controller through the existing wiring for the valve irrigating the sensor location. Sensor readings are periodically transmitted to the controller. When the programmed existing timer prompts an irrigation cycle, the RS500 first checks the moisture level and either allows or suspends the cycle, depending on the moisture level.

The RS500 includes a Moisture Control ON/OFF switch to by-pass the controller if necessary. Moisture readings continue, but there will be no interruption of the programmed cycles. Also, one or two zones may be operated by the existing controller independent of interruption by the RS500 to assure special zones such as xeriscape or newly-seeded areas receive appropriate moisture. The RS500 cabinet dimensions are 4.5” x 2.4” x 1” and it is suitable for indoor installation. The 24V power supply comes from the existing controller or external transformer. Each RS500 is sold with a Digital TDT soil moisture sensor.

The Acclima SC Series Controllers are stand alone Suspended Cycle control units. It is available in 6, 12, 24 and 36 zone configurations and in two cabinet models. These controllers employ standard zone wiring with typical programming processes.

The Acclima SC6/12 controller is designed for residences and light commercial applications with up to 12 zones.

The controller has an LCD display and accepts as many sensors as there are zones. The controller’s programming features include timer or sensor control; simple push-button control; pre-set factory default schedules including, sod, new seed, rotors and spray pop-ups; three independent programs with six start-times each; automatic threshold set-up; non-volatile program memory which preserves programming during power and battery failures; program and circuit test modes; zone error reporting; master valve/pump start capability; rain sensor/accessory terminal and enhanced surge protection.

This controller has an exterior 24V transformer and includes a weatherproof cover, making it suitable for outdoor mounting. The Acclima SC24/36 controller uses traditional valve wiring with four available programs and six start times. Each controller accommodates as many sensors as it has zones, and each sensor adds a new program to the controller. For multiple sensor set-up, each sensor is connected to the valve for each reference zone and sensor readings are transmitted to the controller via the valve wiring.

Zones without sensors are assigned to a reference zone and irrigation occurs based on the soil moisture measured in the reference zone. Unique soil moisture thresholds may be programmed for each reference zone. The controller may be operated in automatic soil moisture based, timed or manual modes. Up to 4 zones, plus a master valve circuit, may run concurrently, dependent on system water volume capacity.

Multi-zone watering may be configured per-zone based on the water usage of that zone versus available water. This may be done automatically when a flow meter is attached to the system, or the configuration can be adjusted manually at any time. These controllers support rain, wind, and freeze sensor inputs to shut off the water when weather does not permit irrigation. Flow meter support checks for broken pipes and valves. Connection of a flow meter requires an interface device manufactured by Acclima.

The controller's calendar/clock automatically compensates for leap years. The clock can be maintained for up to 2 months without power using 2-AA alkaline batteries. The non-volatile program memory maintains configuration information even if the power fails and the batteries are dead. Watering day schedules include Custom, Every Day, Odd Day, Even Day, Every nth Day watering (where n may range from 3 to 31). Zone stacking ensures that all zones will eventually be watered even though program start times may overlap. Other features include soak/cycle, valve circuit test, programmable pause, rain delay (0-14 days) and water budget adjustment (5 to 500 percent). Remote control is available with optional hand-held radio and interface devices.

The controller cabinet measures 12.3" x 10" x 5.9" and is weather resistant extruded ABS plastic, suitable for outdoor installation. The internal power transformer includes over-under detector that automatically detects loads exceeding 2.1 amperes and over-load backup fuse (slow-blow, self-healing fuse: 2.5 A). Station circuit capacity is 0.6 amperes. The controllers possess surge and lighting protection consisting of the following:

- Input: Transient voltage suppressor (TVS)
- Common Wires, Signal Ground: 5,000 Amp gas discharge tube to earth ground
- Each Terminal: Metal oxide varistor (MOV)
- Earth Ground Terminal: Up to #6 copper wire to divert surges to ground

The Acclima CS 3500 controller is a Water on Demand® device operating over a 2-wire communications line, saving copper and allowing flexibility for system modification. Up to 60 sensors may be used with this 64 zone system. The controller operates without programming. The user identifies blocks of time when irrigation is restricted, and sets an upper and lower irrigation threshold.

Water is applied when the sensor reports moisture below the lower threshold and will irrigate until the upper threshold is reported. The 2-wire circuit requires valve adapters (decoders) to establish the 2-wire communications bus to valve interface. These adapters contain electronic switches that apply power to the solenoid valves upon command from the controller. Acclima sensors also contain a single electronic switch so that there is no need for a valve adapter when a sensor is installed in the valve circuit.

The CS3500 offers features similar to the Acclima SC Series, and has central control capabilities using the Acclima Irrigation Manager™ software and advanced communications capabilities through serial cable, dial-in modem, cell phone or radio communications. The clock can be maintained for up to 10 years without 24 volt power using a CR2032 battery. The CS3500 cabinet is the same size and material as the SC24/36 and is suitable for exterior mount. Surge and lightning protection are also similar to the SC24/36. Acclima products may be purchased through distribution by referring to the Acclima website, www.acclima.com or by contacting Aquarius Brands, Inc. of Ontario, California. Acclima products carry a 2-year warranty.

Installation

Detailed installation instructions, manuals and videos are available on the Acclima website. Acclima reports the RS500, SC6 and SC12 controllers may be installed by homeowners, but recommends professional installation of the SC24, SC36 and CS3500 control systems.

Track Record and Water Savings

The accuracy of Acclima's Digital TDT soil moisture sensor is well documented by independent laboratories, and their patented irrigation systems have been tested and researched by numerous academic institutions. Acclima's sensor technology was first evaluated by the Center for Irrigation Technology in 2003.

Since then, dozens of independent university studies have validated unprecedented savings of water and fertilizer. Acclima reports average water savings are approximately 30 to 40 percent. Acclima submitted their technology for independent verification before placing their products on the market. Testing entities include the following:
University of Arkansas New Mexico State University Oregon State University University of Tennessee University of Florida Brigham Young University
Utah State University California State University, Fresno

Information on the above testing and research, and certain study report documents are available on Acclima's website.

Agrilink

Agrilink Holdings Pty Ltd is a manufacturer of irrigation management products headquartered in Adelaide, South Australia. Agrilink has been in business since 1997 and has U.S. offices in Santa Rosa and Santa Ana, California. Agrilink supplies a range of soil moisture sensing products and a specific soil moisture based landscape irrigation scheduling device. The AquaBlu® soil water regulator was introduced by Agrilink in December 2006. This device works with any 24VAC clock-type controller to schedule irrigation based on soil moisture sensor input from an Agrilink AquaBlu Sensor.

Sensor Description and Operation

The AquaBlu Sensor is a capacitance (or FDR) type soil moisture sensor. It is a fully sealed double sided “paddle” shaped sensor made from ABS plastic. The sensor has overall dimensions of 7.5" x 2.8" x 0.5". The AquaBlu Sensor comes with 16 feet of multicore cable for connection to the regulator. The soil moisture signal and power supply for the sensor are transmitted through the cable. The cable can be extended up to 90 feet without signal degradation using conventional multicore irrigation cable (4 cores are required). Further distances (up to 660 feet) can be covered using specialized cable available from Agrilink.

Agrilink recommends installing the sensor using a flat spade to slice a groove in the soil to the required root zone depth. The sensor is inserted into the groove and the surrounding soil is pressed in from both sides of the sensor to ensure complete contact around the sensor.

The AquaBlu system interrupts irrigation when soil moisture exceeds the threshold set by the user. Irrigation is interrupted immediately as opposed to interrupting before the next cycle. A base irrigation schedule is programmed into the clock type controller by the user which typically would irrigate every day without interruption imposed by the AquaBlu regulator.

The total run times and cycle and soak times programmed into the clock controller must be calculated by the user.

Controller Description, Prices and Warranty

The AquaBlu regulator has two parts, a body and an opaque dust cover. It is designed to be wall mounted indoors in the vicinity of the clock controller, and can also be mounted outdoors or within a valve box if placed in a watertight housing. The body is made of ABS plastic and its overall dimensions are 6.5" x 3" x 1". The irrigation interruption threshold is set with its dial type adjustment component and two LED indicator lights show power and interruption status. The system can be powered by either AC or DC, at 9V to 14V at 100mA with a maximum power consumption of 1W. Agrilink’s optional “Line Regulator (24V to 12V)” can be used to convert from the clock controller’s 24VAC supply or an optional “AC power pack” can be used.

The soil moisture threshold adjustment dial has settings corresponding to the spectrum of soil types over a 270 degree control range. Confirmation that the AquaBlu is powered on is provided by a green LED. Indication of soil moisture being at or over the set point is provided by a red 'superbright' LED.

AquaBlu updates soil moisture readings once every second. This allows for the setup of the selected soil moisture point on the regulator to be intuitive and instant. When selecting the desired moisture point with the dial on the regulator, the red 'superbright' LED will come on and correspond with the current soil moisture content without waiting a day for a response.

For a simple residential installation, a single AquaBlu system is installed. The AquaBlu can be connected to the 'sensor' input on most modern clock controllers to cancel irrigation across all zones when soil moisture is sufficient. Alternatively (for older controllers that do not have a 'sensor' input) the AquaBlu is connected to interrupt the valve common wire within the controller.

Multiple AquaBlu devices can be used to control irrigation for different zones or groups of zones. This is achieved by connecting the AquaBlu to interrupt the active valve wire for a single zone or to interrupt a common valve wire for a group of zones. A typical split would be to use one AquaBlu for lawn areas and another for garden areas. The listed retail price for the AquaBlu Soil Regulator, including the AquaBlu Sensor, is $139. The optional “Line Regulator (24v to 12v)” and optional “AC power pack” are $10 each. Agrilink warranties the AquaBlu for 2 years.

Installation

Agrilink recommends professional installation by a contractor with an understanding of where to best locate the sensor(s) and how to adjust the AquaBlu based on soil conditions. Installation time will vary according to how much digging is required to install the cable. If this is completed during irrigation system installation, minimal additional time is required. Agrilink reports it takes about 15 minutes to install the AquaBlu and wire it to the clock controller, and that a homeowner with some basic skills could retrofit an existing clock controller with an AquaBlu in under an hour if minimal digging is required.

Track Record and Water Savings

Agrilink submitted information for this review showing how multiple AquaBlu devices tracked soil moisture levels at the Townsend House (Adelaide, South Australia) demonstration project. Data collection for the demonstration project began in early 2007, with initial results being positive. Soil moisture was measured with a commercial probe (AquaSpyTM Turf Probe) documenting the current irrigation practice for a period of time before the AquaBlu was engaged. What followed was the documentation of the reduction of the number of irrigations when the clock controller was interrupted by the AquaBlu after it was engaged.

There were 14 irrigations prevented out of a possible 20 irrigations that were scheduled by the clock controller during the time the AquaBlu was active. Irrigations were also prevented over the period in response to minor and major rainfall events while the soil moisture was still adequate for viable plant and turf growth.

Timed irrigation events that would have normally occurred by the irrigation timer and were switched off by the AquaBlu are indicated by the red arrows.

The locations of twenty other commercial installations were also provided. No other information on the product's track record or water savings studies was available, which is understandable for such a new product.

Baseline

Baseline, LLC, located in Boise, Idaho, manufactures soil moisture sensor based landscape irrigation control systems. Baseline began business in 1998, and its first soil moisture sensing products entered the market in 2002. Its systems include add-on and stand-alone controllers, as well as centralized control systems.

The Baseline irrigation control systems are based on real-time soil moisture content as measured by Baseline's patented biSensorTM TDT (time domain transmission) soil moisture sensor. All systems (non-centralized) function with one or more soil moisture sensors that are offered with three controller options: a stand-alone controller, an add-on controller that interfaces with an existing clocktype controller, or a computerized system of multiple stand-alone satellite controllers. Baseline manufactures systems that are suitable for both residential and commercial applications.

Sensor Description and Operation

The biSensor comes in three models: a 6-inch rigid sensor used with the S100 controller, a 1.5-foot rigid sensor and a 5-foot flexible sensor. All measure the volumetric soil moisture content near the sensor. The sensors are buried in the root zone, and transmit soil moisture and temperature information to the controller via the same wiring used for valve control. A single sensor can control multiple irrigation zones. A typical residential system includes just one sensor. A commercial system may use numerous sensors associated with various microclimates or landscape types. Baseline recommends installation in a v-shaped trench to minimize soil disturbance where contact is made to the sensor.

The biSensor is constructed of corrosion-resistant fiberglass. The biSensor functions by sending an electronic pulse along an imbedded wire path. The wire is embedded in fiberglass providing desired characteristics by not being in contact with the soil, but the speed of the pulse is delayed by the soil's water content. The higher the water content, the slower the pulse moves around the biSensor.

The biSensor measures the pulse speed to determine the amount of water in the soil. biSensors can reportedly resolve the travel time in increments as small as 10 pico seconds. Baseline's biSensors measure distortion caused by salts and temperature changes and adjust moisture readings accordingly. All sensorrelated electrical components are insulated from the soil, including the actual sensing elements.

Controller Descriptions, Prices and Warranty
Baseline's controllers include one add-on model and four stand-alone models. Three of the stand-alone controllers utilize two-wire valve control wiring and the other supports conventional valve wiring. The add-on model is designed for use with a single biSensor and functions with any clock/controller.

The standalone models can be connected to multiple biSensors. All of Baseline's controllers are rain sensor compatible and have a bypass feature that disables the soil moisture based control. The soil moisture reading for all controllers is displayed as volumetric water content from 0 to100 percent. The stand-alone models include an internal power transformer and the add-on models power supply is from the clock/controller or from an external transformer. The standalone controllers operate on Baseline's Time/biSensor control system allowing for several smart watering strategies from fully automatic to timer type controls and many options in-between.

The Baseline WaterTecTM S100 controller is an add-on device for use with an existing clock/controller and a single biSensor. The S100 cabinet is constructed of heavy duty plastic and is available in an indoor model. Its dimensions are 5.8" x 2.6" x 1.5" and it has a 3-character, one line LCD display and touch pad type controls. The S100 comes with a 6-inch biSensor soil moisture sensor.

Guidelines for performing a site audit and determining appropriate total run times and soak and cycle times are available from Baseline for programming the clock/controller connected to the Watertec S100. The BaseStation 3000R is a stand-alone commercial controller supporting new or existing conventional irrigation wiring and scales from 12 to 200 zones. Baseline biosensor moisture sensors may be connected directly to existing valve lines for existing (or new) sites. The BaseStation 3000R also includes a two-wire expansion port, which allows system expansion using either conventional wiring or two-wire.

The 3000R offers 10 programs with 8 start times for each program. The user programs a base schedule and then the total run times are adjusted by the controller based on its evaluation of soil moisture data. (Guidelines are provided for determining an appropriate base schedule.) Other features include day interval calendar, event scheduling, self-test diagnostics and adjustable soak cycles. The 3000R is remote access capable with Baseline's Base Manager™ computer software package. The 3000R is available in lockable indoor wall mount and outdoor pedestal models. The wall mount cabinet is constructed of powder coated steel, and its dimensions are 12" x 10" x 4". The pedestal cabinet is constructed of stainless steel and its dimensions are 36" x 17.5" x 12.5".

The controller face includes a dial and touch pad controls. The controller's 3.5-inch QVGA display provides 240x320 resolution. The Base Station BL3000 is a stand-alone commercial controller with two-wire biLine™ valve wiring configuration. The two-wire system requires the use of biCoder™ devices at each valve to convert the two wire signal to power and control the valve.

The BL3000 has 200 zone and 25 biSensor capacities. This controller offers the same features of the BL3000R including 10 programs with 8 starts and an event scheduling feature that allows for restrictions for future events.

Also, the user has the option of setting the controller to adjust run times or run frequency. The BL3000 is available in wall mount or pedestal cabinets of the same construction and sizes as the BL3000R. Baseline products are available from its distributors, and a distributor list is available at the Baseline website (www.baselinesystems.com). Baseline controller products have a 1-year warranty (with ability to extend up to 5 years) and the biSensors have a 5-year warranty.

Installation

Although Baseline recommends installation by a landscape professional, it reports the S100 can be installed by most homeowners. The reported average homeowner installation time is about an hour.

Track Record and Water Savings

Although no information was submitted for this report on formal studies and testing, Baseline submitted documentation from numerous customers reporting significant water savings (30 to 50 percent) resulting from installation of Baseline systems.

Calsense

As discussed in the Weather Based Product Descriptions section, Calsense manufactures water management systems for large commercial customers. The Calsense Model 1000-S soil moisture sensor measures and transmits soil moisture readings to a Calsense ET2000e irrigation controller to provide efficient landscape irrigation. The ET2000e will automatically suspend irrigation when the soil moisture level is above the threshold set by the user. A full description of the ET2000e and its features is included in the Calsense discussion in the Weather Based Product Descriptions section.

Sensor Description and Operation

The 1000-S is a solid-state tension-meter type soil moisture sensor that provides consistent long-term soil moisture readings to the Calsense irrigation controller. The moisture sensor electronics are encased in epoxy and the sensor is constructed of heavy duty plastic. There is no maintenance or calibration required for the life of the sensor. The 1000-S readings are unaffected by temperature, salinity or changes in soil pH. The sensor's dimensions are 6.4" x 1.9" x 1.6".

The 1000-S is installed in the root zone and is connected to the valve that controls the area where the sensor is located. Soil moisture data are transmitted to the irrigation controller via the valve control wiring. Special wire runs between the irrigation controller and the sensor are not necessary. The only additional wiring required is between the valve and the 1000-S sensor. The total combined maximum wire run between the moisture sensor and the irrigation controller is 3,000 feet. Calsense reports that maintenance of the 1000-S is only required when the soil becomes extremely dry, requiring the device be removed and soaked and then placed into moist soil. If the soil freezes, removal is not required.

The Calsense ET2000e controller, using the sensor to measure available water in the pore space of the soil, makes a decision before the start of each cycle/soak run whether or not to apply water. This decision is based on the actual moisture reading compared to the user-input moisture set point.

Total run times and cycle and soak times are included in the base program entered by the user, based on field knowledge and soil moisture content for the time of year.

A 1000-S is connected to a representative station for each different climatic and plant material zone, which is defined as a master station. Slave stations are stations without sensors and are assigned to a master station that shares similar water requirements. The user chooses groups of stations controlled by the same sensor during initial setup. Stations can be easily changed or moved from one sensor to another through user friendly programming. Calsense recommends a general guideline of one moisture sensor per four active valves to cover varying moisture needs. Up to one soil moisture sensor per every valve may be connected using the ET2000e controller.

Controller Description, Prices and Warranty

The 2000e features are discussed in more detail under the Calsense portion of the Weather Based Products section. Calsense products are available from many distributors located throughout the U.S. A list of these distributors is available from Calsense upon request (800-572-8608 or www.calsense.com). The current retail price for the 1000-S is $199. It has a 5-year warranty. The price range for the various ET2000e models is from $1,290 to $3,680, as detailed in the Calsense discussion in the Weather Based Products section. Calsense provides technical support at no-charge to assist in the proper installation of the moisture sensors for the most efficient system.

Installation

Calsense recommends professional installation of the ET2000e and installation time varies significantly depending on site conditions.

Track Record and Water Savings

Although Calsense has not participated in any outside studies or demonstration projects, its track record speaks for itself. During Calsense's 20 years of existence, they have developed a large data base on its products' performance and customer success.

Dynamax

Dynamax, Inc. manufactures a wide variety of products used for water status applications, water cycle measurement, plant-water relations, carbon flux instruments, as well as weather stations. Dynamax is located in Houston, Texas and has been in business for 20 years. Distribution of its soil moisture based landscape irrigation control systems began in 1999.

Dynamax offers two add-on systems and a third system that works as an add-on or stand-alone device. The Moisture ClikTM (IL200-MC) and the Moisture SwitchTM (IL200-MS) are add-on only devices that function with newer model non-mechanical clock type controllers. Dynamax's Data Logger/Irrigation Monitor (GP-1) can function as a stand-alone controller or as an add-on device. All three systems utilize the Dynamax SM200 soil moisture sensor.

Sensor Description and Operation
The SM200 is a frequency domain reflectometry (FDR) type of dielectric sensor that measures volumetric soil moisture content from 0 to 60 percent with a Dynamax reported 3.0 percent accuracy. The SM200 soil moisture sensor consists of a waterproof housing that contains the electronics and two sharpened stainless steel rods that are inserted into the soil. The rods are threaded and may be removed from the housing for replacement if damaged or bent.

Each SM200 is adjusted during manufacture to provide a consistent output when measuring media of known dielectric constant, making them readily interchangeable without system re-calibration. Specifically, Dynamax reports soil temperature effects and low to moderate salt and fertilizer (conductance levels below 2,000 micro siemens) effects are negligible.

The overall length of the sensor is 5.4” and the housing diameter is 1.6”. It comes with 85-feet of 4-wire cable. The SM200 is installed into the root zone by pushing the rods into the wall of a shallow trench, resulting in contact with relatively undisturbed soil. The sensor cable is connected to the irrigation scheduling device.

The SM200 is designed to measure volumetric soil water content using a novel technique that the manufacturer reports matches other methods, such as time domain reflectometry, for accuracy and ease-of-use, while reducing the complexity and expense. A simplified standing wave measurement is used to determine the impedance of a sensing rod array and hence the volumetric water content of the soil matrix.

The SM200 applies a 100-megahertz sinusoidal signal via a specially designed transmission line to a sensing array whose impedance depends on the dielectric constant of the soil matrix. Because the dielectric constant of water (80) is significantly greater than that of the other soil matrix materials (3-4) and of air (1), the dielectric constant of the soil depends primarily on soil water content. The signal frequency has been chosen to minimize the effect of ionic conductivity.

Controller Descriptions, Prices and Warranty
The Dynamax add-on only systems (Moisture Clik and Moisture Switch) regulate irrigation by continuously monitoring the soil condition at the sensor, and interrupting the clock controller schedule when enough water is available in the root zone. As soon as the soil dries out below the user programmed set point, an internal switch closes the signal to the clock controller to

irrigate. The clock controller to which the device is connected operates as programmed by the user to replenish the depleted soil moisture. The Dynamax owner's manuals include information regarding appropriate run, cycle and soak times. The GP-1 Irrigation Monitor controls irrigation frequency and run times automatically with on and off soil moisture triggers that are programmed by the user.

The Moisture Clik and Moisture Switch devices come with normally open, and separate hot or neutral outputs providing for several connection options. Specifically, a single Moisture Clik or Moisture Switch controller may be connected to the existing clock controller such that one Dynamax controller and soil moisture sensor will control all stations or multiple Dynamax controllers and sensors may be used to control groups of stations, or individual stations. The Moisture Clik is recommended for residential and smaller commercial applications.

It is typically connected to a clock controller to control and regulate all valves, and up to 3 valves may operate simultaneously. The Moisture Clik controller may also be used where multiple sensors are desired for individual soil moisture control of one or more stations. However, only one SM200 soil moisture sensor may be attached to each individual Moisture Clik. The Moisture Clik may be programmed using its dial settings based on soil type and the desired allowable soil moisture depletion level. Alternatively, advanced users may verify sensor settings and measure soil moisture field capacity with a voltage meter to improve performance.

The Moisture Clik controller cabinet is constructed of polycarbonate and ABS plastics, and is rated for indoor or outdoor installation. Its dimensions are 4.6" x 4.6" x 2.4". The 24 VAC, 3 amperes power supply is either from the clock controller or from an external transformer. (Dynamax recommends using its optional external transformer.) It possesses a 3 ampere input fuse and 0.5 ampere internal fuse. Approximately 6-foot of minimum 12 gauge wire is required to connect the Moisture Clik to the existing controller.

The Moisture Switch controller features are suited for large landscape applications where simultaneous control of multiple valves is necessary. It is typically connected to a clock controller to control and regulate all valves, and up to 10 valves may operate simultaneously. Multiple Moisture Switch controllers may be used where multiple sensors are desired for individual soil moisture control of stations. However, only one SM200 soil moisture sensor may be attached to each individual Moisture Switch. The Moisture Switch requires the use of a standard voltage meter for installation and programming.

The Moisture Switch controller cabinet is constructed of fiberglass reinforced polycarbonate plastic, and is rated for indoor installation only. Its dimensions are 5” x 3.5” x 3”. The 24 VAC, 10 amperes power supply is either from the clock controller or from an external transformer. (Dynamax recommends using its optional external transformer.)

The Moisture Switch possesses a 10 ampere input fuse and 1.0 ampere internal fuse. Approximately 6-foot of minimum 12 gauge wire is required to connect the Moisture Switch to the existing controller.

The Moisture Switch includes an alarm display and a terminal for connection of an external alarm mechanism. As discussed above, installation of the Moisture Switch requires the use of a voltage meter to determine the irrigation set point.

Dynamax’s GP-1 Data Logger/Irrigation Monitor is a more sophisticated commercial product with numerous applications, including use as a stand-alone or add-on landscape irrigation scheduling device. One or two SM200 soil moisture sensors may be connected to it, and it has terminals for up to two temperature sensors, a flow sensor and a rain gauge. It also has a terminal for connection of an external alarm mechanism. The GP-1 has several unique features, including two soil moisture level thresholds for irrigation on and off.

As a stand-alone controller, the GP-1 can be programmed to initiate continuous irrigation at a prescribed soil moisture level and then discontinue irrigation at a second soil moisture level. This is best suited for precision irrigation applications and or drip irrigation systems. As an add-on device, irrigation frequency and total run times are controlled automatically by utilizing the two soil moisture level set points. When the soil moisture drops to the first trigger, irrigation run and soak cycles are initiated.

The cycles are discontinued when the second soil moisture level is measured. With the GP-1 connected to a clock controller, it will control and regulate all valves with one SM200 sensor or two groups of valves with two sensors. Up to 10 valves may operate simultaneously, and multiple GP-1 units can be used to control individual valves or groups of valves as with the other devices.

The GP-1 is constructed of polycarbonate and ABS plastics and is suitable for outdoor installation. Its dimensions are 5.5” x 4.1” x 1.8”. The GP-1 operates on 11-24 VDC power from batteries (alkaline or lithium) or an external transformer.

Approximately 6-foot of minimum 12 gauge wire is required to connect the GP-1 to the existing controller. The GP-1 is programmed using a personal computer or a personal digital assistant (PDA) device. Programming software is included with the GP-1 and an optional PDA and PDA kit is available. (Moisture Clik, Moisture Switch and GP-1 prices include one SM200 soil moisture sensor, cable and owner's manual.)

Dynamax products may be ordered directly by contacting the sales department through their website (www.dynamax.com) or toll free telephone (800-896-7108), and through its distributors and irrigation design consultants. A distributor search engine is also available at its website. Dynamax provides a one year warranty with its soil moisture sensor control systems.

Installation

Dynamax recommends installation by an irrigation professional, however, it reports installation and programming of the Moisture Clik is relatively easy and may be accomplished by some homeowners. Dynamax reports installation time reportedly varies from 1 to 1 1/2 hours.

Track Record and Water Savings

The Macaulay Land Use Research Institute, Aberdeen, UK and Delta-T Devices, Cambridge developed Theta Probe soil moisture sensors jointly. Since its' development and release, Delta-T has sold over 17,500 of its Theta Probe ML2 units into the scientific and research community. The SM200 is very similar to the ML2, but is constructed to meet a slightly less stringent specification.

Copies of several published reports from studies including the Theta Probe ML2 were submitted as part of this review, all reporting favorably on the ML2. A list of websites with product comparisons, technical reports, and completed studies pertaining to Dynamax products are available from Dynamax. Dynamax will also provide a list of their SM200 customers upon request.

Irrometer

The Irrometer Co., Inc., located in Riverside, California, has been in business since 1951. Irrometer manufactures irrigation optimization equipment including soil moisture sensors and control devices, soil solution access tubes for nutrition management, and pressure gauges.

Their original tensiometer type soil moisture sensing products have been on the market since 1951. The Watermark resistance type sensor was introduced in 1985. Irrometer offers 4 different add-on control devices for soil moisture based residential and commercial landscape irrigation control. The controllers use one or more of the Watermark soil moisture sensors to interrupt the existing clock/controller schedule until the soil moisture reaches the user prescribed level.

Included with the purchase of an Irrometer control system is its WaterPerfect turf and landscape irrigation scheduling and water management software. This software program aids the user in the proper scheduling of irrigation utilizing Watermark soil moisture sensors, including calculation of total run times and cycle and soak times based on site conditions.

Sensor Description and Operation
The Watermark is a solid state electrical resistance type sensor which Irrometer reports provides accurate readings from 0 to 200 centibars. This covers the entire soil moisture range required in irrigated landscapes, including heavy clay soils.

The sensor is installed by placing it into a hole made with a 7/8" diameter rod to the desired sensor depth. If a larger diameter hole is made, then a "grout" of the soil and water is poured into the hole. The sensor consists of two concentric electrodes embedded in a reference matrix material, which is surrounded by a synthetic membrane for protection against deterioration. The exterior surface is of ABS plastic and a stainless steel mesh.

The internal matrix includes gypsum, which provides some buffering for the effects of salinity levels normally found in irrigated landscapes. The sensor is 7/8" in diameter by 3" long. The original Watermark (model 200) was improved in 1993 to the current model 200SS, which has improved its soil moisture response characteristics. The sensors are maintenance free and are not damaged by freezing. The reported minimum life span for a Watermark sensor is five to seven years.

Irrometer's soil moisture sensor based control devices include the WaterSwitch (WS1), Watermark Electronic Module (WEM), Battery WEM (WEM-B), and Watermark Multiple Hydrozone System (MHS). As mentioned above, all of these devices use the Watermark sensors and interrupt the common power supply to the clock/controller or interface with the controller's sensor circuit, and the WEM may be used to control individual valves.

The sensor wiring is connected directly to the control module, which is connected to either the clock/controller or the valve(s). The maximum run between the sensor and controller is 1,000 feet using 18 gauge wire. Larger wire sizes can be used for longer distances.

Controller Descriptions, Prices and Warranty

The Watermark Electronic Module is Irrometer's flagship controller. It is a versatile device that can be used in multiple connection scenarios, and in combination with the Multiple Hydrozone System as discussed below. The WEM can be used to control an individual valve, a group of valves watering areas of similar water demand, or all the valves on any clock/controller.

In a typical residential application, a pair of Watermark sensors is connected to the WEM and the wiring configuration for the connection to the clock/controller provides for interruption of the power supply common connection. Alternatively, a pair of sensors and a WEM may be installed and connected to a single valve at the valve box. When a new system is being installed for a large landscape with a need for multiple sensor pairs, multiple common wires can be installed to provide for the use of multiple WEMs and sensors. For a retrofit of an existing system where multiple sensors are needed, a Multiple Hydrozone System device should be used rather than installing the needed additional common wiring.

The WEM's cabinet is constructed of heavy duty plastic and it can be installed indoors or outdoors. It may be installed at the controller or at the valve. The WEM's dimensions are 3" x 2" x 1.5". The WEM is adjustable from 10 to 120 centibars by a simple dial that has an OFF position to allow for overriding the sensors. The WEM's indicator light comes on when the clock/controller is powering a valve controlled by the WEM, and the soil moisture conditions are drier than the selected setting indicating irrigation is allowed. It is powered by a 24 VAC supply from the clock/controller.

The WaterSwitch and the Battery WEM are designed for use with clock/controllers that possess switch terminals (rain, master valve, etc.). This provides for a simple wiring configuration and easy installation. Both function similar to the WEM and possess the same features. The WaterSwitch is constructed of heavy duty plastic and is suitable for indoor or outdoor installation. Its cabinet dimensions are 2" x 2" x 1.25" which make it small enough to mount inside many controller cabinets. The WaterSwitch is powered by the 24 VAC supply from the clock/controller.

The Battery WEM is designed for use with a DC powered clock/ controller. It is constructed of heavy duty plastic and is suitable for outdoor installation. Its cabinet dimensions are 2.5” x 1.5” x 2”. The Battery WEM is powered by a 9-volt battery housed inside its waterproof battery compartment.

The Multiple Hydrozone System device functions with multiple WEMs and is designed for commercial applications where numerous sensor pairs are used, or retrofit of an existing system with a need for more than one sensor pair. The MHS can control valves for up to 8 separate moisture sensing areas. Each area is monitored using a WEM and Watermark sensors allowing for individual adjustment of the soil moisture threshold and a manual override feature is included. This device communicates with the clock/controller such that individual valves or groups of valves can be controlled without the need for multiple power supply common connections.

The MHS is constructed of heavy duty plastic and is suitable for indoor installation. A weatherproof stainless steel cabinet (shown in photograph) is available for outdoor installations. Its dimensions are 11” x 16” x 2” and the outdoor cabinet dimensions are 18” x 18” x 7”.

The MHS is powered by a 24 VAC supply from the clock/controller. Irrometer products are available through irrigation equipment distributors, some of which are listed at its website (www.irrometer.com). Irrometer provides a one year warranty with its soil moisture sensor control systems.

Installation

Irrometer recommends professional installation, but it reports a typical residential system can be installed by some homeowners in approximately 2 to 4 hours.

Track Record and Water Savings

Irrometer’s Watermark sensors have been used in soil science research by universities, as well as in production agriculture and landscape applications, worldwide for over 15 years. Their use in landscape applications has been documented for the longest period of time by a study that originated in 1993 for the city of Boulder, Colorado. The consulting firm conducting the study, Aquacraft, Inc., published numerous papers from 1995 to 2001 for the Irrigation Association, the American Society of Agricultural Engineers, the American Water Resources Journal and the American Water Works Association. The following is an excerpt from one of the papers:

> *“The results of this study were quite encouraging from the standpoint of both irrigation efficiency and cost effectiveness. On a seasonal basis, the systems limited applications to an average of 76% of theoretical requirement when all sites are combined.”*

Irrometer's Watermark control products have also received the *Smart Approved WaterMark* designation**,** Australia's water saving labeling program for products to reduce outdoor water use.

LawnLogic

LawnLogic® products are manufactured by Alpine Automation, Inc., of Aurora, Colorado. The company began business in 1997 as a soil moisture based irrigation systems supplier. Research and product commercialization began on the LawnLogic system in 2003 and it was introduced in the spring of 2004. In June 2006, it was reported that over 400 LawnLogic systems were in place, many of which were operating in their third irrigation season.

The LawnLogic system works with any clock/ controller to independently control individual irrigation zones. Each system consists of one or more control modules and four soil moisture sensors per module. The system is compatible with any combination of sub-surface, pop-up and rotary irrigation system designs.

Sensor Description and Operation

The LawnLogic soil moisture sensor is an electrical conductivity type sensor. It measures the current and resistance between two non-corrosive stainless steel probes that are 3" long and 3" apart from each other. The sensor body is 1/2" wide. Sensor readings are calibrated to volumetric soil moisture content.

The probes are embedded in an impact resistant plastic housing and the wiring and electronics are encased in electrical potting epoxy. The sensors are installed by pushing the probes into relatively undisturbed soil in the wall of a shallow trench and connecting the sensor wiring to the appropriate valve solenoid connectors within the valve box.

The sensors communicate with the control module via the valve wiring and clock controller. When a sensor determines the moisture level is at or above the user defined set point the system does not allow an irrigation cycle. When moisture levels drop below the user adjustable setting, irrigation cycles are allowed.

The control module wiring is connected to the existing clock/timer and the sensor wiring is connected to the valve for each respective zone. The user must program a base schedule into the clock controller, and LawnLogic does not provide information on calculation of total run times and cycle/soak times.

Controller Description, Prices and Warranty

The LawnLogic controller module (model No. LL-1004) connects to any existing 24 VAC clock type controller. The instrument operates with exclusive Alpine Automation developed MLD (Mixed Logic-Dynamic) and MCC (Measurement and Control) software. The LawnLogic system automatically tailors a moisture profile for each zone when the appropriate zone button is held down. For example, the switch marked “2” controls irrigation zone 2 and when the switch is held down for 5 seconds, the LCD displays the message “READING ZONE 2”.

The LawnLogic sensor buried in zone 2 measures the amount of soil moisture present. The message “CALIBRATING 2” then appears on the screen. The system is then operational and the user can increase or decrease the soil moisture threshold in each zone by four levels. If no sensor is present in the zone the message “NO SENSOR 2” appears.

Each module has a one-line,16 character backlit LCD display which displays auto-prompt information for installation and programming. Zone selection, bypass and moisture adjustment controls are two position rocker switches. The module is rated for use with solenoid valves holding 0.5 ampere circuit capacity maximum.

Power to the control module is typically from the existing clock/controller, but an external transformer may be used. Surge suppression is integrated into the measurement and control circuitry. Each irrigation zone can be bypassed independently, which allows the clock/controller to operate without the benefit of the LawnLogic system. All settings are stored in non-volatile memory and no battery backup is required in the case of a power outage. Soil moisture status is updated every 15 minutes and the real time status of each zone is displayed 24/7.

The module enclosure is constructed of heavy duty plastic. Its dimensions are 5” x 3.2” x 2.5”. It is designed for indoor installation, but an optional locking outdoor plastic cabinet is available for mounting outdoors. Up to four modules can be installed in the outdoor cabinet. The dimensions of the outdoor cabinet are 12” x 12” x 4”. Up to 6 modules can be combined to control up to 24 zones, and up to 32 zones can be accommodated for custom projects. LawnLogic products are available through its distributors, which are listed at its website (www.lawnlogic.com). Alpine Automation provides a one year warranty with its LawnLogic soil moisture sensor control systems.

Installation
Alpine Automation recommends installation of large systems by an irrigation professional, however, it reports most homeowners can install a small system. The reported first-time installation time for a small system is estimated to be 1 hour, depending on site specific conditions. The company can make arrangements for professional installation through its distributor/dealer network.

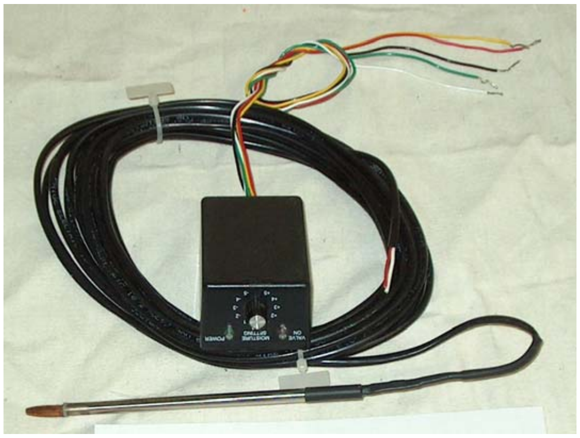
Track Record and Water Savings
Based on performance and warranty tracking, Alpine Automation reports successful overall performance of LawnLogic systems and negligible problems. LawnLogic was included in the University of Florida County Extension Madera home project study of soil moisture sensor based irrigation control. Study results submitted for this report showed a 44 percent average water savings during April to October 2005 for a single study site.

Alpine Automation reports LawnLogic systems have been successfully integrated with dozens of different clock/controllers ranging from unsophisticated 25 year old controllers to state of the art systems. LawnLogic systems are installed across North America and Australia, and are in use on a variety of landscapes. The University of Florida recently initiated a study that incorporates LawnLogic systems on St. Augustine grass. Alpine Automation is working with both standard and ET controller manufactures, and companies that produce automated fertilization systems to facilitate the integration of LawnLogic with their products.

Waternomics

Waternomics soil moisture sensor based irrigation control products are manufactured by ManyWaters, Inc. of Denver, Colorado. ManyWaters has been in business since 2001, and carries a variety of water conservation related products.

Distribution of its soil moisture based landscape irrigation control systems began in 2001. ManyWaters offers the WW1 System which is an add-on soil moisture sensor landscape controller system that functions best with any clock/controller and utilizes an electrical conductivity type soil moisture sensor. The WW1 can also be used to control individual valves with or without the use of a clock/controller.



Sensor Description and Operation

The WW1 soil moisture sensor consists of a stainless steel and plastic probe that is inserted into the root zone. The sensor measures volumetric soil moisture content based on the electrical impedance measured between the probe's two electrodes. Each sensor is calibrated at the factory to provide a consistent output when measuring media of known dielectric constant.

The reported accuracy of the sensor is plus or minus 5 percent, but no information on sensitivity to salts/fertilizer was provided for this report. The overall length of the sensor is 6" and the housing diameter is 0.25". It comes with 25 feet of 4-wire cable. The sensor is installed into the root zone by pushing it into the wall of a shallow trench, resulting in contact with relatively undisturbed soil. The sensor cable wiring may be connected to the existing valve wiring or to the add-on controller.

The WW1 System regulates water applied by continuously monitoring the soil condition at the sensor, and interrupting the clock/controller schedule or individual valve when enough water is available in the root zone. When connected to a clock/controller, the WW1 serves as a switch by overriding the common circuit to all station valves. When one or more controllers are used without a clock/controller, the controller causes irrigation to occur when the soil moisture falls below the user specified threshold and then irrigation ceases once the soil moisture content is measured to be at the threshold. This mode does not allow for prescribing irrigation days, times or soak/cycle periods.

Controller Description, Prices and Warranty

The WW1 controller comes with normally open, and separate hot or neutral outputs providing for several connection options. It may be integrated with an existing clock/controller such that one soil moisture sensor will control all stations or multiple sensors may be used to control groups of stations. The controller may be set from zero to 100 percent saturation soil moisture content in 5 percent increments.

For control of all stations using one sensor, the WW1 controller is typically installed near the clock/controller. When using multiple sensors, the controller may be installed in the individual valve box(es) or at the clock/controller.

The WW1 controller cabinet is constructed of high impact shock resistant plastic, and is rated for indoor or outdoor installation. Its dimensions are 3" x 2" x 1" with a rotating moisture level control knob and LED indicator lights. The controller's circuitry is epoxy-encapsulated. The power supply is either from the clock/controller or from an external transformer. Approximately 6-foot of minimum 12 gauge wiring is required to connect the WW1 to the existing clock/timer.

The current retail price for the Waternomics WW1 System is $179. Waternomics products may be ordered directly from ManyWaters by contacting them at 720-529-3980. ManyWaters provides a one year warranty with their Waternomics soil moisture sensor control systems.

Installation

ManyWaters recommends installation by an irrigation professional; however, installation and programming a one sensor setup may be accomplished by some homeowners. Reported installation time for a simple residential system is less than 1 hour.

Track Record and Water Savings

Waternomics is participating in an ongoing demonstration program with the State of New Mexico which includes the installation of its soil moisture based irrigation control systems at several urban parks and school grounds. These systems are being monitored to evaluate performance and water savings.

2009

Labor Compliance Program

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The Solis Group
Labor Compliance Program

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SECTION I - PUBLIC WORKS SUBJECT TO PREVAILING WAGE LAWS

State prevailing wage rates apply to all public works contracts as set forth in Labor Code Sections 1720 et seq. and include, but are not limited to, such types of work as construction, alteration, demolition, repair, or maintenance work. The Division of Labor Statistics and Research (DLSR) predetermines the appropriate prevailing wage rates for particular construction trades and crafts by county.

A. Types of Contracts to Which Prevailing Wage Requirements Apply

As provided in Labor Code Section 1771 et seq., a Labor Compliance Program as described in subdivision (b) of section 1771.5 of the Labor Code shall be initiated and enforced on all applicable public works projects. Upon approval by the Director of the Department of Industrial Relations, this LCP shall apply to all statutes that require Awarding Bodies to have a LCP to which the payment of prevailing wages apply as a condition of project authorization, project funding, or use of specified contracting authority. The Department of Industrial Relations' website shall maintain a list of statutes requiring LCP oversight.

B. Applicable Dates for Enforcement of the LCP

The applicable dates for enforcement of awarding body Labor Compliance Programs is established by Section 16422 of the California Code of Regulations. Contracts are not subject to the jurisdiction of the Labor Compliance Program until after the program has received approval.

SECTION II - COMPETITIVE BIDDING ON PUBLIC WORKS CONTRACTS

All bid advertisements (or bid invitations) and public works contracts shall contain appropriate language concerning the requirements of the Labor Code. Notice of approval of an Awarding Body's Labor Compliance Program shall be given in the Call for Bids and in the contract or purchase order and shall also be posted at the job site. The Notice of an approved Labor Compliance Program shall contain, at the minimum, the effective date of the Director's initial or final approval, a statement whether the limited exemption from prevailing wages pursuant to Labor Code Section 1771.5(a) applies to contracts under the jurisdiction of the LCP, a telephone number to call for inquiries, questions, or assistance with regard to the LCP, and the name of the agent or office administering the LCP.

SECTION III - JOB START MEETING

After the award of a public works contract, and prior to the commencement of the work, a mandatory Job Start meeting (Pre-Job conference) shall be conducted by TSG with the contractor and those subcontractors listed in its bid documents or who are required to be identified or prequalified in a Design-Build Contract.

At that meeting, federal and state labor law requirements applicable to the contract will be discussed and copies of suggested reporting forms furnished, including prevailing wage requirements, the respective record keeping responsibilities, the requirement for the submittal of certified payroll records, and the prohibition against discrimination in employment.

The contractor and each subcontractor will be provided with a Checklist of Labor Law Requirements (presented in Part Three of this document) and will discuss in detail the following checklist items:

1. The contractor's duty to pay prevailing wages (Labor Code §1770 et seq.);
2. The contractor's duty to employ registered apprentices on public works projects (Labor Code §1777.5);

3. The penalties for failure to pay prevailing wages and to employ apprentices, including forfeitures and debarment (Labor Code §1775, §1777.7, and §1813);
4. The requirement to maintain and submit copies of certified payroll records, on a weekly basis, as required (Labor Code §1776), and penalties for failure to do so (Labor Code §1776(g)); the requirement includes and applies to all subcontractors performing work on projects even if their portion of the work is less than one half of one percent of the total amount of the contract.
5. The prohibition against employment discrimination (Labor Code §1735 and §1777.6; the Government Code; and Title VII of the Civil Rights Act of 1964, as amended);
6. The prohibition against taking or receiving a portion of an employee's wages (Labor Code §1778) (kickback);
7. The prohibition against accepting fees for registering any person for public works (Labor Code §1779) or for filing work orders on public works (Labor Code §1780);
8. The requirement to list all subcontractors that are performing one-half of one percent of the total amount of the contract (Public Contract Code Section 4100 et seq.);
9. The requirement to be properly licensed and to require all subcontractors to be properly licensed, and the penalty for employing workers while unlicensed (Labor Code §1021 and under California Contractors License Law. Also, see Business and Professions Code §7000, et seq);
10. The prohibition against unfair competition (Business and Professions Code §17200-17208);
11. The requirement that the contractor and subcontractor be properly insured for Workers' Compensation (Labor Code §1861);
12. The requirement that the contractor abide by the Occupational Safety and Health laws and regulations that apply to the particular public works project.
13. The requirement to secure proof of eligibility/citizenship from all project workers due to the federal prohibition against hiring undocumented workers.
14. The requirement to provide itemized wage statements to project employees under Labor Code §226.

The contractors and subcontractors present at the Job Start meeting will be given the opportunity to ask questions relative to the items contained in the Labor Law Requirements Checklist. The checklist will then be signed by the contractor's representative, a representative of each subcontractor, and a representative of the LCO.

At the Job Start meeting, the contractor will be provided with a copy of the LCP package which includes: a copy of the approved LCP, the checklist of Labor Law Requirements, applicable Prevailing Wage Rate Determinations, blank certified payroll record forms, fringe benefit statements, State apprenticeship requirements, and a copy of the Labor Code relating to Public Works and Public Agencies (Part 7, Chapter 1, §1720-§1861).

It will be the prime contractor's responsibility to provide copies of the LCP package to all listed subcontractors and to any substituted subcontractors.

SECTION IV – MONITORING PAYMENT OF PREVAILING WAGES

A. Certified Payroll Records Required

The contractor and each subcontractor shall maintain payrolls and basic records (timecards, canceled checks, cash receipts, trust fund forms, accounting ledgers, tax forms, superintendent and foreman daily logs, etc.) during the course of the work and shall preserve them for a period of three (3) years thereafter for all trades workers working on projects which are subject to the LCP. Such records shall include the name, address, and social security number of each worker, his or her classification, a general description of the work each employee performed each day, the rate of pay (including rates of contributions, or costs assumed to provide fringe benefits), daily and weekly number of hours worked, and actual wages paid.

1. Submittal of Certified Payroll Records

   The contractor and each subcontractor shall maintain weekly certified payroll records for submittal as required. The contractor shall be responsible for the submittal of payroll records of all its subcontractors. All certified payroll records shall be accompanied by a statement of compliance signed by the contractor or each subcontractor, indicating that the payroll records are correct and complete, that the wage rates contained therein are not less than those determined by the Director of the Department of Industrial Relations, and that the classifications set forth for each employee conform with the work performed.

   Certified payroll records required by Labor Code Section 1776 may be maintained and submitted electronically subject to the conditions set forth in CCR§16404.

   California Code of Regulations (Title 8, section 16000) defines “payroll records” as: all time cards, cancelled checks, cash receipts, trust fund forms, books, documents, schedules, forms, reports, receipts or other evidences which reflect job assignments, work schedules by days and hours, and the disbursement by way of cash, check, or in whatever form or manner, of funds to a person(s) by job classification and/or skill pursuant to a public works project. TSG may request payroll records at any time and the contractor is required to provide requested payroll records within 10 days following written receipt of the request.

2. Full Accountability

   Each individual, laborer or craftsperson working on a public works contract must appear on the payroll. The basic concept is that the employer who pays the trade worker must report that individual on its payroll. This includes individuals working as apprentices in an apprenticeable trade. Owner-operators are to be reported by the contractor employing them; rental equipment operators are to be reported by the rental company paying the workers’ wages.

   Sole owners and partners who work on a contract must also submit a certified payroll record listing the days and hours worked, and the trade classification descriptive of the work actually done.

   The contractor shall provide the records required under this section within ten (10) days of each payday and make them available for inspection by the Department of Industrial Relations, and shall permit representatives of each to interview trades workers during working hours on the project site.

3. Responsibility for Subcontractors

   The prime contractor shall be responsible for ensuring adherence to labor standards provisions by its subcontractors. Moreover, the prime contractor is responsible for Labor Code violations of its subcontractors in accordance with Labor Code Section 1775.

4. Payment to Employees

Employees must be paid unconditionally, and not less often than once each week, the full amounts, that are due and payable for the period covered by the particular payday. Thus, an employer must establish a fixed workweek (Sunday through Saturday, for example) and payday (such as every Friday or the preceding day should such payday fall on a holiday). On each and every payday, each worker must be paid all sums due as of the end of the preceding workweek and must be provided with an itemized wage statement as required by Labor Code §226.

If an individual is called a subcontractor, whereas, in fact, he/she is merely a journey level mechanic supplying only his/her labor, such an individual would not be deemed a bona fide subcontractor and must be reported on the payroll of the prime contractor as a trade worker. Moreover, any person who does not hold a valid contractor's license cannot be a subcontractor, and anyone hired by that person is the worker or employee of the general contractor for purposes of prevailing wage requirements, certified payroll reporting and workers' compensation laws.

The worker's rate for straight time hours must equal or exceed the rate specified in the contract by reference to the "Prevailing Wage Determinations" for the class of work actually performed. Any work performed on Saturday, Sunday, and/or on a holiday, or portion thereof, must be paid the prevailing rate established for those days regardless of the fixed workweek. The hourly rate for hours worked in excess of 8 hours in a day and 40 hours in a workweek shall be premium pay. All work performed on Saturday, Sunday and holidays shall be paid pursuant to the Prevailing Wage determination.

B. Audit of Certified Payroll Records

Audits shall be conducted under the direction of the LCO, and shall also be conducted at the request of the Labor Commissioner to determine whether all trades workers on project sites have been paid according to the prevailing wage rates.

Payroll records, once furnished by the contractors, shall be reviewed by TSG staff as promptly as practicable after receipt, but in no case not more than 30 days after receipt. A review of payroll records consists of ensuring that all appropriate data elements identified in Labor Code 1776(a) have been reported; certification forms have been signed; correct prevailing wage rates have been reported as paid for each labor classification; and confirmation of payment has been corroborated by TSG staff. TSG staff will review independent sources of information in order to confirm that payments were made to the worker, which may include but not be limited to: employee interviews, worker's paycheck stubs, copies of bank certified cancelled checks, payroll registers, and/or Employer Payments trust fund accounting records.

For each month in which a contractor reports having workers employed on the project, TSG will undertake random confirmation of payroll records for at least one worker for at least one weekly period within that reporting month. Confirmation of payroll records is defined as an independent corroboration of reported prevailing wage payments. Confirmation will be accomplished through on-site worker interviews, examination of paychecks or paycheck stubs, direct confirmation of payments from third party recipients of "employer payments," or any other reasonable method of corroboration.

If a violation is discovered, TSG shall prepare a written report of the investigation/audit, which at minimum will contain the following information:

- Brief written narrative identifying the Bid Advertisement Date of the contract for public work and summarizing the nature of the violation and the basis upon which the determination of underpayment was made;
- Any penalties to be assessed under Labor Code Section 1775 and 1813;

- Public Works Investigation Worksheet, showing the actual hours worked, amounts paid, amounts due, and classifications of workers employed in connection with the public work;
- Public Works Audit Worksheet, summarizing the information contained on the Public Works Investigation Worksheet; and
- Prevailing Wage Determination Summary, which lists the work classifications involved in the audit and associated prevailing wage amounts.

C. On-Site Employee Interviews

Pursuant to California Code of Regulations §16432(d), in order to confirm the payment of prevailing wages for the appropriate work classification performed by workers on the project, TSG staff will conduct on-site project visits to interview project workers.

On-site visits will be undertaken during each week that workers are present at the job site and may be undertaken randomly or as deemed necessary by the Labor Compliance Program. All craft workers shall be interviewed at least once over the life of the project. While on the job site, a representative sample of all crafts should be interviewed. For example, if four carpenters are working on the job site on the inspection day, two should be interviewed. The interview should not be conducted under the immediate supervision of any project foremen, so as to provide the worker with privacy. Any suspicious behavior such as coaching by the supervisor, or a contractor's unwillingness to allow the required site interview to take place, will result in a more in-depth investigation to take place.

D. Worker Complaints

In addition to monitoring all certified payroll records provided by the contractors, worker complaints of underpayment of prevailing wage rates must be investigated. Employees will be informed that the filing of the complaint is confidential, and that his or her identity will be disclosed to the contractor or subcontractor only after an investigation has occurred and only within the context of an audit worksheet.

Once TSG is notified of a complaint, a written acknowledgement that the complaint has been received must be sent promptly to both the complaining party and the Awarding Body. The acknowledgement must state the name, mailing address and telephone number of the TSG staff assigned to the complaint.

Within 10 days of receiving the complaint, both the complaining party and the Awarding Body must be notified in writing of the resolution or of the status of the complaint and the reason the complaint has not been resolved. Further, the complaining party and the Awarding Body must be notified in writing at least once every 30 days of the status of an unresolved complaint.

If an employee of the contractor reports the violation(s), TSG staff will thoroughly investigate the charge by interviewing the affected employee(s) and analyzing the submitted documents. If it is determined that a violation has occurred, the TSG staff shall prepare a Public Works Audit Worksheet, to be sent to the contractor. Major components and tasks related to investigating worker complaints are: gather supporting documents from all available sources to analyze for authenticity; conducting a complete CPR and/or project audit; and review CPRs for errors, inconsistencies, discrepancies, falsification, misclassification, under-reporting and any other omissions that render the records inaccurate where needed by comparing the inspector of records' daily log with all available records.

SECTION V - APPRENTICE REQUIREMENTS

A. Use of Apprentices

Apprentices shall be permitted to work as such only when they are registered, individually, under a bona fide apprenticeship program registered and approved by the State Division of Apprenticeship Standards. The allowable ratio of apprentices to journeypersons in any craft/classification shall not be greater than the ratio permitted to the contractor as to its entire workforce under the registered program.

Any worker listed on a payroll at an apprentice wage rate who is not registered shall be paid the journey level wage rate determined by the Department of Industrial Relations for the classification of the work he/she actually performed. Pre-apprentice trainees, trainees in non-apprenticeable crafts, and others who are not duly registered will not be permitted on public works projects unless they are paid full prevailing wage rates as journeypersons.

Compliance with California Labor Code Section 1777.5 requires all public works contractors and subcontractors to:

1. Submit contract award information to the apprenticeship committees for each apprenticeable craft or trade in the area of the Project. Must send the DAS-140 form to all apprenticeship committees, unless the contractor is registered with a particular one;
2. Request dispatch of apprentices from the applicable Apprenticeship Program(s) and employ apprentices on public works projects in a ratio to journeypersons which in no case shall be less than one (1) hour of apprentice work to each five (5) hours of journeyperson work; and
3. Contribute to the applicable Apprenticeship Program(s) or the California Apprenticeship Council in the amount identified in the prevailing wage rate publication for journeypersons and apprentices. If payments are not made to an Apprenticeship Program, they shall be made to the California Apprenticeship Council, Post Office Box 420603, San Francisco, CA 94142.

If the contractor is registered to train apprentices, it shall furnish written evidence of the registration (i.e., Apprenticeship Agreement or Statement of Registration) of its training program and apprentices, as well as the ratios allowed and the wage rates required to be paid there under for the area of construction, prior to using any apprentices in the contract work. It should be noted that a prior approval for a separate project does not confirm approval to train on any project. The contractor/subcontractor must check with the applicable Joint Apprenticeship Committee to verify status.

B. Apprentice hours-to-Journeyman hours (Ratios)

Unless a collective bargaining agreement specifies a different ratio, the typical ratio of apprentice hours to journeyman hours is one to five; in other words, apprentices in an apprenticeable trade should typically work 20 percent of total hours worked. The Division of Apprenticeship Standards maintains a list of all trades and their applicable specified apprenticeship ratios.

If TSG determines that at the end of a contractor or subcontractor's work on the public works contract that the contractor was in violation of the apprentice-to-journeyman ratio, TSG will require that the regular prevailing wage rate be paid to any worker who is not a duly registered apprentice and for any hours in excess of the maximum ratio permitted under Labor Code Section 1777.5(g).

SECTION VI - REPORTING WILLFUL VIOLATIONS TO THE LABOR COMMISSIONER

If an investigation reveals that a willful violation of the Labor Code has occurred, the LCO will make a written report to the Labor Commissioner reflecting prevailing wage deficiencies for each underpaid worker, and including any penalties to be assessed under Labor Code sections 1775 and 1813, as determined by the LCP after consideration of the best information available as to actual hours worked, amounts paid, and classifications of workers employed in connection with the public work. Such available information may include, but is not limited to, worker interviews, complaints from workers or other interested persons, all time cards, bank certified cancelled checks, cash receipts, trust fund forms, books, documents, schedules, forms, reports, receipts or other evidences which reflect job assignments, work schedules by days and hours, and the disbursement by way of cash, check, or in whatever form or manner, of funds to a person(s) by job classification and/or skill pursuant to a public works project. An Audit using the Audit Record Worksheets found in Attachment E, when accompanied by a brief narrative identifying the Bid Advertisement Date of the contract for public work and summarizing the nature of the violation and the basis upon which the determination of underpayment was made, presumptively demonstrates sufficiency.

Labor Code Section 1777.1 states:

> "A willful violation occurs when the contractor or subcontractor knew or reasonably should have known of his or her obligations under the public works law and deliberately fails or refuses to comply with its provisions."

Six (6) types of willful violations are reported:

A. Failure to Comply with Prevailing Wage Rate Requirements

Whenever it is determined that a willful violation has occurred in failing to comply with prevailing wage rate requirements (as set forth in the Labor Code and public works contracts) by paying less than the stipulated basic hourly rate to trades workers, or if overtime, holiday rates, fringe benefits, and/or employer payments are paid at a rate less than stipulated, it shall be reported to the Labor Commissioner upon completion of an investigation and audit.

B. Falsification of Payroll Records, Misclassification of Work, and/or Failure to Accurately Report Hours of Work

Falsification of payroll records and failure to accurately report hours of work is characterized by deliberate underreporting of hours of work; underreporting the headcount; stating that the proper prevailing wage rate was paid when, in fact, it was not; clearly misclassifying the work performed by the worker; and any other deliberate and/or willful act which results in the falsification or inaccurate reporting of payroll records.

C. Failure to Submit Certified Payroll Records

Whenever it is determined that a willful violation has occurred by the contractors and/or subcontractors not having responded to the 10-day notification by the LCO to comply with the requirement of submittal of weekly certified payroll records and/or to correct inaccuracies or omissions that have been detected, it shall be reported to the Labor Commissioner upon completion of an investigation and audit.

D. Failure to Pay Fringe Benefits (Employer Contributions)

Fringe benefits are defined as the amounts stipulated for employer payments or trust fund contributions and are determined to be part of the required prevailing wage rate. Whenever it is determined that a willful violation has occurred by failure to pay or provide fringe benefits and/or make trust fund contributions on a timely basis, which is equivalent to payment of less than the stipulated wage rate, it shall be reported to the Labor Commissioner upon completion of an investigation and audit.

E. Failure to Pay the Correct Apprentice Rates and/or Misclassification of Workers as Apprentices

Failure to pay the correct apprentice rate or classifying a worker as an apprentice when he/she is not properly registered is equivalent to payment of less than the stipulated wage rate and shall be reported to the Division of Apprenticeship Standards as a willful violation, upon completion of an investigation and audit.

F. Taking or Receiving a Portion of an Employee's Wages (Kickbacks)

Accepting or extracting kickbacks from employee wages under Labor Code Section 1778 constitutes a felony and may be prosecuted by the appropriate enforcement agency.

After the Labor Compliance Program has determined that violations of the prevailing wage laws have resulted in the underpayment of wages and an audit has been prepared, prior to a determination of the amount of forfeiture by the Labor Commissioner, notification shall be provided to the contractor and affected subcontractor of an opportunity to resolve the wage deficiency pursuant to CCR§16432(f). The contractor and affected subcontractor may, within 10 days after notification of the wage deficiency, submit to the Labor Compliance Program for consideration exculpatory information consistent with the "good faith mistake" factors set forth in Labor Code Section 1775(a)(2)(A)(i) and (ii). The Labor Compliance Program shall not be required to request the Labor Commissioner for a determination of the amount of penalties to be assessed under Labor Code Section 1775 if, (a) based upon the contractor's submission, the Labor Compliance Program reasonably concludes that the failure to pay the correct wages was a good faith mistake, and has no knowledge that the contractor and affected subcontractor have a prior record of failing to meet their prevailing wage obligations, and (b) the underpayment of wages to workers is promptly corrected and proof of such payment is submitted to the Labor Compliance Program.

SECTION VII - ENFORCEMENT ACTION

A. Duty of the Awarding Body

The Solis Group, as the entity having an approved LCP, has a duty to the Director of the Department of Industrial Relations to enforce Labor Code Section 1720 et seq. and the procedural regulations of the Department of Industrial Relations in a manner consistent with the practice of DLSE and regulations found at Title 8, California Code Regulations, Section 16000 et seq.

B. Withholding Contract Payments When Payroll Records are Delinquent or Inadequate

1. "Withhold" means to cease payments by the awarding body, its agents or others who pay on its behalf to the contractor. Where the violation is by a subcontractor, the contractor shall be notified of the nature of the violation and reference made to its rights under Labor Code Section 1729.

   A release bond under Civil Code Section 3196 may not be posted for the release of the funds being withheld for the violation of the prevailing wage law.

2. "Contracts" except as otherwise provided by agreement, means only contracts under a single master contract, including a design-build contract, or contracts entered into as stages of a single project which may be the subject of withholding, pursuant to the Labor Code §1720, §1720.2, §1720.3, §1720.4, §1771, and §1771.5;

3. "Delinquent payroll records" means those not submitted on the basis set forth in the Contract;

4. "Inadequate payroll records" are any one of the following:

   a. A record lacking any of the information required by Labor Code §1776;

b. A record which contains all of the required information but is not certified, or is certified by someone who is not an agent of the contractor or subcontractor;

c. A record remaining uncorrected for one payroll period, after the Labor Compliance Program has given the contractor or subcontractor notice of inaccuracies detected by audit or record review. Provided, however, that prompt correction will stop any duty to withhold if such inaccuracies do not amount to one (1) percent of the entire Certified Weekly Payroll in dollar value and do not affect more than half the persons listed as workers employed on that Certified Weekly Payroll, as defined in Labor Code Section 1776 and Title 8 CCR section 16401 of Title 8 of the California Code of Regulations.

5. The withholding of contract payments when payroll records are delinquent or inadequate is required by Labor Code Section 1771.5(b)(5), and it does not require the prior approval of the Labor Commissioner. The Awarding Body shall only withhold those payments due or estimated to be due to the contractor or subcontractor whose payroll records are delinquent or inadequate, plus any additional amount that the LCP has reasonable cause to believe may be needed to cover a back wage and penalty assessment against the contractor or subcontractor whose payroll records are delinquent or inadequate; provided that a contractor shall be required in turn to cease all payments to a subcontractor whose payroll records are delinquent or inadequate until the LCP provides notice that the subcontractor has cured the delinquency or deficiency.

6. When contract payments are withheld, the LCP shall provide the contractor and subcontractor, if applicable, with immediate written notice that includes all of the following: (1) a statement that payments are being withheld due to delinquent or inadequate payroll records, and that identifies what records are missing or states why records that have been submitted are deemed inadequate; (2) specifies the amount being withheld; and (3) informs the contractor or subcontractor of the right to request an expedited hearing to review the withholding of contract payments under Labor Code Section 1742, limited to the issue of whether the records are delinquent or inadequate or the LCP has exceeded its authority under this section.

7. No contract payments shall be withheld solely on the basis of delinquent or inadequate payroll records after the required records have been produced.

8. In addition to withholding contract payments based on delinquent or inadequate payroll records, penalties shall be assessed under Labor Code Section 1776(g) for failure to timely comply with a written request for certified payroll records. The assessment of penalties under Labor Code Section 1776(g) does require the prior approval of the Labor Commissioner under section 16436 of these regulations.

C. Withholding for Violation for Not Paying the Per Diem Prevailing Wages

1. "Withhold" and “contracts” have the same meaning set forth in Sections 16435(a) and 16435(b) of these regulations.

2. Where the violation is by a subcontractor, the general contractor shall be notified of the nature of the violation and reference made to its rights under Labor Code Section 1729.

3. “Amount equal to the underpayment” is the total of the following determined by payroll review, audit, or admission of the contractor or subcontractor:

   a. The difference between amounts paid workers and the correct General Prevailing Rate of Per Diem Wages, as defined in Labor Code Section 1773, and determined to be the prevailing rate due workers in such craft, classification or trade in which they were employed and the amounts paid;

b. The difference between amounts paid on behalf of workers and the correct amounts of Employer Payments, as defined in Labor Code Section 1773.1 and determined to be part of the prevailing rate costs of contractors due for employment of workers in such craft, classification or trade in which they were employed and the amounts paid;

c. Estimated amounts of "illegal taking of wages";

d. Amounts of apprenticeship training contributions paid to neither the program sponsor's training trust nor the California Apprenticeship Council; and

e. Estimated penalties under Labor Code Sections 1775, 1776, and 1813.

4. The withholding of contract payments when, after investigation, it is established that underpayment or other violations have occurred requires the prior approval of the Labor Commissioner under CCR Sections 16436 and 16437.

5. Provisions relating to the penalties under Labor Code Sections 1775, and 1813:

   a. Pursuant to Labor Code Section 1775, the contractor shall, as a penalty, forfeit up to fifty dollars ($50) for each calendar day, or portion thereof, for each worker paid less than the prevailing wages.

   b. Pursuant to Labor Code Section 1813, the contractor shall, as a penalty, forfeit twenty-five dollars ($25) for each worker employed in the execution of the contract by the contractor or by any subcontractor for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any one calendar day and 40 hours in any one calendar week.

D. <u>Forfeitures Requiring Approval by the Labor Commissioner</u>

1. For purposes of this section and CCR Section 16437, "forfeitures" means the amount of wages, penalties, and forfeitures assessed by the LCP and proposed to be withheld pursuant to Labor Code Section 1771.6(a), and includes the following: (1) the difference between the prevailing wage rates and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the prevailing wage rate by the contractor or subcontractor; and (2) penalties assessed under Labor Code Sections 1775, 1776 and 1813.

2. If the aggregate amount of forfeitures assessed as to a contractor or subcontractor is less than $1000.00, the forfeitures shall be deemed approved by the Labor Commissioner upon service and the Labor Commissioner's receipt of copies of the following: (1) the Notice of Withholding of Contract Payments authorized by Labor Code Section 1771.6(a); (2) an Audit as defined in CCR Section 16432(e), and (3) a brief narrative identifying the Bid Advertisement Date of the contract for public work and summarizing the nature of the violation, the basis of the underpayment, and the factors considered in determining the assessment of penalties, if any, under Labor Code Section 1775.

(c) For all other forfeitures, approval by the Labor Commissioner shall be requested and obtained in accordance with CCR Section 16437.

E. Determination of Amount of Forfeiture by the Labor Commissioner

1. When the LCO requests a determination of the amount of forfeiture, the request shall include a file or report to the Labor Commissioner which contains at least the information specified in subparts (a) through (i) below. Attachment G is a sample Request for Approval of Forfeiture under this section.

   (a) Whether the public work has been accepted by the awarding body and whether a valid notice of completion has been filed, and the dates if any when those events occurred, and the amount of funds being held in retention by the Awarding Body;

   (b) Any other deadline which if missed would impede collection;

   (c) Evidence of violation, in narrative form;

   (d) Evidence of violation obtained under CCR Section 16432 and a copy of the Audit prepared in accordance with CCR Section 16432 setting forth the amounts of unpaid wages and applicable penalties;

   (e) Evidence that before the forfeiture was sent to the Labor Commissioner (A) the contractor and subcontractor were given the opportunity to explain why there was no violation, or that any violation was caused by good faith mistake and promptly corrected when brought to the contractor or subcontractor's attention, and (B) the contractor and subcontractor either did not do so or failed to convince the LCP of its position;

   (f) Where the LCP seeks not only wages but also a penalty as part of the forfeiture, and the contractor or subcontractor has unsuccessfully contended that the cause of violation was a good faith mistake that was promptly corrected when brought to the contractor or subcontractor's attention, a short statement should accompany the proposal for a forfeiture, with a recommended penalty amount pursuant to Labor Code Section 1775(a);

   (g) Where the LCP seeks only wages or a penalty less than $50 per day as part of the forfeiture because the contractor or subcontractor has successfully contended that the cause of the violation was a good faith mistake that was promptly corrected when brought to the contractor or subcontractor's attention, the file should include the evidence as to the contractor or subcontractor's knowledge of his or her obligation, including the program's communication to the contractor or subcontractor of the obligation in the bid invitations, at the pre-job conference agenda and records, and any other notice given as part of the contracting process. With the file should be a statement, similar to that described in (6), and recommended penalty amounts, pursuant to Labor Code Section 1775(a);

   (h) The previous record of the contractor and subcontractor in meeting his or her their prevailing wage obligations; and

   (i) Whether the LCP has been granted initial, extended initial or final approval on only an interim or temporary basis under CCR Sections 16425 or 16426 or whether it has been granted extended approval under CCR Section 16427.

2. The file or report shall be served on the Labor Commissioner as soon as practicable after the violation has been discovered, and not less than 30 days before the final payment, but in no event not less than 30 days before the expiration of the limitations period set forth in Labor Code Section 1741.

3. A copy of the recommended forfeiture and the file or report shall be served on the contractor and subcontractor at the same time as it is sent to the Labor Commissioner. The Labor Compliance Program may exclude from the documents served on the contractor and subcontractor copies of documents secured from the contractor or subcontractor during an audit, investigation, or meeting if those are clearly referenced in the file or report.

4. The Labor Commissioner shall affirm, reject, or modify the forfeiture in whole or in part as the wages and penalties due.

5. The Labor Commissioner's determination of the forfeiture is effective on one of the two following dates:

   (1) For all programs other than those having extended authority under CCR Section 16427 LCPs with initial approval or an extension of initial approval pursuant to CCR Section 16425 or 16426, on the date the Labor Commissioner serves by first class mail, on the LCP, on the Awarding Body if different, on the contractor and on the subcontractor, if any, an endorsed copy of the proposed forfeiture, or a newly drafted forfeiture statement which sets out the amount of forfeiture approved. Service on the contractor or subcontractor is effective if made on the last address supplied by the contractor or subcontractor in the record. The Labor Commissioner's approval, modification or disapproval of the proposed forfeiture shall be served within 30 days of receipt of the proposed forfeiture.

   (2) For programs with final approval extended authority under CCR Section 16427 above, approval is effective 20 days after the requested forfeitures are served upon the Labor Commissioner, unless the Labor Commissioner serves a notice upon the parties, within that time period, that this forfeiture request is subject to further review. For such programs, a notice that approval will follow such a procedure will be included in the transmittal of the forfeiture request to the contractor. If the Labor Commissioner notifies the parties of a decision to undertake further review, the Labor Commissioner's final approval, modification or disapproval of the proposed forfeiture shall be served within 30 days of the date of notice of further review.

F. <u>Deposits of Penalties and Forfeitures Withheld</u>

1. Where the involvement of the Labor Commissioner had been limited to a determination of the actual amount of penalty, forfeiture or underpayment of wages, and the matter has been resolved without litigation by or against the Labor Commissioner, the Labor Compliance Program shall deposit penalties and forfeitures with the Awarding Body.

2. Where collection of fines, penalties or forfeitures results from administrative proceedings or court action to which the Labor Commissioner and Awarding Body or its Labor Compliance Program are both parties, the fines, penalties or forfeitures shall be divided between the general funds of the state and the Awarding Body, as the Hearing Officer or court may decide.

3. All penalties recovered in administrative proceedings or court action brought by or against the Labor Commissioner and to which the Awarding Body or its Labor Compliance Program is not a party, shall be deposited in the general fund of the state.

4. All wages and benefits which belong to an employee and are withheld or collected from a contractor or subcontractor, either by withholding or as a result of administrative proceedings or any court action, and which have not been paid to the employee or irrevocably committed on the employee's behalf to a benefit fund, shall be deposited with the Labor Commissioner, who shall handle such wages and benefits in accordance with Labor Code Section 96.7.

G. Debarment Policy

It is the policy of TSG that the public works prevailing wage requirements set forth in the California Labor Code, Section 1720-1861, be strictly enforced. In furtherance thereof, construction contractors and subcontractors found to be repeat violators of the California Labor Code shall be referred to the Labor Commissioner for debarment from bidding on or otherwise being awarded any public work contract, within the state of California, for the performance of construction and/or maintenance services for the period not to exceed three (3) years in duration. The duration of the debarment period shall depend upon the nature and severity of the labor code violations and any mitigating and/or aggravating factors, which may be presented at the hearing conducted by the Labor Commissioner for such purpose.

SECTION VIII - NOTICE OF WITHHOLDING AND REVIEW THEREOF

After determination of the amount of forfeiture by the Labor Commissioner, notice of withholding of contract payments shall be provided to the contractor and subcontractor, if applicable. The notice shall be in writing and shall describe the nature of the violation and the amount of wages, penalties, and forfeitures withheld. Service of the notice shall be completed pursuant to Section 1013 of the Code of Civil Procedure by first-class and certified mail to the contractor and subcontractor, if applicable. The notice shall advise the contractor and subcontractor, if applicable, of the procedure for obtaining review of the withholding of contract payments. TSG shall also serve a copy of the notice by certified mail to any bonding company issuing a bond that secures the payment of wages covered by the notice and to any surety on a bond, if their identities are known to the awarding body. **A copy of the Notice of Withholding of Contract Payments (NWCP) to be utilized is found as Attachment H to this document.**

Review of NWCP

1. An affected contractor or subcontractor may obtain review of a NWCP under this chapter by transmitting a written request to the office of the LCP that appears on the NWCP within 60 days after service of the NWCP. If no hearing is requested within 60 days after service of the NWCP, the NWCP shall become final.

2. Within ten days following receipt of the request for review, the LCP shall transmit to the Office of the Director-Legal Unit the request for review and copies of the Notice of Withholding of Contract Payments, any audit summary that accompanied the notice, and a proof of service or other documents showing the name and address of any bonding company or surety that secures payment of the wages covered by the notice. **A copy of the required Notice of Transmittal to be utilized is found as Attachment I to this document.**

3. Upon receipt of a timely request, a hearing shall be commenced within 90 days before the Director, who shall appoint an impartial hearing officer possessing the qualifications of an administrative law judge pursuant to subdivision (b) of Section 11502 of the Government Code. The appointed hearing officer shall be an employee of the department, but shall not be an employee of the Division of Labor Standards Enforcement. The contractor or subcontractor shall be provided with an opportunity to review evidence to be utilized by the LCP at the hearing within 20 days of the receipt of the written request for a hearing. Any evidence obtained by the LCP subsequent to the 20-day cutoff shall be promptly disclosed to the contractor or subcontractor. **A copy of a Notice of Opportunity to Review Evidence Pursuant to Labor Code Section 1742(b) form is found as Attachment J to this document.**

   The contractor or subcontractor shall have the burden of proving that the basis for the NWCP is incorrect. The NWCP shall be sufficiently detailed to provide fair notice to the contractor or subcontractor of the issues at the hearing.

Within 45 days of the conclusion of the hearing, the Director shall issue a written decision affirming, modifying, or dismissing the assessment. The decision of the Director shall consist of a notice of findings, findings, and an order. This decision shall be served on all parties pursuant to Section 1013 of the Code of Civil Procedure by first-class mail at the last known address of the party on file with the LCP. Within 15 days of the issuance of the decision, the Director may reconsider or modify the decision to correct an error, except that a clerical error may be corrected at any time. The Director has adopted regulations setting forth procedures for hearings**.**

4. An affected contractor or subcontractor may obtain review of the decision of the Director by filing a petition for a writ of mandate to the appropriate superior court pursuant to Section 1094.5 of the Code of Civil Procedure within 45 days after service of the decision. If no petition for writ of mandate is filed within 45 days after service of the decision, the order shall become final. If it is claimed in a petition for writ of mandate that the findings are not supported by the evidence, abuse of discretion is established if the court determines that the findings are not supported by substantial evidence in the light of the whole record.

5. A certified copy of a final order may be filed by the Labor Commissioner in the office of the clerk of the superior court in any county in which the affected contractor or subcontractor has property or has or had a place of business. The clerk, immediately upon the filing, shall enter judgment for the state against the person assessed in the amount shown on the certified order.

6. A judgment entered pursuant to this procedure shall bear the same rate of interest, shall have the same effect as other judgments, and shall be given the same preference allowed by law on other judgments rendered for claims for taxes. The clerk shall not charge for the service performed by him or her pursuant to this section.

7. This procedure shall provide the exclusive method for review of a NWCP to withhold contract payments pursuant to Labor Code Section 1771.7.

SECTION IX - DISTRIBUTION OF FORFEITED SUMS

1. Before making payments to the contractor of money due under a contract for public works, all amounts required to satisfy the NWCP shall be withheld and retained there from. The amounts required to satisfy the NWCP shall not be disbursed until receipt of a final order that is no longer subject to judicial review.

2. Pending a final order, or the expiration of the time period for seeking review of the notice of the withholding, any contract payments withheld shall not be disbursed.

3. From the amount recovered, the wage claim shall be satisfied prior to the amount being applied to penalties. If insufficient money is recovered to pay each worker in full, the money shall be prorated among all workers employed on the public works project who are paid less than the prevailing wage rate. The wage claim shall have **PRIORITY** over all Stop Notices filed against the prime contractor.

4. Wages for workers who cannot be located shall be placed in the Industrial Relations Unpaid Fund and held in trust for the workers pursuant to Labor Code Section 96.7. Penalties shall be paid into the General Fund of the School District that has enforced this chapter pursuant to Labor Code Section 1771.7.

SECTION X - OUTREACH ACTIVITIES

To ensure the successful implementation of the LCP, there shall be several outreach activities initiated and maintained.

A. Providing Information to the Public

The LCO shall be responsible for communication and outreach activities relative to public information on the LCP:

1. Regular presentations to contractors at all Job Walk Meetings (Pre-Bid conferences) and Job Start Meetings (Pre-Job conferences);

2. Ongoing communication via correspondence and with workers at job sites when review of the certified payroll records reveals the possibility of prevailing wage violations;

3. Periodic meetings with contractor organizations, prime contractors, and subcontractors interested in public works contracting.

B. In-Service Management Training on the Labor Compliance Program

TSG shall provide ongoing management in-servicing and workshops for project personnel relative to the terms, requirements and administration of the Labor Compliance Program. TSG shall require all personnel to document their review of TSG's Labor Compliance Policies and Procedures Manual, which outlines the responsibilities and procedures of the Labor Compliance Program. Whenever TSG's Labor Compliance Policies and Procedures Manual is updated to accurately reflect any amendments to the public works laws and regulations (including the laws and regulations governing Labor Compliance Programs), TSG personnel will be required to review and sign-off on the record sheet to indicate that they have undergone the latest training.

SECTION X - ANNUAL REPORTS

The LCP will submit to the Director an annual report on its operation within 60 days after the close of its annual reporting period, as defined in subpart (3) and (4) below. The annual report shall be made on the appropriate form [LCP-AR3, included as Attachment L], unless the Director has agreed to a different reporting format for a Program that has been granted extended authority under CCR Section 16427. A third party LCP that contracted with more than one Awarding Body or Joint Powers Authority during the annual reporting period shall separately report on Labor Code Section 1771.5(b) enforcement activities for each Awarding Body or Joint Powers Authority covered by the report.

The Annual Report for a person or entity operating a third party Labor Compliance Program shall also include: (1) a certification of compliance with conflict of interest disclosure requirements by employees and consultants who participate in making governmental decisions, as defined under Title 2, CCR Section 18701, and (2) a current statement disclosing the information required under CCR Section 16426(a)(2), (3) and (5).

Information in the Annual Report will be reported in sufficient detail to afford a basis for evaluating the scope and level of enforcement activity of the LCP. An annual report shall also include such additional information as the LCP may be required to report as a condition of its approval.

For purposes of this section, the annual reporting period shall be deemed to commence on the first of the month in which the LCP is first granted approval pursuant to CCR Section 16425 or 16426 and shall conclude on the last day of the month immediately preceding that date in the following year.

The Solis Group

Labor Compliance Program

FORMS

LABOR COMPLIANCE PROGRAM
JOB-START/PRE-CONSTRUCTION MEETING PACKET
CONTRACTOR HANDOUT

Included in this packet are materials to assist your company in complying with the Awarding Body's Labor Compliance Program (LCP). The Solis Group monitors and enforces the Awarding Body's LCP.

Have questions about how to comply with the LCP? Call the Lead Labor Compliance Officer assigned to monitor the project at (626) 685-6989.

PACKET INCLUDES:

1. Prevailing Wage / DIR Determination Website Link
2. Sample Prevailing Wage Determination
3. Pre-Construction Meeting Labor Compliance Responsibilities & Requirements
4. Prevailing Wage Contractor Handout
5. Division of Apprenticeship Standards – Apprenticeship Requirements
6. Required LCP Submittal Forms (Blank/Sample Forms)
   Attachment 1: Forms Submittal Schedule
   Attachment 2: LCP Checklist
   Attachment 3: DAS-140
   Attachment 4: DAS-142
   Attachment 5: CAC-2
   Attachment 6: Statement of Compliance
   Attachment 7: Certified Payroll Record
   Attachment 8: Statement of Non-Performance
   Attachment 9: Fringe Benefit Statement
   Attachment 10: Monthly Trustee Report
   Attachment 11: Monthly Employment Utilization Reporting Form
   Attachment 12: Public Works Affidavit

PREVAILING WAGE
DIR DETERMINATION WEBSITE LINK

http://www.dir.ca.gov/DLSR/statistics_research.html

The first bid advertisement date establishes which Department of Industrial Relations (DIR) determination to use for each work classification you assign to this project.

All contractors working on the ___________________ **Project** must refer to the following DIR determination:

200__ - __ / Prevailing Wage Determinations

(i.e. 2007-2 General prevailing wage determinations menu (journeyman) /
2007-2 General prevailing apprentice schedule menu).

NOTE: Contractors are held responsible for any/all increases to the prevailing wages. If you see a double asterisk after the determination expiration date (**), there will be an increase to the prevailing wages. If you have any questions, please call the Labor Compliance Officers assigned to monitor this project, at (626) 685-6989.

SAMPLE PREVAILING WAGE DETERMINATION

GENERAL PREVAILING WAGE DETERMINATION MADE BY THE DIRECTOR OF INDUSTRIAL RELATIONS
PURSUANT TO CALIFORNIA LABOR CODE PART 7, CHAPTER 1, ARTICLE 2, SECTIONS 1770, 1773 AND 1773.1
FOR COMMERCIAL BUILDING, HIGHWAY, HEAVY CONSTRUCTION AND DREDGING PROJECTS

CRAFT: # CARPENTER AND RELATED TRADES

DETERMINATION: SC-23-31-2-2002-1
ISSUE DATE: August 22, 2002
EXPIRATION DATE OF DETERMINATION: June 30, 2003** The rate to be paid for work performed after this date has been determined. If work will extend past this date, the new rate must be paid and should be incorporated in contracts entered into now. Contact the Division of Labor Statistics and Research for specific rates (415) 703-4774.

LOCALITY: All localities within Imperial, Inyo, Kern, Los Angeles, Mono, Orange, Riverside, San Bernardino, San Luis Obispo, Santa Barbara, and Ventura counties.

		Employer Payments				Straight-Time		Overtime Hourly Rate		
Classification (Journeyperson)	Basic Hourly Rate	Health and Welfare	Pension	Vacation/ Holiday	Training	Hours	Total Hourly Rate	Daily 1 1/2X	Saturday [b] 1 1/2X	Sunday and Holiday
[a] **AREA 1**										
Carpenter, Cabinet Installer, Insulation Installer, Hardwood Floor Worker, Acoustical Installer	[c]$29.00	2.45	1.01	2.88[f]	0.34	8	35.68	50.18	50.18	64.68
Pile Driverman, Derrick Bargeman, Rockslinger, Bridge or Dock Carpenter, Cable Splicer	29.13	2.45	1.01	2.88[f]	0.34	8	35.81	50.375	50.375	64.94
Bridge Carpenter	[c] 29.13	2.45	1.01	2.88[f]	0.34	8	35.81	50.375	50.375	64.94
Shingler	[c] 29.13	2.45	1.01	2.88[f]	0.34	8	35.81	50.375	50.375	64.94
Saw Filer	29.08	2.45	1.01	2.882[f]	0.34	8	35.76	50.30	50.30	64.84
Table Power Saw Operator	29.10	2.45	1.01	2.88[f]	0.34	8	35.78	50.33	50.33	64.88
Pneumatic Nailer or Power Stapler	29.25	2.45	1.01	2.88[f]	0.34	8	35.93	50.555	50.555	65.18
Roof Loader of Shingles	20.39	2.45	1.01	2.88[f]	0.34	8	27.07	37.265	37.265	47.46
Scaffold Carpenter	23.20	2.45	1.01	2.88[f]	0.34	8	29.88	41.48	41.48	53.08
Millwright	[c] 29.50	2.45	1.01	2.88[f]	0.34	8	36.18	50.93	50.93	65.68
Head Rockslinger	29.23	2.45	1.01	2.88[f]	0.34	8	35.91	50.525	50.525	65.14
Rock Bargeman or Scowman	29.03	2.45	1.01	2.88[f]	0.34	8	35.71	50.225	50.225	64.74
Diver, Wet (Up To 50 Ft. Depth) [d]	[c] 64.26	2.45	1.01	2.88[f]	0.34	8	70.94	103.07	103.07	135.20
Diver, (Stand-By)	[c] 32.13	2.45	1.01	2.88[f]	0.34	8	38.81	54.875	54.875	70.94
Diver's Tender	[c]31.13	2.45	1.01	2.88[f]	0.34	8	37.81	53.375	53.375	68.94
[a] **AREA 2**										
Carpenter, Cabinet Installer, Insulation Installer, Hardwood Floor Worker, Acoustical Installer	[c] 28.43	2.45	1.01	2.88[f]	0.34	8	35.11	49.325	49.325	63.54
Shingler	[c] 28.56	2.45	1.01	2.88[f]	0.34	8	35.24	49.52	49.52	63.80
Saw Filer	28.51	2.45	1.01	2.88[f]	0.34	8	35.19	49.445	49.445	63.70
Table Power Saw Operator	28.53	2.45	1.01	2.88[f]	0.34	8	35.21	49.475	49.475	63.74
Pneumatic Nailer or Power Stapler	28.68	2.45	1.01	2.88[f]	0.34	8	35.36	49.70	49.70	64.04
Roof Loader of Shingles	20.37	2.45	1.01	2.88[f]	0.34	8	27.05	37.235	37.235	47.42

DETERMINATION: SC-31-741-1-2003-1
ISSUE DATE: February 22, 2003
EXPIRATION DATE OF DETERMINATION: May 31, 2003* Effective until superseded by a new determination issued by the Director of Industrial Relations. Contact the Division of Labor Statistics and Research (415) 703-4774 for the new rates after 10 days from the expiration date, if no subsequent determination is issued.

LOCALITY: All localities within Imperial, Inyo, Kern, Los Angeles, Mono, Orange, Riverside, San Bernardino, San Luis Obispo, Santa Barbara, and Ventura counties.

		Employer Payments				Straight-Time		Overtime Hourly Rate		
Classification (Journeyperson)	Basic Hourly Rate	Health and Welfare	Pension	Vacation/ Holiday	Training	Hours	Total Hourly Rate	Daily 1 1/2x	Saturday/ [b] Sunday 1 1/2x	Holiday 2X
Terrazzo Installer	$30.84	2.45	1.01	2.88[f]	-	8	37.18	52.60	52.60	68.02
Terrazzo Finisher	24.34	2.45	1.01	2.88[f]	-	8	30.68	42.85	42.85	55.02

\# Indicates an apprenticeable craft. Rates for apprentices are available in the General Prevailing Wage Apprentice Schedules.

a **AREA 1** - Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Luis Obispo, Santa Barbara and Ventura counties.

AREA 2 - Inyo, Kern, and Mono counties. For Bridge Carpenter, Scaffold Carpenter, Pile Driverman, Derrick Bargeman, Rockslinger, Bridge or Dock Carpenter, Cable Splicer, Millwright, Head Rockslinger, Rock Bargeman or Scowman, Diver, Wet (Up to 50 Ft. Depth), Diver (Stand-By), and Diver's Tender rates, please see **Area 1** as this rate applies to **Area 2** as well. Basic Hourly Rates for **Area 2** include an additional amount deducted for vacation/holiday.

b Saturdays in the same work week may be worked at straight-time rates if a job is shut down during the normal work week due to inclement weather, major mechanical breakdown or lack of materials beyond the control of the Employer.

c When performing welding work requiring certification, carpenters and pile drivers will receive an additional $1.00 per hour.

d Shall receive a minimum of 8 hours pay for any day or part thereof.

e For specific rates over 50 ft depth, contact the Division of Labor Statistics and Research. Rates for Technicians, Manifold Operators, Pressurized Submersible Operators, Remote Control Vehicle Operators, and Remote Operated Vehicle Operators, as well as rates for Pressurized Bell Diving and Saturation Diving are available upon request.

f Includes an amount for supplemental dues.

RECOGNIZED HOLIDAYS: Holidays upon which the general prevailing hourly wage rate for Holiday work shall be paid, shall be all holidays in the collective bargaining agreement, applicable to the particular craft, classification, or type of worker employed on the project, which is on file with the Director of Industrial Relations. If the prevailing rate is not based on a collectively bargained rate, the holidays upon which the prevailing rate shall be paid shall be as provided in Section 6700 of the Government Code. You may obtain the holiday provisions for the current determinations on the Internet at http://www.dir.ca.gov/DLSR/PWD. Holiday provisions for current or superseded determinations may be obtained by contacting the Prevailing Wage Unit at (415) 703-4774.

TRAVEL AND/OR SUBSISTENCE PAYMENT: In accordance with Labor Code Sections 1773.1 and 1773.9, contractors shall make travel and/or subsistence payments to each worker to execute the work. You may obtain the travel and/or subsistence provisions for the current determinations on the Internet at http://www.dir.ca.gov/DLSR/PWD. Travel and/or subsistence requirements for current or superseded determinations may be obtained by contacting the Prevailing Wage Unit at (415) 703-4774.

PRE-CONSTRUCTION MEETING
LABOR COMPLIANCE RESPONSIBILITIES & REQUIREMENTS

I. REQUIRED SUBMITTALS (Submittal Schedule & Forms)

A. LCP Checklist – Submit at Pre-Construction Meeting (Review and sign)

1. Payment of Prevailing Wage Rates
    - Public Works Project requires the payment of prevailing wages to all employees
    - The prevailing wage determination applicable to this project can be found on the California Department of Industrial Relations website at: http://www.dir.ca.gov/DLSR/statistics_research.html
    - **You must refer to the _____ Determination**
2. Apprentices
    - All contractors must make a "good faith effort" to employ apprentices (if craft is apprenticeable).
    - Submit a DAS-140 (Public Works Contract Award Information) to your appropriate Apprenticeship Committee. Submit copy of your certified mail certificate as proof of your submittal.
3. Penalties
4. CPRs
5. Non-Discrimination in Employment
6. Kickbacks Prohibited
7. Acceptance of Fees Prohibited
8. Listing of Subcontractors
9. Proper Licensing
10. Unfair Competition Prohibited
11. Workers' Compensation Insurance
12. OSHA
13. Hiring Undocumented Workers
14. Itemized Wage Statements to Employees
15. Public Works Affidavit

B. DAS-140 & DAS-142 – Submit before you start work on the project.

- Requirement to "announce" that you will be working on a public works project (compliance is proven via submittal of DAS-140)
- Requirement to "request the dispatch of apprentices" for this public works project (compliance is proven via submittal of DAS-142 or via verbal request)
- These forms should be sent to the local apprenticeship committee for your craft.
- If you need the contact information for your applicable apprenticeship committee, call TSG at (626) 685-6989

C. CAC-2 – Submit each month, or 1-time submittal (at beginning or end of project)

- For every craft and every hour worked in that craft, you must make the appropriate training fund contributions. Record the total number of hours workers worked on the job, multiply by the appropriate training amount for that craft, and send a check to appropriate fund (see below).
- *Union Contractors:* On the CAC-2, indicate which Union Trust Fund you make training fund contributions to. TSG will audit Trust Fund Reports.
- *Non-Union contractors:* Must make training fund contributions to the California Apprenticeship Council. Send a copy of the CAC-2 form & copy of the contribution check to TSG.

D. CPRs & Statements of Compliance – Submit for each week you work on the project.

- *CPRs must be submitted for every week that work was performed on the project.*

- *Make sure that you include an accurate work classification for all your workers. (e.g. 'Laborer Group 2', 'Laborer Apprentice level 1' or 'apprentice 65%'*
- *CPRs are not valid unless accompanied by a signed statement of compliance*
- *CPRs must be submitted even on the weeks in which you did not perform any work – This is called a non-performance payroll.*
- *The last payroll should be marked as "final" – when we see the final payroll it triggers our closeout procedures.*

E. Fringe Benefit Statement - Submit with your 1st CPR.

- *Indicate each benefit amount for every individual craft you employ on this project.*
- *If fringe benefits are paid to workers in cash, please write that next to the benefit dollar amounts on the form.*
- *If fringe benefits are paid to a Union or Employer's Trust Fund on behalf of your workers, write the contact information in the designated places.*
- *Note: Training Fund Contributions are never paid to the employees.*

F. Trustee Reports – Submit monthly (typically 2 months in the rear)

- *If fringe benefits are paid to a Union or Employer's Trust Fund on behalf of your workers, Trust Fund Reports & copies of the contribution checks must be submitted monthly – this proves the benefits were paid for every hour worked on this project.*

G. Public Works Affidavit – Submit with your "final" CPR

- *Once TSG has received all the required submittals from your firm, and has resolved any outstanding issues, TSG will sign-off on the PWA & forward it to the District along with a Request for Release of Retention.*

II. PENALTIES

Goal: Resolve all issues before they reach the penalty stage. If workers are underpaid, we will give you the opportunity to correct the situation. However, if we do not receive the documents we need in a timely manner, or do not receive responses to our letters, we will not hesitate to impose penalties. Penalties can add up, ranging from $25 a day per worker to $50 dollars a day per worker.

LABOR COMPLIANCE PROGRAM
The Solis Group
234 North El Molino Avenue, Suite 202
Pasadena, CA 91101

Phone: (626) 685-6989
Fax: (626) 685-6985

The Solis Group

PREVAILING WAGE CONTRACTOR HANDOUT

PUBLIC WORKS REQUIREMENTS:

(1) The appropriate number of apprentices are on the job site, as set forth in Labor Code Section 1777.5;
(2) Worker's compensation coverage, as set forth in Labor Code Sections 1860 and 1861;
(3) Keep accurate records of the work performed on the public works project, as set forth in Labor Code Section 1812;
(4) Inspection of payroll records pursuant to Labor Code Section 1776, and as set forth in 8 CCR Section 16400(e);
(5) Withhold monies. See Labor Code Section 1727;
(6) Ensure that public works projects are not split or separated into smaller work orders or projects for the purpose of evading the applicable provisions of Labor Code Section 1771;
(7) Deny the right to bid on public work contracts to contractors or subcontractors who have violated public work laws, as set forth in Labor Code Section 1777.7;
(8) Not permit workers on public works to work more than eight hours a day or 40 hours in any one calendar week, unless compensated at not less than time and a half as set forth in Labor Code Section 1815.
Exception: If the prevailing wage determination requires a higher rate of pay for overtime work than is required under Labor Code Section 1815, then that higher overtime rate must be paid [as specified in 16200(a)(3)(F)];
(9) Not take or receive any portion of the workers' wages or accept a fee in connection with a public works project, as set forth in Labor Code Sections 1778 and 1779;
(10) Comply with those requirements as specified in Labor Code Sections 1776(g), 1777.5, 1810, 1813, and 1860; and
(11) Other requirements imposed by law.

THE CONTRACTOR AND SUBCONTRACTOR SHALL:

(1) Pay not less than the prevailing wage to all workers, as defined in the California Code of Regulations Section 16000(a), and as set forth in Labor Code Sections 1771 and 1774;
(2) Comply with the provisions of Labor Code Sections 1773.5, 1775, and 1777.5 regarding public works job sites;
(3) Provide workers' compensation coverage as set forth in Labor Code Section 1861;
(4) Comply with Labor Code Sections 1778 and 1779 regarding receiving a portion of wages or acceptance of a fee;
(5) Maintain and make available for inspection payroll records, as set forth in Labor Code Section 1776;
(6) Pay workers overtime pay, as set forth in Labor Code Section 1815 or as provided in the collective bargaining agreement adopted by the Director as set forth in 8 CCR Section 16200(a)(3);
(7) Comply with Section 16101 of these regulations regarding discrimination.
(8) Be subject to provisions of Labor Code Section 1777.7 which specifies the penalties imposed on a contractor who willfully fails to comply with provisions of Section 1777.5;
(9) Comply with those requirements as specified in Labor Code Sections 1810 and 1813; and
(10) Comply with other requirements imposed by law.

APPRENTICE TRAINING:

SEE LABOR CODE SECTION 1777.5 (e)

Prior to commencing work on a contract for public works, every contractor shall submit contract award information (via submittal of a DAS-140) to an applicable apprenticeship program that can supply apprentices to the site of the public work. The information submitted shall include an estimate of journeyman hours to be performed under the contract, the number of apprentices proposed to be employed, and the approximate dates the apprentices would be employed. A copy of this information shall also be submitted to the awarding body if requested by the awarding body. Within 60 days after concluding work on the contract, each contractor and subcontractor shall submit to the awarding body, if requested, and to the apprenticeship program a verified statement of the journeyman and apprentice hours performed on the contract. The information under this subdivision shall be public. The apprenticeship programs shall retain this information for 12 months.

APPRENTICE TRAINING CONTRIBUTION REQUIREMENTS:

SEE CALIFORNIA CODE OF REGULATIONS: TITLE 8, ARTICLE 4,
16200(G) **Wage rates, training contributions and apprenticeship contributions.**

Apprenticeship rates shall be determined by the Director of Industrial Relations using apprentice wage standards set forth in the collective bargaining agreement and/or approved by the California Apprenticeship Council. A contractor or subcontractor on a public works contract must pay training fund contributions or apprenticeship contributions in one of the following manners:

1. Into the appropriate craft apprenticeship program in the area of the site of the public work; or
2. An equivalent amount shall be paid to the California Apprenticeship Council (CAC) administered by DAS (if the trust fund is unable to accept such contributions).
3. If neither of the above will accept the funds, cash pay shall be as provided for in the California Code of Regulations Section 16200(a)(3)(I).

SEE CALIFORNIA CODE OF REGULATIONS: TITLE 8, ARTICLE 10, SECTION 230.2
§230.2. **Payment of Apprenticeship Training Contributions to the Council.**

(a) Contractors who are neither required nor wish to make apprenticeship training contributions to the applicable local training trust fund shall make their training contributions to the Council. Contractors may refer to the Director of the Department of Industrial Relations applicable prevailing wage determination for the amount owed for each hour of work performed by journeymen and apprentices in each apprenticeable occupation.

(b) Training contributions to the Council are due and payable on the 15th day of each month for work performed during the preceding month.

(c) Training contributions to the Council shall be paid by check and shall be accompanied by a completed CAC-2 Form, Training Fund Contributions or contain the following information:
  (1) The name, address, and telephone number of the contractor making the contribution.
  (2) The contractor's license number.
  (3) The name and address of the public agency that awarded the contract.
  (4) The jobsite location, including the county where the work was performed.
  (5) The contract or project number.
  (6) The time period covered by the enclosed contributions.
  (7) The contribution rate and total hours worked by apprenticeable occupation.

CERTIFYING PERSON

SEE CALIFORNIA CODE OF REGULATIONS: TITLE 8, GROUP 3, ARTICLE 1, SECTION 16000 DEFINITIONS.

A person with the authority to affirm under penalty of perjury that the records provided, depict truly, fully and correctly the type of work performed, the hours worked, days worked and amounts paid.

CHANGES TO PREVAILING RATE AFTER AWARD

SEE LABOR CODE SECTION: 1773.6

1773.6. If during any quarterly period the Director of Industrial Relations shall determine that there has been a change in any prevailing rate of per diem wages in any locality, he shall make such change available to the awarding body and his determination shall be final. Such determination by the Director of Industrial Relations shall not be effective as to any contract for which the notice to bidders has been published. *Exceptions: classifications marked as double asterisks.*

CREDITS, FOR FRINGE BENEFIT PAYMENTS

SEE CALIFORNIA CODE OF REGULATIONS: TITLE 8, GROUP3, ARTICLE 4

16200(i) Credit Available For Actual Payment of Fringe Benefit Costs up to the Prevailing Amount. The contractor obligated to pay the full prevailing rate of per diem wages may take credit for amounts up to the total of all fringe benefit amounts listed as prevailing in the appropriate wage determination. This credit may be taken only as to amounts which are actual payments under Employer Payments Section 16000(1)-(3). In the event that the total of Employer Payments by a contractor for the fringe benefits listed as prevailing is less than the aggregate amount set out as prevailing in the wage determination, the contractor must pay the difference directly to the employee. No amount of credit for payments over the aggregate amount of employer payments shall be taken nor shall any credit decrease the amount of direct payment of hourly wages of those amounts found to be prevailing for straight time or overtime wages.

THE RULE:

The contractor can pay amounts for individual benefits different than the state shows in the wage reports so long as it is not more than the total amount permitted for all benefits. Any contractor paid amount less than the total benefit requirements listed in the state wage reports must be paid to the employee.

EMPLOYEE'S SUBJECT TO PREVAILING WAGES

SEE LABOR CODE SECTION 1771, 1772 & 1776

All workers on the project shall be paid the wage of the trade they are most closely related to. This includes: any one on site, and off site even at remote manufacturing facilities.

1771. Except for public works projects of one thousand dollars ($1,000) or less, not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the public work is performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed as provided in this chapter, shall be paid to all workers employed on public works.

1772. Workers employed by contractors or subcontractors in the execution of any contract for public work are deemed to be employed upon public work.

1776. (a) Each contractor and subcontractor shall keep an accurate payroll record, showing the name, address, social security number, work classification, and straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the public work.

EMPLOYER PAYMENTS

SEE CALIFORNIA CODE OF REGULATIONS: TITLE 8, ARTICLE 1, SECTION 16000 DEFINITIONS

(1) The rate of contribution irrevocably made by a contractor or subcontractor to a trustee or to a third person pursuant to a fund, plan, or program for the benefit of employees, their families and dependents, or retirees;

(2) The rate of costs to the contractor or subcontractor which may be reasonably anticipated in providing benefits to employees, their families and dependents or to retirees pursuant to an enforceable commitment or agreement to carry out a financially responsible plan or program which was communicated in writing to the workers affected; and

(3) The rate of contribution irrevocably made by the contractor or subcontractor for apprenticeship or other training programs authorized by Section 3071 and/or 3093 of the Labor Code.

FRINGE BENEFIT PAYMENT REQUIREMENTS

SEE CALIFORNIA CODE OF REGULATIONS: TITLE 8, ARTICLE 1, SECTION 16000 DEFINITIONS

All fringe benefits must be irrevocably paid to an authorized fund or to the employee.
No unpaid amounts are allowed.

FRINGE BENEFITS INCLUDE

CALIFORNIA CODE OF REGULATIONS: TITLE 8, ARTICLE 1, SECTION 16000. DEFINITIONS

The prevailing rate of employer payments for any or all programs or benefits for employees, their families and dependents, and retirees which are of the types enumerated below:

(1) Medical and hospital care, prescription drugs, dental care, vision care, diagnostic services, and other health and welfare benefits;
(2) Retirement plan benefits;
(3) Vacations and holidays with pay, or cash payments in lieu thereof;
(4) Compensation for injuries or illnesses resulting from occupational activity;
(5) Life, accidental death and dismemberment, and disability or sickness and accident insurance;
(6) Supplemental unemployment benefits;
(7) Thrift, security savings, supplemental trust, and beneficial trust funds otherwise designated, provided all of the money except that used for reasonable administrative expenses is returned to the employees;
(8) Occupational health and safety research, safety training, monitoring job hazards, and the like, as specified in the applicable collective bargaining agreement;
(9) See definition of “Employer Payments,” (3).
(10) Other bonafide benefits for employees, their families and dependents, or retirees as the Director may determine; and
(11) Travel time and subsistence pay as provided for in Labor Code Section 1773.8.

FRINGE BENEFITS DO NOT INCLUDE

CALIFORNIA CODE OF REGULATIONS: TITLE 8, ARTICLE 1, SECTION 16000. DEFINITIONS

The term “general prevailing rate of per diem wages” does not include any employer payments for:

(1) Job related expenses other than travel time and subsistence pay;
(2) Contract administration, operation of hiring halls, grievance processing, or similar purposes except for those amounts specifically earmarked and actually used for administration of those types of employee or retiree benefit plans enumerated above;
(3) Union, organizational, professional or other dues except as they may be included in and withheld from the basic taxable hourly wage rate;
(4) Industry or trade promotion;
(5) Political contributions or activities;

(6) Any benefit for employees, their families and dependents, or retirees including any benefit enumerated above where the contractor or subcontractor is required by Federal, State, or local law to provide such benefit; or

(7) Such other payments as the Director may determine to exclude.

PAYROLL RECORDS INCLUDE

CALIFORNIA CODE OF REGULATIONS: TITLE 8, ARTICLE 1, SECTION 16000. DEFINITIONS

All time cards, bank certified cancelled checks, cash receipts, trust fund forms, books, documents, schedules, forms, reports, receipts or other evidences which reflect job assignments, work schedules by days and hours, and the disbursement by way of cash, check, or in whatever form or manner, of funds to a person(s) by job classification and/or skill pursuant to a public works project.

PERSONS REQUIRED TO RECEIVE PREVAILING WAGES

SEE LABOR CODE SECTIONS:

1771. Prevailing wages shall be paid to all workers employed on public works.

1774. The contractor to whom the contract is awarded, and any subcontractor under him, shall pay not less than the specified prevailing rates of wages to all workmen employed in the execution of the contract.

WITHHOLDING PAYMENTS, JUSTIFICATION

SEE LABOR CODE SECTION: 1727 & 1771.5(b),(5)
SEE CALIFORNIA CODE OF REGULATIONS: TITLE 8, ARTICLE 5, SECTION 16435

16435(a) “Withhold” means to cease payments by the awarding body, or others who pay on its behalf, or agents, to the general contractor. Where the violation is by a subcontractor, the general contractor shall be notified of the nature of the violation and reference made to its rights under Labor Code Section 1729.

(1) “Contracts.” Except as otherwise provided by agreement, only contracts under a single master contract, or contracts entered into as stages of a single project, may be the subject of withholding.

(2) “Delinquent payroll records” means those not submitted on the date set in the contract.

(3) “Inadequate payroll records” are any one of the following:

(4) A record lacking the information required by Labor Code Section 1776;

(5) A record which contains the required information but is not certified, or certified by someone not an agent of the contractor or subcontractor;

(6) A record remaining uncorrected for one payroll period, after the awarding body has given the contractor notice of inaccuracies detected by audit or record review, provided, however, that prompt correction will stop any duty to withhold if such inaccuracies do not amount to one percent of the entire Certified Weekly Payroll in dollar value and do not affect more than half the persons listed as workers employed on that Certified Weekly Payroll, as defined in Labor Code Section 1776 and Title 8 CCR Section 16401.

DIRECTOR OF INDUSTRIAL RELATIONS PRECEDENTIAL DECISIONS WHICH REQUIRE PREVAILING WAGES:

Decision 92-036: stands for the payment of out-of-state workers if they are working on California “Public Works”

Decision 93-019: stands for the payment of truck drivers removing, delivering or relocating material on “Public Works”

Decision 94-017: stands for the payment of waste processors off site if the waste is exclusively from "Public Works"

COURT DECISIONS:

Standard Traffic Services v. Department of Transportation (case 132667) Shasta: partners are due prevailing wages if working on "Public Works"

STATE OF CALIFORNIA

DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF APPRENTICESHIP STANDARDS
28 CIVIC CENTER PLAZA, ROOM 525
SANTA ANA, CA 92701

TO ALL PUBLIC WORKS CONTRACTORS

Congratulations on having been awarded a public works project.

The Division of Apprenticeship Standards wishes to bring to your attention your responsibilities under California Labor Code Section 1777.5 Apprentices on Public Works. (Excerpts from California Labor Code relating to apprentices on public works. DAS-10 is attached).

Compliance with California Labor Code Section 1777.5 requires all public works <u>contractors and subcontractors to:</u>

- Submit contract award information within 10 days of contract award, to the applicable Joint Apprenticeship Committee, which shall include an estimate of Journeyman hours to be performed under the contract, the number of apprentices to be employed, and the approximate dates the apprentices will be employed. This information may be submitted on the attached form. DAS 140.

- Employ apprentices on the public work in a ratio to journeymen of no less than one hour of apprentices work for every five hours of labor performed by a journeyman.

- Pay the apprentice rate on public works projects only to those apprentices who are registered as defined in Labor Code Section 3077.

- Contribute to the training fund in the amount identified in the Prevailing Wage Rate publication for journeymen and apprentices. Contractors who choose not to contribute to the local training trust fund must make their contribution to the California Apprenticeship Council (CAC) at P.O. Box 420603, San Francisco, CA 94142.

Training fund contributions to the CAC are due and payable on the 15th day of each month for work performed during the preceding month.

Training fund contributions to the CAC shall be paid by check and shall be accompanied by a completed form CAC-2 (attached).

Failure to comply with the provisions of the Labor Code Section 1777.5 may result in the loss of the right to bid on all public works projects for a period of one to three years and the imposition of a civil penalty of $100.00 for each calendar day of noncompliance. Contractors should provide a copy of this material to each subcontractor.

If the Division of Apprenticeship Standards can be of assistance to you, please contact our office at (714) 558-4126.

STATE OF CALIFORNIA – DEPARTMENT OF INDUSTRIAL RELATIONS – DIVISION OF APPRENTICESHIP STANDARDS

EXERPTS FROM THE CALFORNIA LABOR CODE RELATING TO APPRENTICES ON PUBLIC WORKS

Chapter 1 of Division 2

APPRENTICES ON PUBLIC WORKS

1773.3. An awarding agency whose public works contract falls within the jurisdiction of Section 1777.5 shall, within five days of the award, send a copy of the award to the Division of Apprenticeship Standards. When specifically requested by a local joint apprenticeship committee, the division shall notify the local joint apprenticeship committee regarding all such awards applicable to the joint apprenticeship committee making the request. Within five days of a finding of any discrepancy regarding the ratio of apprentices to journeymen, pursuant to the certificated fixed number of apprentices to journeymen, the awarding agency shall notify the Division of Apprenticeship Standards.

1776. (a) Each contractor and subcontractor shall keep accurate payroll records, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the public work. Each payroll record shall contain or be verified by a written declaration that it is made under penalty of perjury, stating both of the following:

(1) The information contained in the payroll record is true and correct.

(2) The employer has complied with the requirements of Sections 1771, 1811, and 1815 for any work performed by his or her employees on the public works project.

(b) The payroll records enumerated under subdivision (a) shall be certified and shall be available for inspection at all reasonable hours at the principal office of the contractor on the following basis:

(1) A certified copy of an employee's payroll record shall be made available for inspection or furnished to the employee or his or her authorized representative on request.

(2) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection or furnished upon request to a representative of the body awarding the contract, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the Department of Industrial Relations.

(3) A certified copy of all payroll records enumerated in subdivision (a) shall be made available upon request by the public for inspection or for copies thereof. However, a request by the public shall be made through either the body awarding the contract, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided pursuant to paragraph (2), the requesting party shall, prior to being provided the records, reimburse the costs of preparation by the contractor, subcontractors, and the entity through which the request was made. The public shall not be given access to the records at the principal office of the contractor.

(c) The certified payroll records shall be on forms provided by the Division of Labor Standards Enforcement or shall contain the same information as the forms provided by the division.

(d) A contractor or subcontractor shall file a certified copy of the records enumerated in subdivision (a) with the entity that requested the records within 10 days after receipt of a written request.

(e) Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the awarding body, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement shall be marked or obliterated in a manner so as to prevent disclosure of an individual's name, address, and social security number. The name and address of the contractor awarded the contract or the subcontractor performing the contract shall not be marked or obliterated.

(f) The contractor shall inform the body awarding the contract of the location of the records enumerated under subdivision (a), including the street address, city and county, and shall, within five working days, provide a notice of a change of location and address.

(g) The contractor or subcontractor shall have 10 days in which to comply subsequent to receipt of a written notice requesting the records enumerated in subdivision (a). In the event that the contractor or subcontractor fails to comply within the 10-day period, he or she shall, as a penalty to the state or political subdivision on whose behalf the contract is made or awarded, forfeit twenty-five dollars ($25) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due. A contractor is not subject to a penalty assessment pursuant to this section due to the failure of a subcontractor to comply with this section.

(h) The body awarding the contract shall cause to be inserted in the contract stipulations to effectuate this section.

(i) The director shall adopt rules consistent with the California Public Records Act, (Chapter 3.5 (commencing with Section 6250), Division 7, Title 1, Government Code) and the Information Practices Act of 1977, (Title 1.8 (commencing with Section 1798), Part 4, Division 3, Civil Code) governing the release of these records, including the establishment of reasonable fees to be charged for reproducing copies of records required by this section.

(j) This section shall remain in effect only until January 1, 2003, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2003, deletes or extends that date.

1777.5. (a) Nothing in this chapter shall prevent the employment of properly registered apprentices upon public works.

(b) Every apprentice employed upon public works shall be paid the prevailing rate of per diem wages for apprentices in the trade to which he or she is registered and shall be employed only at the work of the craft or trade to which he or she is registered.

(c) Only apprentices, as defined in Section 3077, who are in training under apprenticeship standards that have been approved by the Chief of the Division of Apprenticeship Standards and who are parties to written apprentice agreements under Chapter 4 (commencing with Section 3070) of Division 3 are eligible to be employed at the apprentice wage rate on public works. The employment and training of each apprentice shall be in accordance with either (1) the apprenticeship standards and apprentice agreements under which he or she is training or (2) the rules and regulations of the California Apprenticeship Council.

(d) When the contractor to whom the contract is awarded by the state or any political subdivision, in performing any of the work under the contract, employs workers in any apprenticeable craft or trade, the contractor shall employ apprentices in at least the ratio set forth in this section and may apply to any apprenticeship program in the craft or trade that can provide apprentices to the site of the public work for a certificate approving the contractor under the apprenticeship standards for the employment and training of apprentices in the area or industry affected. However, approval or denial of the apprenticeship program shall be subject to review by the Administrator of Apprenticeship. The apprenticeship program or programs, upon approving the contractor, shall arrange for the dispatch of apprentices to the contractor. A contractor covered by an apprenticeship program's standards shall not be required to submit any additional application in order to include additional public works contracts under that the program. "Apprenticeable craft or trade," as used in this section, means a craft or trade determined as an apprenticeable occupation in accordance with rules and regulations prescribed by the California Apprenticeship Council. As used in this section, "contractor" includes any subcontractor under a contractor who performs any public works not excluded by subdivision (o).

(e) Prior to commencing work on a contract for public works, every contractor shall submit contract award information to an applicable apprenticeship program that can supply apprentices to the site of the public work. The information submitted shall include an estimate of journeyman hours to be performed under the contract, the number of apprentices proposed to be employed, and the approximate dates the apprentices would be employed. A copy of this information shall also be submitted to the awarding body if requested by the awarding body. Within 60 days after concluding work on the contract, each contractor and subcontractor shall submit to the awarding body, if requested, and to the apprenticeship program a verified statement of the journeyman and apprentice hours performed on the contract. The information under this subdivision shall be public. The apprenticeship programs shall retain this information for 12 months.

(f) The apprenticeship program that can supply apprentices to the area of the site of the public work shall ensure equal employment and affirmative action in apprenticeship for women and minorities.

(g) The ratio of work performed by apprentices to journeymen employed in a particular craft or trade on the public work may be no higher than the ratio stipulated in the apprenticeship standards under which the apprenticeship program operates where the contractor agrees to be bound by those standards, but, except as otherwise provided in this section, in no case shall the ratio be less than one hour of apprentice work for every five hours of journeyman work.

(h) This ratio of apprentice work to journeyman work shall apply during any day or portion of a day when any journeyman is employed at the jobsite and shall be computed on the basis of the hours worked during the day by journeymen so employed. Any work performed by a journeyman in excess of eight hours per day or 40 hours per week shall not be used to calculate the ratio. The contractor shall employ apprentices for the number of hours computed as above before the end of the contract or, in the case of a subcontractor, before the end of the subcontract. However, the contractor shall endeavor, to the greatest extent possible, to employ apprentices during the same time period that the journeymen in the same craft or trade are employed at the jobsite. Where an hourly apprenticeship ratio is not feasible for a particular craft or trade, the Division of Apprenticeship Standards, upon application of an apprenticeship program, may order a minimum ratio of not less than one apprentice for each five journeymen in a craft or trade classification.

(i) A contractor covered by this section that has agreed to be covered by an apprenticeship program's standards upon the issuance of the approval certificate, or that has been previously approved for an apprenticeship program in the craft or trade, shall employ the number of apprentices or the ratio of apprentices to journeymen stipulated in the applicable apprenticeship standards, but in no event less than the 1-to-5 ratio required by subdivision (g).

(j) Upon proper showing by a contractor that he or she employs apprentices in a particular craft or trade in the state on all of his or her contracts on an annual average of not less than one hour of apprentice work for every five hours of labor performed by journeymen, the Division of Apprenticeship Standards may grant a certificate exempting the contractor from the 1-to-5 hourly ratio, as set forth in this section for that craft or trade.

(k) An apprenticeship program has the discretion to grant to a participating contractor or contractor association a certificate, which shall be subject to the approval of the Administrator of Apprenticeship, exempting the contractor from the 1-to-5 ratio set forth in this section when it finds that any one of the following conditions is met:

(1) Unemployment for the previous three-month period in the area exceeds an average of 15 percent.

(2) The number of apprentices in training in the area exceeds a ratio of 1 to 5.

(3) There is a showing that the apprenticeable craft or trade is replacing at least one-thirtieth of its journeymen annually through apprenticeship training, either on a statewide basis or on a local basis.

(4) Assignment of an apprentice to any work performed under a public works contract would create a condition that would jeopardize his or her life or the life, safety, or property of fellow employees or the public at large, or the specific task to which the apprentice is to be assigned is of a nature that training cannot be provided by a journeyman.

(l) When an exemption is granted pursuant to subdivision (k) to an organization that represents contractors in a specific trade from the 1-to-5 ratio on a local or statewide basis, the member contractors will not be required to submit individual applications for approval to local joint apprenticeship committees, if they are already covered by the local apprenticeship standards.

(m) A contractor to whom a contract is awarded, who, in performing any of the work under the contract, employs journeymen or apprentices in any apprenticeable craft or trade shall contribute to the California Apprenticeship Council the same amount that the director determines is the prevailing amount of apprenticeship training contributions in the area of the public works site. A contractor may take as a credit for payments to the council any amounts paid by the contractor to an approved apprenticeship program that can supply apprentices to the site of the public works project. The contractor may add the amount of the contributions in computing his or her bid for the contract. At the end of each fiscal year the California Apprenticeship Council shall make grants to each apprenticeship program in proportion to the number of hours of training provided by the program for which the program did not receive contributions, weighted by the regular rate of contribution for the program. These grants shall be made from funds collected by the California Apprenticeship Council during the fiscal year pursuant to this subdivision from contractors that employed registered apprentices but did not contribute to an approved apprenticeship program. All these funds received during the fiscal year shall be distributed as grants.

(n) The body awarding the contract shall cause to be inserted in the contract stipulations to effectuate this section. The stipulations shall fix the responsibility of compliance with this section for all apprenticeable occupations with the prime contractor.

(o) This section does not apply to contracts of general contractors or to contracts of specialty contractors not bidding for work through a general or prime contractor when the contracts of general contractors or those specialty contractors involve less than thirty thousand dollars ($30,000) or 20 working days.

(p) All decisions of an apprenticeship program under this section are subject to Section 3081.

1777.6. It shall be unlawful for an employer or a labor union to refuse to accept otherwise qualified employees as registered apprentices on any public works, on the ground of the race, religious creed, color, national origin, ancestry, sex, or age, except as provided in Section 3077, of such employee.

1777.7. (a) A contractor or subcontractor that knowingly violates Section 1777.5 shall forfeit as a civil penalty an amount not exceeding one hundred dollars ($100) for each full calendar day of noncompliance. The amount of this penalty shall be based on consideration whether the violation was a good faith mistake due to inadvertence. A contractor or subcontractor that knowingly commits a second or subsequent violation of Section 1777.5 within a three-year period, where the noncompliance results in apprenticeship training not being provided as required by this chapter, shall forfeit as a civil penalty the sum of not more than three hundred dollars ($300) for each full calendar day of noncompliance. Notwithstanding Section 1727, upon receipt of a determination that a civil penalty has been imposed, the awarding body shall withhold the amount of the civil penalty from contract progress payments then due or to become due.

(b) (1) In the event a contractor or subcontractor is determined by the Administrator of Apprenticeship to have knowingly violated any provision of Section 1777.5, the Administrator shall deny to the contractor or subcontractor, both individually and in the name of the business entity under which the contractor or subcontractor is doing business, the right to bid on or receive any public works contract for a period of up to one year for the first violation and for a period of up to three years for a second or subsequent violation. Each period of debarment shall run from the date the determination of noncompliance by the Administrator of Apprenticeship.

(2) An affected contractor or subcontractor may obtain a review of the debarment or civil penalty by transmitting a written request to the office of the Administrator within 30 days after service of the order of debarment or civil penalty. If the Administrator receives no request for review within 30 days after service, the order of debarment or civil penalty shall become final for the period authorized.

(3) Within 20 days of the timely receipt of a request for hearing, the Administrator shall provide the contractor or subcontractor the opportunity to review any evidence the Administrator may offer at the hearing. The Administrator shall also promptly disclose to the contractor or subcontractor any nonprivileged documents obtained after the 20-day time limit.

(4) Within 90 days of the timely receipt of the a request for hearing, a hearing shall be commenced before an impartial hearing officer designated by the Administrator and possessing the qualifications of an administrative law judge pursuant to Section 11502 of the Government Code. The contractor or subcontractor shall have the burden of showing compliance with Section 1777.5. The decision to debar shall be reviewed by a hearing officer or court only for abuse of discretion.

(5) Within 45 days of the conclusion of the hearing, the hearing officer shall issue a written decision affirming, modifying, or dismissing the debarment or civil penalty. The decision shall contain a notice of findings, findings, and an order. This decision shall be deemed the final decision of the Administrator and shall be served on all parties and the awarding body pursuant to Section 1013 of the Code of Civil Procedure by first-class mail at the last known address of the party on file with the Administrator. Within 15 days of issuance of the decision, the hearing officer may reconsider or modify the decision to correct an error, except that a clerical error may be corrected at any time.

(6) An affected contractor or subcontractor may obtain review of the final decision of the Administrator by filing a petition for a writ of mandate to the appropriate superior court pursuant to Section 1094.5 of the Code of Civil Procedure within 45 days after service of the final decision to debar or to assess a civil penalty. If no petition for a writ of mandate is filed within 45 days after service of the final decision, the order shall become final. If the petitioner claims that the findings are not supported by the evidence, abuse of discretion is established if the court determines that the findings are not supported by substantial evidence in light of the entire record.

(7) The Administrator may file a certified copy of a final order with the clerk of the superior court in any county in which the affected contractor or subcontractor has property or has or had a place of business.

(c) If a subcontractor is found to have violated Section 1777.5, the prime contractor of the project is not liable for any penalties under subdivision (a), unless the prime contractor had knowledge of the subcontractor's failure to comply with the provisions of Section 1777.5 or unless the prime contractor fails to comply with any of the following requirements:

(1) The contract executed between the contractor and the subcontractor or the performance of work on the public works project shall include a copy of the provisions of Sections 1771, 1775, 1776, 1777.5, 1813, and 1815.

(2) The contractor shall continually monitor a subcontractor's use of apprentices required to be employed on the public works project pursuant to subdivision (d) of Section 1777.5, including, but not limited to, periodic review of the certified payroll of the subcontractor.

(3) Upon becoming aware of a failure of the subcontractor to employ the required number of apprentices, the contractor shall take corrective action, including, but not limited to, retaining funds due the subcontractor for work performed on the public works project until the failure is corrected.

(4) Prior to making the final payment to the subcontractor for work performed on the public works project, the contractor shall obtain an affidavit signed under penalty of perjury from the subcontractor that the subcontractor has employed the required number of apprentices on the public works project.

(d) In lieu of the penalty provided for in subdivision (a) or (b), the director may for a first-time violation and with the concurrence of the apprenticeship program, order the contractor or subcontractor to provide apprentice employment equivalent to the work hours that would have been provided for apprentices during the period of noncompliance.

(e) Any funds withheld by the awarding body pursuant to this section shall be deposited in the General Fund if the awarding body is a state entity, or in the equivalent fund of an awarding body if the awarding body is an entity other than the state.

(f) The interpretation and enforcement of Section 1777.5 and this section shall be in accordance with the rules and procedures of the California Apprenticeship Council.

Division of Apprenticeship Standards

APPRENTICES ON PULIC WORKS

SUMMARY OF REQUIREMENTS

Compliance with California Labor Code Section 1777.5 requires all public works contractors and subcontractors to:

- Submit contract award information to the applicable joint apprenticeship committee, including an estimate of the journeyman hours to be performed under the contract, the number of apprentices to be employed, and the approximate dates the apprentices will be employed.

  The contract award information shall be in writing, and shall be provided to the applicable apprenticeship committee within 10 days of the date of the agreement or contract award, but in no event later than the first day in which the contractor has workers employed upon the public work. (California Code of Regulations, Title 8, Section 230.)

- Employ apprentices on the public work in a ratio to journeymen of no less than one hour of apprentice work for every five hours of labor performed by a journeyman.

- Contribute to the training fund in the amount identified in the Prevailing Wage Rate publication for journeymen and apprentices. Contractors who choose not to contribute to the local training trust fund must make their contributions to the California Apprenticeship Council, P.O. Box 420603, San Francisco, CA 94142. Training contributions to the Council are due and payable on the 15th of the month for work performed during the preceding month.

  Training contributions to the Council shall be paid by check and shall be accompanied by a completed CAC2 form, Training Fund Contributions, or the following information (California Code of Regulations, Title 8, Section 230.2 c):

  1. Name, address and telephone number of the contractor making the contribution.
  2. Contractor's license number.
  3. Name and address of the public agency that awarded the contract.
  4. Jobsite location, including the county where the work was performed.
  5. Contract or project number
  6. Time period covered by the enclosed contributions.
  7. Contribution rate and total hours worked by the apprenticable occupation(s).

- Pay the apprentice rate on public works projects only to those apprentices who are registered, as defined in Labor Code Section 3077:

Sec. 3077. The term "apprentice" as used in this chapter means a person at least 16 years of age who has entered into a written agreement, in this chapter called an "apprentice agreement," with an employer or program sponsor. The term of apprenticeship for each apprenticeable occupation shall be approved by the chief, and in no case shall provide for no less than 2,000 hours or reasonably continuous employment for such person for his or her participation in an approved program of training through employment and through education in related and supplemental subjects.

FORMS SUBMITTAL SCHEDULE

Document Name	Frequency	Submittal Due Date	Notes:
LCP Checklist	1-time submittal	At pre-construction/LCP meeting	Must be submitted by all listed contractors and subcontractors
Form DAS-140 Public Works Contract Award Info **Form DAS-142** (recommended)	1-time submittal	Prior to start of work	A copy MUST be forwarded to the Labor Compliance Officer *A DAS-142, the form to "request for dispatch of an apprentice" is not a required submittal; however, making a request for the dispatch of an apprentice IS REQUIRED (verbal or written). Therefore, the submittal of a DAS-142 is recommended, since it serves as proof the request was made.*
Fringe Benefit Statement	1-time submittal, then as benefit amounts change	Submitted with 1st CPR, then as contribution amount changes	In the event fringe benefits are paid "in cash" to workers, contractor should indicate "fringe benefits paid in cash" across this form. Note: Training contributions should be paid to the CAC or an approved apprenticeship training program; not to the employee.
Statement of Compliance **Certified Payroll Report (CPR)** **Statement of Non-Performance**	Weekly	Within 10 days of end of payroll period	CPRs to be submitted to the Labor Compliance Officer within 10 days from the end of the payroll period. All documents modifying the payrolls must accompany the CPR; these include but are not limited to: approved "make-up days," "special-shifts," "alternative work schedules." All inactive workweeks (after the submission of the 1st CPR) should be reported on a "Statement of Non-Performance"
Owner-Operators Statement of Compliance **Owner-Operator CPR**	Weekly	(If applicable) Within 10 days of end of payroll period	If applicable, all Owner-Operators are to be reported on these forms. Forward forms to the Labor Compliance Officer weekly.
Employer's Monthly Report to Trustees **Copy of the contribution check**	Monthly	Within 15 days of end of reporting month	Submit monthly reports sent to the trust/plan along with a copy of the contribution check, to the Labor Compliance Officer.
Form CAC-2 Training Funds Contributions **Copy of the contribution check**	Monthly	By the 15th of each month, for work performed in the preceding month	A copy MUST be forwarded to the Labor Compliance Officer Monthly submittal should reflect the accurate monthly man-hours performed during the previous month. The CAC-2 form must be accompanied with a copy of the contribution check.
List of Sub-Tier Subcontractors	1-time submittal, then as subs are brought on	Prior to start of work	Must be submitted by all contractors. Indicate which subcontractors the contractor intends to utilize in execution of its project work
Public Works Affidavit	1-time submittal	At conclusion of work	To be submitted to the Labor Compliance Officer by the prime and each sub at the conclusion of the work and prior to release of retention.

CALIFORNIA CODE OF REGULATIONS CHECKLIST

LABOR COMPLIANCE PROGRAM
The Solis Group
234 North El Molino Avenue, Suite 202
Pasadena, CA 91101
Phone: (626) 685-6989
Fax: (626) 685-6985

The Solis Group

CHECKLIST OF LABOR LAW REQUIREMENTS FOR REVIEW AT JOB START MEETINGS

(In accordance with CCR Section 16430)

The federal and state labor law requirements applicable to the contract are composed of, but not limited to, the following:

LCP Checklist	**Contractor's Initials**
1. Payment of Prevailing Wage Rates The award of a public works contract requires that all workers employed on the project be paid not less than the specified general prevailing wage rates by the contractor and its subcontractors per Labor Code Section 1770. The contractor is responsible for obtaining and complying with all applicable general prevailing wage rates for trades workers and any rate changes which may occur during the term of the contract. Prevailing wage rates and rate changes are to be posted at the job site for workers to view or be provided to workers upon request. By signing the LCP Checklist, all contractors and subcontractors are assenting to obtaining the correct prevailing wage rates.	
2. Apprentices It is the duty of the contractor and subcontractors to employ registered apprentices on public works projects per Labor Code Section 1777.5;	
3. Penalties Penalties, including forfeitures and debarment, shall be imposed for contractor/subcontractor failure to pay prevailing wages, failure to maintain and submit accurate certified payroll records upon request, failure to employ apprentices, and failure to pay employees for all hours worked at the correct prevailing wage rate, in accordance with Labor Code Sections 1775, 1776, 1777.7, and 1813.	
4. Certified Payroll Records Per Labor Code Section 1776, contractors and subcontractors are required to keep accurate payroll records which reflect the name, address, social security number, and work classification of each employee; the straight time and overtime hours worked each day and each week; the fringe benefits; and the actual per diem wages paid to each journeyperson, apprentice, worker, or other employee hired in connection with a public works project. In an effort to prove that per diem wages were paid to the workers on behalf of the contractor, by signing the LCP Checklist the contractor is assenting to the fact that it will provide TSG with copies of bank certified cancelled checks make to workers, the California Apprenticeship Council, and/or Union or other trust funds, as required by the California Labor Code §1776(a)(2)(b), and the California Department of Industrial Relations (Chapter 8, Subchapter 3, Article 1, §16000). Employee payroll records shall be certified and shall be made available for inspection at all reasonable hours at the principal office of the contractor/subcontractor, or shall be furnished to any employee, or to his or her authorized representative, on request. Contractors and subcontractors shall maintain their certified payrolls on a weekly basis and shall submit said payrolls to TSG in a timely manner, and at least on a monthly basis. In the event that there has been no work performed during a given week, the Certified Payroll Record shall be annotated "No Work" for that week.	

CALIFORNIA CODE OF REGULATIONS CHECKLIST

5. Nondiscrimination in Employment

   Prohibitions against employment discrimination are contained in Labor Code Sections 1735 and 1777.6; the Government Code; the Public Contracts Code; and Title VII of the Civil Rights Act of 1964, as amended. All contractors and subcontractors are required to implement equal employment opportunities as delineated below:

   a. Equal Employment Poster

      The equal employment poster shall be posted at the job site in a conspicuous place visible to employees and employment applicants for the duration of the project.

6. Kickbacks Prohibited

   Per Labor Code Section 1778, contractors and subcontractors are prohibited from accepting, taking wages illegally, or extracting "kickbacks" from employee wages.

7. Acceptance of Fees Prohibited

   Contractors and subcontractors are prohibited from exacting any type of fee for registering individuals for public work (Labor Code Section 1779), or for filling work orders on public works contracts (Labor Code Section 1780);

8. Listing of Subcontractors

   Contractors are required to list all subcontractors hired to perform work on a public works project when that work is equivalent to more than one-half of one percent of the total effort (Public Contracts Code Section 4104) TSG will request sub-contractor listings for all project contractors reported on the project.

9. Proper Licensing

   Contractors and subcontractors are required to be properly licensed. Penalties will be imposed for employing workers while unlicensed (Labor Code Section 1021 and Business and Professions Code Section 7000 et seq. under California Contractors License Law).

10. Unfair Competition Prohibited

    Contractors and subcontractors are prohibited from engaging in unfair competition (Business and Professions Code Sections 17200-17208).

11. Workers' Compensation Insurance

    All contractors and subcontractors are required to be insured against liability for workers' compensation, or to undertake self-insurance in accordance with the provisions of Labor Code §3700 (LC§1861).

12. OSHA

    Contractors and subcontractors are required to comply with the Occupational, Safety and Health laws and regulations applicable to the particular public works project.

    In accordance with federal and state laws and contract documents, the undersigned contractor herein certifies that it will comply with the foregoing labor law requirements; and fully understands that failure to comply with these requirements will subject it to the penalties cited herein.

13. Hiring Undocumented Workers

    Contractors and subcontractors are required to secure proof of eligibility/citizenship from all project workers due to the federal prohibition against hiring undocumented workers.

14. Itemized Wage Statements to Employees

    Contractors and subcontractors are required to provide itemized wage statements to their employees under Labor Code Section 226.

15. Public Works Affidavit

    Prior to the release of the final payment to the subcontractors, the prime Contractor shall obtain a Public Works Affidavit (signed under penalty of perjury) from the subcontractor stating that the subcontractor paid the specified prevailing wage rates to its workers (CLC §1775.5 (b) (4)).

Certification:

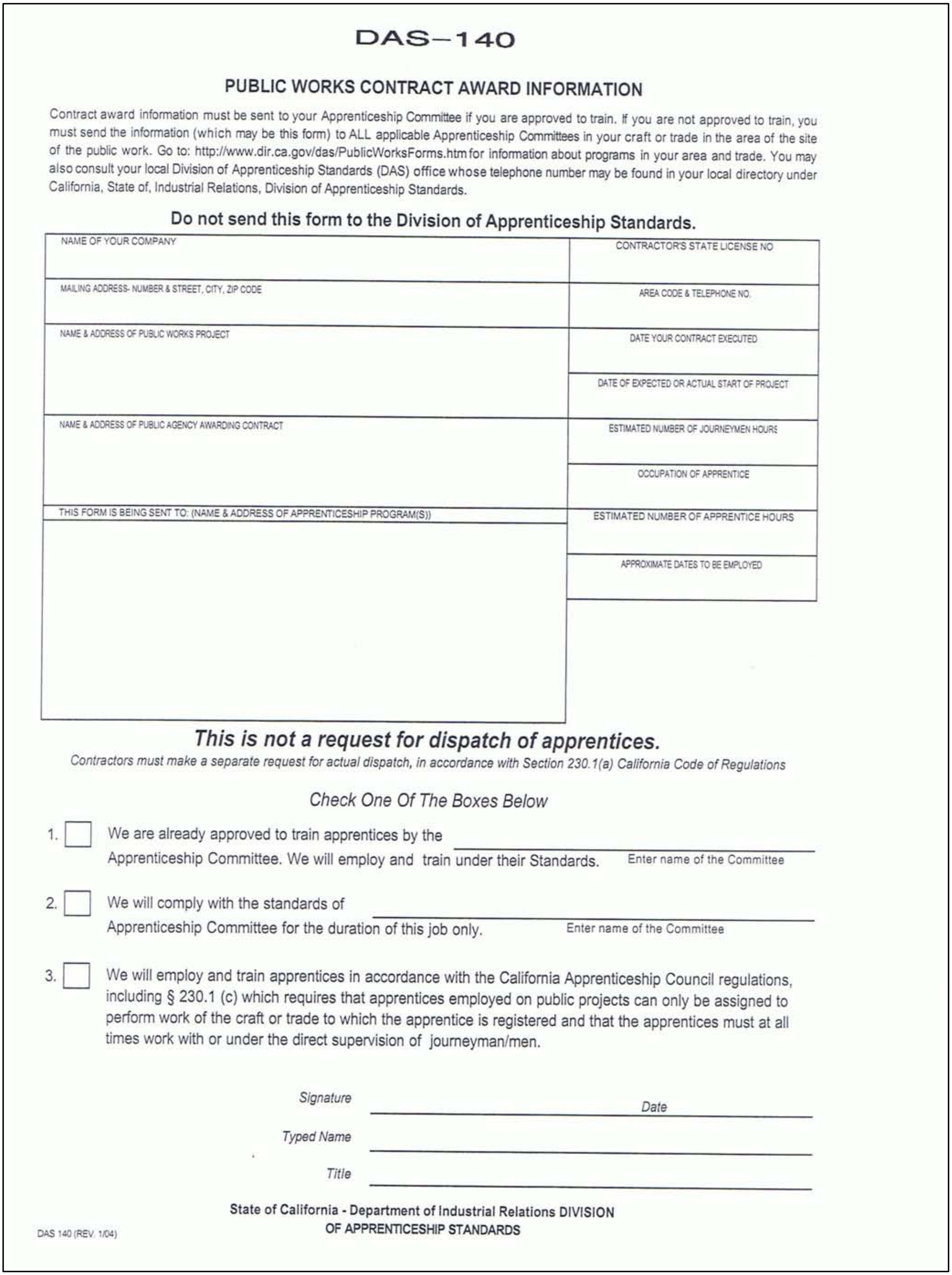
I acknowledge that I have been informed and are aware of the foregoing requirements and that I am authorized to make and sign this certification.

Contractor Signature: ***Date:***

Labor Compliance Officer's Signature: ***Date:***

Awarding Body:

Project Name or Number:



DAS–140

PUBLIC WORKS CONTRACT AWARD INFORMATION

Contract award information must be sent to your Apprenticeship Committee if you are approved to train. If you are not approved to train, you must send the information (which may be this form) to ALL applicable Apprenticeship Committees in your craft or trade in the area of the site of the public work. Go to: http://www.dir.ca.gov/das/PublicWorksForms.htm for information about programs in your area and trade. You may also consult your local Division of Apprenticeship Standards (DAS) office whose telephone number may be found in your local directory under California, State of, Industrial Relations, Division of Apprenticeship Standards.

Do not send this form to the Division of Apprenticeship Standards.

NAME OF YOUR COMPANY	CONTRACTOR'S STATE LICENSE NO
MAILING ADDRESS- NUMBER & STREET, CITY, ZIP CODE	AREA CODE & TELEPHONE NO.
NAME & ADDRESS OF PUBLIC WORKS PROJECT	DATE YOUR CONTRACT EXECUTED DATE OF EXPECTED OR ACTUAL START OF PROJECT
NAME & ADDRESS OF PUBLIC AGENCY AWARDING CONTRACT	ESTIMATED NUMBER OF JOURNEYMEN HOURS OCCUPATION OF APPRENTICE
THIS FORM IS BEING SENT TO: (NAME & ADDRESS OF APPRENTICESHIP PROGRAM(S))	ESTIMATED NUMBER OF APPRENTICE HOURS APPROXIMATE DATES TO BE EMPLOYED

This is not a request for dispatch of apprentices.

Contractors must make a separate request for actual dispatch, in accordance with Section 230.1(a) California Code of Regulations

Check One Of The Boxes Below

1. ☐ We are already approved to train apprentices by the ______________________ Apprenticeship Committee. We will employ and train under their Standards. Enter name of the Committee

2. ☐ We will comply with the standards of ______________________ Apprenticeship Committee for the duration of this job only. Enter name of the Committee

3. ☐ We will employ and train apprentices in accordance with the California Apprenticeship Council regulations, including § 230.1 (c) which requires that apprentices employed on public projects can only be assigned to perform work of the craft or trade to which the apprentice is registered and that the apprentices must at all times work with or under the direct supervision of journeyman/men.

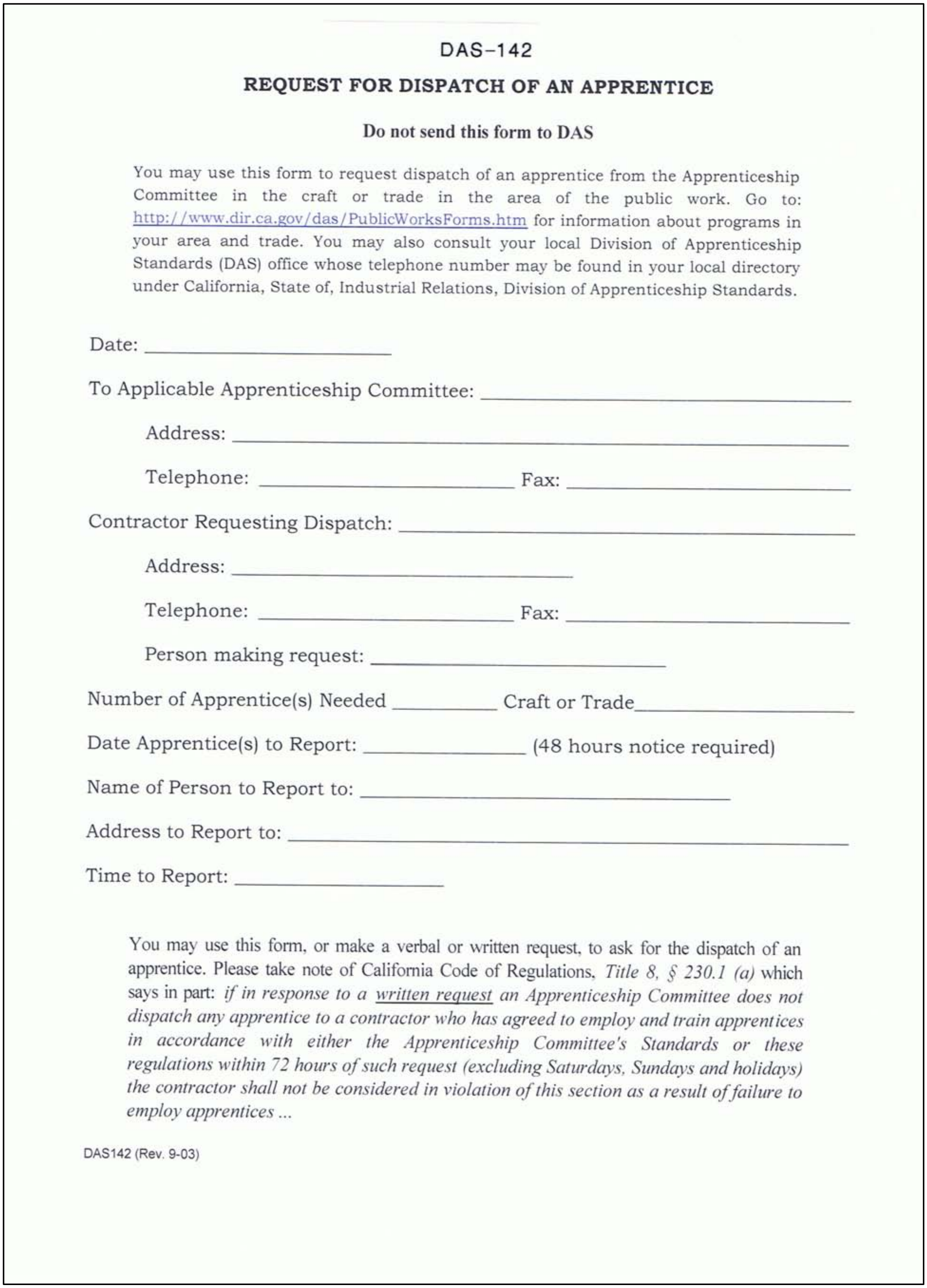
Signature ______________________ *Date*

Typed Name ______________________

Title ______________________

State of California - Department of Industrial Relations DIVISION OF APPRENTICESHIP STANDARDS

DAS 140 (REV. 1/04)



DAS–142

REQUEST FOR DISPATCH OF AN APPRENTICE

Do not send this form to DAS

You may use this form to request dispatch of an apprentice from the Apprenticeship Committee in the craft or trade in the area of the public work. Go to: http://www.dir.ca.gov/das/PublicWorksForms.htm for information about programs in your area and trade. You may also consult your local Division of Apprenticeship Standards (DAS) office whose telephone number may be found in your local directory under California, State of, Industrial Relations, Division of Apprenticeship Standards.

Date: ____________________

To Applicable Apprenticeship Committee: ______________________________

Address: ______________________________

Telephone: ____________________ Fax: ____________________

Contractor Requesting Dispatch: ______________________________

Address: ______________________________

Telephone: ____________________ Fax: ____________________

Person making request: ______________________________

Number of Apprentice(s) Needed __________ Craft or Trade____________________

Date Apprentice(s) to Report: ______________ (48 hours notice required)

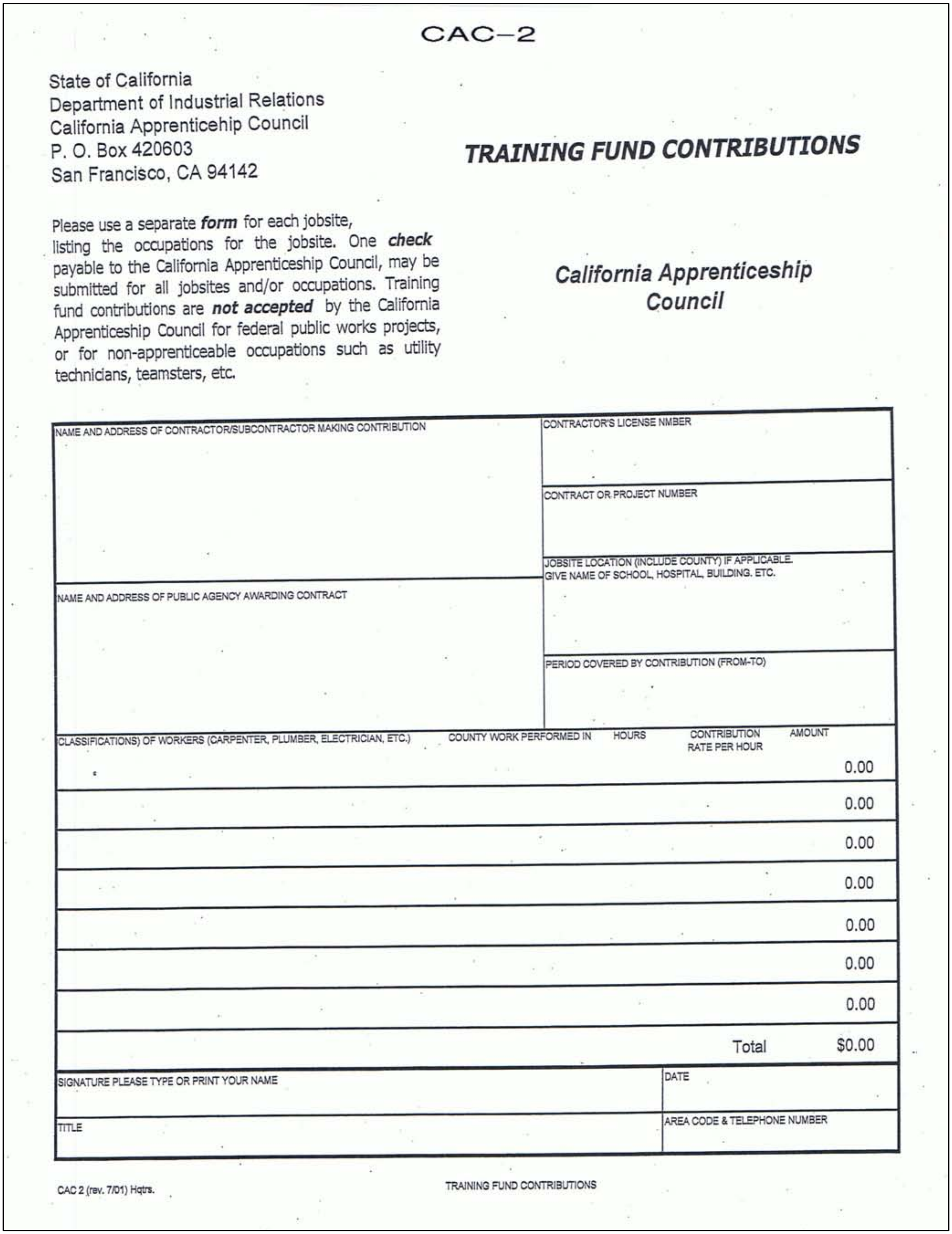
Name of Person to Report to: ______________________________

Address to Report to: ______________________________

Time to Report: ____________________

You may use this form, or make a verbal or written request, to ask for the dispatch of an apprentice. Please take note of California Code of Regulations, *Title 8, § 230.1 (a)* which says in part: *if in response to a written request an Apprenticeship Committee does not dispatch any apprentice to a contractor who has agreed to employ and train apprentices in accordance with either the Apprenticeship Committee's Standards or these regulations within 72 hours of such request (excluding Saturdays, Sundays and holidays) the contractor shall not be considered in violation of this section as a result of failure to employ apprentices ...*

DAS142 (Rev. 9-03)



CAC–2

State of California
Department of Industrial Relations
California Apprenticehip Council
P. O. Box 420603
San Francisco, CA 94142

TRAINING FUND CONTRIBUTIONS

Please use a separate **form** for each jobsite, listing the occupations for the jobsite. One **check** payable to the California Apprenticeship Council, may be submitted for all jobsites and/or occupations. Training fund contributions are ***not accepted*** by the California Apprenticeship Council for federal public works projects, or for non-apprenticeable occupations such as utility technicians, teamsters, etc.

California Apprenticeship Council

NAME AND ADDRESS OF CONTRACTOR/SUBCONTRACTOR MAKING CONTRIBUTION

CONTRACTOR'S LICENSE NMBER

CONTRACT OR PROJECT NUMBER

JOBSITE LOCATION (INCLUDE COUNTY) IF APPLICABLE. GIVE NAME OF SCHOOL, HOSPITAL, BUILDING. ETC.

NAME AND ADDRESS OF PUBLIC AGENCY AWARDING CONTRACT

PERIOD COVERED BY CONTRIBUTION (FROM-TO)

CLASSIFICATIONS) OF WORKERS (CARPENTER, PLUMBER, ELECTRICIAN, ETC.)	COUNTY WORK PERFORMED IN	HOURS	CONTRIBUTION RATE PER HOUR	AMOUNT
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
			Total	$0.00

SIGNATURE PLEASE TYPE OR PRINT YOUR NAME

DATE

TITLE

AREA CODE & TELEPHONE NUMBER

CAC 2 (rev. 7/01) Hqtrs.

TRAINING FUND CONTRIBUTIONS

STATEMENT OF COMPLIANCE

Date:___________

I, ____do hereby certify under penalty of perjury:
(Name of signatory party) (Title)

(1) That all the information in this report is true and correct;

(2) That I pay or supervise the payment of the persons reported as employed by ______________________________
(Contractor or Subcontractor)
on the ______________________________, that during the payroll period commencing on the ___ day of ________
(Project)
20 __and ending the ___ day of ___________, 20 __, all persons employed on said project have been paid their full weekly wages earned, that no rebates have or will be made either directly or indirectly to or on behalf of said ____________________________________ from the full weekly wages earned by any person and that no deductions
(Contractor or Subcontractor)
have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions, as described below.

(3) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wages contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he or she performed.

(4) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency.

(5) That :

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS OR PROGRAMS

_______ In addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payment of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 5 (c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

_____ Each laborer or mechanic listed in the above referenced payroll has been paid as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract except as noted in Section 5 (c) below:

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION
Remarks:	
Name and Title	Signature

On federally-funded projects, permissible deductions are defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948; 63 Stat. 108; 72 Stat. 967; 76 Stat. 357; 40 U.S. C. 276c). The willful falsification of any of the above statements may subject the contractor or subcontractor to civil or criminal prosecution (Section 1001 of Title 118 and Section 231 of Title 31 of the United States Code.)

CERTIFIED PAYROLL

NAME OF CONTRACTOR/SUBCONTRACTOR	ADDRESS	CONTRACTOR'S LICENSE #/SPECIALTY LICENSE # WORKERS COMPENSATION POLICY #

PAYROLL NO.	FOR WEEK ENDING	PROJECT NAME AND LOCATION	CONTRACT NO.

(1) NAME, ADDRESS, AND SOCIAL SECURITY NUMBER OF EMPLOYEE	(2) No. of W/H Exmptn	(3) Work Classification	OT or ST	(4) Day and Date							(5) Hour Total	(6) Pay Rate	(7) Gross Amount Earned										
				Hours Worked Daily									This Project	All Projects	Federal Tax	FICA	State Tax	SDI	VAC	Other	Total Deduction	(9) Net Wages Paid for Week	Check No.
			OT																				
			ST																				
			OT																				
			ST																				
			OT																				
			ST																				
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STATEMENT OF NON-PERFORMANCE

Payroll Number: ____________

I, ____________________, ____________________ do hereby state that
(Name of Signatory party) (Title)

NO PERSONS employed by _________________________ performed work on
(Name of submitting company)

the construction project known as _____________________________________

for the payroll period commencing on the _________ day of _________, 200__
(1st date of week) (month)

and ending on the _________ day of _________, 200__.
(last date of week) (month)

____
Signature of Authorized Person

____
Date

*THIS STATEMENT IS NOT REQUIRED TO BE SUBMITTED UNTIL AFTER SUBMISSION OF THE INITIAL PAYROLL REPORT

FRINGE BENEFIT STATEMENT

Contract No.:	Project Name:	Date:

INSTRUCTIONS: This form is to be submitted with the first certified payroll. In order that the Fringe Benefit rates can be used for checking payrolls or applied to Force Account work which may be done on the above contract the hourly rates for fringe bene

Classification:	Effective Date:	Subsistence or Travel Pay:
Health and Welfare $	Trust Fund Paid To: (Name)	
	Address:	
Pension $	Trust Fund Paid To: (Name)	
	Address:	
Vacation/Holiday $	Trust Fund Paid To: (Name)	
	Address:	
Training and/or Other $	Trust Fund Paid To: (Name)	
	Address:	
Classification:	Effective Date:	Subsistence or Travel Pay:
Health and Welfare $	Trust Fund Paid To: (Name)	
	Address:	
Pension $	Trust Fund Paid To: (Name)	
	Address:	
Vacation/Holiday $	Trust Fund Paid To: (Name)	
	Address:	
Training and/or Other $	Trust Fund Paid To: (Name)	
	Address:	
Classification:	Effective Date:	Subsistence or Travel Pay:
Health and Welfare $	Trust Fund Paid To: (Name)	
	Address:	
Pension $	Trust Fund Paid To: (Name)	
	Address:	
Vacation/Holiday $	Trust Fund Paid To: (Name)	
	Address:	
Training and/or Other $	Trust Fund Paid To: (Name)	
	Address:	

Supplemental statement must be submitted during the progress of work should a change in rate of any of the classifications be made. I CERTIFY THAT THE FRINGE BENEFIT PAYMENTS ARE MADE TO THE APPROVED PLANS, FUNDS OR PROGRAMS AS LISTED ABOVE.

Submitted (Contractor/Subcontractor)	By (Name and Title)	Signature

EMPLOYER'S MONTHLY REPORT TO TRUSTEES

1 THIS REPORT IS TO COVER HOURS FOR THE MONTH OF:

ACCOUNT NO.

LICENSE NO.

EMPLOYER NAME AND ADDRESS

If the above information is incorrect, please indicate changes which should be made.

I do hereby certify under penalty of perjury that the employees listed below constitute all the employees that I am required to make payments to the Trust. Furthermore, I certify that the hours shown for each employee are the total hours which he/she worked or was paid.

Signed by: ____________________

Title: ____________________

2 COMPUTATION OF CONTRIBUTIONS

6 TOTAL HOURS ON ALL PAGES	A. VACATION/DUES	B. PENSION	C. TRAINING AND RETRAINING	D. HEALTH AND WELFARE	E. INDUSTRY
	________PER HOUR $	________PER HOUR $	________PER HOUR $	________PER HOUR $	________PER HOUR $
LIQUIDATED DAMAGES					
TOTAL DUE EACH TRUST	$	$	$	$	$

MAKE ONE CHECK FOR TOTAL AMOUNTS OF COLUMNS A, B, C, D & E

3 EMPLOYEE'S NAME	INITIALS 1ST 2ND	4 SOCIAL SECURITY NO.	5 HOURS

IMPORTANT: SOCIAL SECURITY NUMBER MUST BE FILLED TO ASSURE PROPER CREDIT.

TOTAL HOURS THIS PAGE ________

7 IMPORTANT THIS REPORT MUST BE FILED EVEN THOUGH NO EMPLOYEES WORKED THIS MONTH.

☐ NO EMPLOYEES WORKED THIS MONTH. PLEASE CONTINUE MAILING REPORT FORMS.

☐ TRANSFER TO INACTIVE STATUS. WE HAD NO EMPLOYEE TO REPORT THIS MONTH AND DO NOT ANTICIPATE HIRING ANY IN THE NEAR FUTURE.

IMPORTANT

REPORTS ARE DUE THE 15TH OF THE FOLLOWING MONTH AND MUST BE RECEIVED AT THE BANK BY THE 20TH TO AVOID LIGUIDATED DAMAGES (EVEN IF THERE WERE NO EMPLOYEES) AND INTEREST. LIQUIDATED DAMAGES ARE CALCULATED AT 20% OF THE TRUST OR $25 PER TRUST, WHICHEVER IS GREATER. INTEREST IS DUE AT THE MAXIMUM RATES PERMITTED BY LAW AND SPECIFIED IN THE TRUST AGREEMENT OF EACH TRUST. THESE RATES VARY AND MAY APPROACH OR EXCEED 20% PER ANNUM.

MONTHLY EMPLOYMENT UTILIZATION REPORT U.S. DEPARTMENT OF LABOR EMPLOYMENT STANDARDS ADMINISTRATION TSG/ACTA008

This report is required by Executive Order 11246, Sec. 203. Faliure to report can result in contracts being canceled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further government contracts for federally	1. Covered Area (SMSA OR EA) **LOS ANGELES COUNTY** 2. Employer I. D. No.	3. Current Goals Minority: Female:	4. Reporting Period From:___________________ To:_____________________
Project Name and Address	Contract Number(s)	Name and Address of Reporting Contractor	Federal Funding Agency

5. Construction Trade	Classification	6. TOTAL ALL HOURS OF EMPLOYMENT (Federal and Non-Federal)												9. Total Number of Employees		10. Total Number of Minority Employees	
		6a. Total Hours of All Employees by Trade		6b. Black (not of Hispanic Origin)		6c. Hispanic		6d. Asian or Pacific Islander		6e. American Indian or Alaskan Native		7. Minority Percentage	8. Female Percentage				
		M	F	M	F	M	F	M	F	M	F			M	F	M	F
	Journeyworkers																
	Apprentices																
	Trainees																
	Subtotal																
	Journeyworkers																
	Apprentices																
	Trainees																
	Subtotal																
	Journeyworkers																
	Apprentices																
	Trainees																
	Subtotal																
	Journeyworkers																
	Apprentices																
	Trainees																
	Subtotal																
Total Journeyworkers (All Trades)																	
Total Apprentices (All Trades)																	
Total Trainees (All Trades)																	
Grand Total (All Trades/All Classifications)																	

11. COMPANY OFFICIAL'S SIGNATURE AND TITLE	12. TELEPHONE ( )	13. DATE SIGNED	PAGE _______ OF _______

PUBLIC WORKS AFFIDAVIT

California Labor Code §1775(b)(4)

The undersigned Contractor/Subcontractor has complied with the provisions of the California Labor Code §1771, §1773.1, §1775, §1776, §1777.5, §1813 and §1815, and has paid all employees the specified general prevailing rate of per diem wages to its employees, and any amounts due pursuant to §1813, on the public project:

Awarding Body/District: ____

Project: ____

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed this ______________ day of __________________, 20_____ at _______________, California.

____
(Company Name)

____
(Name)

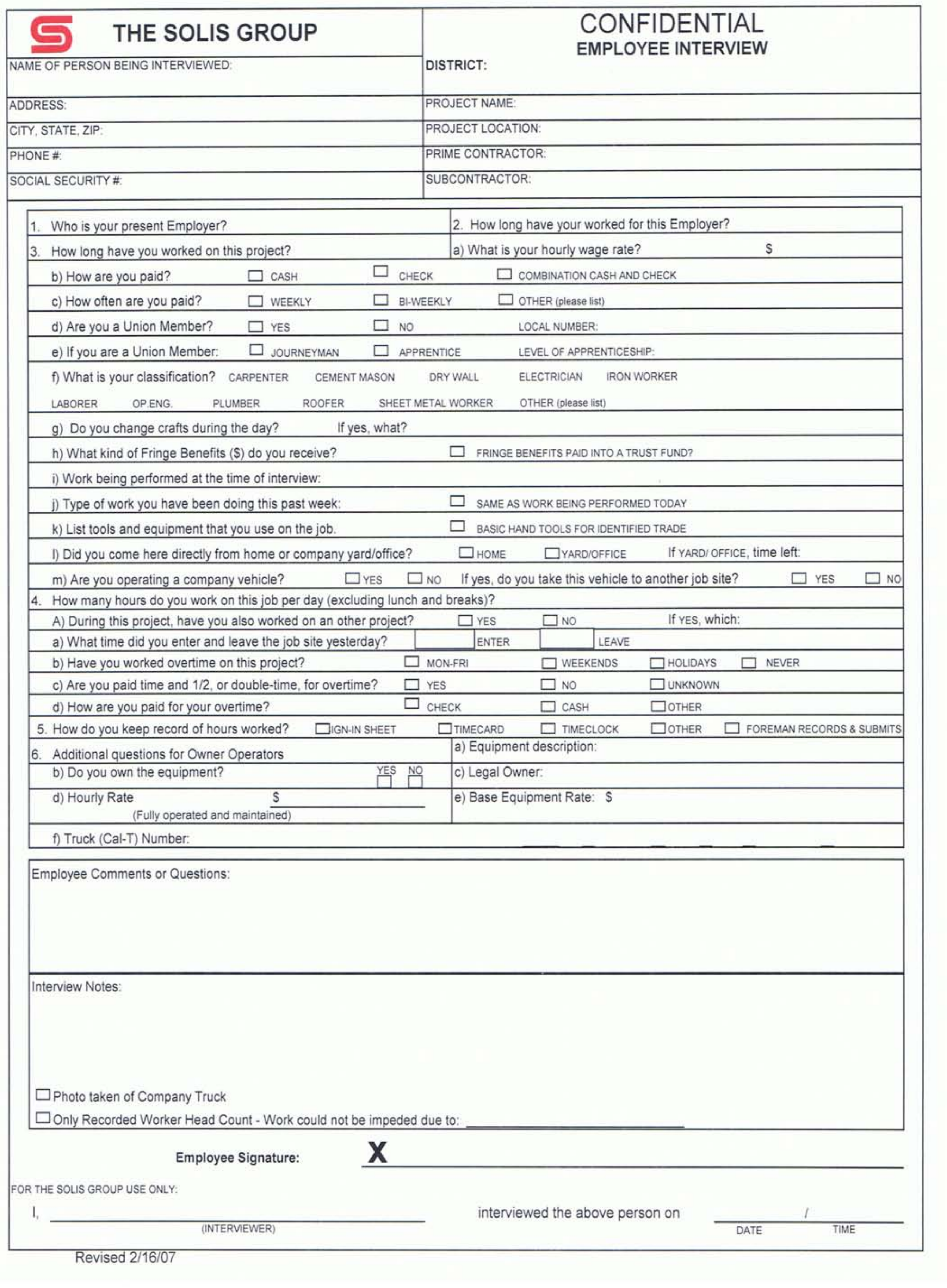
____
(Title)

____
(Signature)

____
(Approved by LCO/Program Manager)

[No final payment or retention shall be paid to the contractor until it certifies that all benefit payments owed by the contractor are made or otherwise guaranteed.]

SITE VISITATION EMPLOYEE INTERVIEW FORM



THE SOLIS GROUP

CONFIDENTIAL
EMPLOYEE INTERVIEW

NAME OF PERSON BEING INTERVIEWED:	**DISTRICT:**
ADDRESS:	PROJECT NAME:
CITY, STATE, ZIP:	PROJECT LOCATION:
PHONE #:	PRIME CONTRACTOR:
SOCIAL SECURITY #:	SUBCONTRACTOR:

1. Who is your present Employer?
2. How long have your worked for this Employer?
3. How long have you worked on this project?

a) What is your hourly wage rate? $

b) How are you paid? ☐ CASH ☐ CHECK ☐ COMBINATION CASH AND CHECK

c) How often are you paid? ☐ WEEKLY ☐ BI-WEEKLY ☐ OTHER (please list)

d) Are you a Union Member? ☐ YES ☐ NO LOCAL NUMBER:

e) If you are a Union Member: ☐ JOURNEYMAN ☐ APPRENTICE LEVEL OF APPRENTICESHIP:

f) What is your classification? CARPENTER CEMENT MASON DRY WALL ELECTRICIAN IRON WORKER
LABORER OP.ENG. PLUMBER ROOFER SHEET METAL WORKER OTHER (please list)

g) Do you change crafts during the day? If yes, what?

h) What kind of Fringe Benefits ($) do you receive? ☐ FRINGE BENEFITS PAID INTO A TRUST FUND?

i) Work being performed at the time of interview:

j) Type of work you have been doing this past week: ☐ SAME AS WORK BEING PERFORMED TODAY

k) List tools and equipment that you use on the job. ☐ BASIC HAND TOOLS FOR IDENTIFIED TRADE

l) Did you come here directly from home or company yard/office? ☐ HOME ☐ YARD/OFFICE If YARD/ OFFICE, time left:

m) Are you operating a company vehicle? ☐ YES ☐ NO If yes, do you take this vehicle to another job site? ☐ YES ☐ NO

4. How many hours do you work on this job per day (excluding lunch and breaks)?

A) During this project, have you also worked on an other project? ☐ YES ☐ NO If YES, which:

a) What time did you enter and leave the job site yesterday? ☐ ENTER ☐ LEAVE

b) Have you worked overtime on this project? ☐ MON-FRI ☐ WEEKENDS ☐ HOLIDAYS ☐ NEVER

c) Are you paid time and 1/2, or double-time, for overtime? ☐ YES ☐ NO ☐ UNKNOWN

d) How are you paid for your overtime? ☐ CHECK ☐ CASH ☐ OTHER

5. How do you keep record of hours worked? ☐ IGN-IN SHEET ☐ TIMECARD ☐ TIMECLOCK ☐ OTHER ☐ FOREMAN RECORDS & SUBMITS

6. Additional questions for Owner Operators

a) Equipment description:

b) Do you own the equipment? YES ☐ NO ☐

c) Legal Owner:

d) Hourly Rate $
(Fully operated and maintained)

e) Base Equipment Rate: $

f) Truck (Cal-T) Number:

Employee Comments or Questions:

Interview Notes:

☐ Photo taken of Company Truck
☐ Only Recorded Worker Head Count - Work could not be impeded due to: ____________

Employee Signature: **X** ____________

FOR THE SOLIS GROUP USE ONLY:

I, ____________ (INTERVIEWER) interviewed the above person on ______ / ______
DATE TIME

Revised 2/16/07

SITE VISITATION EMPLOYEE INTERVIEW TRACKING LOG

SAMPLE SITE VISITATION LOG

SITE	VISIT DATE	PRIME CONTRACTOR	SUB CONTRACTOR	EMPLOYEE NAME	SOCIAL SECURITY #	POSITION TITLE	TASK PERFORMED AT INTERVIEW	PAY RATE	COMPLIANT/ NON-COMPLIANT	CROSS-CHECK WITH PAYROLL DOCS / COMMENTS
Hoover	9/1/99	Baker	Mills Plumbing	John Doe	111-11-1111	Plumber	Repairing Plumbing	$34.19	Compliant	Certified Payroll Records check out
Hoover	9/1/00	Baker	Mills Plumbing	Mark Baker	222-22-2222	Laborer	Painting	$10.40	Non-Compliant	Certified Payroll does not check out with interview

SITE VISITATION EMPLOYEE INTERVIEW TRACKING LOG

APPENDIX C

Storm Drain Improvements and Installation of Infiltration Chambers – City of Hawthorne

City of Hawthorne

General Plan Land Uses

Legend

- Low-Density Residential
- Medium-Density Residential
- High-Density Residential
- Freeway Commercial/Mixed Use
- Local Commercial
- General Commercial
- Industrial
- General Industrial
- Open Space
- Public Facility
- Pacific Glen Specific Plan
- Willow Glen Specific Plan
- Mixed Use

0 500 1,000 2,000 3,000 4,000 Feet

1:7,200

1 inch equals 600 feet

Updated: October 6, 2008

CURRENT YEAR PROJECTS

FY 2004-2005

			Project Cost			*Project Funding*			
	Project Location	**Description**	**Design**	**Construction**	**Total Cost**	**General Fund Contribution**	**Other Funds**	**Source**	**Total Funding**
1	Eucalyptus Park	Park Renovation	$ 100,000.00	$ 1,517,095.00	$ 1,617,095.00 **(4)**	**(4)**	**$ 969,542.00** **$ 150,000.00** **$ 250,000.00**	CDBG PY 2003 RZH	**$ 1,369,542.00**
2	Glasgow Strip	New Park **(6)**			$ 847,107.50		**$ 847,107.50**	2000 Park Board Act (PC)	**$ 847,107.50**
3	ROSECRANS / AVIATION (WIDENING) PHASE II	WIDNING	$ 1,000,000.00	$ 4,200,000.00	$ 5,200,000.00	**(4)**	**$ 4,000,000.00**	Federal **(3)**	**$ 4,000,000.00**
4	2005 LOCAL STREET IMPROVEMENTS	Excavation, cold planning, lime	$ 30,000.00	$ 3,000,000.00	$ 3,030,000.00	**(3)**	**(3)**	**(3)**	**$ 3,030,000.00**
5	ROSECRANS / AVIATION (WIDENING) PHASE I	CHEVRON RELOCATION	$ 850,000.00	$ 4,500,000.00	$ 5,350,000.00	**(4)**	**$ 4,300,000.00**	**(3)**	**$ 4,300,000.00**
6	EDISON UNDERGROUND DISTRICT	Installation of Fire Suppression	$ 50,000.00	$ 2,000,000.00	$ 2,050,000.00		**$ 2,050,000.00**	R20	**$ 2,050,000.00**
7	ST. IMPROVEMENT LOW-MODERATE	Streetscape Improvements	$ 100,000.00	$ 4,000,000.00	$ 4,100,000.00			CDBG PY 2003	**$ 4,100,000.00**
8	TRAFFIC SIGNAL INSTALLATION	Expansion	$ 80,000.00	$ 450,000.00	$ 530,000.00	**(4)**	**400000**	CDBG PY 2003	**$ 530,000.00**
9	Airport	Ramp and Taxiway Reconstruction	$ 90,000.00	$ 898,500.00	$ 988,500.00		**(4)**	A.I.P. Airport	**$ 988,500.00**
10	RAILROAD CROSSING AT GREVILLEA	Reconstruction	$ 3,000.00	$ 90,000.00	**$ 93,000.00**	**(4)**	**(4)**	**(3)**	**$ 93,000.00**

Footnotes:

(1) *Design & Property Acquisition Completed in Previous FY. Cost included in total project cost.*

(2) *In-Kind Engineering Services provided by Engineering Division of Public Works Department Reflected in Personnel Costs for Engineering Division.*

(3) *Funding Source not determined at this time.*

(4) *Additional Funding Required-Project to be constructed in phases.*

(5) *Project Costs not determined at this time.*

FY 2005-2006

39	Airport	Reconstruction of Ramp and Runway Safety Area	$ 100,000.00	$ 1,303,000.00	$ 1,403,000.00		$ 140,300.00 $ 1,262,700.00	Airport A.I.P.	$ 1,403,000.00
40	Hawthorne Blvd.	Streetscape Improvements			**(5)**		**(3)**		

FY 2006-2007

41	Airport	Slurry Seal South Taxiway	$ 5,000.00	$ 45,000.00	$ 50,000.00		$ 4,500.00 $ 45,500.00	Airport A.I.P.	$ 50,000.00
42	Hawthorne Blvd.	Streetscape Improvements			**(5)**		**(3)**		
	SUBTOTAL (2003-2007) Future Years				**$ 17,594,500.00**	**$ -**	**$ 8,203,000.00**		**$ 16,544,500.00**

GRAND TOTAL *(Five Years from 2002-2003 to 2006-2007)*

Footnotes:

(1) *Design & Property Acquisition Completed in Previous FY. Cost included in total project cost.*
(2) *In-Kind Engineering Services provided by Engineering Division of Public Works Department Reflected in Personnel Costs for Engineering Division.*
(3) *Funding Source not determined at this time.*
(4) *Additional Funding Required-Project to be constructed in phases.*
(5) *Project Costs not determined at this time.*

Funding Sources:

SILB - State Infrastructure Loan Bank (Loan)
Gas Tax - State Gas Tax Subvention Funds
2000 Park Bond Act (PC)-2000 State Park Bond Act, Per Capita
CDBG PY 2002- Community Development Block Grant (Federal - HUD) Program year 2002
CDBG PY 2001- Community Development Block Grant (Federal - HUD) Program year 2001
Prop C - 20% Local Return Funds from LA County special sales tax designated for transportation uses.
STPL - Federal Surface Transportation Program (Local) funds for roadway improvements to arterials and select streets on federal highway system
RZH - Roberti Ziberg Harris State Parks Grant

DIF 1600 - Development Impact Fees collected in accordance with AB1600
SB-821 - State Funds for Pedestrian Facilities
AB 2928 - State Funding for roadway improvements
LACSP (92) - Los Angeles County Safe Parks Grant (1992)
Sewer Fund - Sewer and Storm Drain Fund
A.I. P. - Airport Improvement Program (Federal FAA Grant)
Airport - Airport Enterprise Fund

City of Hawthorne - S.D. CAPITAL IMPROVEMENT PLAN

4/5/2009

			Project Cost			*Proposed*
	Project Location	**Description**	**Design & Project Management**	**Construction**	**Total Cost**	**Source Funding**
1	Hawthorne Blvd. from Imperial Highway to Rosecrans Ave.	Installation of new Storm Drain and alteration of existing Storm Drain system.	$ 396,000.00 **(2)**	$ 2,640,000.00 **(1)**	$ 3,036,000.00	**(3)**
2	Rosecrans Ave.	Installation of new Storm Drain and alteration of existing Storm Drain system.	$ 93,750.00 **(2)**	$ 625,000.00 **(1)**	$ 718,750.00	**(3)**
3	El Segundo Blvd. from Hawthorne Blvd. to Crenshaw Blvd.	Installation of new Storm Drain	$ 198,000.00 **(2)**	$ 1,320,000.00 **(1)**	$ 1,518,000.00	**(3)**
4	Marine Ave. from Aviation Blvd. To 405 FWY	Installation of new Storm Drain	$ 112,500.00 **(2)**	$ 750,000.00 **(1)**	$ 862,500.00	**(3)**

$ 6,135,250.00

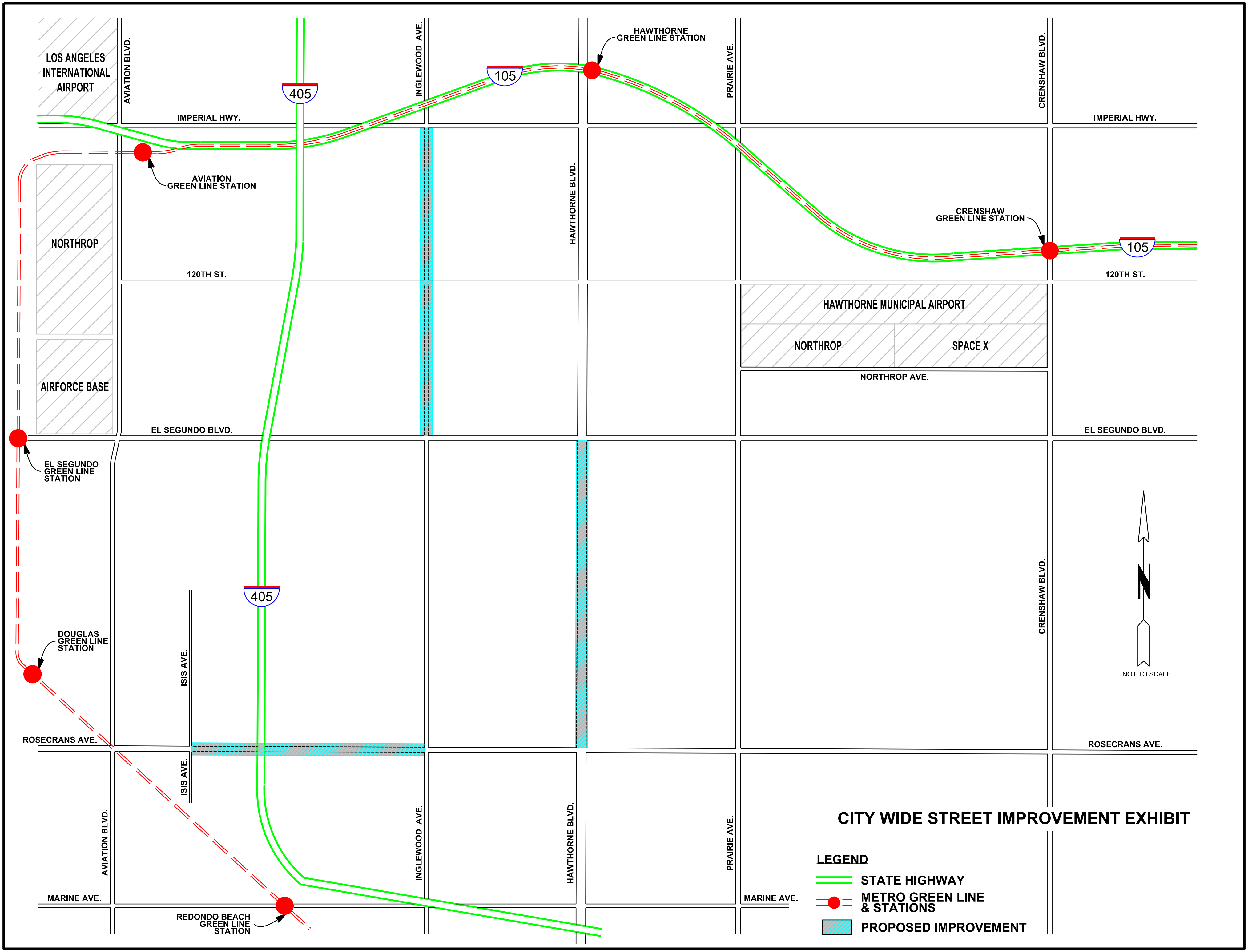
Footnotes:

(1) *Design & Construction Cost included in total project cost.*

(2) *In-Kind Engineering Services provided by Engineering Division of Public Works Department Reflected in Personnel Costs for Engineering Division.*

(3) *Proposed Funding Source Development Impact Fee*

(4) *Additional Funding Required-Project to be constructed in phases.*



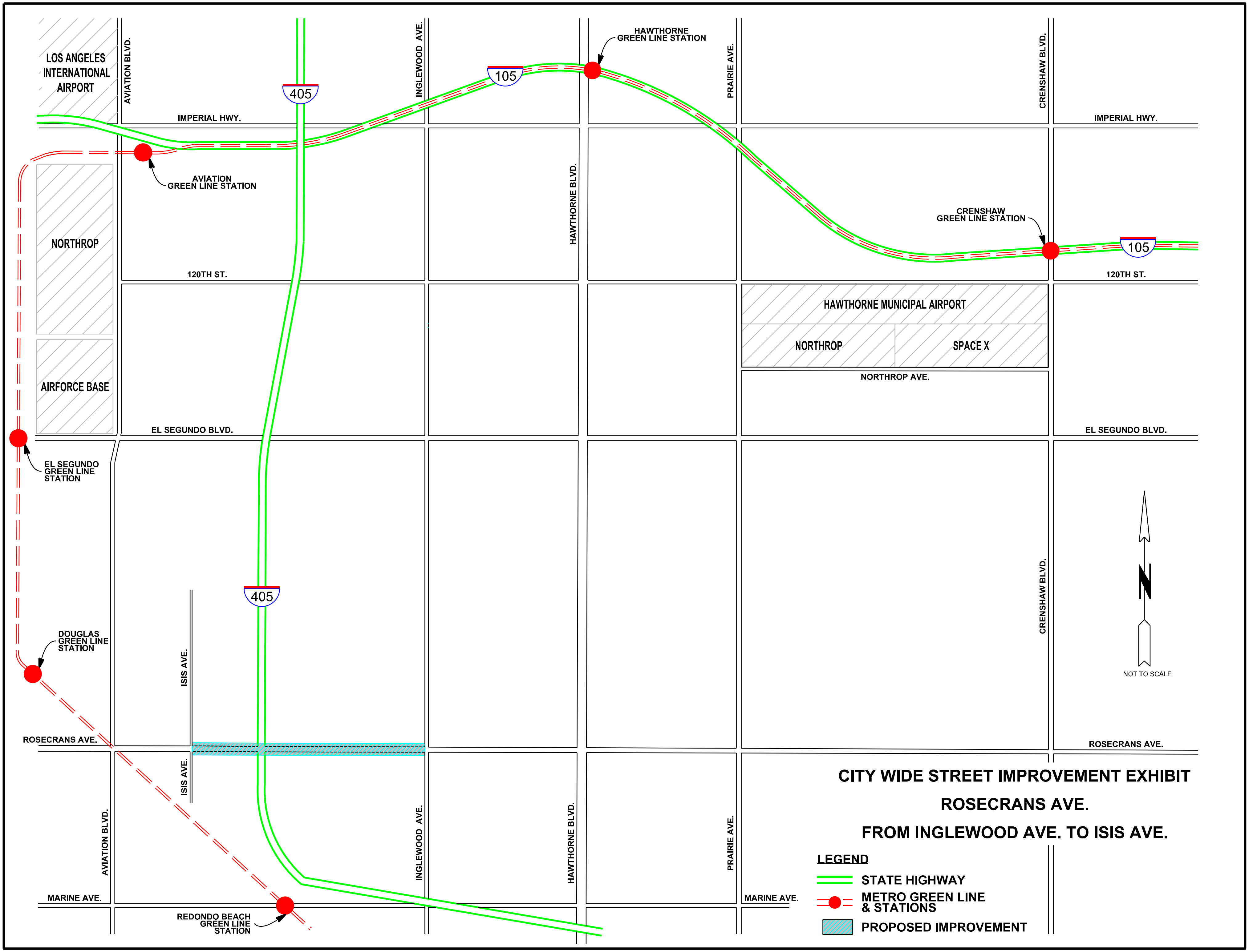
CITY WIDE STREET IMPROVEMENT EXHIBIT

LEGEND

🟩 STATE HIGHWAY

● METRO GREEN LINE & STATIONS

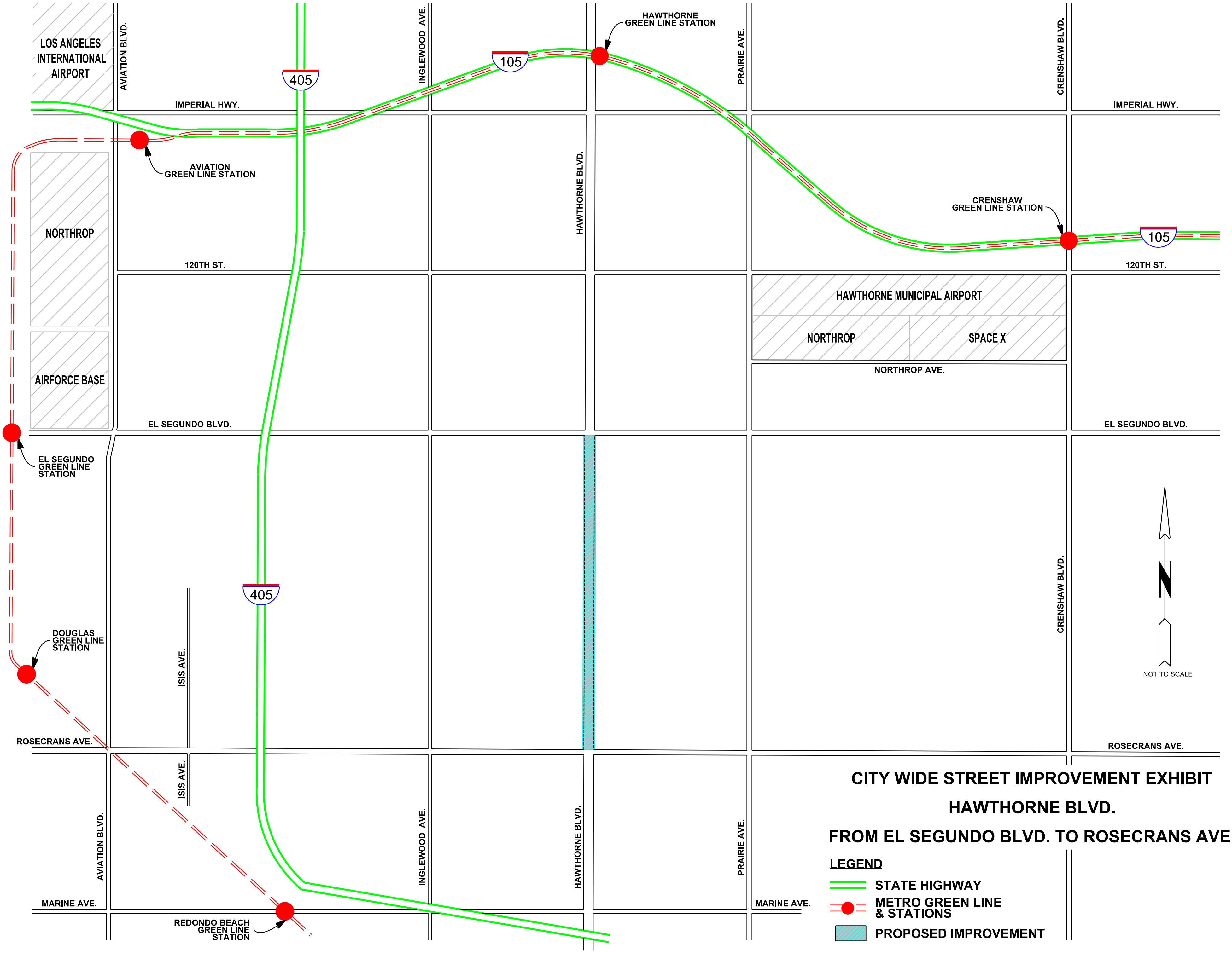
▨ PROPOSED IMPROVEMENT



CITY WIDE STREET IMPROVEMENT EXHIBIT

ROSECRANS AVE.

FROM INGLEWOOD AVE. TO ISIS AVE.



CITY WIDE STREET IMPROVEMENT EXHIBIT

HAWTHORNE BLVD.

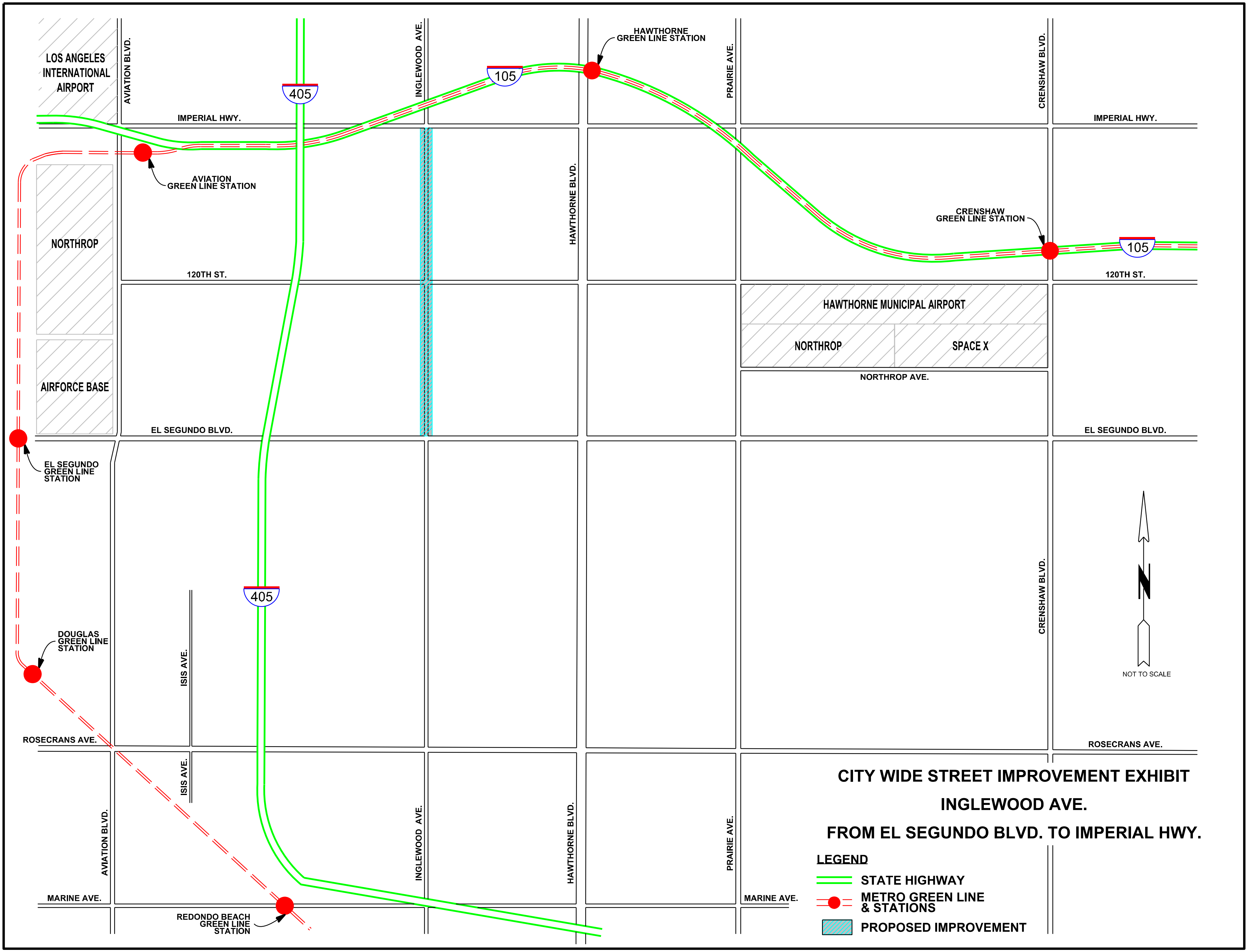
FROM EL SEGUNDO BLVD. TO ROSECRANS AVE.

LEGEND

🟩 STATE HIGHWAY

● METRO GREEN LINE & STATIONS

▨ PROPOSED IMPROVEMENT



CITY WIDE STREET IMPROVEMENT EXHIBIT

INGLEWOOD AVE.

FROM EL SEGUNDO BLVD. TO IMPERIAL HWY.

LEGEND

- 🟩 STATE HIGHWAY
- ● METRO GREEN LINE & STATIONS
- ▨ PROPOSED IMPROVEMENT

APPENDIX D

Penmar Water Quality and Runoff Reuse – City of Los Angeles, Bureau of Sanitation

CITY OF LOS ANGELES
CALIFORNIA

ANTONIO R. VILLARAIGOSA
MAYOR

DEPARTMENT OF
PUBLIC WORKS
BUREAU OF
ENGINEERING
GARY LEE MOORE, P.E
CITY ENGINEER
1149 S. BROADWAY ST., SUITE 700
LOS ANGELES, CA 90015
http://eng.lacity.org

July 26, 2007

Black & Veatch
800 Wilshire Blvd.
Suite 600
Los Angeles, CA 90017

File #: SWP-7169-1-8-2

Attention: Ms. Hala Titus, Project Manager

Subject: **Pre-Qualified On-Call Wastewater and Environmental Engineering Consultant Contract Task Order Solicitation No. 4 – Penmar Water Quality Improvement Project**

Dear Ms. Titus:

This Task Order Solicitation (TOS) is being sent to all of the firms on the contract list. Please note that a Non-Collusion Affidavit is also being provided under the cover of this transmittal. You must execute this affidavit and include it with your response.

Note: The Pre-Qualified On-Call Wastewater and Environmental Engineering Consultants List is pending final approval. It is anticipated that the on-call contracts will be executed by the Board of Public Works by August 2007, however no assurance is made. This TOS will not be awarded until after execution of the on-call contracts by the City of Los Angeles.

Procurement of Pre-Design Services

At the City's discretion, the Pre-Design Services under this TOS will be procured on either a cost-plus-reimbursable, hourly billing, or lump sum basis as stipulated in the draft contract.

The consultant's TOS Response shall include a fee estimate for the work described in Section 2.1. Estimate must be supported with detailed cost calculations as required by Section 5 of the TOS.

Procurement of Design Services and Design Services During Construction

The selected consultant will initially be authorized to proceed with the Pre-Design Services. Procession of Design Services and Design Services During Construction will be entirely at the discretion of the City.

For evaluation purposes, Responses must also include a fee estimate for work described in Sections 2.2 and 2.3. Estimates must be supported with detailed cost calculations as required by Section 5 of the TOS.

The budgeted construction cost for this project is $15,750,000. The estimated cost for the Pre-Design Services for this TOS is $350,000.

If the executed contract contains a clause regarding failure to respond, it will not apply to this TOS. A Pre-proposal meeting is scheduled for 2:00 p.m. on August 13, 2007 at the Public Works Building, at 1149 S. Broadway, Los Angeles, California 90015. The meeting will take place in Conference Room 6024 on the 6th Floor. It is suggested that all interested firms attend this meeting.

Thank you for your interest and we look forward to receiving your response to this Task Order Solicitation. **Solicitation Responses are to be submitted on Tuesday, September 4, 2007, no later than 2 PM.**

If you have any questions regarding the on-call contract, please contact me at (213) 485-1165. Questions related to this task order should be directed to Ms. Chris Salvaggio at (213) 847-0304.

Sincerely,

Kendrick K Okuda

Kendrick K. Okuda, P.E.
Program Manager
Proposition O Implementation Program
Bureau of Engineering
Department of Public Works

Attachments

cc: Michael Brown, PACD
Alfred Mata, Prop O
Chris Salvaggio, Prop O
Shahram Kharaghani, BOS
Master File

City of Los Angeles
Department of Public Works
Bureau of Engineering

Pre-Qualified On-Call
Wastewater & Environmental Engineering Consultant Contract
Proposition O – Clean Water Bond
Task Order Solicitation No. 4

Penmar Water Quality Improvement Project

Predesign Services, Design Services, and Design Support Services During Construction

July 2007

1. Introduction

The voters of Los Angeles approved Proposition O (Prop O) authorizing the issuance of $500 million in General Obligation Bonds to finance the design and construction of facilities that provide water quality benefits and reduce pollutant loads to the impaired waters of the City to meet water quality standards. An Administrative Oversight Committee (AOC) and a Citizens Oversight Advisory Committee (COAC) oversee the program. The predesign and design of the Penmar Water Quality Improvement project was approved for Prop O funding.

Under this Task Order, the Bureau of Engineering (BOE), Prop O Bond Program plans to utilize the services of a consulting engineering firm for predesign and design of the Penmar Water Quality Improvement project.

As part of the Prop O project approval process, the Bureau of Sanitation prepared the enclosed Penmar Water Quality Improvement and Runoff Reuse Project Concept Report (March, 2007). The predesign services for the proposed Penmar Water Quality Improvement Project include reviewing and validating the concepts presented in the concept report and developing the project scope into a predesign report that will be used as the basis for design.

The Penmar Water Quality Improvement Project will be located in West Los Angeles at sites commonly known as Penmar Golf, Penmar Rec & Park, and Marine Park. These sites total approximately 90 acres and straddle the Los Angeles /Santa Monica city boundary along Dewey Street. Land use in the surrounding area is predominantly light commercial, industrial, and high-density single family. Stormwater runoff from the surrounding areas has the potential to contribute oil & grease, suspended solids, metals, hydrocarbons, organic chemicals, and pathogens to the stormwater conveyance system. The objective of the Penmar Water Quality Improvement Project is to incorporate Best Management Practices (BMPs) to reduce the introduction of these pollutants to the maximum extent practicable.

The proposed project is a joint collaboration between the City of Los Angeles and the City of Santa Monica. The cities are working together to implement a regional project which combines water quality improvement and stormwater reuse. The goals of the project are to increase the beneficial and recreational uses of the receiving water bodies (i.e. the Santa Monica Bay and the Pacific Ocean), reduce potential for human safety and health risk, reduce beach closures, preserve aquatic marine and plant habitat, and benefit the tourism industry. The main objective is to enable the cities of Los Angeles and Santa Monica to reduce the bacterial levels in the surf zone and comply with National Pollutant Discharge Elimination System Total Maximum Daily Load regulations. The project, as proposed, would provide the added benefit of reusing stormwater for landscape irrigation. Reuse of stormwater would turn a by-product of urbanization into a resource and would reduce the need for imported potable water.

As proposed, the Penmar Water Quality Improvement Project would incorporate the following BMPs: (1) diversion of stormwater (and dry weather runoff) from the existing stormdrain system to the project site; (2) pre-treatment of the diverted stormwater through hydrodynamic separators; (3) retention of pre-treated stormwater in underground detention tanks; (4) disinfection of the stormwater; and (5) reuse application of treated stormwater through landscape irrigation. The concept report targets a drainage area of approximately 1,468 acres and a capture rate of up to 88.4 million gallons of surface runoff per year.

2. <u>Scope of Services</u>

The BOE is interested in obtaining the services of a consulting engineering firm for design services associated with the Penmar Water Quality Improvement project. The selected consultant will initially be authorized to proceed with the predesign services. Proceeding with the design services and design services during construction will be entirely at the discretion of the City. The basis for the project scope is contained in the enclosed March 2007 Concept Report.

To successfully deliver the project, it is important for the BOE and its consultant to work closely with the City of Santa Monica, the Bureau of Sanitation (BOS), the Department of Recreation and Parks (RAP), other City offices, government agencies and multiple community groups as described in the concept report. As such, their input and review is critical to the success of this project.

2.1 Pre-design Report

Consultant predesign activities include:

- Provide project work plan.
- Review and validate the concept report.
- Develop project scope within approved budget

- Coordinate Predesign activities with City Project Manager/Project Engineer (i.e. meeting schedule, topics for discussion, required attending personnel, proposed site visits, etc.).
- Provide and implement a Quality Assurance/Quality Control Plan.
- Prepare and update a predesign schedule (Microsoft Project) with activities and milestones, including, but not limited to, progress meetings, workshops, draft Predesign Report reviews/workshop and Final Predesign Report workshop.
- Site investigations (inclusive of survey and geotechnical).
- At a minimum, 12 Project/Progress meetings/Workshops (with BOE, BOS, RAP, other City of Los Angeles staff, and City of Santa Monica staff) at City of Los Angeles location. Consultant shall prepare agendas and meeting minutes.
- Public outreach: Develop a public outreach program, identifying stakeholders, preparing project information sheets (handouts), preparing sketches and artist renderings large enough for display purposes, organizing neighborhood council and community meetings in coordination with the Department of Public Works Public Affairs Office, the Mayor's Office, City Council District 11 Office, and the City of Santa Monica. At a minimum, 6 public outreach meetings.
- When necessary, obtain conceptual approval from governing commissions such as the Cultural Affairs Commission, Recreation and Parks Board, and/or Cultural Heritage Commission.
- Coordinate with and provide supporting information to BOE in the preparation of the CEQA documents.
- Provide and maintain a project website.
- Provide all project documentation in PDF format.
- Conduct Value Engineering workshop(s) to discuss report and resolution to evaluated items.
- Predesign Report shall include:
    - Evaluation of alternatives to satisfy objectives of the Concept Report
    - Description of proposed facilities, including a storm water flow schematic
    - Description of proposed control logic for storm water facilities
    - Site Plans showing existing conditions and proposed improvements
    - Illustrative elevations
    - Preliminary control loop descriptions for the storm drain improvements such as the flow diversion facility, stormwater lift station, hydrodynamic separators, underground detention tank, underground infiltration units, disinfection facility, effulent pump station, recirculation pump, and overflow system
    - Size and flow rate calculations for all improvements
    - Preliminary Flow Sheet(s) and Piping & Instrumentation Drawings/Diagrams
    - List of major equipment
    - Design requirements
    - Calculations
    - Description of construction sequence with minimal disruption to golf course and park use. Identify construction constraints.
    - Identify all required permits. Identify the agencies and identify the projected schedule to obtain each permit.
    - Identify utility interferences

  - Validate watershed area, hydrology, and expected pollutant loading
  - Validate expected pollutant removal
  - Identify operations and maintenance requirements.
  - Construction cost estimate (class C estimate) in Bureau of Engineering Prop O Program format and supporting documentation
  - Total project cost estimate (within project budget)
  - Project implementation schedule
  - Preliminary specification table of contents
  - Preliminary list of drawings
  - Consultant design cost estimate
  - List of comments to Draft Pre-Design Report and their resolution
  - Draft Predesign Report (30 Copies)
  - Draft Final Predesign Report (30 Copies)
  - Final Predesign Report (30 Copies) with Client Approval sign-off sheet
- Provide electronic files of Final Pre-Design report (5 CD copies)
- Project Management (Consultant Activities)
- Weekly Progress Report (actual vs. planned work progress)
- Monthly Progress Report (actual vs. planned work progress, updated project schedule, MBE/WBE/OBE Utilization Profile and expenditure report)

City's predesign activities include:
- Provide Concept Report
- Provide reasonable site access
- Provide suitably representative staff at meetings and workshops
- Provide a City Project Manager and City Project Engineer
- Provide website information to download record drawings
- Provide necessary electronic files, record drawings, etc. not found on City website
- Provide timely reviews
- Lead CEQA process and prepare CEQA documentation

2.2 Detailed Design

Consultant Design Activities include:
- Provide a design with a construction cost under the construction budget.
- Coordinate Design activities with City Project Manager/Project Engineer (ie. meeting schedule, topics for discussion, required attending personnel, proposed site visits, etc.)
- Provide and implement a Quality Control/Quality Assurance Plan
- Prepare Design schedule with activities (meetings, workshops, value engineering, site visits, etc.) and milestones
- Participate in project meetings (with BOE, BOS, RAP, other City of Los Angeles staff, and City of Santa Monica staff) at City of Los Angeles location. Consultant shall prepare agendas and meeting minutes.
- Conduct site investigations (inclusive of survey and geotechnical)

- Provide Value Engineering (VE) for design at 50% design completion.
- Provide 20 copies of VE report and electronic files of report (5 CD copies).
- Conduct VE workshop(s) to discuss report and resolution to evaluated items.
- Provide 20 copies of Final Resolution report of VE evaluations and electronic files of report (5 CD copies).
- Provide Intermediate Progress Drawing prints
- At a minimum, 3 design review workshops (with BOE, BOS, RAP, other City of Los Angeles staff, and City of Santa Monica staff) at City of Los Angeles location. Consultant shall prepare agendas and meeting minutes.
- Project Management (Consultant Activities)
- Submit Weekly Progress Reports (actual vs. planned work progress)
- Submit Monthly Progress Reports (actual vs. planned work progress, updated project schedule, MBE/WBE/OBE Utilization Profile and expenditure report)
- Design submittals (Drawings per BOE CADD standards and on BOE drawing borders. Specifications based on BOE format using City Standard Specifications, both General Conditions (GC's) and General Requirements (GRs) and technical specification sections. Drawings: Microstation. Specifications: Microsoft Word).
  - 50% submittal (Drawings – thirty (30) 11" x 17" hard copies with spiral binding and six (6) 24" x 36" hard copy plus electronic files. Specifications - thirty (30) hard copies with spiral binding plus electronic files and Class B cost estimate).
  - 90% submittal (Drawings – thirty (30) 11" x 17" hard copies with spiral binding and six (6) 24" x 36" hard copy plus electronic files (including 3D files). Specifications - thirty (30) hard copies with spiral binding plus electronic files.)
  - 100% submittal (Drawings: signed & stamped mylars plus electronic files. Specs: one signed & stamped master hard copy plus electronic files)
- Acquire all necessary permits and approvals of behalf of the City. These may include, but are not limited to: Planning, Zoning, Cultural Affairs, Board of Zoo Commissioners, Greater Los Angeles Zoo Association, Building & Safety, Street Use, Los Angeles County Department of Public Works, Army Corps of Engineers, Regional Water Quality Control Board, and Department of Fish and Game.
- Consultant is responsible for paying all permitting fees.
- Conduct Quality Control prior to 100% submittal
  - Discipline check
  - Inter-discipline check (Squad Check); City PM/PE may attend
  - Provide completed Quality Assurance/Quality Control check list
  - Final calculations sign off (Provide City with bound, sealed record of all calculations)
- Prepare construction cost estimate (class A estimate) and supporting documentation with 100% submittal
- Attend Pre-bid meeting
- Assist with Pre-Bid meeting minutes
- Assist with addenda preparation
- Assist with bid evaluation
- Prepare "As-Bid" documents (plans & specifications), incorporating all addenda issued during the bidding process.

Upon receipt of construction bids, should the amount of the bid of the lowest, responsive, responsible bidder exceed the construction cost budget by 10% or more, the consultant shall, if requested, revise the design at no cost to the City, so as to secure bids within budget.

City's Design Activities include:

- Lead CEQA process and prepare CEQA documentation
- Provide reasonable site access
- Provide electronic copy of BOE drawing borders.
- Provide copy of BOE CADD Standards
- Provide website information to download City Standard Specifications and record drawings
- Provide suitably representative staff at meetings and workshops
- Provide a City Project Manager and City Project Engineer
- Provide timely reviews
- Provide City Project Engineer for assistance during the acquisition of permits and approvals
- Prepare "Bid Proposal"
- Coordinate plan processing of 100% drawings
- Coordinate and lead pre-bid meeting
- Prepare City Board Reports
- Manage and lead Bid and Award activities

2.3 Design Support Services During Construction

Consultant Technical Assistance During Construction Activities include:

- Attend Pre-Construction Meeting
- Review submittals (as requested)
- Prepare plan clarifications
- Assist with preparing replies to RFI's (as requested)
- Assist with preparing Change Orders (as requested)
- Meet with contractor (as required)
- Prepare record drawings (As-Built Drawings)
- Project Management (Consultant Activities)
- Submit Monthly Progress Report of Consultant's Activity (include Expenditure Report)
- Participate in the final acceptance inspections of the project and advise the City regarding the acceptability of the work

City's Construction Management Activities include:

- Manage and lead Construction Management Activities
- Provide resident inspection
- Provide materials testing
- Conduct factory inspection and tests

3. Project Schedule

The following is an estimated Project Schedule:

- Pre-Design....................7 Months
- Design....................12 Months
- Bid and Award....................6 Months
- Construction....................12 Months
- Project Close-out....................6 Months

4. Solicitation Schedule

- Issue Task Order Solicitation ....Date of Cover Letter
- Pre-Proposal meeting with site visit .... 2 weeks after issuance of TOS
    - ➢ Date, time and location by separate notification.
- Receive Solicitation Responses.................... 5 weeks after issuance of TOS
- Conduct Interviews.................... 7 weeks after issuance of TOS
- Select and Negotiate....................9 weeks after issuance of TOS
- Issue Task Work Order....................15 weeks after issuance of TOS

5. Construction Budget

The estimated construction budget for this project is $15,750,000.

6. Solicitation Response Requirements

Solicitation Responses shall be bound and not exceed 30 pages, exclusive of cover, dividers and resumes. 10 copies shall be submitted no later than 2:00 PM, 6 weeks after the date the TOS was issued. Solicitation Responses shall be hand delivered and submitted to the sixth floor receptionist (for log-in) at the **Public Works Building, 1149 S. Broadway, Los Angeles, CA 90015, Attention: Chris Salvaggio.** Consultant is responsible for advising the Task Order Manager if Solicitation Responses are mailed to the above address. Bound Solicitation Responses shall include:

- Section 1 - Project Understanding: Explain your firm's overall approach to the work.
- Section 2 - Related Experience: Describe similar projects your firm has recently completed.
- Section 3 - Project Team: Provide project team organization chart and describe background, roles and responsibilities of key team members. Provide information on MBE/WBE/OBE involvement. Provide resumes of those who will actually work on the project in the Appendix.
- Section 4 - Detailed Scope of Work & Schedule: Expand and develop the City's Scope of Work and Schedule contained herein.
- Section 5 - Fee Estimate. Provide cost calculations (firm) for the work described in 2.1 Pre-design Report and 2.2 Detailed Design. Provide cost calculations

(estimated) for the work described in 2.3 Design Support Services During Construction.

- List assumptions associated with all cost calculations. List MBE, WBE and OBE participation as a % for each phase (i.e. 2.1, 2.2 & 2.3)
- Appendix: Include resumes

7. Selection Criteria

Item	Selection Criteria	Max. Score
A	Capability of the Project Team to provide the Scope of Services as demonstrated by the solicitation response and interview.	20
B	The Project Team's and/or individual Team member's experience as it relates to the scope of this project.	20
C	Development of the scope of work (i.e. Content of Section 4 in the Consultant's proposal).	20
D	The value offered to the City considering cost in comparison to capabilities and experience of the project team.	20
E	Project Team's knowledge of the City facilities, procedures and practices.	10
F	Project Manager's experience, qualifications and availability.	10
	Total Maximum Score	**100**

8. Anticipated Participation Levels

The anticipated participation levels for this Task order are 12% MBE and 2% WBE.

9. Managers

The City's Task Order Manager is Chris Salvaggio, Project Manager, Prop O Implementation Program (213) 847-0304.

10. Disclaimer

The City may or may not decide to award any or part of this task order based on its sole convenience and shall not be responsible for any solicitation response costs.

PENMAR WATER QUALITY IMPROVEMENT AND RUNOFF REUSE PROJECT

Santa Monica Bay Beaches Bacterial TMDL Implementation Plan

Project Concept Report

March 2007

Prepared by:

CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SANITATION

WATERSHED PROTECTION DIVISION

CITY OF SANTA MONICA
ENVIRONMENTAL & PUBLIC WORKS
MANAGEMENT DEPARTMENT

ENVIRONMENTAL PROGRAMS DIVISION

CONTENTS:

FIGURES AND TABLES:

1. EXECUTIVE SUMMARY

Storm water runoff from a site has the potential to contribute oil and grease, suspended solids, metals, hydrocarbons, organic chemicals, and pathogens to the storm water conveyance system. The Penmar Water Quality Improvement and Runoff Reuse Project goal is to minimize, to the maximum extent practicable, the introduction of pollutants of concern that may result in significant impacts, generated from site runoff to the storm water conveyance system. Pollutants of concern, consist of any pollutants that exhibit one or more of the following characteristics:

- Current loadings or historic deposits of the pollutant are impacting the beneficial uses of receiving water bodies.

- Elevated levels of the pollutant are found in sediments of receiving water and/or have the potential to bioaccumulate in organisms therein.

- The detectable inputs of the pollutant are at a concentrations or loads considered potentially toxic to humans and habitats.

In meeting this specific requirement, "minimization of the pollutants of concern" will require the incorporation of a Best Management Practices (BMP) or combination of BMPs best suited to maximize the reduction of pollutant loadings in that runoff to the Maximum Extent Practicable.

Proposed stormwater BMPs for this project site include:

1- Diversion of stormwater (and dry weather runoff) from existing stormdrain system to the project site.
2- Pretreatment of diverted stormwater through hydrodynamic separators.
3- Retention of pretreated stormwater in underground detention tanks.
4- Disinfection of the stormwater.
5- Reuse application of treated stormwater through landscape irrigation.

The project will be a joint collaboration between City of Los Angeles and City of Santa Monica to work together to implement the water quality improvement and stormwater reuse. This project will result in an increased beneficial and recreational uses of receiving water bodies, reduced potential for human safety and health risk, reduced beach closures, preserved aquatic marine and plant habitat and benefited tourism industry while enabling both Cities to meet the new requirements of the stormwater NPDES permit to reduce bacterial levels in the surf zone. An additional benefit to this project is the beneficial reuse application of stormwater through the Penmar Water Quality Improvement and Runoff Reuse Project landscape irrigation. Reuse of stormwater turns a by-product of urbanization into a local water resource, reducing the dependence of imported potable water.

2. PROJECT SCOPE

2.1 Existing Conditions

The project location was selected based upon potential project sites from the Santa Monica Bay Beaches Wet Weather Bacterial TMDL Implementation Plan. The Penmar Water Quality Improvement and Runoff Reuse Project are within the Santa Monica subwatershed and located at Penmar Golf, Penmar Rec. & Park, and Marine Park., which has a predominantly light commercial, industrial, and high-density single-family land use area (Figures 1 and 2). The Penmar Water Quality Improvement and Runoff Reuse Project have an area of approximately 90 acres and is owned and operated by the City of Los Angeles (Department of Parks and Recreation) and City of Santa Monica. This project targets a drainage area of approximately 1,468 acres [625 acres (43%) is City of Los Angeles and 843 (57%) is City of Santa Monica]. This project will be capable of capturing up to 88.4 million gallons of surface run-off per year.

2.2 Project Description

Penmar Water Quality Improvement and Runoff Reuse Project is a good potential site for implementation of sub-regional solutions such as underground detention and infiltration systems. The area is large enough to provide a large underground detention tank to capture and store surface runoff for reuse application of stormwater through irrigation of the Penmar area and Marine park landscapes.

The advantages of applying underground detention tank BMP at Penmar Water Quality Improvement and Runoff Reuse Project site are as follows:

- Capturing, storing and treating the surface runoff which leads to pollutant load reduction
- Decreasing the demand for costly imported potable water
- Improving air quality by reducing the demand for energy
- Full use of the land
- Aesthetically pleasing (out of sight- out of mind!)

The Penmar Water Quality Improvement and Runoff Reuse Project includes installation of a stormwater lift station (to be sized for flowrate), a flow diversion facility, two hydrodynamic separator (to be sized for 60 cfs each unit, for a total of 120 cfs), an underground detention tank (2,000,000 gallons), underground infiltration units in the Penmar area [walk way around Penmar Golf on the Northwest {900' L by 20' W}, alley next to Tennis court in Marine Park {400' L by 40' W}, 16th St. {400' L by 40' W}, Penmar Golf course in the Northeast (infiltration and BMPs from Santa Monica airport flow)], pond in the Golf course, disinfection facility, final effluent pump station, recirculation pump and overflow system.

Off-site surface runoff will be diverted from the existing 84" storm drain pipe at Rose Ave. and Frederick St. to a stormwater lift station. Stormwater is pumped to a diversion structure and to a hydrodynamic separator for removal of heavy sediments, oil, grease and floatable wastes. The pretreated stormwater runoff is then conveyed for storage in the proposed underground detention tank and to the infiltration units, when the cisterns overflow, creating a dual treatment system..

The stored stormwater will be transferred to a disinfection unit, which provides the required contact time to disinfect the water in compliance with Title 22. The disinfected effluent will be pumped through the irrigation system to decrease the current landscaping irrigation demand. It is very important to have a completely isolated system to prevent effluent backflow into the potable water system that is currently used for landscape irrigation

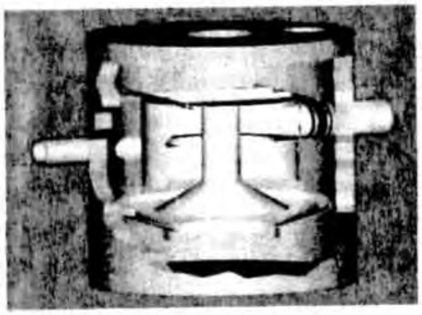
In order to enhance the quality of the stored stormwater and maintain an aerobic environment in detention tank to reduce the odor issues, a recirculation pump shall circulate the stored water through the proposed hydrodynamic separator into the detention tank. This also helps prevent excessive sediment build up at the bottom of the detention tank, which will reduce the O&M cost of the project. The lift station pump will be triggered and shut down by Low-Low & High-High level signals from detention tank. The lift station pump will also shut down by Low-Low level signal from the lift station pump wet well. In case of malfunction of detention tank level transmitters, the flow will be diverted to the existing storm drain system through an overflow pipe.

Due to the existence of an active water well (2539 L) in the vicinity of the Penmar Water Quality Improvement and Runoff Reuse Project and also a high level of groundwater table at the project site (approximately 5 feet to the bottom of the detention tank), infiltration from the underground detention tank would need to be investigated at Penmar. Review of a 1979 boring log reported Ground water to be 18 feet below ground surface. Infiltration could be prevented by applying an impervious PVC liner inside of the detention tank, for holding the stormwater for reuse.

Figure 3 illustrates the proposed Project site layout and BMP layout schematic. Figure 4 shows the infiltration locations around the Penmar area.

2.2.1 Description of the Proposed BMPs

2.2.1.1 Hydrodynamic Separator



Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments and other pollutants that are widely used in storm water treatment. No outside power source is required because the energy of the flowing water allows the sediments to efficiently separate. Depending on the type of unit, this separation may be by means of swirl action or indirect filtration. Variations of this unit have been designed to meet specific needs.

Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables - which can be captured, rather than solids with poor settleability or dissolved pollutants. In addition to the standard units, some vendors offer supplemental features to reduce the velocity of the flow entering the system. This increases the efficiency of the unit by allowing more sediments to settle out.

This technology may be used by itself or in conjunction with other storm water BMPs as part of an overall storm water control strategy. Hydrodynamic separators come in a wide size range and some are small enough to fit in conventional manholes. This makes hydrodynamic separators ideal for areas where land availability is limited. Also, because they can be placed in almost any specific location in a system, hydrodynamic separators are ideal for use in potential storm water "hotspots"--areas such as near gas stations, where higher concentrations of pollutants are more likely to occur. The need for hydrodynamic separators is growing as a result of decreasing land availability for the installation of storm water BMPs.

Although there are many hydrodynamic separation systems available, these four vendors are the major types:

- Continuous Deflective Separation (CDS)
- Downstream Defender™.
- Stormceptor®
- Vortechs™

Hydrodynamic separators are most effective where the separation of heavy particulate or floatables from wet weather runoff is required. The typical concentrations of heavy particulate and floatable pollutants found in storm water are shown in Table 1. They are designed to remove settleable solids and capture floatables; however, suspended solids are not effectively removed. Most units are small (depending on the flow entering needing to be treated) and may be able to fit into pre-existing manholes. For this reason, this technology is particularly well suited to locations where there is limited land available.

The use of hydrodynamic separators as wet weather treatment options may be limited by the variability of net solids removal. While some data suggest excellent removal rates, these rates often depend on site-specific conditions, as well as other contributing factors.

Pollutants such as nutrients, which adhere to fine particulates or are dissolved, will not be significantly removed by the unit. Site constraints, including the availability of suitable land, appropriate soil depth, and stable soil to support the unit structurally, may also limit the applicability of the hydrodynamic separator. The slope of the site or collection system may necessitate the use of an underground unit, which can result in an extensive excavation.

Observable improvements in waterways are often attributable to the use of hydrodynamic separators. This is due to the reduction of sediments, floatables, and oil and grease in the flow out of the unit. These positive impacts are only achievable when proper design and O&M of the unit are implemented.

Hydrodynamic separators do not have any moving parts, and are consequently not maintenance intensive. However, maintaining the system properly is very important in ensuring that it is operating as efficiently as possible. Proper maintenance involves frequent inspections throughout the first year of installation. The unit is full when the sediment level comes within one foot of the unit's top. This is recognized through experience or the use of a "dip stick" or rod for measuring the sediment depth. When the unit has reached capacity, it must be cleaned out. This may be performed with a sump Vac. or vacuum truck, depending on which unit is used. In general, hydrodynamic separators require a minimal amount of maintenance, but lack of attention will lower their overall efficiency.

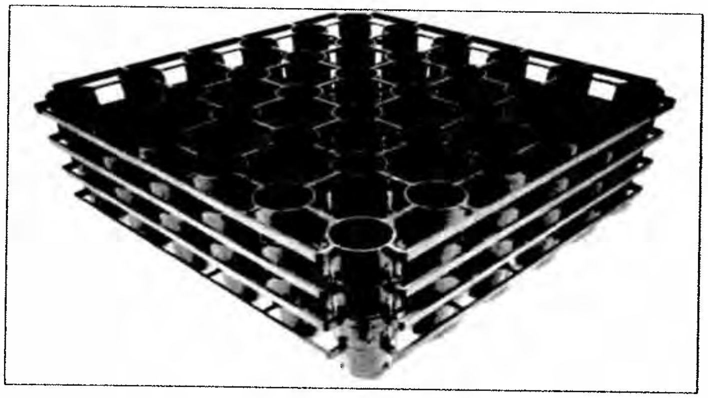
2.2.1.2 Stormwater Underground Detention/Infiltration System

Underground detention/infiltration structures manage runoff quality similar to ponds. They provide necessary volumes for capturing the stormwater and attenuating stormwater peak flows. In areas where land is not available for traditional wet or dry ponds, underground detention systems are an option. A BMP underground detention system functions to mitigate storm water runoff by holding excess water for slow release. Underground detention systems vary greatly in size and complexity, and can be installed at almost any location. The greatest benefit of this type of BMP is that it is hidden from view, and does not require surface land.

- Modest removal efficiencies for the larger particulate fraction of pollutants.
- Removal of sediment and buoyant materials. Nutrients, heavy metals, toxic materials, and oxygen-demanding particles are also removed with sediment substances associated with the particles.
- Can be designed for combined flood control and stormwater quality control.
- Require sufficient area and hydraulic head to function properly

- Generally not effective in removing dissolved and finer particulate size pollutants from stormwater.
- Some constraints other than the existing topography include, but are not limited to, the location of existing and proposed utilities, depth to bedrock, location and number of existing trees, and wetlands.
- Extended/dry detention basins have moderate to high maintenance requirements.
- Sediments can be resuspended if allowed to accumulate over time and escape through the hydraulic control to downstream systems.

2.2.1.2.1 Plastic Infill Detention/Infiltration System



These systems include a free-form structure encased in a plastic liner. The structure can be used for water retention by the use of an impervious liner. Water is then accessible for irrigation for Penmar area and Marine Park.

These plastic structures can have a maximum void volume of 95%, maximizing water storage capacity while the intrinsic strength permits heavy loads over completed structure.

They have profound logistical advantages over traditional installations, due to its modular design and lightweight characteristics. In addition, using systems like StormTech chambers and Infiltrators which are other system for infiltration and potential cost saving.

Following are three well-known vendors for these products:

- Rainstore[1]
- StormCell^{R}
- ADS (StormTech)
- Infiltrator

Maintenance is usually conducted by periodically pumping out sediments and debris. In areas of high sediment flows, pretreatment is required to minimize the inflow of particulates so that the need to clean the system is reduced. Frequent maintenance is required to resuspend and remove sediment and debris and to ensure that the outlet structure is functioning properly. Large-scale removal of accumulated sediment in the system may be difficult due to limited access. In addition, underground systems will be considered confined spaces that require additional safety requirements for inspection and maintenance.

2.2.2 Preliminary Design Criteria and Initial Calculations

Penmar Water Quality Improvement and Runoff Reuse Project potentially is a good site for implementation of sub-regional solutions such as underground detention and infiltration basins. The area is large enough to provide a large underground detention tank for capturing and storing surface runoff, offers opportunities for underground infiltration, and should the demand and infrastructure be in place, opportunities for reuse and irrigation of the Penamr vicinity.

The advantages of applying underground detention tank BMP at Penmar Water Quality Improvement and Runoff Reuse Project site are as follows:

- Capturing, storing and treating the surface runoff which leads to pollutant load reduction
- Project Capturing flow from 100% of the watershed
- Full use of the land
- Aesthetically pleasing (out of sight, out of mind!)

Tables 1 summarizes the generated runoff, infiltration, irrigation and retained volumes managed by installation of underground detention/infiltration system at this Project location, which were estimated by the procedures outlined in the following sections.

2.2.2.1 Estimated Runoff Flow and Volume

Estimated surface runoff flow rate was calculated by evaluating all storm events from 1948 – 1998 at the Downtown Los Angeles rain gage and using the Rational Method *(Los* Angeles County Hydrology Manual, 2000). From that data a CDF Rainfall Intensity graph was developed. Choosing to capture 90% of all the storm events will lead to a rain fall intensity of 0.18 in/hr.

$$Q_{90\ percentile}\ (cfs) = C * I\ (in/hr) * Area\ (ac)$$

C = Imperviousness value (based on land use form 2005 SCAG data)
I = Rainfall intensity (based on CDF Rainfall Intensity Curve (Downtown LA 1948 – 1998)
A= Area for specific land use (based on land use form 2005 SCAG data)

$$Q_{90\%\ percentile}\ (cfs) = 100\ cfs$$

Similarly, the estimated annual mean storm runoff volume per year was calculated based on 12.01 in/yr (30 years mean rainfall 1961-1990 Los Angeles).

$$V_{(MG)} = 182\ MG$$

2.2.2.2 Estimated Landscape Irrigation Demand:

Estimated (Penmar Rec/park and Golf course are actual LADWP number, but for Marine Park it was estimated on land area with Rec/park number) water use for irrigation of Penmar Water Quality Improvement and Runoff Reuse Project is approximately 42.7 million gallons in 2005-06 (Ref. 6), Table 1.

Detention/Irrigation Mass Balance

The estimated volume of runoff for re-use in irrigation is approximately 39.9 million gallon per year. In most months, except June and July, the runoff volume exceeds the demand for irrigation.

2.2.2.3 Estimated Detention/Infiltration Capacity Demand

The estimated volume of detention capacity is based on meeting the 10% reduction of SMBB wet weather bacterial TMDL by July 2009. The estimated 4th rainfall event is 2.52 inches (review of 1970 to 1998 Downtown rainfall totals and taking the second highest rainfall in the year which was on 1982-1983 (31.25")). The 4th rainfall inches was taken for the 24 hours period and the 2.52 inches was used to calculated the volume based on the drainage area (1,468 acres) and runoff coefficient (0.38). The total volume was calculated to be 37,800,000 gallons for Penmar Drainage area and based on 10% detention/infiltration capacity the volume is approximately 3.75 MG (2.0 MG detention/1.75 MG infiltration).

Table 1- Detention/Infiltration/Irrigation Mass Balance (Rose Ave Storm Drain Pipe)

Drainage Area: 1468 acres
Runoff Coefficient: 0.38
Landscape Area: 60
Detention/Infiltration Capacity: 3,750,000 gallons (2.0 MG detention/1.75 MG infiltration)
Run-off Peak Flowrate: 120 cfs (two 60 cfs Hydrodynamic Separator)
Run-off Captured: 88.4 MG/Yr
Run-off Irrigated: 39.9 MG/Yr
Run-off Infiltrated: 48.5 MG/Yr

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Mean Rainfall (in)	0.34	1.76	1.68	2.4	2.51	1.98	0.72	0.14	0.03	0.01	0.15	0.31	12.01
Mean Rain Event	1.4	3.1	3.8	4.5	4.6	4.9	2.5	0.6	0.2	0.2	0.4	1	27.2
Runoff Volume (gal)	5,160,516	26,713,262	25,195,463	36,427,175	38,096,754	30,052,419	10,928,153	2,124,919	455,340	151,780	2,276,698	4,705,177	182,287,656
Irrigation Demand Rec Center (gal)*	743,512	478,720	318,648	74,052	324,632	104,720	187,748	295,460	682,176	713,592	750,992	750,244	5,424,496
Irrigation Demand Golf (gal)*	2,629,220	3,714,568	4,250,884	5,626,456	5,195,608	4,189,548	3,016,684	1,050,940	658,988	1,929,092	515,372	1,841,576	34,618,936
Irrigation Demand Marine Park (gal)**	371,756	239,360	159,324	37,026	162,316	52,360	93,874	147,730	341,088	356,796	375,496	375,122	2,712,248
Stormwater Reused Irrigation (gal)	3,744,488	4,432,648	4,728,856	5,737,534	5,682,556	4,346,628	3,298,306	1,494,130	1,682,252	151,780	1,641,860	2,966,942	39,907,980
Stormwater Reused Infiltration (gal)***	1,393,339	7,212,581	6,802,775	9,835,337	10,286,124	8,114,153	2,950,601	0	0	0	614,709	1,270,398	48,480,017
Irrigation satisfied %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	64.6	5.1	100.0	100.0	89.1
Stormwater Captured %	99.6	43.6	45.8	42.8	41.9	41.5	57.2	70.3	100.0	100.0	99.1	90.1	47.82

* Data from Cityofla DWP water usage for 2005-2006
** Data estimated from Rec Center using half water usage by size of Landscape
*** Data estimated for infiltration to be 27% of Runoff (during Wet Weather)

2.2.3 Project Benefits

2.2.3.1 Water Quality Benefits

The following water quality benefits will be achieved by implementing a **series** of sub-regional projects such as the Penmar Reuse Project, targeting "hot spots:"

- Achieving the compliance target of a 10% reduction of SMBB wet weather bacterial exeedance days by first interim compliance milestone (July 2009)
- Addressing multiple pollutants with which the SMBB is impaired.
- Enhancing receiving water bodies beneficial and recreational uses
- Preserving the aquatic marine habitat
- Reducing the potential for human health risk and safety

Since pollutant concentrations tends to be much higher at the beginning of a storm compared to the middle or the end of the event, a significant pollutant load reduction can occur as a result of capturing the first flush of the storm runoff.

Table 2 indicates the estimated pollutants removal efficiencies as a function of inches of stormwater captured:

Table 2- Estimated Pollutants Removal Efficiencies (Ref #5)

TSS	TP	TN	Metals	BOD	Bacteria	Comments
75	50 - 55	45 - 55	75 - 80	70	75	Capture of 0.5 in of runoff
90	60 - 70	55 - 60	85 - 90	80	90	Capture of 2 in of runoff

2.2.3.2 Additional Benefits

Additional benefits to this project are the beneficial reuse application of stormwater through the Penmar Golf and Recreation Center, and marine Park for landscape irrigation.

2.2.4 Operation/Maintenance Considerations

The Cities of Los Angeles (Bureau of Sanitation) and Santa Monica (Environmental & Public Works Management Department) will coordinate and develop responsibility for water quality monitoring, operation and maintenance of the installed BMPs.

2.2.4.1 Underground Stormwater Detention system

Maintenance is usually conducted by periodically pumping out sediments and debris. In areas of high sediment flows, pretreatment is required to minimize the inflow of particulates so that the need to clean the system is reduced. Frequent maintenance is required to resuspend and remove sediment and debris and to ensure that the outlet structure is functioning properly. Removal of accumulated sediment in the system may be difficult due to limited access. In addition, underground systems will be considered confined spaces that require additional safety requirements for inspection and maintenance.

2.2.4.2 Hydrodynamic Separator

Hydrodynamic separators do not have any moving parts, and are consequently not maintenance intensive. However, maintaining the system properly is very important in ensuring that it is operating as efficiently as possible. Proper maintenance involves frequent inspections throughout the first year of installation. The unit is full when the sediment level comes within one foot of the unit's top. This is recognized through experience or the use of a "dip stick" or rod for measuring the sediment depth. When the unit has reached capacity, it must be cleaned out. Cleanout may be performed with a sump vac. or vacuum truck, depending on which unit is used. In general, hydrodynamic separators require a minimal amount of maintenance, but lack of attention will lower their overall efficiency.

2.2.5 Permit Requirements

The following permits might be required for this project:

- Coastal Commission
- California Environmental Quality Act (CEQA) Documents
- LA County
- LA Department of Building and Safety

2.2.6 Additional Design Considerations

The location of treatment structures shall be considered in areas that are easily accessible to maintenance staff and vehicles. Access entries should be located away from playing fields and baseball diamonds, and golf courses. Treatment structures placed above ground should be secured and protected in the interest of public health and safety. Consideration should be taken to (1) minimize the disruption to the community during construction, and (2) ensure enough time in the project schedule to replace turf and install a new irrigation system. The Department of Recreation and Parks and Bureau of Sanitation shall be included in the design process.

2.2.7 Project Coordination

In the development and preparation of this concept report, the following individuals have conducted field visits and coordinated with one another to ensure that this project is supported by their respective departments and/or agencies.

Representative	Agency
Wing Tam	City of Los Angles/DPW/BOS
Majid Sedeghi	City of Los Angles/DPW/BOS
Nasir Emami	City of Los Angles/DPW/BOS
Kendrick Okuda	City of Los Angles/DPW/BOE
Alfred Mata	City of Los Angles/DPW/BOE
Rick Viergutz	City of Los Angles/DPW/BOE
Timothy Marxer	City of Los Angles/GSD
Mike Shull	City of Los Angeles/Dept. Rec & Parks
James Ward	City of Los Angeles/Dept. Rec & Parks
David Attaway	City of Los Angeles/Dept. Rec & Parks
Darryl Ford	City of Los Angeles/Dept. Rec & Parks
Neal Shapiro	City of Santa Monica

2.3 Public Outreach

2.3.1 Public Participation and Review of Implementation Plan

Interested persons and the public have had the opportunity to participate in the development and review of the Bacterial TMDL Implementation Plan for Jurisdictional 2 and 3. The responsible jurisdictions and agencies in Jurisdictional 2 and 3 held four half-day stakeholder workshops during the development of the Implementation Plan. These were held on May 29, 2003; August 12, 2004; and November 9, 2004.

2.3.2 Public Education and Awareness

The Cities of Los Angeles (Department of Recreation and Parks, Bureau of Engineering, and Bureau of Sanitation) and Santa Monica (Environmental & Public Works Management Department) will conduct additional public outreach campaigns for community input as part of the design, approval and construction processes. This could include potential safety and vandalism concerns.

3. Preliminary Cost Estimate

The total project cost is estimated at $23,585,000. The amount requested from Prop O is $23,585,000. Detailed cost breakdowns are shown in Table 3-1 and 3-2 below.

Table 3-1
Water Quality Benefits Construction Cost Estimate

Description	Unit	Quantity	Item Total
Stormwater Lift Station	LS	1	$500,000
Stormwater Diversion Structure	LS	1	$50,000
Hydrodynamic Separators (2 @ 60 cfs)	EA	2	$950,000
Underground Detention System (2 MG)	LS	1	$2,000,000
Pond in Golf Course	LS	1	$2,000,000
Infiltration Sites (1.75 MG)	LS	1	$1,575,000
Recirculation Pump	LS	1	$50,000
Disinfection	LS	1	$500,000
Instrumentation and control System	LS	1	$300,000
Power/Electrical cabinets	LS	1	$200,000
Piping and Valves	LS	1	$550,000
Irrigation Pumps / upgrades to exisiting system	LS	1	$1,000,000
Smart Irrigation System to be provided by Department of Water and Power ($100,000)			$0
Subtotal (1)			**9,675,000**
Mobilization - 0% to 7% of Subtotal (1)		**5%**	483,750
Permits - 2% to 5% of Subtotal (1), use **3%**		**3%**	290,250
Allowances - 5% of Subtotal (1)		**5%**	483,750
Subtotal (2)			**10,932,750**
Estimating Contingency - 10% to 25% of Subtotal (2)		**25%**	2,733,188
Subtotal (3)			**13,665,938**
Escalation -5% to 10% per year of Subtotal (3)		**3 yrs%**	3,696,636
Subtotal (4)			**17,362,574**
Construction Contingency - 10% to 20% of Subtotal (1)		**10%**	1,736,257
Total Estimated Project Construction Cost			**19,098,831**

Table 3-2 Project Cost Estimate Table

	Budget Category	**Non-Proposition O Funding (if applicable) Project Benefits**	**Requested Proposition O**		**Total**
			Water Quality Benefits Cost	**Other Project Benefits**	
(a)	Construction Cost (including estimating contingency, mobilization, allowances, construction contengency, and material cost escalation		$19,100,000	$0	$19,100,000
(b)	Land Purchase/Right-of-Way acquisition		$0	$0	$0
(c)	Pre-Design and Design (including environmental clearance, design project management, bid & award)		$2,721,750	$0	$2,721,750
(d)	Construction and Post-Construction management		$1,762,930	$0	$1,762,930
(e)	**Grand Total [Sum (a) through (d) for each column]**	**$0**	**$23,585,000**	**$0**	**$23,585,000**
Sources of Non-Proposition O Funds					

Estimated Annual O&M (3-6% of construction cost): $290,300/yr to $580,500/yr.

4. Project Implementation Schedule

PENMAR WATER QUALITY IMPROVEMENT AND RUNOFF REUSE PROJECT IMPLEMENTATION SCHEDULE

	2007							2008												2009					
Work Items	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
City Council Fund Approval	▨	▨	▨	▨																					
CEQA/NEPA Preparation and Completion			▨	▨	▨																				
Community Outreach				▨		▨								▨	▨										
Project Pre-Design			▨	▨	▨																				
Project Design					▨	▨	▨	▨	▨	▨															
Bid Solicitation Process											▨	▨	▨												
Maintenance Agreement					▨	▨	▨	▨	▨	▨															
Permitting identification and Acquisition					▨	▨	▨	▨	▨	▨															
Construction Duration														▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		
Environmental Mitigation or Enhancement Efforts																								▨	▨
Post Implementation, Construction and Follow Up Efforts																									
Other work Items																									

5. References

1- EPA 832-F-99-044 (September 1999) - http://www.epa.gov/owm/mtb/modtreat.pdf
2- Minnesota Urban Small Size BMP Manual - http://www.metrocouncil.org/Environment/Watershed/BMP/CH3_STFiltBioretention.pdf
3- FILTERRA® Stormwater Bioretention Filtration System - http://www.americastusa.com/filterra.html
4- Invisible Structures, Inc.- http://www.invisiblestructures.com/RS3/rainstore.htm
5 - Stormwater BMP Infiltration Basin - http://www.fhwa.dot.gov/environment/ultraurb/3fs2.htm
6 - Personal communication with Timothy Marxer, City of Los Angeles, General Services Department.

Appendix A

Plan & Profile
Of
Storm Drain in Penmar Project

Figure 1- Penmar Water Quality Improvement and Runoff Reuse Project Drainage Map and Land Use

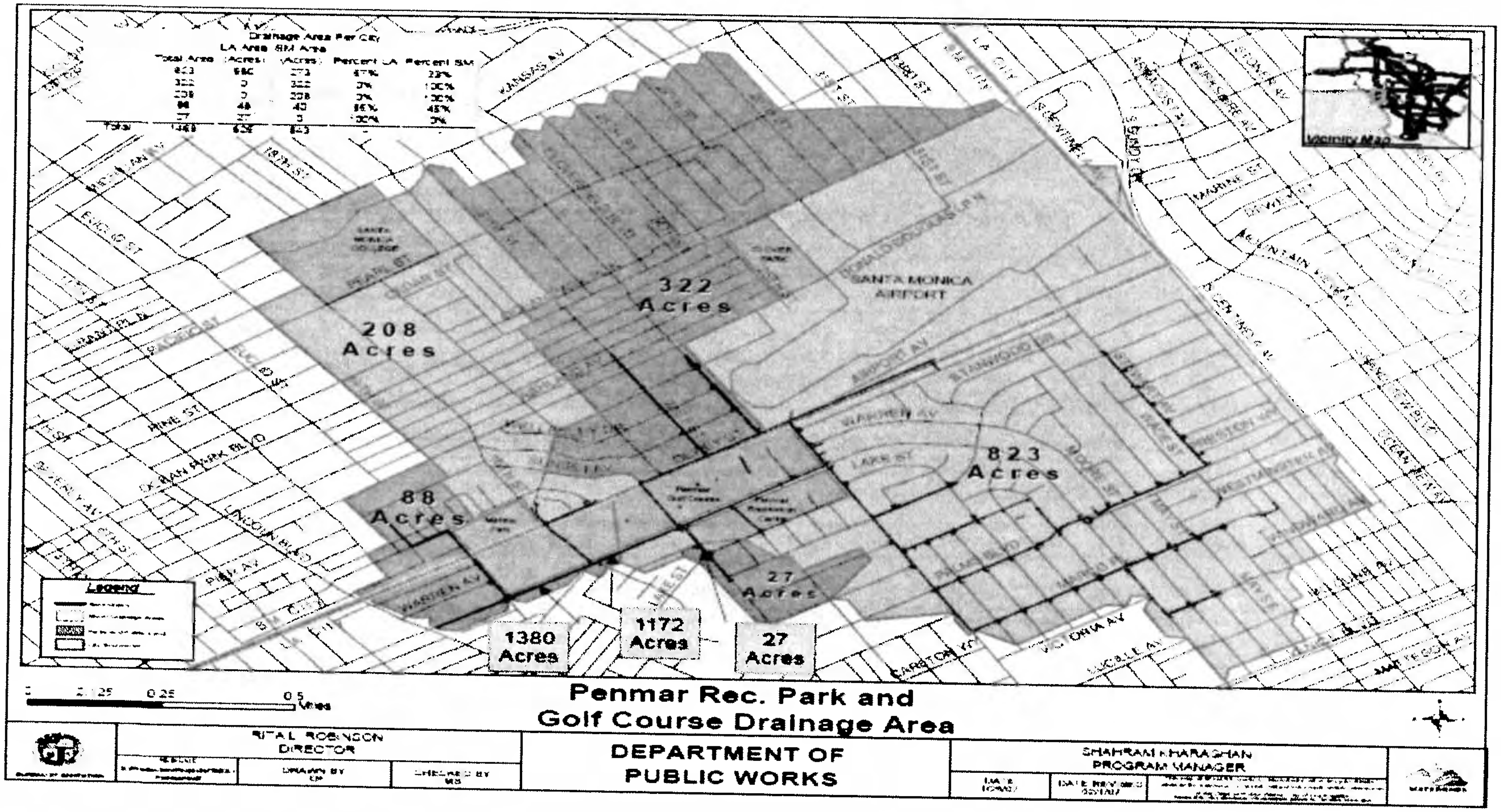


Figure 2- Map of Project Aerial Overview and Site Conditions

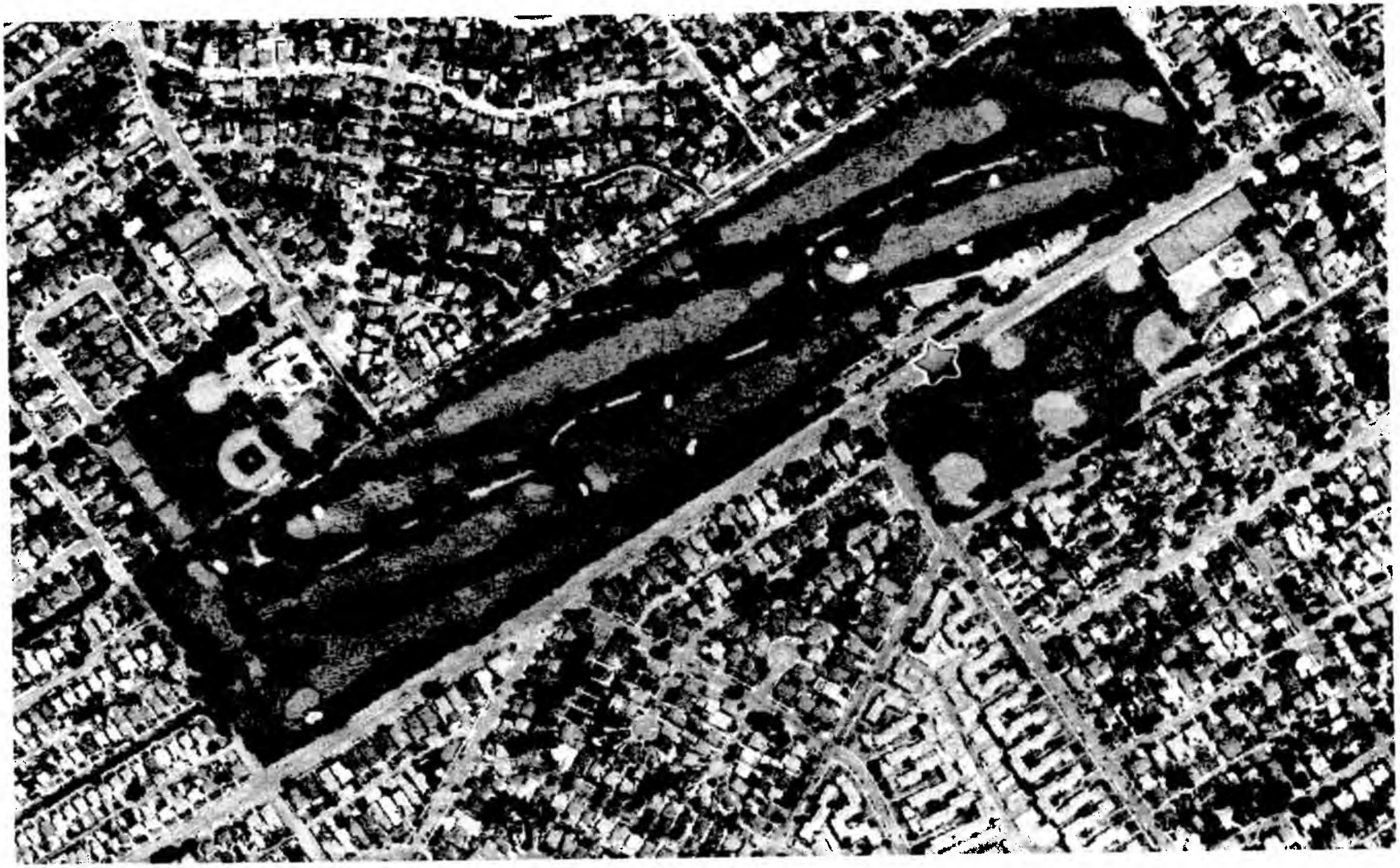


Figure 3- Proposed BMP Layout Schematic

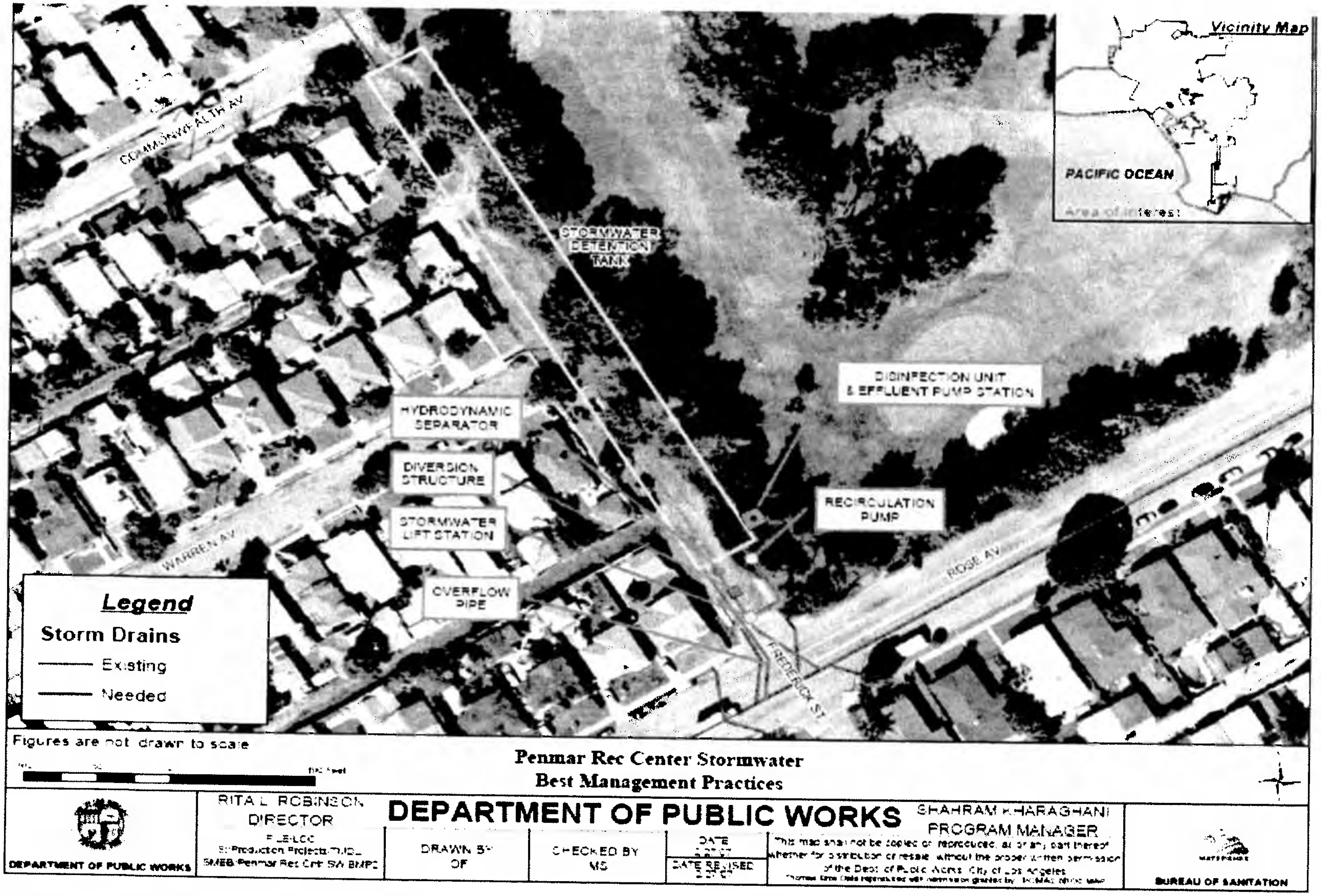


Figure 4- Proposed Infiltration Layout

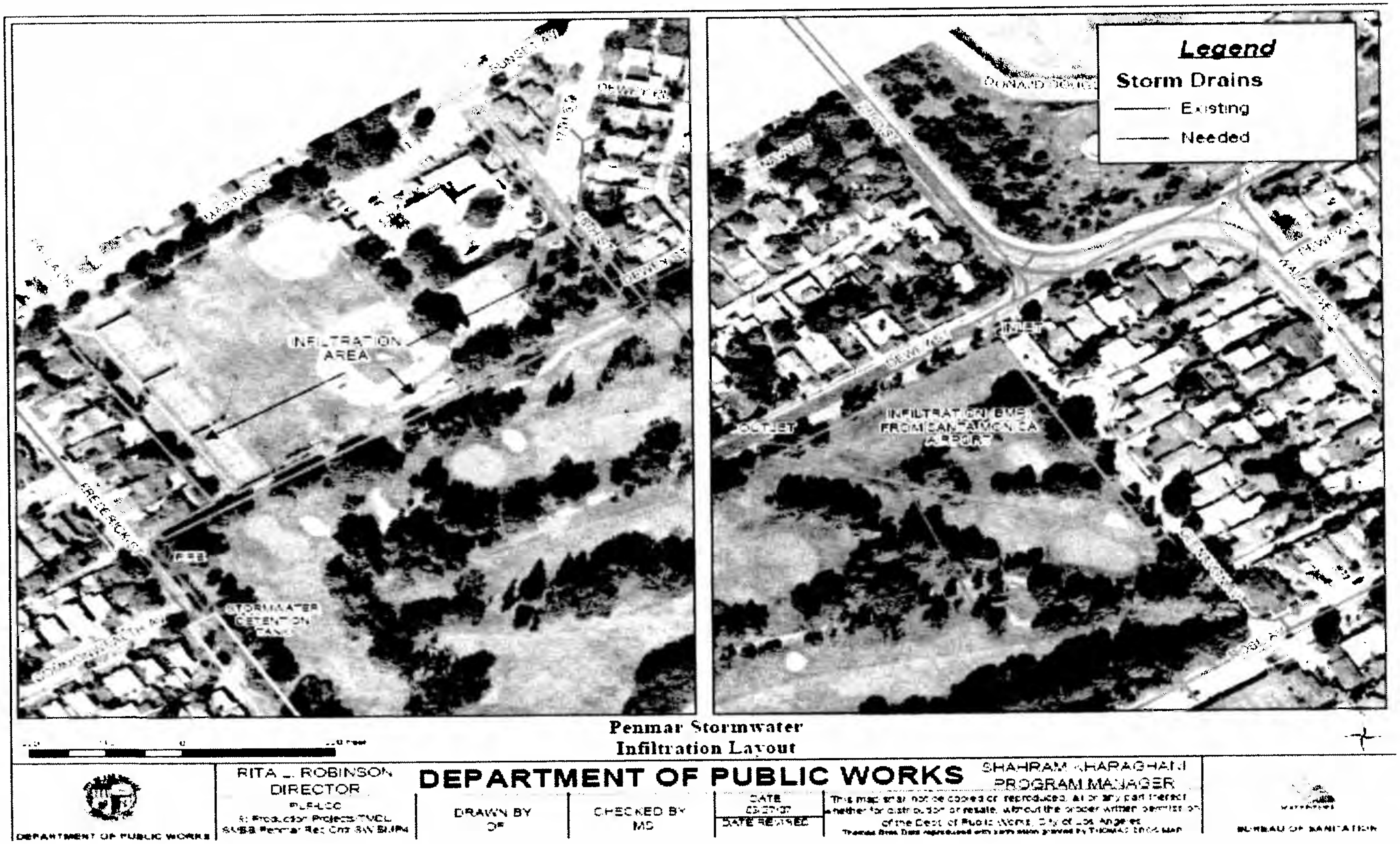


Figure 5- Photos of Existing Condition

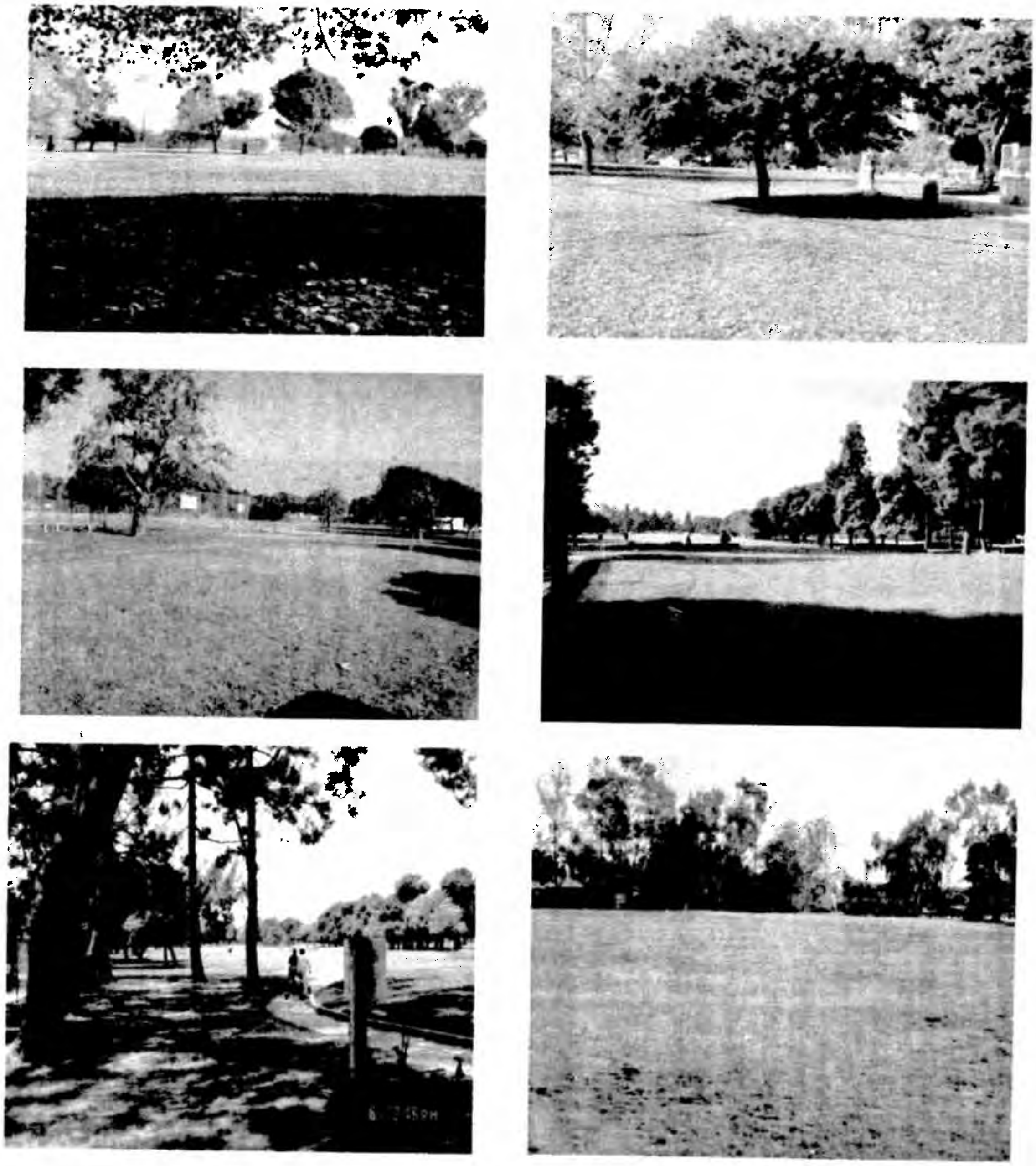


Figure 4- Photos of Existing Condition (continue)

City of Los Angeles, Department of Public Works
Bureau of Engineering
Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

FINAL

Pre-Design Report

November 2008

Prepared by:

BROWN AND CALDWELL

801 South Figueroa Street, Suite 950
Los Angeles, California 90017

W.O. No. EW40019F

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Attachment 5:	Technical Memorandum No. 5 Force Mains
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Appendix B:	Geotechical Evaluation, Penmar Water Quality Impropvement Project, Ninyo and Moore Report Dated June 13, 2008
Appendix C:	Penmar Water Quality Improvement Project Schedule
Appendix D:	Class B Construction Cost Estimate Dated October 14, 2008

1.0 INTRODUCTION

This Pre-Design Report (PDR) presents the eight technical memoranda used to develop the design components associated with the Penmar Water Quality Improvement Project. This project has been divided into two components. Phase I, the subject of the technical memoranda, addresses the bacteria TMDL requirements which the City faces. Phase II, not included as part of this document, represents future reuse of the stormwater, including potential disinfection of the stormwater.

The eight technical memoranda are provided as Attachments 1 through 8 to this report. Also included as Attachment 9 are the responses to comments for Technical Memorandum No. 1 through No. 8 and supplemental information.

Appendices include the preliminary geotechnical report, the geotechnical investigation, the project schedule, and the Class B Construction Cost Estimate.

As part of the contract negotiations, the City requested the consultant team examine ways to expedite the designs to allow for an accelerated construction schedule for meeting the TMDL compliance deadlines. It should be noted that in the interest of expediting this project's designs, it was decided early on in the design process by the design (City and consultant) team to utilize a series of technical memoranda that would be prepared and approved in parallel versus compilation of one overall (single) pre-design report. The PDR presented herein, therefore, represents a summation of previously submitted and approved technical memoranda for this project.

2.0 TECHNICAL MEMORANDA DESCRIPTIONS (ATTACHMENTS 1 THROUGH 8)

The eight technical memoranda (TMs) provided as attachments are described as follows:

- **Technical Memorandum No. 1 – Combination Underground Detention/Infiltration System**

  The purpose of this TM was to examine whether significant infiltration can be achieved to meet TMDL compliance in the Penmar drainage area. With this approach, water would be collected in an underground detention/infiltration system at the Penmar project site and would infiltrate into the ground over time. Due to the low permeability of the soil at the project site, the infiltration rate is too low for infiltration to be used as an effective BMP. In addition to the physical limitation on effective rates listed above, our project geotechnical sub consultant, Ninyo & Moore, has also recommended against the use of infiltration at the Penmar site due to the risk of hydro-collapse (settlement). Furthermore, the variability of the old fill soils on the site makes the prediction of long-term infiltration rates difficult to determine. However, the detention volume that can be attained in the underground detention/infiltration systems may be used to supplement the volume of stormwater that can be stored in a separate storage tank as described in TM No. 7.

- **Technical Memorandum No. 2 – Right-of-way Availability on Fredrick Street for Construction**

  The purpose of this TM was to examine whether there is right-of-way availability for the future construction of the Pump Station facility on Frederick Street near the Penmar golf course. The entire Frederick Street right-of-way of 50 feet wide by 400 feet long could be made available for the construction of the Pump Station. However, existing utilities which include sewer, water and storm drains, may have to be relocated to make room for the new pump station.

- **Technical Memorandum No. 3 – Discharge to Sewer System**

  In this TM, a 16-inch sewer pipe has been identified as a potential connection point into which stormwater from the Penmar drainage area could be discharged. Based on preliminary information obtained from BOS, it is estimated that approximately 727,056 gallons (442,696 gallons discharged from the buried tank and 284,360 gallons from dry weather flows) of stormwater could be discharged into this sewer pipe. Several other constraints/ bottle-necks to the wastewater collection system are also identified which require upsizing to accommodate the anticipated stormwater discharge. These additional locations are discussed as part of TM No. 8.

- **Technical Memorandum No. 4 – Penmar Stormwater Pump Station**

  This TM presents the findings and recommendations for a pumping station which will route the stormwater to the reservoir. The pumping station capacity is interrelated with both the capacity of the storage reservoir and the elapsed time required to empty the reservoir. These capacities have been used in modeling storm events to estimate the number of annual events in which stormwater will flow to the beach and potentially cause a violation of the Santa Monica Bay Beaches bacteria TMDL. Based on the Concept Report, subsequent stormwater system hydraulic modeling, and discussions with City staff, the capacities required for the system components to meet the TMDL attainment objectives for the project are as follows:

• Wet well storage ahead of pumping system	70,000 gallons
• Pumping capacity	20 cubic feet per second (cfs)
• Number of pumps	four at 5 cfs each
• Storage reservoir	2.75 million gallons
• Available sewer capacity (discharge rate)	1.5 cfs from 12 Midnight to 6 AM (6 hours) 0 cfs from 6 AM to 12 Midnight (18 hours)
• Dry weather flow (base flow in storm drain)	0.44 cfs (estimated at 0.0003 cfs/acre in the Interim Hydrologic Design Analysis)

  Stormwater runoff and dry weather flows will be diverted to the pump station wet well by a passive diversion structure in which all flow is diverted to the wet well through a side or bottom opening in the storm drain box structure. As the wet well water surface elevation rises, the four constant speed pumps will come on in sequence to pump storm flow to the reservoir. If the flow continues to rise at a rate that is in excess of the pumping capacity, the wet well will reach capacity and excess flow will remain in the storm drain and continue to flow down stream to the current drain outlet.

  The pumps will fill the reservoir to a maximum capacity of 2.75 million gallons. Level control at the reservoir will shut down the pumps when the maximum capacity is reached. The stormwater will be held in the reservoir until the wet weather period ends and the sanitary sewer system has the capacity to receive the flow from the tank. LABOS has determined that the stormwater will need to be held for 72 hours after a storm event passes before the sanitary sewer system has capacity available to begin to receive the stored water.

As capacity in the sanitary sewer is available, stormwater from the pump station wet well will be pumped to the sanitary sewer by a smaller pump system consisting of two pumps with a capacity of approximately 0.5 cfs each. The flow will include any base flow or dry weather flow that continues to enter the wet well from the storm drain. This base flow is estimated to be approximately 0.5 cfs. During non-storm periods, the small pumps will discharge base flow only directly to the sanitary sewer. It is expected that the small pump will operate to remove base flows throughout the year.

- **Technical Memorandum No. 5 – Force Mains**

  This TM details the three force main systems identified within the project scope to convey the dry and wet weather flows between the proposed stormwater pump station sump, the proposed storage tank, and the Rose Avenue sanitary trunk sewer. The three lines are located along Rose Avenue between Penmar Avenue and Frederick Street on the south side of the Penmar golf course. General ground elevation within the area is approximately 25 feet above mean sea level.

  The following summarizes the naming conventions and flow rates for the proposed force mains:

  - Force Main No. 1—from the proposed pump station to the proposed storage tank: 20 cfs (8,976 gpm).
  - Force Main No. 2A—from the proposed storage tank to the designated sanitary sewer manhole: 1.0 cfs (450 gpm) from 6:00 AM to Midnight and 1.5 cfs (673 gpm) from Midnight to 6:00 AM.
  - Force Main No. 2B—from the proposed pump station to the designated sanitary sewer manhole: up to 1.5 cfs (673 gpm) including 0.44 cfs dry weather flow to allow for direct pumping from the pump station wet well to the sanitary sewer during dry weather periods, thereby keeping the majority of the wet well storage capacity available to receive diverted wet weather flows.

- **Technical Memorandum No. 6 – Penmar Diversion Structure**

  This TM addresses the diversion structure from the storm drain in Rose Avenue and the conveyance of stormwater to the pump station. It calls for a passive connection to the storm drain relying on an open connection to the side or bottom of the RCBs to divert flows to the stormwater pump station. A low barrier, less than 2 feet high, will be required to ensure that flow does not bypass the entrance to the wet well. The barrier can be configured similar to a speed bump to ensure that it does not impede maintenance of the box culverts. All aspects of the design of the connection to the Los Angeles County DPW (County) storm drain will have to be coordinated with and approved by the County.

- **Technical Memorandum No. 7 – Buried Reservoir**

  This TM describes the recommended design concept for the 2.75 million gallon (MG) underground stormwater storage reservoir element of the Penmar Water Quality Improvement and Runoff Reuse Project. This reservoir is proposed as a “DYK” type pre-stressed circular reservoir buried beneath the Penmar Recreation Center.

- **Technical Memorandum No. 8 – Utility Relocation/Replacement**

  This TM describes utilities relocation issues associated with the construction of the Penmar Water Quality Improvement Project. At five locations (Frederick Street, Oakwood Avenue, Rialto Court, Crescent Place, and Abbot Kinney Boulevard), project improvements will require relocation and replacement of existing utilities. In Frederick Street, a recently completed sanitary sewer line will need to be relocated to accommodate the proposed diversion structure and pump station sump to be constructed within the Frederick Street right-of-way. In Oakwood Avenue, Rialto Court, Crescent Place, and Abbot Kinney Boulevard, approximately 700 feet of existing sanitary sewer will need to be replaced in order to eliminate "bottlenecks" that presently restricts the discharge rate into the sanitary sewer from the proposed 2.75 MG Penmar storm water storage reservoir. The intent of this TM is to describe the existing conditions along Frederick Street, Oakwood Avenue, Rialto Court, Crescent Place, and Abbot Kinney Boulevard, the proposed upgrade, relocation work, review construction sequencing and methodology for relocating and replacing the existing utilities.

3.0 ATTACHMENT 9

The eight TMs are presented as Attachments 1 through 8. Attachment 9 presents a summary table of comments made to the TMs as part of review by the City of Los Angeles and indicates how the TMs were revised to incorporate those comments.

4.0 APPENDICES

Four appendices have been included within this document. These appendices include documents relevant to the overall pre-design of this project, but which were not addressed as part of the TMs. These appendices are:

- **Appendix A: Preliminary Geotechnical Findings, Ninyo and Moore Report Dated January 3, 2008**

  This appendix presents the initial findings as gathered by the geotechnical engineer for this project, Ninyo and Moore. These findings were used as part of recommendations for TM No. 1 regarding infiltration expectations for this site.

- **Appendix B: Geotechnical Evaluation, Penmar Water Quality Impropvement Project, Ninyo and Moore Report Dated June 13, 2008**

  This appendix presents the final geotechnical report as prepared by the geotechnical engineer for this project, Ninyo and Moore.

- **Appendix C: Penmar Water Quality Improvement Project Schedule**

  The schedule covering pre-design, design, bid and award, and construction for Phase I of this project is included within this appendix.

- **Appendix D: Class B Construction Cost Estimate Dated October 14, 2008**

  The Class B Construction Cost Estimate is presented as part of this appendix. It should be noted that this project was awarded on the part of the Bureau of Engineering with a "design-to-budget" of $15.75 million. Apportioning the initial concept report budget into Phase 1 (TMDL Compliance) and Phase 2 (Beneficial Reuse) components as a percentage of the initial concept report budget yields 88 percent of the project budget as part of Phase 1 and

12 percent as part of Phase 2. In terms of dollar allocation, applying these percentages against the initial total budget of $15.75 millions yields a Phase 1 budget of $13.91 million and a Phase 2 budget of $1.84 million. The Class B Construction Cost estimate was prepared based on the 50 percent design submittal for Phase 1 and is included as part of Appendix D. This Class B Construction Cost Estimate found that the Phase 1 construction costs should be $13.9 million, within the established budget of $13.91 million.

5.0 CONCLUSIONS

This pre-design report presents the eight TMs with supporting documents that were developed as the basis for the Phase 1 design documents.

City of Los Angeles, Department of Public Works
Bureau of Engineering
Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Technical Memorandum No. 1
Combination Underground Detention/Infiltration System

August 2008

BROWN AND CALDWELL

W.O. No. EW40019F

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LIST OF TABLES

1.0 INTRODUCTION

This Technical Memorandum (Tech Memo) describes the infiltration at the Penmar Golf Course.

2.0 PROJECT DESCRIPTION

The Penmar Water Quality Improvement and Runoff Reuse Project is located at Penmar Golf, Penmar Recreation Center and Marine Park. These sites straddle the Los Angeles and Santa Monica city boundary along Dewey Street. The City of Los Angeles and the City of Santa Monica are working together to implement a regional project which ultimately combines water quality improvement and stormwater reuse. The main objective is to achieve compliance with the national pollutant discharge elimination system (NPDES) Total Maximum Daily Load (TMDL) regulations for bacteria at coastal beaches. This project will incorporate various Best Management Practices (BMPs) to reduce the introduction of pollutants into the local receiving water bodies to the maximum extent practicable, as well as reuse stormwater for landscape irrigation.

The Bureau of Sanitation prepared a report titled, “Penmar Water Quality Improvement and Runoff Reuse Project Concept Report” (Concept Report) in March 2007. Several potential BMPs were identified in this report. The Brown and Caldwell/Black and Veatch team will review and validate the Concept Report during the preliminary design phase of the project.

3.0 STORMWATER UNDERGROUND DETENTION/INFILTRATION SYSTEM

The Concept Report identified an underground detention/infiltration system as one of the potential BMPs. This Tech Memo summarizes the results of our preliminary geotechnical findings and initial interpretation of the infiltration and detention capacity that might be associated with this BMP.

3.1 Description

Underground detention/infiltration systems consist of pipes, vaults, chambers, or modular structures buried underground to infiltrate stormwater. Typically, runoff is stored in the voids of the stones, or plastic media, and is slowly infiltrated through the bottom and into the soil matrix over a period of few days. The primary pollutant removal mechanism of this practice is filtration through the soil matrix.

The benefits of these systems include:

- Provides for groundwater recharge;
- Ideal for highly urbanized areas, particularly in areas where land is expensive or may not be available for ponds or wetlands;
- Short construction time; and
- Limited access makes them safer than ponds or other aboveground stormwater BMPs.

The disadvantages of these systems include:

- Pre-treatment is required;
- Potential for groundwater contamination;

- High clogging potential; should not be used on sites with fine-particle soils (clays or silts) in drainage area;
- Susceptible to failure if not properly maintained;
- Limited access makes them hard to maintain; and
- Significant setback requirements due to concerns over surface soil settlement.

3.2 Types of Underground Detention/Infiltration Systems

There are many types of stormwater underground detention/infiltration systems. While some can be constructed with rocks or stones, others are prefabricated. Some of the prefabricated systems available in the market include:

- Modular blocks made of lightweight materials such as PVC or polypropylene. Suppliers include Stormcell, StormTech, Rainstore3, etc.
- Large diameter pipes such as corrugated metal or high density polyethylene pipes. Suppliers include CONTECH.
- Precast concrete structures. Suppliers include CONTECH.

The advantages and disadvantages of these prefabricated systems are identified in Table 1.

Table 1. Advantages and Disadvantages of Prefabricated Underground Detention/Infiltration Systems

Prefabricated System	Advantages	Disadvantages
Modular blocks	▪ High void ratio or high percentage of excavated vol. available for water storage means smaller footprint ▪ Simple installation, no cranes are needed ▪ Modular blocks can be arranged and stacked for efficient use of space ▪ High percentage of surface area available for infiltration	▪ Hard to inspect and maintain ▪ May not be suitable for use under H-20 loaded conditions
Large diameter pipes	▪ Easy to access for inspection and maintenance	▪ Large portion of excavated volume is occupied by stone ▪ Longer construction time ▪ Small percentage of surface area available for infiltration
Precast concrete structures	▪ High percentage of surface area available for infiltration ▪ Can be installed in a shorter amount of time ▪ Off-site fabrication ensures tight adherence to spec, less on-site work, and quality control of modular units	▪ Low void ratio which means low water storage volume ▪ Large portion of excavated volume is occupied by stone ▪ May require cranes to install

3.3 Design Factors

Several factors need to be considered when locating underground detention/infiltration systems. These factors include site feasibility, potential groundwater contamination, and long term maintenance.

3.3.1 Soils

Soils and topography are a strongly limiting factor when locating underground detention/infiltration systems. Soils must be significantly permeable to ensure that structure can infiltrate quickly enough to reduce the potential for clogging. On the other hand, soils that permeate too quickly may not provide sufficient treatment, creating the potential for groundwater contamination. Generally, an infiltration rate between 0.5 to 3 inches per hour is optimal.

Eight exploratory borings were drilled at the project site in December 2007 by Ninyo & Moore. The general subsurface profile at each of the eight boring locations included older fill soils overlying native alluvial sediments. The older fill soils ranged from approximately 4 to 15-feet deep and included silty sand, clayey sand, and sandy clay. The alluvial materials generally consisted of an upper zone of fine silty and sandy clay underlain by predominantly granular silty sand and sand. A copy of the preliminary geotechnical findings is included in Attachment 1.

Percolation testing was also performed at the project site on December 27 and 28, 2007 at four locations at the Penmar site. The result of the testing indicates that the permeability at these four locations range from 0.0005 to 0.008 ft/day (0.004 inches per hour).

The Concept Report estimated the volume of detention/capacity to be 3.75 MG (2.0 MG detention/1.75 MG infiltration). This is based on the detention/capacity volume to be 10% of the total runoff volume for the Penmar Drainage area. Table 1 of the Concept Report assumed the infiltrate rate to be 27% of the runoff volume during wet weather season, which varies monthly. The total infiltration volume per year shown in this table is 48.5 MG/year.

3.3.2 Proximity to Groundwater Table

Proximity to Groundwater Table is another significant factor. Sufficient separation between the seasonally high groundwater table and the bottom of the infiltration system should be provided. This distance should be a minimum of 2 to 5 feet.

The Preliminary Geotechnical Findings identified the historical high groundwater level to be approximately 20 feet below the ground surface at the northeastern end of the site. During the exploratory work in December 2007, groundwater was encountered at 24 feet below grade. It was recommended in the Preliminary Geotechnical findings that a minimum vertical separation of 10 feet be maintained between the bottom of the detention/infiltration system and the groundwater table.

3.3.3 Proximity to Drinking Water Wells

Infiltration systems should be located at least 150 feet from adjunct drinking water wells. According to the Concept Report, there is an active drinking water well (2539 L) in the vicinity of the Penmar project site. Additional research and field investigation is needed to identify the location of this well.

3.3.4 Construction Issues

Site accessibility for truck delivery and crane access (if needed), construction traffic loading, and backfill procedures are some of the construction issues that need to be considered to ensure a smooth construction. Large and deep storage volumes may demand a drivable access route for excavation, leveling, compacting and placing the prefabricated underground detention/infiltration systems. Some systems, such as precast concrete structures, may require the use of a crane to unload and place the structures.

4.0 CONCEPTUAL DESIGN

Based on the Concept Report, the capacity needed for the combined underground detention/infiltration system for Penmar Drainage area is approximately 2.75 MG (2.0 MG detention/.75 MG infiltration). The flow rate and the capacity of the required system is currently being re-evaluated by the Bureau of Sanitation.

Three locations within the Penmar area have been identified as the potential locations for the combined underground detention/infiltration systems.

1. Dewey Street Right-of-Way (Figure 1):
   - Estimated size:
     - 2,300 feet in length
     - 15 feet in width
     - Approximate square footage: 34,500 ft^2
   - Extent:
     - South end of Dewey Street south sidewalk.
     - Extends under southern unpaved area parallel to golf course.
     - Terminates at north eastern corner of golf course property.
2. Northeast Corner Rectangle (Figure 2):
   - Estimated Size:
     - 280 feet in length
     - 75 feet in width
     - Approximate square footage: 21,000 ft^2
   - Extent:
     - Northeastern corner of the golf course's fenced property extending along the eastern boundary 75 feet to the existing tree line.
     - Northeastern corner of the golf course's fenced property extending southwest along the fence line 280 feet.
3. Northeast Corner Triangle (Figure 3):
   - Estimated Size:
     - 270 feet in length
     - 260 feet in length
     - 350 feet in length
     - Approximate square footage: 35,100 ft^2

- Extent:
  - Northeastern corner of the golf course's fenced property extending along the eastern boundary 260 feet to the existing east-west tree line.
  - Northeastern corner of the golf course's fenced property extending southwest along the fence line 270 feet.
  - The 350 feet extent runs along the east-west orientated tree line.

Table 2. Summary of Detention Volume and Infiltration Rate

Location	Area (ft2)	Detention Volume[1] (MG)	Infiltration Rate (gal/day)	Days to Infiltrate Stored Volume (days)
Dewey Street Right-of-Way	34,500	1.70	780	2,180
Northeast Corner Rectangle	21,000	1.03	470	2,191
Northeast Corner Triangle	35,100	1.73	490	3,530

1. Assuming a void ratio of 0.94 and 10 feet vertical separation between bottom of the detention/infiltration system and the groundwater table (20 feet below grade).

Table 2 shows the approximate area and the potential detention volume of each area based on an assumed typical void ratio of 0.94 for these types of systems. Also shown on the table are the anticipated infiltration rates from each area based on the summary of geotechnical investigations presented above. Both the soil infiltration rates presented above and the area specific infiltration volume that can be anticipated, as shown on Table 2, indicates that the project objectives can not be achieved at the site using infiltration as the only mechanism. The number of days necessary to infiltrate the amount of stormwater stored in the underground detention/infiltration systems far exceeds the frequency of storm events. However, any one of the detention/infiltration systems described above can be used in conjunction with an underground storage tank to reach the total detention capacity needed for the Penmar Drainage area. The stored water might then need to be disposed off in an alternate way, such as discharging into the sewer. The location, description and design guidelines for the underground storage tank are discussed in Tech Memo No. 7, Buried Reservoir.

5.0 CONCLUSIONS

The purpose of this Tech Memo was to examine whether significant infiltration can be achieved to meet TMDL compliance in the Penmar Drainage area. With this approach, water would be collected in an underground detention/infiltration system at the Penmar project site and would infiltrate into the ground over time. Due to the low permeability of the soil at the project site, the infiltration rate is too low for infiltration to be used as an effective BMP. In addition to the physical limitation on effective rates listed above, our project geotechnical sub consultant, Ninyo & Moore, has also recommended against the use of infiltration at the Penmar site due to the risk of hydro-collapse (settlement). Furthermore, the variability of the old fill soils on the site makes the prediction of long-term infiltration rates difficult to determine. However, the detention volume that can be attained in the underground detention/infiltration systems may be used to supplement the volume of stormwater that can be stored in a separate storage tank as described in Tech Memo No. 7. The detention volume needs to be carefully sized such that the number of days it takes to infiltrate the stored stormwater is reasonable. Standing water in the detention basin in excess of a few days could become a source for mosquitoes.

FIGURES

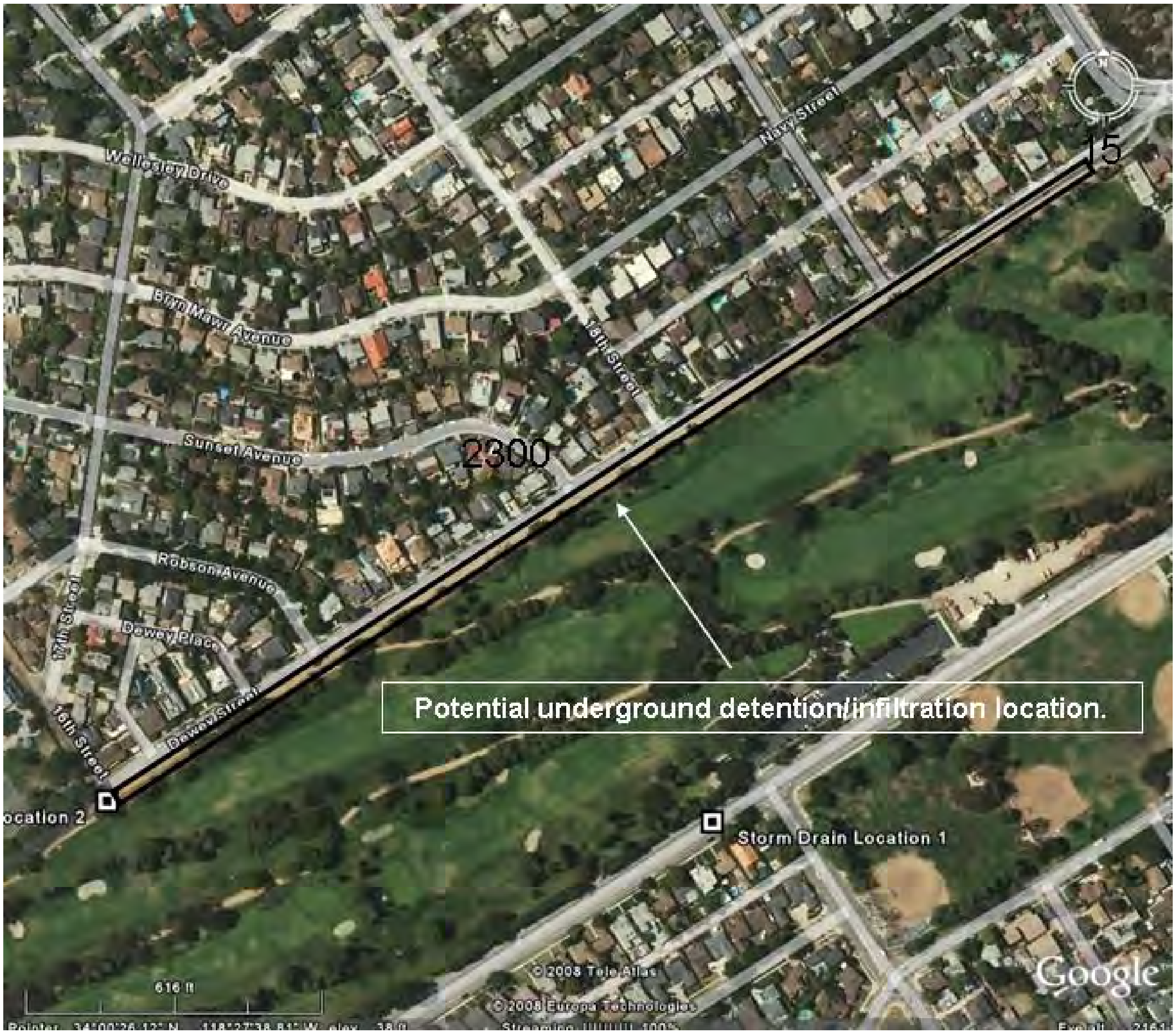


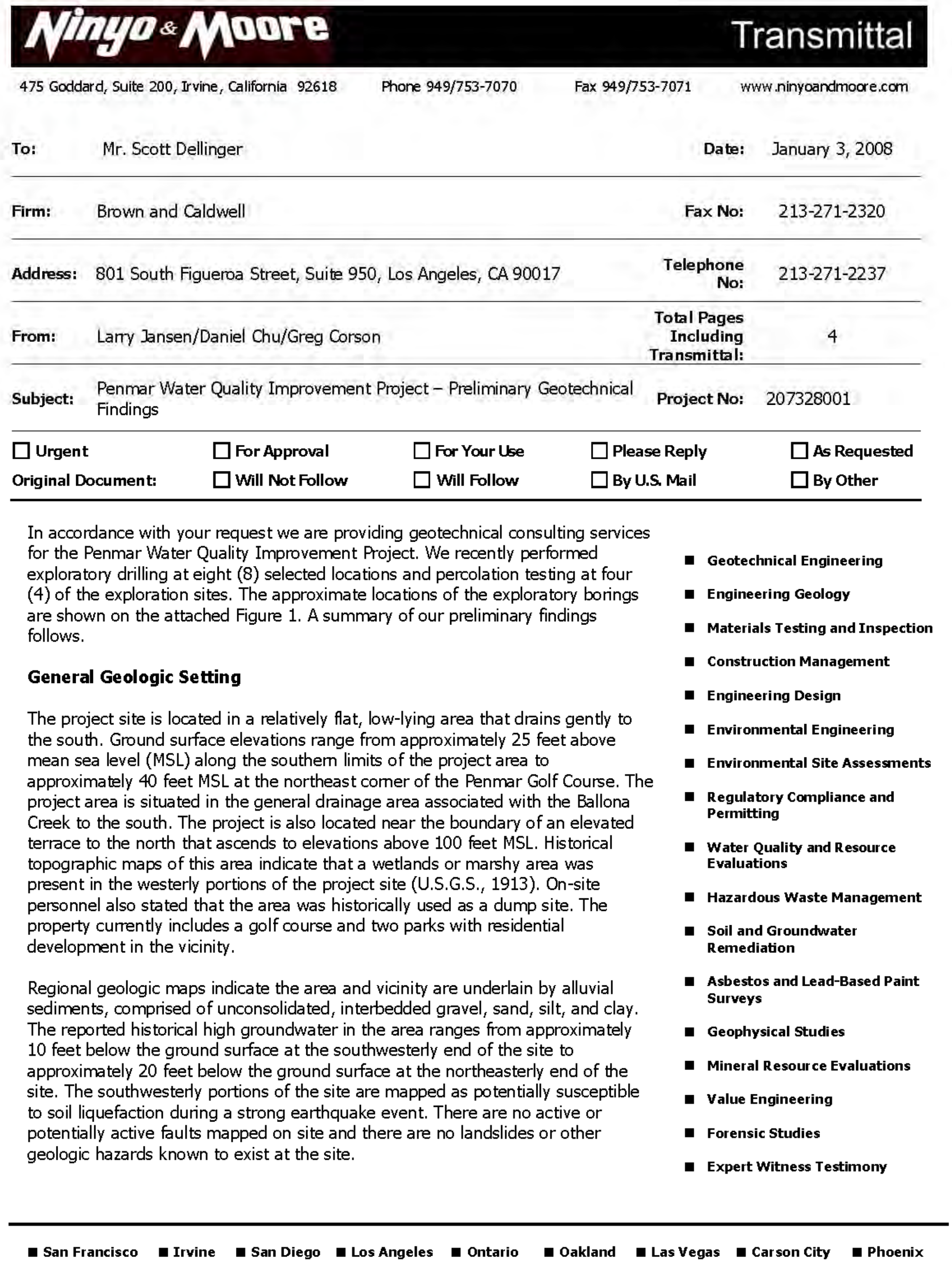
Figure 1. Dewey Street Right-of-Way

Figure 2. Northeast Corner Rectangle

Figure 3. Northeast Corner Triangle

ATTACHMENT A

Preliminary Geotechnical Findings by Ninyo and Moore



Ninyo & Moore Transmittal

475 Goddard, Suite 200, Irvine, California 92618 Phone 949/753-7070 Fax 949/753-7071 www.ninyoandmoore.com

To: Mr. Scott Dellinger **Date:** January 3, 2008

Firm: Brown and Caldwell **Fax No:** 213-271-2320

Address: 801 South Figueroa Street, Suite 950, Los Angeles, CA 90017 **Telephone No:** 213-271-2237

From: Larry Jansen/Daniel Chu/Greg Corson **Total Pages Including Transmittal:** 4

Subject: Penmar Water Quality Improvement Project – Preliminary Geotechnical Findings **Project No:** 207328001

☐ **Urgent** ☐ **For Approval** ☐ **For Your Use** ☐ **Please Reply** ☐ **As Requested**

Original Document: ☐ **Will Not Follow** ☐ **Will Follow** ☐ **By U.S. Mail** ☐ **By Other**

In accordance with your request we are providing geotechnical consulting services for the Penmar Water Quality Improvement Project. We recently performed exploratory drilling at eight (8) selected locations and percolation testing at four (4) of the exploration sites. The approximate locations of the exploratory borings are shown on the attached Figure 1. A summary of our preliminary findings follows.

General Geologic Setting

The project site is located in a relatively flat, low-lying area that drains gently to the south. Ground surface elevations range from approximately 25 feet above mean sea level (MSL) along the southern limits of the project area to approximately 40 feet MSL at the northeast corner of the Penmar Golf Course. The project area is situated in the general drainage area associated with the Ballona Creek to the south. The project is also located near the boundary of an elevated terrace to the north that ascends to elevations above 100 feet MSL. Historical topographic maps of this area indicate that a wetlands or marshy area was present in the westerly portions of the project site (U.S.G.S., 1913). On-site personnel also stated that the area was historically used as a dump site. The property currently includes a golf course and two parks with residential development in the vicinity.

Regional geologic maps indicate the area and vicinity are underlain by alluvial sediments, comprised of unconsolidated, interbedded gravel, sand, silt, and clay. The reported historical high groundwater in the area ranges from approximately 10 feet below the ground surface at the southwesterly end of the site to approximately 20 feet below the ground surface at the northeasterly end of the site. The southwesterly portions of the site are mapped as potentially susceptible to soil liquefaction during a strong earthquake event. There are no active or potentially active faults mapped on site and there are no landslides or other geologic hazards known to exist at the site.

- **Geotechnical Engineering**
- **Engineering Geology**
- **Materials Testing and Inspection**
- **Construction Management**
- **Engineering Design**
- **Environmental Engineering**
- **Environmental Site Assessments**
- **Regulatory Compliance and Permitting**
- **Water Quality and Resource Evaluations**
- **Hazardous Waste Management**
- **Soil and Groundwater Remediation**
- **Asbestos and Lead-Based Paint Surveys**
- **Geophysical Studies**
- **Mineral Resource Evaluations**
- **Value Engineering**
- **Forensic Studies**
- **Expert Witness Testimony**

■ **San Francisco** ■ **Irvine** ■ **San Diego** ■ **Los Angeles** ■ **Ontario** ■ **Oakland** ■ **Las Vegas** ■ **Carson City** ■ **Phoenix**

Subsurface Conditions

The exploratory borings were drilled with truck-mounted drilling equipment and hollow stem augers on December 21 and 27, 2008 to depths ranging from approximately 21.5 to 51.5 feet. Our representative was on site during drilling to log the soils encountered and to collect samples for laboratory testing. A summary of exploration results is presented below for preliminary planning, but laboratory testing has not been performed and some classifications may change depending on test results.

The general subsurface profile at each of the eight boring locations included older fill soils overlying native alluvial sediments. The older fill soils ranged from approximately 4 to 15 feet deep and included silty sand, clayey sand, and sandy clay with minor amounts of gravel and trace amounts of debris such as wood fragments, metal, glass, etc. The alluvial materials generally consisted of an upper zone of fine silty and sandy clay underlain by predominantly granular silty sand and sand. A summary of boring data follows.

<u>Boring B-1</u>

Fill: 0′-10′ - silty sand and clayey sand
Alluvium: 10′-31.5′ - silty clay and clayey silt
Groundwater: 24′

<u>Boring B-2</u>

Fill: 0′-8′ - clayey sand and silty sand
Alluvium: 8′-25′ - sandy clay
Alluvium: 25′-31′ - silty sand and sand
Groundwater: 25′

<u>Boring B-3</u>

Fill: 0′-7′ - sandy clay
Alluvium: 7′-25′ - silty clay
Alluvium: 25′-31.5′ - silty sand and sand
Groundwater: 18′

<u>Boring B-4</u>

Fill: 0′-7′ - sandy clay, clayey sand, and silty sand
Alluvium: 7′-20′ - silty clay
Alluvium: 20′-31.5′ - silty sand and clayey sand
Groundwater: 20′

<u>Boring B-5</u>

Fill: 0′-6′ - sandy clay
Alluvium: 6′-13′ - silty clay
Alluvium: 13′-20′ - silty sand and sandy silt
Alluvium: 20′-51.5′ - silty sand and sand
Groundwater: 20.5′

<u>Boring B-6</u>

Fill: 0′-4′ - silty sand
Alluvium: 4′-20′ - silty clay
Alluvium: 20′-31.5′ - silty sand and sand
Groundwater: 16′

Boring B-7

Fill: 0'-15' - sandy clay and clayey sand
Alluvium: 15'-20' - silty clay
Alluvium: 20'-31.5' - silty sand and sandy silt
Groundwater: 24'

Boring B-8

Fill: 0'-6' - sandy clay
Alluvium: 6'-16' - silty clay
Alluvium: 16'-21.5' - silty sand with gravel (met drilling refusal)
Groundwater: 20'

NOTE: The information provided above is preliminary. In particular, the depths to groundwater do not represent stabilized water levels. Water levels were measured at the time of drilling and up to 1 hour after drilling. Actual depths to groundwater will vary.

Percolation Testing

Percolation testing was performed on December 27 and 28, 2007 at the locations of Borings B-1, B-5, B-6, and B-7. At each test location the depth to groundwater was evaluated during the initial drilling. A separate percolation test hole was drilled at each location to a depth of approximately 10 to 15 feet (to maintain approximately 5 feet of clearance above the water table). A PVC pipe (slotted below 5 feet) was placed in each test hole and backfilled with gravel. Testing included pre-soaking each hole during the day on December 27 and performing falling head percolation tests on December 28. The tests included placing water in each test hole, measuring the water level at the start of the test and measuring the drop in water level over a period of time between approximately 4 to 6 hours and up to 28 hours. At the completion of testing the PVC pipes were removed and the test holes were backfilled with on-site soil.

The results of the testing are presented below and indicate a wide range in percolation rates:

Test No.	Minutes/Inch Percolation	Permeability	Comments
B-1	13.8	0.003 ft/day	Clayey-silty sand fill 5-10 feet
B-5	3.1	0.008 ft/day	Sandy alluvium 13-15 feet
B-6	---	---	No percolation over 28 hours
B-7	53.0	0.0005 ft/day	Sandy clay and clayey sand fill

Discussion

The purpose of our subsurface exploration was to develop general information regarding the soil and groundwater conditions for geotechnical engineering purposes and to evaluate the feasibility of on-site infiltration of storm water runoff. The wide range in percolation rates reflect the difference between the more sandy fill/alluvium and the more clayey fill/alluvium. Based on review of the subsurface exploration, we anticipate that the more clayey soil types are the predominant material type in the zones of infiltration. In order to maintain approximately 10 feet clearance above the water table, the infiltration zone would be limited to depths of approximately 5 to 10 feet. Based on our evaluation of the data collected, it is our preliminary opinion that the project site is not suitable for long-term infiltration purposes. Our preliminary opinion is based on the following:

> The project area includes variable depths and types of old, undocumented fill soils. The fill soils vary from silty sand to clayey sand to sandy clay. Some of the fill encountered was in a loose condition. The old fill soils are erratic in material type, depth and lateral extent, which makes the design infiltration rates difficult to predict.
>
> It is generally not recommended to construct infiltration systems into fill soils, which may be susceptible to hydro-collapse (settlement).
>
> The relatively higher percolation rates measured are considered to be the result of sandy soil conditions at those locations. The subsurface environment included clayey alluvium with few sandy alluvium lenses (and sandy fills) in the upper approximately 20 feet. Higher percolation rates in localized sand layers may reflect short-term conditions during the test period.
>
> Based on review of the subsurface exploration data, the predominant soil type was more clay than sand in the anticipated zones of infiltration. Relatively low permeability rates are anticipated for the predominantly clayey soil types. At Boring B-6, no infiltration was measured after a test period of approximately 28 hours.
>
> Groundwater was encountered at depths ranging from approximately 16 to 25 feet below the ground surface at the time of drilling. Stabilized groundwater levels will vary. The historically shallow groundwater reported for this area ranges from approximately 10 feet in the southwest to approximately 20 feet in the northwest. Infiltration systems should maintain approximately 10 feet of vertical separation between the bottom of the infiltration system and the water table.

City of Los Angeles, Department of Public Works
Bureau of Engineering
Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Technical Memorandum No. 2
Right-of-way Availability on Frederick Street for Construction Facility

September 2008

W.O. No. EW40019F

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ABBREVIATIONS AND ACRONYMS

BMPs	Best Management Practices
NPDES	National Pollutant Dischrage Elimination System
TM	Technical Memorandum
TMDL	Total Maximum Daily Load

INTRODUCTION

This Technical Memorandum (TM) describes our findings for the right-of-way availability on Frederick Street for construction facility.

1.0 PROJECT DESCRIPTION

The Penmar Water Quality Improvement and Runoff Reuse Project is located at Penmar Golf, Penmar Rec. & Park, and Marine Park. These sites straddle the Los Angeles and Santa Monica city boundary along Dewey Street. The City of Los Angeles and the City of Santa Monica are working together to implement a regional project which combines water quality improvement and stormwater reuse. The main objective is to achieve compliance with the National Pollutant Discharge Elimination System (NPDES) Total Maximum Daily Load (TMDL) regulations. This project will incorporate various Best Management Practices (BMPs) to reduce the introduction of pollutants into the local receiving water bodies to the maximum practicable extent and potentially reuse storm water for landscape irrigation.

The Bureau of Sanitation prepared a report titled, *Penmar Water Quality Improvement and Runoff Reuse Project Concept Report* (Concept Report) in March 2007. Several potential BMPs and locations were identified in this report.

2.0 RIGHT-OF-WAY AVAILABILITY ON FREDERICK STREET FOR CONSTRUCTION FACILITY

This TM summarizes the results of our preliminary findings for the availability of the right–of-way for the new construction facility on Frederick Street.

2.1 Initial Findings

Following are our initial findings for the right-of-way availability:

- At the intersection of Rose Avenue and Frederick Street, there is a 50 foot right-of-way on Frederick Street. There is a sewer line in the center, which is an 8-inch VCP sewer pipe, through which sewage flows towards Rose Avenue. This sewer was recently reinstalled in 2007. This is shown as part of the Bureau of Engineering As-Built plan and presented in Figure 1.
- There is a vacated property on the Frederick Street approximately 400 feet away from Rose Avenue. This yields approximately 7,927 sq. ft. of area which could be made available for the construction of the Pumping Station and Piping between Rose Avenue and the vacated property. Figure 2 shows the location of the vacated lot on the Frederick Street.
- The sewer right-of-way is 14 feet (i.e., 7 feet on each side of the central sewer line). The remaining width of 18 feet on the each side is available for the facility sitting. It is presumed that there are not any other utilities buried under the ground surface in that area. Figure 3 shows the detailed section of Frederick Street and shows the proposed location for the construction of Pump Station. As part of these project improvements, it will require relocating the existing sewer line on Frederick Street and it is discussed in detail in TM 8 for sewer relocation and replacement.

- The sewer pipe is buried under the Frederick Street at 25 feet inside the road right-of-way and 11 feet deep from the ground surface. Taking 1:1 as the influence zone ratio, the estimated maximum depth which a facility can be constructed beneath the road is 24 feet.
- Water pipe and storm water inlets with piping are also located in Frederick Street.

2.2 Conclusions

The purpose of this TM was to examine whether there is right-of-way availability for the future construction of the Pump Station facility on the Frederick Street near the Penmar golf course. The entire Frederick Street right-of-way of 50 feet wide by 400 feet long could be made available for the construction of the Pump Station. However, existing utilities which include sewer, water and storm drains, may have to be relocated to make room for the new pump station.

3.0 ROW FREDERICK STREET CONSTRUCTION ISSUES

3.1 Relocation

As part of the project, the Utilities on Frederick Street need to be relocated. It is described in detail in TM 8 for utility relocation.

3.2 Trees

There are some shrubs encroaching on the street and the right-of-way and they need to be removed as part of the construction process. Trees on the golf Course will be protected or removed and replaced.

3.3 Noise

To reduce the noise during the construction, noise monitoring and noise mitigating plans will be required. By limiting the working hours, the noise issues can be mitigated. It would be consistent with the community concerns expressed by the Public Outreach Plan.

FIGURES

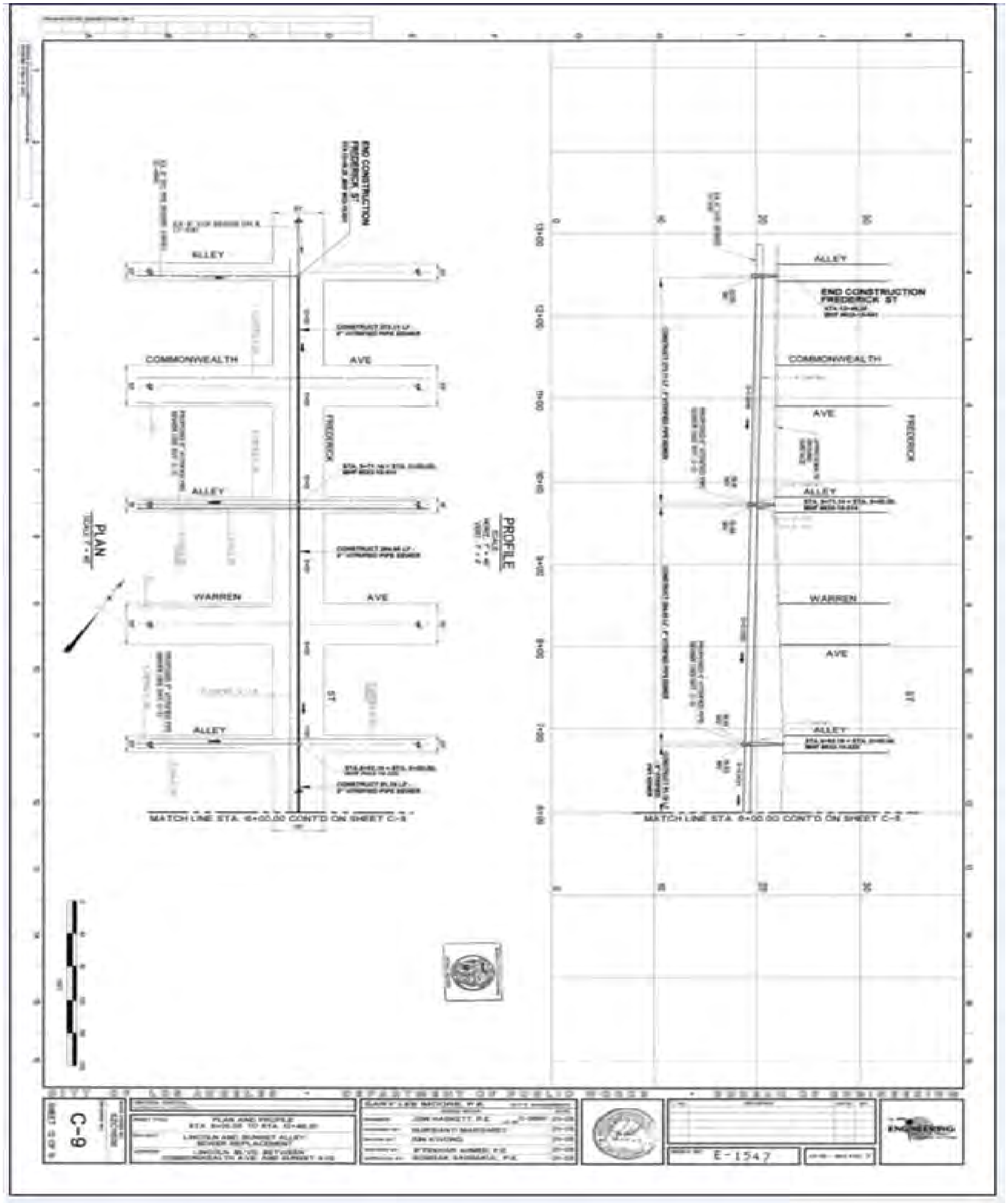

Figure 1: Frederick Street Sewer Plan and Profile

Figure 2: Construction on Frederick Street

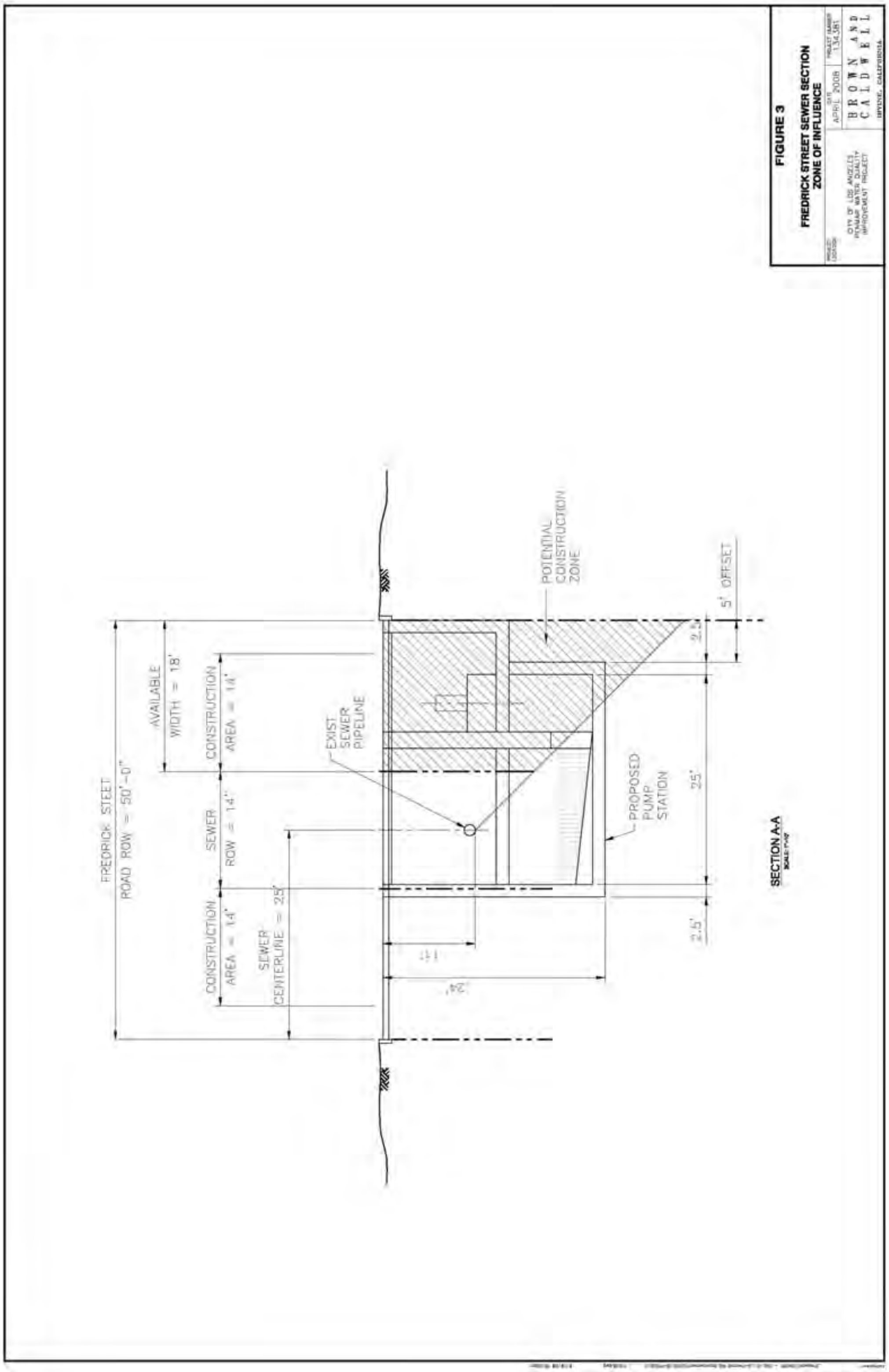

Figure 3: Frederick Street Sewer Profile Zone of Influence

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City of Los Angeles, Department of Public Works
Bureau of Engineering
Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Technical Memorandum No. 3
Discharge to Sewer System

August 2008

BROWN AND CALDWELL

W.O. No. EW40019F

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ABBREVIATIONS AND ACRONYMS

BMPs	Best Management Practices
BOS	Bureau of Sanitation
Concept Report	Penmar Water Quality Improvement and Runoff Reuse Project Concept Report
Hyperion	Hyperion Wastewater Treatment Plant
NPDES	National Pollutant Discharge Elimination System
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
VOS	Venice Outfall Sewer

INTRODUCTION

This Technical Memorandum (TM) describes the option of discharging captured stormwater to the City of Los Angeles Sewer System for conveyance to Hyperion Wastewater Treatment Plant for treatment.

1.0 PROJECT DESCRIPTION

The Penmar Water Quality Improvement and Runoff Reuse Project is located at Penmar Golf, Penmar Rec. & Park, and Marine Park. These sites straddle the Los Angeles and Santa Monica city boundary along Dewey Street. The City of Los Angeles and the City of Santa Monica are working together to implement a regional project, which combines water quality improvement and stormwater reuse. The main objective is to achieve compliance with the National Pollutant Discharge Elimination System (NPDES) Total Maximum Daily Load (TMDL) regulations. This project will incorporate various Best Management Practices (BMPs) to reduce the introduction of pollutants into the local receiving water bodies to the maximum extent practicable, as well as reuse stormwater for landscape irrigation.

The Bureau of Sanitation prepared a report titled *Penmar Water Quality Improvement and Runoff Reuse Project Concept Report* (Concept Report) in March 2007. Several potential BMPs were identified in this report. The Brown and Caldwell/Black and Veatch team will review and validate the topics presented in the Concept Report during the development of TM's that address specific topics in the concept report..

2.0 DISCHARGE TO SEWER

Although not included in the Concept Report, discharging stormwater into the wastewater collection system is a BMP that has been identified for the Penmar project. This TM identifies a potential connection point and evaluates its available capacity.

2.1 Discharge to Sewer on Sunset Avenue

The Wastewater Engineering Services Division of the City of Los Angeles, Bureau of Sanitation (BOS) has identified a potential connection point for the discharge of stormwater collected within the Penmar drainage area. The sewer manhole, that is the closest point of connection to the Penmar project site, is a 16-inch VCP pipe located near the intersection of Rose Avenue and Sunset Avenue (SSMH 53315009). This sewer pipe is part of the Mildwood Reach and runs along Sunset Ave that begins inside the Penmar Golf Course towards Lincoln Blvd. and eventually discharges into the Venice Outfall Sewer (VOS). The description of each segment of the sewer, including beginning and end points, approximate lengths, pipe sizes and pipe materials are shown in Table 1. Figure 1 also depicts the alignment of this sewer pipe.

Information provided by the BOS indicates that the 16-inch line has a full capacity of 3.29 cfs. However, since this line was built in 1925 and is mainly VCP, portions of the line are likely in bad condition and in need of rehabilitation. Furthermore, there are a couple of hydraulic choke points near Lincoln Blvd. that are recommended for relief by 2014. Currently, the capacity at these choke points is approximately 1.09 cfs.

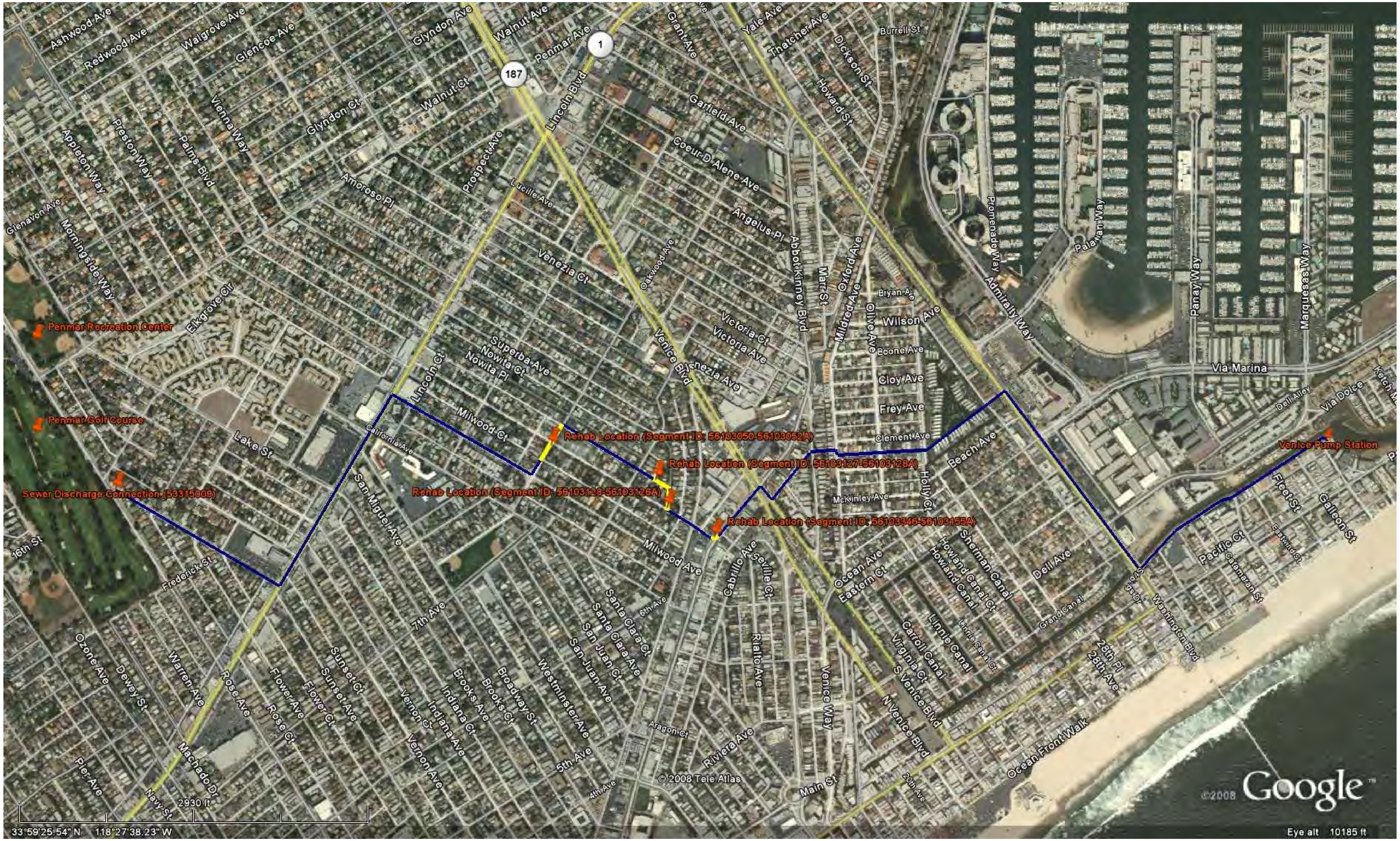


Figure 1 – Sanitary Sewer Alignment and Upgrade Locations

Note: Sanitary sewer illustrated in blue, section for rehabilitation highlighted in yellow. Top of the page is east.

Table 1. Discharge Sewer Sizes[1]

Sewer Alignment Street	Upstream Starting Point	Downstream End Point	Approximate Segment Length (feet)	Cumulative Length (feet)	Pipe Size (inches)	Pipe Material
Sunset Ave.	Rose Ave. Siphon	Lincoln Blvd.	1542.3	1542.3	16	VCP
Sunset Ave.	Lincoln Blvd.	Lincoln Blvd.	73.5	1615.8	18	VCP
Lincoln Blvd.	Sunset Ave.	Milwood Ave.	1850.8	3466.6	16	VCP
Milwood Ave.	Lincoln Blvd.	Oakwood Ave.	1356.8	4823.4	16	VCP
Oakwood Ave.	Milwood Ave.	Rialto Ct.	485.5	5308.9	16	VCP
Rialto Ct.	Oakwood Ave.	Crescent Pl.	1049.2	6358.1	16	VCP
Crescent Pl.	Rialto Ct.	Palms Blvd.	181.5	6539.6	16	VCP
Palms Blvd.	Crescent Pl.	Electric Ave.	281.3	6820.9	16	VCP
Palms Blvd.	Electric Ave.	Electric Ave	10	6830.9	18	VCP
Palms Blvd.	Electric Ave.	Abbot Kinney Blvd.	176.7	7007.6	unknown	VCP
Palms Blvd.	Abbot Kinney Blvd.	Abbot Kinney Blvd.	76.1	7083.7	6	VCP
Abbot Kinney Blvd.	Palms Blvd.	South Venice Blvd.	566.5	7650.2	20	VCP
South Venice Blvd.	Abbot Kinney Blvd.	Alley West of Abbot Kinney Blvd.	169.3	7819.5	15	VCP
Alley West of Abbot Kinney Blvd.	South Venice Blvd.	Washington Way	520.7	8340.2	45	RCP
Easement North of Mildred Ave.	Washington Way	Mildred Ave	221.8	8562.0	45	RCP
Alley East of Clark Ave.	Mildred Ave	Harbor St.	733	9295.0	45	RCP
Easement Northeast of Beach Ave	Harbor St.	Washington Blvd.	802.2	10097.2	45	RCP
Washington Blvd.	Easement Northeast of Beach Ave	Peach Ave.	291.5	10388.7	36	VCP
Washington Blvd.	Peach Ave.	Strongs Dr.	1662.3	12051.0	42	VCP
Strongs Dr.	Washington Blvd.	Venice Pumping Plant	1925.9	13976.9	66	RCP

[1] *Based on data available on Navigate LA (http://navigatela.lacity.org/index01.htm)*

The flow in the VOS eventually reaches Hyperion Wastewater Treatment Plant (Hyperion) for treatment. BOS has consented to allow storm water to be sent to Hyperion during the plant's diurnal low flow period, which is from midnight to 6 a.m. at 1.5 cfs and any other time at 1.0 cfs, after required sewer upgrades are made. In addition, there will be no discharge to the sanitary sewer system during a rain event or for the 72 hours following a rain event. Using capacity provided by the Bureau of Sanitation the daily discharge volume to the sanitary sewer system is 727,056 gallons, of which 442,696 gallons is discharged from the buried tank and 284,360 gallons from dry weather flows (calculations illustrated in Table 2). Based on these figures it would take approximately 6.2 days to drain the 2.75 million gallon tank.

Table 2. Sewer Discharge Calculations

		12 AM to 6 AM	6 AM to 12 AM
Duration	hours	6	18
Available Flow Rate	cfs	1.50	1.00
Dry Weather Flow Rate	cfs	0.44	0.44
	gal/hr	11,848	11,848
Net Available Flow Rate (For Tank Discharge)	cfs	1.06	0.56
	gal/hr	28,544	15,080
Daily Tank Discharge Volume	gal/day	442,696	
Daily Dry Weather Discharge Volume	gal/day	284,360	
Total Daily Discharge Volume	gal/day	727,056	
Total Tank Volume	gal	2,750,000	
Days to Drain Tank	days	6.2	

2.2 Connection to Sewer on Sunset Avenue

The connections to the sewer will be made from the buried storage tank and the pump station forebay by way of force main. Issues regarding force main construction and the force main connection to the sanitary sewer system are addressed in Technical Memorandum #5 – Force Mains.

3.0 REQUIRED SEWER UPGRADES

In order to accommodate the additional dry weather flows there, the project will also involve upgrading approximately 700 feet of trunk sanitary sewer (illustrated in Figure 1) west of the diversion point up to a 21 inch diameter pipe. The upgrade will occur on three sections of sewer pipe as follows: Figure 2: 270 feet on Oakwood Avenue (Segment ID #: 56103050-56103052A); Figure 3: 335 feet on Rialto Court (Segment ID #: 56103127-56103128A) and Crescent Place (Segment ID #: 56103128-56103126A); and Figure 4: 95 feet on Abbot Kinney Boulevard (Segment ID #: 56103346-56103155A).

Figure 2 – Existing Sanitary Sewer "choke point" on Oakwood Avenue

Note: Sanitary sewer illustrated in blue, section for rehabilitation highlighted in yellow. Top of the page is east

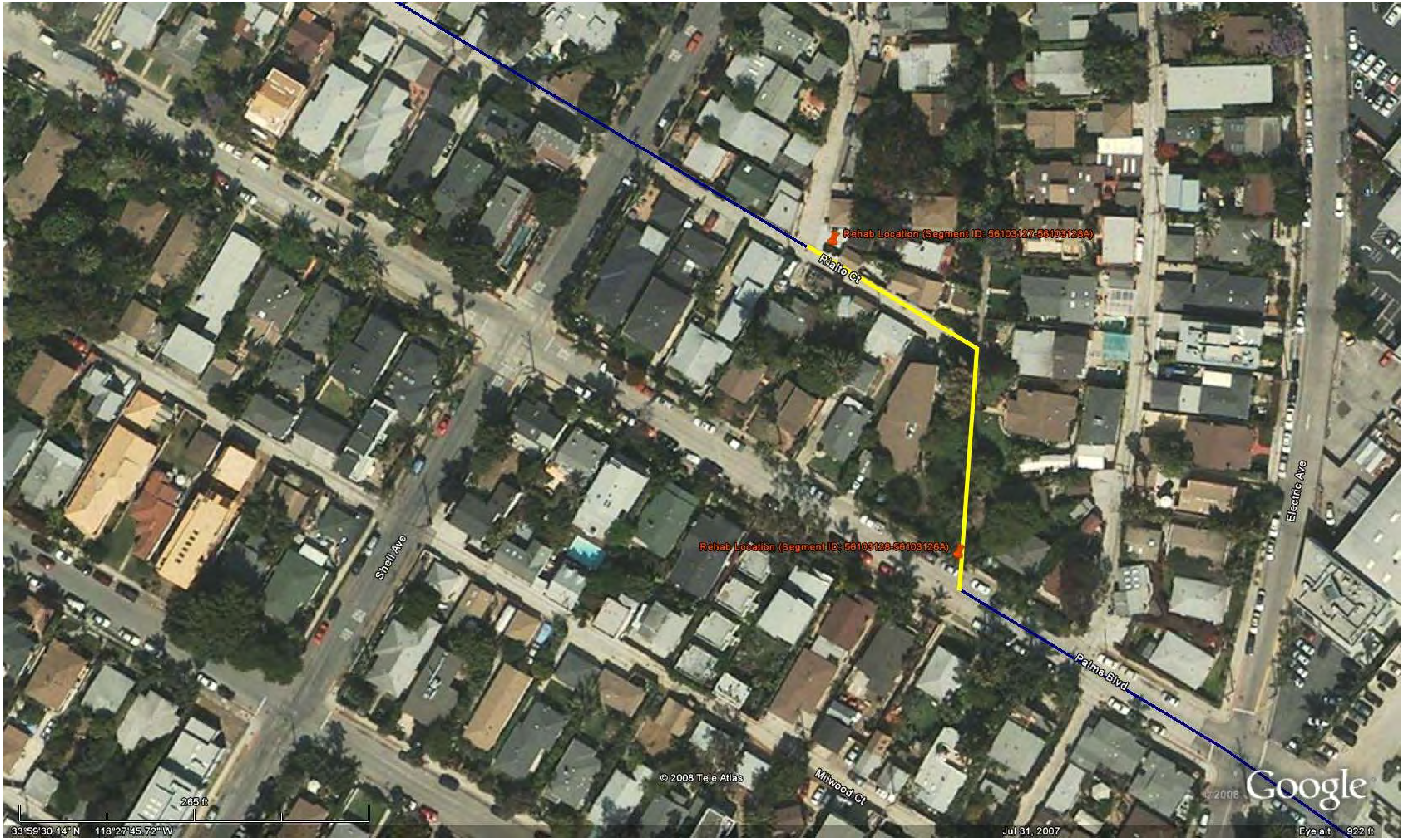


Figure 3 – Existing Sanitary Sewer "choke point" on Rialto Court and Crescent Place

Note: Sanitary sewer illustrated in blue, section for rehabilitation highlighted in yellow. Top of the page is east.

Figure 4 – Existing Sanitary Sewer "choke point" on Abbot Kinney Boulevard

Note: Sanitary sewer illustrated in blue, section for rehabilitation highlighted in yellow. Top of the page is east.

3.1 Utility Relocation and Traffic Impacts

Issues regarding potential utility relocation associated with the sanitary sewer upgrade along Oakwood Avenue, Rialto Court, Crescent Place, and Abbott Kinney Boulevard are addressed in Technical Memorandum #8 – Sewer Relocation/Replacement.

4.0 CONCLUSIONS

In this Tech Memo, a 16-inch sewer pipe has been identified as a potential connection point into which stormwater from the Penmar drainage area could be discharged. Based on preliminary information obtained from BOS, it is estimated that approximately 727,056 gallons (442,696 gallons is discharged from the buried tank and 284,360 gallons from dry weather flows) of stormwater could be discharged into this sewer pipe.

ATTACHMENTS

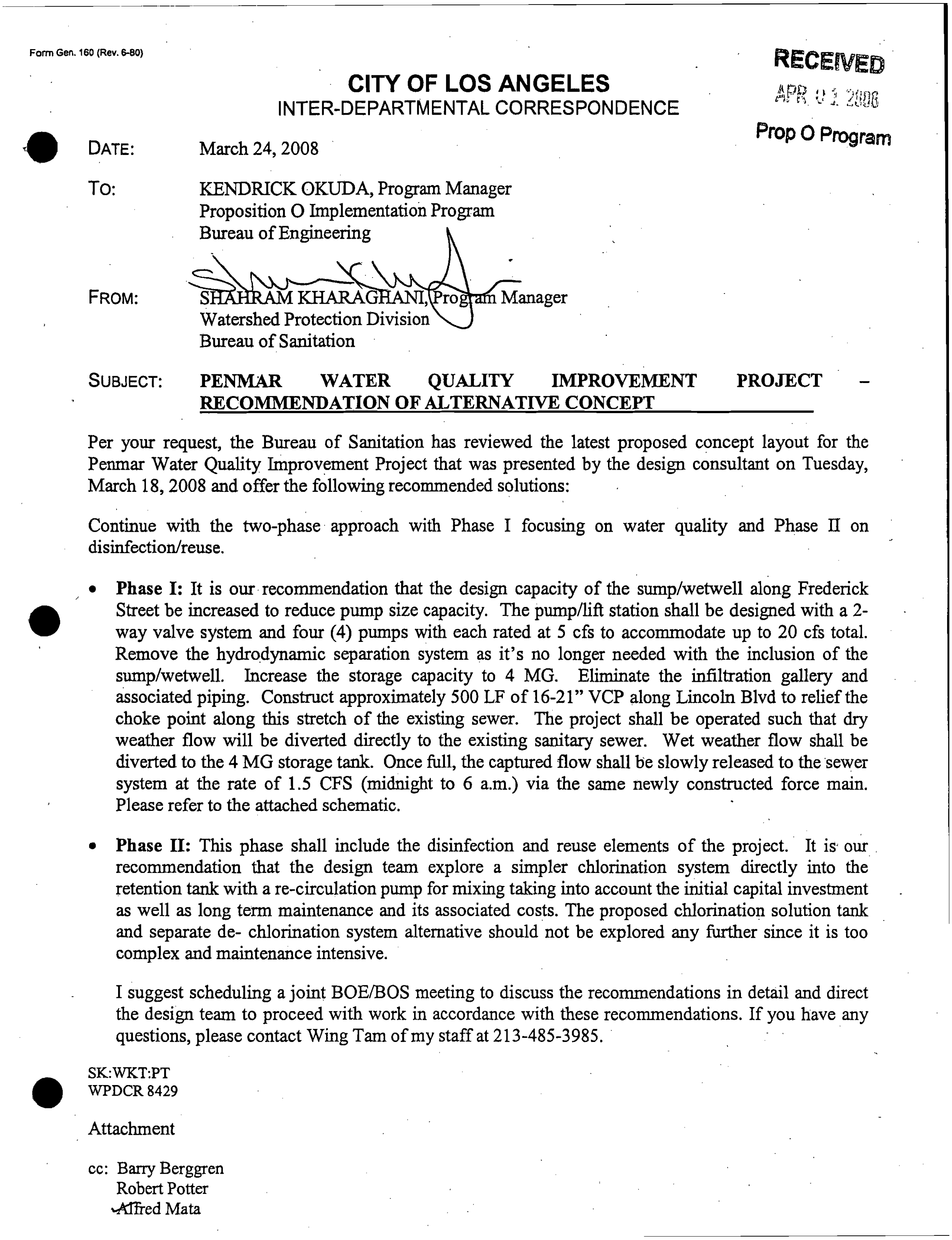
1. Bureau of Sanitation Memorandum to Bureau of Engineering Regarding Recommendation of Alternative Concept. Dated March 24, 2008, Approved by Prop O on April 2, 2008.

2. Email from Bureau of Sanitation to Bureau of Engineering Identifying Locations for Sewer Rehabilitation. Dated May 9, 2008

Attachment 1

Bureau of Sanitation Memorandum to Bureau of Engineering Regarding Recommendation of Alternative Concept.

Dated March 24, 2008, Approved by Prop O on April 2, 2008.



Form Gen. 160 (Rev. 6-80)

RECEIVED
APR 01 2008
Prop O Program

CITY OF LOS ANGELES
INTER-DEPARTMENTAL CORRESPONDENCE

DATE: March 24, 2008

TO: KENDRICK OKUDA, Program Manager
Proposition O Implementation Program
Bureau of Engineering

FROM: SHAHRAM KHARAGHANI, Program Manager
Watershed Protection Division
Bureau of Sanitation

SUBJECT: **PENMAR WATER QUALITY IMPROVEMENT PROJECT – RECOMMENDATION OF ALTERNATIVE CONCEPT**

Per your request, the Bureau of Sanitation has reviewed the latest proposed concept layout for the Penmar Water Quality Improvement Project that was presented by the design consultant on Tuesday, March 18, 2008 and offer the following recommended solutions:

Continue with the two-phase approach with Phase I focusing on water quality and Phase II on disinfection/reuse.

- **Phase I:** It is our recommendation that the design capacity of the sump/wetwell along Frederick Street be increased to reduce pump size capacity. The pump/lift station shall be designed with a 2-way valve system and four (4) pumps with each rated at 5 cfs to accommodate up to 20 cfs total. Remove the hydrodynamic separation system as it's no longer needed with the inclusion of the sump/wetwell. Increase the storage capacity to 4 MG. Eliminate the infiltration gallery and associated piping. Construct approximately 500 LF of 16-21" VCP along Lincoln Blvd to relief the choke point along this stretch of the existing sewer. The project shall be operated such that dry weather flow will be diverted directly to the existing sanitary sewer. Wet weather flow shall be diverted to the 4 MG storage tank. Once full, the captured flow shall be slowly released to the sewer system at the rate of 1.5 CFS (midnight to 6 a.m.) via the same newly constructed force main. Please refer to the attached schematic.

- **Phase II:** This phase shall include the disinfection and reuse elements of the project. It is our recommendation that the design team explore a simpler chlorination system directly into the retention tank with a re-circulation pump for mixing taking into account the initial capital investment as well as long term maintenance and its associated costs. The proposed chlorination solution tank and separate de- chlorination system alternative should not be explored any further since it is too complex and maintenance intensive.

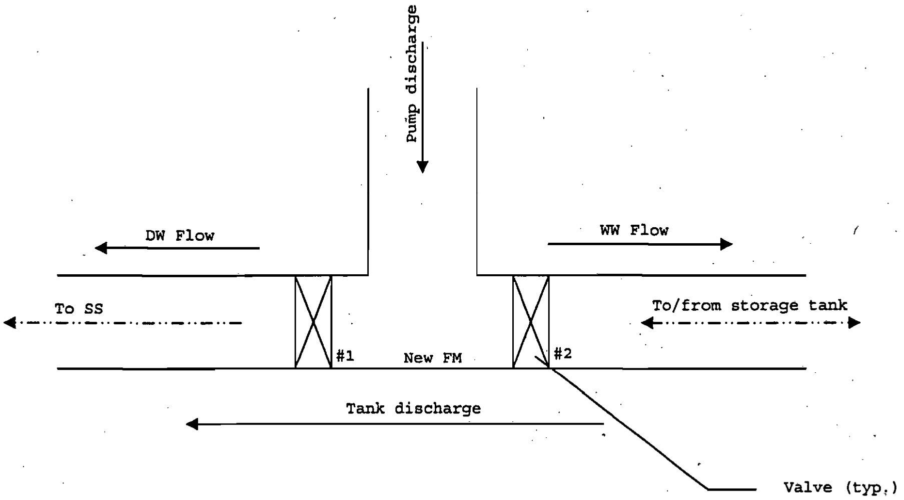
I suggest scheduling a joint BOE/BOS meeting to discuss the recommendations in detail and direct the design team to proceed with work in accordance with these recommendations. If you have any questions, please contact Wing Tam of my staff at 213-485-3985.

SK:WKT:PT
WPDCR 8429

Attachment

cc: Barry Berggren
Robert Potter
Alfred Mata

Attachment



DW flow to sewer: valve #1 open, valve #2 close

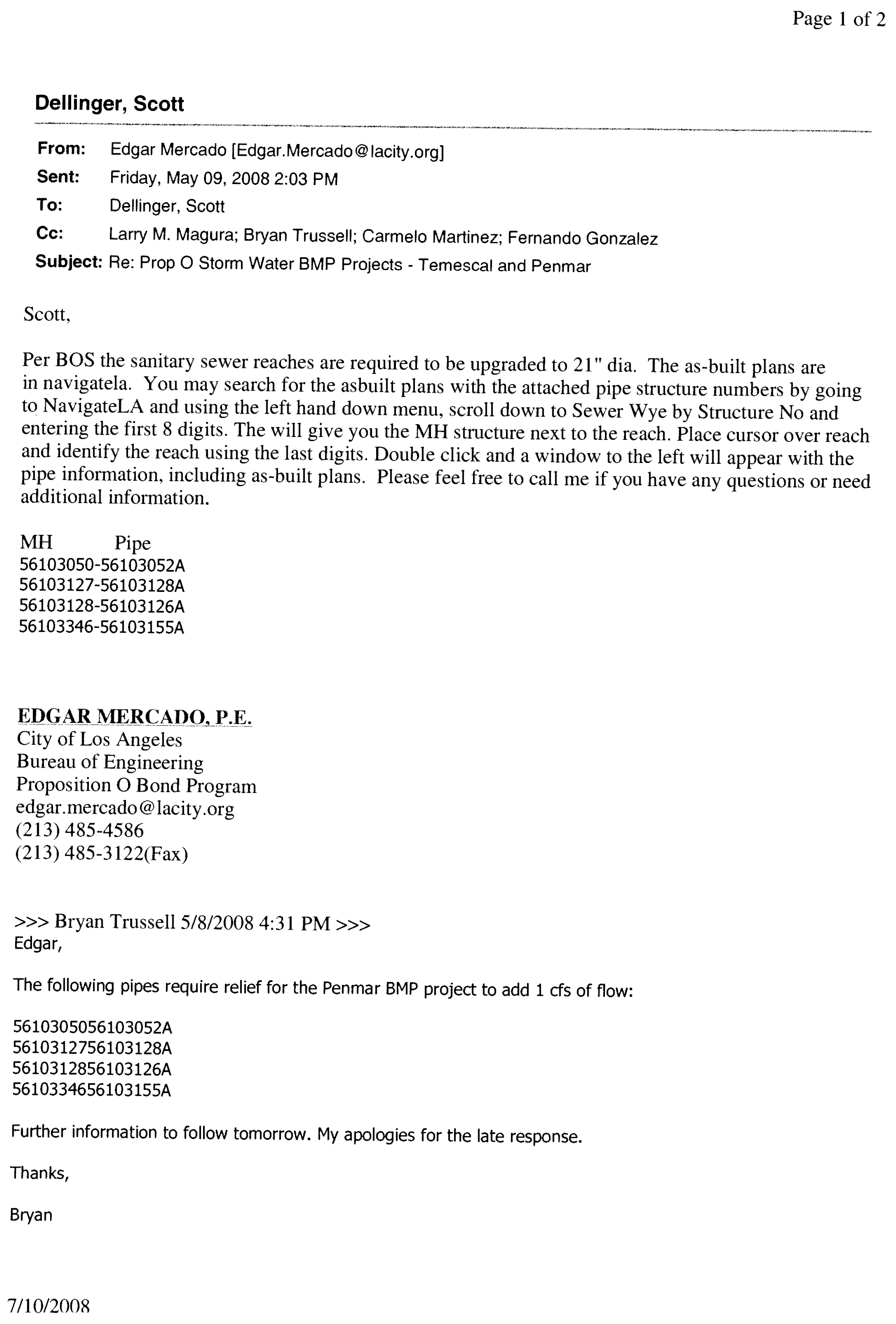
WW flow to storage tank: valve #1 close, valve #2 open

Tank discharge: both valves open

Attachment 2

Email from Bureau of Sanitation to Bureau of Engineering Identifying Locations for Sewer Rehabilitation.

Dated May 9, 2008



Dellinger, Scott

From: Edgar Mercado [Edgar.Mercado@lacity.org]
Sent: Friday, May 09, 2008 2:03 PM
To: Dellinger, Scott
Cc: Larry M. Magura; Bryan Trussell; Carmelo Martinez; Fernando Gonzalez
Subject: Re: Prop O Storm Water BMP Projects - Temescal and Penmar

Scott,

Per BOS the sanitary sewer reaches are required to be upgraded to 21" dia. The as-built plans are in navigatela. You may search for the asbuilt plans with the attached pipe structure numbers by going to NavigateLA and using the left hand down menu, scroll down to Sewer Wye by Structure No and entering the first 8 digits. The will give you the MH structure next to the reach. Place cursor over reach and identify the reach using the last digits. Double click and a window to the left will appear with the pipe information, including as-built plans. Please feel free to call me if you have any questions or need additional information.

MH Pipe
56103050-56103052A
56103127-56103128A
56103128-56103126A
56103346-56103155A

EDGAR MERCADO, P.E.
City of Los Angeles
Bureau of Engineering
Proposition O Bond Program
edgar.mercado@lacity.org
(213) 485-4586
(213) 485-3122(Fax)

>>> Bryan Trussell 5/8/2008 4:31 PM >>>
Edgar,

The following pipes require relief for the Penmar BMP project to add 1 cfs of flow:

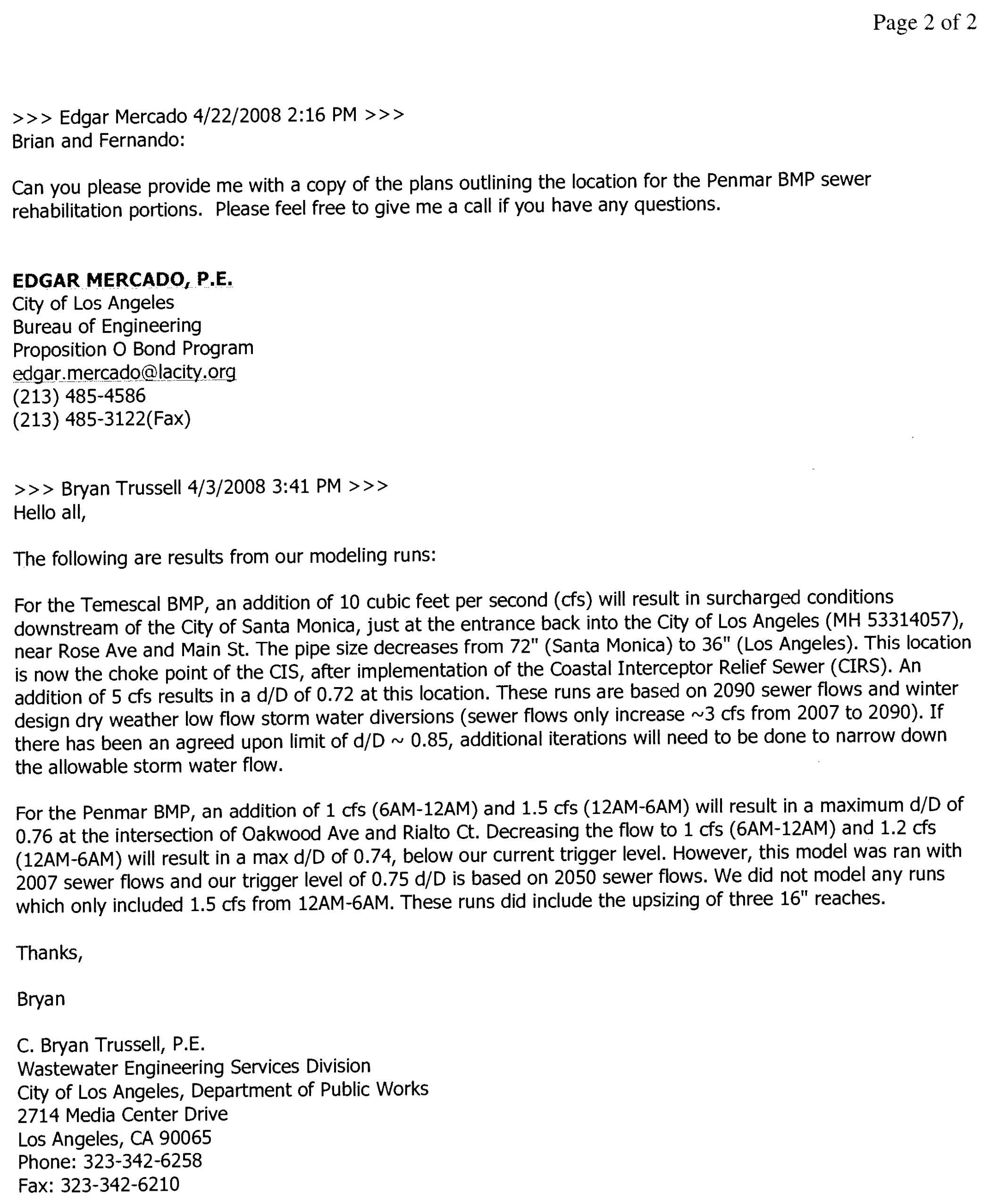
5610305056103052A
5610312756103128A
5610312856103126A
5610334656103155A

Further information to follow tomorrow. My apologies for the late response.

Thanks,

Bryan

7/10/2008



Page 2 of 2

>>> Edgar Mercado 4/22/2008 2:16 PM >>>
Brian and Fernando:

Can you please provide me with a copy of the plans outlining the location for the Penmar BMP sewer rehabilitation portions. Please feel free to give me a call if you have any questions.

EDGAR MERCADO, P.E.
City of Los Angeles
Bureau of Engineering
Proposition O Bond Program
edgar.mercado@lacity.org
(213) 485-4586
(213) 485-3122(Fax)

>>> Bryan Trussell 4/3/2008 3:41 PM >>>
Hello all,

The following are results from our modeling runs:

For the Temescal BMP, an addition of 10 cubic feet per second (cfs) will result in surcharged conditions downstream of the City of Santa Monica, just at the entrance back into the City of Los Angeles (MH 53314057), near Rose Ave and Main St. The pipe size decreases from 72" (Santa Monica) to 36" (Los Angeles). This location is now the choke point of the CIS, after implementation of the Coastal Interceptor Relief Sewer (CIRS). An addition of 5 cfs results in a d/D of 0.72 at this location. These runs are based on 2090 sewer flows and winter design dry weather low flow storm water diversions (sewer flows only increase ~3 cfs from 2007 to 2090). If there has been an agreed upon limit of d/D ~ 0.85, additional iterations will need to be done to narrow down the allowable storm water flow.

For the Penmar BMP, an addition of 1 cfs (6AM-12AM) and 1.5 cfs (12AM-6AM) will result in a maximum d/D of 0.76 at the intersection of Oakwood Ave and Rialto Ct. Decreasing the flow to 1 cfs (6AM-12AM) and 1.2 cfs (12AM-6AM) will result in a max d/D of 0.74, below our current trigger level. However, this model was ran with 2007 sewer flows and our trigger level of 0.75 d/D is based on 2050 sewer flows. We did not model any runs which only included 1.5 cfs from 12AM-6AM. These runs did include the upsizing of three 16" reaches.

Thanks,

Bryan

C. Bryan Trussell, P.E.
Wastewater Engineering Services Division
City of Los Angeles, Department of Public Works
2714 Media Center Drive
Los Angeles, CA 90065
Phone: 323-342-6258
Fax: 323-342-6210

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City of Los Angeles, Department of Public Works
Bureau of Engineering

Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Technical Memorandum No. 4
Stormwater Pump Station

August 2008

BROWN AND CALDWELL

W.O. No. EW40019F

TABLE OF CONTENTS

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

BMPs	Best Management Practices
cfs	cubic feet per second
Concept Report	Penmar Water Quality Improvement and Runoff Reuse Project concept Report
DWP	Department of Water and Power
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
LABOE	Los Angeles Bureau of Engineering
LABOS	Los Angeles Bureau of Sanitation

INTRODUCTION

This Technical Memorandum (TM) describes the Penmar Stormwater Pumping Station. The intent of the TM is to describe the basis of design and the general layout of the pump station prior to the beginning of design.

1.0 PROJECT DESCRIPTION

The Penmar Water Quality Improvement Project is located at Penmar Golf Course and Penmar Recreation and Park Facility. The City of Los Angeles is planning to implement a regional project for stormwater quality improvement. The main objective is to achieve compliance with the Total Maximum Daily Load (TMDL) regulations for bacteria at the Santa Monica Bay Beaches. This project will divert storm flows from the Rose Avenue storm drain to a storage reservoir and then release or pump the flow from the reservoir at a regulated rate to the sanitary sewer system. Storm flows within the design capacity of the system will be completely diverted to the wastewater treatment system. The project configuration will also allow the City to develop various Best Management Practices (BMPs) in the future to manage the stormwater quality and potentially use the water for reclamation. The project schematic is shown on Figure 1.

Dry weather flow from the storm drain will also be diverted and pumped directly to the sanitary sewer from the pump station wet well.

The Los Angeles Bureau of Sanitation (LABOS) prepared a report titled Penmar Water Quality Improvement and Runoff Reuse Project Concept Report (Concept Report) in March 2007. Several components of the project were identified in this report. A key element of the project described in that report, and the subject of this TM, is a stormwater pump station wet well designed to lift stormwater diverted from the Rose Avenue storm drain (at Frederick Street) to a storage tank to be located adjacent to the station. The pump station wet well will still be located on Frederick Street; however, the reservoir has been relocated to the southwest area of the Penmar Recreation Facility.

2.0 STORMWATER PUMP STATION

The Concept Report identified the need to construct a stormwater pump station wet well to lift stormwater runoff from the Rose Avenue storm drain for storage and subsequent treatment and reuse. The pump station wet well and force main will convey the storm flows to the reservoir located approximately one half mile northeast up Rose Avenue at the Penmar Recreation Center. The rate of flow intercepted by the pump station, including the wet well, determines the upper limit of what storm intensity can be fully intercepted and prevented from impacting beach bacteria levels. The sizing of the pumping capacity needed to manage the impacts was developed in the “Interim Hydrologic Design Analysis” being performed for the City of Los Angeles Bureau of Engineering (LABOE) by Geosyntec Consultants.

2.1 Location

The location of the pump station wet well will be in the abandoned Frederick Street right-of-way easement northwest of the junction with Rose Avenue as shown on Figure 2. Stormwater runoff and dry weather flow will be diverted from the existing Los Angeles County storm drain in Rose Avenue. The storm drain consists of two 9 foot wide by 12 foot high reinforced concrete culvert boxes. The centerline of the boxes is 2 feet south of the centerline of the 80 foot wide Rose Avenue right-of-way. The invert elevation of the storm drain culvert at Rose and Frederick Streets is approximately 6.6 feet above the City datum (based on City drawings for Frederick Storm Drain reference USGS July

1925. Rose Ave storm drain by county and recent sewer relocation drawings appear to hall have matching elevations). The pump station structure including wet well/storage sump and the diversion will be constructed from the storm drain culvert northwest into the abandoned Frederick Street right-of-way which is 50 feet wide. Ground surface elevation in the area is approximately 24 feet above the City datum. Groundwater is at approximately elevation 5 feet above the datum.

Frederick Street, at this location, has single family housing on the south side and the Penmar Golf Course on the north side. There is a tree line consisting of mature pine trees within the golf course along the street. Because of the residential land use of the area, the pump station wet well structure will be constructed below grade with surface access. The structure will thus have minimal visual impact on the local area.

According to the most recent record drawings, Frederick Street has an 8 inch vitrified clay sewer pipe laid on the centerline of the street, a 6 inch water line located 9 feet southwest of the centerline and storm drain inlets on both sides of the street at the junction with Rose Avenue. The utilities will have to be relocated around or above the stormwater pump station wet well. Utilities relocation for the Penmar project will be discussed in a separate TM.

2.2 Conceptual Design

The pumping station capacity is interrelated with both the capacity of the storage reservoir and the elapsed time required to empty the reservoir. These capacities have been used in modeling storm events to estimate the number of annual events in which stormwater will flow to the beach and potentially cause a violation of the Santa Monica Bay Beaches bacteria TMDL. Based on the Concept Report, subsequent stormwater system hydraulic modeling and discussions with City staff, the capacities required for the system components to meet the TMDL attainment objectives for the project are as follows:

• Wet well storage ahead of pumping system	70,000 gallons
• Pumping capacity	20 cubic feet per second (cfs)
- Number of pumps	four at 5 cfs each
• Storage reservoir	2.75 million gallons
• Available sewer capacity (discharge rate)	1.5 cfs from 12 Midnight to 6 AM (6 hours) 0 cfs from 6 AM to 12 Midnight (18 hours)
• Dry weather flow (base flow in storm drain)	0.44 cfs (estimated at 0.0003 cfs/acre in the Interim Hydrologic Design Analysis)

Stormwater runoff and dry weather flows will be diverted to the pump station wet well by a passive diversion structure in which all flow is diverted to the wet well through a side or bottom opening in the storm drain box structure. As the wet well water surface elevation rises, the four constant speed pumps will come on in sequence to pump storm flow to the reservoir. If the flow continues to rise at a rate that is in excess of the pumping capacity, the wet well will reach capacity and excess flow will remain in the storm drain and continue to flow down stream to the current drain outlet.

The pumps will fill the reservoir to a maximum capacity of 2.75 million gallons. Level control at the reservoir will shut down the pumps when the maximum capacity is reached. The stormwater will be held in the reservoir until the wet weather period ends and the sanitary sewer system has the capacity to receive the flow from the tank. LABOS has determined that the stormwater will need to be held for 72 hours after a storm event passes before the sanitary sewer system has capacity available to begin to receive the stored water.

As capacity in the sanitary sewer is available, stormwater from the pump station wet well will be pumped to the sanitary sewer by a smaller pump system consisting of two pumps with a capacity of approximately 0.5 cfs each. The flow will include any base flow or dry weather flow that continues to enter the wet well from the storm drain. This base flow is estimated to be approximately 0.5 cfs. During non-storm periods, the small pumps will discharge base flow only directly to the sanitary sewer. It is expected that the small pump will operate to remove base flows throughout the year.

Stormwater stored in the reservoir will be discharged to the sanitary sewer through a combined gravity and pump system that is separate from the primary pump station. The reservoir pump system will consist of a pre-designed pump station in a precast wet well with two pumps to discharge the stored stormwater to the sanitary sewer. The pump station will be located adjacent to the reservoir and include a bypass with a control valve to release stormwater to the sanitary sewer without pumping when the water level in the reservoir is high enough.

2.3 Pump Station Design Factors

The basic requirement of the various components of the pump station and auxiliary facilities are described in the following sections. The basic layout of the station is shown on Figure 3.

2.3.1 Diversion Structure

The diversion structure will be a passive connection to the storm drain, relying on an open connection to the side or bottom of the drain to divert all flows to the pump station wet well. A low barrier across both barrels of the Rose Avenue storm drain, approximately 2 feet high, will be required to ensure that flow does not bypass the entrance to the wet well. The barrier can be configured similar to a speed bump to make sure it does not become a maintenance impediment. All aspects of the design of the connection to the County storm drain will need to be coordinated with Los Angeles County DPW. The design of the diversion will be developed in a separate technical memorandum.

2.3.2 Trash Racks

All of the stormwater flow diverted from the Rose Avenue storm drain will pass through a removable screening basket (stainless steel) that will trap the trash and heavy debris. The basket will be designed to be hoisted through a hatch structure to the surface for removal of the material. The need for trash racks is due to the invert of the Rose Avenue storm drain being approximately 18 feet below the surface. With the pump station sump even lower we are beyond the normal range for a vactor operation. We are investigating a trash pump system to move debris to a higher elevation that can be accessed by vactor truck.

The discharge opening from the storm drain can be designed with a stationary trash rack to keep large debris items in the Rose Avenue storm drain culvert from entering the wet well. During high flows that exceed the capacity of the pump station, the material would be carried downstream. The bar spacing would be sized to protect the impellers of the pumps selected for the project. It is expected to be approximately 2 inches clear. The bar sizing and placement of additional screens will be developed after the individual pumps are selected and will depend on the ability of the pumps to pass solids.

Additional trash racks will be positioned in the wet well in front of the pump screens. The pump impellers will thus be protected by these trash racks and the large material will deposit in the wet well. Multiple hatches will be positioned in the roof of the wet well to facilitate collection and removal of all debris that accumulates in the wet well. The pumps will pass the smaller material to the reservoir and most of the material will be discharged to the sanitary sewer.

2.3.3 Wet Well and Storage

The pump station wet well will function as a normal wet well configuration to minimize the number of pump start-stop cycles and to provide volume for level control setting needed to sequence the pumping units. In addition, the wet well is a storage facility needed to accept the short storm peak flows and therefore decrease the maximum pumping rate required for the station. The storage volume that has been selected and modeled in the Interim Hydrologic Design Analysis is 70,000 gallons. The wet well will have access from the surface in Frederick Street for cleaning out accumulated material. Passive ventilation of the wet well during filling will be to the Rose Avenue storm drain.

2.3.4 Pumps

The four pumps that will lift the stormwater to the reservoir will be 5 cfs each. The preliminary estimate of static and dynamic head on the pump is approximately 30 feet based on a 30-inch diameter force main and a distance of 2,500 feet to the reservoir. Therefore, the pumps will require approximately 25 horsepower motors. The pumps will all be constant speed units. The operating set points and motor size will be confirmed during final design.

The pumps that will discharge the storm water remaining in the wet well post-storm and the base flow to the sanitary sewer will be approximately 0.5 cfs each. Since the dry weather bacteria TMDL does not allow discharges to the beach, a two pump system is recommended in order to operate dependably throughout the year. The smaller pumps will also be constant speed and operate using the wet well to limit start-stop cycles to an acceptable value.

Stormwater pumping stations can be configured with a variety of pump designs:

- Submersible pumps in a wet well – pump and motor are submersed;
- Submersible pumps in a dry well configuration – pump and motor are in a dry well but can withstand flooding;
- Vertical column pumps with motors on a raised floor but below grade – the mixed flow impeller is submerged and the motor is housed above water level on a dry floor connected to the impeller by a drive shaft; and
- Close coupled pumps in a dry well configuration – any configuration of horizontal or vertical pumps with close coupled motors in a dry pit.

The considerations for selecting the pumping configuration include City standards, capital cost, maintenance requirements, impact on the adjacent area, site constraints and criticality of the installation. Considering the need to minimize the footprint of the pump station, minimize the cost of the structure and the relatively low run time for the pumps – either the submersible pump in a wet well or vertical column pump configuration will be selected.

2.3.4.1 Submersible Pumps

Submersible pumps would be installed in the wet well in a baffled space adjacent to the wall. The baffles prevent vortexing and interference with the adjacent pump's suction. The motor and pump are close coupled and the motor is submersible. The pump and motor combination is attached to rails or enclosed in a column so that the unit can be lifted from the wet well for service or repair. The pumps are self priming when submerged and cooled by the water in the wet well. The installation is relatively simple and the station would not have any underground vaults requiring regular access by maintenance personnel. Since the pump and motor are submerged, it will be the quietest option. Submersible pumps will be specified according to City master specification section 11221 Submersible Non-Clog pumps. The master specifications list pumps by Flyght Corporation, ABS, and Fairbanks Morse for this application

2.3.4.2 Vertical Column Pumps

Vertical column pumps have an impeller in a bowl assembly at the base of the wet well and a column containing the discharge flow and a drive shaft running up to the motor on a floor above the water level. The pumps can be single or multiple stage units with second impeller doubling the head produced. For the design capacity and head of the larger pumps the units will have mixed flow impellers. The motor floor provides easy access for maintenance of the motor. Maintenance of the pump requires pulling the column and pump up through the surface access. The motor floor will require an access stair from the surface and building services including lighting and ventilation. The pumps will be specified according to City specification 11223 Vertical Non-Clog Pumps. The master specifications name Aurora, Crane Co., Deming Division, Fairbanks Morse and Worthington Pump Corporation as the manufacturers of this type of pump.

2.3.4.3 Selection

The City has had good experience with vertical column type pumps and LABOS has indicated that this would be the preferred type of installation. The design team will proceed to design for the vertical column, utilizing mixed flow impellers selected for the best efficiency at the design points. The smaller pumps are at the very low range of the capacity for this type of impeller. They will be designed as vertical column, but will require a different type of impeller and suction screening to limit solids passed through the pumps.

2.3.5 Other Design Considerations

The potential for water hammer and need for surge control will be calculated during design. It is not

expected to be a problem or require additional equipment since the flow can be released back into the wet well if needed.

2.3.5.1 Operational Issues

Pump station noise will be mitigated by having the pumps below grade and in an enclosed concrete vault. Ventilation fans will be required during periods when personnel are at the site and to remove excess heat from the vault. Noise will be mitigated by putting the fan run cycles on thermostat control.

2.3.5.2 Construction Issues

As discussed in TM-5 which concerns the force main connections to the pump station, appropriate traffic control will be required for the connection to the Rose Avenue storm drain. The connection will be coordinated with the lane closures that will also be required to install the force main. Daily street sweeping will be required to control dust and dirt.

2.3.6 Electrical and Controls

2.3.6.1 Electrical

The pump station will require 480 volt three phase electrical service for the pumps. Required amperage will be determined during final design. A motor control center will be located above aground and screened from view using fencing and plantings or located on the motor floor if vertical column pumps are selected. The station will not have standby or emergency power, but will be provided with a connection for a portable trailer mounted generator to be brought to the site, should it be needed. Design of the electrical systems will also involve the coordination with DWP and the obtaining of required DWP permits.

2.3.6.2 Controls

The Penmar stormwater pump station, a well as all of the operating facilities at the location, will be designed with a SCADA system to allow remote control of the pumping operation and transmission to the sewer system as well as coordination with the Venice Pump Station. This will be important during pump down of the reservoir to make sure the capacity of the sewer system is maximized but not exceeded as the storm water system is drained and dry weather storm flow capture resumes after an event. Both sewage flow and dry weather storm drain flow will vary over time of day and by season. The basic pump station controls will include:

- Storm flow conditions:
    - Water level depth in the wet well will control the start/stop and sequencing of the 5 cfs pumps and status will be transmitted to a remote monitoring station.
    - High water level in the reservoir will stop the pumps from pumping stormwater to the reservoir. Water level status in the reservoir will be sent to the remote monitoring station.
    - Base flow pumps will be locked out at the water level that starts the first large pump.
- Post storm condition:
    - Post storm sequence initiated from the remote monitoring location.
    - Water level depth in the wet well will control the start/stop of the small pump(s) that pumps directly to the sanitary sewer. Status will be transmitted to a remote monitoring station.
    - Sewer flow depth will be monitored at an appropriate downstream manhole location and shut down the pump sending flow to the sewer based on high flow in the collection system. Depth will be transmitted to the remote monitor.

- At the reservoir, a control valve with companion flow measurement will activate the release of stormwater from the reservoir to sewer. Flow rate will be transmitted to remote monitor. Valve and rate can be adjusted remotely. As the water level decreases in the reservoir, the reservoir pump station will complete the draining of the reservoir to the sewer. The control of release of water from the reservoir will be interconnected with the drawdown of the pump station wet well so as not to cause high surcharge in the sewer.

Detailed control strategies will be prepared during design including the extent of remote control of the pump station functions and the location of the remote monitoring control station.

2.3.7 Structure

As shown on Figure 3, the wet well and pump station will be approximately 25 feet wide and 180 feet long and contained within the Frederick Street right-of-way. The wet well structure will be approximately 25 feet deep. It will require significant shoring and dewatering to construct in this location. The anticipated groundwater level in this area is approximately 10 feet higher than the floor of the wet well. Anti-flotation provisions will be incorporated into the design of the facility. The structure will be reinforced concrete with surface access hatches for cleaning and pump installation and removal. The station will be below grade and will have minimal visual impact on the adjacent neighborhood.

If a wet well submersible pump configuration is used, the pumps and motors will be submerged and there will not be any requirement for operational access to the station. Pumps will be on rails and will be removed through surface access hatches.

For the preferred vertical column pumps, the motors and discharge piping will be located on a slab in a vault above the wet well but still below grade. The vault will require operational access through a stair well to the operating floor and will require ventilation and lighting design to provide a safe atmosphere. Pumps will still be removed through surface openings using crane trucks or similar equipment.

FIGURES

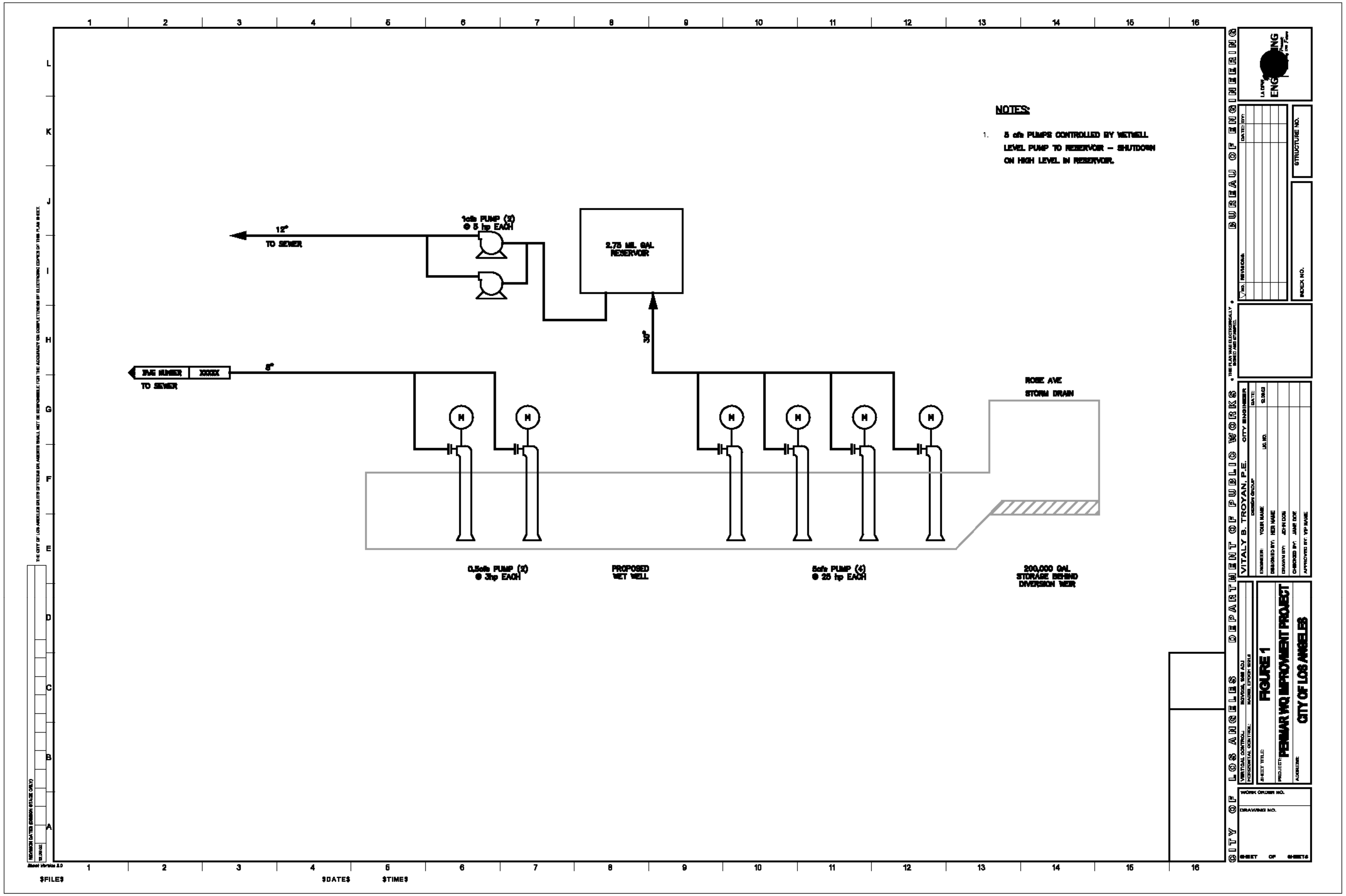

Figure 1 – Penmar Pump Station Schematic

Figure 2 – Penmar Pump Station Site Plan

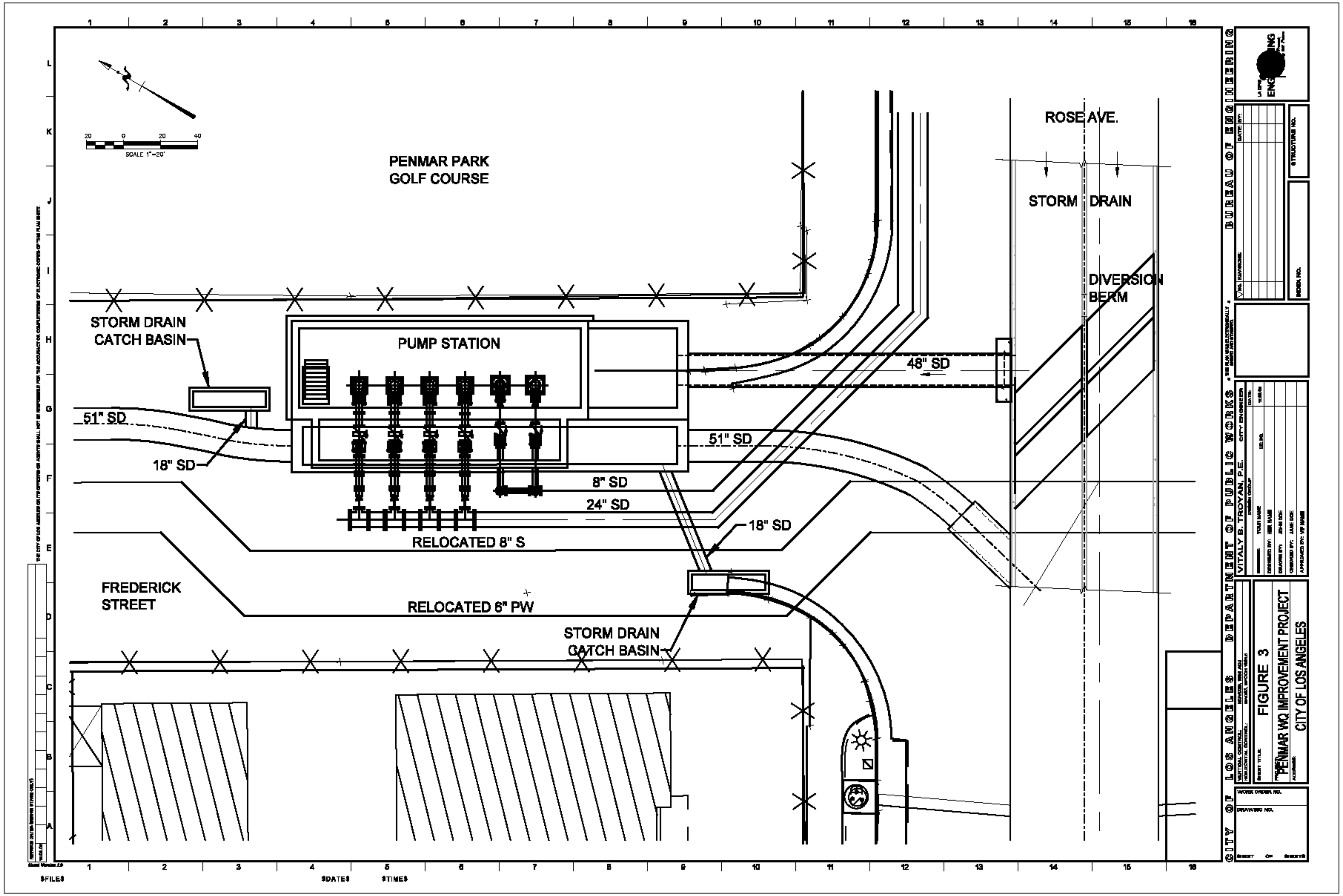

Figure 3 – Penmar Pump Station Plan

City of Los Angeles, Department of Public Works
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Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Technical Memorandum No. 5
Force Mains

August 2008

W.O. No. EW40019F

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ABBREVIATIONS AND ACRONYMS

BMPs	Best Management Practices
BOE	Bureau of Engineering
Concept Report	Penmar Water Quality Improvement and Runoff Reuse Project Concept Report
DIP	Ductile Iron Pipe
FHWA	Federal Highway Administration
FRP	Fiber Reinforced Plastic
LABOS	Los Angeles Bureau of Sanitation
MUTCD	Manual on Uniform Traffic Control Devices
PVC	Polyvinyl Chloride
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
WATCH	Work Area Traffic Control Handbook
WCSD	Wasterwater Collection System Division

INTRODUCTION

This Technical Memorandum (TM) describes the piping requirements for the force mains that are to be constructed as part of the Penmar Water Quality Improvement Project. The intent of the memorandum is to describe the basis of design and the general layout of the piping system prior to the beginning of final design.

1.0 PROJECT DESCRIPTION

The Penmar Water Quality Improvement Project is located at Penmar Golf Course and Penmar Recreation Center in the western section of the City of Los Angeles, immediately south of the City of Santa Monica. The City of Los Angeles Bureau of Sanitation (LABOS) prepared a report titled *Penmar Water Quality Improvement and Runoff Reuse Project Concept Report* (Concept Report) in March 2007. A key element of the project described in that report and the subject of this TM, is the different piping systems required to divert the flows from the proposed stormwater pump station to the proposed stormwater storage tank; from the storage tank to the designated sanitary sewer manhole in Rose Avenue; and for the conveyance of dry weather flow from the proposed stormwater pump station to the same designated sanitary sewer manhole.

Since the release of the Concept Report several key concepts have evolved through a series of workshops with the BOE and project stakeholders. The resulting concept for the Project is shown in Figure 1.

The City of Los Angeles desires to implement a regional project for stormwater quality improvement at this location. The main objective is to achieve compliance with the Wet Weather Total Maximum Daily Load (TMDL) regulations for bacteria at the Santa Monica Bay Beaches. The project will divert dry-season and storm flows (up to 20 cfs) from the Rose Avenue storm drain culvert to a large sump, and then pump the accumulated water to a 2.75 million gallon storage reservoir. After a 72-hour post-storm holding period, the stormwater collected in the reservoir and sump will be pumped from these facilities at a regulated rate to the sanitary sewer system (maximum flow rate of 1.0 cfs from 6 a.m. to Midnight, and 1.5 cfs from Midnight to 6 a.m.) and sent to the Hyperion Waste Water Treatment Plant for treatment. The project will also allow the City to develop various Best Management Practices (BMPs) in the future to manage the stormwater quality and potentially re-use the water for irrigation of the golf course and adjacent park areas.

2.0 PIPING SYSTEMS REQUIREMENTS

2.1 Location

Three force main systems are identified within the project scope to convey the dry and wet weather flows between the proposed stormwater pump station sump, the proposed storage tank, and the Rose Avenue sanitary trunk sewer. The three lines are located along Rose Avenue between Penmar Avenue and Frederick Street on the south side of the Penmar golf course. General ground elevation within the area is approximately 25 feet above mean sea level.

Existing nearby utilities at the intersection of Rose Avenue and Frederick Street include a 6-inch water line and storm drain inlets and an 8-inch vitrified clay sewer pipe along the center line of Frederick Street. Relocation of these utilities to accommodate the proposed pump station and sump will be the subject of a separate TM (8). Other existing utilities in Rose Avenue, as well as the Frederick Street water line will be located by the project surveyor and verified prior to completion of the detailed design phase of the project in order to determine the most desirable locations for the proposed force mains.

2.2 Pipe Flows

As part of this concept, dry weather flow (approximately 0.44 cfs) will be routed directly to the sanitary sewer while the wet weather flows will be diverted to the reservoir. The reservoir is currently sized for 2.75 MG.

Typical discharge time from the reservoir is estimated at 6.2 days. Sanitary sewer manhole number 53315009 has been identified by the LABOS as the desired connection point for possible diversion of dry weather and wet weather flows to the sanitary sewer system.

The following summarizes the naming conventions and flow rates for the proposed force mains:

- Force Main No. 1 - From the proposed pump station to the proposed storage tank: 20 cfs (8,976 gpm).
- Force Main No. 2A - From the proposed storage tank to the designated sanitary sewer manhole: 1.0 cfs (450 gpm) from 6:00 AM to Midnight and 1.5 cfs (673 gpm) from Midnight to 6:00 AM.
- Force Main No. 2B - From the proposed pump station to the designated sanitary sewer manhole: up to 1.5 cfs (673 gpm) including 0.44 cfs dry weather flow to allow for direct pumping from the pump station wet well to the sanitary sewer during dry weather periods, thereby keeping the majority of the wet well storage capacity available to receive diverted wet weather flows.

2.3 Pipe Sizes and Lengths

The flow requirements indicated above were evaluated using the Hazen-Williams equation with an average C-value of 120.

$$V = 1.318 \quad C \quad R_h^{0.63} \quad S^{0.54}$$

Typical Hazen-Williams C-values range between 140 for Cement mortar lined Ductile Iron Pipe (DIP) and 150 for Polyvinyl Chloride (PVC) pipes and Fiber Reinforced Plastic (FRP) pipes. Lower Hazen-Williams

C-values are typically used during pipe sizing calculations to account for future aging of pipes within a system after years of operation and minor losses from valves, bends and tees that remain unknown during this stage of design. Acceptable ranges for velocity were assumed to range between 1.25 fps to 4.5 fps with the resulting headloss not exceeding 2.5 ft/1000 ft or 0.25 percent over the entire length of the force main. With these criteria, the following preliminary pipe sizes have been identified:

- Force Main No. 1: 30-inch internal diameter at a flow velocity of 4.1 fps and average headloss of 2.0 ft/1000 ft. resulting in a total headloss of approximately 4.6 ft over the 2,300 ft total length of this pipeline segment.
- Force Main No. 2A:

  Scenario 1: Between 6 a.m. to Midnight:

12-inch internal diameter at a flow velocity of 1.27 fps and an average headloss of 0.67 ft/1000 ft. resulting in a total headloss of approximately 0.8 ft over the 1,200 ft total length of this pipeline segment.

Scenario 2: Between Midnight and 6 a.m.:

12-inch internal diameter at a flow velocity of 1.95 fps and an average headloss of 1.84 ft/1000 ft. resulting in a total headloss of approximately 2.21 ft over the 1,200 ft total length of this pipeline segment.

- Force Main No. 2B: 8-inch internal diameter at a flow velocity of 1.4 fps and an average headloss of 1.4 ft/1000 ft resulting in a total headloss of approximately 1.54 ft over the 1,100 ft total length of this pipeline segment.

2.4 Pipe Material

The use of standard cement mortar lined DIP with a minimum pressure class of 150 psi conforming to SSPWC 207-9.2 and AWWA C151/A21.51 is recommended for the 30-inch diameter Force Main No. 1, due to the durability of this pipe material and inexpensive method of passive corrosion protection. All DIP and fittings shall be provided with foundry-applied polyurethane coating. Even though this will not be a high pressure system, the possibility of water hammer due to rapid pump startup or shut down will need to be mitigated by including calculations for required thrust restraint in the overall design of the force mains at all changes of direction (straight runs of pipe do not develop thrust that requires restraint). Several excellent thrust restraint systems are commonly available for ductile iron pipe (TR-Flex™, Mega-Lug™, and Field Lock™ gaskets to name a few). Thus use of thrust blocks is not recommended, because of the difficultly most contractors have is properly casting and placing them. Thrust blocks would be redundant in any case if restrained joint pipe is used at all changes of direction. We will consider these and other options in our design approach and include appropriate thrust restrain systems in the project specifications.

DIP is well-suited to resist both traffic impact damage and deflection due to loss of support resulting from frequent repair work on nearby structures and utilities. For the smaller diameter force mains (Force Mains 2A and 2B), PVC pipes conforming to AWWA C-900 requirements with a minimum working pressure rating of class 150 can be recommended. Since the smaller diameter force mains will be located beneath Rose Avenue, where they will be subject to some degree of cyclic loading due to heavy traffic, it may be desirable to substitute ductile iron pipe for PVC due to its much greater structural strength and longevity.

For joints, rubber gasketed bell and spigot type joints are recommended for straight runs. The use of restrained joints, as discussed above, is recommended where the pipe changes direction.

3.0 FORCE MAIN CONSTRUCTION ISSUES:

3.1 Force Main Installation

Force main installation will be by open cut-and-cover methods with a four foot minimum depth of cover over installed force mains. Installation by trenchless technology means is not anticipated to be justified for this project.

3.2 Pavement Cutting & Patching

Pavement cutting and patching will be required during construction of the proposed force mains in Rose Avenue and through the parking lot of the Penmar Municipal Golf Course. All paved areas including asphaltic concrete berms cut or damaged during construction will be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas. Temporary resurfacing may be required by the City or other project stakeholders. The temporary surfacing is usually placed promptly after backfilling and is maintained until the contractor is ready for the final restoration of the improvements. It is anticipated that a standard Tee-cut pavement cutting system will be used, where the initial pavement cut is equal to the design trench width, and the second cut is 6 inches outside of the initial cut to provide an undisturbed clean edge for repaving operations after the pipe is installed and the trench filled with compacted backfill material.

Anticipated minimum trench widths for this project should comply with the said reference and shall be as shown in Table 1, below:

Table 1 - Required Minimum Trench Widths

Pipe Size, Nominal Diameter, inches	Required Minimum Trench Width, inches
8	16
12	24
30	60

3.3 Sewage Bypass and Sanitary Manhole Connection

Both the 8 and 12 inch force mains are proposed to connect at the same elevation into opposite sides of manhole number 53315009. After a storm event, discharge is anticipated from draining the storage tank and a discharge of base dry weather flow going into the sewer simultaneous. The connection points will be angled and offset to avoid interference. In order to make these connections to the existing sewer, a temporary bypass of the manhole will be required. This bypass will require careful coordination with BOS and approval by WCSD. A fully-detailed submittal from the Contractor on the proposed method of bypassing will be reviewed and approved by WCSD before any work commences. A separate submittal for force main connections to sanitary sewer manhole number 53315009 shall include the date, time and duration of the planned shutdown/tie-in, description of the work to be performed during shutdown/tie-in and brief description of the facilities or sewers impacted by the shutdown/tie-in including drawings and sketches illustrating the work to be performed and the facilities to be affected.

Additional requirements may include confined space entry permits and shutdown/tie-in safety plans.

Manhole location and connection details will need to be verified during the detailed design phase and preliminary shutdown/tie-in description will be provided. In addition a visual inspection of the manhole will occur to verify the condition of the manhole and design assuptions.

The connection requirements are to be further assessed during the detailed design phase to determine the optimum setup for the required connection.

3.4 Traffic Control

Force main construction in Rose Avenue will require the temporary closure of a portion of the street to traffic. A traffic control plan that meets City of Los Angeles requirements shall be prepared by the Contractor and submitted to the City for approval during the submittals phase of project construction.

The City of Los Angeles uses Manual on Uniform Traffic Control Devices (MUTCD) by the Federal Highway Administration (FHWA) and the Work Area Traffic Control Handbook (WATCH) by American Public Works Association.

Contacts for approval of the traffic control plan as it effects Penmar Municipal Golf Course and the Penmar Recreation Center are: Liza Mendoza, Facility Director at (310) 396-8735 and Pete Frey, Penmar Golf Operations Supervisor at (818) 246-1435.

Specific traffic mitigation details shall be submitted to City Traffic Engineering Division before executing mitigation plans in the field.

It is recommended to hold an initial meeting with all project stakeholders to discuss traffic mitigation plan prior to any site disturbance or construction work initiation.

3.5 Construction Restrictions

Noise—sound walls, sound blankets, and low noise generating equipment are used to muffle noise from work areas; noise must not exceed specified levels. Exterior noise levels during construction shall be maintained under 50 dBA and should comply with the City of Los Angeles municipal code and applicable Noise Ordinances within the project site.

Work Schedules—most work takes place during hours when people are not sleeping; work is efficiently scheduled so that the project can be finished in the minimum time possible. Permissible hours of work shall be determined in consultation with the City of Los Angeles Bureau of Engineering and in reference to the project specifications.

Dirt and Dust—daily street sweeping and water spreading; cleaning services when necessary; car wash services when necessary

General Livability—on site assistance is provided to help neighbors and local services work around construction (parking, garbage services, etc)

Parking and Traffic Flow—safe and adequate pedestrian and vehicle access shall be maintained at all times to residences and businesses

Safety—enclosures are placed around all excavation; crossing guards are provided at impacted intersections

Trees—plans will call out care and protection of trees; some triming may be required due to narrow ROW

Specific requirements will be developed during the design phase and incorporated into the specifications for the Project.

Special care shall be exercised during construction for all existing utilities and improvements not designated for removal or relocation, details of the existing nearby utilities are not available at the present time, but will be incorporated into the project design as soon as the information is collected by the project surveyor.

3.6 Public Outreach / Education Program

Public Outreach and information regarding project construction impacts and Traffic Control issues will be prepared and distributed to ensure that the general public and project stakeholders are informed of the plans general construction requirements and the anticipated duration of the impacts on traffic flow.

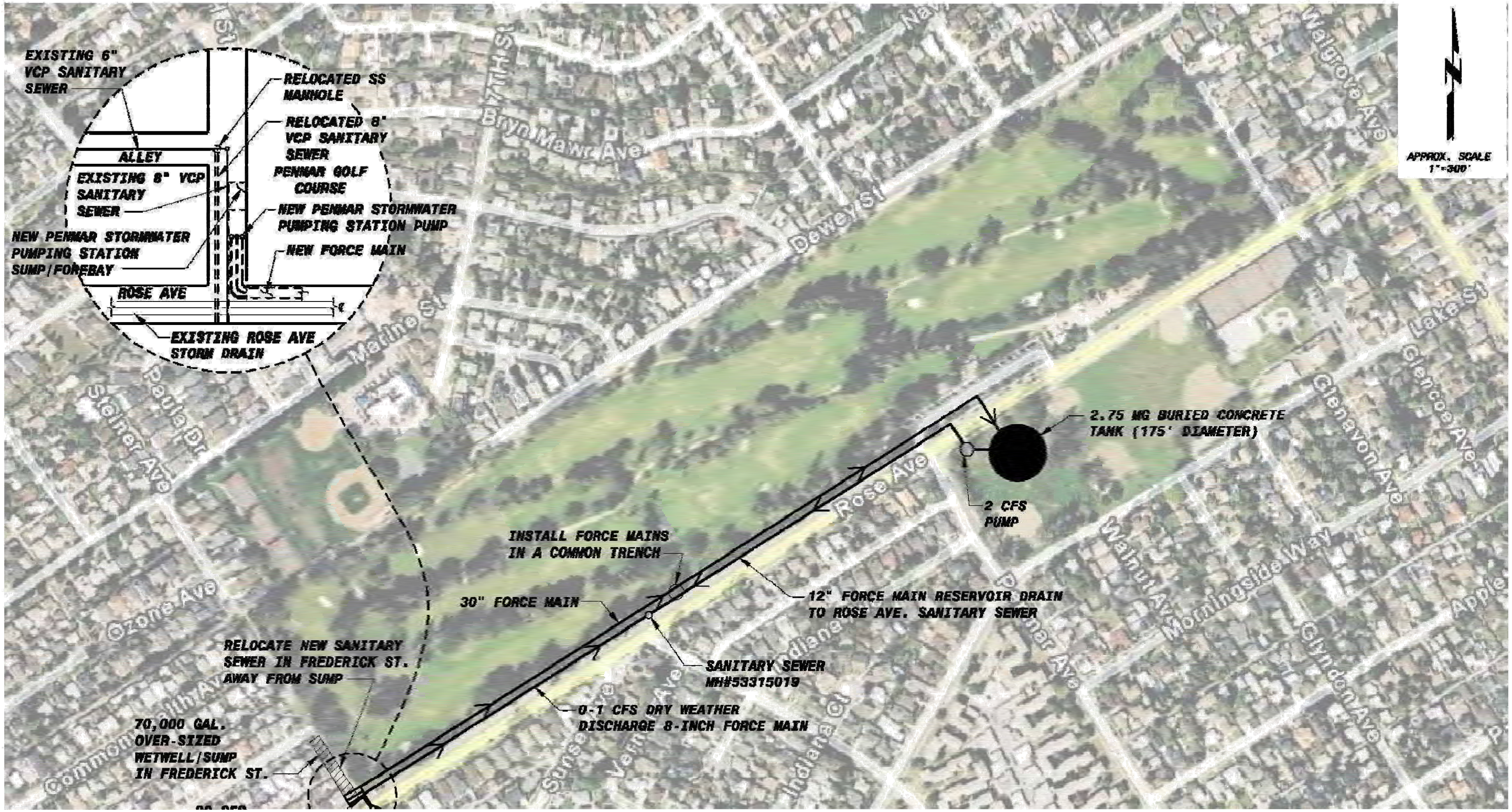
3.7 Force Main Properties Summary

Table 2 presents a summary of the recommended physical properties and pipe materials for the force mains that will be constructed as part of the Penmar Water Quality Improvement Project. A schematic layout of the proposed force mains is shown on Figure 3.

Table 2 - Force Main Summary

	Force Main 1	Force Main 2A	Force Main 2B
Material/Standard	Cement mortar lined DIP AWWA C151/A21.51	DR 18 PVC – AWWA C-900	
Flow	20 cfs	1.5 cfs	0.44 cfs
Nominal Size	30-inch	12-inch	8-inch
Length	~2,300 L.F.	~1,200 L.F.	~ 1,100 L.F.
Pressure Class	150 psi	150 psi	150 psi
Flow Velocity	4.1 ft/s	1.95 ft/s	1.4 ft/s
Total Headloss	4.6 ft	2.21 ft	1.54 ft

FIGURES


EXISTING 6" VCP SANITARY SEWER
RELOCATED SS MANHOLE
RELOCATED 8" VCP SANITARY SEWER
ALLEY
EXISTING 8" VCP SANITARY SEWER
PENMAR GOLF COURSE
NEW PENMAR STORMWATER PUMPING STATION PUMP
NEW PENMAR STORMWATER PUMPING STATION SUMP/FOREBAY
NEW FORCE MAIN
ROSE AVE
EXISTING ROSE AVE STORM DRAIN
APPROX. SCALE 1"=300'
2.75 MG BURIED CONCRETE TANK (175' DIAMETER)
2 CFS PUMP
INSTALL FORCE MAINS IN A COMMON TRENCH
30" FORCE MAIN
12" FORCE MAIN RESERVOIR DRAIN TO ROSE AVE. SANITARY SEWER
SANITARY SEWER MH#53315019
0-1 CFS DRY WEATHER DISCHARGE 8-INCH FORCE MAIN
RELOCATE NEW SANITARY SEWER IN FREDERICK ST. AWAY FROM SUMP
70,000 GAL. OVER-SIZED WETWELL/SUMP IN FREDERICK ST.
Bryn Mawr Ave
Dewey St
Marine St
Rose Ave
Walgrove Ave
Lake St
Glencoe Ave
Glenavon Ave
Walnut Ave
Morningside Way
Glyndon Ave
Penmar Ave
Indiana Ct
Sunset Ave
Vernon Ave
Ozone Ave
Commonwealth Ave
Steiner Ave
Paula Dr
Apple

City of Los Angeles, Department of Public Works
Bureau of Engineering

Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Technical Memorandum No. 6
Diversion Structure

September 2008

BROWN AND CALDWELL

W.O. No. EW40019F

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ABBREVIATIONS AND ACRONYMS

BMPs	Best Management Practices
LABOS	Los Angeles Bureau of Sanitation
RCBs	reinforced concrete boxes
TM	Technical Memorandum
TMDL	Total Maximum Daily Load

INTRODUCTION

This Technical Memorandum (TM) describes the Penmar Diversion Structure. The intent of the memo is to describe the basis of design of the diversion structure prior to the beginning of design.

1.0 PROJECT DESCRIPTION

The Penmar Water Quality Improvement Project is located at Penmar Golf Course and Penmar Recreation and Park Facility. The City of Los Angeles is planning to implement a regional project for stormwater quality improvement. The main objective is to achieve compliance with the Total Maximum Daily Load (TMDL) regulations for bacteria at the Santa Monica Bay Beaches. This project will divert dry weather and storm flows from the Rose Avenue storm drain to a storage reservoir and then the flow will be pumped from the reservoir at a regulated rate to the sanitary sewer system. Dry weather and storm flows within the design capacity of the system will be completely diverted to the wastewater treatment system. The project will also allow the City to develop various Best Management Practices (BMPs) in the future to manage the stormwater quality and potentially use the water for reclamation.

The Los Angeles Bureau of Sanitation (LABOS) prepared a report titled *Penmar Water Quality Improvement and Runoff Reuse Project Concept Report* (Concept Report) in March 2007. Several components of the project were identified in this report. A key element of the project described in that report, and the subject of this Tech Memo, is a diversion structure designed to divert stormwater from the Rose Avenue Storm Drain (at Frederick Street) to the a storage tank to be located at the Penmar Recreation Facility.

2.0 DIVERSION STRUCTURE

A diversion structure is needed to divert stormwater from the existing storm drain in Rose Avenue to the stormwater pump station. The pump station will then convey the storm flows to the reservoir located approximately one half mile up Rose Avenue at the recreation facility.

2.1 Location

The diversion structure will be located at the intersection of Rose Avenue and Frederick Street and will divert dry weather and storm flow from the existing Los Angeles County storm drain in Rose Avenue to the pump station structure which will be located on the abandoned Frederick Street. The existing storm drain consists of two 9-foot wide by 12-foot high reinforced concrete boxes (RCBs). The centerline of the boxes is 2 feet south of the centerline of the 80-foot wide Rose Avenue right-of-way. The invert elevation of the storm drain at Rose and Frederick Streets is approximately 6.6 feet above the City datum. Attachment 1 includes a 1955 Los Angeles County Flood Control District drawing that shows the plan and profile of the storm drain at the project location.

2.2 Conceptual Design

The diversion structure will be a passive connection to the storm drain relying on an open connection to the side or bottom of the RCBs to divert flows to the stormwater pump station. A low barrier, less than 2 feet high, will be required to ensure that flow does not bypass the entrance to the wet well. The barrier can be configured similar to a speed bump to ensure that it does not impede maintenance of the box culverts. All aspects of the design of the connection to the Los Angeles County DPW (County) storm drain will have to be coordinated with and approved by the County.

Two different conceptual designs for the diversion structure are shown on Figures 1 and 2. Option 1 consists of an open connection to the bottom of the storm drain is provided on Figure 1. Two 24-inch-diameter drop inlets with safety grates would be constructed at the bottom of the storm drain and would connect to a 36-inch reinforced concrete pipe jacked to beneath the storm drain. A concrete berm would be constructed in the bottom of the box culverts to help divert flow into the drop inlets.

As shown on Figure 2, Option 2 involves connecting to the storm drain from the side of the structure. An opening would be created in the wall between the two box culverts to allow stormwater to flow from one box to the other. For this option, the concrete berms would be angled at 45 degrees to direct the flow towards the openings in the box culvert walls. The 48-inch RCP connection would be installed using open cut construction.

For either connection option, access to the storm drain will be needed. New access manholes will be located at the diversion structure for easier access.

2.3 Discussion

An advantage to connecting to the bottom of the culverts is the ability to divert all flows to the pump station, even during very low flow conditions. During low flows, the side-outlet option may result in a small pool of standing water in the low spot in the center of the RCB. The need for structural reinforcement will be evaluated during the design phase; however, the side outlet option will most likely require reinforcement to the side wall and perhaps the middle wall since the walls will be weakened by the new openings. The wall reinforcement will most likely be a substantial structure cast beneath the outside edge of the RCB.

Typically, trenchless construction is more expensive than open-cut construction on a per-linear-foot basis. In this case, the cost difference may not be substantial since the bottom-connection option may be easier to construct and will require less construction time than the side-connection option.

Safety grates have been shown at the openings in both options for public safety. Alternately, the grates can be eliminated to allow debris to pass to the pump station for removal.

In conclusion, two decisions will need to be made prior to the detailed design phase. The first decision is which connection option is to be used for the design. Two options — one with a connection to the bottom of the culvert; and the other with a connection to the side of the culvert — have been shown on Figures 1 and 2. The second decision is whether safety grates should be installed at the openings in the culverts. Safety grates may be needed for public safety. However, if it is desired to remove debris from the storm flows, the grates may be eliminated to allow for removal of debris at the stormwater pump station.

Since the publishing of the draft version of this TM, the County has revealed that the concept per Figure 2 has been implemented by the County and permitted to other agencies. Due to this reason, detailed design will be based on the side connection option as shown in Figure 2. Furthermore, the City has expressed preference in removing debris from the pump station using vactor trucks. It is recommended that a grate with 3-inch spacing be placed at the connection to the storm culvert, thus preventing larger debris from entering the pump station. A screen with 1-inch spacing will be placed upstream of the pumps to protect the pumps.

3.0 CONSTRUCTION ISSUES

3.1 Traffic Control

Appropriate traffic control will be required for the construction of the diversion structure. The connection will be coordinated with the lane closures that will also be required to install the force main. Daily street sweeping will be required to control dust and dirt.

3.2 Noise/Work Schedules

Noise level during construction will be mitigated by limiting the working hours, which will be determined in consultation with the City of Los Angeles Bureau of Engineering and in reference to the project specifications.

ATTACHMENT 1

1955 Los Angeles County Flood Control District Drawing

FIGURES

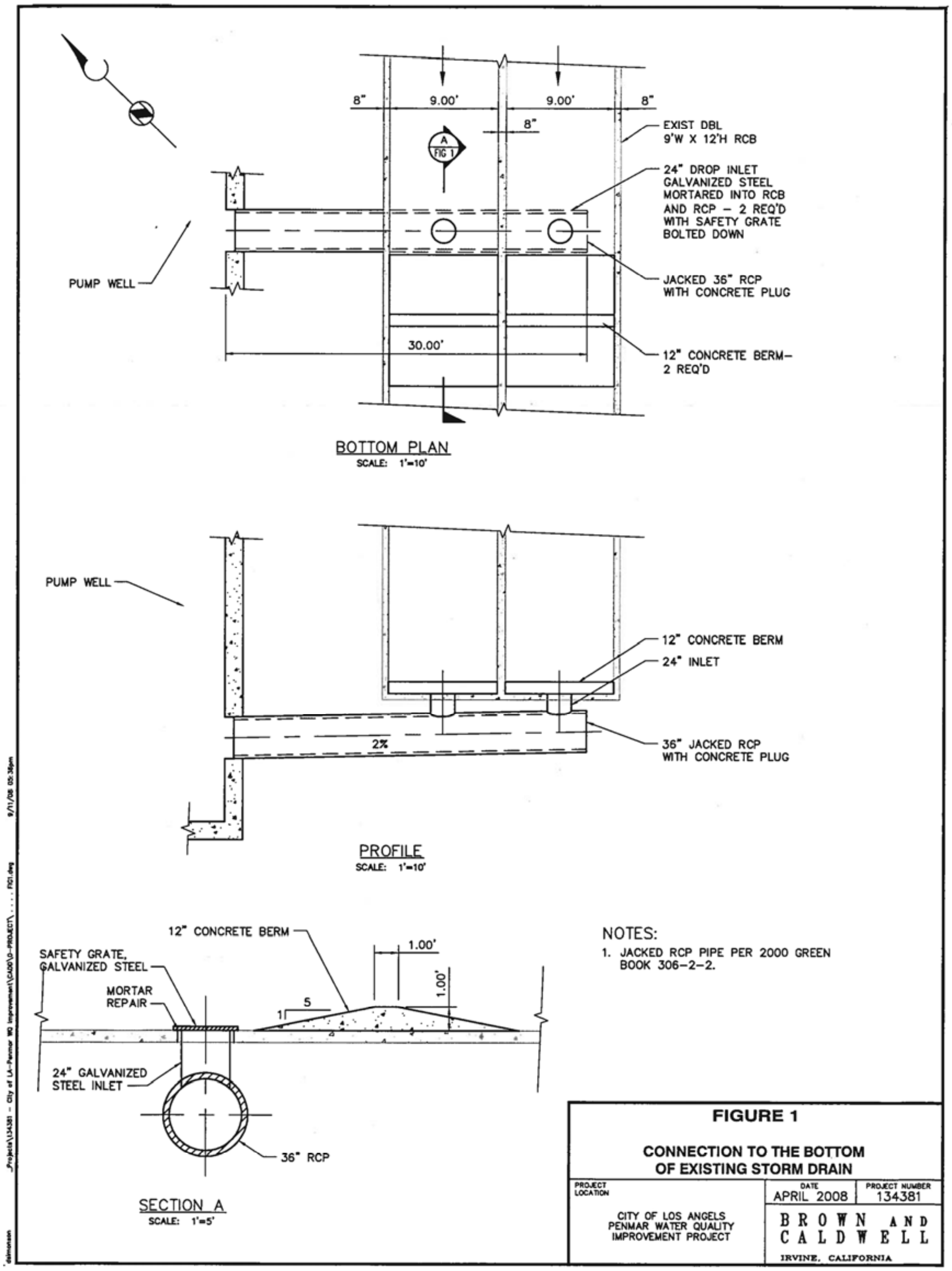

Figure 1. Connection to the Bottom of Existing Storm Drain

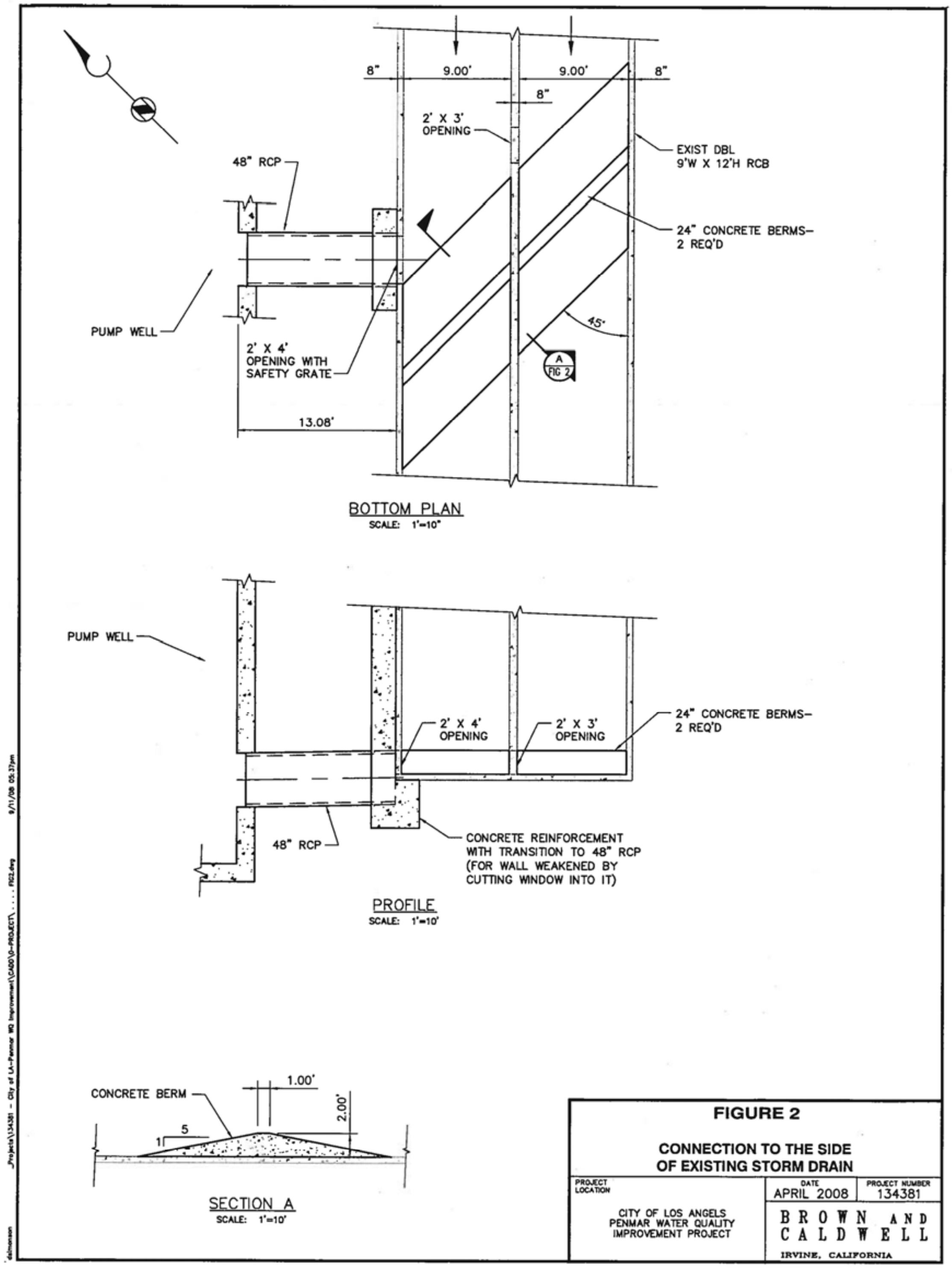

Figure 2. Connection to the Side of the Existing Storm Drain

City of Los Angeles, Department of Public Works
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Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Technical Memorandum No. 7
Buried Reservoir

August 2008

W.O. No. EW40019F

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ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ASCE	American Society of Civil Engineers
AWWA	American Water Works Association
B&V	Black & Veatch
BC	Brown and Caldwell
CBC	California Building Code
FHWA	Federal Highway Administration
LABOE	Los Angeles Bureau of Engineering
LABOS	Los Angeles Bureau of Sanitation
LADWP	Los Angeles Department of Water and Power
LARAP	Los Angeles Department of Recreation and Parks
MCE	Maximum Considered Earthquake
MG	million gallon
MUTCD	Manual on Uniform Traffic Control Devices
Project	Penmar Water Quality Improvement and Runoff Reuse Project
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
VFD	variable frequency drive
WATCH	Work Area Traffic Control Handbook

INTRODUCTION

This Technical Memorandum (TM) describes the recommended design concept for the underground stormwater storage reservoir element of the Penmar Water Quality Improvement and Runoff Reuse Project (Project), which is proposed to be constructed near the Penmar Golf Course and Penmar Recreation Center approximately 1¼ miles from the Pacific Ocean in the western-most portion of the City of Los Angeles.

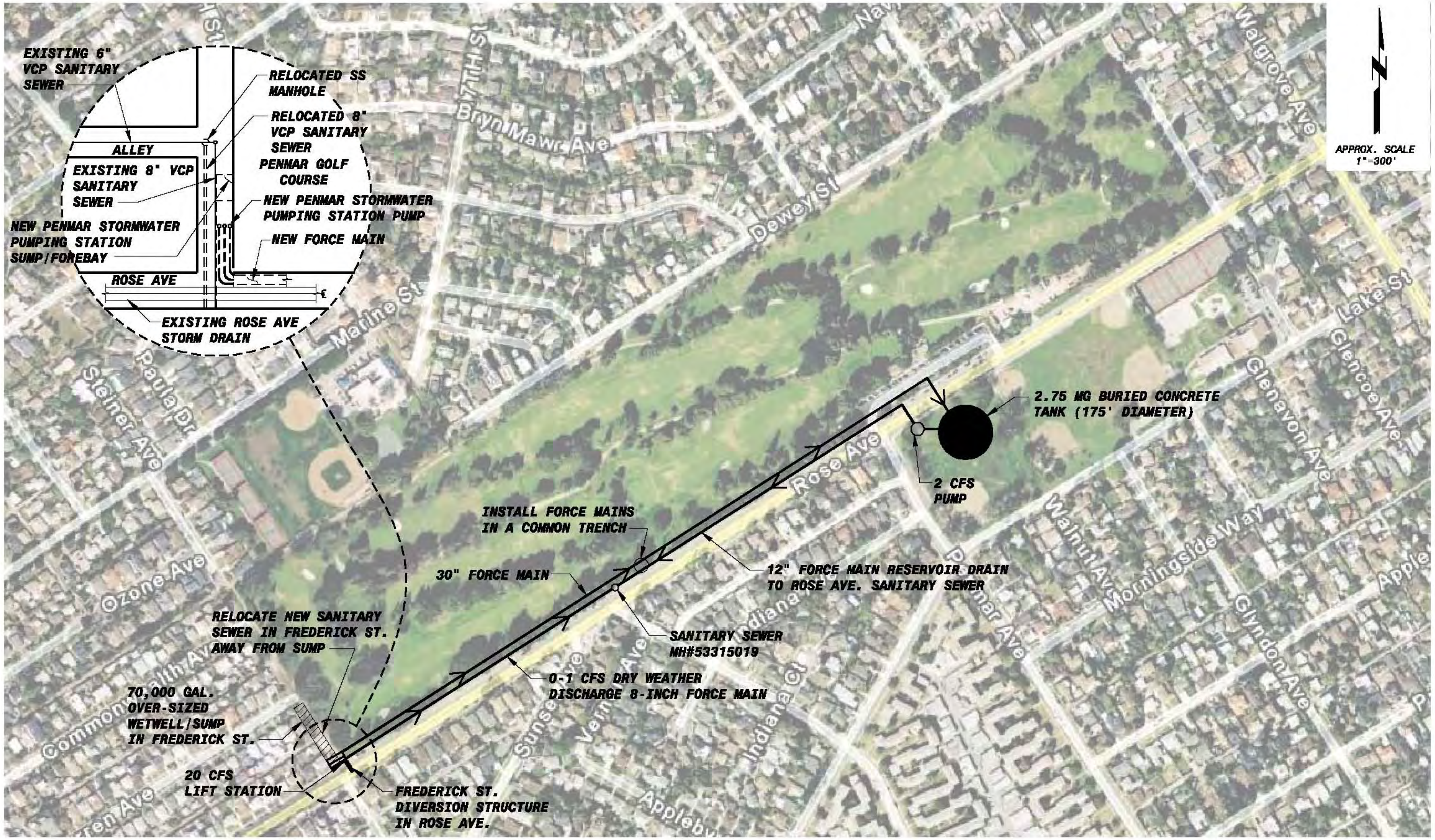
1.0 PROJECT BACKGROUND AND DESCRIPTION

The Penmar Water Quality Improvement and Runoff Reuse Project (Project) will be located at Penmar Golf Course and Penmar Recreation Center near the western edge of the City of Los Angeles, immediately south of the City of Santa Monica. The project is described in a report prepared by the City of Los Angeles Bureau of Sanitation (LABOS) entitled Penmar Water Quality Improvement and Runoff Reuse Project Concept Report, issued in March 2007.

The purpose of the project is to assist the City in attaining compliance with a Wet Weather Total Maximum Daily Load (TMDL) requirement for bacteria established by the Los Angeles Regional Water Quality Control Board. The Brown and Caldwell/Black & Veatch (BC/B&V) team relied on the Concept Report to prepare an estimated fee and level of effort sufficient to complete design of the Project. Recent findings, however, have caused the City (Los Angeles Bureau of Engineering [LABOE] and LABOS) to make significant modifications to the scope and configuration of the project to improve its ability to meet the wet weather bacteria TMDL. The revised conceptual layout for the project is shown in Figure 1 of this TM.

One component of the Project that has been changed significantly from what was proposed in the Concept Report is the underground detention tank. The Concept Report states (page 5) that the components of the project shall include "…an underground detention tank (2,000,000 gallons)…". No other information regarding the design or specifications for the tank is provided in the report. The original proposed location of this facility is not mentioned in the text, but is shown on the site schematic layout (Concept Report, Figure 3) on page 20 as being beneath Frederick Street at the western edge of the Penmar Golf Course. Figure 1 of this Technical memorandum shows the new proposed location of the underground detention tank, 2,200 feet east on Rose Avenue from Frederick Street at the Penmar Recreation Center. The size of the proposed tank has also been increased to 2,750,000 gallons.

The Concept Report also did not provide any definitive guidance regarding what the buried underground detention reservoir should consist of, but it did provide some indication (page 9) that pre-engineered plastic stormwater detention systems such as Rainstore™, StormCell®, or ADS (StormTech) were all viewed as potentially acceptable alternatives. The BC/B&V team accordingly included an allowance of staff time in our estimated level of effort for the project to prepare a site plan and draft a performance-based "or approved equal" specification for the pre-engineered detention component of the project, so that bidders could select the most cost-competitive system for inclusion in their bids.



NOT SHOWN:
OFFSITE SANITARY SEWER
UPGRADES ON OAK WOOD AVE.,
RIALTO COURT, CRESCENT PLACE,
AND ABBOT KINNEY BLVD.

CITY OF LOS ANGELES
PENMAR WATER QUALITY IMPROVEMENT PROJECT
MODIFIED CONCEPT REPORT
SCENARIOS N OR P
GENERAL ARRANGEMENT
REV. 8/4/08

Figure 1 – Revised Conceptual Layout of the Penmar Water Quality Improvement Project

When a closer examination of the various pre-engineered plastic stormwater detention systems was undertaken by LABOS, LABOE staff and the BC/B&V team, the pre-engineered plastic detentions systems were all eventually dropped from further consideration for the following reasons:

- None of the proposed pre-engineered systems were (at the time) accepted by the City of Los Angeles for use in public works projects.
- The small cells that all of the pre-engineered plastic detention systems use in one form or another appear to make long-term cleaning, inspection, and maintenance of the inside of the reservoir problematic.
- The structural integrity of all of the proposed systems, particularly the roof element and how it is supported by the rest of the structure to meet seismic loads, could not be adequately determined from manufacturer-supplied information. This was especially important for the Penmar Recreation Center site, which would have a significant dead load imposed upon the reservoir roof by soil backfill required for re-establishment of grass cover post-construction. This would make selection, evaluation, and bidding these systems a challenge.
- Design of a pre-engineered plastic stormwater detention system, which would be very light and essentially neutrally buoyant, would require extensive anti-floatation features in the design to ensure that it remained in the ground, given the fairly high groundwater conditions that exist at the site.,

After further evaluation, the BC/B&V team suggested to LABOE that a buried circular prestressed concrete reservoir would offer the most cost effective stormwater detention solution for the Penmar project, and could probably be accommodated within the established budget for the project that has been prepared by the B&C/B&V team and submitted to LABOE.

The team then arranged for a workshop presentation to LABOE and LABOS staff representatives by representatives from DYK Inc. (DYK), of El Cajon, California, a regional supplier of prestressed concrete circular reservoirs, on April 23, 2008. At the workshop, it was pointed out to the City staff that the circular prestressed concrete reservoir option has already been used successfully on a number of potable water storage projects by the City of Los Angeles Department of Water and Power (LADWP) . A significant advantage of the circular prestressed reservoir system that was also covered at the workshop is that it is expected to have a lower cost-per-gallon of storage capacity than a conventional reinforced concrete tank of equivalent storage volume for buried applications, because the prestressed system requires less concrete and reinforcing steel than a conventional reinforced concrete tank.

At the conclusion of the DYK workshop, no objections were expressed by any of the LABOS or LABOE attendees about the proposed use of a prestressed concrete reservoir for the Penmar Project, and it was affirmed that the BC/B&V team should proceed with the conceptual design of the Penmar Project with a prestressed concrete reservoir as a key component.

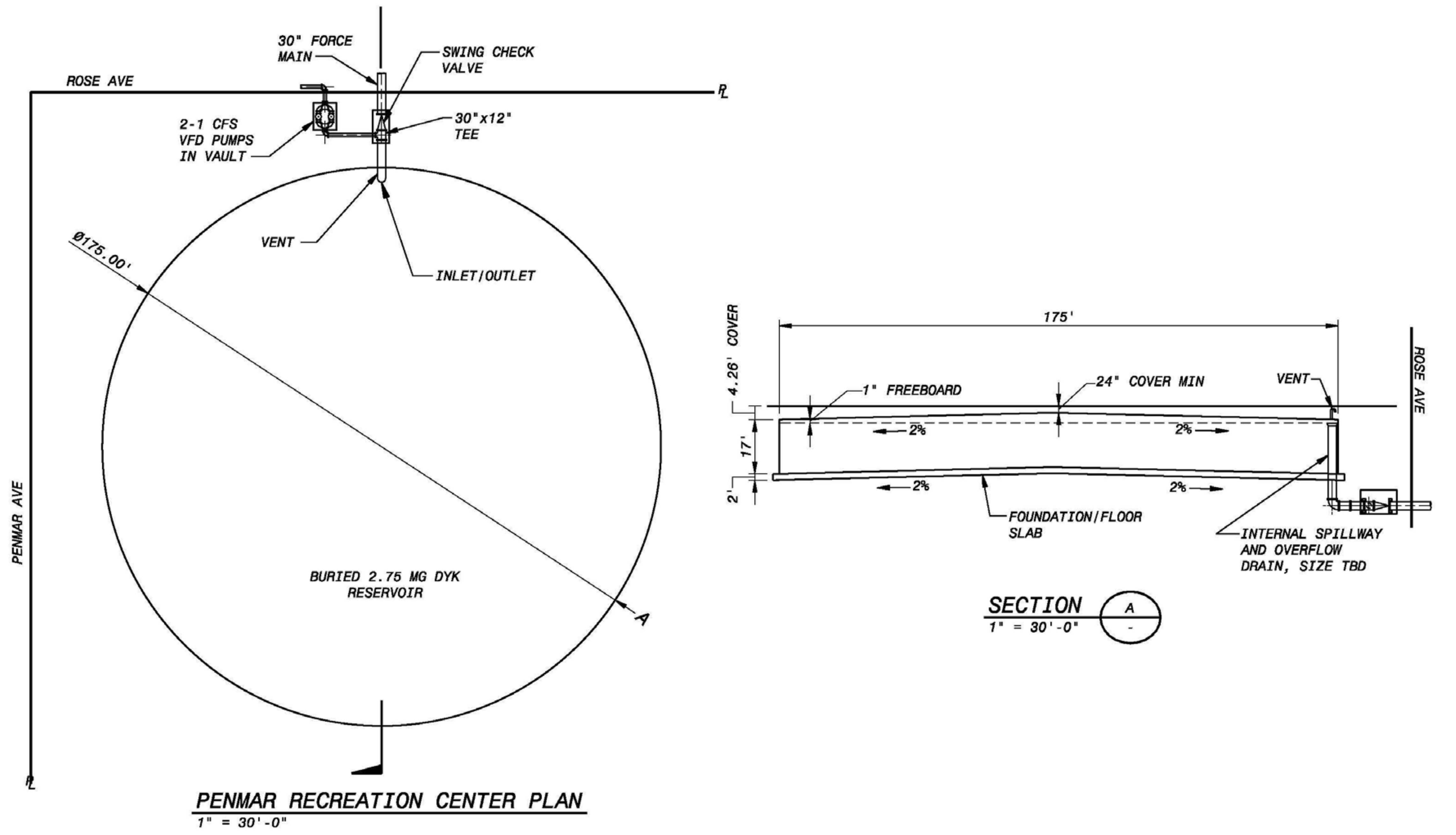
2.0 BURIED RESERVOIR GENERAL DESIGN REQUIREMENTS

2.1 Reservoir Depth and Diameter

A geotechnical investigation for the Penmar Project was conducted by our geotechnical subconsultant Ninyo & Moore and summarized in a report dated June 13, 2008. The investigation included one geotechnical boring at the proposed Penmar Recreation Center reservoir site. The boring encountered groundwater at a depth of 20.5 feet below the ground surface. A follow-up conversation with Larry Jansen, Principal geologist for Ninyo & Moore disclosed that in some years, seasonal high groundwater levels may be as much as 10 feet higher than the groundwater elevation encountered in the boring. Based on this observation, appropriate anti-floatation measures will be included in the design of the buried reservoir, assuming a maximum groundwater elevation of 10 feet below the ground surface. A copy of the geotechnical report with site-specific design information is included as an appendix to this report. In order to avoid having to deal with groundwater as a significant design issue, it is therefore recommended that the depth of the tank, including its sod cover and foundation slab, not exceed approximately 21 feet in depth.. This means that the reservoir will have an internal diameter of approximately 175 feet, which includes a preliminary allowance for the storage capacity that will be taken up by roof support columns, and a side wall water depth of 17 feet (16 feet maximum water depth plus 1 foot of freeboard) to achieve the desired 2.75 million gallon storage capacity. A conceptual plan and sectional layout for the buried prestressed concrete reservoir is shown in Figure 2. The project geotechnical report includes a refined estimate of the range of groundwater elevation fluctuation so that bidders can include appropriate allowances in their bids for temporary dewatering during construction of the reservoir. A dewatering allowance for the reservoir construction was included in the preliminary cost estimate for the project that was previously submitted to LABOE by the BC/B&V team.

2.2 Reservoir Inlet/Outlet

As shown in Figure 2, the reservoir will be supplied by a 30-inch force main from the Penmar Pumping Station at Frederick Street (see TMs 4 and 5 for details). Installation of a swing check valve on the 30-inch force main that supplies the reservoir immediately upstream of the 30-inch by 12-inch tee fitting in the reservoir isolation valve vault, will allow the reservoir to be filled and drained by a single inlet/outlet structure plumbed into the lowest point in the floor at the edge of the reservoir. The tee fitting in the isolation valve vault will be blind-flanged on one 12-inch side, to serve as a connection point to a future disinfection and reuse component (Phase 2) of the project. Note that no disinfection of water stored in the reservoir is contemplated or included in the design of the reservoir. Disinfection requirements for water discharged from the reservoir for possible non-potable reuse or discharge to the storm sewer will be determined in Phase 2 of the project. The other 12-inch side of the fitting will connect to the two 1 cfs capacity variable frequency drive (VFD) suction pumps installed in an adjacent vault that will be used to drain the reservoir and send the stored stormwater to the sanitary sewer line in Rose Avenue (allowable reservoir draft rate plus possible direct discharge from the pumping station wet well to the sanitary sewer shall not (combined) exceed 1.5 cfs between Midnight and 6:00 AM, and 1 cfs at all other times, per LABOS). The depth required for the vaults will be determined by calculating the required submergence for the suction pumps to prevent cavitation. Consideration will also be given during the design phase to making the reservoir floor slope asymmetrical so the drain can be located closer to the wall of the reservoir, thereby avoiding the need to design the inlet/outlet pipe to be able to resist the weight of the reservoir and its contents.



CITY OF LOS ANGELES
PENMAR WATER QUALITY IMPROVEMENT PROJECT
PENMAR 2.75MG RESERVOIR
PLAN AND SECTION

Figure 2 – Conceptual Buried 4 MG Storage Reservoir at Penmar Recreation Cente

2.3 Reservoir Internal Overflow Spillway

The reservoir design will include an emergency overflow spillway, which shall be connected to the Rose Avenue storm drain culvert. The spillway will begin to receive overflow if the reservoir's maximum 16-foot storage depth is exceeded and water begins to encroach into the 1-foot of freeboard included in the design of the reservoir. The spillway would only come into service if the "reservoir full – pump shut off" sensor ever failed and the Penmar Pumping Station at Frederick Street in turn did not shut off.

2.4 Location of Access Hatch

It is anticipated that the reservoir will be equipped with a standard on-grade access hatch to provide for access for inspection and maintenance of the interior of the reservoir. Since the reservoir will be sited in a recreational area, every attempt will be made to place the access hatch at a location that will not interfere with use of the existing baseball field. (i.e., not in the middle of the outfield, for example). The B&C/B&V team will consult with the City of Los Angeles Department of Recreation and Parks (LARAP) staff of the preferred location for the access hatch and what sort of protective measures should be incorporated into its design to prevent both unauthorized access to the reservoir and injury to the public from any accidental encounters with the hatch structure.

2.5 Reservoir Vents

Air vents with sufficient air exchange capacity will be included in the reservoir design. The design and location of these vents (two vents are anticipated at this time) will also be coordinated with LARAP staff at the same time that the location and design of the reservoir access hatch is discussed.

3.0 BURIED RESERVOIR DESIGN

As was discussed in Section 2 of this TM, the BC/B&V team, relied on the project components that were specified in the Penmar Project Concept Report as the basis for our fee estimate for design services, and preparation of detailed plans and specifications for a buried prestressed concrete reservoir was not anticipated when the original design fee estimate was prepared for the Penmar project, It is now proposed that a prestressed, wire-wrapped concrete tank be used as an economical structure to serve as the buried 2.75 MG stormwater detention reservoir for the Penmar Project. A contract amendment has been prepared and submitted to LABOE for this additional design work, along with other design modifications that have been requested by LSBOE and LABOS. The BC/B&V team is prepared to start design work on the buried reservoir and the other revised components of the Penmar project as soon as we receive approval for the contract amendment.

It is recommended that the reservoir be designed and constructed by one of the following suppliers:

- DYK Prestressed Tanks, Inc.
- Natgun Precast Concrete Tanks
- Preload Company, Inc.

We are not aware of any other qualified suppliers for this type of reservoir system.

The reservoir shall be a liquid-containing, circular, prestressed concrete tank and consist of the following key features:

- Conventional, cast-in-place reinforced concrete floor and roof slab.
- Interior cast-in-place concrete columns.
- Cast-in-place concrete core wall with steel diaphragm wound with prestressed reinforcement.
- Shotcrete exterior wall and protective coating.

3.1 Governing Codes and Standards

The structural design procedures, loads and provisions for the reservoir tank shall comply with applicable codes and standards as follows:

- California Building Code (CBC), 2007 Edition.
- American Society of Civil Engineers (ASCE), ASCE 7-05, Minimum Design Loads for Buildings and Other Structures
- American Water Works Association (AWWA), AWWA D110, Wire and Strand-Wound, Circular, Prestressed Concrete Water Tanks.
- American Concrete Institute (ACI), ACI 318-05, Building Code Requirements for Structural Concrete.
- ACI 350.3-06, Seismic Design of Liquid-Containing Concrete Structures and Commentary.
- ACI 372R, Design and Construction of Circular Wirewrapped Prestressed Concrete Structures.
- American Association of State Highway and Transportation Officials (AASHTO), Standard Specification for Highway Bridges – for Vehicle and Traffic Loads.

Although there are several codes, standards, and design aids used by various structural engineers, the above list is intended to identify the primary documents that establish the minimum design criteria for the tank. Modification or the uses of equivalent standards may be used only after approval by the B&V/B&V team lead engineer. Proposed changes to the design criteria and/or design standards shall be submitted to the Owner for review and approval prior to implementation. In addition, the 90% complete reservoir plans and specifications shall be submitted to the City of Los Angeles Division of Building and Safety (LADBS) for approval prior to completion of final design.

The following information is typically contained in the specifications for a designed-by-supplier prestressed concrete tank.

3.2 Prestressed Concrete (PSC) Tank Supplier Qualifications

The tank supplier shall be qualified and experienced in the design and construction of strandwrapped, prestressed concrete tanks. The tank supplier shall have successfully completed a minimum of five (5) similar projects within the last ten (10) years. Documentation that verifies this minimum experience shall be submitted to the Owner for review and determination of the acceptability of the tank supplier’s qualifications for this project.

3.3 Important Design Criteria and Salient Design Features of Prestressed Concrete Tanks

The following specific design criteria and salient characteristics are considered essential to the successful construction of a prestressed concrete tank:

a. The design should incorporate flexible liners to be installed under the reservoir floor and subgrade to prevent water migration.

b. Compatibility of the reservoir design with the site soil conditions requirements as indicated in the project Geotechnical Report.

c. Satisfactory response of the tank under design seismic conditions and all other specified loading conditions.

d. A minimal number of vertical wall joints.

e. PVC waterstops between each vertical wall joint.

f. Conventional two way, flat slab reinforced concrete roof and slope as shown on the Drawings. (No post tensioned, precast, waffle, dome or other types of roof systems will be allowed.)

g. Wall-to-roof connection design shall be shown on the project Drawings.

h. External coatings or moisture protection in conformance with the project specifications.

i. Determination of an acceptable tank leakage rate and acceptable leakage test results that are in conformance with the project specifications

j. A “freed” condition between wall and wall-footing by use of neoprene bearing pads to allow for minor movement without accumulating stress during a seismic event.

k. A PVC waterstop between the reservoir corewall and the wall footing.

l. Properly formed, poured and reinforced poured-in-place walls.

m. Vertical prestressing tendons consisting of individual threadbars encased in PVC tubing.

n. External, continuously strandwrapped circumferential prestressing providing the desired bond with the shotcrete in addition to the final force specified. (No stressing system based on single wire wrapping, pulling wire through a die or jack operated, circumferential tendon or cable systems, based on circumferential movement of the prestressing steel after it is placed in/around the wall, will be allowed.)

o. A positive anchoring system of circumferential prestressing to the corewall and spaced as shown on the Drawings.

p. Maximum allowable spacing of circumferential prestressing shall be shown on the project Drawings.

q. Galvanized circumferential prestressing for corrosion resistance and long life performance.

r. Continuous and instantaneous recording and correction of all applied prestressing forces.

s. A maximum acceptable stress tolerance of + 1.5% at any point along the prestressing steel.

t. No variation in prestressing forces due to friction losses.

u. Use of an automated, wet mix 10 sack shotcrete application system to apply shotcrete over a fully abrasive- blasted concrete corewall.

3.4 Design Load Criteria

The buried concrete tank shall be designed to support loads in accordance with the applicable codes and design recommendations. Design loads used shall be appropriate for the actual conditions that the tank is expected to be subjected to during its service life. Compliance with the code design provisions shall ensure that adequate strength and serviceability of the tank are met. The following is a partial summary of the significant load requirements:

3.4.1 Dead Loads

Dead loads shall consist of the self-weight of the structure and all permanently-installed equipment, including but not limited to process equipment, piping, ductwork, soil overburden and other mechanical or electrical services.

3.4.2 Live Loads

Live loads shall consist of uniform and concentrated loads as appropriate. Unless noted otherwise, design live loads shall be as indicated on Tables 1607.6 and 1607.1 within the CBC.

As a minimum, the tank roof shall be designed for HS15-44 AASTHO live loads. Impact from vehicle loading shall be included in the design.

3.4.3 Seismic Loads

Seismic loads and design methods shall be in compliance with the appropriate code standard for tank structure type. Design parameters regarding specific site coefficients and adjusted Maximum Considered Earthquake (MCE) response accelerations shall be as indicated in the project Geotechnical Report (attached as Appendix A to this TM).

The tank structural design and its components shall be assigned an Importance Factor of 1.0 for seismic loading.

3.4.4 Soil Loads

Foundation design shall be based upon the recommendations indicated in the project Geotechnical Report (attached as Appendix A to this TM).

Below grade wall design shall use lateral soil loads as indicated in the project Geotechnical Report. Design shall include effects from both static and dynamic loading.

Construction sequencing and backfilling shall be considered during design of all below grade structures. Backfill work shall be permitted to begin only after the completion of the structural top slab. Backfill shall be installed in uniform lifts around the perimeter of the tank to prevent any significant unbalanced lateral loading condition from occurring.

Where hydrostatic uplift may occur, resistance shall be provided by increasing the dead weight of the structure to obtain a minimum factor of safety of 1.25 against flotation.

All structures and components shall be designed to adequately support all applicable loads in combination as required in CBC Section 1605. Live loads shall be arranged to cause maximum shear and bending stresses along the structural member.

4.0 CONSTRUCTION ISSUES

As shown in Figure 1, the proposed reservoir will be constructed at the Penmar Recreation Center on the south side of Rose Avenue, opposite the parking area for the Penmar Golf Course. It is anticipated that approximately 3½ acres, comprising the western end of the Penmar Recreation Center will be required for the reservoir, soil stockpile, and contractor's work area. The reservoir site contains a lighted baseball field and turf area and is presently used for a variety of recreational activities and youth team sports. It is estimated that the construction of the reservoir will require approximately 10 months to complete, which means that essentially one full year's worth of recreational activities that presently take place at the site will need to be accommodated elsewhere.

Representatives of the City of Los Angeles Department of Recreation and Parks (LARAP) have attended and participated in several of the Penmar Project workshops to date, and they are aware of the project and its potential impact on use of the Penmar Recreation Center. While no agreement has been brokered yet between LABOE and LARAP, there are three general principals that must be addressed in any agreement:

A. Official notification to LARAP and the general public who use the facility of the construction schedule as soon as possible after it has been confirmed, so that the process of re-scheduling activities that would normally occur at the construction site can start.

B. Complete fencing and security screening of the site so that the remainder of the Penmar Recreation Center can continue to function as usual during the construction period.

C. Full restoration of the construction site to "at least" the pre-construction condition so that it can be returned to its pre-project use. It is anticipated that this will include finish grading of the entire site (reservoir plus soil stockpile and contractor's staging area) and re-establishment of any electrical and irrigation lines that are impacted by the construction activity.

The most salient feature of the construction of the reservoir will be the large, approximately 23-foot deep excavation that will need to be completed before actual construction of the reservoir can commence. The proposed reservoir is within a baseball field. One of the reasons why this site was selected was to enable the reservoir to be constructed without the need to remove any trees. It will be up to the selected contractor to determine the means and methods used for the excavation, in terms of the use of shoring and bracing or benching to safely accomplish the excavation, but avoiding construction-related impacts to trees will be stated in the project specifications.. Excavated material will become the property of the contractor to either temporarily stockpile on-site or dispose of off-site, but it is recognized that a significant portion of the excavated material will eventually be re-used on-site for backfill around the completed tank, provide cover for re-establishment of a grass surface over the top of the tank, and to mass grade the whole disturbed area at the end of the project.

At present, it is anticipated that the buried reservoir will be advertised for bids as an element of the overall Penmar Project. Since the reservoir site is separated from the rest of the project, it would also be possible to put the reservoir out to bid on a separate schedule. LABOE should consider the pros and cons of both options and then select the one that, in their judgment, offers the most advantages to the City in terms of cost competitive bidding and schedule.

5.0 PUBLIC OUTREACH

As soon as LABOE accepts the final version of this Technical Memorandum, the project public outreach subconsultant will be authorized to prepare a detailed public outreach plan that specifically addresses public impacts associated with the reservoir construction. The plan will be presented to LABOE for review and approval prior to implementation.

6.0 TRAFFIC CONTROL

Reservoir construction will require the temporary closure of curb parking on the east side of Penmar Avenue between Indiana and Rose Avenues. A construction entrance for the contractor will also be located on the Penmar Avenue side of the reservoir construction site. Short-duration closures of one or more lanes on Rose Avenue may be required to allow the contractor to make connections between the reservoir, the inlet and outlet force mains The Contractor will be required to coordinate the traffic closure for this portion of the work with the closures needed to perform all other portions of the work. An overall project traffic control plan will be included in the project plan set.

The City of Los Angeles uses the Manual of Uniform Traffic Control Devices (MUTCD) by the Federal Highway Administration (FHWA) and the Work Area Traffic Control Handbook (WATCH) by American Public Works Association.

Contacts for approval of the traffic control plan as it effects Penmar Municipal Golf Course and the Penmar Recreation Center are: Liza Mendoza, Facility Director at (310) 396-8735 and Pete Frey, Penmar Golf Operations Supervisor at (818) 246-1435.

Specific traffic mitigation details shall be submitted to City Traffic Engineering Division before executing mitigation plans in the field.

7.0 OTHER RESERVOIR CONSTRUCTION-RELATED ISSUES

Noise— sound walls, sound blankets, and low noise generating equipment are used to muffle noise from work areas; noise must not exceed specified levels. Exterior noise levels during construction shall be maintained under 50 dBA and should comply with the City of Los Angeles municipal code and applicable Noise Ordinances within the project site.

Work Schedules— Permissible hours of work shall be determined in consultation with the City of Los Angeles Bureau of Engineering and in reference to the project specifications.

Dirt and Dust— Daily street sweeping and water spreading; cleaning services when necessary; car wash services when necessary.

Parking and Traffic Flow— Safe and adequate pedestrian and vehicle access shall be maintained at all times to residences and businesses.

Safety— K-rail enclosures shall be placed around all open excavations; crossing guards may be required at impacted intersections. Steel plates shall be placed over open trenches at the end of each day’s work.

Specific safety requirements will be developed during the design phase and incorporated into the specifications for the Project.

Special care shall be exercised during construction for all other existing utilities and improvements that are not designated for removal or relocation, details of the existing nearby utilities are not available at the present time, but will be incorporated into the project design as soon as the information is collected by the project surveyor.

8.0 PERMITTING REQUIREMENTS

Grading and structural approvals for the reservoir will be obtained from LADBS. Other construction approvals for the reservoir will be covered under the permits required for other elements of the Penmar project.

9.0 RECOMMENDATIONS

The following recommendations are presented for LABOE consideration with regard to the buried reservoir element of the Penmar Water Quality Improvement Project:

1. 1. LABOE immediately begin negotiations with LARAP for use of the Penmar Recreation Center Site for the buried reservoir so that any key LARAP issues can be efficiently incorporated into the project plans.
2. 2. LABOE confirm the design approach for the buried reservoir outlined in this Technical Memorandum.
3. 3. LABOE confirm the use of a circular prestressed concrete reservoir with the approximate dimensions contained in this Technical memorandum for the Penmar Water Quality Improvement Project.

ATTACHMENT A

Preliminary Geotechnical Findings by Ninyo and Moo

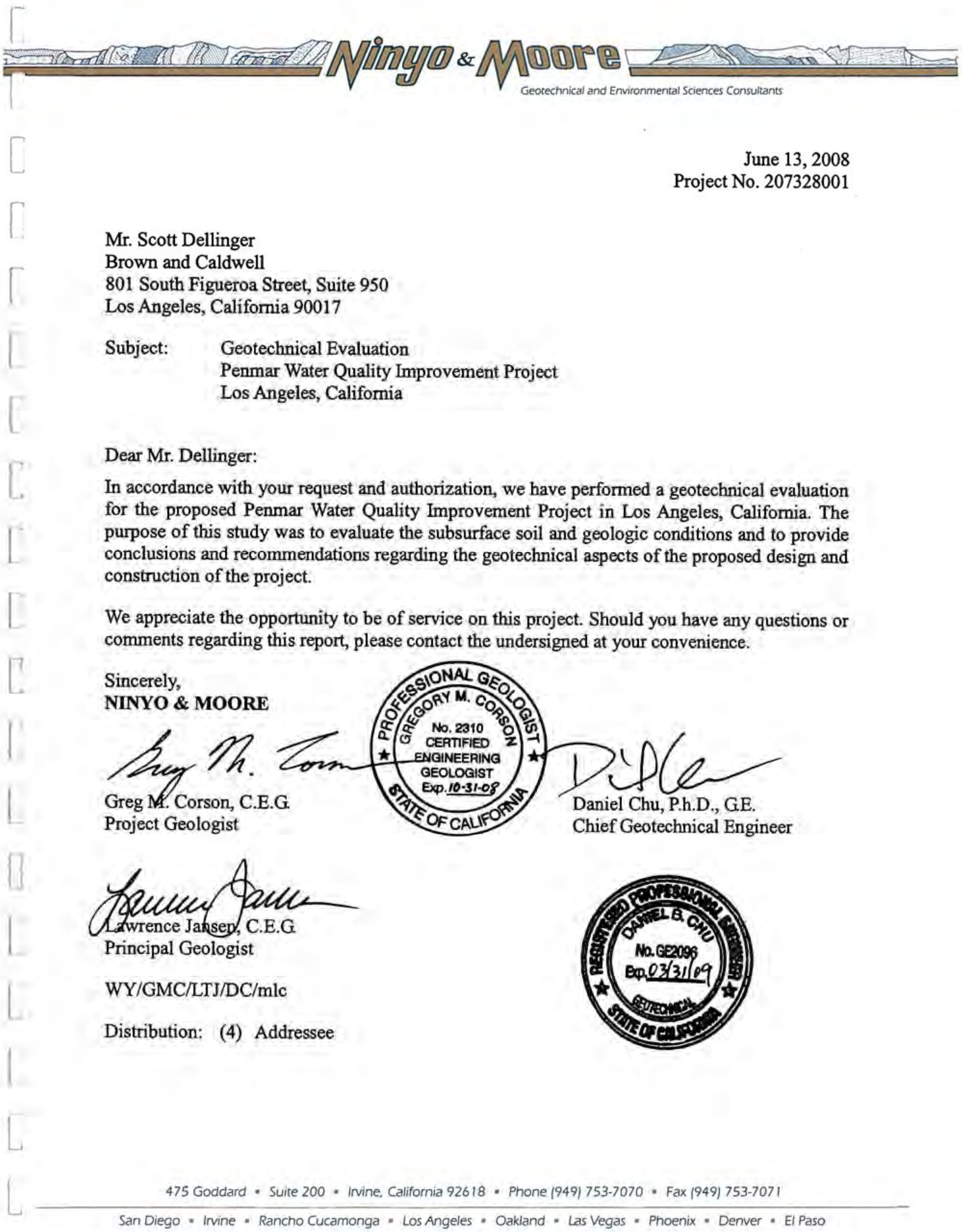
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

GEOTECHNICAL EVALUATION PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA

PREPARED FOR:
Brown and Caldwell
11111 Santa Monica Boulevard, Suite 750
Los Angeles, California 90025

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
475 Goddard, Suite 200
Irvine, California 92618

June 13, 2008
Project No. 207328001



Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

June 13, 2008
Project No. 207328001

Mr. Scott Dellinger
Brown and Caldwell
801 South Figueroa Street, Suite 950
Los Angeles, California 90017

Subject: Geotechnical Evaluation
Penmar Water Quality Improvement Project
Los Angeles, California

Dear Mr. Dellinger:

In accordance with your request and authorization, we have performed a geotechnical evaluation for the proposed Penmar Water Quality Improvement Project in Los Angeles, California. The purpose of this study was to evaluate the subsurface soil and geologic conditions and to provide conclusions and recommendations regarding the geotechnical aspects of the proposed design and construction of the project.

We appreciate the opportunity to be of service on this project. Should you have any questions or comments regarding this report, please contact the undersigned at your convenience.

Sincerely,
NINYO & MOORE

Gregory M. Corson
No. 2310
Exp. 10-31-08

Greg M. Corson, C.E.G.
Project Geologist

Daniel Chu, P.h.D., G.E.
Chief Geotechnical Engineer

Lawrence Jansen, C.E.G.
Principal Geologist

Daniel B. Chu
No. GE2096
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WY/GMC/LTJ/DC/mlc

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1. INTRODUCTION

In accordance with your request, we have performed a geotechnical evaluation for the proposed Penmar Water Quality Improvement Project located at 1233 Rose Avenue in Venice, California (Figure 1). The project is a joint collaboration between the City of Los Angeles and City of Santa Monica to improve water quality of the Santa Monica Bay and Pacific Ocean. The water quality will be improved through the use of Best Management Practices (BMPs) to reduce the introduction of pollutants associated with stormwater runoff into the stormwater conveyance system. The project will target a drainage area of approximately 1,468 acres. The purpose of our study was to evaluate the subsurface soil and geologic conditions of the project site and to provide geotechnical recommendations for the design and construction of the proposed BMPs. Our evaluation was performed in generally accordance with our proposal dated August 27, 2007. This report presents our findings, conclusions, and recommendations based on our background review, site reconnaissance, subsurface evaluation, laboratory testing, and geotechnical analyses.

2. SCOPE OF SERVICES

The scope of our geotechnical services included the following:

- Review of readily available geologic maps, published literature, stereoscopic aerial photographs, and in-house information.
- Review of seismic data, including fault hazard maps, seismic hazards maps, and other readily available data regarding geologic and seismic hazards within the project areas.
- Performance of a site reconnaissance to evaluate the existing site conditions and mark proposed boring locations for utility clearance.
- Subsurface exploration consisting of the drilling, logging, and sampling of eight hollow-stem auger borings to depths of up to approximately 51½ feet. The borings were logged by a representative of our firm. Bulk and relatively undisturbed soil samples were collected at selected intervals for laboratory testing.
- Infiltration testing at four boring locations to evaluate the percolation rates of the subsurface soils.
- Laboratory testing of selected soil samples to evaluate in-situ moisture and dry density, sieve analysis, Atterberg Limits, expansion index, consolidation, and corrosivity.

- Compilation and geotechnical analysis of background information and field and laboratory data.
- Preparation of this geotechnical report presenting our findings, conclusions, and recommendations regarding the proposed project.

3. SITE DESCRIPTION

The project is generally located within the Penmar Golf Course and Penmar Recreation and Park in the City of Los Angeles (Figure 1). The golf course is bounded by Dewey Street on the northwest, Glenavon Avenue on the northeast, a closed portion of Frederick Street on the southwest, and Rose Avenue on the southeast. Penmar Park is located on the opposite side of Rose Avenue near the middle of the golf course. Dewey Street marks the approximate boundary between Los Angeles and Santa Monica. Land use bordering the golf course and park includes light commercial, industrial, and high-density residential.

The project site is located in a relatively flat, low-lying area that drains gently to the southwest. Ground surface elevations range from approximately 25 feet above mean sea level (MSL) along the southern limits of the project area to approximately 35 feet MSL at the northeast corner of the Penmar Golf Course. A terrace is located north and northwest of the site with an elevation of approximately 100 feet MSL. Historical topographic maps of this area indicate that a wetlands or marshy area was present in the southwesterly portions of the project site (USGS, 1913). Personnel from the golf course indicated that the area was historically used as a dump site.

4. PROPOSED CONSTRUCTION

Based on our review of the Phase 1 Design Elements prepared for the project dated April 3, 2008, structures associated with the project include new BMPs for treating stormwater runoff, including a diversion structure, pump station, underground reservoir, and underground force main piping (Figure 2). The project includes relocating existing utilities along Frederick Street and the rehabilitation of an existing sewer along Lincoln Boulevard. Generalized descriptions of each structure are provided below.

- **Diversion Structure** – The new diversion structure will connect to two existing approximately 10-feet by 14-feet box culverts in Rose Avenue and divert stormwater flow to the

new pump station. Diversion of the flow will be passive and routed by gravity to the pump station. The structure will have an opening size of approximately 10 feet by 5 feet with a point of connection at the lower floor of box the culverts.

- **Pump Station** – The new pump station will be approximately 180 feet by 25 feet with a maximum depth of approximately 30 feet below the ground surface. The storage capacity will be approximately 200,000 gallons. The station will include 2 pumps that connect to the sewer system and 4 pumps that connect to the new underground reservoir. The pump station will include trash racks/screens constructed of stainless steel and removable by a hoist.
- **Underground Reservoir** – The new reservoir will hold approximately 4 million gallons (MG). The reservoir will have an approximately 210-feet diameter and total depth of approximately 24 feet below the ground surface. The reservoir will be constructed with cast-in-place concrete and will have approximately 15-feet high inner walls, an approximately 1-foot-thick floor, and approximately 2-feet-thick roof. The roof will be covered by approximately 3 feet of ground cover.
- **Force Mains** – Two new force mains will be constructed between the underground reservoir and the pump station. The pipe diameter, material types, and length are still to be determined.
- **Frederick Street Utilities Relocation** – Existing utilities within Frederick Street will be relocated as part of the project.
- **Sewer Rehabilitation (Lincoln Boulevard)** - An existing sewer pipeline(s) will be rehabilitated as a part of the project.

5. SUBSURFACE EXPLORATION AND LABORATORY TESTING

Our subsurface evaluation was conducted on December 21 and 27, 2007, and included the drilling, logging, and sampling of eight small-diameter borings with a truck-mounted drill rig utilizing 8-inch-diameter hollow-stem augers. The approximate locations of the borings are presented on the Boring Location Map (Figure 2). The borings were explored to depths ranging from approximately 21½ to 51½ feet below the ground surface and were logged by a representative of our firm. Bulk and relatively undisturbed soil samples were obtained at selected depths for laboratory testing. The logs of the exploratory borings are presented in Appendix A.

Laboratory testing of representative soil samples was performed to evaluate in-situ moisture content and dry density, gradation analysis, percentage of particles finer than the No. 200 sieve, Atterberg Limits, expansion index, consolidation potential, collapse potential, and soil corrosiv-

ity. The results of our in-situ moisture content and dry density evaluation are presented on the borings log in Appendix A. The remaining laboratory testing results are presented in Appendix B.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The subject site is located in the northwestern portion of the Los Angeles Basin, which is situated at the northwest end of the Peninsular Ranges geomorphic province of southern California. The Los Angeles Basin has been divided into four structural blocks, which are generally bounded by prominent northwest trending fault systems: the Northwestern Block, the Southwestern Block, the Central Block, and the Northeastern Block (Norris and Webb, 1990). The site is located in the Southwestern Block, which is bounded by the Newport-Inglewood fault to the northeast and the Palos Verdes Hills fault to the southwest, the Santa Monica Mountains to the northwest, and the Pacific Ocean to the south and southeast. The block is underlain by up to approximately 20,500 feet of Miocene-age or younger marine deposits over basement rock consisting of the Catalina Schist.

According to Dibblee (1991), the site is underlain by younger alluvium consisting of unconsolidated gravel, sand, and silty clay with interbeds of gravelly and sandy stream deposits (Figure 3) associated with the Ballona Creek drainage. The State of California (1998) maps the site as being underlain by younger alluvium consisting of alternating beds of silt, clay, and fine to medium sand with some gravelly layers. Dibblee (1991) maps the terrace north of the project site as marine deposits consisting of sand, pebbly sand gravel and silt. Our review of geologic literature and stereoscopic aerial photographs did not indicate the presence of landslides or active faulting at the site.

The materials encountered in the borings generally consisted of surficial fill soils underlain by alluvial deposits to the depths explored of approximately 21½ to 51½ feet. Fill soils generally consist of loose to medium dense, silty sand and clayey sand and stiff to very stiff sandy clay to depths up to approximately 10 feet. Below the fill, alluvial soils generally consisting of stiff to very stiff sandy clay and silty clay interbedded with clayey silt, silty sand and poorly graded sand were encountered in our exploratory borings to the depths explored of 51½ feet. More detailed descriptions of the subsurface materials are presented on the boring logs in Appendix A.

7. FIELD PERCOLATION TESTING

Percolation testing was performed on December 27 and 28, 2007 at borings B-1, B-5, B-6 and B-7 to evaluate the percolation rate of the on-site soils. The testing was performed for the purpose of evaluating an infiltration system as part of the project. At each of these boring locations, a separate percolation test hole was drilled to depths of approximately 10 to 15 feet. The infiltration tests were performed at a depth interval of approximately 5 to 10 feet for B-6 and a depth interval of approximately 5 to 15 feet for B-1, B-5 and B-7. Preparation of the borings for percolation testing included placing a 2-inch-diameter PVC pipe in the borings, backfilling around the lower approximate 5 feet of pipe with clean sand, and placing a bentonite cap above the sand. The lower approximately 5 feet of PVC pipe within the sand zone was slotted. The infiltration zone was pre-soaked on December 27, 2007. Percolation testing was conducted on December 28, 2007 by placing water in the PVC pipe to establish a head of water. The drop in water level was measured over time. The results of our percolation testing are presented in Table 1.

Table 1 – Percolation Test Results

Test Hole	Coefficient of Permeability (ft/day)
B-1 (5-15 feet)	0.05
B-5 (5-15 feet)	0.15
B-6 (5-10 feet)	No Percolation Over 28 Hours
B-7 (5-15 feet)	0.014

Notes:
ft/day – feet per day

8. GROUNDWATER

Groundwater was encountered in our exploratory borings ranging from approximately 16 to 29 feet below ground surface. Based on review of the State of California Seismic Hazard Evaluation (1998), the historical high groundwater level mapped at the site ranges from approximately 30 feet below the ground surface at the northwest corner of the site to less than 10 feet at the southwest corner. It should be noted that fluctuations in the level of groundwater at the subject site may occur due to variations in ground surface topography, groundwater pumping, subsurface

stratification, rainfall, irrigation practices, and other factors which may not have been evident at the time of our evaluation.

9. FAULTING AND SEISMICITY

The subject site is not located within a State of California Earthquake Fault Zone (EFZ), formerly Alquist-Priolo Special Studies Zone (Hart and Bryant, 1997). However, the site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed structure. Figure 4 shows the approximate site location relative to the major faults in the region. Table 1 lists selected principal known active faults that may affect the subject site and the maximum moment magnitude (Mmax) as published for the California Geological Survey (CGS) by Cao, et al. (2003). The approximate fault to site distance was calculated by the computer program FRISKSP (Blake, 2001a).

Table 2 – Principal Active Faults

Fault	Approximate Fault to Site Distance in miles (km)	Maximum Moment Magnitude[1] (Mmax)
Santa Monica	2.2 (3.6)	6.6
Malibu Coast	4.4 (7.1)	6.7
Newport-Inglewood (L.A. Basin)	4.8 (7.8)	7.1
Hollywood	6.2 (10.0)	6.4
Palos Verdes	7.3 (11.7)	7.3
Upper Elysian Park Blind Thrust	11.9 (19.2)	6.4
Anacapa-Dume	13.4 (21.6)	7.5
San Andreas-1857 Rupture	42.5 (68.4)	7.8

Notes:
[1] Cao, et al., 2003.

The principal seismic hazard considerations at the site are ground shaking and surface ground rupture. A brief description of the hazards and the potential for their occurrence on site are presented below.

9.1. Surface Ground Rupture

The potential for surface ground rupture at the project site is considered low due to the lack of known active faults crossing the site. The site is not located within an EFZ. Surface ground cracking related to shaking from distant events is not considered a significant hazard, although it is a possibility.

9.2. Ground Motion

Our evaluation of the ground shaking hazard at the site included review of a probabilistic seismic hazard assessment that consisted of statewide estimates of peak horizontal ground accelerations conducted for California (Peterson, et al., 1996). In addition, for the purposes of evaluating seismically induced geotechnical hazards at the site, a site-specific probabilistic seismic hazard analysis was performed to evaluate anticipated peak ground accelerations (PGAs) using the computer program FRISKSP developed by Blake (2001a). A probabilistic analysis incorporates uncertainties in time, recurrence intervals, size, and location (along faults) of hypothetical earthquakes. This method thus accounts for likelihood (rather than certainty) of occurrence and provides levels of ground acceleration that might be more reasonably hypothesized for a finite exposure period. FRISKSP calculates the probability of experiencing various ground accelerations at a site over a period of time and the probability of exceeding expected ground accelerations within the lifetime of the proposed structure from the significant earthquakes within a specific radius of search. For the present case, a search radius of 62 miles (i.e., 100 kilometers) was selected. The earthquake magnitudes used in this program are based on the current CGS fault model.

The 2007 California Building Code (CBC) recommends that the design of structures be based on the peak horizontal ground acceleration having a 2 percent probability of exceedance in 50 years which is defined as the Maximum Considered Earthquake (MCE). The statistical return period for PGA_{MCE} is approximately 2,475 years. In evaluating the seismic hazards associated with the subject site, we have used the United States Geological Survey (USGS, 2008) ground motion calculator (web-based). The design PGA for the site

was calculated as 0.45g. These estimates of ground motion do not include near-source factors that may be applicable to the design of structures on site.

9.3. Liquefaction and dynamic Settlement of Saturated Soils

Liquefaction is the phenomenon in which loosely deposited granular soils with fines (i.e., silts and clays) content less than approximately 35 percent and located below the water table undergo rapid loss of shear strength when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid rise in pore water pressure causing the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking. Groundwater was encountered at depths of approximately 16 to 29½ feet. Historic high groundwater for the site ranges from approximately 10 feet at the southwest corner of the site to approximately 30 feet at the northeast corner (CDMG, 1998).

The southwest approximate half of the site is located in an area mapped as potentially liquefiable (CDMG, 1999)(Figure 5), and our site-specific investigation revealed the presence of saturated, cohesionless and loose to medium dense soils in a zones between approximately 35 to 40 feet below the ground surface. As a result, an evaluation of the liquefaction potential of the soil layers located below the groundwater was performed. Evaluations of the liquefaction potential of soil layers located below the historic high groundwater level of 10 feet was performed. An idealized soil profile was established for the site based on the subsurface information obtained from our exploratory borings.

An analysis of the earthquake-induced liquefaction potential at the site was performed utilizing the LIQUEFY2 Computer Program (Blake, 2001b). The liquefaction evaluation, assuming the historic groundwater level of 10 feet, indicates that the alluvial sediments between depths of approximately 35 and 40 feet below the surface are susceptible to

liquefaction and liquefaction-related seismic hazards (e.g., dynamic settlement and/or ground subsidence) during the design seismic event.

9.4. Dynamic Settlement of Saturated Soils

Based on our analysis of the site's liquefaction potential, the proposed improvements may be subject to liquefaction-induced dynamic settlement. In order to estimate the amount of post-earthquake settlement, the method proposed by Tokimatsu and Seed (1987) was used in which the seismically induced cyclic stress ratios and corrected N-values are related to the volumetric strain of the soil. The amount of soil settlement during a strong seismic event depends on the thickness of the liquefiable layers and the density and/or consistency of the soils. Under the historic high groundwater condition, a total post-earthquake settlement of approximately 3 inches is estimated for the site. It is our opinion that the differential settlement should not exceed approximately 1 inch in 40 feet. However, based on the depths and thicknesses of the liquefiable soil layers and the very dense overlying non-liquefiable layers, we estimate that the surface manifestation of dynamic settlement will not cause damage to shallow foundations and mat foundations based on the study by Ishihara (1995).

10. CONCLUSIONS

Based on the results of our geotechnical evaluation, it is our opinion that the proposed Penmar Water Quality Improvement project is feasible from a geotechnical standpoint, provided the recommendations in this report are incorporated into the design and construction of the subject project. Geotechnical conditions that affect the design and construction of the project include:

- Based on our exploratory borings, existing undocumented fill overlying the native alluvium is present at the site. The existing fill extends to a depth of up to approximately 10 feet at the locations explored. We recommend that the near surface fill soils be overexcavated and recompacted in areas underlying proposed at-grade improvements.

- Excavations during site grading should be feasible with earthmoving equipment in good working order. We anticipate that the near-surface soils should be generally suitable for use as compacted fill (except for structure backfill). However, the moisture contents of clay and silt materials encountered in our borings ranged from approximately 18 to 34 percent. Prior to using clay or silt as backfill, the clay and silt will need to be dried to slightly above opti-

mum moisture content. In addition, material excavated from below the groundwater table will be in a wet condition and will involve processing prior to use as compacted fill.

- Groundwater was encountered during our evaluation at depths of approximately 16 to 29 feet. Historic high groundwater is mapped at a depth ranging from approximately 10 to 30 feet below the ground surface. Consequently, groundwater should be expected to impact excavations deeper than approximately 10 feet and dewatering should be anticipated. Grading equipment should be used that limits the potential for soil pumping during grading and fill compaction. Groundwater levels are subject to variation due to seasonal precipitation, subsurface conditions, irrigation, groundwater pumping, and other factors.

- The reported historic shallow groundwater levels on site are approximately 10 to 30 feet below grade. When evaluating potential uplift effects on buried structures and for construction, we recommend that a groundwater level of 10 feet below the ground surface be considered. An appropriate factor of safety should also be utilized in the design for resisting the uplift force.

- The site is located in an area mapped as potentially liquefiable (CDMG, 1998). Our liquefaction evaluation of site soils below the historic high groundwater indicates that the soils between approximate depths of 35 and 40 feet below the surface are susceptible to liquefaction. We have calculated approximately 3 inches of liquefaction-induced dynamic settlement. Our analysis indicated that the surface manifestation of dynamic settlement should not cause damage to shallow foundations.

- Some of the proposed structures and pipelines will extend to or below the water table. Accordingly, considerations for the construction sequence should include: 1) installation of the sheet piles to create a cofferdam-type structure to facilitate dewatering and excavation, 2) consideration of the stability of the excavation by applying appropriate bracing systems during construction, and 3) dewatering of the area contained by the cofferdams.

- The on-site materials should be considered Type C soils in accordance with Occupational Safety and Health Administration (OSHA) soil classifications. It is anticipated that these soils will be exposed during project excavations. Temporary vertical excavations over approximately 4 feet in height will involve shoring, or, as an alternative to shoring, should be sloped back at an inclination of 1½:1 (horizontal to vertical) in accordance with OSHA regulations. Appropriate shoring systems for these types of materials should be considered during planning.

- The subject site is not located within a State of California EFZ. The probability of surface fault rupture at the site is considered to be low.

- The design PGA was estimated to be 0.45g based on the USGS (2008) ground motion calculator (web-based).

- Our limited laboratory corrosion testing indicates that the near-surface site soils can be classified as non-corrosive based on California Department of Transportation (Caltrans, 2003) corrosion guidelines.
- Coefficient of permeability for the site soils ranged from approximately less than 0.014 to 0.15 feet/day.

11. RECOMMENDATIONS

The following sections include our geotechnical recommendations for construction of the proposed Penmar Water Quality Improvement project. These recommendations are based on our evaluation of the site geotechnical conditions and our understanding of the planned construction. The proposed construction should also be performed in accordance with the requirements of applicable governing agencies.

As indicated in Section 12 of this report, we recommend additional exploratory borings to confirm the subsurface conditions and our design assumptions. The locations of our borings were based on the conceptual design of the project and were located to provide preliminary subsurface information for the project. Subsequent detailed project design information indicates that the proposed pump station is approximately 200 feet south of the nearest boring, B-8. We have provided our recommendations below assuming similar material types are present.

11.1. Earthwork

Earthwork will generally include the removal of below-grade improvements, including existing underground utilities, excavations to construct the diversion structure, pump station, and underground reservoir, and installation of underground utilities. Earthwork recommendations presented in the following sections are based on the assumption that grading to achieve the finish grades at the site will be relatively minor. Earthwork should be performed in accordance with the requirements of applicable agencies, and the recommendations presented herein.

11.1.1. Construction Plan Review and Pre-Construction Conference

We recommend that the grading and foundation plans be submitted to Ninyo & Moore for review to check for conformance to the recommendations provided in this report. We further recommend that a pre-construction conference be held in order to discuss the grading recommendations presented in this report. The owner and/or their representative, the governing agencies' representatives, the civil engineer, Ninyo & Moore, and the contractor should be in attendance to discuss the work plan, project schedule, and earthwork requirements.

11.1.2. Clearing and Grubbing

Prior to commencing earthwork operations, deleterious materials, including vegetation, pavement, and/or other site improvements should be cleared from the site. Debris from the clearing operations should be disposed off-site. Resulting holes due to removal of obstructions that extend below grade, such as foundations or underground utilities, should be removed and filled with compacted fill per Sections 11.1.8 and 11.1.9 of this report.

11.1.3. Pump Station and Underground Reservoir Pad Preparation

Based on our exploratory borings, relatively dense, granular, alluvial soils are anticipated at the bottom of the pump station and reservoir excavations that should be suitable for support of the structures. We recommend that the structure pads be over-excavated approximately 1½ feet, and replaced with compacted aggregate base material, such as Class 2 aggregate base or crushed miscellaneous base (CMB) wrapped in filter fabric. The actual limits and methods to stabilize the subgrade should be based on evaluation of the subgrade conditions in the field at the time of construction. The excavation bottom should be evaluated by our representative during the excavation work. Prior to placement of the foundation, the bottom should be scarified to a depth of approximately 12 inches, moisture conditioned, and compacted.

11.1.4. Treatment of Near Surface Soils for At-Grade Structures

In order to provide suitable support for at-grade structures we recommend that undocumented fill beneath the structures be removed and recompacted to provide approximately 3 feet or more compacted fill beneath the bottom of the foundations. The overexcavation should expose relatively dense alluvial deposits. Additional overexcavation of loose, soft, and/or wet areas may be appropriate. The limits of the excavation should extend laterally so that the bottom of the excavation is approximately 5 feet beyond the perimeter of the structure or a distance equal to the depth of the overexcavation, whichever is farther. The excavation bottom should be evaluated by our representative during the excavation work. The exposed subgrade should be scarified to approximately 6 inches deep, moisture conditioned, and compacted prior to the placement of fill. To reduce the adverse effect to the foundation caused by the on-site expansive soils, we recommend that the upper 2 feet of soil beneath the foundations be comprised of low-expansion potential material that is in accordance with the CBC (2007). On-site and imported soils should be compacted to 90 percent or more relative compaction as evaluated by the latest edition of ASTM D 1557.

11.1.5. Excavation Characteristics

We anticipate that excavation within the fill and alluvial materials present on site may be accomplished with grading equipment in good operating condition. Based on the results of our subsurface exploration, we anticipate that the subsurface soils encountered will generally consist of sand, silty sand, clayey sand, silt, and clay. Although oversize materials were not encountered in our borings, oversize materials may be encountered during excavation, including debris in the undocumented fills. The contractor should be prepared to take appropriate measures to address the presence of oversize materials.

11.1.6. Shoring

Where excavations extend below the water table or where temporary slopes are not possible, shoring will be involved. Shoring systems will be constructed through fill and alluvial deposits. The types of shoring systems for the project are unknown at this time.

We anticipate that braced driven sheet pile shoring systems will be appropriate for the project to excavation depths up to approximately 30 feet. Cantilevered shoring systems (if used) should be limited to retain excavation heights of up to 10 feet due to soft clay/loose sand conditions. The braced sheet pile shoring systems should be designed using the lateral earth pressure values provided on Figure 6. Tieback-anchored shoring system may be used in lieu of braced shoring, provided the easements for tiebacks are available. Tieback anchor constraints include conflicts with existing structures, underground utilities, and remnant foundation systems. In addition, tieback anchors that are embedded in loose sand or soft clay below groundwater may not provide the desired bond strength even under the temporary loading condition, and may need to be lengthened. The shoring systems planned for the project should be reviewed by our office to evaluate the design considerations and geotechnical parameters used.

The recommended design pressures are based on the assumptions that the shoring system is constructed without raising the ground surface elevation behind the shoring system, that there are no surcharge loads, such as soil stockpiles, construction materials, construction equipment, or vehicular traffic, and that no loads act above a 1:1 (horizontal to vertical) plane extending up and back from the base of the shoring system. For shoring system subjected to the above-mentioned surcharge loads, the contractor should include the effect of these loads on the lateral pressures against the shoring system.

Ground settlement may occur behind the shoring system wall during excavation. The amount of settlement depends heavily on the type of shoring system, the contractor's workmanship, and soil conditions. Based on our experience, we anticipate that sheet pile driving may cause settlement and possible impact to structures within distances of up to approximately 25 feet from the sheet pile operation. We recommend that structures/improvements in the vicinity of the planned shoring installation be reviewed with regard to foundation support and tolerance to settlement. To reduce the potential for distress to adjacent structures, we recommend that the shoring system be designed to limit the ground settlement behind the shoring system to ½ inch or less, which would equal

approximately ½ inch of deflection. Possible causes of settlement that should be addressed include settlement during installation of the sheet piling, excavation for structure construction, construction vibrations, dewatering, and removal of the support system. The vibrations from the driving of sheet piles may result in some dynamic settlement of granular soils that may affect the adjacent structures. We recommend that shoring installation be evaluated carefully by the contractor prior to construction and that ground vibration and settlement monitoring be performed during construction. Vibration and settlement monitoring should be performed during pile driving. If settlement is detected or peak particle velocities of approximately 0.2 inches per second or more are measured adjacent to existing improvements, the pile driving should be stopped and evaluated. The evaluation may include changing the hammer vibration frequency and monitoring for settlement and vibrations. To reduce the potential for settlement associated with sheet pile removal, sheet piles may be left in place. In the event excessive settlement or other damage occurs associated with the pile driving operations, it may be appropriate to perform grouting beneath nearby structure(s) to mitigate the pile driving effects.

The contractor should retain a licensed, qualified and experienced engineer to design the shoring system. The shoring parameters presented in this report are minimum requirements, and the contractor should evaluate the adequacy of these parameters and make the required modifications for their design. We recommend that the contractor take appropriate measures to protect workers. OSHA requirements pertaining to worker safety should be observed.

11.1.7. Construction Dewatering

The project site is underlain by relatively shallow groundwater, and dewatering is anticipated for deeper excavations so that work can be performed in a dry condition. The depth to groundwater was variable at the time of our field exploration. Groundwater depths are anticipated to range from approximately 16 to 29 feet, but could be as shal-

low as 10 feet deep (historical shallow groundwater data). The pump system design should be performed by a specialty dewatering contractor.

Lowering the water table during dewatering activities will result in an increase in effective stresses and may induce settlements of the soils underlying adjacent structures. Based on the anticipated depths of excavations (approximately 30 feet or less), we anticipate that the potential for settlement associated with construction dewatering is low. We recommend that the dewatering be performed such that the groundwater level be lowered no more than approximately 3 feet below the depths of excavations. Monitoring wells should be installed outside of the excavation to monitor the impact of dewatering to the groundwater. Existing structures in the vicinity of planned excavations should be evaluated with regard to foundation type and potential for settlement. Settlement monuments should be provided to monitor settlement-sensitive structures. Disposal of groundwater should be performed in accordance with guidelines of the Regional Water Quality Control Board (RWQCB). Design of the groundwater control system is the responsibility of the contractor.

11.1.8. Fill Material

In general, the on-site earth materials should be suitable for reuse as general fill and trench backfill. The on-site clay and silt materials are generally above optimum moisture content and will need to be processed prior to placing as fill to reduce the moisture content of these materials to slightly above optimum moisture content. In addition, debris may be encountered in the existing undocumented fill. On-site and imported fill soils should be free of trash, debris, roots, vegetation, or deleterious materials. Fill should generally be free of rocks or hard lumps of materials more than approximately 4 inches in diameter. Rocks or hard lumps larger than about 4 inches in diameter should be broken into smaller pieces or should be removed from the site. Imported materials should consist of clean, granular materials with a low expansion potential, corresponding to an expansion index of 50 or less as evaluated in accordance with ASTM D4829-07. Imported materials should be submitted to the project geotechnical consultant for

review prior to their importation to the site. The corrosion potential of proposed imported soils should also be evaluated if structures will be in contact with the imported soils. The contractor should be responsible for the uniformity of imported materials brought to the site.

We recommend that structural backfill material as specified in "Greenbook" Standard Specifications for Public Works Construction (Building News, 2003) be used to backfill behind the proposed retaining walls, including walls for the pump station and underground reservoir.

11.1.9. Fill Placement and Compaction

Fill, structure backfill, and trench backfill should be compacted in uniform horizontal lifts to a relative compaction of 90 percent or more as evaluated by ASTM D 1557-00. Fill soils should be placed at near optimum moisture content as evaluated by ASTM D 1557-00. The optimum lift thickness of fill will depend on the type of compaction equipment used, but generally should not exceed 8 inches in loose thickness. Special care should be taken to avoid pipe damage when compacting trench backfill above the pipe. Placement and compaction of the fill soils should be in general accordance with local grading ordinances and good construction practice.

11.1.10. Pipe Bedding

We recommend that bedding material be placed around pipe zones 1 foot or more above the top of the pipe. The bedding material should be classified as sand, be generally free of organic material, and have a sand equivalent (SE) of 30 or more. We do not recommend crushed rock be used for bedding material because of the fine grain nature of the subsurface material. It has been our experience that the voids within a crushed rock material are sufficiently large to allow fines to migrate into the voids, thereby creating the potential for sinkholes and depressions to develop at the ground surface. Where soft, wet soil conditions are encountered, the trench excavation should be excavated ap-

proximately 1 to 2 feet or more below the pipe invert and should be backfilled with gravel wrapped in filter fabric.

Special care should be taken not to allow voids beneath and around the pipe. Compaction of the bedding material and backfill should proceed uniformly up both sides of the pipe. Trench backfill, including bedding material, should be placed in accordance with the recommendations presented in the preceding section.

11.1.11. Modulus of Soil Reaction for Pipe Design

The modulus of soil reaction is used to characterize the stiffness of soil backfill placed at the sides of buried flexible pipelines for the purpose of evaluating deflection caused by the weight of the backfill above the pipe. We recommend that a modulus of soil reaction of 1,000 pounds per square inch (psi) be used for design, provided that granular bedding material be placed adjacent to the pipe, as recommended in the previous section.

11.2. Seismic Design Considerations

Design of the proposed improvements should comply with design for structures located in Seismic Zone 4 and should be designed in accordance with the requirements of governing jurisdictions and applicable building codes. Table 2 presents the seismic design parameters for the site in accordance with CBC (2007) guidelines and mapped spectral acceleration parameters (United States Geological Survey [USGS], 2008).

Table 3 – 2007 California Building Code Seismic Design Criteria

Seismic Design Factors	Value
Site Class	D
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.5
Mapped Spectral Acceleration at 0.2-second Period, S_s	1.566 g
Mapped Spectral Acceleration at 1.0-second Period, S_1	0.600 g
Adjusted MCE Spectral Response Acceleration at 0.2-second Period, S_{MS}	1.566 g

Table 3 – 2007 California Building Code Seismic Design Criteria

Seismic Design Factors	Value
Adjusted MCE Spectral Response Acceleration at 1.0-second Period, S_{M1}	0.900 g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	1.044 g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.600 g

11.3. Mat Foundations

Based on our analysis, it is our opinion that the proposed underground reservoir and pump station can be supported by mat foundations. Mat foundations may be designed assuming the allowable bearing capacities presented in Table 4. The anticipated total and differential settlements corresponding to these allowable bearing loads is estimated to be approximately 1 inch and ½ inch, respectively. Mat foundations typically experience some deflection due to loads placed on the mat and the reaction of the soils directly underlying the mat. Table 4 presents the design modulus of subgrade reaction that may be used for evaluating such deflections for each structure.

We recommend that a 1½-foot-thick gravel mat be placed in the bottom of the excavations prior to construction of the structure floors to provide a suitable working surface. The gravel should be clean ¾-inch to 1½-inch rock, underlain by non-woven filter fabric (Mirafi 140N or approved equivalent).

Table 4 – Soil Design Parameters for Mat Foundations

Structures	Approximate Depth of Structure Below Grade (feet)	Net Allowable Bearing Capacity (psf)*	Modulus of Subgrade Reaction (kcf)
Underground Reservoir	24	5,000	500
Pump Station	30	5,000	350

Notes:
psf – pounds per square foot
kcf – kips per cubic foot
* The net allowable bearing capacity, means the weight of the mat and soil backfill may be ignored in calculating foundation loads.

11.4. Footing Foundations

Footings bearing in soils of low expansion potential should extend 18 inches or more below the lowest adjacent finished grade. Continuous footings should have a width of 24 inches or more. Isolated footings should have a width of 24 inches or more. Continuous footings should be reinforced with two No. 5 steel reinforcing bars, one placed near the top and one placed near the bottom of the footings, and further detailed in accordance with the recommendations of the structural engineer.

Footings, as described above and bearing on compacted fill, may be designed using a net allowable bearing capacity of 2,500 psf. (weight of footings and soil backfill may be ignored when calculating footing loads). Total and differential settlements for footings designed in accordance with the above recommendations are estimated to be less than approximately 1 inch and ½ inch, respectively.

Foundations bearing in compacted fill may be designed using a coefficient of friction of 0.35, where the total frictional resistance equals the coefficient of friction times the dead load. Foundations may be designed using a passive resistance value of 300 psf per foot of depth, with a maximum value of 3,000 psf. The allowable lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided the passive resistance does not exceed two-thirds of the total allowable resistance. The passive resistance (including the maximum value) may be increased by one-third when considering loads of short duration such as wind or seismic forces.

11.5. Floor Slabs

Floor slabs should have a thickness of 5 inches or more and be reinforced with No. 4 steel reinforcing bars placed 18 inches on-center (each way) in the middle one-third of the slab height. The proper placement of the reinforcement in the slab is vital for satisfactory performance. The floor slab and foundations should be tied together by extending the slab reinforcement into the footings. Floor slabs should be underlain by a 2-inch layer of clean sand, underlain by a polyethylene vapor retarder, 10-mil or thicker, underlain by a 4-inch

layer of gravel with a particle size up to approximately $^{3}/_{8}$ inch. The vapor retarder is recommended in areas where moisture sensitive floor coverings are anticipated. Soils underlying the slabs should be moisture conditioned and compacted in accordance with the recommendations contained in this report prior to concrete placement. Joints should be constructed at intervals designed by the structural engineer to help reduce random cracking of the slab. Floor slabs subject to heavy wheel loads should be evaluated on a case-by-case basis by the structural engineer.

11.6. Earth Pressures

Walls for below grade facilities when constructed as recommended above, including structural backfill per "Greenbook," may be designed for lateral pressures represented by the pressure diagram on Figure 7. The exterior of underground walls should be carefully waterproofed. We recommend that horizontal and vertical construction joints of underground structures have water stops to reduce the likelihood of water infiltration. For pipe penetrating into the structures, standard "water-tight" penetration design should be utilized. To reduce the potential for pipe-to-wall differential settlement, which could cause pipe shearing, we recommend that a flexible pipe joint be located close to the exterior of the wall. The type of joint should be such that minor relative movement can be accommodated without distress. The pipe connections should be sufficiently flexible to withstand differential settlement of approximately ½ inch. The amount of differential settlement is from static loading of the structure. Dynamic settlement of up to approximately 3 inches during a design earthquake may occur. However, our analysis also indicated that the surface manifestation of dynamic settlement will not cause damage to shallow foundations. Repairs to connections may be required after strong seismic events.

The dynamic lateral earth pressures presented in Figure 7 apply to retaining walls that are more than 12 feet in height in accordance with the 2007 CBC. Retaining walls may be supported by conventional mat foundations and shallow foundations, using the design parameters presented in Section 11.3 and 11.4 of this report, respectively.

11.7. Lateral Pressures for Thrust Blocks

Thrust restraint for buried pipelines may be achieved by transferring the thrust force to the soil outside the pipe through a thrust block. Thrust blocks may be designed using the lateral passive earth pressures presented on Figure 8. Thrust blocks should be backfilled with granular backfill material, compacted as outlined in Section 11.1.9.

11.8. Uplift Considerations

For structures that will extend below the water table, uplift force will need to be considered. Hydrostatic uplift forces should be evaluated for a potential shallow groundwater condition of approximately 10 feet below the ground surface. The resistance to uplift may then be taken as the sum of the weight of the structure and the uplift resistance of the sidewalls.

We recommend that the concrete mat foundation and structure be designed to resist hydrostatic uplift. Two alternatives for resisting the anticipated uplift pressures are: 1) constructing a thicker concrete mat foundation, or 2) extending the mat foundation a selected distance outside the exterior walls of the structure (flanges). The resistance to uplift may then be taken as the sum of the weight of the structure and the weight of the wedge of soil within the zone of influence (Figure 9).

11.9. Corrosivity

Laboratory testing was performed on representative samples of near-surface soil to evaluate soil pH, electrical resistivity, water-soluble chloride content, and water-soluble sulfate content. The soil pH and electrical resistivity tests were performed in general accordance with California Test Method (CT) 643. Chloride content tests were performed in general accordance with CT 422. Sulfate testing was performed in general accordance with CT 417. The laboratory test results are presented in Appendix B.

The soil pH was measured to be approximately 6.5 and 6.7. The electrical resistivity was measured to be approximately 670 and 2,345 ohm-centimeters. The chloride content of the samples were approximately 115 and 150 ppm. The sulfate content of the tested samples

were approximately 0.015 and 0.004 percent by weight (i.e., 150 and 40 ppm, resepectively). Based on the laboratory test results and Caltrans (2003) corrosion criteria, the project site can be classified as a non-corrosive site, which is defined as having earth materials with less than 500 ppm chlorides, less than 0.20 percent sulfates (i.e., 2,000 ppm), or a pH of 5.5 or less.

11.10. Concrete Placement

Concrete in contact with soil or water that contains high concentrations of soluble sulfates can be subject to chemical and/or physical deterioration. Based on the UBC criteria (UBC, 1997), the potential for sulfate attack is negligible for water-soluble sulfate contents in soil ranging from 0.00 to 0.10 percent by weight (0 to 1,000 ppm). As indicated above, the soil samples tested for this evaluation indicate water-soluble sulfate contents of 0.015 and 0.004 percent by weight (i.e., 150 and 40 ppm, respectively). Accordingly, the on-site soils are considered to have a negligible potential for sulfate attack. However, due to the potential variability in soil conditions across the site and the possible use of reclaimed water, we recommend that Type V cement with a water/cement ratio of 0.45 or less be considered for the project.

In order to reduce the potential for shrinkage cracks in the concrete during curing, we recommend that the concrete be placed with a slump of 4 inches based on ASTM C 143. The slump should be checked periodically at the site prior to concrete placement. We also recommend that crack control joints be provided in sidewalks and exterior hardscape in accordance with the recommendations of the project structural engineer to reduce the potential for distress due to minor soil movement and concrete shrinkage. The project structural engineer should be consulted for additional concrete specifications.

11.11. Drainage

Proper surface drainage is imperative for satisfactory site performance. Positive drainage should be provided and maintained to direct surface water away from foundations and off-site. Positive drainage is defined as a slope of 2 percent or more for a distance of 5 feet

or more away from foundations and tops of slopes. Runoff should then be directed by the use of swales or pipes into a collective drainage system. Surface waters should not be allowed to pond adjacent to footings. We recommend that structures have roof drains and downspouts installed to collect runoff. Surface water should not be allowed to flow over slope faces or pond adjacent to footings. Area drains for landscaped and paved areas are recommended.

11.12. Landscaping

Project landscaping should consist of drought tolerant plants. Landscape irrigation should be kept to a level just sufficient to maintain plant vigor. Overwatering should not be permitted.

12. ADDITIONAL EXPLORATION

Our subsurface exploration was based on conceptual design information provided prior to the detailed information and at the locations requested by the client. One boring was performed at the site of the underground reservoir. We recommend that two additional borings be performed in the footprint of the reservoir to confirm our design assumptions. We also recommend that one boring be performed at the location of the pump station to confirm our design assumptions. Additional borings should also be considered along the new force main alignments to evaluate trenching and pipe support conditions.

13. CONSTRUCTION OBSERVATION

The conclusions and recommendations presented in this report are based on analysis of observed conditions in widely spaced exploratory borings. If conditions are found to vary from those described in this report, Ninyo & Moore should be notified and additional recommendations will be provided upon request. Ninyo & Moore should observe and test fill placement and compaction. Project plans should also be reviewed by Ninyo & Moore prior to the start of construction.

The recommendations provided in this report are based on the assumption that Ninyo & Moore will provide geotechnical observation and testing services during construction. In the event that

the Irvine Ranch Water District decides not to utilize the services of Ninyo & Moore during construction, we request that the selected consultant provide the Irvine Ranch Water District with a letter (with a copy to Ninyo & Moore) indicating that they fully understand Ninyo & Moore's recommendations and that they are in full agreement with the design parameters and recommendations contained in this report.

14. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

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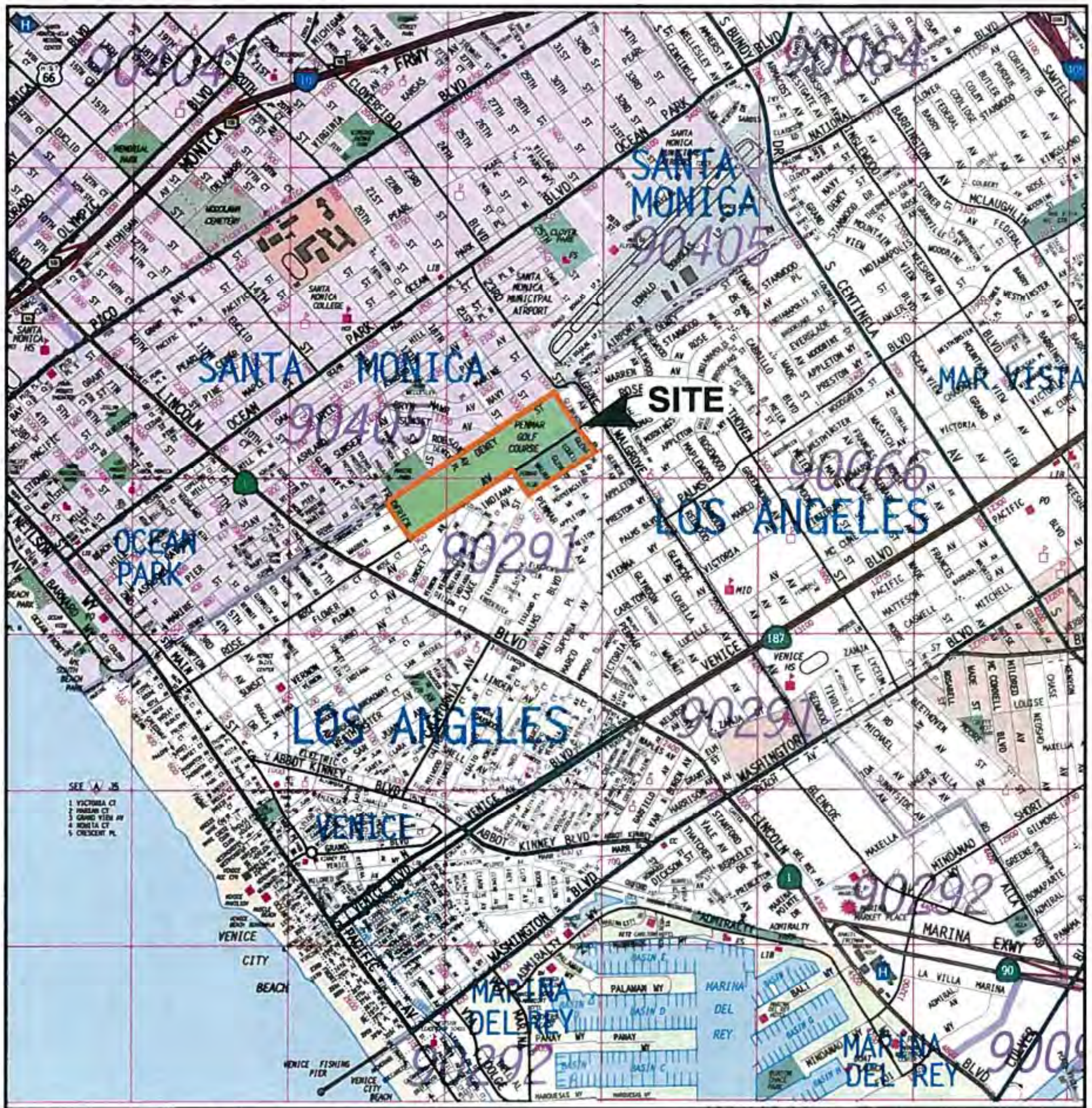
AERIAL PHOTOGRAPHS

Source	Scale	Date	Flight	Numbers
USDA	1:20,000	11-4-52	AXJ-3K	128 & 129



REFERENCE: 2005 THOMAS GUIDE FOR LOS ANGELES/ORANGE COUNTIES, STREET GUIDE AND DIRECTORY

APPROXIMATE SCALE IN FEET

0 2400 4800

N

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

Map © Rand McNally, R.L.07-S-129

207328-A1.DWG

Ninyo & Moore

PROJECT NO.	DATE
207328001	6/08

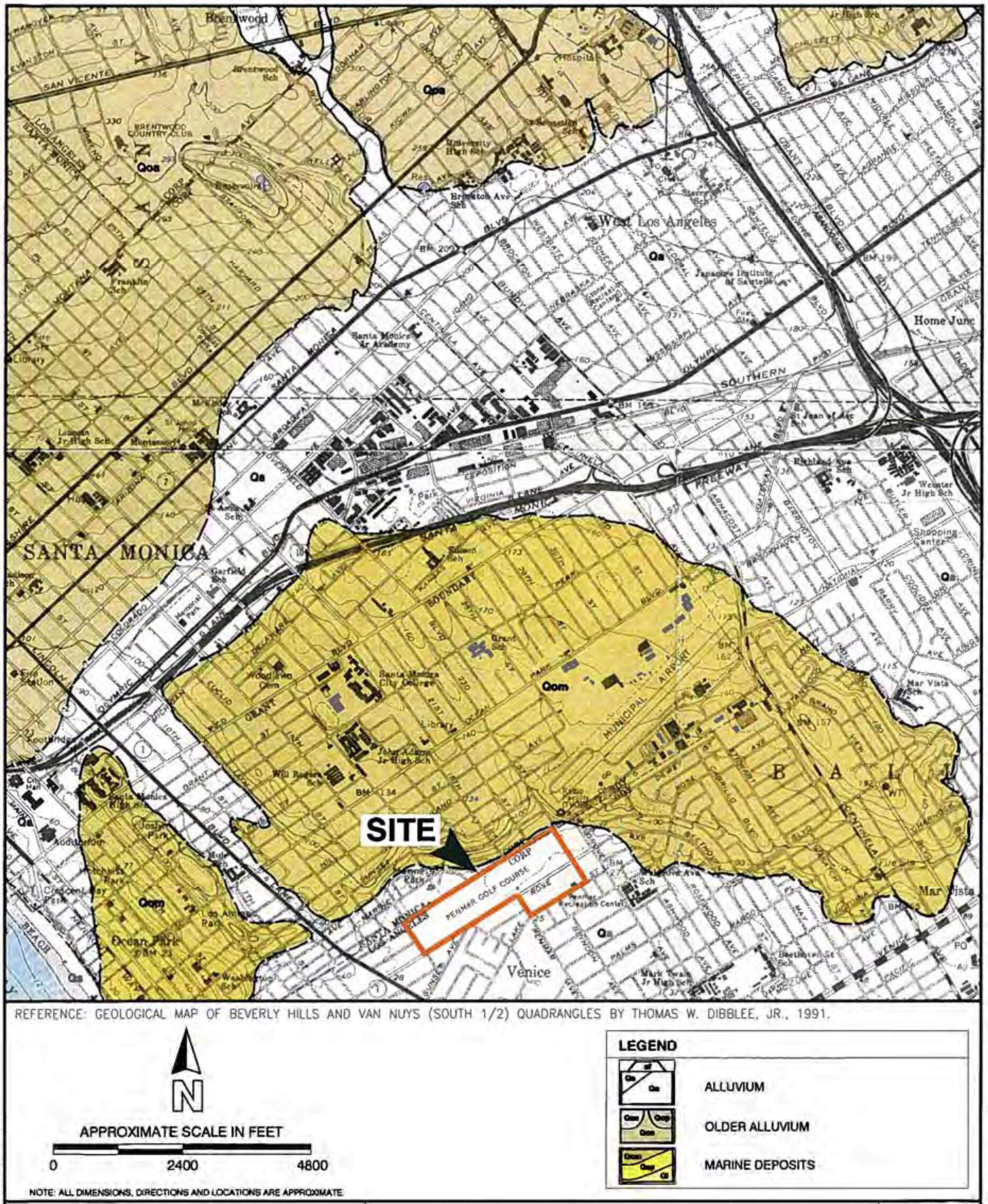
SITE LOCATION MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

1


B-1 TD=31.5
B-2 TD=31.5
B-3 TD=31.5
B-4 TD=31.5
NEW 5mg RESERVOIR
B-5 TD=31.5
B-7 TD=31.5
NEW FORCE MAIN PIPELINES
NEW DIVERSION AND PUMP STATION
B-8 TD=21.5
B-6 TD=31.5
Google
N
REFERENCE: GOOGLE EARTH
LEGEND
B-8 ● APPROXIMATE LOCATION OF EXPLORATORY BORING
TD=TOTAL DEPTH IN FEET
Ninyo & Moore
PROJECT NO.
207328001
DATE
6/08
BORING LOCATION MAP
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA
FIGURE
2
207328-A2.dwg



REFERENCE: GEOLOGICAL MAP OF BEVERLY HILLS AND VAN NUYS (SOUTH 1/2) QUADRANGLES BY THOMAS W. DIBBLEE, JR., 1991.

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

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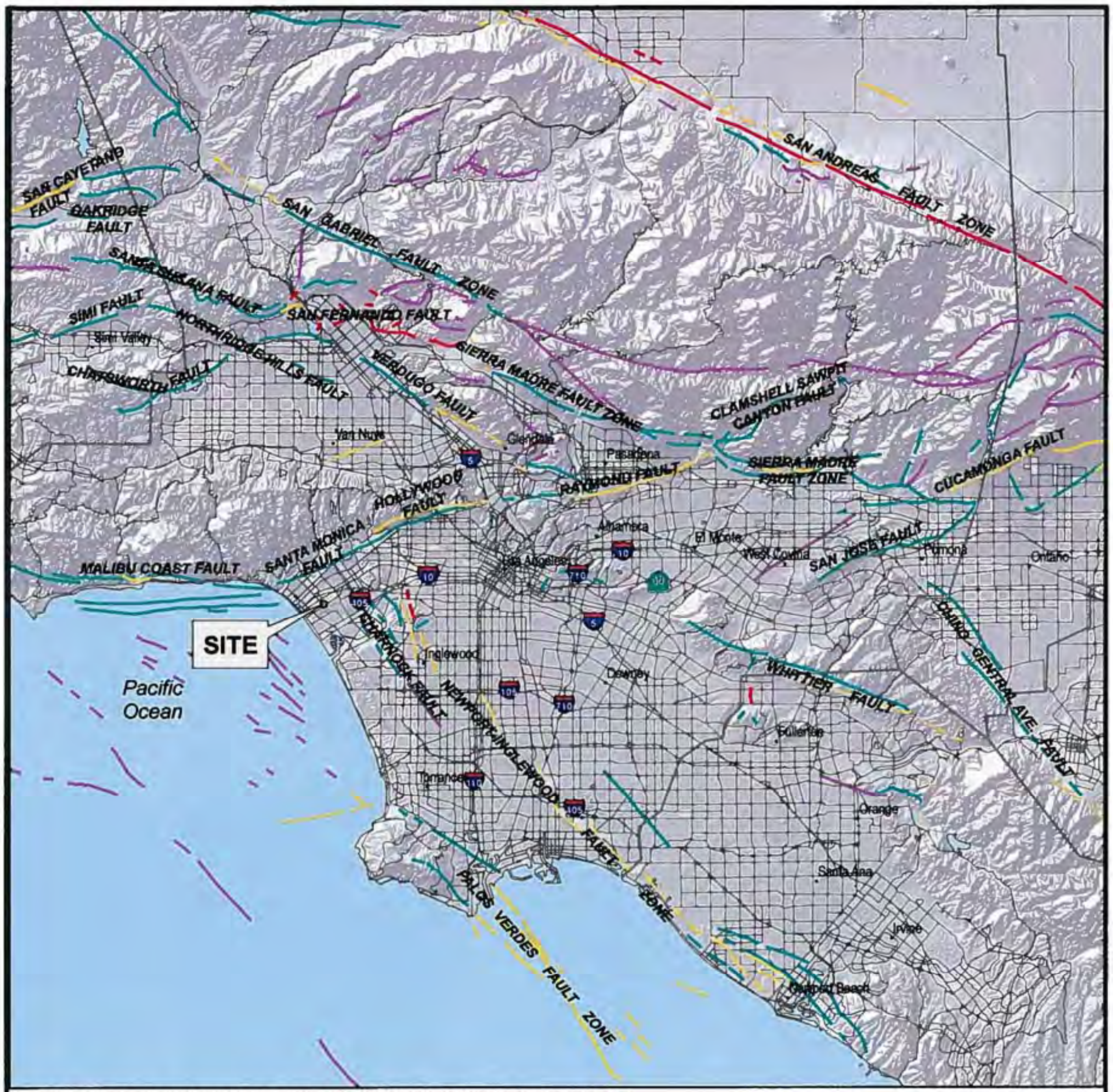
REGIONAL GEOLOGIC MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	3



GIS DATA SOURCE: CALIFORNIA GEOLOGICAL SURVEY (CGS); ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE (ESRI)
REFERENCE: JENNINGS, 1994, FAULT ACTIVITY MAP OF CALIFORNIA AND ADJACENT AREAS

LEGEND

FAULT ACTIVITY:

HISTORICALLY ACTIVE	LATE QUATERNARY
HOLOCENE ACTIVE	QUATERNARY
COUNTY BOUNDARIES	

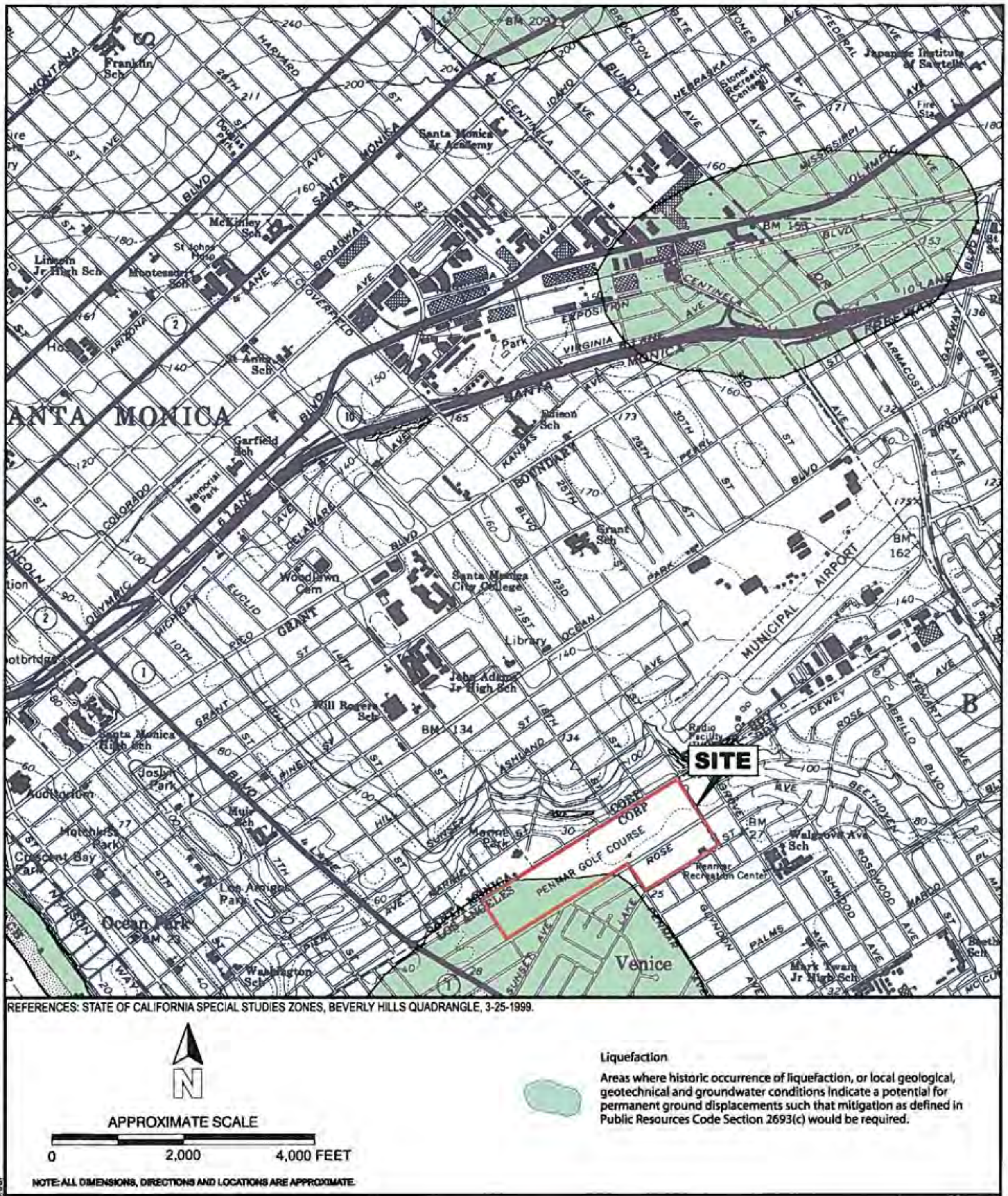
N

10 0 10
Miles

NOTE: ALL DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE

207328_a4.gis

Ninyo & Moore		FAULT LOCATION MAP	FIGURE
PROJECT NO.	DATE	PENNMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	4
207328001	6/08		



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Liquefaction

🟩 Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

SEISMIC HAZARDS ZONES MAP

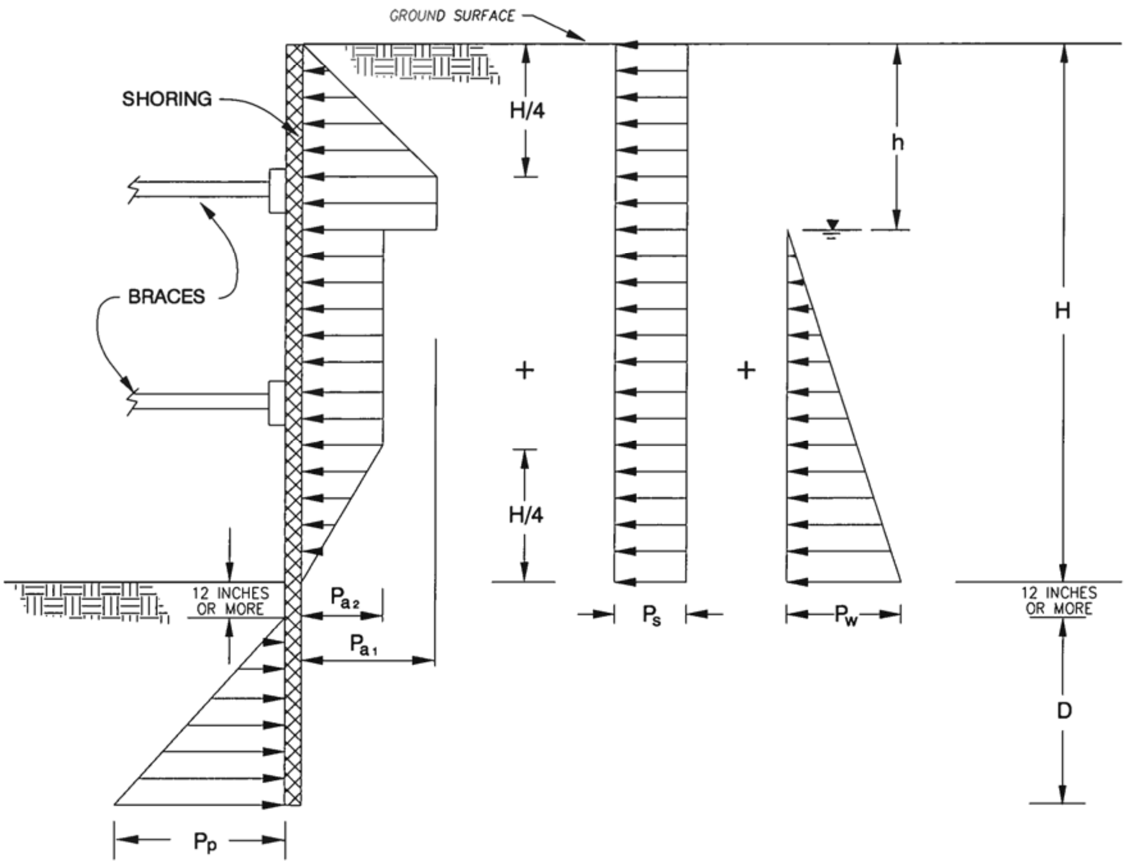
FIGURE

5

PROJECT NO. 207328001

DATE 6/08

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA



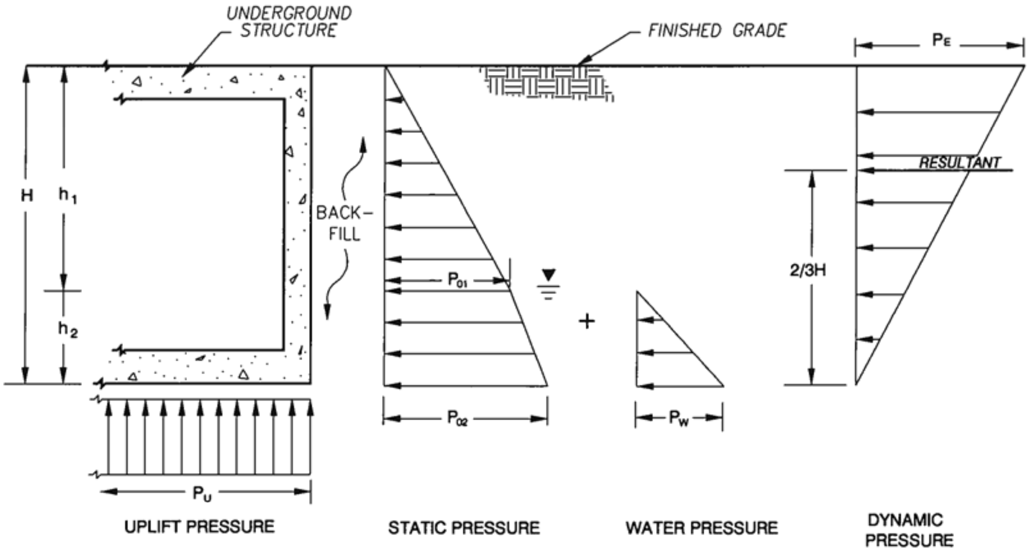
NOTES:

1. APPARENT LATERAL EARTH PRESSURE, P_a
   P_{a1} = 48 H psf; P_{a2} = 24 H psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
   P_s = 120 psf
3. HYDROSTATIC PRESSURE, P_w
   P_w=62.4 (H - h) psf
4. PASSIVE LATERAL EARTH PRESSURE, P_p
   P_p = 200 D
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H, h AND D ARE IN FEET
7. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328–A6.DWG

Ninyo & Moore		LATERAL EARTH PRESSURES FOR BRACED EXCAVATION BELOW GROUNDWATER (STIFF CLAY)	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	6
207328001	6/08		



NOTES:

1. APPARENT LATERAL EARTH PRESSURES, P_{01} AND P_{02}
   $P_{01} = 60\ h_1$ psf
   $P_{02} = 60\ h_1 + 29\ h_2$ psf
2. WATER PRESSURE, P_W
   $P_W = 62.4\ h_2$ psf
3. DYNAMIC LATERAL EARTH PRESSURE IS BASED ON A PEAK GROUND ACCELERATION OF 0.45 g
   $P_E = 17\ H$ psf
4. UPLIFT PRESSURE, P_u
   $P_u = 62.4\ h_2$ psf
5. SURCHARGE PRESSURES CAUSED BY VEHICLES OR NEARBY STRUCTURES ARE NOT INCLUDED
6. H, h_1 AND h_2 ARE IN FEET
7. ▼ GROUNDWATER TABLE

NOT TO SCALE

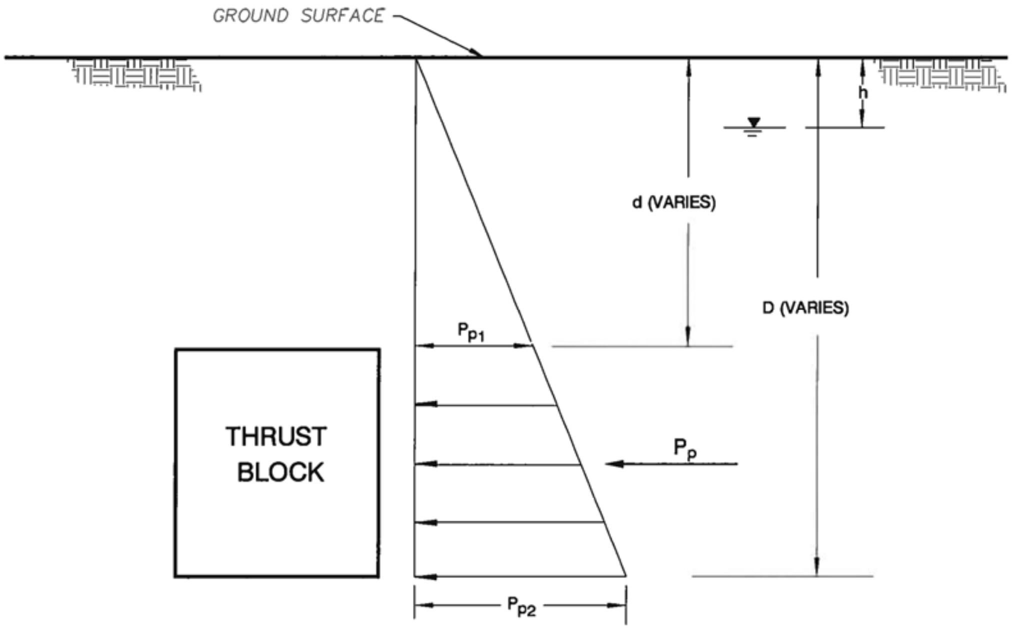
207328-A6.DWG

Ninyo & Moore

LATERAL EARTH PRESSURES FOR UNDERGROUND STRUCTURES (SAND)

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	7



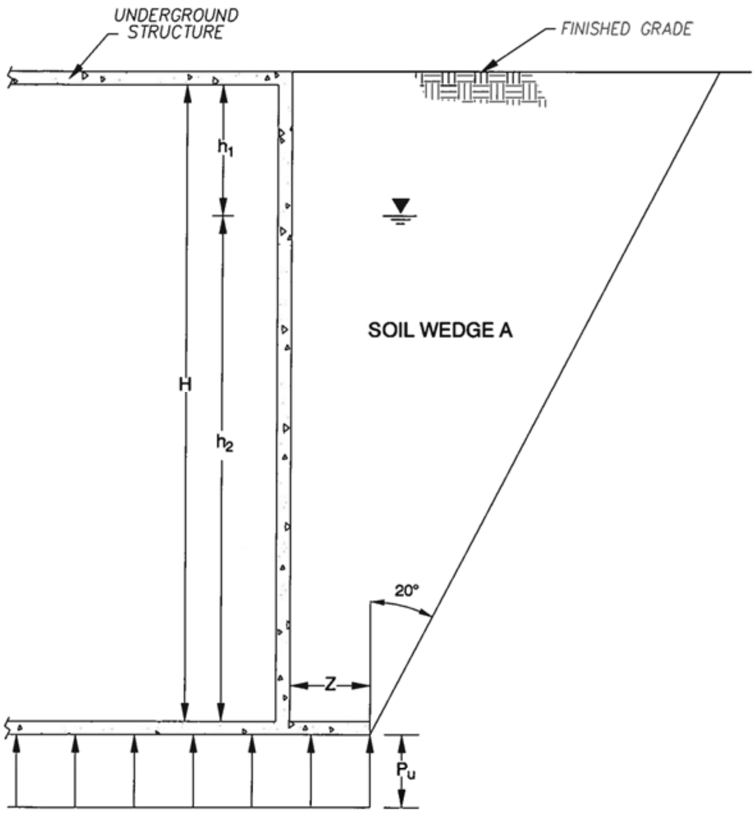
NOTES:

1. GROUNDWATER BELOW BLOCK
   $P_p = 200\ (D^2 - d^2)$ lb/ft
2. GROUNDWATER ABOVE BLOCK
   $P_p = 1.6\ (D - d)[\ 124.8h + 60\ \ (D+d)]$ lb/ft
3. ASSUMES BACKFILL IS GRANULAR MATERIAL
4. ASSUMES THRUST BLOCK IS ADJACENT TO COMPETENT MATERIAL
5. D, d AND h ARE IN FEET
6. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328–A7.DWG

Ninyo & Moore		THRUST BLOCK LATERAL EARTH PRESSURE DIAGRAM	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	8
207328001	6/08		



RESISTANCE TO UPLIFT = WEIGHT OF STRUCTURE + WEIGHT OF SOIL WEDGE A

NOTES:

1. UNIT WEIGHT OF SOILS, γ OR γ_b
   γ = 120 pcf ABOVE GROUNDWATER TABLE
   γ_b = 58 pcf BELOW GROUNDWATER TABLE
2. UPLIFT PRESSURE, P_u
   $P_u = 62.4\, h_2$ psf
3. H, Z, h_1 AND h_2 ARE IN FEET
4. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328–A8.DWG

Ninyo & Moore

UPLIFT RESISTANCE DIAGRAM FOR UNDERGROUND STRUCTURES (MAT)

PROJECT NO.	DATE
207328001	6/08

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE
9

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory excavations. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test (SPT) Spoon

Disturbed drive samples of earth materials were obtained by means of an SPT spoon sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of $1^3/_8$ inches. The spoon was driven into the ground 12 to 18 inches with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586-84. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the spoon, bagged, sealed, and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3 inches, was lined with 1-inch-long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer or the kelly bar of the drill rig in general accordance with ASTM D 3550-84. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer or bar, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

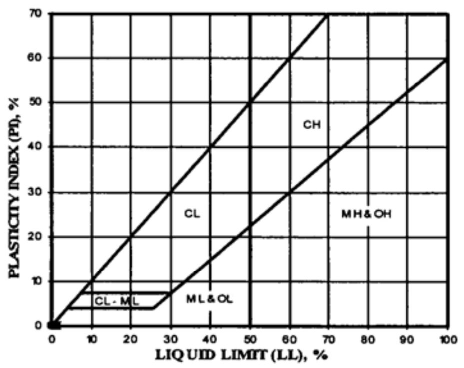
U.S.C.S. METHOD OF SOIL CLASSIFICATION

MAJOR DIVISIONS		SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 1/2 of soil >No. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction <No. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than 1/2 of soil <No. 200 sieve size)	SILTS & CLAYS Liquid Limit <50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

GRAIN SIZE CHART

CLASSIFICATION	RANGE OF GRAIN SIZE	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL Coarse Fine	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND Coarse Medium Fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.075 4.76 to 2.00 2.00 to 0.420 0.420 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

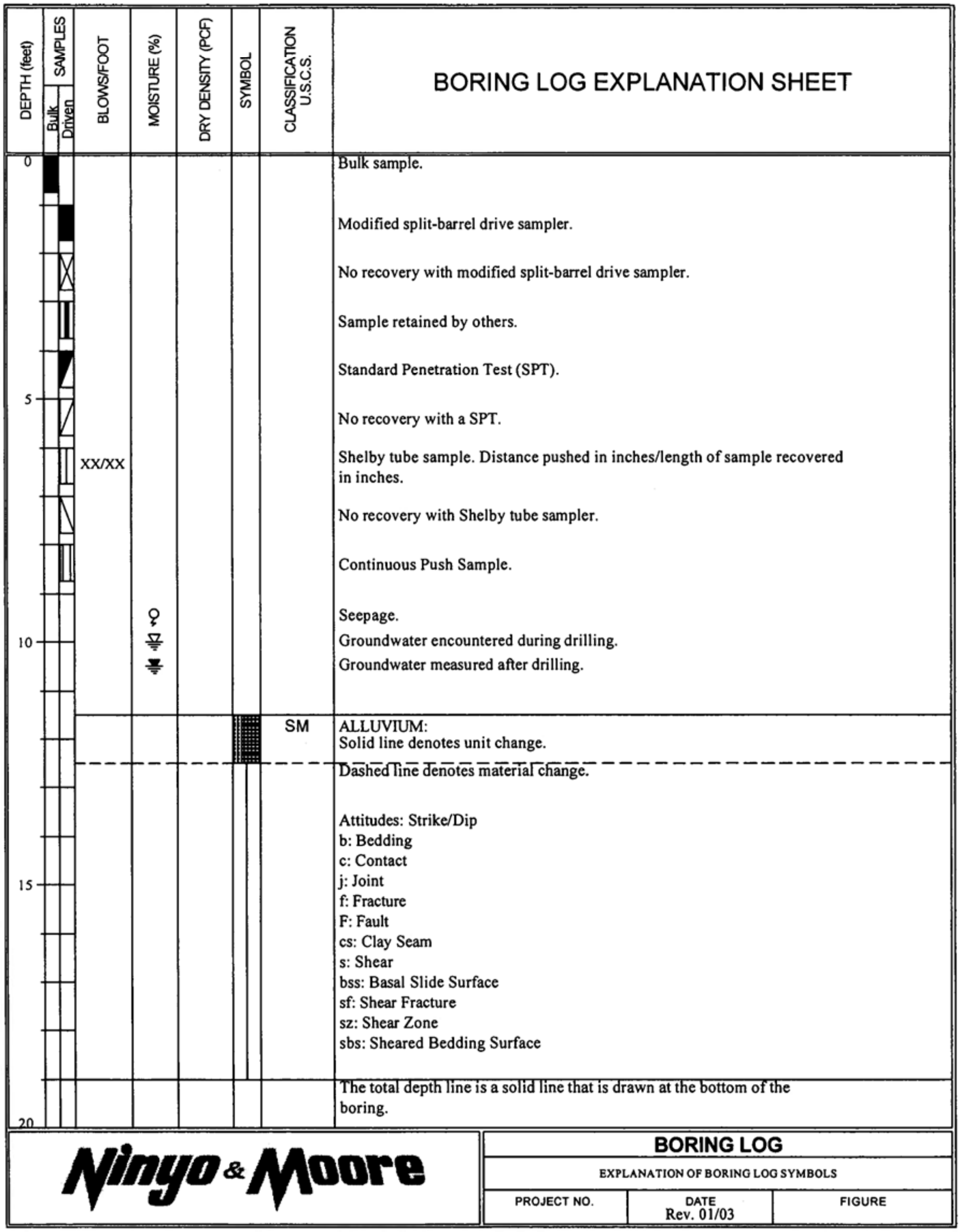
PLASTICITY CHART



Ninyo & Moore | **U.S.C.S. METHOD OF SOIL CLASSIFICATION**

Document1

Updated Nov. 2004



DEPTH (feet)	SAMPLES Bulk / Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	BORING LOG EXPLANATION SHEET
0							Bulk sample.
							Modified split-barrel drive sampler.
							No recovery with modified split-barrel drive sampler.
							Sample retained by others.
							Standard Penetration Test (SPT).
5							No recovery with a SPT.
		XX/XX					Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
							No recovery with Shelby tube sampler.
							Continuous Push Sample.
			♀				Seepage.
10			▽				Groundwater encountered during drilling.
			▼				Groundwater measured after drilling.
					▩	SM	ALLUVIUM: Solid line denotes unit change.
							Dashed line denotes material change.
15							Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Sheared Bedding Surface
20							The total depth line is a solid line that is drawn at the bottom of the boring.

Ninyo & Moore

BORING LOG

EXPLANATION OF BORING LOG SYMBOLS

PROJECT NO.	DATE	FIGURE
	Rev. 01/03	

DATE DRILLED 12/27/07 BORING NO. B-1
GROUND ELEVATION 35' ± (MSL) SHEET 1 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SM	<u>FILL</u>: Dark brown, moist, loose, silty SAND.
5			9	11.8	108.0			Brown.
10			55	13.8			SC	<u>ALLUVIUM</u>: Olive green, moist, very dense, clayey medium to coarse SAND.
							CL-CH	Olive green, moist to wet, hard, CLAY; caliche stringers.
15			29	27.4	94.6			
20								

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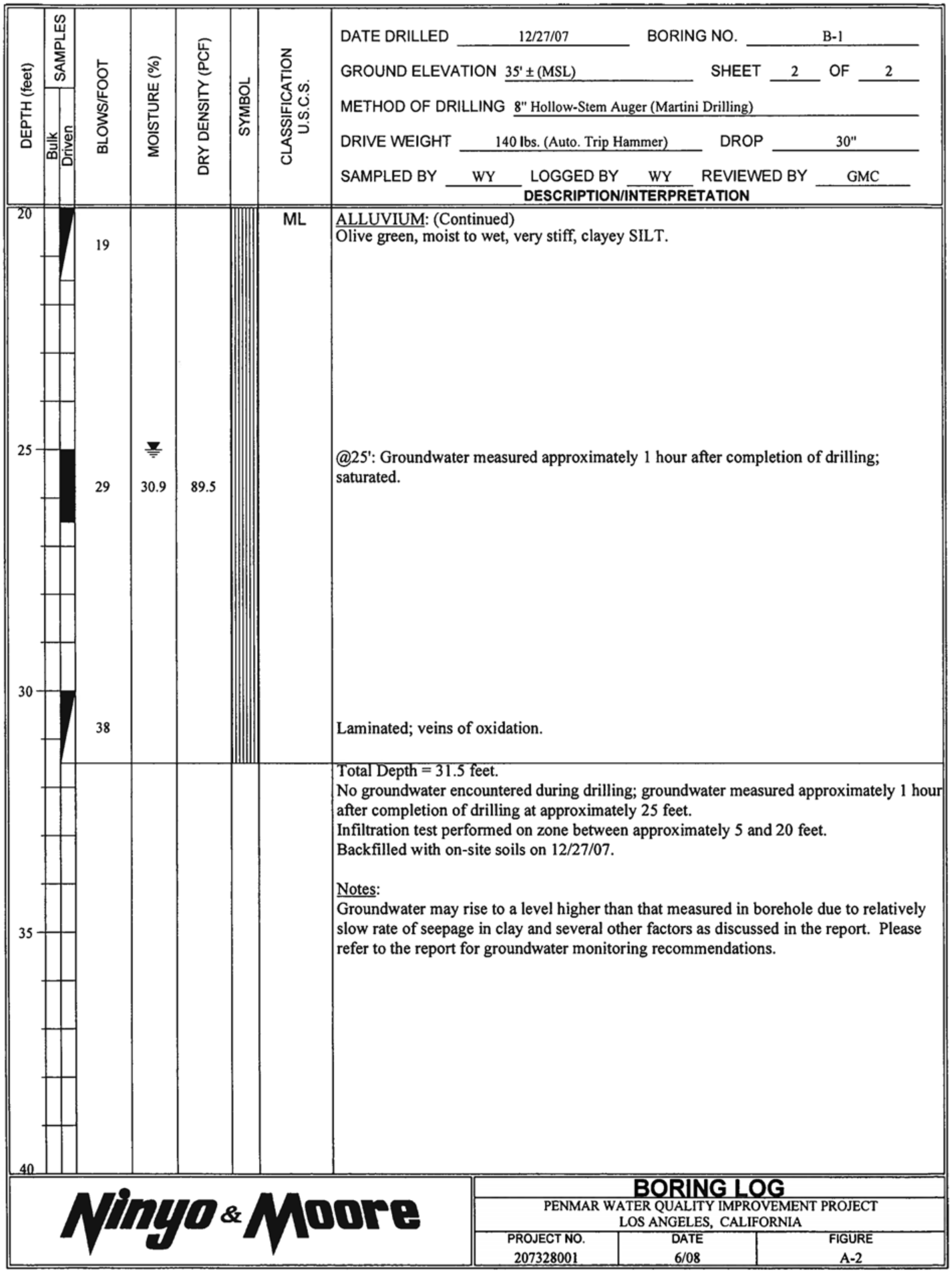
BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-1



DATE DRILLED 12/27/07 BORING NO. B-1
GROUND ELEVATION 35' ± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20			19				ML	ALLUVIUM: (Continued) Olive green, moist to wet, very stiff, clayey SILT.
25			29	▼ 30.9	89.5			@25': Groundwater measured approximately 1 hour after completion of drilling; saturated.
30			38					Laminated; veins of oxidation.
								Total Depth = 31.5 feet. No groundwater encountered during drilling; groundwater measured approximately 1 hour after completion of drilling at approximately 25 feet. Infiltration test performed on zone between approximately 5 and 20 feet. Backfilled with on-site soils on 12/27/07.
35								Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
40								

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BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-2

DATE DRILLED 12/27/07 BORING NO. B-2

GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■						SC	FILL: Dark brown, damp, medium dense, clayey medium to coarse SAND.
							SM	Brown, damp, medium dense, silty medium to coarse SAND; wire fragment.
5		■	36	1.8	107.9			
							CL	ALLUVIUM: Dark brown, moist, very stiff, sandy CLAY; few caliche stringers.
10		■	19	18.3				
15		■	33	28.6	93.8			Olive green to greenish gray; moist to wet; hard.
20								

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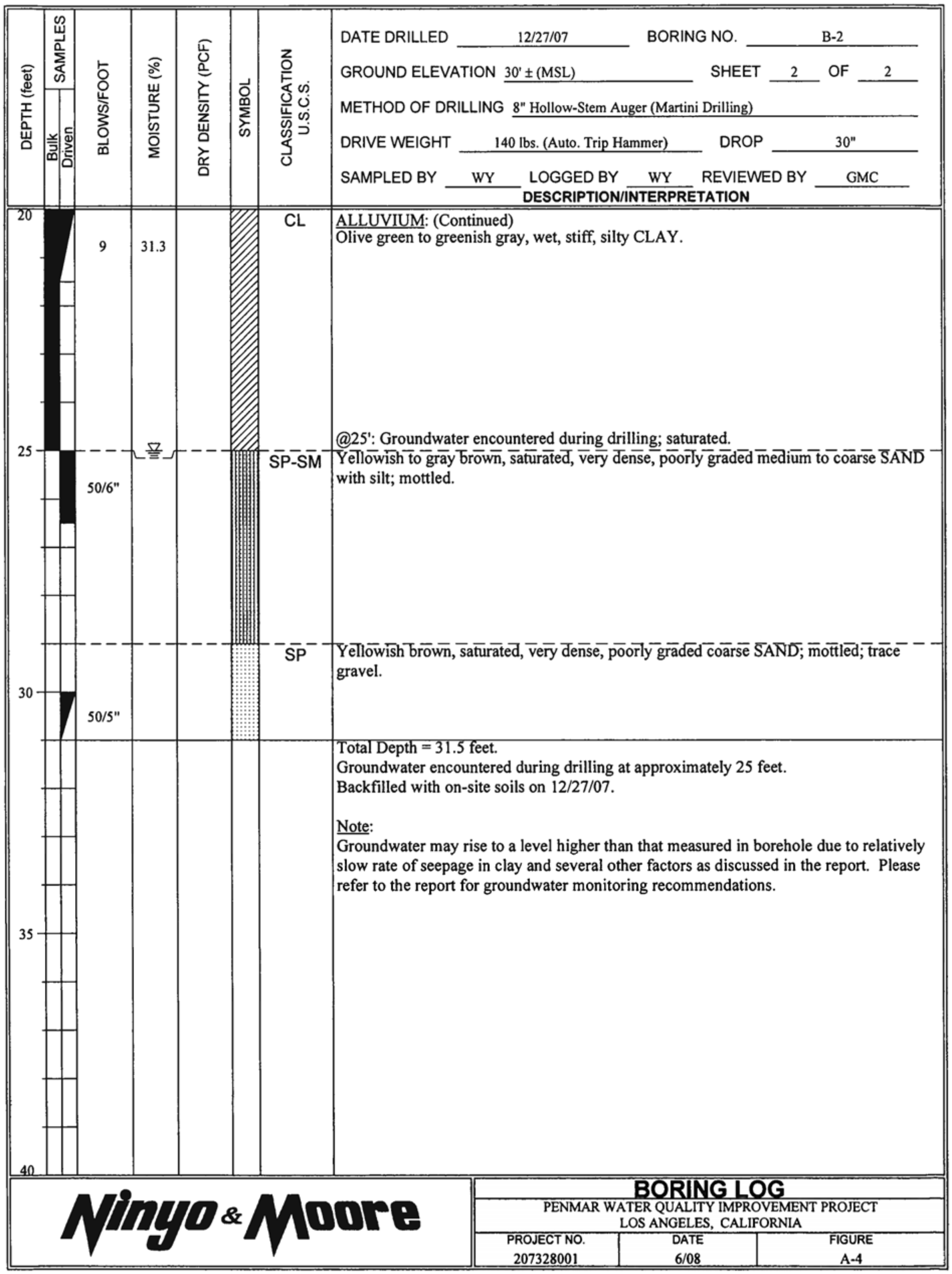
BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-3



DATE DRILLED 12/27/07 BORING NO. B-2
GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20			9	31.3			CL	ALLUVIUM: (Continued) Olive green to greenish gray, wet, stiff, silty CLAY. @25': Groundwater encountered during drilling; saturated.
25			50/6"	▽			SP-SM	Yellowish to gray brown, saturated, very dense, poorly graded medium to coarse SAND with silt; mottled.
30			50/5"				SP	Yellowish brown, saturated, very dense, poorly graded coarse SAND; mottled; trace gravel.
35								Total Depth = 31.5 feet. Groundwater encountered during drilling at approximately 25 feet. Backfilled with on-site soils on 12/27/07. Note: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
40								

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BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-4

DATE DRILLED 12/21/07 BORING NO. B-3
GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■					▨	CL	FILL: Dark brown, moist to wet, very stiff, sandy CLAY; trace gravel and wood fragments.
5	■	■	19	25.6	96.2	▨		
						▨	CL	ALLUVIUM: Light green to olive gray, moist, very stiff, silty CLAY; veins of oxidation.
10		◣	17			▨		
15	■	■	33	26.9	97.0	▨		
	■			▽		▨		@18.2': Groundwater measured approximately 15 minutes after completion of drilling; saturated.
20								

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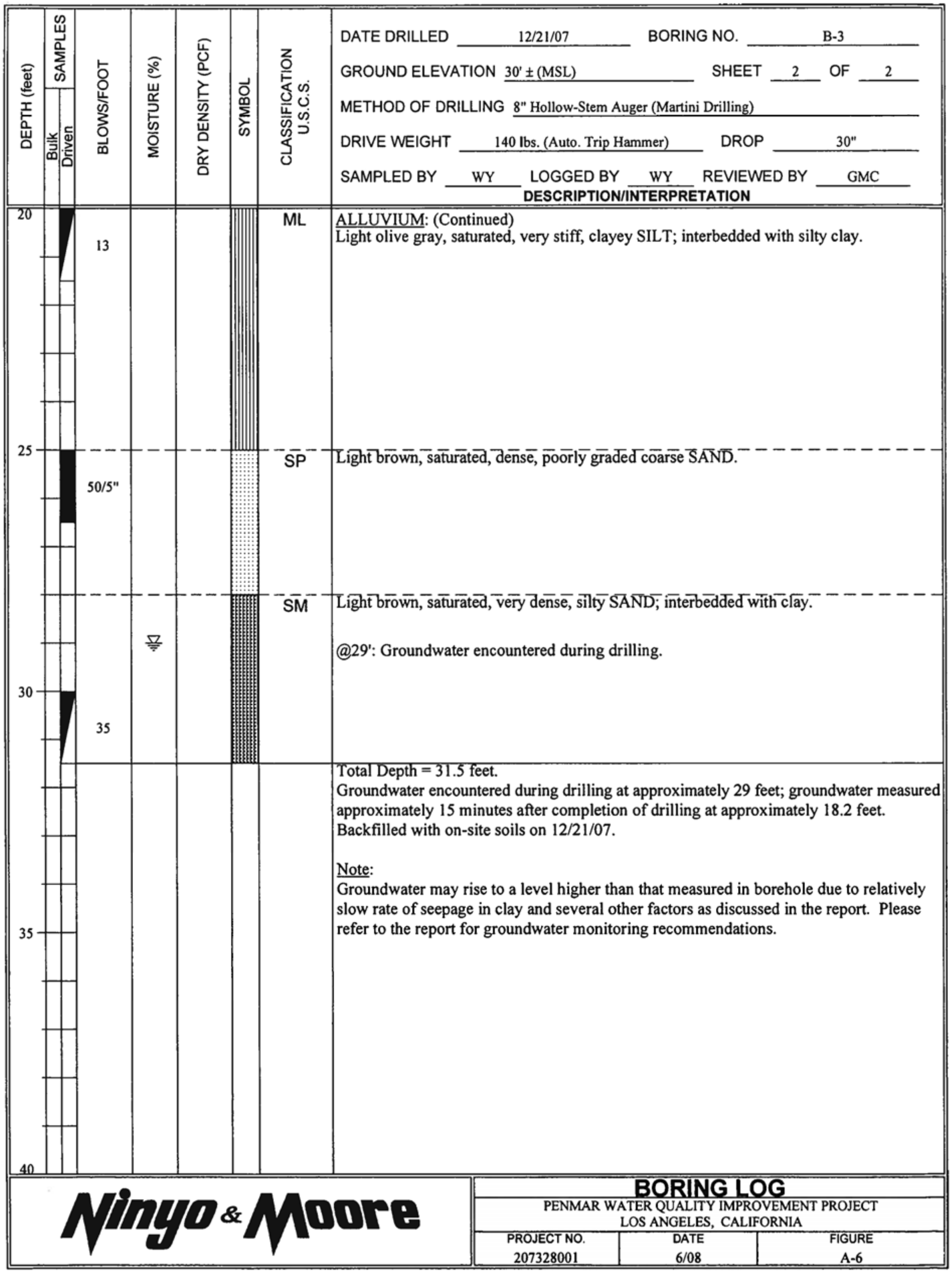
BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-5



DATE DRILLED 12/21/07 BORING NO. B-3
GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		■	13				ML	ALLUVIUM: (Continued) Light olive gray, saturated, very stiff, clayey SILT; interbedded with silty clay.
25		■	50/5"				SP	Light brown, saturated, dense, poorly graded coarse SAND.
				▽			SM	Light brown, saturated, very dense, silty SAND; interbedded with clay. @29': Groundwater encountered during drilling.
30		■	35					
35								Total Depth = 31.5 feet. Groundwater encountered during drilling at approximately 29 feet; groundwater measured approximately 15 minutes after completion of drilling at approximately 18.2 feet. Backfilled with on-site soils on 12/21/07. Note: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
40								

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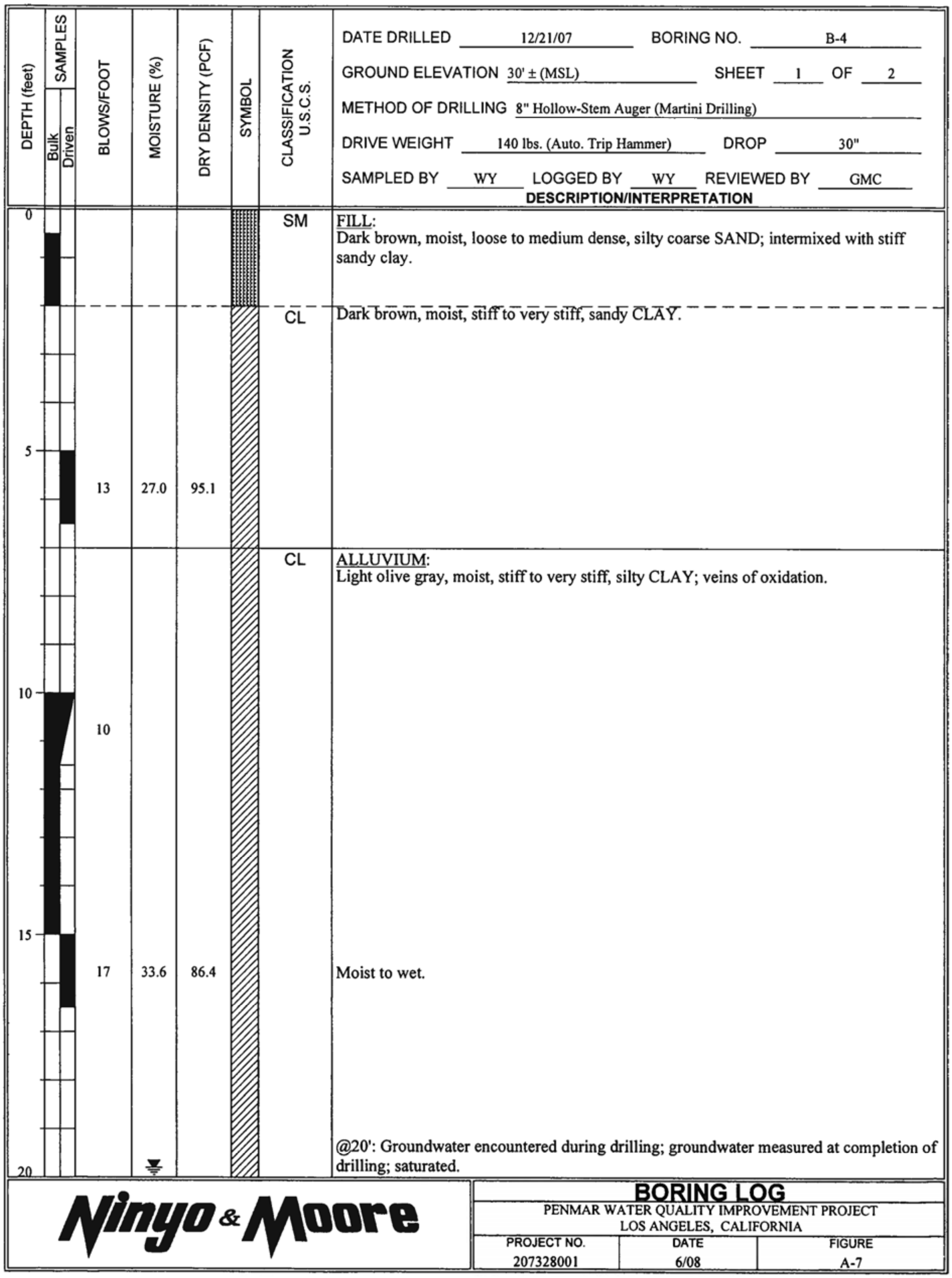
BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-6



DATE DRILLED 12/21/07 BORING NO. B-4

GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SM	FILL: Dark brown, moist, loose to medium dense, silty coarse SAND; intermixed with stiff sandy clay.
							CL	Dark brown, moist, stiff to very stiff, sandy CLAY.
5			13	27.0	95.1			
							CL	ALLUVIUM: Light olive gray, moist, stiff to very stiff, silty CLAY; veins of oxidation.
10			10					
15			17	33.6	86.4			Moist to wet.
20				▼				@20': Groundwater encountered during drilling; groundwater measured at completion of drilling; saturated.

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BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-7

DATE DRILLED 12/21/07 BORING NO. B-4
GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20			37				SP-SM	ALLUVIUM: (Continued) Light gray, saturated, very dense, poorly graded fine SAND with silt; laminated; veins of oxidation.
25			50/5"	22.9	101.1			Yellowish brown; coarse sand; trace gravel.
30			24					Dense; few to little gravel.
								Total Depth = 31.5 feet. Groundwater encountered during drilling at approximately 20 feet; groundwater measured at completion of drilling at approximately 20 feet. Backfilled with on-site soils on 12/21/07. Note: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
35								
40								

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BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-8

DATE DRILLED 12/21/07 BORING NO. B-5
GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 3
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■					▨	CH	FILL: Dark brown, stiff, moist, sandy CLAY.
5		■	12	25.7	93.1	▨		
						▨	CL	ALLUVIUM: Light gray, moist, stiff, CLAY; veins of oxidation.
10	■	■	11	32.8		▨		
						▥	ML	Light gray, moist, very dense, sandy fine SILT; laminated.
15		■	85	23.8	100.4	▥		
20								

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PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-9

DATE DRILLED 12/21/07 BORING NO. B-5
GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 3
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20			39	▼ 14.7			SM	ALLUVIUM: (Continued) Yellowish brown, saturated, medium dense, silty coarse SAND; mottled. @20.5': Groundwater measured approximately 1 hour after completion of drilling. @22': Groundwater encountered during drilling.
				▽			SP	Yellowish brown, saturated, very dense, poorly graded coarse SAND.
25			50/4"					
							SP-SM	Yellowish brown, saturated, very dense, poorly graded SAND with silt and gravel.
30			50/5"					
35			4					Loose.
40								

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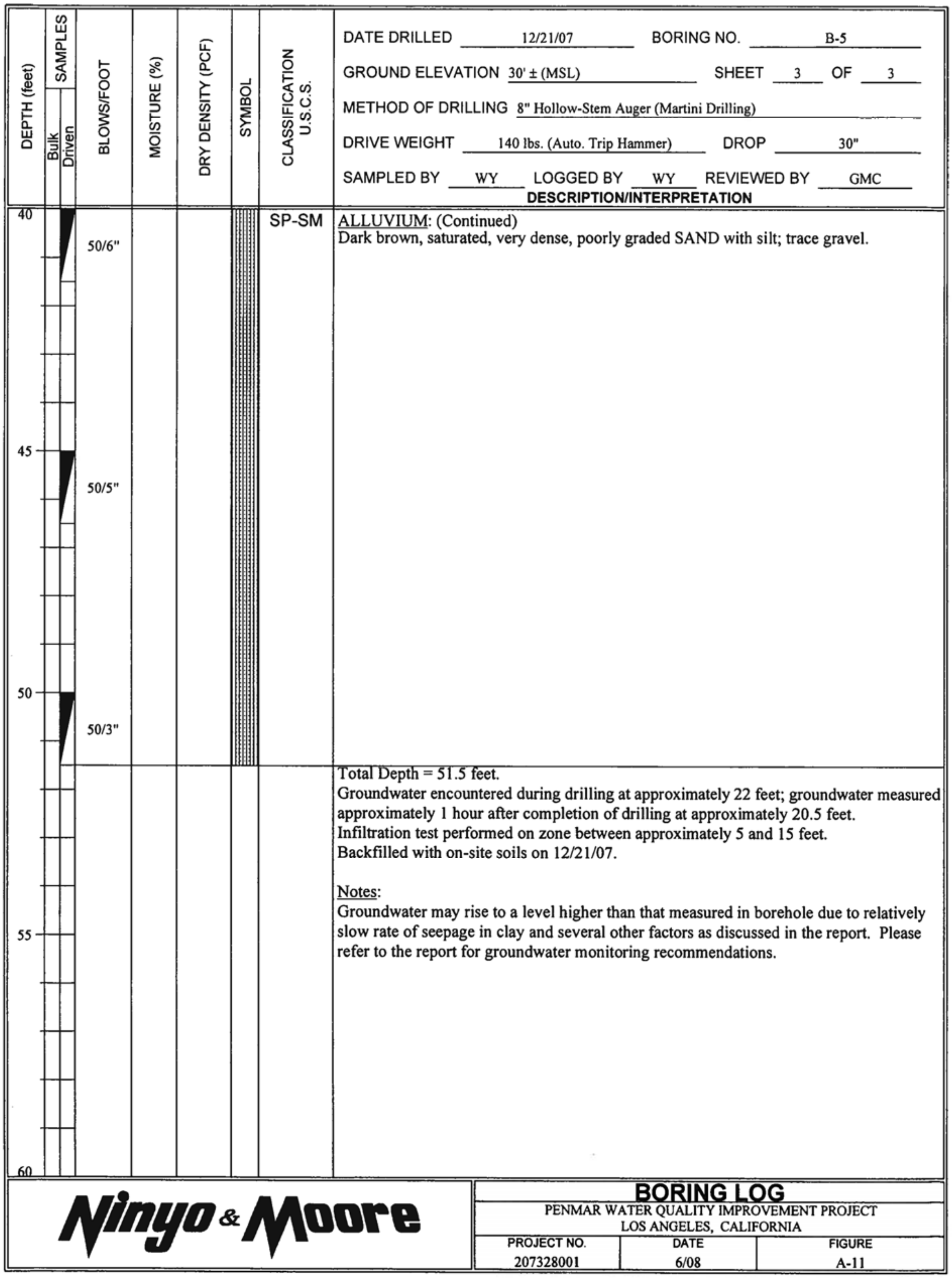
BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-10



DATE DRILLED 12/21/07 BORING NO. B-5
GROUND ELEVATION 30' ± (MSL) SHEET 3 OF 3
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40							SP-SM	ALLUVIUM: (Continued) Dark brown, saturated, very dense, poorly graded SAND with silt; trace gravel.
			50/6"					
45			50/5"					
50			50/3"					
								Total Depth = 51.5 feet. Groundwater encountered during drilling at approximately 22 feet; groundwater measured approximately 1 hour after completion of drilling at approximately 20.5 feet. Infiltration test performed on zone between approximately 5 and 15 feet. Backfilled with on-site soils on 12/21/07.
55								Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
60								

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BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-11

DATE DRILLED 12/21/07 BORING NO. B-6
GROUND ELEVATION 25' ± (MSL) SHEET 1 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SM	FILL: Dark brown, moist, medium dense, silty coarse SAND.
							CL	ALLUVIUM: Dark gray, moist to wet, very stiff, silty CLAY.
5			14	33.7	88.4			
10			17					
15			14	41.4 ▽	75.8			Light olive gray to yellowish brown; veins of oxidation. @16': Groundwater encountered during drilling; saturated.
20								

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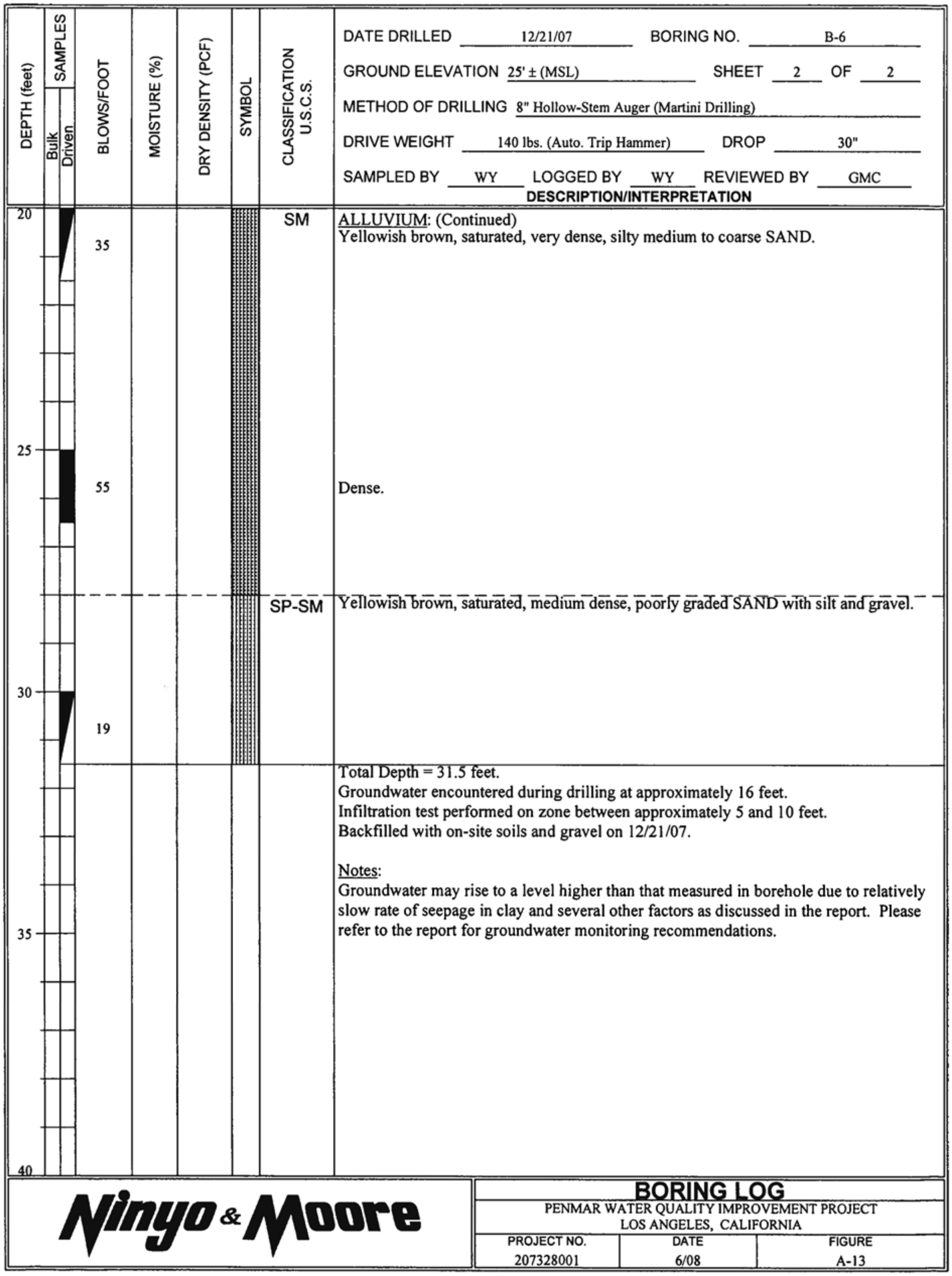
BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-12



DATE DRILLED 12/21/07 BORING NO. B-6
GROUND ELEVATION 25' ± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		■	35			▨	SM	ALLUVIUM: (Continued) Yellowish brown, saturated, very dense, silty medium to coarse SAND.
25		■	55			▨		Dense.
						▨	SP-SM	Yellowish brown, saturated, medium dense, poorly graded SAND with silt and gravel.
30		■	19			▨		
								Total Depth = 31.5 feet. Groundwater encountered during drilling at approximately 16 feet. Infiltration test performed on zone between approximately 5 and 10 feet. Backfilled with on-site soils and gravel on 12/21/07.
								Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
35								
40								

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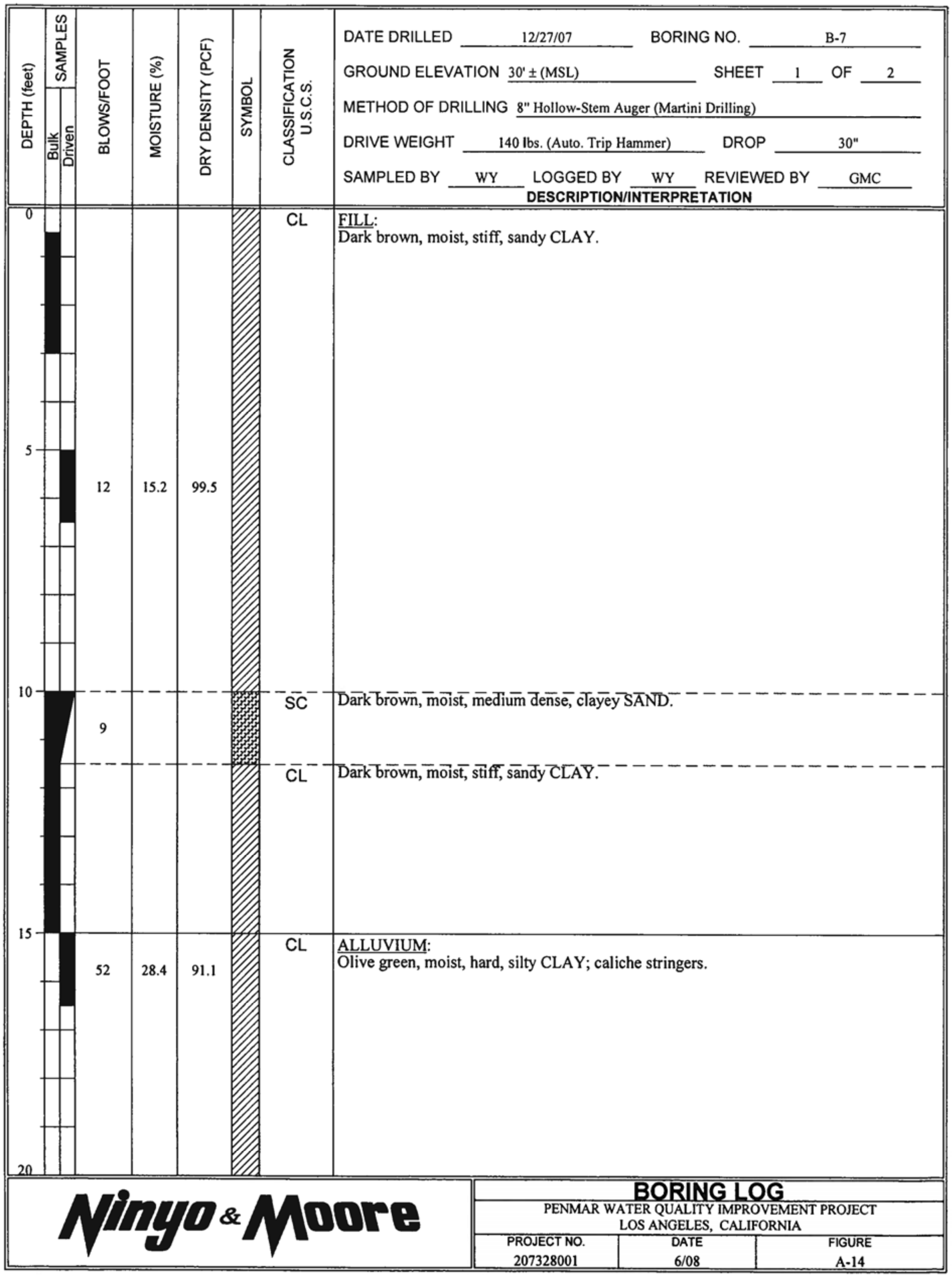
BORING LOG
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-13



DATE DRILLED 12/27/07 BORING NO. B-7
GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							CL	FILL: Dark brown, moist, stiff, sandy CLAY.
5			12	15.2	99.5			
10			9				SC	Dark brown, moist, medium dense, clayey SAND.
							CL	Dark brown, moist, stiff, sandy CLAY.
15			52	28.4	91.1		CL	ALLUVIUM: Olive green, moist, hard, silty CLAY; caliche stringers.
20								

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PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-14

DATE DRILLED 12/27/07 BORING NO. B-7

GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20			38				SM	ALLUVIUM: (Continued) Dark yellowish brown, moist to wet, medium dense, silty medium to coarse SAND.
				▽				@24': Groundwater measured at completion of drilling; saturated.
25			16					
							ML	Dark gray, saturated, firm, SILT.
30			4					
								Total Depth = 31.5 feet. No groundwater encountered during drilling; groundwater measured at completion of drilling at approximately 24 feet. Infiltration test performed on zone between approximately 5 and 15 feet. Backfilled with on-site soils and gravel on 12/27/07. Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
35								
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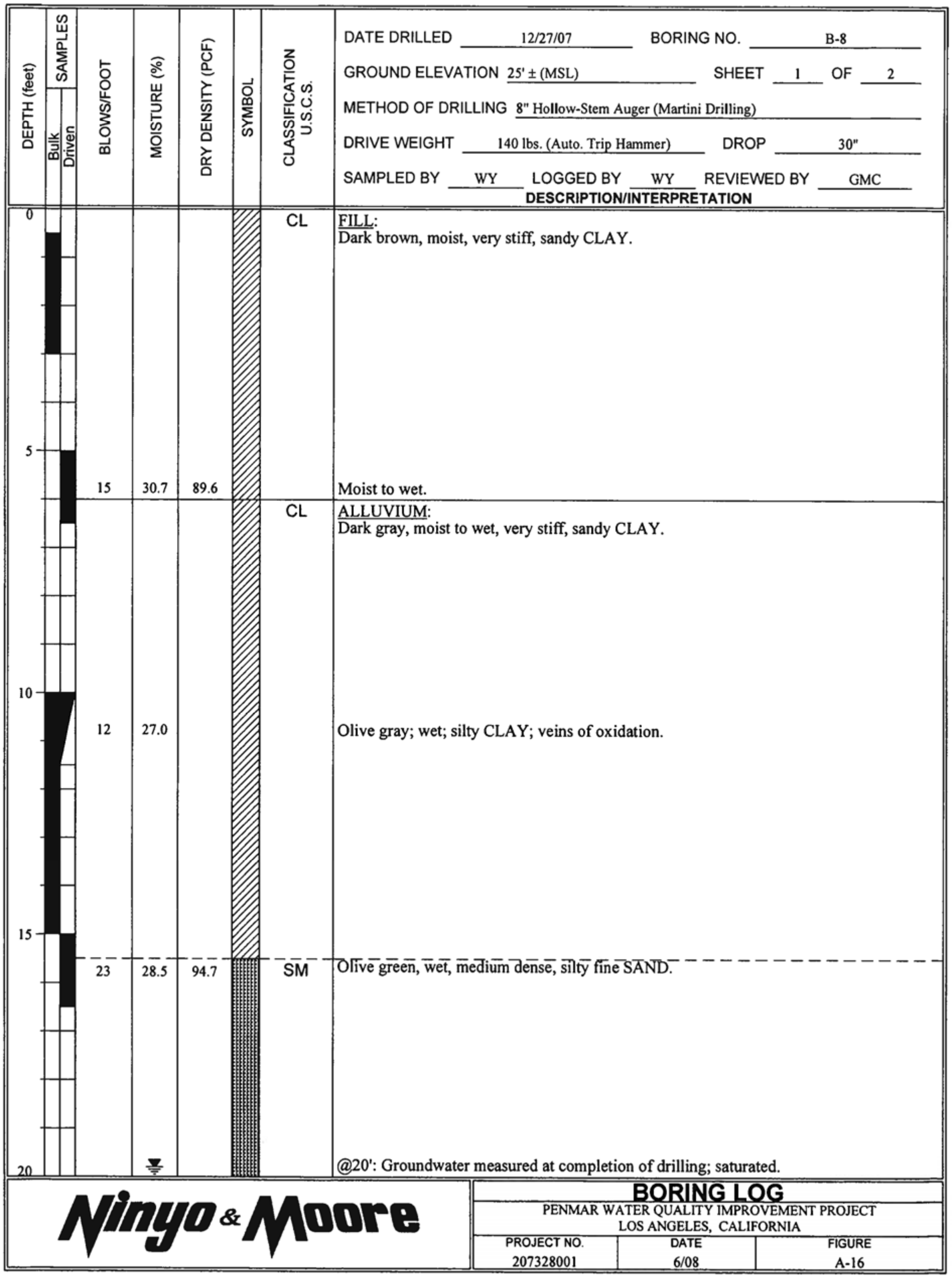
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-15



DATE DRILLED 12/27/07 BORING NO. B-8

GROUND ELEVATION 25' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0				CL	FILL: Dark brown, moist, very stiff, sandy CLAY.
5	15	30.7	89.6		Moist to wet.
				CL	ALLUVIUM: Dark gray, moist to wet, very stiff, sandy CLAY.
10	12	27.0			Olive gray; wet; silty CLAY; veins of oxidation.
15	23	28.5	94.7	SM	Olive green, wet, medium dense, silty fine SAND.
20		▽			@20': Groundwater measured at completion of drilling; saturated.

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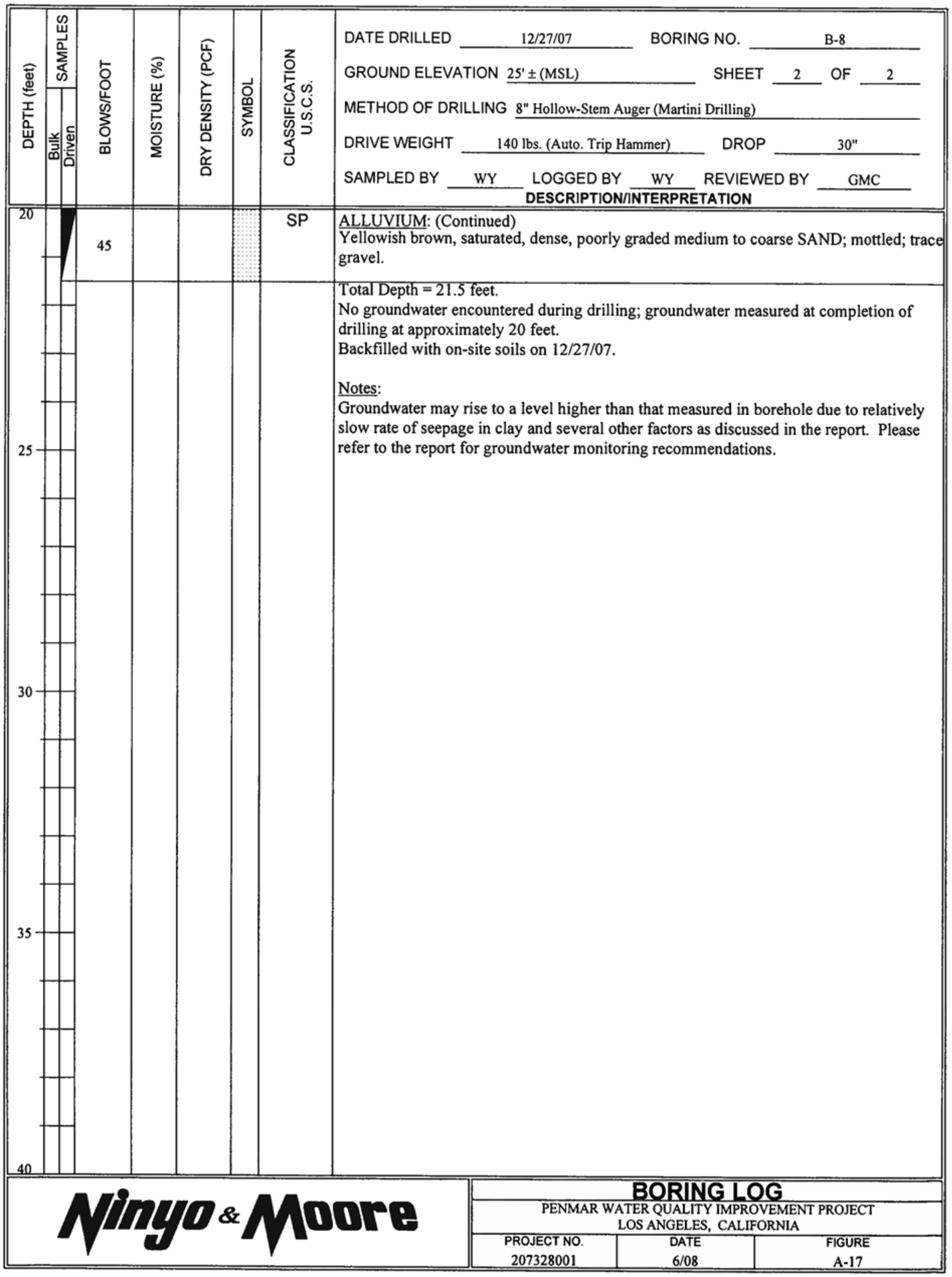
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-16



DATE DRILLED 12/27/07 BORING NO. B-8
GROUND ELEVATION 25' ± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		■	45			▨	SP	ALLUVIUM: (Continued) Yellowish brown, saturated, dense, poorly graded medium to coarse SAND; mottled; trace gravel.
								Total Depth = 21.5 feet. No groundwater encountered during drilling; groundwater measured at completion of drilling at approximately 20 feet. Backfilled with on-site soils on 12/27/07. Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
25								
30								
35								
40								

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PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-17

APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-00. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937-04. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422-63. The grain-size distribution curves are shown on Figures B-1 through B-3 These test results were utilized in evaluating the soil classifications in accordance with the USCS.

200 Wash

An evaluation of the percentage of minus-200 sieve material in selected soil samples was performed in general accordance with ASTM D 1140-00. The results of the tests are presented on Figure B-4.

Atterberg Limits

Tests were performed on a selected representative fine-grained soil sample to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318-05. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure B-5.

Expansion Index Tests

The expansion index of a selected material was evaluated in general accordance with UBC Standard No. 18-2 (ASTM D 4829-03). The specimen was molded under a specified compactive energy at approximately 50 percent saturation (plus or minus 1 percent). The prepared 1-inch-thick by 4-inch-diameter specimen was loaded with a surcharge of 144 pounds per square foot and were inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The results of these test are presented on Figure B-6.

Consolidation Tests

Consolidation tests were performed on a selected relatively undisturbed soil samples in general accordance with ASTM D 2435-04. The sample was inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of the test is summarized on Figure B-7.

Collapse Potential Tests

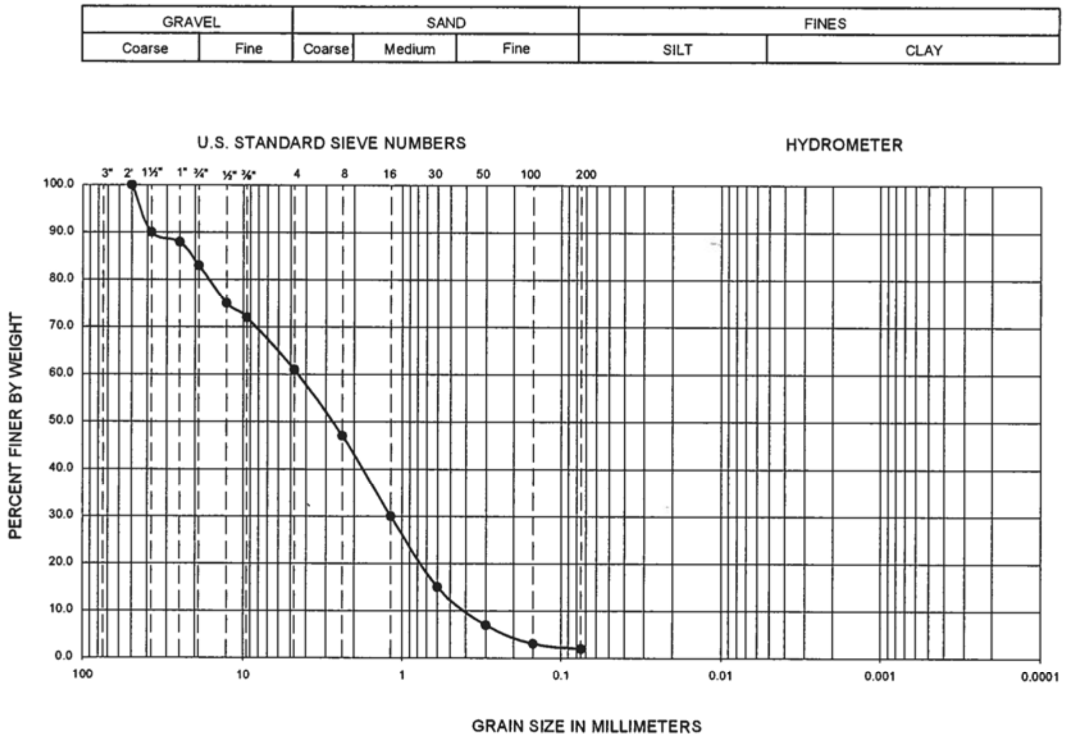
A collapse potential test was performed on a selected relatively undisturbed soil sample in general accordance with ASTM D 5333. The sample was inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The result of the test is summarized on Figure B-8.

Direct Shear Tests

Direct shear tests were performed on a relatively undisturbed sample in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of selected materials. The sample was inundated during shearing to represent adverse field conditions. The results are shown on Figure B-9.

Soil Corrosivity Tests

Soil pH and resistivity tests were performed on representative samples in general accordance with California Test (CT) 643. The chloride content of selected samples was evaluated in general accordance with CT 422. The sulfate content of selected samples was evaluated in general accordance with CT 417. The test results are presented on Figure B-10.

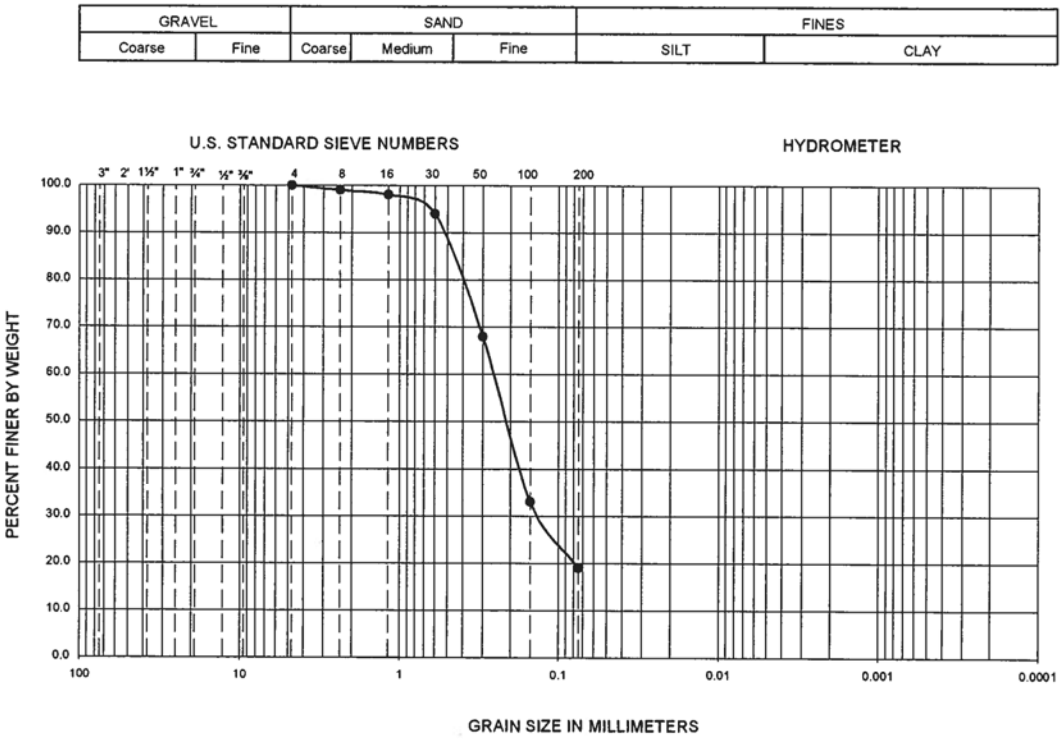


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-3	25.0-26.5	--	--	--	0.40	1.18	4.45	11.1	0.8	2	SP

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	B-1
207328001	6/08		

207328001 B-1, SIEVE w No 8 B-3--25.0-26.5.xls



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-7	20.0-21.5	--	--	--	--	--	--	--	--	19	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore

PROJECT NO.	DATE
207328001	6/08

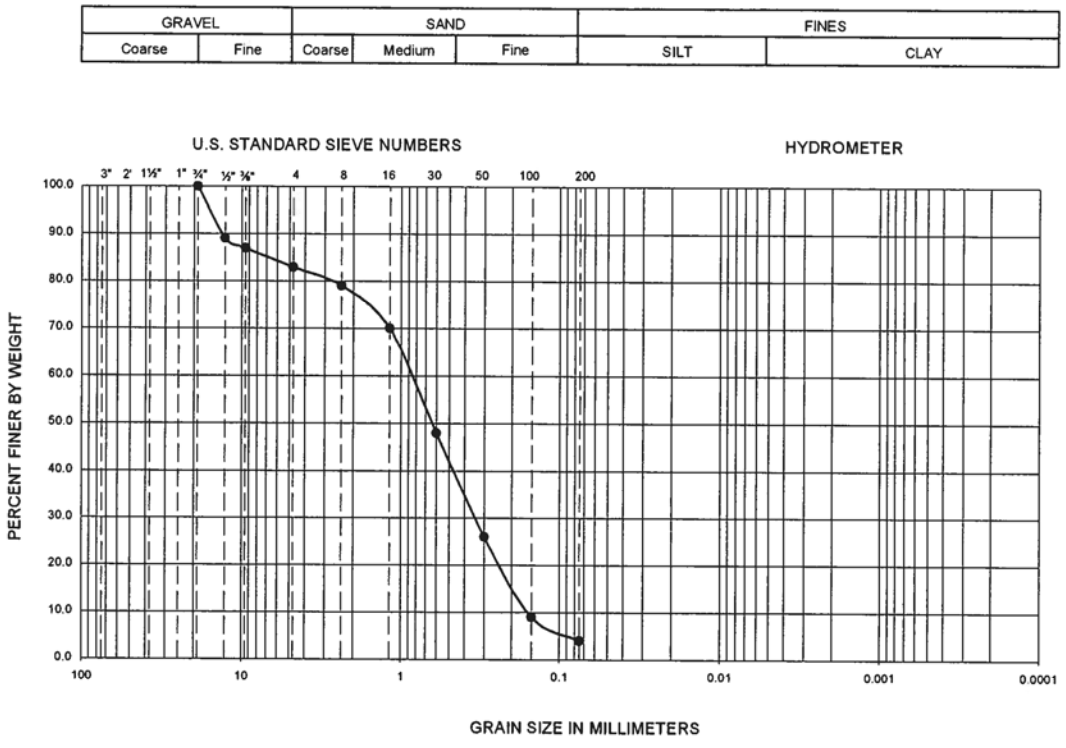
GRADATION TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

B-2

207328001 B-2, SIEVE w No 8 B-7--20.0-21.5.xls



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-8	20.0-21.5	--	--	--	0.16	0.34	0.84	5.3	0.9	4	SP

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore

PROJECT NO.	DATE
207328001	6/08

GRADATION TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE
B-3

207328001 B-3, SIEVE w No 8 B-8~20.0-21.5.xls

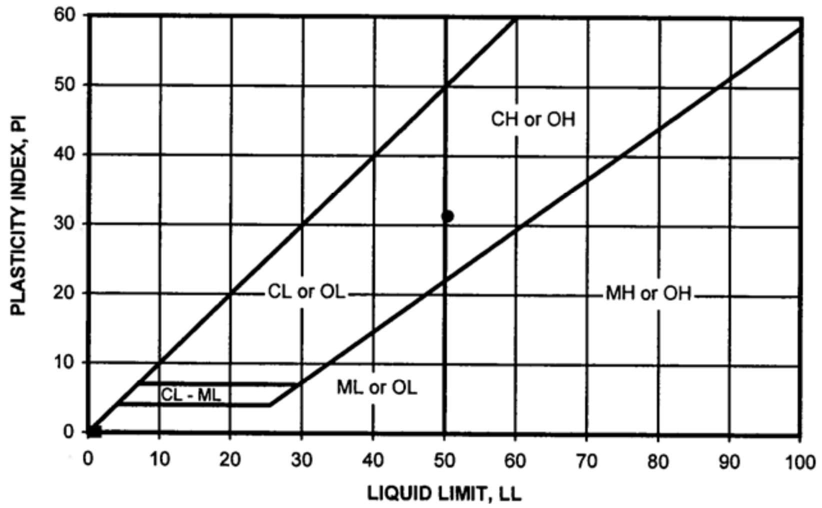
SAMPLE LOCATION	SAMPLE DEPTH (FT)	DESCRIPTION	PERCENT PASSING NO. 4	PERCENT PASSING NO. 200	USCS (TOTAL SAMPLE)
B-2	25.0-26.5	POORLY GRADED SAND WITH SILT	88	7	SP-SM
B-4	30.0-31.5	POORLY GRADED SAND WITH SILT AND GRAVEL	76	7	SP-SM
B-5	15.0-16.5	SANDY SILT	100	54	ML
B-5	25.0-26.5	POORLY GRADED SAND	95	4	SP
B-5	35.0-36.5	POORLY GRADED SAND WITH SILT AND GRAVEL	84	6	SP-SM
B-5	45.0-46.5	POORLY GRADED SAND WITH SILT	100	8	SP-SM
B-6	30.0-31.5	POORLY GRADED SAND WITH SILT AND GRAVEL	68	8	SP-SM
B-7	25.0-26.5	SILTY SAND	100	46	SM
B-8	5.0-6.5	LEAN CLAY	100	91	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1140-00

Ninyo & Moore		NO. 200 SIEVE ANALYSIS	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	B-4
207328001	6/08		

207328001 B-4, 200-WASHB-2-B-8.xls

SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
●	B-1	15.0-20.0	50	19	31	CL-CH	CL-CH



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-05

Ninyo & Moore

PROJECT NO.	DATE
207328001	6/08

ATTERBERG LIMITS TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE
B-5

207328001 B-5, ATTERBERG B-1–15.0-20.0.xls

SAMPLE LOCATION	SAMPLE DEPTH (FT)	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (IN)	EXPANSION INDEX	POTENTIAL EXPANSION
B-5	8.0-12.0	13.4	98.0	30.5	0.056	56	Medium

PERFORMED IN GENERAL ACCORDANCE WITH ☑ UBC STANDARD 18-2 ☐ ASTM D 4829-03

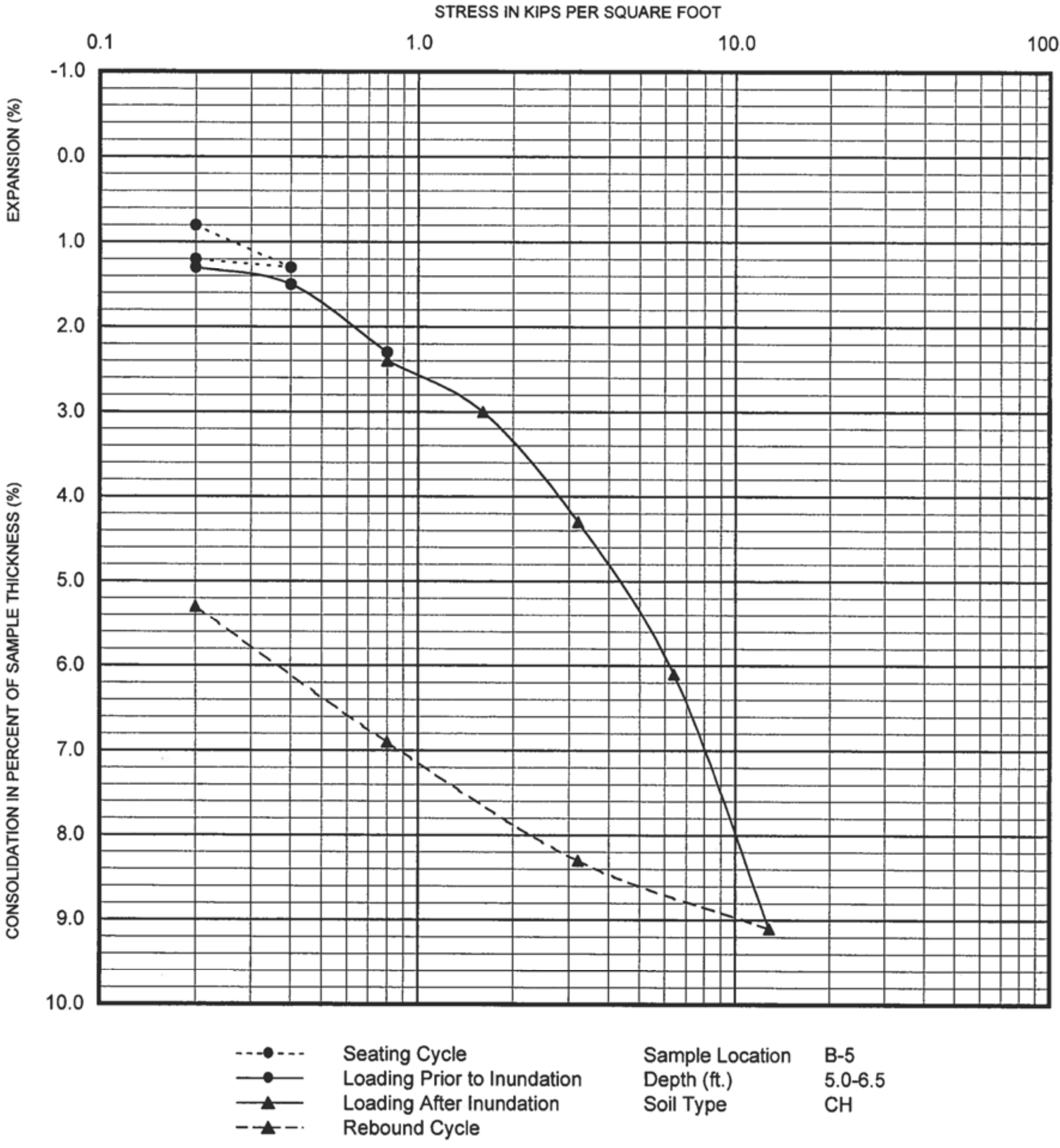
Ninyo & Moore

EXPANSION INDEX TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	B-6

207328001 B-6, EXPANSION B-5–8.0-12.0.xls



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-04

Ninyo & Moore

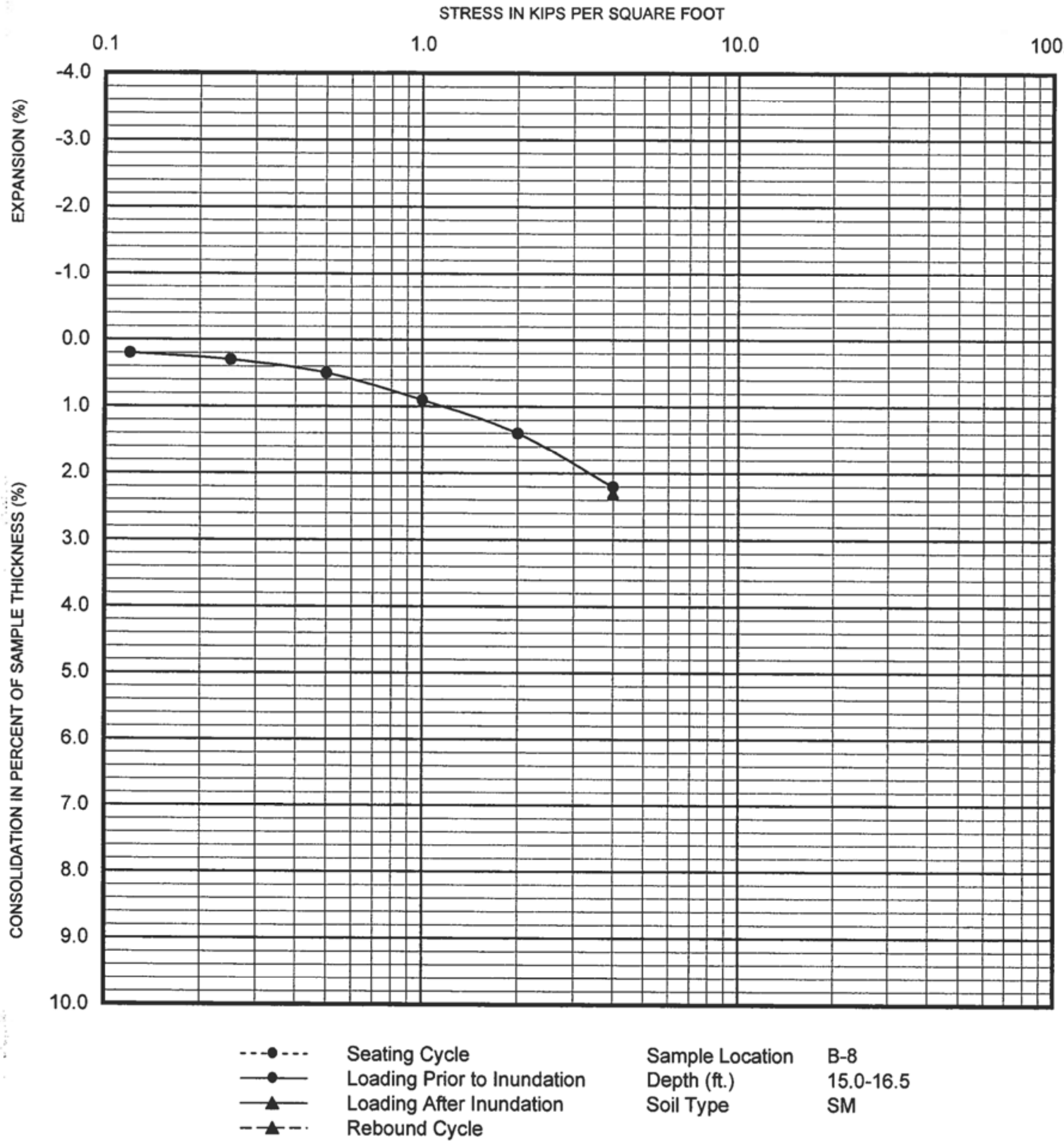
CONSOLIDATION TEST RESULTS

PROJECT NO.	DATE
207328001	6/08

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE
B-7

207328001 B-7, CONSOLIDATION B-5--5.0-6.5.xls



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 5333-03

Ninyo & Moore

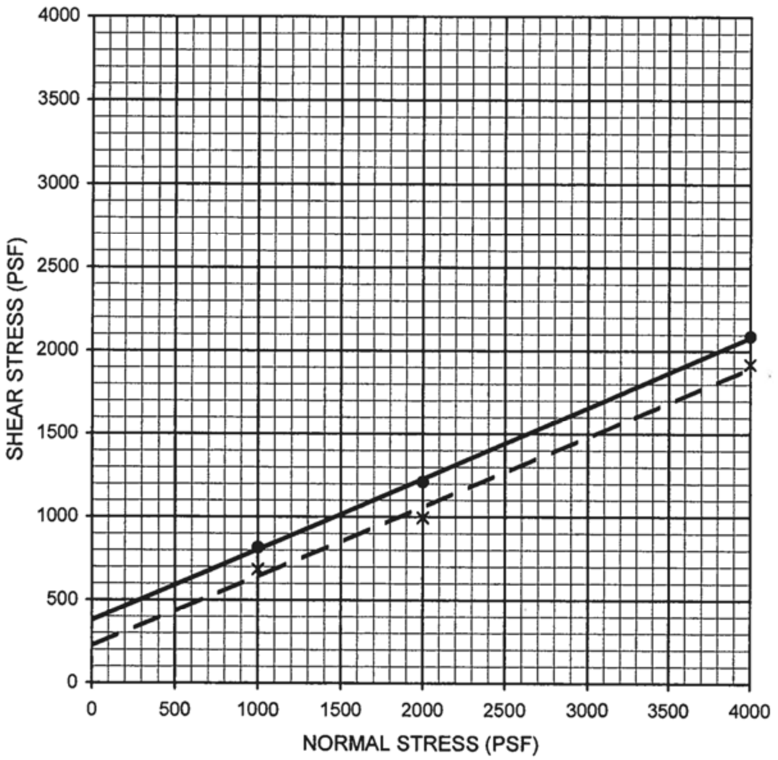
PROJECT NO.	DATE
207328001	6/08

COLLAPSE POTENTIAL TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE
B-8

207328001 B-8, CONSOLIDATION B-8--15.0-16.5.xls

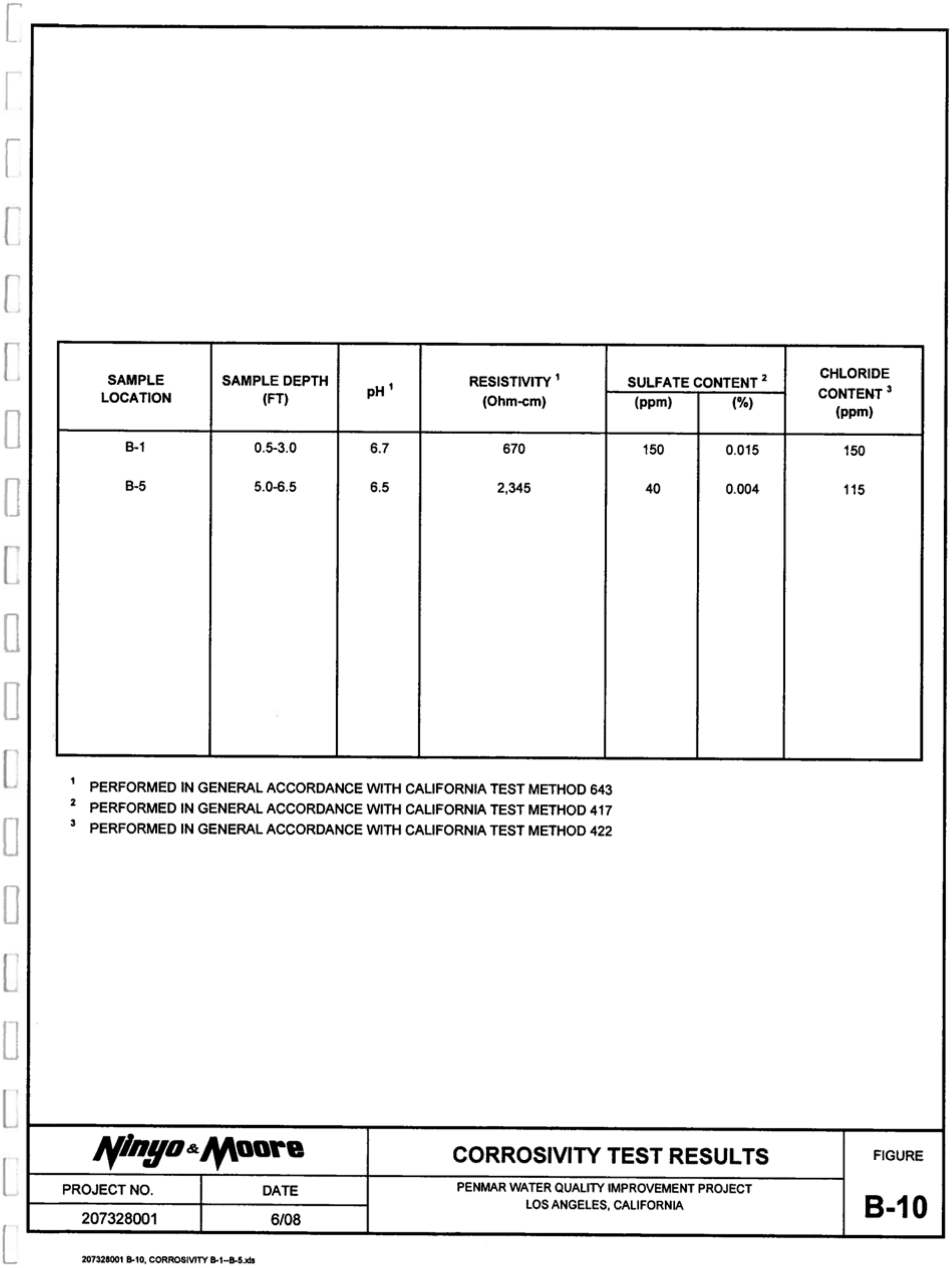


Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion, c (psf)	Friction Angle, ϕ (degrees)	Soil Type
Dark brown, sandy CLAY	—●—	B-5	5.0-6.5	Peak	378	23	CH
Dark brown, sandy CLAY	- - X - -	B-5	5.0-6.5	Ultimate	222	23	CH

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080-04

Ninyo & Moore		DIRECT SHEAR TEST RESULTS	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	B-9
207328001	6/08		

207328001 B-9, DIRECT SHEAR B-5–5.0-6.5.xls



SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH [1]	RESISTIVITY [1] (Ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-1	0.5-3.0	6.7	670	150	0.015	150
B-5	5.0-6.5	6.5	2,345	40	0.004	115

[1] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 643
[2] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 417
[3] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 422

Ninyo & Moore

PROJECT NO.	DATE
207328001	6/08

CORROSIVITY TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE
B-10

207328001 B-10, CORROSIVITY B-1--B-5.xls

City of Los Angeles, Department of Public Works
Bureau of Engineering

Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Technical Memorandum No. 8
Utility Relocation / Replacement

August 2008

BROWN AND CALDWELL

W.O. No. EW40019F

TABLE OF CONTENTS

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

BOE	Bureau of Engineering
Concept Report	Penmar Water Quality Improvement and Runoff Reuse Project Concept Report
FHWA	Federal Highway Administration
LABOS	Los Angeles Bureau of Sanitation
MG	million gallon
MUTCD	Manual on Uniform Traffic Control Devices
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
VCP	vitiried clay
WATCH	Work Area Traffic Control Handbook

INTRODUCTION

This Technical Memorandum (TM) describes utilities relocation issues associated with the construction of the Penmar Water Quality Improvement Project. At five locations (Frederick Street, Oakwood Avenue, Rialto Court, Crescent Place, and Abbot Kinney Boulevard), project improvements will require relocation and replacement of existing utilities. In Frederick Street, a recently completed sanitary sewer line will need to be relocated to accommodate the proposed diversion structure and pump station sump to be constructed within the Frederick Street right-of-way. In Oakwood Avenue, Rialto Court, Crescent Place, and Abbot Kinney Boulevard, approximately 700 feet of existing sanitary sewer will need to be replaced in order to eliminate “bottlenecks” that presently restricts the discharge rate into the sanitary sewer from the proposed 2.75 million gallon (MG) Penmar storm water storage reservoir. The intent of this TM is to describe the existing conditions along Frederick Street, Oakwood Avenue, Rialto Court, Crescent Place, and Abbot Kinney Boulevard, the proposed upgrade, relocation work, review construction sequencing, methodology for relocating and replacing the existing utilities.

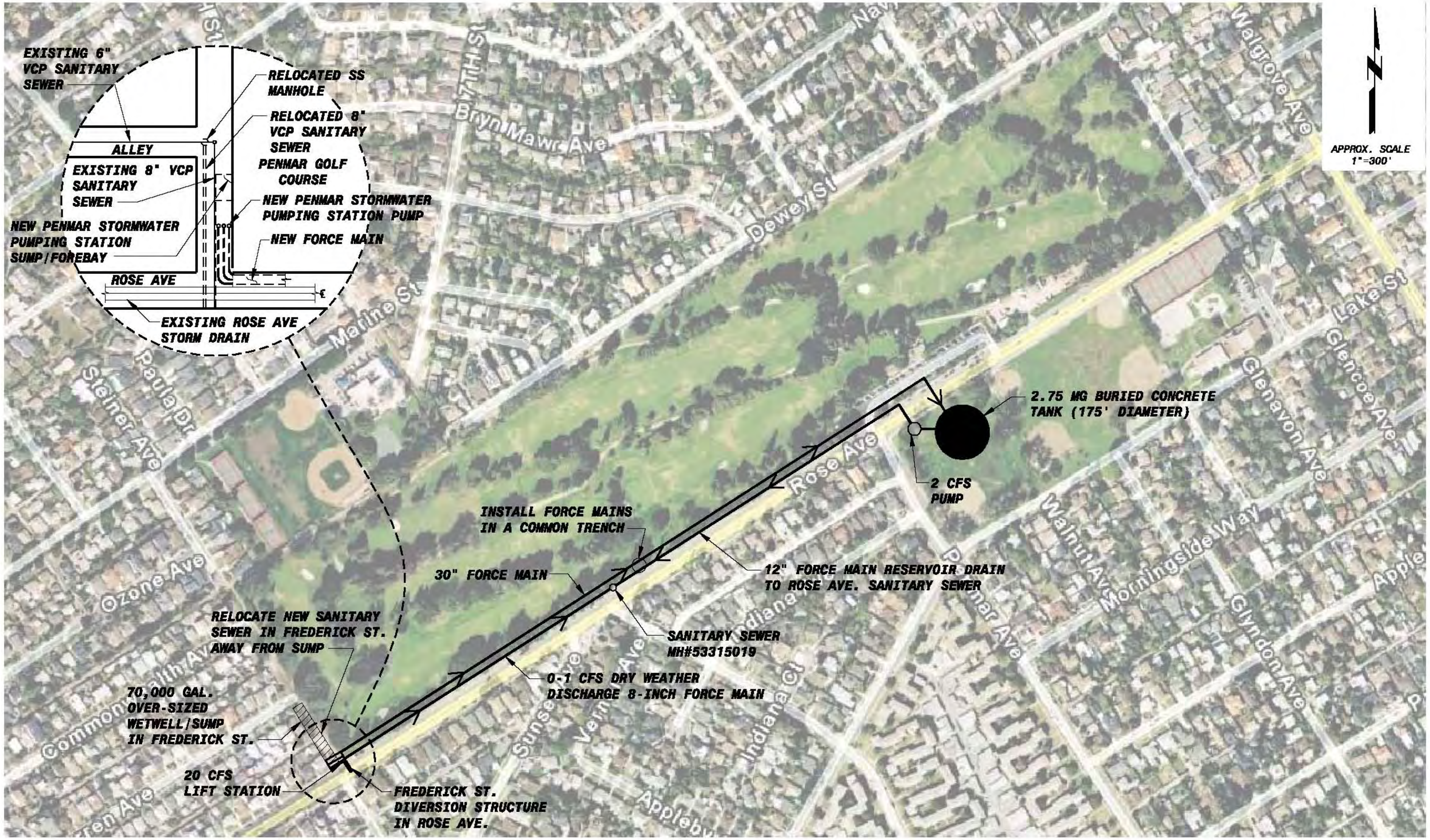
1.0 PROJECT DESCRIPTION

The Penmar Water Quality Improvement Project is located at Penmar Golf Course and Penmar Recreation Center in the western section of the City of Los Angeles, immediately south of the City of Santa Monica. The City of Los Angeles Bureau of Sanitation (LABOS) prepared a report titled *Penmar Water Quality Improvement and Runoff Reuse Project Concept Report* (Concept Report) in March 2007. This TM discusses plans for relocating and upgrading existing utilities in the project area in order to accommodate the needs of the project.

Since the release of the Concept Report, several key project features have evolved through a series of workshops with the BOE and project stakeholders. The resulting concept for the Project, which differs significantly from the one discussed in the Concept Report is shown in Figure 1.

The City of Los Angeles wishes to construct a regional stormwater quality improvement project at the Penmar location. The main objective of the project is to achieve compliance with the Wet Weather Total Maximum Daily Load (TMDL) regulations for bacteria at the Santa Monica Bay Beaches. The project includes constructing a diversion structure in the Los Angeles County Rose Avenue storm drainage culvert and diverting dry-season and storm flows (up to 20 cfs) into a pump station wet well. Diverted stormwater will be pumped to a 2.75 MG storage reservoir. After a 72-hour post storm holding period, the stormwater collected in the reservoir and sump will be pumped from these facilities at a regulated rate into the sanitary sewer system (maximum flow rate of 1.0 cfs from 6 a.m. to Midnight, and 1.5 cfs from Midnight to 6 a.m.) and sent to the Hyperion Waste Water Treatment Plant for treatment. The project design will also include provisions to allow the City to develop a stormwater treatment and disinfection system in the future, enabling the stormwater to potentially be re-used for irrigation of the golf course and adjacent park areas.

The diversion structure, along with the proposed pump station, will be constructed at the intersection of Rose Avenue and Frederick Street, requiring the existing utilities within Frederick Street to be relocated outside of the footprint of the proposed pump station and wet well. General ground surface elevation within the area is approximately 22 feet above City datum.



NOT SHOWN:
OFFSITE SANITARY SEWER
UPGRADES ON OAK WOOD AVE.,
RIALTO COURT, CRESCENT PLACE,
AND ABBOT KINNEY BLVD.

CITY OF LOS ANGELES
PENMAR WATER QUALITY IMPROVEMENT PROJECT
MODIFIED CONCEPT REPORT
SCENARIOS N OR P
GENERAL ARRANGEMENT
REV. 8/4/08

Figure 1 – Schematic Layout of the Penmar Water Quality Improvement Project

The project will also involve upgrading approximately 650 feet of trunk sanitary sewer (illustrated in Figure 2) south of the discharge point in order to accommodate the design discharge rates from the Penmar project. The upgrade will occur to create sufficient additional hydraulic capacity on three sections of sewer pipe as follows: Figure 3: 250 feet of 16-inch VCP on Oakwood Avenue (Segment ID #: 56103050-56103052A); Figure 4: 145 feet of 16-inch on Rialto Court (Segment ID #: 56103127-56103128A) and 180 feet of 16-inch VCP Crescent Place (Segment ID #: 56103128-56103126A); and Figure 5: 75 feet of 16-inch VCP on Abbot Kinney Boulevard (Segment ID #: 56103346-56103155A).

2.0 UTILITIES DESCRIPTION

2.1 Frederick Street Existing Utilities

Frederick Street is located at the western end of the Penmar Golf Course. The street contains an existing 8 inch vitrified clay (VCP) sanitary sewer collector pipe that was installed along the centerline of the street in 2007 (BOE Project No. E-1543). As-built drawings for the sanitary sewer project also show a 6-inch lateral sewer running down the alley between Rose and Warren Avenues, which connects to the 8-inch Frederick Street line at a manhole (Manhole # 533-15-023) in Frederick Street. As-built drawings for the sanitary sewer project also show a 6-inch water line as being installed 16 feet east of the Frederick Street western right-of-way line. Invert elevation for this sanitary sewer is approximately 19-feet above the City datum at Manhole # 533-15-023. Available as-built information does not indicate the material for the water line, but it is presumed to be ductile iron pipe (DIP).

A Los Angeles County twin box culvert with two 9-feet wide by 12-feet high reinforced concrete boxes is centered approximately 2-feet south of the centerline of the Rose Avenue right-of-way (BOE Project No. D-15476). Invert elevation for the culvert is approximate 6.6-feet above the City datum. The new sanitary sewer in Frederick Street passes over the top of the culvert and continues across Rose Avenue to the south.

In addition, 2-inch and 3-inch Southern California Gas lines and electric lines are identified in the vicinity and are to be verified by the project surveyor prior to completion of the detailed design phase of the project in order to finalize the utilities relocation plan.

It is unclear whether Frederick Street was paved prior to the 2007 sanitary sewer replacement project. However, upon completion of the sewer replacement project, the street was turned into an unpaved buffer area. We understand that the street has been vacated by the City of Los Angeles and exists today only as a “paper street.” We presume that title to the underlying Frederick Street right-of-way remains with the City of Los Angeles, but this has not yet been confirmed by the City.

Other existing utilities in Rose Avenue, as well as the Frederick Street water line will be located by the project surveyor and verified prior to completion of the detailed design phase of the project in order to determine the exact locations for the relocations.

Figure 2 – Sanitary Sewer Alignment and Upgrade Locations

Note: Sanitary sewer illustrated in blue, section for rehabilitation highlighted in yellow. Top of the page is east.

Figure 3 – Existing Sanitary Sewer "choke point" on Oakwood Avenue (Segment ID #: 56103050-56103052A)

Note: Sanitary sewer illustrated in blue, section for rehabilitation highlighted in yellow. Top of the page is east.

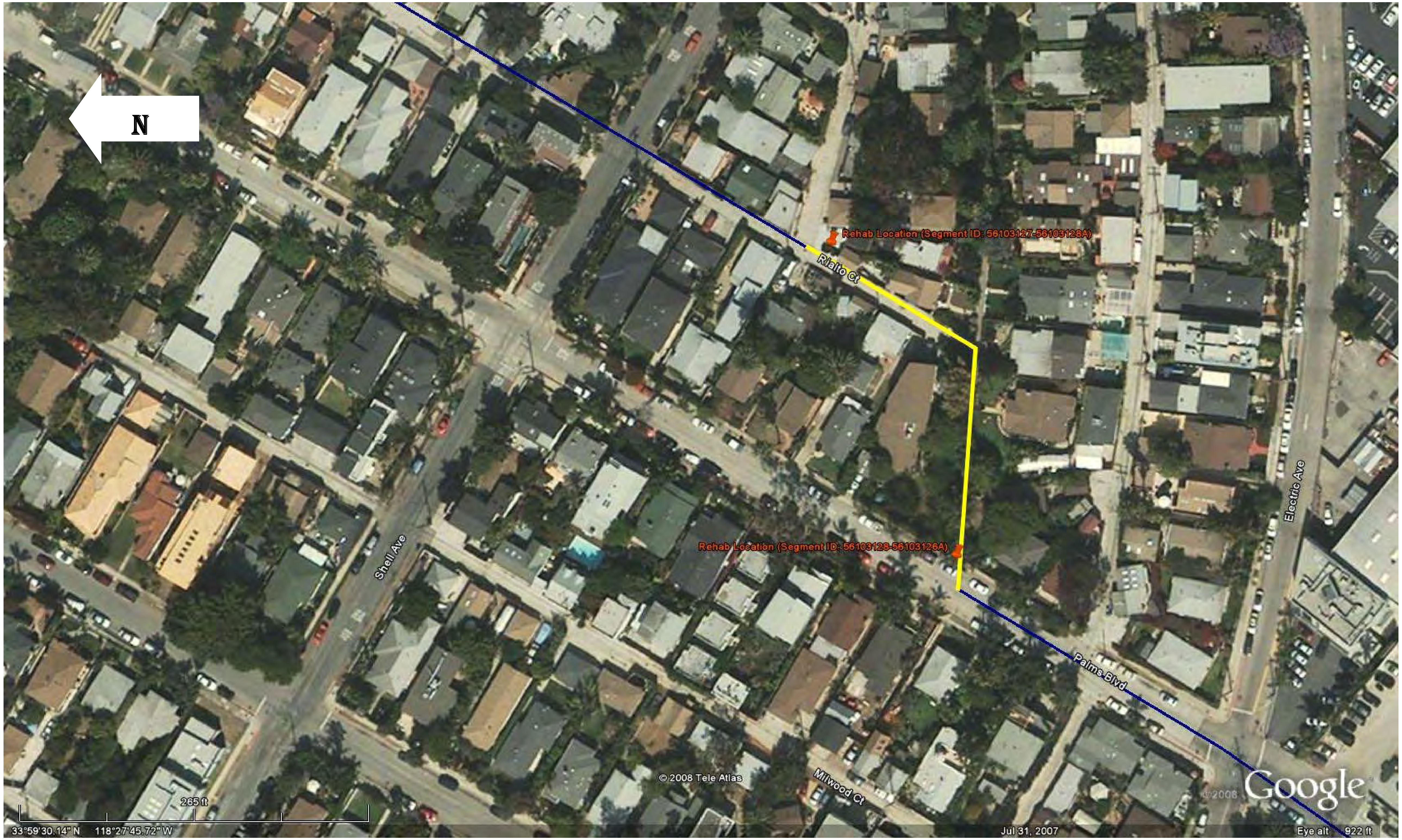


Figure 4 – Existing Sanitary Sewer "choke points" on Rialto Court (Segment ID #: 56103127-56103128A) and Crescent Place (Segment ID #: 56103128-56103126A)

Note: Sanitary sewer illustrated in blue, section for rehabilitation highlighted in yellow. Top of the page is east.

Figure 5 – Existing Sanitary Sewer "choke point" on Abbot Kinney Boulevard (Segment ID #: 56103346-56103155A)

Note: Sanitary sewer illustrated in blue, section for rehabilitation highlighted in yellow. Top of the page is east.

2.2 Proposed Frederick Street Utilities Relocation

The section of sanitary sewer to be rehabilitated of the Frederick Street pump station and sump is approximately 27 feet from outside wall to outside wall. The outside face of the eastern wall of the sump will be located approximately 5 feet west of the eastern right-of-way line for Frederick Street, which means that the sump/pump station will encroach 32 feet into the 50-foot wide Frederick Street right-of-way. In order to accommodate this facility, it will be necessary to relocate the 8-inch VCP sanitary sewer line to the west to move it outside of the sump/pump station footprint, and to also relocate the 6-inch water line to the west to avoid conflicts with the relocated sanitary sewer line. Relocation will be accommodated by installing a new maintenance hole to allow a 30° angle off the existing alignment of the 8-inch VCP sanitary sewer at about STA 7+50 (see Bureau of Engineering, Department of Public Works, City of Los Angeles ESRP – Lincoln & Sunset Alley Sewer Replacement Project plans for stationing and details) and deflecting the pipe approximately 17 feet to the west where a new maintenance hole will deflect the pipe into a new alignment parallel to the existing alignment for a distance of approximately 250 feet. The pipe will be deflected to the east with another maintenance hole allowing for 30° angle off the new alignment to another maintenance hole for connection back to the original alignment for eventual reconnection to the existing line at approximately STA 5+00. Since this is a gravity sanitary sewer line, no joint restraint shall be required, but careful attention shall be paid to proper bedding and backfilling of the new pipe around all joints and angle points.

Standard practice dictates that water lines should be located a minimum of 10 feet horizontally from sanitary sewer lines, whenever possible. In order to meet this desired horizontal separation, the sanitary sewer will be relocated from the centerline of Frederick Street to a new location 5 feet past the outside of the western wall of the pump station sump and the water line will be relocated approximately 10 feet west of the relocated sanitary sewer, approximately 3 feet from the western boundary of the Frederick Street right-of-way. This will be accomplished by cutting into the existing water line with a standard 45° restrained joint ductile iron fitting at STA 7+10 to deflect the pipe to the west. Restrained joints shall be required at all fittings and points of deflection. The relocated water line will be re-deflected back to the east at approximately STA 5+ 25 for reconnection back to the existing water line at approximately STA 5+7.5. An existing water service connection for the house on the northwest corner of the intersection of Frederick Street and Rose Avenue will be reconnected onto the relocated water line. The proposed plan of utilities relocation for Frederick Street is shown in Figure 6.

2.3 Oakwood Avenue Existing Utilities

The location of sewer rehabilitation on Oakwood Avenue is located approximately one mile downstream of the sewer discharge connection at Sunset Avenue and Rose Avenue. The street contains a 16-inch VCP sanitary sewer collection pipe that was installed in 1975 that will require upgrading 250 feet of sewer pipe to a minimum of 21-inch VCP installed along the existing sewer alignment and slope. The as-built drawings indicate the sewer is approximately 7 feet north of the Oakwood Avenue centerline approximately 8 feet below ground surface.

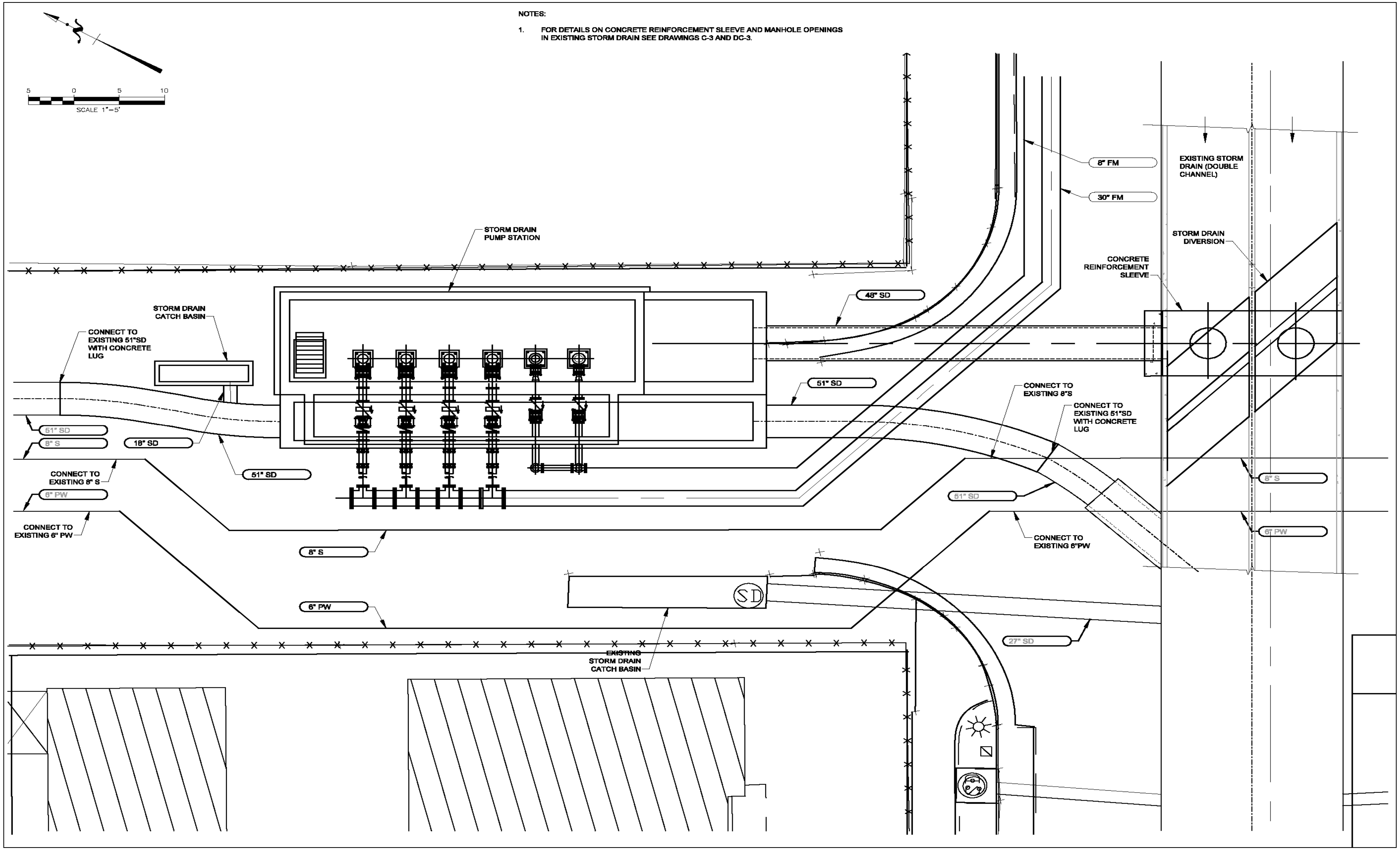


Figure 6 – Proposed Frederick Street Utilities Relocation

A Los Angeles County storm drain consisting of a single 27-inch Circular RCP is located approximately 12.5 feet south of the Oakwood Avenue centerline. The as-built drawings also indicate a 6-inch VCP sanitary sewer on the Oakwood Avenue centerline and a 6-inch water line 6 feet north of the Oakwood Avenue centerline. The location of buried infrastructure along the alignment of the sanitary sewer rehabilitation (Segment ID #: 56103050-56103052A) available through NavigateLA for Oakwood Avenue is illustrated in Figure 7.

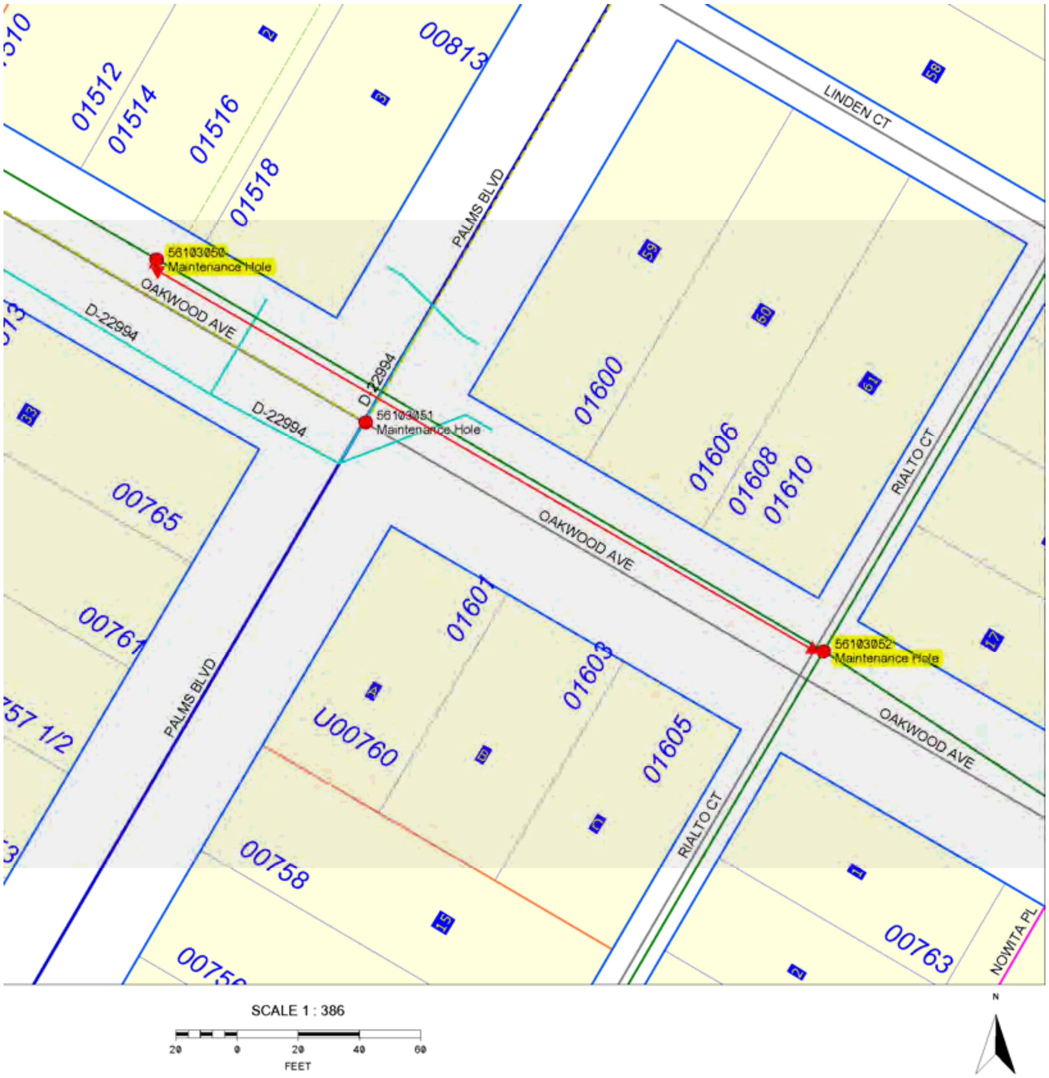


Figure 7 – Preliminary Identification of Existing Utilities on Oakwood Avenue

Note: Not all utilities are shown in figure.

Green Line: Sanitary Sewer, Red line: Sewer Segment for Rehabilitation, Light Blue Line: Storm Drain

In addition, there is a reasonable assumption that gas and electric lines exist buried in Oakwood Avenue, as well as the potential for other buried infrastructure such as telephone/data lines that were either not identified on the as-built drawings or installed at a point in time after the completion of the as-built drawings.

The exact locations of all buried infrastructure along the alignment of Oakwood Avenue sewer rehabilitation should be established via survey. Responsibility to determine the location of all underground utilities will be the responsibility of the contractor conducting the rehabilitation work.

2.4 Rialto Court Existing Utilities

The section of sewer to be rehabilitated on Rialto Court is located approximately 1.2 miles downstream of the sewer discharge connection at Sunset Avenue and Rose Avenue. The street contains a 16-inch VCP sanitary sewer collection pipe that was installed in 1975 that will require upgrading 145 feet of sewer pipe to a minimum of 21-inch VCP installed along the existing sewer alignment and slope. The as-built drawings indicate the sewer is approximately 2.5 feet east of the Rialto Court centerline approximately 6 feet below ground surface. The location of buried infrastructure along the alignment of sanitary sewer rehabilitation (Segment ID #: 56103127-56103128A) available through NavigateLA for Rialto is illustrated in Figure 8.

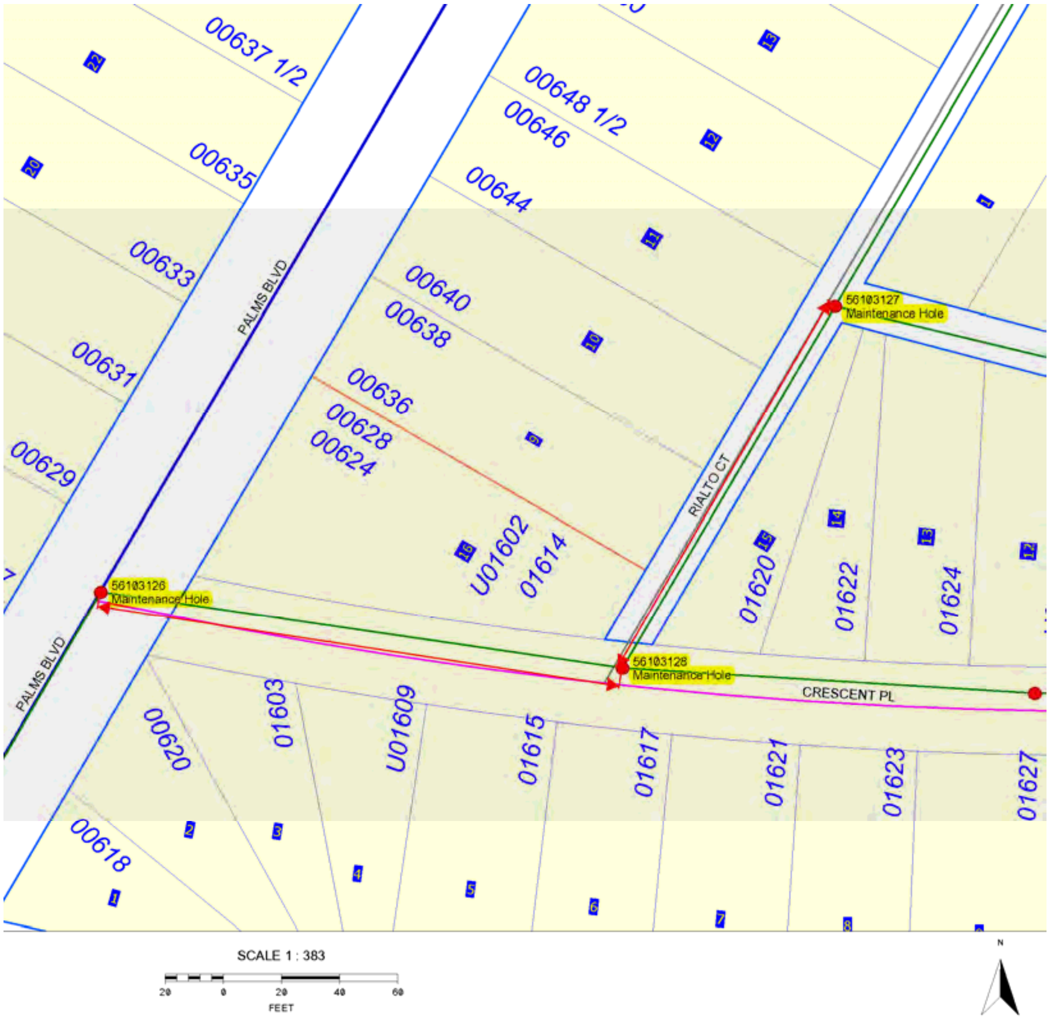


Figure 8 – Preliminary Identification of Existing Utilities on Rialto Court and Crescent Place

Note: Not all utilities are shown in figure.
Green Line: Sanitary Sewer, Red line: Sewer Segment for Rehabilitation

As-built drawings and information available through NavigateLA indicate that there is no other buried infrastructure present on Rialto Court. However, it can be presumed that gas and electric lines exist buried in Rialto Court as well as the potential for other buried infrastructure such as telephone/data lines that were either not identified on the as-built drawings or installed at a point in time after the completion of the as-built drawings.

The exact locations of all buried infrastructure along the alignment of Rialto Court sewer rehabilitation should be established via survey. Responsibility to determine the location of all underground utilities will be the responsibility of the contractor conducting the rehabilitation work.

2.5 Crescent Place Existing Utilities

The section of sewer to be rehabilitated on Crescent Place is located approximately 1.2 miles downstream of the sewer discharge connection at Sunset Avenue and Rose Avenue. The street contains a 16-inch VCP sanitary sewer collection pipe that was installed in 1975 that will require upgrading 180 feet of sewer pipe to a minimum of 21-inch VCP installed along the existing sewer alignment and slope. The as-built drawings indicate the sewer is generally north of the Crescent Place centerline (exact distance is inconsistent because Crescent Place is a curving street) approximately 5 feet below ground surface. The location of buried infrastructure along the alignment of sanitary sewer rehabilitation (Segment ID #: 56103128-56103126A) available through NavigateLA for Crescent Place is also illustrated in Figure 8.

As-built drawings and information available through NavigateLA indicate that there is no other buried infrastructure present on Crescent Place. However, it can be presumed that gas and electric lines exist buried in Crescent Place as well as the potential for other buried infrastructure such as telephone/data lines that were either not identified on the as-built drawings or installed at a point in time after the completion of the as-built drawings.

In addition, NavigateLA shows that Crescent Place is a vacated street along the sewer rehabilitation alignment and available aerial photographs seem to show the local homeowner's yards have extended out over the sewer alignment. There is also a park like walkway along the vacated street with plant growth on both sides of the walkway creating a tunnel effect. From a site visit it is approximately 6' to 8' in width (the concrete path is approximately 6'-wide) bordered by well-established real estate on both sides of the concrete walk lined with walls and hedges (See Figure 9).

Obvious impacts on constructability by open cut and cover methods exist as those methods could pose a major disruption to private property that is adjacent to the rehabilitation alignment. Based on the realities of this site it is very likely that the rehabilitation cannot be accomplished by open cut and cover methods and would require alternate construction methods such as micro-tunneling, pipe bursting or pipe reaming. Further discussion on the alternative construction methods can be found in Section 4.1.

The exact locations of all buried infrastructure as well as the locations of adjacent property along the alignment of Crescent Place sewer rehabilitation should be established via survey. Responsibility to determine the location of all underground utilities will be the responsibility of the contractor conducting the rehabilitation work.

Figure 9 – Current View of Crescent Place Alignment

2.6 Abbot Kinney Boulevard Existing Utilities

The section of sewer to be rehabilitated on Abbot Kinney Boulevard is located approximately 1.3 miles downstream of the sewer discharge connection at Sunset Avenue and Rose Avenue. The street contains an 18 inch VCP sanitary sewer collection pipe that was installed in 1975 that will require upgrading 75 feet of sewer pipe to a minimum of 21-inch VCP installed along the existing sewer alignment and slope. These upgrades may also require the replacement of the manholes at the two points of connection for rehabilitation.

A Los Angeles County storm drain consisting of a single 24-inch Circular RCP traverses the intersection of Palms Boulevard, Abbot Kinney Boulevard and Rialto Court. On the as-built drawings it does not appear that the sanitary sewer line to be rehabilitated crosses the storm sewer; however, at manhole #56103346 the space between the manhole structure and the storm sewer is approximately 2 feet. The location of buried infrastructure along the alignment of sanitary sewer rehabilitation (Segment ID #: 56103346-56103155A) available through NavigateLA for Abbot Kinney Boulevard is illustrated in Figure 10.

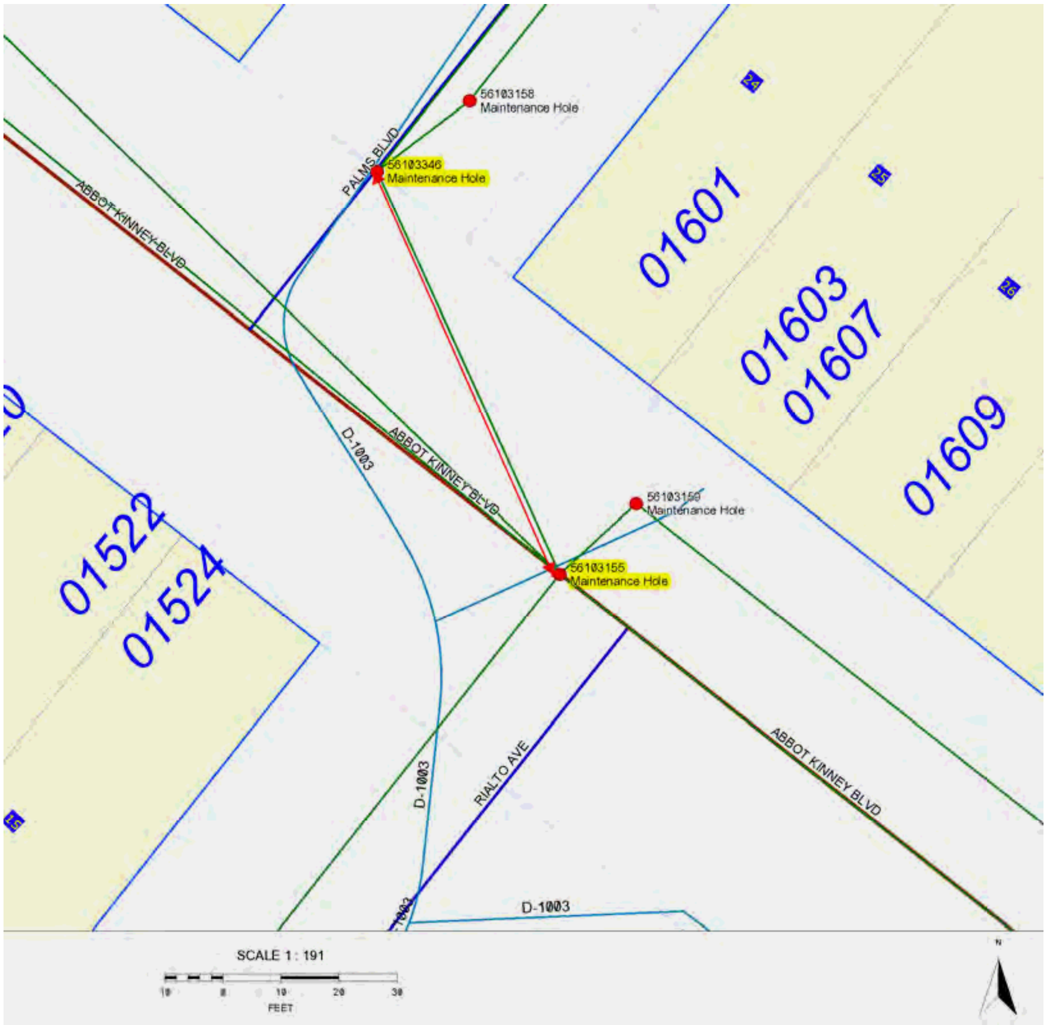


Figure 10 – Preliminary Identification of Existing Utilities on Abbot Kinney Boulevard

Note: Not all utilities are shown in figure.
Green Line: Sanitary Sewer, Red line: Sewer Segment for Rehabilitation, Light Blue Line: Storm Drain

As-built drawings and information available through NavigateLA indicate that there is no other buried infrastructure present on Abbot Kinney Boulevard. However, it can be presumed that gas and electric lines exist buried in Abbot Kinney Boulevard as well as the potential for other buried infrastructure such as telephone/data lines that were either not identified on the as-built drawings or installed at a point in time after the completion of the as-built drawings.

The exact locations of all buried infrastructure along the alignment of Abbot Kinney Boulevard sewer rehabilitation should be established via survey. Responsibility to determine the location of all underground utilities will be the responsibility of the contractor conducting the rehabilitation work.

2.7 Proposed Oakwood Avenue, Rialto Court, Crescent Place and Abbot Kinney Boulevard Sanitary Sewer Upgrade

From preliminary information based on information on NavigateLA and as-built drawings, there is not any anticipated permanent utilities relocation. There may be a need for some temporary relocation of an existing waterline on Oakwood Avenue. However, the full extent of potential temporary and permanent utilities relocation will not be known until a full underground survey of the sites is conducted. Recommendations regarding utilities relocation will be made after a full survey of the sites are conducted.

3.0 UTILITIES CONNECTIONS AND FLOW HANDLING

Flow bypassing will be required during the Frederick Street sanitary sewer relocation and the Oakwood Avenue, Rialto Court, Crescent Place, and Abbot Kinney Boulevard sanitary sewer upgrade. This will require careful coordination and a fully-detailed submittal by the selected Contractor on the proposed method of bypassing the generated flows. The submittal shall include the date, time and duration of the planned shutdown/tie-in, description of the work to be performed during shutdown/tie-in, and brief description of the facilities or sewers impacted by the shutdown/tie-in including possible drawings and sketches illustrating the work to be performed and the facilities to be affected.

Initial review of as-built drawings indicated that there may have been at least one water line connection on the Frederick Street 6-inch water line that will need to be transferred over to the relocated water line. However, a subsequent site visit indicated the connection to the house on the cornet of Fredrick Street and Rose Avenue is located in the alley behind the property and will not require a temporary water line connection during construction activities. Any potential water line relocation along the Oakwood Avenue, Rialto Court, Crescent Place, and Abbot Kinney Boulevard sanitary sewer upgrade alignments will be conducting according to the following protocols. All contract documents will specify that this connection will be completed after proper advance notice is provided to the residents of the house(s) affected. The duration of water service disruption can be minimized by requiring the relocated water line to be completed and tied back in to the system before the existing connection and water line are taken out of service.

Additional requirements may include confined space entry permits and shutdown/tie-in safety plans.

Manhole location and connection details will need to be verified during the detailed design phase and shutdown/tie-in descriptions will be provided as part of the final design. Lincoln Boulevard is anticipated to have a number of other buried utilities in the vicinity of the existing and upgraded sanitary sewer lines. The project plans will include a complete list of all affected utilities along with points of contact that contractor will be responsible for coordinating with during construction.

4.0 CONSTRUCTION CONSIDERATIONS:

4.1 Pipeline Installation

Pipeline installation will be conducted using one of the two following methods:

- Open cut-and-cover methods
- Micro-tunneling
- Pipe bursting

- Pipe reaming

Open cut-and-cover with be the preferred method however, some areas may require hand-excavation to work around other utilities. This method is anticipated to be used on Oakwood Avenue and Abbot Kinney Boulevard.

Pipe reaming was developed by Nowak Pipe Reaming Inc. It utilizes a directional drilling unit, specialized tooling and techniques to grind and remove the existing pipe as the replacement is pulled into place. Removal of the in-place pipe is accomplished by "back reaming" using the Horizontal Directional Drill with a back reamer that reduces the existing pipe to small pieces which are carried along with other excess particles by the drilling fluid to an extraction point. The system can be used to remove existing VCP, PVC, AC, Reinforced (Class II and III) or Non Reinforced Concrete Pipe, and the simultaneous replacement with an HDPE, PVC, or Restrained Joint Ductile Iron pipe of equal or larger diameter. Upsizing is possible up to twice the diameter of existing pipe. Due to space restrictions this method may be necessary on Rialto Court and Crescent Place.

4.2 Pavement Cutting & Patching

Pavement cutting and patching will be required during the construction of the proposed diversion structure and pump station along the Rose Avenue frontage of the Frederick Street utilities relocation work. All paved areas, including asphaltic concrete berms cut or damaged during construction, will be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas. Temporary resurfacing may be required by the City or other project stakeholders. The temporary surfacing is usually placed promptly after backfilling and is maintained until the contractor is ready for the final restoration of the improvements. It is anticipated that a standard double Tee-cut pavement cutting system will be used, where the initial pavement cut is equal to the design trench width, and the second cut is 6 inches outside of the initial cut to provide an undisturbed clean edge for repaving operations after the pipe is installed and the trench filled with compacted backfill material.

4.3 Protection Requirements During Construction

4.3.1 Traffic Control

Utilities construction in Frederick Street and Rose Avenue will require the temporary closure of a portion of Rose Avenue to traffic. The Contractor will be required to coordinate the traffic closure for this portion of the work with the closures needed to perform all other portions of the work. A traffic control plan that meets City of Los Angeles requirements shall be prepared by the Contractor and submitted to the City for approval during the submittals phase of project construction.

The City of Los Angeles uses the Manual on Uniform Traffic Control Devices (MUTCD) by the Federal Highway Administration (FHWA) and the Work Area Traffic Control Handbook (WATCH) by American Public Works Association.

Contacts for approval of the traffic control plan as it effects Penmar Municipal Golf Course and the Penmar Recreation Center are: Liza Mendoza, Facility Director at (310) 396-8735 and Pete Frey, Penmar Golf Operations Supervisor at (818) 246-1435.

Specific traffic mitigation details shall be submitted to the City of Los Angeles Traffic Engineering Division before executing mitigation plans in the field.

Street closures are not anticipated for sanitary sewer upgrades along Oakwood Avenue, Rialto Court and Crescent Place. Rialto Court is a dead an alley and may require some temporary access restrictions to move equipment in and out of the construction area. It is anticipated traffic control will consist of lane closures along the rehabilitation alignments to allow for excavation and construction activities, subject to the findings of the underground surveys along the rehabilitation alignment. Abbot Kinney Boulevard may require a lane and/or intersection closure. Some locations may require temporary parking restrictions during work hours. All issues regarding parking restrictions will be addressed during the development of the traffic control plans. The traffic control plans developed for these activities will follow the protocols outlined above.

It is recommended that the Contractor hold an initial meeting with all project stakeholders to discuss the approved traffic control plan and parking restrictions prior to any site disturbance or construction work is initiated.

4.3.2 Construction Restrictions

Noise: Sound walls, sound blankets and low noise generating equipment are used to muffle noise from work areas; noise must not exceed specified levels. Exterior noise levels during construction shall be maintained under 50 dBA and should comply with the City of Los Angeles municipal code and applicable Noise Ordinances within the project site.

Work Schedules: Permissible hours of work shall be determined in consultation with the City of Los Angeles Bureau of Engineering and in reference to the project specifications.

Dirt and Dust: Daily street sweeping and water spreading; cleaning services when necessary; car wash services when necessary

Parking and Traffic Flow: Safe and adequate pedestrian and vehicle access shall be maintained at all times to residences and businesses.

Safety: K-rail enclosures shall be placed around all open excavations; crossing guards may be required at impacted intersections. Steel plates shall be placed over open trenches at the end of each day’s work.

Specific safety requirements will be developed during the design phase and incorporated into the specifications for the Project.

Special care shall be exercised during construction for all other existing utilities and improvements that are not designated for removal or relocation, details of the existing nearby utilities are not available at the present time, but will be incorporated into the project design as soon as the information is collected by the project surveyor.

4.4 Permitting Requirements

This work will be covered under the permits required for other elements of the Penmar project.

LA DPW ENGINEERING
Serving the Present; Designing the Future

City of Los Angeles, Department of Public Works
Bureau of Engineering
Prop O - Clean Water Bond Program

Penmar Water Quality Improvement and Runoff Reuse Project

Responses to Comments for Technical Memorandum No. 1 through No. 8 and Supplemental Information

November 2008

BROWN AND CALDWELL

W.O No. EW40019F

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
1	BOE	3 / Conclusions	Include in Recommendations why there is no infiltration.	Included in Conclusion that infiltration is low due to low permeability of the soil.
1	BOE	3 / Conclusions	Need to include underground storage recommendations	Underground storage reservoir is described separately in TM 7. Reference to TM 7 added to Conclusions.
1	BOE	3 / Design Factors - Conceptual Design	Dewey Street Right-of-Way - Bio-Infiltration & Evapotransperation Swale? Add Description	We're only considering underground infiltration/detention systems since we're capturing storm water from a storm conduit, and not surface runoff around the golf course. Bio-infiltration and evapotranpiration may still take place but will not be the main vehicle to get rid of the stormwater.
1	BOE	3 / Design Factors - Conceptual Design	Northeast Corner Corner Rectangle - Infiltration & Hazard Golf Course Pond? Add Description	It is not the intent to have a hazard golf course pond as it will require that the pond be filled at all times. It also reduces the underground storage capacity.
1	BOE	3 / Design Factors - Conceptual Design	Northeast Corner Corner Triangle - Infiltration & Hazard Golf Course Pond? Add Description	It is not the intent to have a hazard golf course pond as it will require that the pond be filled at all times. It also reduces the underground storage capacity.
1	BOE	3 / Design Factors - Conceptual Design	Add a combination underground detention / infiltration system to discussion, add description and construction issues.	Comment incorporated
1	BOE	3 / Design Factors - Conceptual Design	Revise language clarifying that infiltration was not expected to be the only mechanism in the concept report.	It is indicated towards the end of the paragraph that the stored storm water can be disposed off in an alternate way. Added discharging into the sewer as an alternative.
1	BOE	3 / Design Factors - Proximity to Drinking Water Wells	Include location of well	Infiltration eliminated from project scope. Location of drinking water wells no longer required.
1	BOE	3 / Design Factors - Soils	Include calculations and/or Geotech Report to support infiltration rates	Included Geotech Report as Attachment 1
1	BOE	3 / Design Factors - Soils	Mention expected infiltration rates from concept report	Comment incorporated
1	BOE	3 / Design Factors - Soils	Attach Soil Boxing Location Map	Included Geotech Report and Soil Boring Locations as Attachment 1
1	BOE	3 / Types of Underground Detention / Infiltration Systems	Expand discussion on alternatives to include pros and cons of each system.	Added a table to describe pros and cons of each system.
1	BOE	Attachments	Attach Geotech Report's)	Included Geotech Report
1	BOE	Figure Descriptions	Add descriptions of highlighted areas in the figures.	Revised to add description
1	BOE	General	Expand on Storage tank discussion to include Location, pros and Cons, maintenance, etc.	Added reference to TM 7
1	BOS		No comments on TM #1.	No Change Needed to Address
2	BOE	3 / Initial Findings	Vacant Frederick Street	Comment incorporated

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
2	BOE	Conclusion	Revise to include work for Pump Station and Fore bay.	Comment incorporated
2	BOE	Conclusion	Recommend SS Location	Comment incorporated
2	BOE	Conclusion	Tree Protection/ Removal/Relocation	Comment incorporated
2	BOE	Construction Issues	1. Relocation 2. Trees 3. Noise 4. Etc.	Added section to address
2	BOE	Construction Issues	Do we need to include ROW for piping?	ROW for force main piping would not be required for Fredrick Street as the piping on Fredrick Street would be contained in the existing Fredrick Street ROW.
2	BOE	Construction Issues	Do we need to include ROW for storage tank?	ROW for storage tank would not be required on Fredrick Street. ROW for the storage tank in Penmar Park would be through an agreement between BOS/BOE and Parks and Recreation. Parks and Recreation provided input on their requirements for the locations of access points for the storage tank which are incorporated into the design and layout of the tank.
2	BOE	Fig 1 Frederick Street and Rose Avenue Google map	Identify the area of vacated parcel	New image added to identify the area of vacated parcel
2	BOE	Fig 2 Frederick Street ROW dimensions	Show work area for pump station	Figure revised
2	BOE	Fig 3 Frederick Street sewer profile zone of influence	Show the pump bay and SS relocation.	Figure revised
2	BOS	Figure 3	Figure 3 is confusing. Recommend using one section drawing to show existing sewer location and another to show the relocated sewer, new facilities, and the zone of influence.	Figure revised
2	BOS	Page 2/ Section 3/ 2nd bullet under "Initial Findings"	As written, "available for the construction of the Pumping Station . . ." is somewhat confusing as it implies the pumping station will be built in the vacated parcel. Recommend rephrasing to clarify.	Revised wording to, "which could be made available…"
2	BOS	Page 2/ Section 3/ 3rd bullet and Page 3/ Section 3/ "Conclusions"	The referenced sections make inconsistent statements about the existence of utilities. Please reconcile.	Comment incorporated
2	BOS	Page 3/ Section 3/ "Conclusions"	Conclusion doesn't clearly state if Frederick Street is in fact available for future construction of the Pump Station facility. Please clarify.	Comment incorporated
2	BOE	Page2/Section 3	Verify the existence or non existence of 51" RCP. See attached plans.	The 51 inch storm drain has been added to the plans and is being accounted for in the design of the diversion structure and pump station to capture flows from the storm drain and relocate sections of the pipe around the pump station.

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
3	BOE	Conclusion	Refer to emails/memos and specify No Diversion during rain events (72 hours post rain) etc.	Comment incorporated
3	BOE	Discharge	Title for the Calculation Table; Calculate Discharge - 12 -5 AM @ 1.5 cfs and 5 AM- 12 AM @ 1.0 cfs. Verify per the memo.	Calculations updated
3	BOE	Discharge Sewer sizes	Verify the calculation. Check @ 1.5 cfs and another time for 1.0 cfs etc.	Calculations updated
3	BOE	Discharge to Sanitary sewer construction issues	1. FM Construction tech memos 2. SS MH rehab/ reconstruction 3. Traffic Impacts 4. SS rehabilitation/ upgrade.	Discussion assed, referenced other TMs for full discussion
3	BOE	Discharge to sewer on sunset ave.	Identify SSMH connection location	Comment incorporated
3	BOE	Routing of proposed connection	Identify SSMH # and show the location to be upgraded.	Comment incorporated
3	BOE		Revise to include emails from BOS	Comment incorporated
3	BOE		Identify SS lines to be upgraded and	Comment incorporated
3	BOE		Attach Emails and Memos.	Comment incorporated
4	BOE	3 / Conceptual Design	revise outfall to "drain outlet"	Comment Incorporated
4	BOE	3 / Electrical and Controls	The pump down should be controlled SCADA	Comment Incorporated
4	BOE	3 / Electrical and Controls	Will there be times when the reservoir and the dry weather flow fight for capacity the 1.0 or 1.5 CFS drain to the sanitary sewer. If so what take priority? Not create capacity issue is outlined but what is the max will it always be 1 - 1.5 cfs - .44 dry weather? Detail and control is it SCADA or local control?	The two flows will compete for capacity and dry weather flow will take priority to prevent multiple days of discharge to the storm drain outlet. We have indicated that the sewer will need depth measurement and transmission to control discharge capacity and is should have SCADA ability. Local override and the capability for reconfiguration of priorities will be part of the design. Detailed P&ID drawings will be developed as part of the designs and the system will be designed to provide operational flexibility based on actual and not necessarily modeled flow scenarios.
4	BOE	3 / Pumps	Mixed flow pumps should be included with the options. Similiar to Fairbanks Morris 8300 series http://www.fairbanksmorsepump.com/products/Mixed_Flow_Propeller_Pumps.htm	We have checked the head and capacity and the vertical column type pumps will have mixed flow impellers for this application - agreed
4	BOE	3 / Pumps	Will the motors include VFD (power savings)?	With the large wet well it is not anticipated that VFDs will be needed or that they will produce any power savings. The final decision can be made during actual design
4	BOE	Figures	No List of Figures	Revised Accordingly
4	BOE	Figures	Figure 1 Revise the reservoir and wet well size	Revised Accordingly

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
4	BOE	Figures	Figure 2 and 3 Revise the wet well size (show dimensions on Fig 3 and label ex structure)	Revised Accordingly
4	BOE	Page 2/ Section 3 Location	The invert elevation of SD inv is referred to what City datum?	City drawings for Frederick Storm Drain reference USGS July 1925. Rose Ave storm drain by county and recent sewer relocation drawings appear to hall have matching elevations.
4	BOS	Page 4/ Section 3/ “Trash Racks,” 1st paragraph	WCSD prefers using vactor trucks to extract debris because baskets are more difficult to remove and clean. Please rewrite accordingly.	The invert of the Rose Avenue storm drain is approximately 18 feet below the surface. With the PS sump even lower we are beyond the normal range for a vactor operation. We are investigating a trash pump system to move debris to a higher elevation that can be accessed by vactor truck.
4	BOS	Page 4/ Section 3/ “Trash Racks,” 1st paragraph	The preferred submersible pumps are not KSB, but ABS, Flyght and Fairbanks Morse.	Comment Incorporated
4	BOE	Page3/ Section 3 Conceptual Design	Please revised size of Wet well storage according to our previous discussion of budget and TMDL compliance. The Storage volume can consider the volume retain on the existing SD (behind the diversion weir) excluding the average typical volume expected during dry weather.	Comment Incorporated
4	BOE	Page3/ Section 3 Conceptual Design second Paragraph	Clarify pumping to reservoir: The pumps will continue to pump from the wet well to the reservoir until reservoir has reach its limits, it is until then that the flow will continue down the SD. Revised new reservoir capacity according to our previous discussion of budget and TMDL compliance.	Comment Incorporated
4	BOE	Page6/ Section 3 Controls	Control should be on SCADA system Coordination with the Venice pump station is required for startup and After a rain even is a manual startup of the facility is required?	Control will be SCADA so that it can be coordinated with the Venice pump station. Remote startup will be possible.
4	BOE	Page6/ Section 3 Electrical	Coordination and permits with DWP is required.	Design will be coordinated with DWP

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
4	BOE	Page6/ Section 4	No construction Issues section was included: Consider addressing, Pump Noise, Traffic during construction and maintenance, dirt/dust etc	Under "Other Design Considerations" Operational Issues Pump station noise will be mitigated by having the pumps below grade and in an enclosed concrete vault. Ventilation fans will be required during periods when personnel are at the site and to remove excess heat from the vault. Noise will be mitigated by putting the fan run cycles on thermostat control. Construction Issues As discussed in TM-5 which concerns the force main connections to the pump station, appropriate traffic control will be required for the connection to the Rose Avenue storm drain. The connection will be coordinated with the lane closures that will also be required to install the force main. Daily street sweeping will be required to control dust and dirt.
5	BOS	Figure 3	There appears to be a 30' separation between the 30" and the 12" and 8" force mains. Seems this would require 3 trenches. Is it possible to place all three FM's in one trench?	The 30" and 12" force mains will be in a common trench. The 8" will probably be on a different alignment
5	BOS	Figures	Call outs are difficult to read, especially on Figures 1 and 2. Please make them clearer.	Revised Accordingly
5	BOE	Figures	No List of Figures.	Revised Accordingly
5	BOE	Figures	Figure 1 Figure is not legible. Revise the reservoir and wet well size.	Revised Accordingly
5	BOE	Figures	Figure 2 Figure is not legible.	Revised Accordingly
5	BOE	Figures	Figure 3 Revise the reservoir and wet well size. Clarify direction of Flow	Revised Accordingly
5	BOE	Page / Section 4 / Cutting and Patching	What is the depth of the FMs? Is the proposed width adequate to achieve the required compactions? Or will this be slurry?	Assume 4 feet of cover for all force mains.
5	BOE	Page 3 / Section 3	Revised the summary of FMs / FM No 2B – 1.5 cfs is max during dry weather at limited times.	Revised Accordingly
5	BOE	Page 5 / Section 4 / Cutting and Patching	Does MH required to be rehabilitated or modified to accommodate pressure flows?	MH has not been inspected yet, but rebuild is not anticipated discharges into the MH will be elbowed 90 degrees downward and should not accelerate wear

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
5	BOS	Page 5/ Section 4/ “Sewer Bypass,” 1st paragraph	Section states that simultaneous discharges from both the 12" and 8" force mains are unlikely. This is incorrect - after a storm event, there will be a discharge from draining the storage tank and a discharge of base dry weather flow going into the sewer at the same time.	It is possible that there will be simultaneous discharges from both force mains however the P&ID plan will be designed such that only a maximum of one pump is discharging to the sewer system at a given point in time.
5	BOE	Page 6 / Section 4 / Cutting and Patching	Are there any impacts to trees?	Plans will call out care and protection of trees. Some limbing will probably be required however due to narrow ROW.
6	BOS	Figure 1	Evaluate a drop floor as a third alternative to divert flow. This may eliminate the need for a berm. County has previously stated that they don’t like berms.	The smaller pump station needs the storage behind the diversion berm to help capture the design volume. Furthermore, LACO has already indicated that the concept per Figure 2 in the Tech Memo has been implemented by LACO and permitted to other agencies.
6	BOE	Figures	Show proposed MH over each of the boxes	Prefer not showing MH since bottom plan is being shown. However, will change “PLAN” to “BOTTOM PLAN” to clarify.
6	BOE	Figures	Label “Ex” to existing structures	Will label “EX” to existing structures.
6	BOE	Page 2 / Section 3/ Location	Specify which datum or location. Elevation reference not clear in all memos	We have worked from the LACFCD Rose Ave drawings and City drawings for Frederick Street storm and sewer pipes. The elevations appear to match.
6	BOE	Page 2-3 / Section 3/ Conceptual Design	Clearly identify Option 1 and 2	Revised Accordingly
6	BOE	Page 2-3 / Section 3/ Conceptual Design	Clearly specify that LA county approval is required	Revised Accordingly
6	BOE	Page 2-3 / Section 3/ Conceptual Design	MH was required over each of the boxes over the berm	Revised Accordingly
6	BOE	Page 3 / Section 3/ Discussion	Provide a recommendation for the diversion structure	Revised to include recommendation
6	BOE	Page 3 / Section 4/ Construction Issues	Provide construction issues, Including but not limited to traffic, noise, dust, etc	Will revise to include Section 4 - Construction Issues
6	BOS	Page 3/ Section 3/ “Discussion,” last two paragraphs	WPD would prefer not to have safety grates, but will defer to what LA County prefers or requires since it is their storm drain. Please check w/ County.	Will be discussed with LACFCD
6	BOE		There needs to be a maintenance structure directly above any berm or Down drain inlet structure for cleaning from street level (we do not enter drains for cleaning as a rule).	Noted. Changed text to indicate a manhole access will be provided at the Diversion Structure.
6	BOE		If you have a screen or grate anywhere in the system we also need to be able to clean without entering.	Noted (for design). No change to text.
6	BOE		The berm height for plan two in 2" or 2' if 2" any small debris accumulation will allow for bypass of dry weather flow.	Should be 2'. Updated figure.

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
6	BOE		The outlet to the wet well needs to be higher as to not create and hydraulics in the box culvert (this be related to float settings).	If outlet is raised, dry weather storm flow may become stagnant behind the berm. Please elaborate what hydraulics will be created in the box culvert and what floats are being referred to.
7	BOE	Figure 1	Figure too small to read, make into full page	Figure revised accordingly
7	BOE	Figure 2	Figure too small to read, make into full page	Figure revised accordingly
7	BOE	Figure 2	Show over flow pipe and size	Figure revised accordingly
7	BOE	Figure 2	How is backflow prevented	Figure revised accordingly
7	BOE	Figure 2	Show vent	Figure revised accordingly
7	BOE	Figure 2	Show 1 foot freeboard	Figure revised accordingly
7	BOE	Figure 2	Denote cover as "minimum cover"	Figure revised accordingly
7	BOE	Figure 2	Denote Fredrick Street on Figure	Denoted Penmar Ave on Figure, site not near Fredrick Street
7	BOE	Figure 2	Show North Arrow	North arrow added to overall site layout drawing
7	BOE	Figure 2	Denote Property Line	Figure revised accordingly
7	BOE	General	Geotechnical report should be attached to this tech memo	Comment incorporated
7	BOE	Page 10 / Construction Issues	Should we use the deep end? (23 feet)	Comment incorporated
7	BOE	Page 10 / Construction Issues	Potential for benching?	Incorporated in text
7	BOE	Page 10 / Construction Issues	Tree impact?	Incorporated in text
7	BOE	Page 12 / Permitting Requirements	LADBS? Grading and Structural Approval	Incorporated in the test – 90% plans to be submitted for approval to LADBS
7	BOE	Page 3 /Project Description	What about groundwater and buoyancy?	Section 2.1 modified to include discussion of anti-floatation provisions that will be included in reservoir design
7	BOE	Page 5 / Reservoir Inlet/Outlet	Discus inlet & outlets for disinfection	Sec. 2.2 revised to clearly state that provisions for in-line disinfection of reservoir contents prior to release to either Rose Ave. storm sewer or for non-potable re-use
7	BOE	Page 5 / Reservoir Inlet/Outlet	Not to exceed combine with flow to SS from pump well. Clarify	This text has been deleted. The project team will provide a complete design package for the reservoir.
7	BOE	Page 6 / Buried Reservoir Design / 2nd Paragraph	To be discussed. Clarify	See previous comment. Approved contract modification provides for a complete reservoir design package
7	BOE	Page 6 / Buried Reservoir Design / 3rd Paragraph	Clarify the last two sentences	See previous two comments
7	BOE	Page 7 / Governing Codes and Standards	Submit to building and safety	Comment addressed – text revised

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
7	BOE	Page 7 / Prestressed Concrete (PSC) Tank Supplier Responsibility	Submit to building and safety	Comment addressed – text revised
7	BOE	Page 8 / Important Design Criteria / Item g	What Drawings?	These items will be included in the project drawings
7	BOE	Page 8 / Important Design Criteria / Item p	What Drawings?	These items will be included in the project drawings
8	BOS WPD	General	The Bureau of Sanitation Wastewater Services Division (BOS-WESD) is proposing to rehab this sewer line by 2014. Please coordinate work with WSED to avoid overlap/redundancies	Comment note. Contractor will be required to provide as-built drawings for rehabilitated sewer lines.
8	BOS WPD	General	Per Frenando Gonzalez's 12/21/07 email to the project's former PM (Chris Salvaggio), WESD has identified the hydraulic choke points to be near Lincoln Blvd. Additionally the 16" VCP has a max capacity of 3.29 cfs but the choke points limit the line's capacity to approximately 1 cfs. Relieving these choke points will bring the max capacity back to the 3 cfs, not the 1.0 - 1.5 cfs as indicated in the TM. Has there been recent developments that show otherwise? Please verify with WESD.	Email from Edgar Mercado on 05/09/08 indicate the sanitary sewer reaches need to be upgraded to 21" and included the email from Bryan Trussell on 05/08/08 identified the following pipes that require relief for the Penmar BMP project to add 1 cfs of flow: 56103020-56103052A, 56103127-56103128A, 56103128-56103126A, & 56103346-56103155A and an email from Byran Trussell on 04/03/08 identifying the discharge limits of 1 cfs from 6AM to 12AM and 1.5 cfs from 12AM to 6AM
8	BOS WPD	General	If the stormwater is being collected for reuse and actually reused, would the need for sewer upgrades (and the associated costs) exists?	Comment noted.
8	BOS WPD	Introduction & Section 1	TM No. 7 (and other documents proposes a 4 MG storage reservoir. This section references a 2.75 MG storage reservoir. Please Verify	All TMs were revised from 4 MG to 2.75 MG per email from Iftekar Ahmed on 07/31/08
8	BOS WPD	Section 2 / Figure 2	Figure is not readable.	Figure revised for clarity
8	BOS WPD	Section 2 / Figure 2	The 650 feet of trunk line upgrades referred in the text is not clearly identified on the drawing (though it is described in the text).	Figure revised to show upgrade locations clearly
8	BOS WPD	Section 2 / Figure 2	North is hard to read and appears to be oriented in some unusual fashion.	Figure orientation adjusted, top of the page is east.
8	BOS WPD	Section 2 / Figure 2	Is there a scale on the drawing?	Scale added to figure.
8	BOS WPD	Section 2 / Figure 2	Penmar diversion point is difficult to locate on the drawing.	Discharge connection called out
8	BOS WPD	Section 2 / Figure 2	Abbot Kinney Boulevard is not labeled on Figure 2	Figure adjusted accordingly Marker indicates location of rehabilitation
8	BOS WPD	Section 2 / Figure 2	The red line appears to be much longer than 650 feet.	Red line changed to blue, intended to illustrate entire length of sewer from discharge to Venice Pump Station. Locations for rehabilitation are highlighted in yellow

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
8	BOS WPD	Section 2 / Figure 2	Only a few isolated sections of the red line appear to be actually "west" of the diversion structure.	Sewer heads south from discharge point at Penmar Park to Venice Pump Station. Text adjusted accordingly to say south and identify discharge point instead of diversion point.
8	BOS WPD	Section 2 / Figure 2	Details that appear on figures 3-5 should be located clearly on Figure 2 (It does appear there is a slight difference in colors - red vs magenta - but it is not clear)	Sewer segments to be rehabilitated are called out in Figure 2 by Segment ID #, Segment ID #s referenced in titles of Figures 3 to 5
8	BOS WPD	Section 2 / Figure 2	It appears the upgrade(s) is actually on 3 non-contiguous sections of the redline?	That is correct. Rehabilitation occurs at 3 non-contiguous locations.
8	BOS WPD	Section 2 / Figures 3-5	There appears to be no measurements or scales on figures	Scale added to figures.
8	BOS WPD	Section 2 / Figures 4	Streets are not sufficiently labeled	Adjusted Figures in Google Earth to show more streets
8	BOS WPD	Section 2 / Figures 5	Streets are not sufficiently labeled	Adjusted Figures in Google Earth to show more streets
8	BOS WCSD	Section 2.2	We are concerned with the proximity of the proposed domestic water line relocation with respect to the proposed sewer realignment. Please ensure compliance with applicable health & safety separation limits as set forth under current City Regulations regarding separation of water and sewer lines. A suggestion would be to start the proposed water line relocation at the same location that the sewer line relocation will start or just north of this location to avoid having the water line cross the sewer line, keeping both line parallel to each other.	Figure 6 revised to show that appropriate separation will be maintained between relocated water and sewer lines. Relocated water line location and offsets will be submitted to LADWP for review and approval.
8	BOS WCSD	Section 2.2	The proposed relocated sewer line should have MH's at each change of direction per City Regulations.	Maintenance Holes will be used in all direction changes for sewer piping. Clarified in Section 2.2
8	BOS WCSD	Section 2.2	Please ensure that no structure is constructed on top of the existing storm drain box on Rose Ave.	Preliminary Figure 6 revised to show that structures (maintenance holes) will not be build on top of Rose Ave. Storm Drain.
8	BOS WCSD	Section 2.2	The proposed relocated section of water line should be restrained throughout as well as have concrete/anchor tie backs per LADWP standards. All water line relocations should be made per LADWP standards.	Comment noted. LADWP standards will be followed in the design of the Fredrick Street Utility Relocation.
8	BOS WCSD	Section 2.2	Please advise if a concrete support for the proposed relocated section of sewer line is over the storm drain per LA City Std S-253-0	Comment noted. Designs will meet City Standards.

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
8	BOS WCSD	Section 2.2	The existing 51" RCP Storm Drain line on Frederick Street is not shown or mentioned in the report. Please identify the line in relation to all of the proposed improvements and relocation.	51" RCP Storm Drain added to Figure 6. Detailed discussion on improvements to the Storm Drain will be covered in TM-4, which covers the design of the pump station and wet well.
8	BOS WCSD	Section 2.2	On the 51" RCP please advise if a bypass will be employed once the first flush is collected into the pump station and where this bypass will be constructed in relation to the proposed wet well and proposed relocated water and sewer lines.	The current intent is to have the diversion in the 51" Storm Drain on Fredrick Street mimic the design of the diversion structure on the Rose Ave Storm drain. Specifics on the design will be developed during the development of the design submittals.
8	BOS WPD	Section 2.3	It appears the upgrade is from 16" to 21". Are the beginning and end of the upgraded sections currently 21"?	No, the sections on either end of the upgrade are 16"
8	BOS WPD	Section 2.3	The Discussion is difficult to follow as it relates to Figure 7.	Comment Noted.
8	BOS WPD	Section 2.3	There are different color lines on Figure 7, but it's not clear which is the existing 16" line, the 27" county line, the 6" sewer line (yellow?) or the 6" water line (green?).	Notes added to figure to explain colors. Note that only property lines, sewer and storm drains displayed on NavigateLA. Water Line location was estimated based on review of the sewer line as-builts.
8	BOS WPD	Section 2.3	A change order is noted on the bottom of page 8-12	Locating all of the existing utilities with field surveying is not in the current scope of work and would require a change order to implement
8	BOS WPD	Section 2.3	Loss of parking may be an issue in this area during construction.	Addressed parking in traffic control (Section 4.3.1).
8	BOS WCSD	Section 2.3	In reviewing the proposed relocation and upsizing of the sewer line, a suggestion would be to look at improving the abrupt change in direction of flow of the 16" sewer line in both maintenance holes.	Per City direction, sewer sections only to be upsized.
8	BOS WPD	Section 2.4	It appears the upgrade is from 16" to 21". Are the beginning and end of the upgraded sections currently 21"?	No, the sections on either end of the upgrade are 16"
8	BOS WPD	Section 2.4	Rialto is more or less an alley - there may be some access/parking issues during construction.	Comment incorporated and discussion of trenchless construction alternatives included.
8	BOS WPD	Section 2.4	The Discussion is difficult to follow as it relates to Figure 8.	Comment Noted
8	BOS WPD	Section 2.4	There are different color lines on Figure 8	Notes added to figure to explain colors. Note that only property lines, sewer and storm drains are displayed on NavigateLA.
8	BOS WPD	Section 2.4	A change order is noted in section	Locating all of the existing utilities with field surveying is not in the current scope of work and would require a change order to implement. As a result the contractor will be required to field locate all utilities prior to construction and identify any conflicts.

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
8	BOS WPD	Section 2.4	Loss of parking may be an issue in this area during construction.	Addressed parking in traffic control (Section 4.3.2).
8	BOS WCSD	Section 2.4	In looking at aerial photos of the area, electric, telephone and cable lines may be located overhead on poles within the alley the sewer is in. If so, temporary relocation of these lines may be required due to the low levels of these lines and the relative depth of the sewer. Further field investigation may be necessary to confirm this and the constructability of the line with out the relocation of the overhead lines.	Added alternative trenchless construction methods to Section 4.1. Details of the need for utility relocation and the plans for utility relocation will be the responsibility of the rehabilitation contractor.
8	BOS WPD	Section 2.5	It appears the upgrade is from 16" to 21". Are the beginning and end of the upgraded sections currently 21"?	No, the sections on either end of the upgrade are 16"
8	BOS WPD	Section 2.5	The Discussion is difficult to follow as it relates to Figure 8.	Comment Noted.
8	BOS WPD	Section 2.5	There are different color lines on Figure 8	Notes added to figure to explain colors. Note that only property lines, sewer and storm drains displayed on NavigateLA.
8	BOS WPD	Section 2.5	A change order is noted in section	Locating all of the existing utilities with field surveying is not in the current scope of work and would require a change order to implement. As a result the contractor will be required to field locate all utilities prior to construction and identify any conflicts.
8	BOS WPD	Section 2.5	Crescent Place appears to be a park-like walkway. This is understated from the text discussion.	Discussion revised to further explain existing conditions.
8	BOS WPD	Section 2.5	Along the "walkway", it appears there is a 6' to 8' width (the concrete is approximately 6'-wide) bordered by well-established, relatively expensive real estate on both sides of the concrete walk. Is this a serious problem (w/ respect to cost/potential community opposition)?	Comment incorporated. Conditions observed on the ground do not match those depicted on Navigate LA website. Unless BOS/BOE staff can confirm correctness of information shown on Navigate LA, in which case we are dealing with illegal encroachments into the sanitary sewer ROW, we will assume that what we see is what we have to deal with and will approach the design for this site with trenchless construction techniques in mind.
8	BOS WPD	Section 2.5 / Page 14 / 4th Paragraph	An easement issue is implied.	Review of NavigateLA, Record Drawings and site visits indicate that the yards of adjacent property extend on to the right-of-way for the paper street (Crescent Place). With out a review of the appropriate records easement related issues cannot be dismissed
8	BOS WPD	Section 2.6	It appears the upgrade is from 6" to 21". Are the beginning and end of the upgraded sections currently 21"?	No, the sections on either end of the upgrade are 18". Also note the upgrade is from 18" (not 6") to 21"
8	BOS WPD	Section 2.6	The Discussion is difficult to follow as it relates to Figure 9.	Comment Noted

Table 1. Comments and Responses

TM #	Comment by	Page / Section / Paragraph / Line #	Comments / Recommendations	Response
8	BOS WPD	Section 2.6	There are different color lines on Figure 9	Notes added to figure to explain colors. Note that only property lines, sewer and storm drains are displayed on NavigateLA.
8	BOS WPD	Section 2.6	A change order is noted in section	Locating all of the existing utilities with field surveying is not in the current scope of work and would require a change order to implement. As a result the contractor will be required to field locate all utilities prior to construction and identify any conflicts.
8	BOS WCSD	Section 2.6	The proposed upsized section of sewer line is called out as being a 6" line. In reviewing various sewer as-built plants (D-9750) and the nearby storm drain plan (D-1003) the line noted as 6" in the report is actually 18" sewer pipe. The 18" sewer pipe extends from MH 561-03-156 to MH 561-03-155. Please re-evaluate the proposed upsizing of this section of pipe based upon the true size of the line as the hydraulics will change significantly due to the disparity of sizes.	Corrected to reflect the actual size of the pipe as 18" instead of 6". Identification of sections of pipe for rehabilitation and hydraulic calculations were provided by LABOS and forwarded to the consulting team in the emails from Edgar Mercado and Byran Trussell discussed above.
All	BOS		As discussed in pre-design meetings and shown in BOS' concept report, there is a 51" RCP storm drain in Frederick Street (see attached as-built plans). Please investigate and assess impact on design if existence is confirmed.	Comment incorporated in relevant sections
All	BOE		All technical Memorandum should credit the City of LA and Bureau of Engineering and show both Logo	Format Adjusted to match other City TMs
All	BOE		Compile technical memorandum should be address to Kendrick K. Okuda Program manager and to the attention of new the new project Manager Iftekhar Ahmed.	Format Adjusted to match other City TMs

Ninyo & Moore **Transmittal**

475 Goddard, Suite 200, Irvine, California 92618 Phone 949/753-7070 Fax 949/753-7071 www.ninyoandmoore.com

To: Mr. Scott Dellinger **Date:** January 3, 2008

Firm: Brown and Caldwell **Fax No:** 213-271-2320

Address: 801 South Figueroa Street, Suite 950, Los Angeles, CA 90017 **Telephone No:** 213-271-2237

From: Larry Jansen/Daniel Chu/Greg Corson **Total Pages Including Transmittal:** 4

Subject: Penmar Water Quality Improvement Project – Preliminary Geotechnical Findings **Project No:** 207328001

☐ **Urgent** ☐ **For Approval** ☐ **For Your Use** ☐ **Please Reply** ☐ **As Requested**

Original Document: ☐ **Will Not Follow** ☐ **Will Follow** ☐ **By U.S. Mail** ☐ **By Other**

In accordance with your request we are providing geotechnical consulting services for the Penmar Water Quality Improvement Project. We recently performed exploratory drilling at eight (8) selected locations and percolation testing at four (4) of the exploration sites. The approximate locations of the exploratory borings are shown on the attached Figure 1. A summary of our preliminary findings follows.

General Geologic Setting

The project site is located in a relatively flat, low-lying area that drains gently to the south. Ground surface elevations range from approximately 25 feet above mean sea level (MSL) along the southern limits of the project area to approximately 40 feet MSL at the northeast corner of the Penmar Golf Course. The project area is situated in the general drainage area associated with the Ballona Creek to the south. The project is also located near the boundary of an elevated terrace to the north that ascends to elevations above 100 feet MSL. Historical topographic maps of this area indicate that a wetlands or marshy area was present in the westerly portions of the project site (U.S.G.S., 1913). On-site personnel also stated that the area was historically used as a dump site. The property currently includes a golf course and two parks with residential development in the vicinity.

Regional geologic maps indicate the area and vicinity are underlain by alluvial sediments, comprised of unconsolidated, interbedded gravel, sand, silt, and clay. The reported historical high groundwater in the area ranges from approximately 10 feet below the ground surface at the southwesterly end of the site to approximately 20 feet below the ground surface at the northeasterly end of the site. The southwesterly portions of the site are mapped as potentially susceptible to soil liquefaction during a strong earthquake event. There are no active or potentially active faults mapped on site and there are no landslides or other geologic hazards known to exist at the site.

- **Geotechnical Engineering**
- **Engineering Geology**
- **Materials Testing and Inspection**
- **Construction Management**
- **Engineering Design**
- **Environmental Engineering**
- **Environmental Site Assessments**
- **Regulatory Compliance and Permitting**
- **Water Quality and Resource Evaluations**
- **Hazardous Waste Management**
- **Soil and Groundwater Remediation**
- **Asbestos and Lead-Based Paint Surveys**
- **Geophysical Studies**
- **Mineral Resource Evaluations**
- **Value Engineering**
- **Forensic Studies**
- **Expert Witness Testimony**

Subsurface Conditions

The exploratory borings were drilled with truck-mounted drilling equipment and hollow stem augers on December 21 and 27, 2008 to depths ranging from approximately 21.5 to 51.5 feet. Our representative was on site during drilling to log the soils encountered and to collect samples for laboratory testing. A summary of exploration results is presented below for preliminary planning, but laboratory testing has not been performed and some classifications may change depending on test results.

The general subsurface profile at each of the eight boring locations included older fill soils overlying native alluvial sediments. The older fill soils ranged from approximately 4 to 15 feet deep and included silty sand, clayey sand, and sandy clay with minor amounts of gravel and trace amounts of debris such as wood fragments, metal, glass, etc. The alluvial materials generally consisted of an upper zone of fine silty and sandy clay underlain by predominantly granular silty sand and sand. A summary of boring data follows.

Boring B-1

Fill: 0’-10’ - silty sand and clayey sand
Alluvium: 10’-31.5’ - silty clay and clayey silt
Groundwater: 24’

Boring B-2

Fill: 0’-8’ - clayey sand and silty sand
Alluvium: 8’-25’ - sandy clay
Alluvium: 25’-31’ - silty sand and sand
Groundwater: 25’

Boring B-3

Fill: 0’-7’ - sandy clay
Alluvium: 7’-25’ - silty clay
Alluvium: 25’-31.5’ - silty sand and sand
Groundwater: 18’

Boring B-4

Fill: 0’-7’ - sandy clay, clayey sand, and silty sand
Alluvium: 7’-20’ - silty clay
Alluvium: 20’-31.5’ - silty sand and clayey sand
Groundwater: 20’

Boring B-5

Fill: 0’-6’ - sandy clay
Alluvium: 6’-13’ - silty clay
Alluvium: 13’-20’ - silty sand and sandy silt
Alluvium: 20’-51.5’ - silty sand and sand
Groundwater: 20.5’

Boring B-6

Fill: 0’-4’ - silty sand
Alluvium: 4’-20’ - silty clay
Alluvium: 20’-31.5’ - silty sand and sand
Groundwater: 16’

Boring B-7

Fill: 0'-15' - sandy clay and clayey sand
Alluvium: 15'-20' - silty clay
Alluvium: 20'-31.5' - silty sand and sandy silt
Groundwater: 24'

Boring B-8

Fill: 0'-6' - sandy clay
Alluvium: 6'-16' - silty clay
Alluvium: 16'-21.5' - silty sand with gravel (met drilling refusal)
Groundwater: 20'

NOTE: The information provided above is preliminary. In particular, the depths to groundwater do not represent stabilized water levels. Water levels were measured at the time of drilling and up to 1 hour after drilling. Actual depths to groundwater will vary.

Percolation Testing

Percolation testing was performed on December 27 and 28, 2007 at the locations of Borings B-1, B-5, B-6, and B-7. At each test location the depth to groundwater was evaluated during the initial drilling. A separate percolation test hole was drilled at each location to a depth of approximately 10 to 15 feet (to maintain approximately 5 feet of clearance above the water table). A PVC pipe (slotted below 5 feet) was placed in each test hole and backfilled with gravel. Testing included pre-soaking each hole during the day on December 27 and performing falling head percolation tests on December 28. The tests included placing water in each test hole, measuring the water level at the start of the test and measuring the drop in water level over a period of time between approximately 4 to 6 hours and up to 28 hours. At the completion of testing the PVC pipes were removed and the test holes were backfilled with on-site soil.

The results of the testing are presented below and indicate a wide range in percolation rates:

Test No.	Minutes/Inch Percolation	Permeability	Comments
B-1	13.8	0.003 ft/day	Clayey-silty sand fill 5-10 feet
B-5	3.1	0.008 ft/day	Sandy alluvium 13-15 feet
B-6	---	---	No percolation over 28 hours
B-7	53.0	0.0005 ft/day	Sandy clay and clayey sand fill

Discussion

The purpose of our subsurface exploration was to develop general information regarding the soil and groundwater conditions for geotechnical engineering purposes and to evaluate the feasibility of on-site infiltration of storm water runoff. The wide range in percolation rates reflect the difference between the more sandy fill/alluvium and the more clayey fill/alluvium. Based on review of the subsurface exploration, we anticipate that the more clayey soil types are the predominant material type in the zones of infiltration. In order to maintain approximately 10 feet clearance above the water table, the infiltration zone would be limited to depths of approximately 5 to 10 feet. Based on our evaluation of the data collected, it is our preliminary opinion that the project site is not suitable for long-term infiltration purposes. Our preliminary opinion is based on the following:

> The project area includes variable depths and types of old, undocumented fill soils. The fill soils vary from silty sand to clayey sand to sandy clay. Some of the fill encountered was in a loose condition. The old fill soils are erratic in material type, depth and lateral extent, which makes the design infiltration rates difficult to predict.
>
> It is generally not recommended to construct infiltration systems into fill soils, which may be susceptible to hydro-collapse (settlement).
>
> The relatively higher percolation rates measured are considered to be the result of sandy soil conditions at those locations. The subsurface environment included clayey alluvium with few sandy alluvium lenses (and sandy fills) in the upper approximately 20 feet. Higher percolation rates in localized sand layers may reflect short-term conditions during the test period.
>
> Based on review of the subsurface exploration data, the predominant soil type was more clay than sand in the anticipated zones of infiltration. Relatively low permeability rates are anticipated for the predominantly clayey soil types. At Boring B-6, no infiltration was measured after a test period of approximately 28 hours.
>
> Groundwater was encountered at depths ranging from approximately 16 to 25 feet below the ground surface at the time of drilling. Stabilized groundwater levels will vary. The historically shallow groundwater reported for this area ranges from approximately 10 feet in the southwest to approximately 20 feet in the northwest. Infiltration systems should maintain approximately 10 feet of vertical separation between the bottom of the infiltration system and the water table.

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

GEOTECHNICAL EVALUATION
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PREPARED FOR:
Brown and Caldwell
11111 Santa Monica Boulevard, Suite 750
Los Angeles, California 90025

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
475 Goddard, Suite 200
Irvine, California 92618

June 13, 2008
Project No. 207328001

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

June 13, 2008
Project No. 207328001

Mr. Scott Dellinger
Brown and Caldwell
801 South Figueroa Street, Suite 950
Los Angeles, California 90017

Subject: Geotechnical Evaluation
Penmar Water Quality Improvement Project
Los Angeles, California

Dear Mr. Dellinger:

In accordance with your request and authorization, we have performed a geotechnical evaluation for the proposed Penmar Water Quality Improvement Project in Los Angeles, California. The purpose of this study was to evaluate the subsurface soil and geologic conditions and to provide conclusions and recommendations regarding the geotechnical aspects of the proposed design and construction of the project.

We appreciate the opportunity to be of service on this project. Should you have any questions or comments regarding this report, please contact the undersigned at your convenience.

Sincerely,
NINYO & MOORE

Greg M. Corson, C.E.G.
Project Geologist

PROFESSIONAL GEOLOGIST
GREGORY M. CORSON
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Appendices

1. INTRODUCTION

In accordance with your request, we have performed a geotechnical evaluation for the proposed Penmar Water Quality Improvement Project located at 1233 Rose Avenue in Venice, California (Figure 1). The project is a joint collaboration between the City of Los Angeles and City of Santa Monica to improve water quality of the Santa Monica Bay and Pacific Ocean. The water quality will be improved through the use of Best Management Practices (BMPs) to reduce the introduction of pollutants associated with stormwater runoff into the stormwater conveyance system. The project will target a drainage area of approximately 1,468 acres. The purpose of our study was to evaluate the subsurface soil and geologic conditions of the project site and to provide geotechnical recommendations for the design and construction of the proposed BMPs. Our evaluation was performed in generally accordance with our proposal dated August 27, 2007. This report presents our findings, conclusions, and recommendations based on our background review, site reconnaissance, subsurface evaluation, laboratory testing, and geotechnical analyses.

2. SCOPE OF SERVICES

The scope of our geotechnical services included the following:

- Review of readily available geologic maps, published literature, stereoscopic aerial photographs, and in-house information.
- Review of seismic data, including fault hazard maps, seismic hazards maps, and other readily available data regarding geologic and seismic hazards within the project areas.
- Performance of a site reconnaissance to evaluate the existing site conditions and mark proposed boring locations for utility clearance.
- Subsurface exploration consisting of the drilling, logging, and sampling of eight hollow-stem auger borings to depths of up to approximately 51½ feet. The borings were logged by a representative of our firm. Bulk and relatively undisturbed soil samples were collected at selected intervals for laboratory testing.
- Infiltration testing at four boring locations to evaluate the percolation rates of the subsurface soils.
- Laboratory testing of selected soil samples to evaluate in-situ moisture and dry density, sieve analysis, Atterberg Limits, expansion index, consolidation, and corrosivity.

- Compilation and geotechnical analysis of background information and field and laboratory data.
- Preparation of this geotechnical report presenting our findings, conclusions, and recommendations regarding the proposed project.

3. SITE DESCRIPTION

The project is generally located within the Penmar Golf Course and Penmar Recreation and Park in the City of Los Angeles (Figure 1). The golf course is bounded by Dewey Street on the northwest, Glenavon Avenue on the northeast, a closed portion of Frederick Street on the southwest, and Rose Avenue on the southeast. Penmar Park is located on the opposite side of Rose Avenue near the middle of the golf course. Dewey Street marks the approximate boundary between Los Angeles and Santa Monica. Land use bordering the golf course and park includes light commercial, industrial, and high-density residential.

The project site is located in a relatively flat, low-lying area that drains gently to the southwest. Ground surface elevations range from approximately 25 feet above mean sea level (MSL) along the southern limits of the project area to approximately 35 feet MSL at the northeast corner of the Penmar Golf Course. A terrace is located north and northwest of the site with an elevation of approximately 100 feet MSL. Historical topographic maps of this area indicate that a wetlands or marshy area was present in the southwesterly portions of the project site (USGS, 1913). Personnel from the golf course indicated that the area was historically used as a dump site.

4. PROPOSED CONSTRUCTION

Based on our review of the Phase 1 Design Elements prepared for the project dated April 3, 2008, structures associated with the project include new BMPs for treating stormwater runoff, including a diversion structure, pump station, underground reservoir, and underground force main piping (Figure 2). The project includes relocating existing utilities along Frederick Street and the rehabilitation of an existing sewer along Lincoln Boulevard. Generalized descriptions of each structure are provided below.

- **Diversion Structure** – The new diversion structure will connect to two existing approximately 10-feet by 14-feet box culverts in Rose Avenue and divert stormwater flow to the

new pump station. Diversion of the flow will be passive and routed by gravity to the pump station. The structure will have an opening size of approximately 10 feet by 5 feet with a point of connection at the lower floor of box the culverts.

- **Pump Station** – The new pump station will be approximately 180 feet by 25 feet with a maximum depth of approximately 30 feet below the ground surface. The storage capacity will be approximately 200,000 gallons. The station will include 2 pumps that connect to the sewer system and 4 pumps that connect to the new underground reservoir. The pump station will include trash racks/screens constructed of stainless steel and removable by a hoist.

- **Underground Reservoir** – The new reservoir will hold approximately 4 million gallons (MG). The reservoir will have an approximately 210-feet diameter and total depth of approximately 24 feet below the ground surface. The reservoir will be constructed with cast-in-place concrete and will have approximately 15-feet high inner walls, an approximately 1-foot-thick floor, and approximately 2-feet-thick roof. The roof will be covered by approximately 3 feet of ground cover.

- **Force Mains** – Two new force mains will be constructed between the underground reservoir and the pump station. The pipe diameter, material types, and length are still to be determined.

- **Frederick Street Utilities Relocation** – Existing utilities within Frederick Street will be relocated as part of the project.

- **Sewer Rehabilitation (Lincoln Boulevard)** - An existing sewer pipeline(s) will be rehabilitated as a part of the project.

5. SUBSURFACE EXPLORATION AND LABORATORY TESTING

Our subsurface evaluation was conducted on December 21 and 27, 2007, and included the drilling, logging, and sampling of eight small-diameter borings with a truck-mounted drill rig utilizing 8-inch-diameter hollow-stem augers. The approximate locations of the borings are presented on the Boring Location Map (Figure 2). The borings were explored to depths ranging from approximately 21½ to 51½ feet below the ground surface and were logged by a representative of our firm. Bulk and relatively undisturbed soil samples were obtained at selected depths for laboratory testing. The logs of the exploratory borings are presented in Appendix A.

Laboratory testing of representative soil samples was performed to evaluate in-situ moisture content and dry density, gradation analysis, percentage of particles finer than the No. 200 sieve, Atterberg Limits, expansion index, consolidation potential, collapse potential, and soil corrosiv-

ity. The results of our in-situ moisture content and dry density evaluation are presented on the borings log in Appendix A. The remaining laboratory testing results are presented in Appendix B.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The subject site is located in the northwestern portion of the Los Angeles Basin, which is situated at the northwest end of the Peninsular Ranges geomorphic province of southern California. The Los Angeles Basin has been divided into four structural blocks, which are generally bounded by prominent northwest trending fault systems: the Northwestern Block, the Southwestern Block, the Central Block, and the Northeastern Block (Norris and Webb, 1990). The site is located in the Southwestern Block, which is bounded by the Newport-Inglewood fault to the northeast and the Palos Verdes Hills fault to the southwest, the Santa Monica Mountains to the northwest, and the Pacific Ocean to the south and southeast. The block is underlain by up to approximately 20,500 feet of Miocene-age or younger marine deposits over basement rock consisting of the Catalina Schist.

According to Dibblee (1991), the site is underlain by younger alluvium consisting of unconsolidated gravel, sand, and silty clay with interbeds of gravelly and sandy stream deposits (Figure 3) associated with the Ballona Creek drainage. The State of California (1998) maps the site as being underlain by younger alluvium consisting of alternating beds of silt, clay, and fine to medium sand with some gravelly layers. Dibblee (1991) maps the terrace north of the project site as marine deposits consisting of sand, pebbly sand gravel and silt. Our review of geologic literature and stereoscopic aerial photographs did not indicate the presence of landslides or active faulting at the site.

The materials encountered in the borings generally consisted of surficial fill soils underlain by alluvial deposits to the depths explored of approximately 21½ to 51½ feet. Fill soils generally consist of loose to medium dense, silty sand and clayey sand and stiff to very stiff sandy clay to depths up to approximately 10 feet. Below the fill, alluvial soils generally consisting of stiff to very stiff sandy clay and silty clay interbedded with clayey silt, silty sand and poorly graded sand were encountered in our exploratory borings to the depths explored of 51½ feet. More detailed descriptions of the subsurface materials are presented on the boring logs in Appendix A.

7. FIELD PERCOLATION TESTING

Percolation testing was performed on December 27 and 28, 2007 at borings B-1, B-5, B-6 and B-7 to evaluate the percolation rate of the on-site soils. The testing was performed for the purpose of evaluating an infiltration system as part of the project. At each of these boring locations, a separate percolation test hole was drilled to depths of approximately 10 to 15 feet. The infiltration tests were performed at a depth interval of approximately 5 to 10 feet for B-6 and a depth interval of approximately 5 to 15 feet for B-1, B-5 and B-7. Preparation of the borings for percolation testing included placing a 2-inch-diameter PVC pipe in the borings, backfilling around the lower approximate 5 feet of pipe with clean sand, and placing a bentonite cap above the sand. The lower approximately 5 feet of PVC pipe within the sand zone was slotted. The infiltration zone was pre-soaked on December 27, 2007. Percolation testing was conducted on December 28, 2007 by placing water in the PVC pipe to establish a head of water. The drop in water level was measured over time. The results of our percolation testing are presented in Table 1.

Table 1 – Percolation Test Results

Test Hole	Coefficient of Permeability (ft/day)
B-1 (5-15 feet)	0.05
B-5 (5-15 feet)	0.15
B-6 (5-10 feet)	No Percolation Over 28 Hours
B-7 (5-15 feet)	0.014

Notes:
ft/day – feet per day

8. GROUNDWATER

Groundwater was encountered in our exploratory borings ranging from approximately 16 to 29 feet below ground surface. Based on review of the State of California Seismic Hazard Evaluation (1998), the historical high groundwater level mapped at the site ranges from approximately 30 feet below the ground surface at the northwest corner of the site to less than 10 feet at the southwest corner. It should be noted that fluctuations in the level of groundwater at the subject site may occur due to variations in ground surface topography, groundwater pumping, subsurface

stratification, rainfall, irrigation practices, and other factors which may not have been evident at the time of our evaluation.

9. FAULTING AND SEISMICITY

The subject site is not located within a State of California Earthquake Fault Zone (EFZ), formerly Alquist-Priolo Special Studies Zone (Hart and Bryant, 1997). However, the site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed structure. Figure 4 shows the approximate site location relative to the major faults in the region. Table 1 lists selected principal known active faults that may affect the subject site and the maximum moment magnitude (Mmax) as published for the California Geological Survey (CGS) by Cao, et al. (2003). The approximate fault to site distance was calculated by the computer program FRISKSP (Blake, 2001a).

Table 2 – Principal Active Faults

Fault	Approximate Fault to Site Distance in miles (km)	Maximum Moment Magnitude[1] (Mmax)
Santa Monica	2.2 (3.6)	6.6
Malibu Coast	4.4 (7.1)	6.7
Newport-Inglewood (L.A. Basin)	4.8 (7.8)	7.1
Hollywood	6.2 (10.0)	6.4
Palos Verdes	7.3 (11.7)	7.3
Upper Elysian Park Blind Thrust	11.9 (19.2)	6.4
Anacapa-Dume	13.4 (21.6)	7.5
San Andreas-1857 Rupture	42.5 (68.4)	7.8
Notes: [1] Cao, et al., 2003.		

The principal seismic hazard considerations at the site are ground shaking and surface ground rupture. A brief description of the hazards and the potential for their occurrence on site are presented below.

9.1. Surface Ground Rupture

The potential for surface ground rupture at the project site is considered low due to the lack of known active faults crossing the site. The site is not located within an EFZ. Surface ground cracking related to shaking from distant events is not considered a significant hazard, although it is a possibility.

9.2. Ground Motion

Our evaluation of the ground shaking hazard at the site included review of a probabilistic seismic hazard assessment that consisted of statewide estimates of peak horizontal ground accelerations conducted for California (Peterson, et al., 1996). In addition, for the purposes of evaluating seismically induced geotechnical hazards at the site, a site-specific probabilistic seismic hazard analysis was performed to evaluate anticipated peak ground accelerations (PGAs) using the computer program FRISKSP developed by Blake (2001a). A probabilistic analysis incorporates uncertainties in time, recurrence intervals, size, and location (along faults) of hypothetical earthquakes. This method thus accounts for likelihood (rather than certainty) of occurrence and provides levels of ground acceleration that might be more reasonably hypothesized for a finite exposure period. FRISKSP calculates the probability of experiencing various ground accelerations at a site over a period of time and the probability of exceeding expected ground accelerations within the lifetime of the proposed structure from the significant earthquakes within a specific radius of search. For the present case, a search radius of 62 miles (i.e., 100 kilometers) was selected. The earthquake magnitudes used in this program are based on the current CGS fault model.

The 2007 California Building Code (CBC) recommends that the design of structures be based on the peak horizontal ground acceleration having a 2 percent probability of exceedance in 50 years which is defined as the Maximum Considered Earthquake (MCE). The statistical return period for PGA_{MCE} is approximately 2,475 years. In evaluating the seismic hazards associated with the subject site, we have used the United States Geological Survey (USGS, 2008) ground motion calculator (web-based). The design PGA for the site

was calculated as 0.45g. These estimates of ground motion do not include near-source factors that may be applicable to the design of structures on site.

9.3. Liquefaction and dynamic Settlement of Saturated Soils

Liquefaction is the phenomenon in which loosely deposited granular soils with fines (i.e., silts and clays) content less than approximately 35 percent and located below the water table undergo rapid loss of shear strength when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid rise in pore water pressure causing the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking. Groundwater was encountered at depths of approximately 16 to 29½ feet. Historic high groundwater for the site ranges from approximately 10 feet at the southwest corner of the site to approximately 30 feet at the northeast corner (CDMG, 1998).

The southwest approximate half of the site is located in an area mapped as potentially liquefiable (CDMG, 1999)(Figure 5), and our site-specific investigation revealed the presence of saturated, cohesionless and loose to medium dense soils in a zones between approximately 35 to 40 feet below the ground surface. As a result, an evaluation of the liquefaction potential of the soil layers located below the groundwater was performed. Evaluations of the liquefaction potential of soil layers located below the historic high groundwater level of 10 feet was performed. An idealized soil profile was established for the site based on the subsurface information obtained from our exploratory borings.

An analysis of the earthquake-induced liquefaction potential at the site was performed utilizing the LIQUEFY2 Computer Program (Blake, 2001b). The liquefaction evaluation, assuming the historic groundwater level of 10 feet, indicates that the alluvial sediments between depths of approximately 35 and 40 feet below the surface are susceptible to

liquefaction and liquefaction-related seismic hazards (e.g., dynamic settlement and/or ground subsidence) during the design seismic event.

9.4. Dynamic Settlement of Saturated Soils

Based on our analysis of the site's liquefaction potential, the proposed improvements may be subject to liquefaction-induced dynamic settlement. In order to estimate the amount of post-earthquake settlement, the method proposed by Tokimatsu and Seed (1987) was used in which the seismically induced cyclic stress ratios and corrected N-values are related to the volumetric strain of the soil. The amount of soil settlement during a strong seismic event depends on the thickness of the liquefiable layers and the density and/or consistency of the soils. Under the historic high groundwater condition, a total post-earthquake settlement of approximately 3 inches is estimated for the site. It is our opinion that the differential settlement should not exceed approximately 1 inch in 40 feet. However, based on the depths and thicknesses of the liquefiable soil layers and the very dense overlying non-liquefiable layers, we estimate that the surface manifestation of dynamic settlement will not cause damage to shallow foundations and mat foundations based on the study by Ishihara (1995).

10. CONCLUSIONS

Based on the results of our geotechnical evaluation, it is our opinion that the proposed Penmar Water Quality Improvement project is feasible from a geotechnical standpoint, provided the recommendations in this report are incorporated into the design and construction of the subject project. Geotechnical conditions that affect the design and construction of the project include:

- Based on our exploratory borings, existing undocumented fill overlying the native alluvium is present at the site. The existing fill extends to a depth of up to approximately 10 feet at the locations explored. We recommend that the near surface fill soils be overexcavated and recompacted in areas underlying proposed at-grade improvements.
- Excavations during site grading should be feasible with earthmoving equipment in good working order. We anticipate that the near-surface soils should be generally suitable for use as compacted fill (except for structure backfill). However, the moisture contents of clay and silt materials encountered in our borings ranged from approximately 18 to 34 percent. Prior to using clay or silt as backfill, the clay and silt will need to be dried to slightly above opti-

mum moisture content. In addition, material excavated from below the groundwater table will be in a wet condition and will involve processing prior to use as compacted fill.

- Groundwater was encountered during our evaluation at depths of approximately 16 to 29 feet. Historic high groundwater is mapped at a depth ranging from approximately 10 to 30 feet below the ground surface. Consequently, groundwater should be expected to impact excavations deeper than approximately 10 feet and dewatering should be anticipated. Grading equipment should be used that limits the potential for soil pumping during grading and fill compaction. Groundwater levels are subject to variation due to seasonal precipitation, subsurface conditions, irrigation, groundwater pumping, and other factors.

- The reported historic shallow groundwater levels on site are approximately 10 to 30 feet below grade. When evaluating potential uplift effects on buried structures and for construction, we recommend that a groundwater level of 10 feet below the ground surface be considered. An appropriate factor of safety should also be utilized in the design for resisting the uplift force.

- The site is located in an area mapped as potentially liquefiable (CDMG, 1998). Our liquefaction evaluation of site soils below the historic high groundwater indicates that the soils between approximate depths of 35 and 40 feet below the surface are susceptible to liquefaction. We have calculated approximately 3 inches of liquefaction-induced dynamic settlement. Our analysis indicated that the surface manifestation of dynamic settlement should not cause damage to shallow foundations.

- Some of the proposed structures and pipelines will extend to or below the water table. Accordingly, considerations for the construction sequence should include: 1) installation of the sheet piles to create a cofferdam-type structure to facilitate dewatering and excavation, 2) consideration of the stability of the excavation by applying appropriate bracing systems during construction, and 3) dewatering of the area contained by the cofferdams.

- The on-site materials should be considered Type C soils in accordance with Occupational Safety and Health Administration (OSHA) soil classifications. It is anticipated that these soils will be exposed during project excavations. Temporary vertical excavations over approximately 4 feet in height will involve shoring, or, as an alternative to shoring, should be sloped back at an inclination of 1½:1 (horizontal to vertical) in accordance with OSHA regulations. Appropriate shoring systems for these types of materials should be considered during planning.

- The subject site is not located within a State of California EFZ. The probability of surface fault rupture at the site is considered to be low.

- The design PGA was estimated to be 0.45g based on the USGS (2008) ground motion calculator (web-based).

- Our limited laboratory corrosion testing indicates that the near-surface site soils can be classified as non-corrosive based on California Department of Transportation (Caltrans, 2003) corrosion guidelines.
- Coefficient of permeability for the site soils ranged from approximately less than 0.014 to 0.15 feet/day.

11. RECOMMENDATIONS

The following sections include our geotechnical recommendations for construction of the proposed Penmar Water Quality Improvement project. These recommendations are based on our evaluation of the site geotechnical conditions and our understanding of the planned construction. The proposed construction should also be performed in accordance with the requirements of applicable governing agencies.

As indicated in Section 12 of this report, we recommend additional exploratory borings to confirm the subsurface conditions and our design assumptions. The locations of our borings were based on the conceptual design of the project and were located to provide preliminary subsurface information for the project. Subsequent detailed project design information indicates that the proposed pump station is approximately 200 feet south of the nearest boring, B-8. We have provided our recommendations below assuming similar material types are present.

11.1. Earthwork

Earthwork will generally include the removal of below-grade improvements, including existing underground utilities, excavations to construct the diversion structure, pump station, and underground reservoir, and installation of underground utilities. Earthwork recommendations presented in the following sections are based on the assumption that grading to achieve the finish grades at the site will be relatively minor. Earthwork should be performed in accordance with the requirements of applicable agencies, and the recommendations presented herein.

11.1.1. Construction Plan Review and Pre-Construction Conference

We recommend that the grading and foundation plans be submitted to Ninyo & Moore for review to check for conformance to the recommendations provided in this report. We further recommend that a pre-construction conference be held in order to discuss the grading recommendations presented in this report. The owner and/or their representative, the governing agencies' representatives, the civil engineer, Ninyo & Moore, and the contractor should be in attendance to discuss the work plan, project schedule, and earthwork requirements.

11.1.2. Clearing and Grubbing

Prior to commencing earthwork operations, deleterious materials, including vegetation, pavement, and/or other site improvements should be cleared from the site. Debris from the clearing operations should be disposed off-site. Resulting holes due to removal of obstructions that extend below grade, such as foundations or underground utilities, should be removed and filled with compacted fill per Sections 11.1.8 and 11.1.9 of this report.

11.1.3. Pump Station and Underground Reservoir Pad Preparation

Based on our exploratory borings, relatively dense, granular, alluvial soils are anticipated at the bottom of the pump station and reservoir excavations that should be suitable for support of the structures. We recommend that the structure pads be over-excavated approximately 1½ feet, and replaced with compacted aggregate base material, such as Class 2 aggregate base or crushed miscellaneous base (CMB) wrapped in filter fabric. The actual limits and methods to stabilize the subgrade should be based on evaluation of the subgrade conditions in the field at the time of construction. The excavation bottom should be evaluated by our representative during the excavation work. Prior to placement of the foundation, the bottom should be scarified to a depth of approximately 12 inches, moisture conditioned, and compacted.

11.1.4. Treatment of Near Surface Soils for At-Grade Structures

In order to provide suitable support for at-grade structures we recommend that undocumented fill beneath the structures be removed and recompacted to provide approximately 3 feet or more compacted fill beneath the bottom of the foundations. The overexcavation should expose relatively dense alluvial deposits. Additional overexcavation of loose, soft, and/or wet areas may be appropriate. The limits of the excavation should extend laterally so that the bottom of the excavation is approximately 5 feet beyond the perimeter of the structure or a distance equal to the depth of the overexcavation, whichever is farther. The excavation bottom should be evaluated by our representative during the excavation work. The exposed subgrade should be scarified to approximately 6 inches deep, moisture conditioned, and compacted prior to the placement of fill. To reduce the adverse effect to the foundation caused by the on-site expansive soils, we recommend that the upper 2 feet of soil beneath the foundations be comprised of low-expansion potential material that is in accordance with the CBC (2007). On-site and imported soils should be compacted to 90 percent or more relative compaction as evaluated by the latest edition of ASTM D 1557.

11.1.5. Excavation Characteristics

We anticipate that excavation within the fill and alluvial materials present on site may be accomplished with grading equipment in good operating condition. Based on the results of our subsurface exploration, we anticipate that the subsurface soils encountered will generally consist of sand, silty sand, clayey sand, silt, and clay. Although oversize materials were not encountered in our borings, oversize materials may be encountered during excavation, including debris in the undocumented fills. The contractor should be prepared to take appropriate measures to address the presence of oversize materials.

11.1.6. Shoring

Where excavations extend below the water table or where temporary slopes are not possible, shoring will be involved. Shoring systems will be constructed through fill and alluvial deposits. The types of shoring systems for the project are unknown at this time.

We anticipate that braced driven sheet pile shoring systems will be appropriate for the project to excavation depths up to approximately 30 feet. Cantilevered shoring systems (if used) should be limited to retain excavation heights of up to 10 feet due to soft clay/loose sand conditions. The braced sheet pile shoring systems should be designed using the lateral earth pressure values provided on Figure 6. Tieback-anchored shoring system may be used in lieu of braced shoring, provided the easements for tiebacks are available. Tieback anchor constraints include conflicts with existing structures, underground utilities, and remnant foundation systems. In addition, tieback anchors that are embedded in loose sand or soft clay below groundwater may not provide the desired bond strength even under the temporary loading condition, and may need to be lengthened. The shoring systems planned for the project should be reviewed by our office to evaluate the design considerations and geotechnical parameters used.

The recommended design pressures are based on the assumptions that the shoring system is constructed without raising the ground surface elevation behind the shoring system, that there are no surcharge loads, such as soil stockpiles, construction materials, construction equipment, or vehicular traffic, and that no loads act above a 1:1 (horizontal to vertical) plane extending up and back from the base of the shoring system. For shoring system subjected to the above-mentioned surcharge loads, the contractor should include the effect of these loads on the lateral pressures against the shoring system.

Ground settlement may occur behind the shoring system wall during excavation. The amount of settlement depends heavily on the type of shoring system, the contractor's workmanship, and soil conditions. Based on our experience, we anticipate that sheet pile driving may cause settlement and possible impact to structures within distances of up to approximately 25 feet from the sheet pile operation. We recommend that structures/improvements in the vicinity of the planned shoring installation be reviewed with regard to foundation support and tolerance to settlement. To reduce the potential for distress to adjacent structures, we recommend that the shoring system be designed to limit the ground settlement behind the shoring system to ½ inch or less, which would equal

approximately ½ inch of deflection. Possible causes of settlement that should be addressed include settlement during installation of the sheet piling, excavation for structure construction, construction vibrations, dewatering, and removal of the support system. The vibrations from the driving of sheet piles may result in some dynamic settlement of granular soils that may affect the adjacent structures. We recommend that shoring installation be evaluated carefully by the contractor prior to construction and that ground vibration and settlement monitoring be performed during construction. Vibration and settlement monitoring should be performed during pile driving. If settlement is detected or peak particle velocities of approximately 0.2 inches per second or more are measured adjacent to existing improvements, the pile driving should be stopped and evaluated. The evaluation may include changing the hammer vibration frequency and monitoring for settlement and vibrations. To reduce the potential for settlement associated with sheet pile removal, sheet piles may be left in place. In the event excessive settlement or other damage occurs associated with the pile driving operations, it may be appropriate to perform grouting beneath nearby structure(s) to mitigate the pile driving effects.

The contractor should retain a licensed, qualified and experienced engineer to design the shoring system. The shoring parameters presented in this report are minimum requirements, and the contractor should evaluate the adequacy of these parameters and make the required modifications for their design. We recommend that the contractor take appropriate measures to protect workers. OSHA requirements pertaining to worker safety should be observed.

11.1.7. Construction Dewatering

The project site is underlain by relatively shallow groundwater, and dewatering is anticipated for deeper excavations so that work can be performed in a dry condition. The depth to groundwater was variable at the time of our field exploration. Groundwater depths are anticipated to range from approximately 16 to 29 feet, but could be as shal-

low as 10 feet deep (historical shallow groundwater data). The pump system design should be performed by a specialty dewatering contractor.

Lowering the water table during dewatering activities will result in an increase in effective stresses and may induce settlements of the soils underlying adjacent structures. Based on the anticipated depths of excavations (approximately 30 feet or less), we anticipate that the potential for settlement associated with construction dewatering is low. We recommend that the dewatering be performed such that the groundwater level be lowered no more than approximately 3 feet below the depths of excavations. Monitoring wells should be installed outside of the excavation to monitor the impact of dewatering to the groundwater. Existing structures in the vicinity of planned excavations should be evaluated with regard to foundation type and potential for settlement. Settlement monuments should be provided to monitor settlement-sensitive structures. Disposal of groundwater should be performed in accordance with guidelines of the Regional Water Quality Control Board (RWQCB). Design of the groundwater control system is the responsibility of the contractor.

11.1.8. Fill Material

In general, the on-site earth materials should be suitable for reuse as general fill and trench backfill. The on-site clay and silt materials are generally above optimum moisture content and will need to be processed prior to placing as fill to reduce the moisture content of these materials to slightly above optimum moisture content. In addition, debris may be encountered in the existing undocumented fill. On-site and imported fill soils should be free of trash, debris, roots, vegetation, or deleterious materials. Fill should generally be free of rocks or hard lumps of materials more than approximately 4 inches in diameter. Rocks or hard lumps larger than about 4 inches in diameter should be broken into smaller pieces or should be removed from the site. Imported materials should consist of clean, granular materials with a low expansion potential, corresponding to an expansion index of 50 or less as evaluated in accordance with ASTM D4829-07. Imported materials should be submitted to the project geotechnical consultant for

review prior to their importation to the site. The corrosion potential of proposed imported soils should also be evaluated if structures will be in contact with the imported soils. The contractor should be responsible for the uniformity of imported materials brought to the site.

We recommend that structural backfill material as specified in "Greenbook" Standard Specifications for Public Works Construction (Building News, 2003) be used to backfill behind the proposed retaining walls, including walls for the pump station and underground reservoir.

11.1.9. Fill Placement and Compaction

Fill, structure backfill, and trench backfill should be compacted in uniform horizontal lifts to a relative compaction of 90 percent or more as evaluated by ASTM D 1557-00. Fill soils should be placed at near optimum moisture content as evaluated by ASTM D 1557-00. The optimum lift thickness of fill will depend on the type of compaction equipment used, but generally should not exceed 8 inches in loose thickness. Special care should be taken to avoid pipe damage when compacting trench backfill above the pipe. Placement and compaction of the fill soils should be in general accordance with local grading ordinances and good construction practice.

11.1.10. Pipe Bedding

We recommend that bedding material be placed around pipe zones 1 foot or more above the top of the pipe. The bedding material should be classified as sand, be generally free of organic material, and have a sand equivalent (SE) of 30 or more. We do not recommend crushed rock be used for bedding material because of the fine grain nature of the subsurface material. It has been our experience that the voids within a crushed rock material are sufficiently large to allow fines to migrate into the voids, thereby creating the potential for sinkholes and depressions to develop at the ground surface. Where soft, wet soil conditions are encountered, the trench excavation should be excavated ap-

proximately 1 to 2 feet or more below the pipe invert and should be backfilled with gravel wrapped in filter fabric.

Special care should be taken not to allow voids beneath and around the pipe. Compaction of the bedding material and backfill should proceed uniformly up both sides of the pipe. Trench backfill, including bedding material, should be placed in accordance with the recommendations presented in the preceding section.

11.1.11. Modulus of Soil Reaction for Pipe Design

The modulus of soil reaction is used to characterize the stiffness of soil backfill placed at the sides of buried flexible pipelines for the purpose of evaluating deflection caused by the weight of the backfill above the pipe. We recommend that a modulus of soil reaction of 1,000 pounds per square inch (psi) be used for design, provided that granular bedding material be placed adjacent to the pipe, as recommended in the previous section.

11.2. Seismic Design Considerations

Design of the proposed improvements should comply with design for structures located in Seismic Zone 4 and should be designed in accordance with the requirements of governing jurisdictions and applicable building codes. Table 2 presents the seismic design parameters for the site in accordance with CBC (2007) guidelines and mapped spectral acceleration parameters (United States Geological Survey [USGS], 2008).

Table 3 – 2007 California Building Code Seismic Design Criteria

Seismic Design Factors	Value
Site Class	D
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.5
Mapped Spectral Acceleration at 0.2-second Period, S_s	1.566 g
Mapped Spectral Acceleration at 1.0-second Period, S_1	0.600 g
Adjusted MCE Spectral Response Acceleration at 0.2-second Period, S_{MS}	1.566 g

Table 3 – 2007 California Building Code Seismic Design Criteria

Seismic Design Factors	Value
Adjusted MCE Spectral Response Acceleration at 1.0-second Period, S_{M1}	0.900 g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	1.044 g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.600 g

11.3. Mat Foundations

Based on our analysis, it is our opinion that the proposed underground reservoir and pump station can be supported by mat foundations. Mat foundations may be designed assuming the allowable bearing capacities presented in Table 4. The anticipated total and differential settlements corresponding to these allowable bearing loads is estimated to be approximately 1 inch and ½ inch, respectively. Mat foundations typically experience some deflection due to loads placed on the mat and the reaction of the soils directly underlying the mat. Table 4 presents the design modulus of subgrade reaction that may be used for evaluating such deflections for each structure.

We recommend that a 1½-foot-thick gravel mat be placed in the bottom of the excavations prior to construction of the structure floors to provide a suitable working surface. The gravel should be clean ¾-inch to 1½-inch rock, underlain by non-woven filter fabric (Mirafi 140N or approved equivalent).

Table 4 – Soil Design Parameters for Mat Foundations

Structures	Approximate Depth of Structure Below Grade (feet)	Net Allowable Bearing Capacity (psf)*	Modulus of Subgrade Reaction (kcf)
Underground Reservoir	24	5,000	500
Pump Station	30	5,000	350

Notes:
psf – pounds per square foot
kcf – kips per cubic foot
* The net allowable bearing capacity, means the weight of the mat and soil backfill may be ignored in calculating foundation loads.

11.4. Footing Foundations

Footings bearing in soils of low expansion potential should extend 18 inches or more below the lowest adjacent finished grade. Continuous footings should have a width of 24 inches or more. Isolated footings should have a width of 24 inches or more. Continuous footings should be reinforced with two No. 5 steel reinforcing bars, one placed near the top and one placed near the bottom of the footings, and further detailed in accordance with the recommendations of the structural engineer.

Footings, as described above and bearing on compacted fill, may be designed using a net allowable bearing capacity of 2,500 psf. (weight of footings and soil backfill may be ignored when calculating footing loads). Total and differential settlements for footings designed in accordance with the above recommendations are estimated to be less than approximately 1 inch and ½ inch, respectively.

Foundations bearing in compacted fill may be designed using a coefficient of friction of 0.35, where the total frictional resistance equals the coefficient of friction times the dead load. Foundations may be designed using a passive resistance value of 300 psf per foot of depth, with a maximum value of 3,000 psf. The allowable lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided the passive resistance does not exceed two-thirds of the total allowable resistance. The passive resistance (including the maximum value) may be increased by one-third when considering loads of short duration such as wind or seismic forces.

11.5. Floor Slabs

Floor slabs should have a thickness of 5 inches or more and be reinforced with No. 4 steel reinforcing bars placed 18 inches on-center (each way) in the middle one-third of the slab height. The proper placement of the reinforcement in the slab is vital for satisfactory performance. The floor slab and foundations should be tied together by extending the slab reinforcement into the footings. Floor slabs should be underlain by a 2-inch layer of clean sand, underlain by a polyethylene vapor retarder, 10-mil or thicker, underlain by a 4-inch

layer of gravel with a particle size up to approximately $^3/_8$ inch. The vapor retarder is recommended in areas where moisture sensitive floor coverings are anticipated. Soils underlying the slabs should be moisture conditioned and compacted in accordance with the recommendations contained in this report prior to concrete placement. Joints should be constructed at intervals designed by the structural engineer to help reduce random cracking of the slab. Floor slabs subject to heavy wheel loads should be evaluated on a case-by-case basis by the structural engineer.

11.6. Earth Pressures

Walls for below grade facilities when constructed as recommended above, including structural backfill per "Greenbook," may be designed for lateral pressures represented by the pressure diagram on Figure 7. The exterior of underground walls should be carefully waterproofed. We recommend that horizontal and vertical construction joints of underground structures have water stops to reduce the likelihood of water infiltration. For pipe penetrating into the structures, standard "water-tight" penetration design should be utilized. To reduce the potential for pipe-to-wall differential settlement, which could cause pipe shearing, we recommend that a flexible pipe joint be located close to the exterior of the wall. The type of joint should be such that minor relative movement can be accommodated without distress. The pipe connections should be sufficiently flexible to withstand differential settlement of approximately ½ inch. The amount of differential settlement is from static loading of the structure. Dynamic settlement of up to approximately 3 inches during a design earthquake may occur. However, our analysis also indicated that the surface manifestation of dynamic settlement will not cause damage to shallow foundations. Repairs to connections may be required after strong seismic events.

The dynamic lateral earth pressures presented in Figure 7 apply to retaining walls that are more than 12 feet in height in accordance with the 2007 CBC. Retaining walls may be supported by conventional mat foundations and shallow foundations, using the design parameters presented in Section 11.3 and 11.4 of this report, respectively.

11.7. Lateral Pressures for Thrust Blocks

Thrust restraint for buried pipelines may be achieved by transferring the thrust force to the soil outside the pipe through a thrust block. Thrust blocks may be designed using the lateral passive earth pressures presented on Figure 8. Thrust blocks should be backfilled with granular backfill material, compacted as outlined in Section 11.1.9.

11.8. Uplift Considerations

For structures that will extend below the water table, uplift force will need to be considered. Hydrostatic uplift forces should be evaluated for a potential shallow groundwater condition of approximately 10 feet below the ground surface. The resistance to uplift may then be taken as the sum of the weight of the structure and the uplift resistance of the sidewalls.

We recommend that the concrete mat foundation and structure be designed to resist hydrostatic uplift. Two alternatives for resisting the anticipated uplift pressures are: 1) constructing a thicker concrete mat foundation, or 2) extending the mat foundation a selected distance outside the exterior walls of the structure (flanges). The resistance to uplift may then be taken as the sum of the weight of the structure and the weight of the wedge of soil within the zone of influence (Figure 9).

11.9. Corrosivity

Laboratory testing was performed on representative samples of near-surface soil to evaluate soil pH, electrical resistivity, water-soluble chloride content, and water-soluble sulfate content. The soil pH and electrical resistivity tests were performed in general accordance with California Test Method (CT) 643. Chloride content tests were performed in general accordance with CT 422. Sulfate testing was performed in general accordance with CT 417. The laboratory test results are presented in Appendix B.

The soil pH was measured to be approximately 6.5 and 6.7. The electrical resistivity was measured to be approximately 670 and 2,345 ohm-centimeters. The chloride content of the samples were approximately 115 and 150 ppm. The sulfate content of the tested samples

were approximately 0.015 and 0.004 percent by weight (i.e., 150 and 40 ppm, resepectively). Based on the laboratory test results and Caltrans (2003) corrosion criteria, the project site can be classified as a non-corrosive site, which is defined as having earth materials with less than 500 ppm chlorides, less than 0.20 percent sulfates (i.e., 2,000 ppm), or a pH of 5.5 or less.

11.10. Concrete Placement

Concrete in contact with soil or water that contains high concentrations of soluble sulfates can be subject to chemical and/or physical deterioration. Based on the UBC criteria (UBC, 1997), the potential for sulfate attack is negligible for water-soluble sulfate contents in soil ranging from 0.00 to 0.10 percent by weight (0 to 1,000 ppm). As indicated above, the soil samples tested for this evaluation indicate water-soluble sulfate contents of 0.015 and 0.004 percent by weight (i.e., 150 and 40 ppm, respectively). Accordingly, the on-site soils are considered to have a negligible potential for sulfate attack. However, due to the potential variability in soil conditions across the site and the possible use of reclaimed water, we recommend that Type V cement with a water/cement ratio of 0.45 or less be considered for the project.

In order to reduce the potential for shrinkage cracks in the concrete during curing, we recommend that the concrete be placed with a slump of 4 inches based on ASTM C 143. The slump should be checked periodically at the site prior to concrete placement. We also recommend that crack control joints be provided in sidewalks and exterior hardscape in accordance with the recommendations of the project structural engineer to reduce the potential for distress due to minor soil movement and concrete shrinkage. The project structural engineer should be consulted for additional concrete specifications.

11.11. Drainage

Proper surface drainage is imperative for satisfactory site performance. Positive drainage should be provided and maintained to direct surface water away from foundations and off-site. Positive drainage is defined as a slope of 2 percent or more for a distance of 5 feet

or more away from foundations and tops of slopes. Runoff should then be directed by the use of swales or pipes into a collective drainage system. Surface waters should not be allowed to pond adjacent to footings. We recommend that structures have roof drains and downspouts installed to collect runoff. Surface water should not be allowed to flow over slope faces or pond adjacent to footings. Area drains for landscaped and paved areas are recommended.

11.12. Landscaping

Project landscaping should consist of drought tolerant plants. Landscape irrigation should be kept to a level just sufficient to maintain plant vigor. Overwatering should not be permitted.

12. ADDITIONAL EXPLORATION

Our subsurface exploration was based on conceptual design information provided prior to the detailed information and at the locations requested by the client. One boring was performed at the site of the underground reservoir. We recommend that two additional borings be performed in the footprint of the reservoir to confirm our design assumptions. We also recommend that one boring be performed at the location of the pump station to confirm our design assumptions. Additional borings should also be considered along the new force main alignments to evaluate trenching and pipe support conditions.

13. CONSTRUCTION OBSERVATION

The conclusions and recommendations presented in this report are based on analysis of observed conditions in widely spaced exploratory borings. If conditions are found to vary from those described in this report, Ninyo & Moore should be notified and additional recommendations will be provided upon request. Ninyo & Moore should observe and test fill placement and compaction. Project plans should also be reviewed by Ninyo & Moore prior to the start of construction.

The recommendations provided in this report are based on the assumption that Ninyo & Moore will provide geotechnical observation and testing services during construction. In the event that

the Irvine Ranch Water District decides not to utilize the services of Ninyo & Moore during construction, we request that the selected consultant provide the Irvine Ranch Water District with a letter (with a copy to Ninyo & Moore) indicating that they fully understand Ninyo & Moore's recommendations and that they are in full agreement with the design parameters and recommendations contained in this report.

14. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

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Source	Scale	Date	Flight	Numbers
USDA	1:20,000	11-4-52	AXJ-3K	128 & 129

REFERENCE: 2005 THOMAS GUIDE FOR LOS ANGELES/ORANGE COUNTIES, STREET GUIDE AND DIRECTORY

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.
Map © Rand McNally, R.L.07-S-129

207328-A1.DWG

Ninyo & Moore

SITE LOCATION MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	1

REFERENCE: GOOGLE EARTH

LEGEND

B-8 ● TD=31.5	APPROXIMATE LOCATION OF EXPLORATORY BORING TD=TOTAL DEPTH IN FEET

Ninyo & Moore

PROJECT NO.	DATE
207328001	6/08

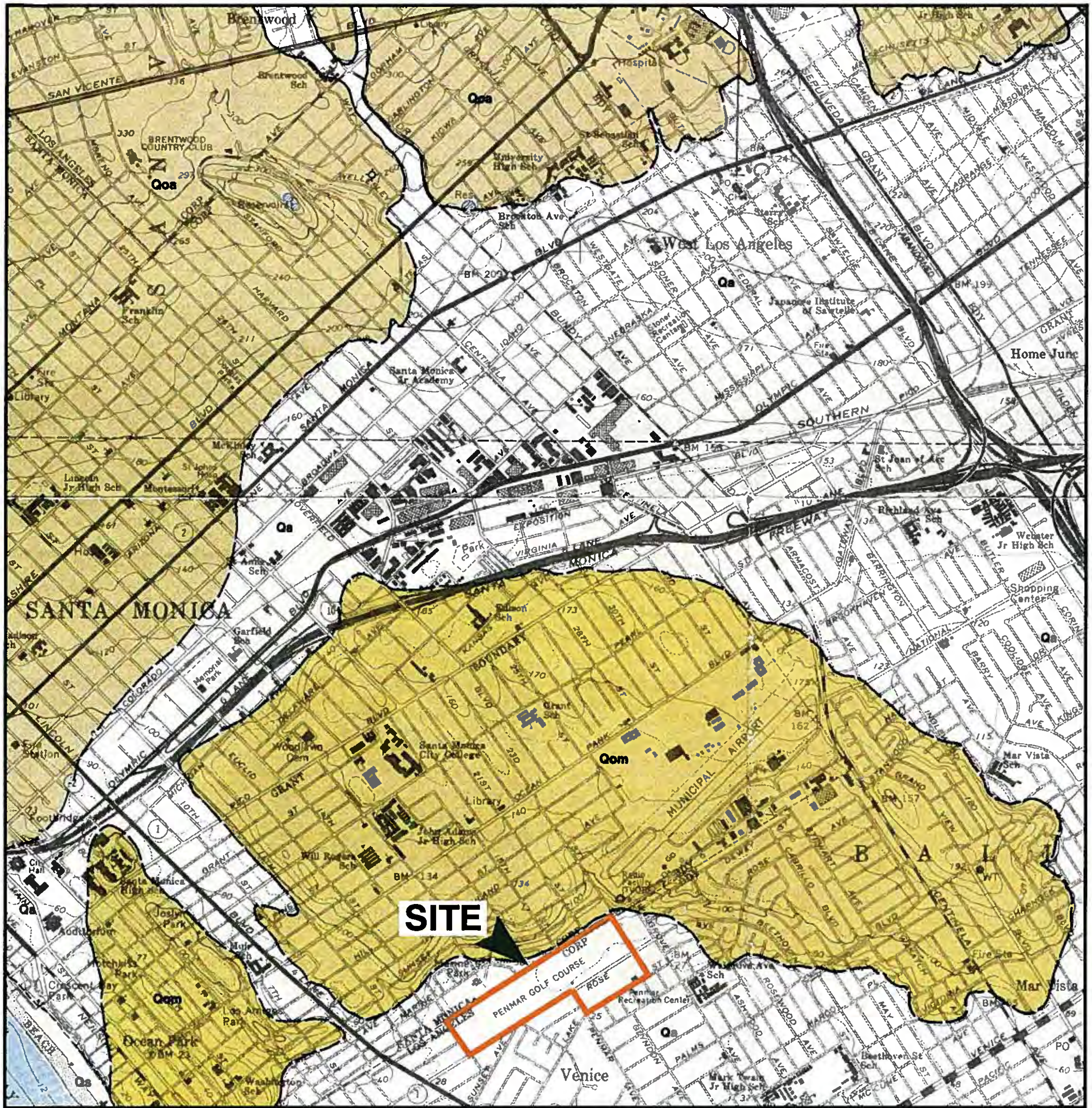
BORING LOCATION MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

2

207328–A2.dwg



REFERENCE: GEOLOGICAL MAP OF BEVERLY HILLS AND VAN NUYS (SOUTH 1/2) QUADRANGLES BY THOMAS W. DIBBLEE, JR., 1991.

N

APPROXIMATE SCALE IN FEET

0 2400 4800

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

Qa af Qa	ALLUVIUM
Qoa Qop Qoa	OLDER ALLUVIUM
Qom Qop Ql	MARINE DEPOSITS

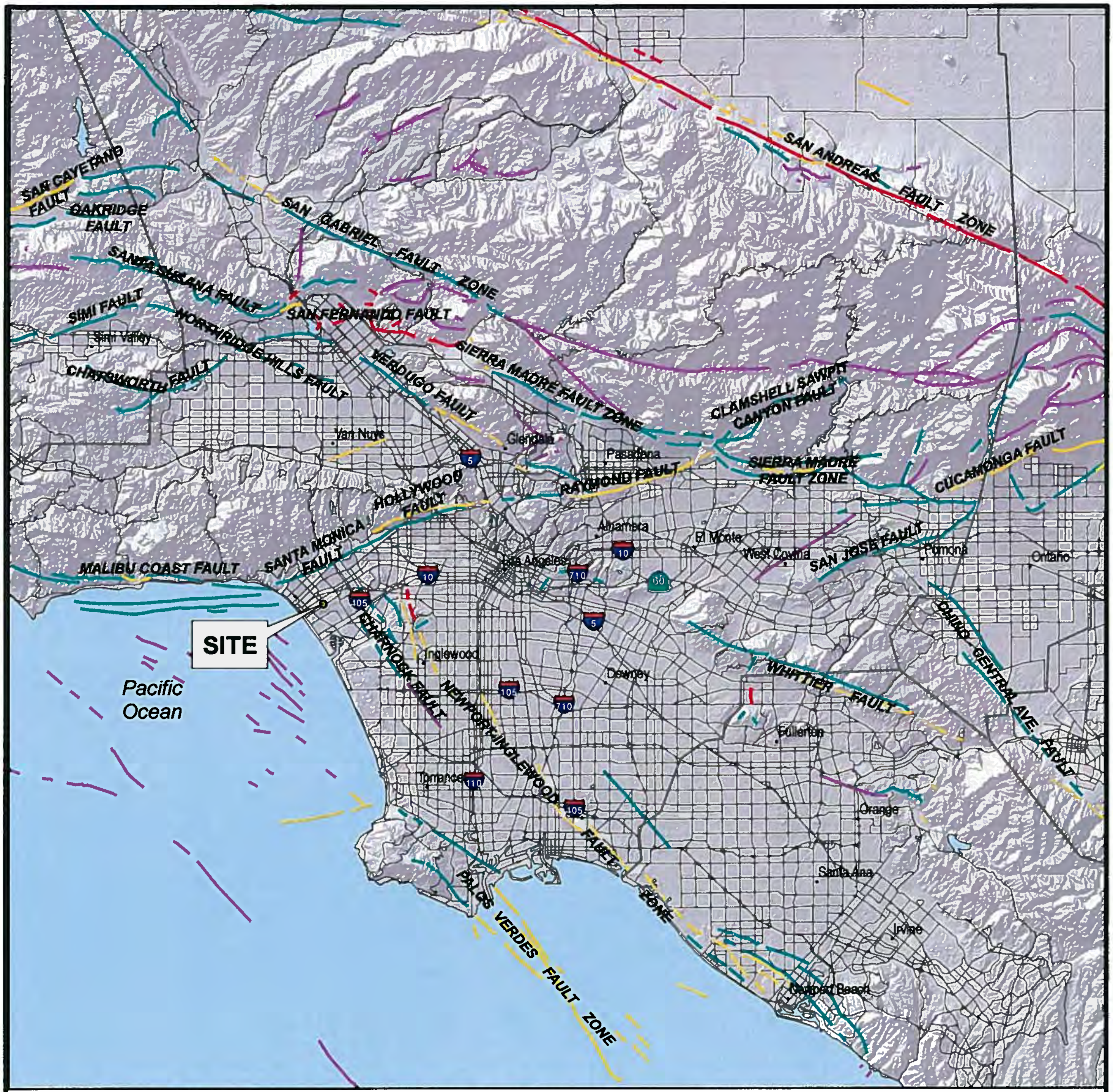
207328-A3.DWG

Ninyo & Moore

REGIONAL GEOLOGIC MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	3



GIS DATA SOURCE: CALIFORNIA GEOLOGICAL SURVEY (CGS); ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE (ESRI)
REFERENCE: JENNINGS, 1994, FAULT ACTIVITY MAP OF CALIFORNIA AND ADJACENT AREAS

LEGEND

FAULT ACTIVITY:

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- COUNTY BOUNDARIES
- LATE QUATERNARY
- QUATERNARY

N

10 0 10

Miles

NOTE: ALL DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE

207328_a4.gis

Ninyo & Moore

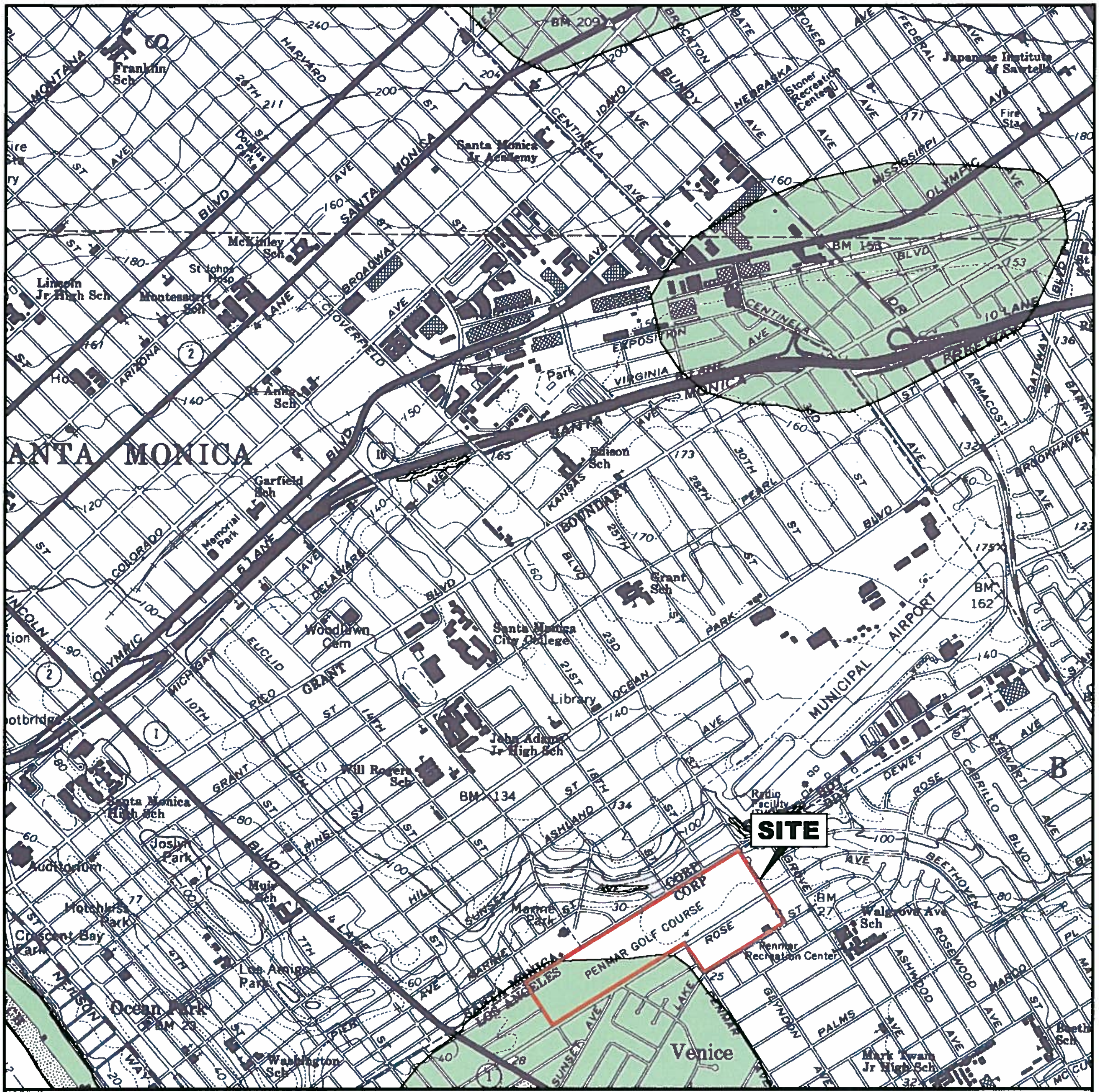
PROJECT NO.	DATE
207328001	6/08

FAULT LOCATION MAP

PENNMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

4



REFERENCES: STATE OF CALIFORNIA SPECIAL STUDIES ZONES, BEVERLY HILLS QUADRANGLE, 3-25-1999.

N

APPROXIMATE SCALE

0 2,000 4,000 FEET

Liquefaction

🟩 Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

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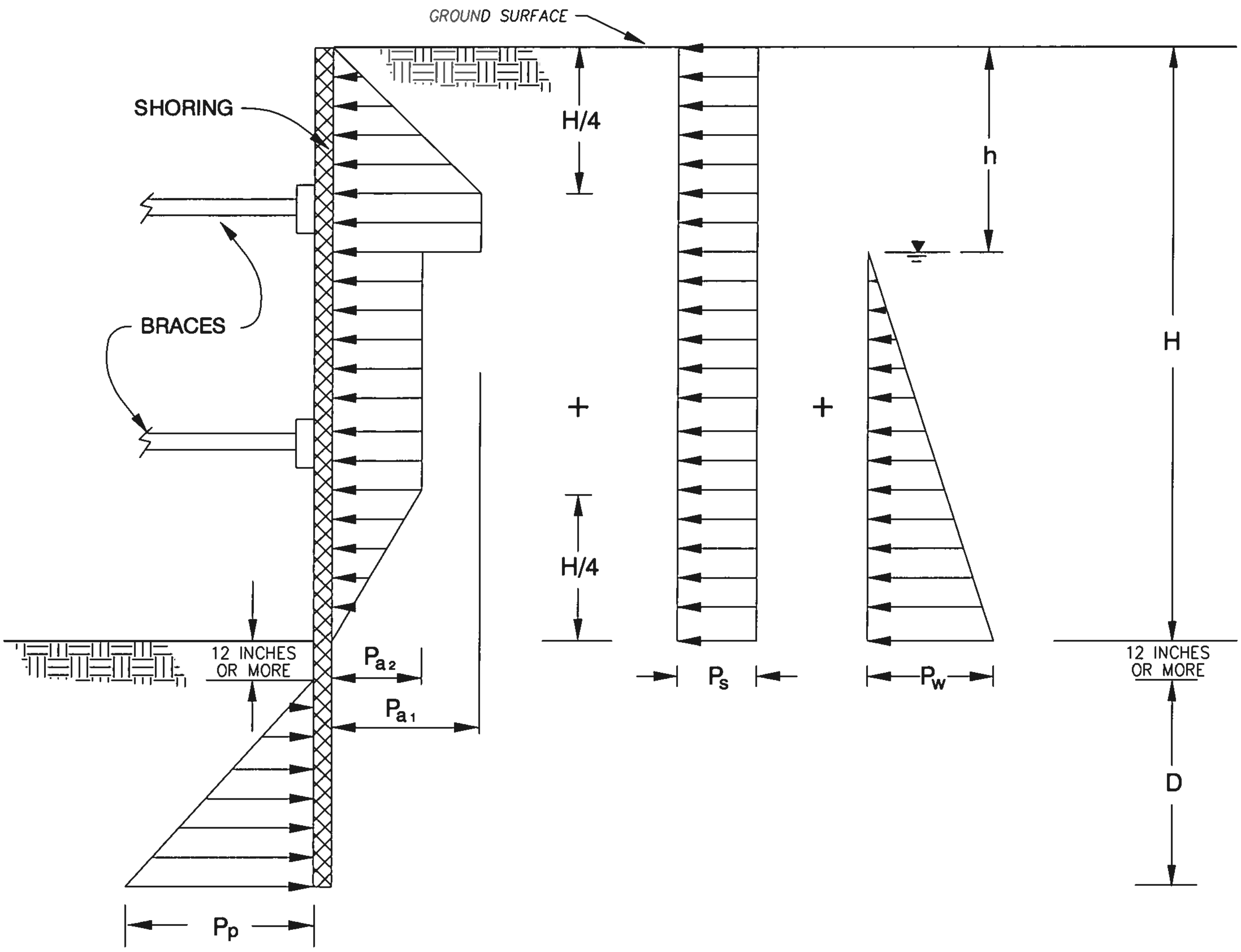
SEISMIC HAZARDS ZONES MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE
207328001	6/08

FIGURE
5



NOTES:

1. APPARENT LATERAL EARTH PRESSURE, P_a
   P_{a1} = 48 H psf; P_{a2} = 24 H psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
   P_s = 120 psf
3. HYDROSTATIC PRESSURE, P_w
   P_w=62.4 (H - h) psf
4. PASSIVE LATERAL EARTH PRESSURE, P_p
   P_p = 200 D
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H, h AND D ARE IN FEET
7. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328-A6.DWG

Ninyo & Moore

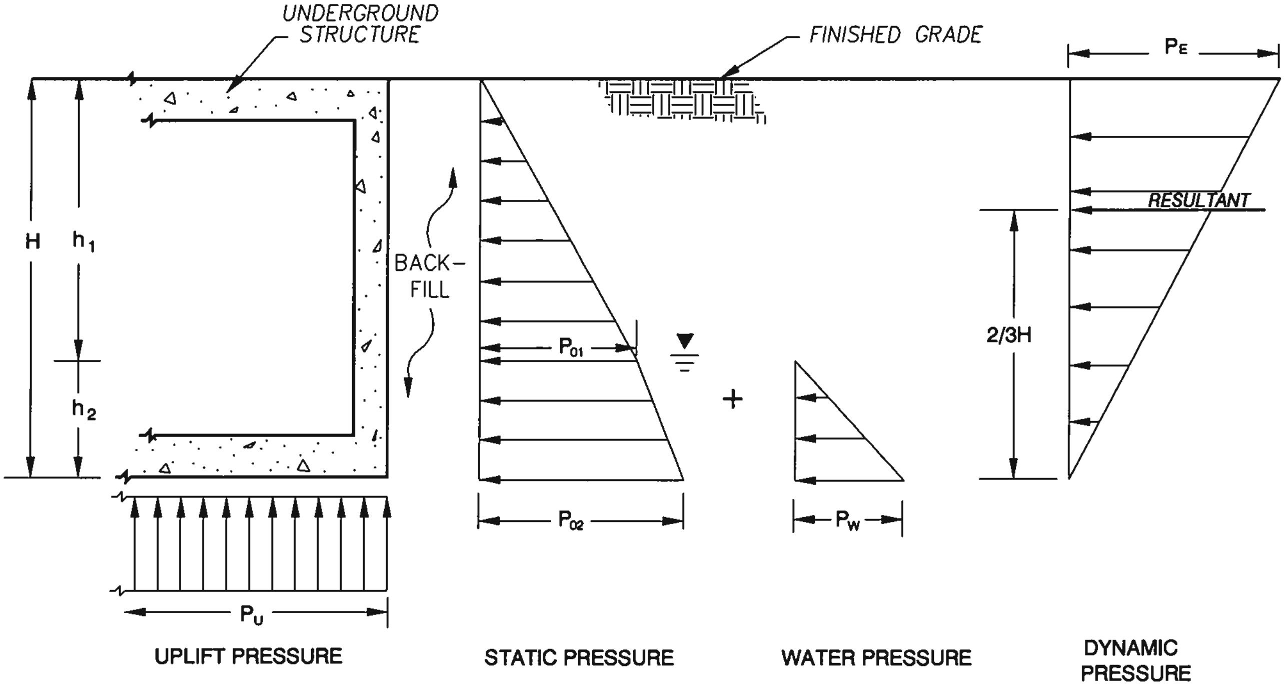
LATERAL EARTH PRESSURES FOR BRACED EXCAVATION BELOW GROUNDWATER (STIFF CLAY)

PROJECT NO.	DATE
207328001	6/08

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

6



NOTES:

1. APPARENT LATERAL EARTH PRESSURES, P_{01} AND P_{02}
   $P_{01} = 60\ h_1$ psf
   $P_{02} = 60\ h_1 + 29\ h_2$ psf
2. WATER PRESSURE, P_w
   $P_w = 62.4\ h_2$ psf
3. DYNAMIC LATERAL EARTH PRESSURE IS BASED ON A PEAK GROUND ACCELERATION OF 0.45 g
   $P_E = 17\ H$ psf
4. UPLIFT PRESSURE, P_u
   $P_u = 62.4\ h_2$ psf
5. SURCHARGE PRESSURES CAUSED BY VEHICLES OR NEARBY STRUCTURES ARE NOT INCLUDED
6. H, h_1 AND h_2 ARE IN FEET
7. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328-A6.DWG

Ninyo & Moore

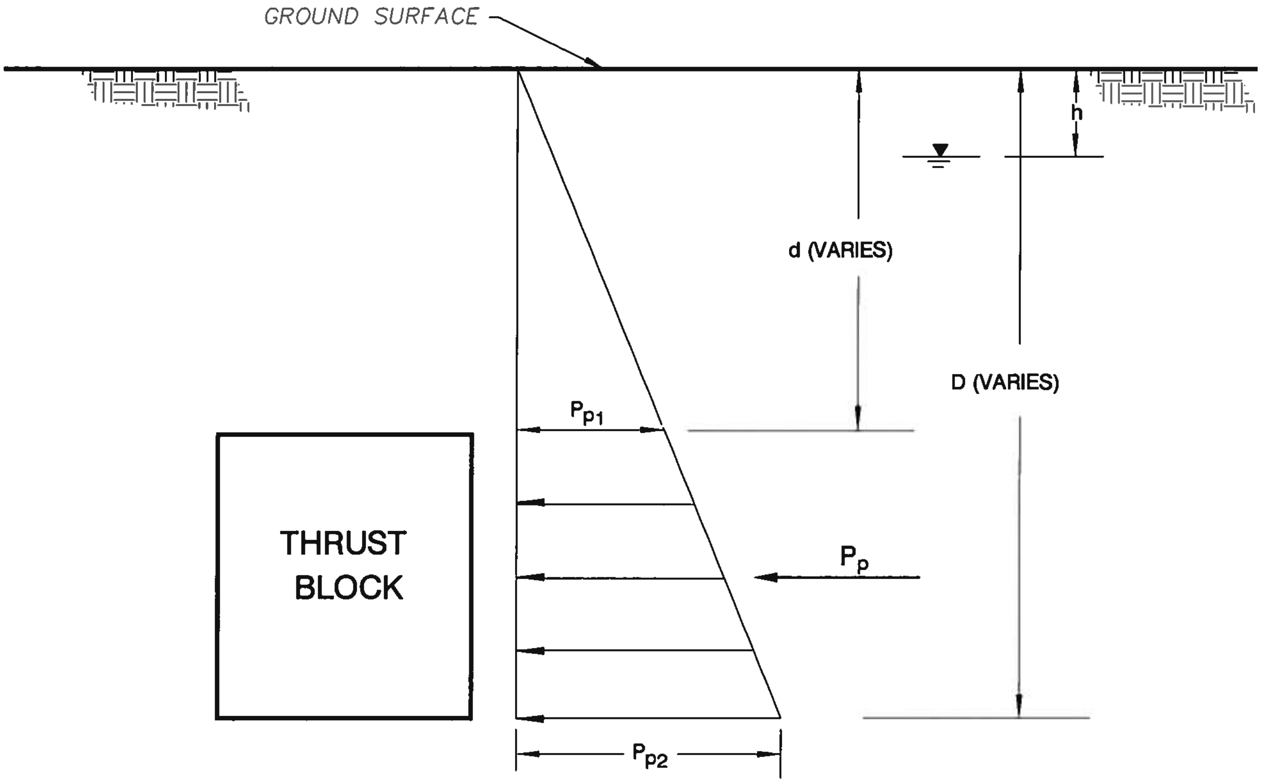
LATERAL EARTH PRESSURES FOR UNDERGROUND STRUCTURES (SAND)

PROJECT NO.	DATE
207328001	6/08

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

7



NOTES:

1. GROUNDWATER BELOW BLOCK

   $P_p = 200\ (D^2\text{-}d^2)$ lb/ft

2. GROUNDWATER ABOVE BLOCK

   $P_p = 1.6\,(D - d)[\,124.8h + 60\ (D+d)]$ lb/ft

3. ASSUMES BACKFILL IS GRANULAR MATERIAL
4. ASSUMES THRUST BLOCK IS ADJACENT TO COMPETENT MATERIAL
5. D, d AND h ARE IN FEET
6. ▼ GROUNDWATER TABLE

207328-A7.DWG

NOT TO SCALE

NOT TO SCALE

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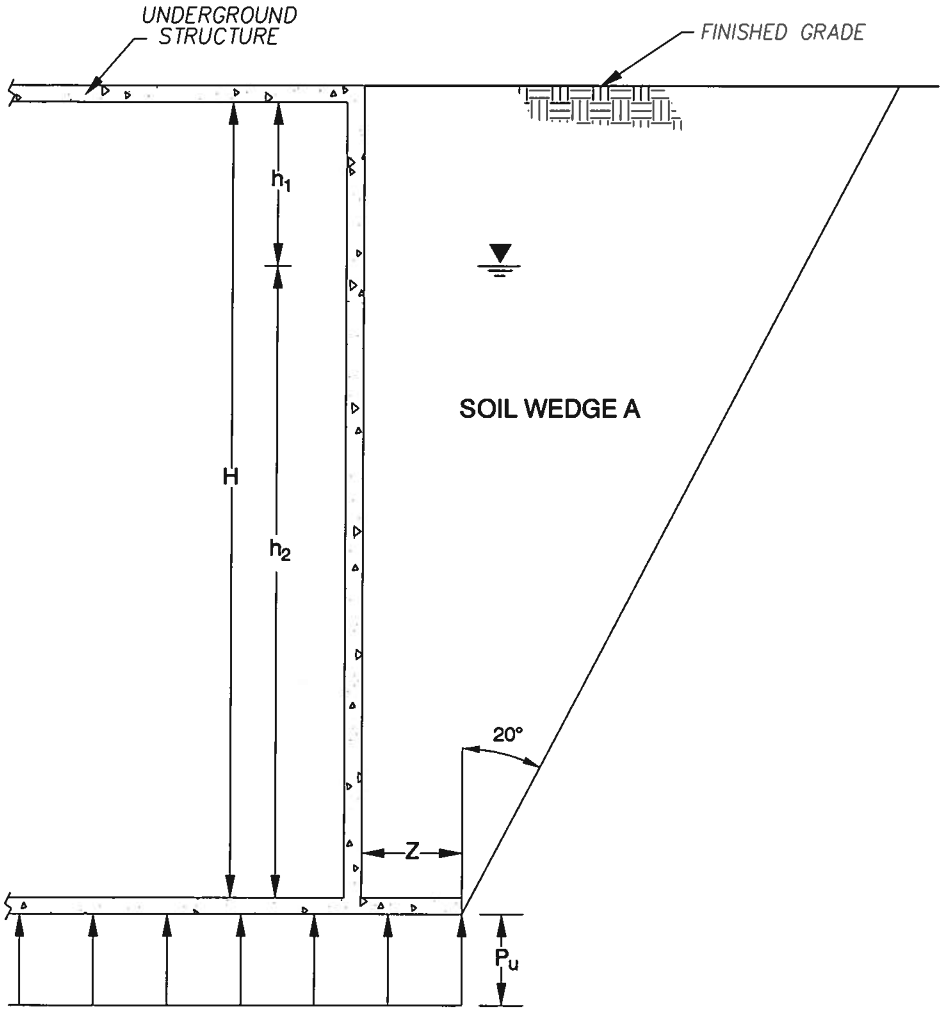
THRUST BLOCK LATERAL EARTH PRESSURE DIAGRAM

PROJECT NO.	DATE
207328001	6/08

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

8



RESISTANCE TO UPLIFT = WEIGHT OF STRUCTURE + WEIGHT OF SOIL WEDGE A

NOTES:

1. UNIT WEIGHT OF SOILS, γ OR γ_b
   γ = 120 pcf ABOVE GROUNDWATER TABLE
   γ_b = 58 pcf BELOW GROUNDWATER TABLE
2. UPLIFT PRESSURE, P_u
   $P_u = 62.4\ h_2$ psf
3. H, Z, h_1 AND h_2 ARE IN FEET
4. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328-A8.DWG

Ninyo & Moore

UPLIFT RESISTANCE DIAGRAM FOR UNDERGROUND STRUCTURES (MAT)

PROJECT NO.	DATE
207328001	6/08

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE
9

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory excavations. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test (SPT) Spoon

Disturbed drive samples of earth materials were obtained by means of an SPT spoon sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of $1^3/_8$ inches. The spoon was driven into the ground 12 to 18 inches with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586-84. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the spoon, bagged, sealed, and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3 inches, was lined with 1-inch-long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer or the kelly bar of the drill rig in general accordance with ASTM D 3550-84. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer or bar, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

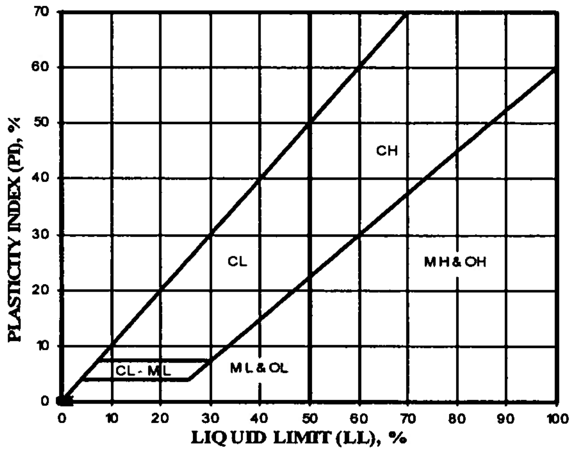
U.S.C.S. METHOD OF SOIL CLASSIFICATION

MAJOR DIVISIONS		SYMBOL		TYPICAL NAMES
COARSE-GRAINED SOILS (More than 1/2 of soil >No. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)	⁘	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		⁘	GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		▥	GM	Silty gravels, gravel-sand-silt mixtures
		▨	GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction <No. 4 sieve size)		SW	Well graded sands or gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		▥	SM	Silty sands, sand-silt mixtures
		▨	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than 1/2 of soil <No. 200 sieve size)	SILTS & CLAYS Liquid Limit <50	▥	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with
		▨	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean
		■	OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit >50	▥	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		▨	CH	Inorganic clays of high plasticity, fat clays
		▩	OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils

GRAIN SIZE CHART

CLASSIFICATION	RANGE OF GRAIN SIZE	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL **Coarse** **Fine**	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND **Coarse** **Medium** **Fine**	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.075 4.76 to 2.00 2.00 to 0.420 0.420 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

PLASTICITY CHART



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U.S.C.S. METHOD OF SOIL CLASSIFICATION

BORING LOG EXPLANATION SHEET

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	
0	■							Bulk sample.
		■						Modified split-barrel drive sampler.
		☒						No recovery with modified split-barrel drive sampler.
		‖						Sample retained by others.
		◤						Standard Penetration Test (SPT).
5		⧄						No recovery with a SPT.
		▯	XX/XX					Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
		⧄						No recovery with Shelby tube sampler.
		▯						Continuous Push Sample.
				♀				Seepage.
10				∇				Groundwater encountered during drilling.
				▼				Groundwater measured after drilling.
						▨	SM	ALLUVIUM: Solid line denotes unit change.
								Dashed line denotes material change.
15								Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Sheared Bedding Surface
20								The total depth line is a solid line that is drawn at the bottom of the boring.

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BORING LOG		
EXPLANATION OF BORING LOG SYMBOLS		
PROJECT NO.	DATE Rev. 01/03	FIGURE

DATE DRILLED 12/27/07 BORING NO. B-1

GROUND ELEVATION 35' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						▒	SM	FILL: Dark brown, moist, loose, silty SAND.
	■					▒		
5	■	■	9	11.8	108.0	▒		Brown.
10		◣	55	13.8		▨	SC	ALLUVIUM: Olive green, moist, very dense, clayey medium to coarse SAND.
						▧	CL-CH	Olive green, moist to wet, hard, CLAY; caliche stringers.
15	■	■	29	27.4	94.6	▧		
20								

Ninyo & Moore

BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-1

DATE DRILLED 12/27/07 BORING NO. B-1
GROUND ELEVATION 35' ± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		◤	19			▥	ML	ALLUVIUM: (Continued) Olive green, moist to wet, very stiff, clayey SILT.
25		■	29	▼ 30.9	89.5	▥		@25': Groundwater measured approximately 1 hour after completion of drilling; saturated.
30		◤	38			▥		Laminated; veins of oxidation.
								Total Depth = 31.5 feet. No groundwater encountered during drilling; groundwater measured approximately 1 hour after completion of drilling at approximately 25 feet. Infiltration test performed on zone between approximately 5 and 20 feet. Backfilled with on-site soils on 12/27/07. Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-2

DATE DRILLED 12/27/07 BORING NO. B-2

GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■						SC	FILL: Dark brown, damp, medium dense, clayey medium to coarse SAND.
							SM	Brown, damp, medium dense, silty medium to coarse SAND; wire fragment.
5		■	36	1.8	107.9			
							CL	ALLUVIUM: Dark brown, moist, very stiff, sandy CLAY; few caliche stringers.
10		■	19	18.3				
15		■	33	28.6	93.8			Olive green to greenish gray; moist to wet; hard.
20								

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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-3

DATE DRILLED 12/27/07 BORING NO. B-2

GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20	■	■	9	31.3		▨	CL	ALLUVIUM: (Continued) Olive green to greenish gray, wet, stiff, silty CLAY. @25': Groundwater encountered during drilling; saturated.
25		■	50/6"	▽		▥	SP-SM	Yellowish to gray brown, saturated, very dense, poorly graded medium to coarse SAND with silt; mottled.
						░	SP	Yellowish brown, saturated, very dense, poorly graded coarse SAND; mottled; trace gravel.
30		■	50/5"					
								Total Depth = 31.5 feet. Groundwater encountered during drilling at approximately 25 feet. Backfilled with on-site soils on 12/27/07. Note: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-4

DATE DRILLED 12/21/07 BORING NO. B-3

GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						▨	CL	FILL: Dark brown, moist to wet, very stiff, sandy CLAY; trace gravel and wood fragments.
5			19	25.6	96.2	▨		
						▨	CL	ALLUVIUM: Light green to olive gray, moist, very stiff, silty CLAY; veins of oxidation.
10			17			▨		
15			33	26.9	97.0	▨		
				▽		▨		@18.2': Groundwater measured approximately 15 minutes after completion of drilling; saturated.
20						▨		

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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-5

DATE DRILLED 12/21/07 BORING NO. B-3
GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		■	13				ML	ALLUVIUM: (Continued) Light olive gray, saturated, very stiff, clayey SILT; interbedded with silty clay.
25		■	50/5"				SP	Light brown, saturated, dense, poorly graded coarse SAND.
							SM	Light brown, saturated, very dense, silty SAND; interbedded with clay.
				▽				@29': Groundwater encountered during drilling.
30		■	35					
								Total Depth = 31.5 feet. Groundwater encountered during drilling at approximately 29 feet; groundwater measured approximately 15 minutes after completion of drilling at approximately 18.2 feet. Backfilled with on-site soils on 12/21/07. Note: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-6

DATE DRILLED 12/21/07 BORING NO. B-4
GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■					▦	SM	FILL: Dark brown, moist, loose to medium dense, silty coarse SAND; intermixed with stiff sandy clay.
						▨	CL	Dark brown, moist, stiff to very stiff, sandy CLAY.
5		■	13	27.0	95.1	▨		
						▨	CL	ALLUVIUM: Light olive gray, moist, stiff to very stiff, silty CLAY; veins of oxidation.
10	■	■	10			▨		
15		■	17	33.6	86.4	▨		Moist to wet.
20				▼		▨		@20': Groundwater encountered during drilling; groundwater measured at completion of drilling; saturated.

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PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-7

DATE DRILLED 12/21/07 BORING NO. B-4

GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20			37				SP-SM	<u>ALLUVIUM</u>: (Continued) Light gray, saturated, very dense, poorly graded fine SAND with silt; laminated; veins of oxidation.
25			50/5"	22.9	101.1			Yellowish brown; coarse sand; trace gravel.
30			24					Dense; few to little gravel.
								Total Depth = 31.5 feet. Groundwater encountered during drilling at approximately 20 feet; groundwater measured at completion of drilling at approximately 20 feet. Backfilled with on-site soils on 12/21/07. <u>Note</u>: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-8

DATE DRILLED 12/21/07 BORING NO. B-5

GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 3

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						▨	CH	FILL: Dark brown, stiff, moist, sandy CLAY.
	■							
5		■	12	25.7	93.1			
						▨	CL	ALLUVIUM: Light gray, moist, stiff, CLAY; veins of oxidation.
	■							
10		■	11	32.8				
						▥	ML	Light gray, moist, very dense, sandy fine SILT; laminated.
15		■	85	23.8	100.4			
20								

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PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-9

DATE DRILLED 12/21/07 BORING NO. B-5

GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 3

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		◤	39	▼ 14.7		▦	SM	ALLUVIUM: (Continued) Yellowish brown, saturated, medium dense, silty coarse SAND; mottled. @20.5': Groundwater measured approximately 1 hour after completion of drilling. @22': Groundwater encountered during drilling.
				∇		░	SP	Yellowish brown, saturated, very dense, poorly graded coarse SAND.
25		■	50/4"					
						▦	SP-SM	Yellowish brown, saturated, very dense, poorly graded SAND with silt and gravel.
30		◤	50/5"					
35		◤	4					Loose.
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PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-10

DATE DRILLED 12/21/07 BORING NO. B-5

GROUND ELEVATION 30' ± (MSL) SHEET 3 OF 3

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40		◣	50/6"			▨	SP-SM	ALLUVIUM: (Continued) Dark brown, saturated, very dense, poorly graded SAND with silt; trace gravel.
45		◣	50/5"			▨		
50		◣	50/3"			▨		
								Total Depth = 51.5 feet. Groundwater encountered during drilling at approximately 22 feet; groundwater measured approximately 1 hour after completion of drilling at approximately 20.5 feet. Infiltration test performed on zone between approximately 5 and 15 feet. Backfilled with on-site soils on 12/21/07. Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
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PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-11

DATE DRILLED 12/21/07 BORING NO. B-6

GROUND ELEVATION 25' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■					▦	SM	FILL: Dark brown, moist, medium dense, silty coarse SAND.
						▨	CL	ALLUVIUM: Dark gray, moist to wet, very stiff, silty CLAY.
5	■	■	14	33.7	88.4	▨		
10		■	17			▨		
15		■	14	41.4 ▽	75.8	▨		Light olive gray to yellowish brown; veins of oxidation. @16': Groundwater encountered during drilling; saturated.
20								

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PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-12

DATE DRILLED 12/21/07 BORING NO. B-6

GROUND ELEVATION 25' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		▼	35			▒	SM	ALLUVIUM: (Continued) Yellowish brown, saturated, very dense, silty medium to coarse SAND.
25		■	55			▒		Dense.
						▒	SP-SM	Yellowish brown, saturated, medium dense, poorly graded SAND with silt and gravel.
30		▼	19			▒		
								Total Depth = 31.5 feet. Groundwater encountered during drilling at approximately 16 feet. Infiltration test performed on zone between approximately 5 and 10 feet. Backfilled with on-site soils and gravel on 12/21/07. Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-13

DATE DRILLED 12/27/07 BORING NO. B-7
GROUND ELEVATION 30' ± (MSL) SHEET 1 OF 2
METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)
DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"
SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■					▨	CL	FILL: Dark brown, moist, stiff, sandy CLAY.
5		■	12	15.2	99.5	▨		
10	■	■	9			▩	SC	Dark brown, moist, medium dense, clayey SAND.
	■					▨	CL	Dark brown, moist, stiff, sandy CLAY.
15		■	52	28.4	91.1	▨	CL	ALLUVIUM: Olive green, moist, hard, silty CLAY; caliche stringers.
20								

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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-14

DATE DRILLED 12/27/07 BORING NO. B-7

GROUND ELEVATION 30' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		■	38				SM	ALLUVIUM: (Continued) Dark yellowish brown, moist to wet, medium dense, silty medium to coarse SAND.
				▼				@24': Groundwater measured at completion of drilling; saturated.
25		■	16					
							ML	Dark gray, saturated, firm, SILT.
30		■	4					
								Total Depth = 31.5 feet. No groundwater encountered during drilling; groundwater measured at completion of drilling at approximately 24 feet. Infiltration test performed on zone between approximately 5 and 15 feet. Backfilled with on-site soils and gravel on 12/27/07. Notes: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-15

DATE DRILLED 12/27/07 BORING NO. B-8

GROUND ELEVATION 25' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	■					▨	CL	<u>FILL</u>: Dark brown, moist, very stiff, sandy CLAY.
5		■	15	30.7	89.6	▨		Moist to wet.
						▨	CL	<u>ALLUVIUM</u>: Dark gray, moist to wet, very stiff, sandy CLAY.
10	■	■	12	27.0		▨		Olive gray; wet; silty CLAY; veins of oxidation.
15		■	23	28.5	94.7	▒	SM	Olive green, wet, medium dense, silty fine SAND.
20				▼		▒		@20': Groundwater measured at completion of drilling; saturated.

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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-16

DATE DRILLED 12/27/07 BORING NO. B-8

GROUND ELEVATION 25' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 8" Hollow-Stem Auger (Martini Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY WY LOGGED BY WY REVIEWED BY GMC

DEPTH (feet)	SAMPLES Bulk	 Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		▮	45			▒	SP	<u>ALLUVIUM</u>: (Continued) Yellowish brown, saturated, dense, poorly graded medium to coarse SAND; mottled; trace gravel.
								Total Depth = 21.5 feet. No groundwater encountered during drilling; groundwater measured at completion of drilling at approximately 20 feet. Backfilled with on-site soils on 12/27/07. <u>Notes</u>: Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report. Please refer to the report for groundwater monitoring recommendations.
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35								
40								

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BORING LOG

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE	FIGURE
207328001	6/08	A-17

APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-00. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937-04. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422-63. The grain-size distribution curves are shown on Figures B-1 through B-3 These test results were utilized in evaluating the soil classifications in accordance with the USCS.

200 Wash

An evaluation of the percentage of minus-200 sieve material in selected soil samples was performed in general accordance with ASTM D 1140-00. The results of the tests are presented on Figure B-4.

Atterberg Limits

Tests were performed on a selected representative fine-grained soil sample to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318-05. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure B-5.

Expansion Index Tests

The expansion index of a selected material was evaluated in general accordance with UBC Standard No. 18-2 (ASTM D 4829-03). The specimen was molded under a specified compactive energy at approximately 50 percent saturation (plus or minus 1 percent). The prepared 1-inch-thick by 4-inch-diameter specimen was loaded with a surcharge of 144 pounds per square foot and were inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The results of these test are presented on Figure B-6.

Consolidation Tests

Consolidation tests were performed on a selected relatively undisturbed soil samples in general accordance with ASTM D 2435-04. The sample was inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of the test is summarized on Figure B-7.

Collapse Potential Tests

A collapse potential test was performed on a selected relatively undisturbed soil sample in general accordance with ASTM D 5333. The sample was inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The result of the test is summarized on Figure B-8.

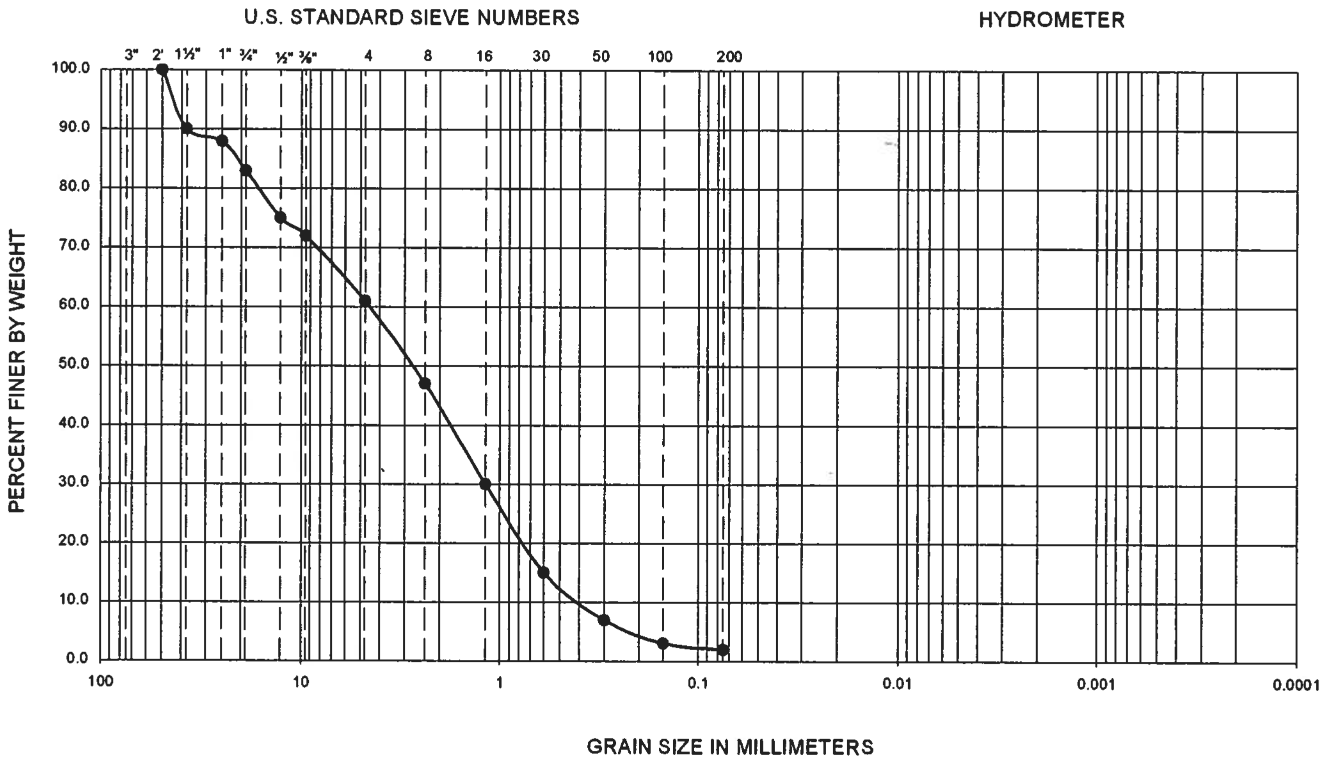
Direct Shear Tests

Direct shear tests were performed on a relatively undisturbed sample in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of selected materials. The sample was inundated during shearing to represent adverse field conditions. The results are shown on Figure B-9.

Soil Corrosivity Tests

Soil pH and resistivity tests were performed on representative samples in general accordance with California Test (CT) 643. The chloride content of selected samples was evaluated in general accordance with CT 422. The sulfate content of selected samples was evaluated in general accordance with CT 417. The test results are presented on Figure B-10.

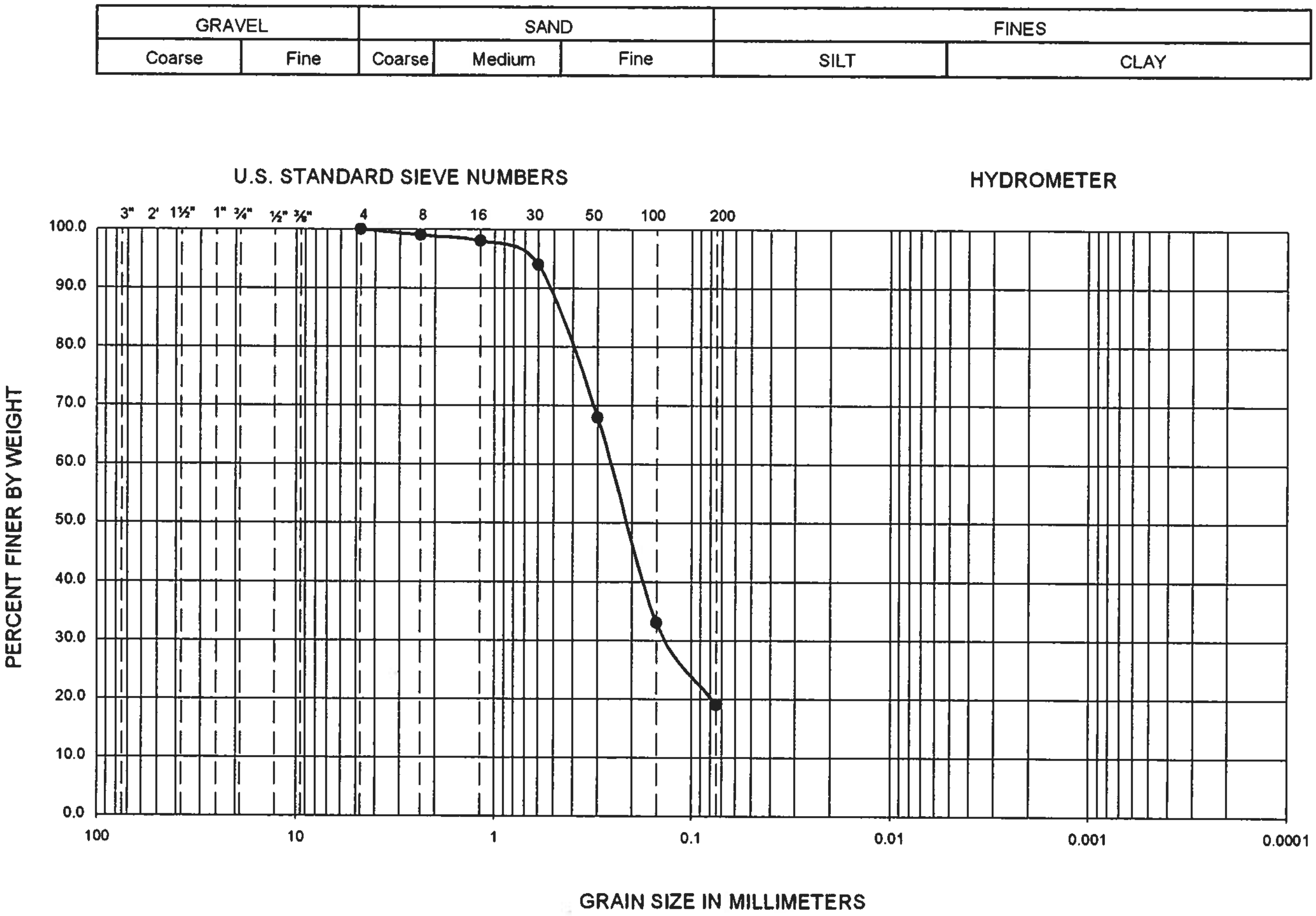
GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-3	25.0-26.5	--	--	--	0.40	1.18	4.45	11.1	0.8	2	SP

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	B-1
207328001	6/08		



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-7	20.0-21.5	--	--	--	--	--	--	--	--	19	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore

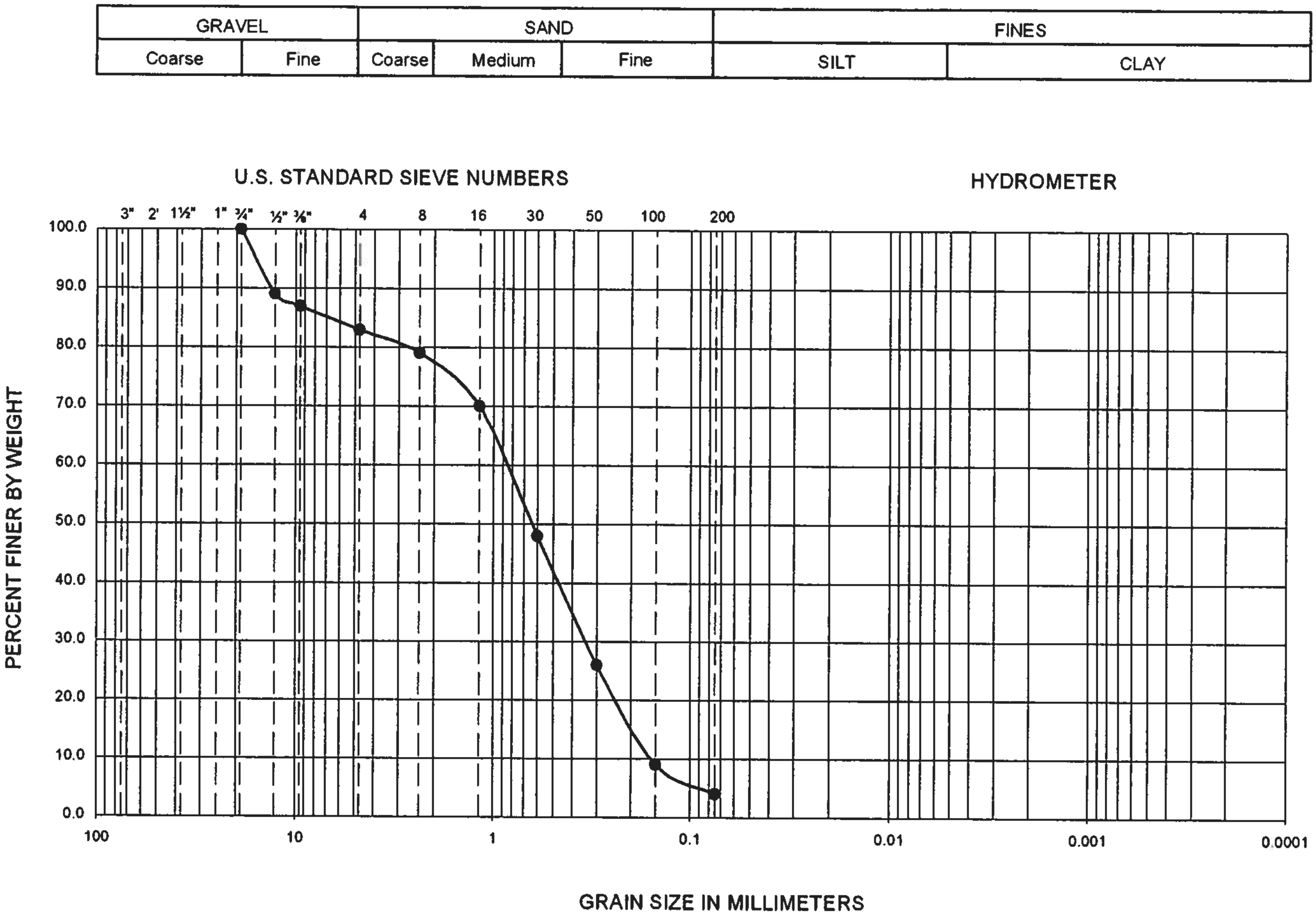
PROJECT NO.	DATE
207328001	6/08

GRADATION TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

B-2



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-8	20.0-21.5	--	--	--	0.16	0.34	0.84	5.3	0.9	4	SP

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore		**GRADATION TEST RESULTS**	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	**B-3**
207328001	6/08		

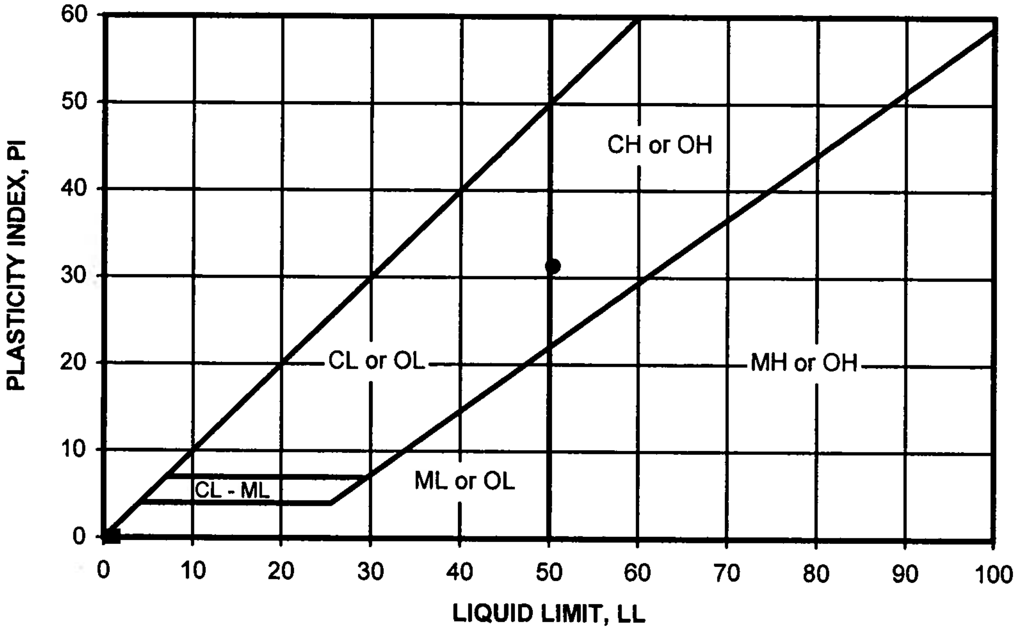
207328001 B-3, SIEVE w No 8 B-8~20.0-21.5.xls

SAMPLE LOCATION	SAMPLE DEPTH (FT)	DESCRIPTION	PERCENT PASSING NO. 4	PERCENT PASSING NO. 200	USCS (TOTAL SAMPLE)
B-2	25.0-26.5	POORLY GRADED SAND WITH SILT	88	7	SP-SM
B-4	30.0-31.5	POORLY GRADED SAND WITH SILT AND GRAVEL	76	7	SP-SM
B-5	15.0-16.5	SANDY SILT	100	54	ML
B-5	25.0-26.5	POORLY GRADED SAND	95	4	SP
B-5	35.0-36.5	POORLY GRADED SAND WITH SILT AND GRAVEL	84	6	SP-SM
B-5	45.0-46.5	POORLY GRADED SAND WITH SILT	100	8	SP-SM
B-6	30.0-31.5	POORLY GRADED SAND WITH SILT AND GRAVEL	68	8	SP-SM
B-7	25.0-26.5	SILTY SAND	100	46	SM
B-8	5.0-6.5	LEAN CLAY	100	91	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1140-00

Ninyo & Moore		NO. 200 SIEVE ANALYSIS	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	B-4
207328001	6/08		

SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
●	B-1	15.0-20.0	50	19	31	CL-CH	CL-CH



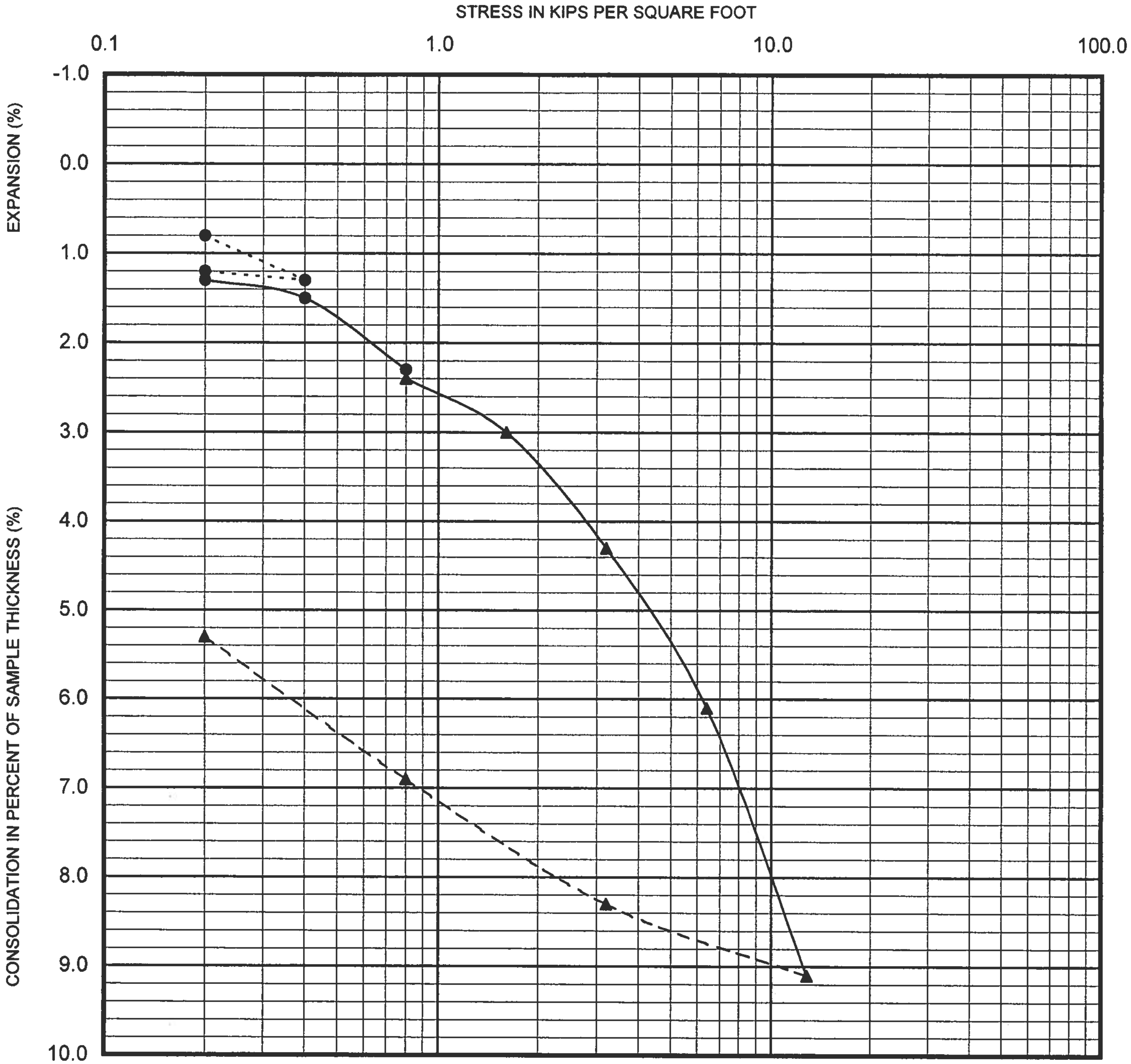
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-05

Ninyo & Moore		ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	B-5
207328001	6/08		

SAMPLE LOCATION	SAMPLE DEPTH (FT)	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (IN)	EXPANSION INDEX	POTENTIAL EXPANSION
B-5	8.0-12.0	13.4	98.0	30.5	0.056	56	Medium

PERFORMED IN GENERAL ACCORDANCE WITH ☑ UBC STANDARD 18-2 ☐ ASTM D 4829-03

Ninyo & Moore		EXPANSION INDEX TEST RESULTS	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	B-6
207328001	6/08		



---●--- Seating Cycle		Sample Location	B-5
—●— Loading Prior to Inundation		Depth (ft.)	5.0-6.5
—▲— Loading After Inundation		Soil Type	CH
--▲-- Rebound Cycle			

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435-04

Ninyo & Moore

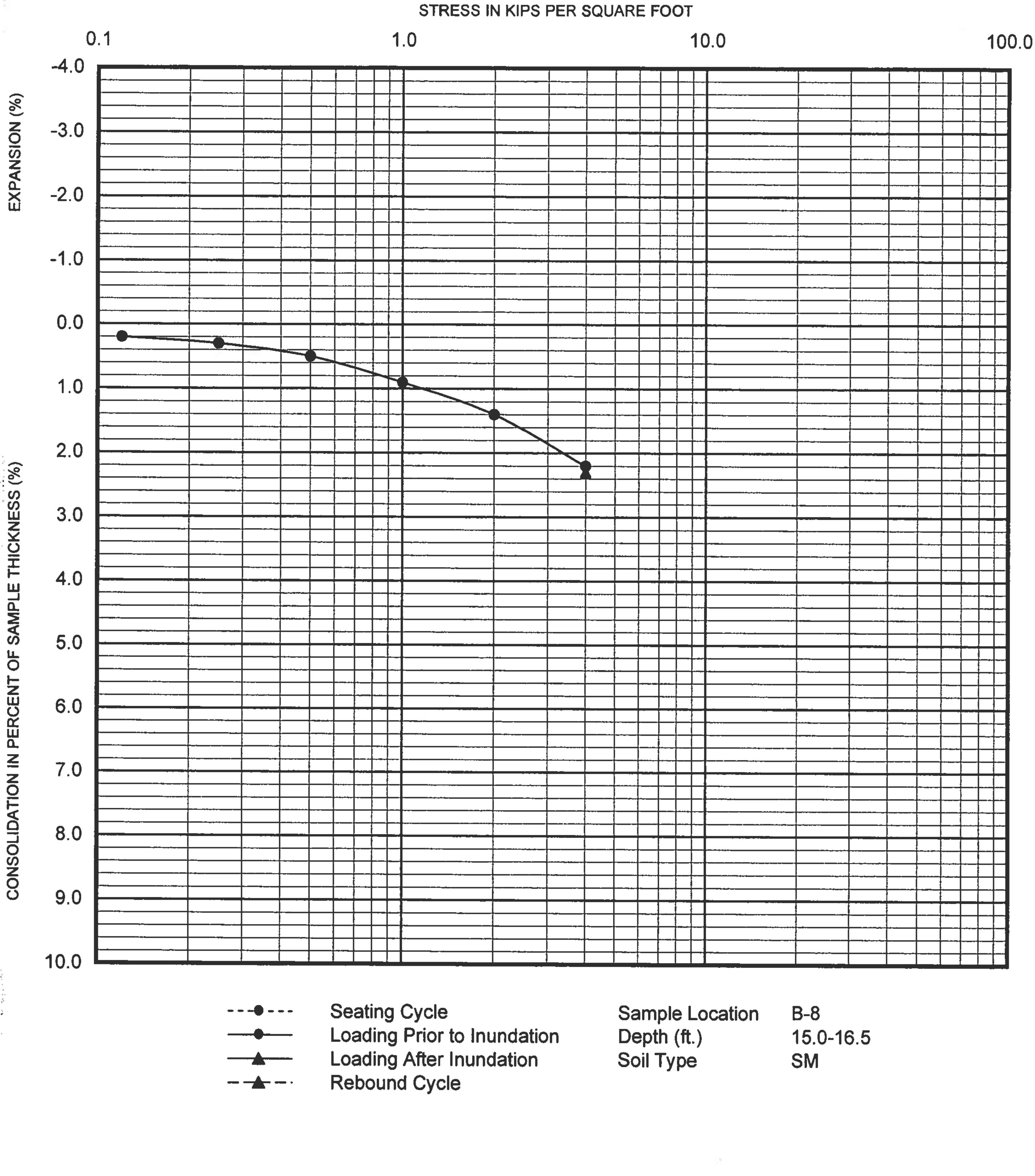
CONSOLIDATION TEST RESULTS

FIGURE

B-7

PROJECT NO.	DATE
207328001	6/08

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

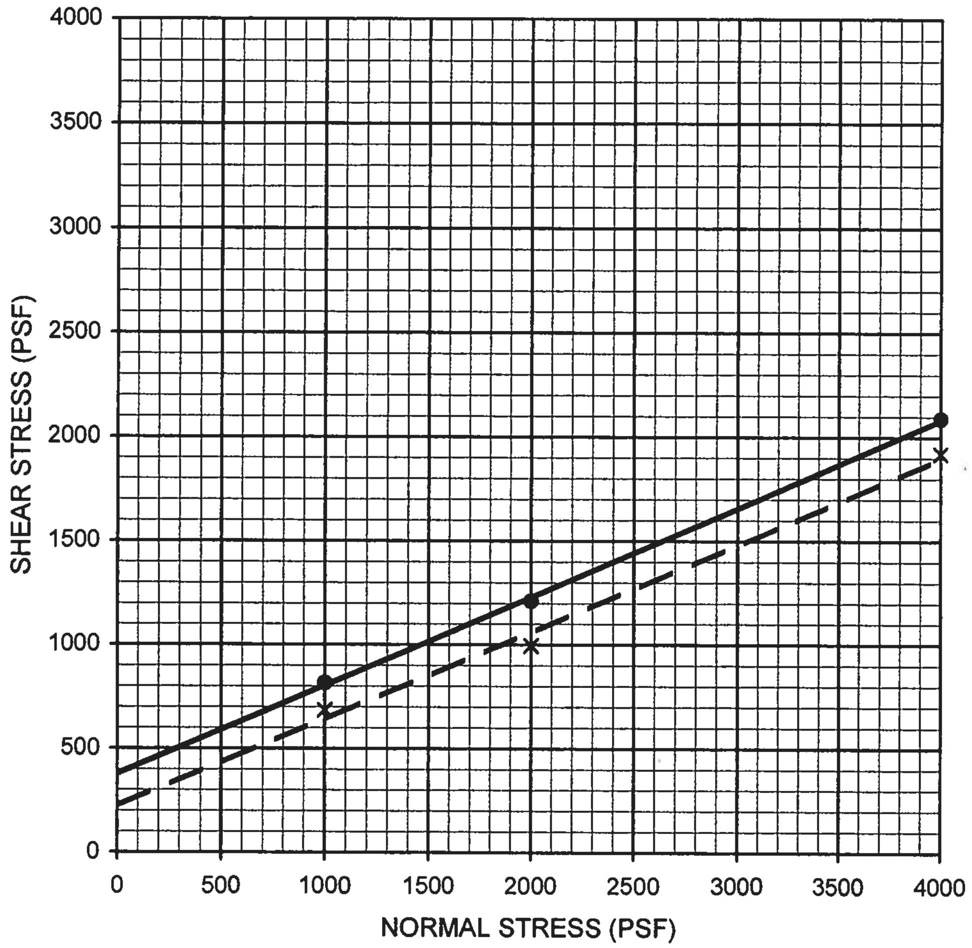


- - -●- - -	Seating Cycle	Sample Location	B-8
——●——	Loading Prior to Inundation	Depth (ft.)	15.0-16.5
——▲——	Loading After Inundation	Soil Type	SM
— —▲— —	Rebound Cycle		

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 5333-03

Ninyo & Moore		COLLAPSE POTENTIAL TEST RESULTS	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	B-8
207328001	6/08		

207328001 B-8, CONSOLIDATION B-8--15.0-16.5.xls



Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion, c (psf)	Friction Angle, ϕ (degrees)	Soil Type
Dark brown, sandy CLAY	—●—	B-5	5.0-6.5	Peak	378	23	CH
Dark brown, sandy CLAY	- - X - -	B-5	5.0-6.5	Ultimate	222	23	CH

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080-04

Ninyo & Moore

PROJECT NO.	DATE
207328001	6/08

DIRECT SHEAR TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

B-9

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH [1]	RESISTIVITY [1] (Ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-1	0.5-3.0	6.7	670	150	0.015	150
B-5	5.0-6.5	6.5	2,345	40	0.004	115

[1] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 643

[2] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 417

[3] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 422

Ninyo & Moore

CORROSIVITY TEST RESULTS

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE
207328001	6/08

FIGURE

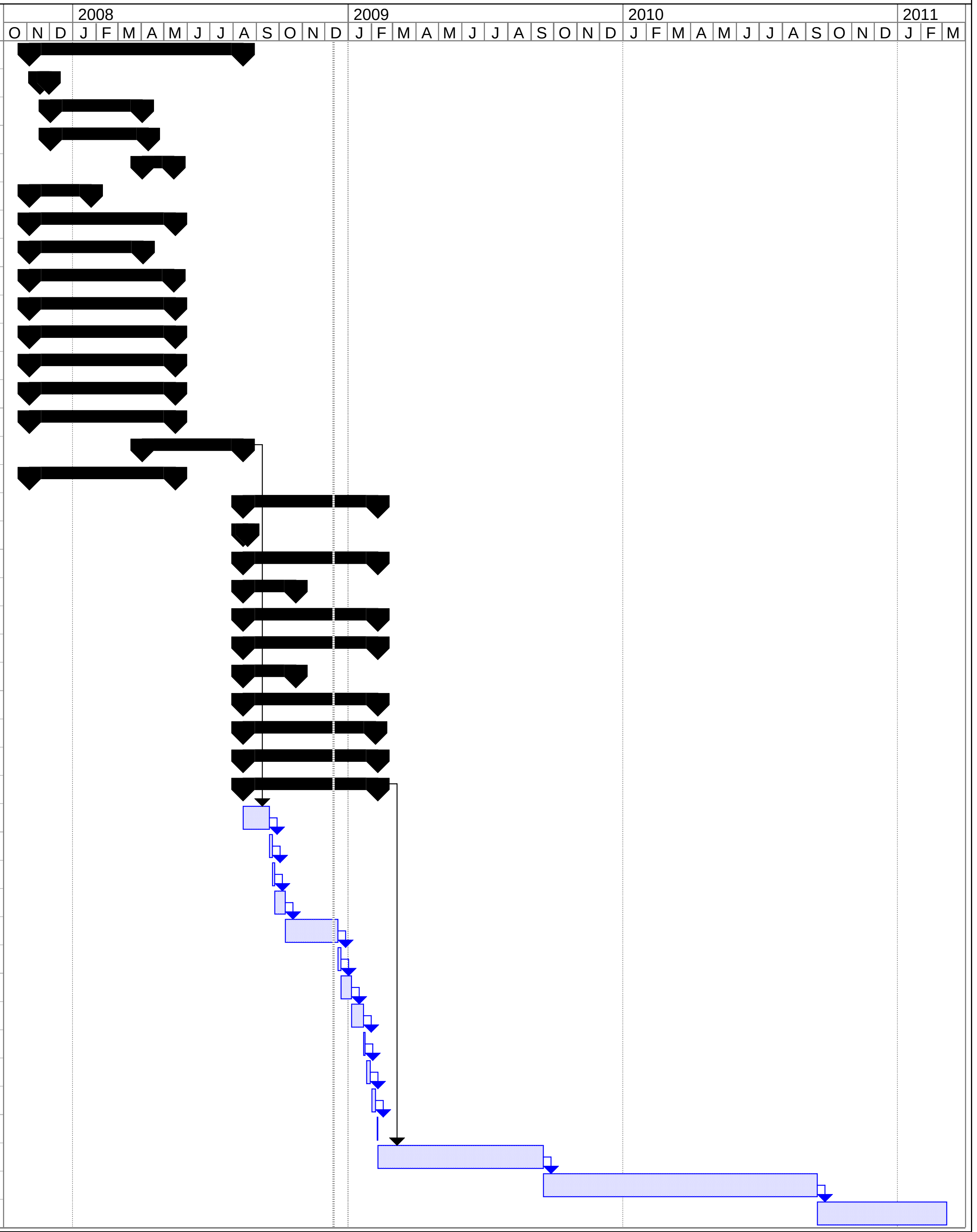
B-10

City of Los Angeles
Bureau of Engineering

Penmar Water Quality Improvement Project

Brown and Caldwell/Black & Veatch

ID	Text1	Task Name	Duration	Start	Finish	Predecessors
1	**1.0**	**Preliminary Design Phase**	**204 days**	**Mon 11/5/07**	**Thu 8/14/08**	
2	**1.01**	**Provide Project Workplan**	**10 days**	**Mon 11/19/07**	**Fri 11/30/07**	
10	**1.02**	**Review and Validate the Concept Report**	**88 days**	**Mon 12/3/07**	**Thu 4/3/08**	
23	**1.04**	**Develop Prelim. Project Scope within Approved Budget**	**94 days**	**Mon 12/3/07**	**Thu 4/10/08**	
27	**1.05**	**Coordinate Pre-Design Activities w/ City Staff**	**30 days**	**Thu 4/3/08**	**Wed 5/14/08**	
29	**1.06**	**Provide and Implement a QA/QC Plan**	**60 days**	**Mon 11/5/07**	**Fri 1/25/08**	
31	**1.07**	**Prepare and Update Pre-Design Schedule**	**140 days**	**Mon 11/5/07**	**Fri 5/16/08**	
33	**1.08**	**Infiltration Design Selection/Criteria**	**109 days**	**Mon 11/5/07**	**Thu 4/3/08**	
40	**1.09**	**Site Investigation**	**138 days**	**Mon 11/5/07**	**Wed 5/14/08**	
50	**1.10**	**Attend Project/Progress Meetings**	**140 days**	**Mon 11/5/07**	**Fri 5/16/08**	
53	**1.11**	**Public/Community Outreach**	**140 days**	**Mon 11/5/07**	**Fri 5/16/08**	
56	**1.12**	**Obtain Conceptual Approval From Governing Commissions**	**140 days**	**Mon 11/5/07**	**Fri 5/16/08**	
61	**1.13**	**CEQA Assistance**	**140 days**	**Mon 11/5/07**	**Fri 5/16/08**	
63	**1.14**	**Provide all project documentation in PDF Format**	**140 days**	**Mon 11/5/07**	**Fri 5/16/08**	
65	**1.16**	**Develop Preliminary Design Report (PDR)**	**96 days**	**Thu 4/3/08**	**Thu 8/14/08**	
97	**1.19**	**Project Administration, Management and Progress Reports**	**140 days**	**Mon 11/5/07**	**Fri 5/16/08**	
101	**2.0**	**Detailed Design Phase**	**127 days**	**Thu 8/14/08**	**Mon 2/9/09**	
102	**2.01**	**Provide project design within budget**	**4 days**	**Fri 8/15/08**	**Wed 8/20/08**	
107	**2.02**	**Coordinate Design Activities w/ City Staff**	**127 days**	**Fri 8/15/08**	**Mon 2/9/09**	
109	**2.03**	**Provide and implement QA/QC Plan**	**50 days**	**Fri 8/15/08**	**Thu 10/23/08**	
112	**2.04**	**Prepare Design Schedule with Activities**	**127 days**	**Fri 8/15/08**	**Mon 2/9/09**	
114	**2.05**	**Attend Project Meetings with Stakeholders**	**127 days**	**Fri 8/15/08**	**Mon 2/9/09**	
119	**2.06**	**Site Investigation**	**50 days**	**Thu 8/14/08**	**Thu 10/23/08**	
125	**2.07**	**Public/Community Outreach**	**127 days**	**Fri 8/15/08**	**Mon 2/9/09**	
130	**2.08**	**CEQA Assistance**	**126 days**	**Fri 8/15/08**	**Fri 2/6/09**	
132	**2.10**	**Provide Intermediate and Final Project Documents**	**127 days**	**Fri 8/15/08**	**Mon 2/9/09**	
133	**2.101**	**Phase I: Diversion Structure/ Pump Station/ Reservoir**	**127 days**	**Fri 8/15/08**	**Mon 2/9/09**	
134	2.1011	Develop 50% Progress Documents	25 days	Fri 8/15/08	Thu 9/18/08	65
135	2.1012	QA/QC Review 50% Progress Documents	2 days	Fri 9/19/08	Mon 9/22/08	134
136	2.1013	Submit draft 50% Progress Documents	3 days	Tue 9/23/08	Thu 9/25/08	135
137	2.1014	City Review 50% Progress Documents	10 days	Fri 9/26/08	Thu 10/9/08	136
138	2.1015	Develop 90% Progress Documents	50 days	Fri 10/10/08	Thu 12/18/08	137
139	2.1016	QA/QC Review 90% Progress Documents	2 days	Fri 12/19/08	Mon 12/22/08	138
140	2.1018	City Review 90% Progress Documents	10 days	Tue 12/23/08	Mon 1/5/09	139
141	2.1019	Develop 100% Documents	12 days	Tue 1/6/09	Wed 1/21/09	140
142	2.1020	QA/QC Review 100% Documents	2 days	Thu 1/22/09	Fri 1/23/09	141
143	2.1021	City Review 100% Draft Documents	5 days	Mon 1/26/09	Fri 1/30/09	142
144	2.1022	Update draft 100% Documents	5 days	Mon 2/2/09	Fri 2/6/09	143
145	2.1023	Submit 100% Bid Documents	1 day	Mon 2/9/09	Mon 2/9/09	144
146	**3.0**	**Bid and Award**	**158 days**	**Tue 2/10/09**	**Thu 9/17/09**	**133**
147	**4.0**	**Construction**	**260 days**	**Fri 9/18/09**	**Thu 9/16/10**	**146**
148	**5.0**	**Post-Construction**	**122 days**	**Fri 9/17/10**	**Mon 3/7/11**	**147**



Project: Penmar Schedule (02-28-08)
Date: Fri 12/12/08

Task	▭	Progress	▬	Summary	▬	External Tasks	▭	Deadline	⇩
Split	┈	Milestone	◆	Project Summary	▬	External Milestone	◆		

801 South Figueroa Street, Suite 950
Los Angeles, California 90017

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Fax: (213) 271-2320

www.brownandcaldwell.com

October 14, 2008

BROWN AND CALDWELL

Mr. Iftekhar Ahmed
Project Manager
1149 S. Broadway, 6th Floor
Los Angeles, California 90015

Subject: Class Construction Cost Estimate
Penmar Water Quality Improvement Project, Los Angeles, CA

Dear Mr. Ahmed:

Enclosed for your review is a detailed copy of the Class B Cost Estimate for this project. This estimate has been prepared based on the 50% design drawings previously transmitted to your attention. Please note that there are several components to this estimate which I am summarizing as follows to allow for a true comparison to the Phase I "design-to" budget of $13,905,998. The items are:

Subtotal - Class B Estimate	$	13,592,166.00
Mobilization (included in Contractor's General Conditions)	$	-
Permits (3% of subtotal w/o contingencies)	$	308,430.00
Allowances (5%, included)	$	-
Estimating Contingency (20%, included)	$	-
Escalation (1 yr, 6%, included)	$	-
Total	**$**	**13,900,596.00**

As you can see, after the various allowances are allocated, we are within 10% of the initial design-to budget.

Please let me know if you have any questions.

Very truly yours,

BROWN AND CALDWELL

A. Scott Dellinger, P.E.
Project Manager

FS: jw
CC: Larry Magura (Black & Veatch)
File: Brown and Caldwell

Environmental Engineers & Consultants

MEMORANDUM

1045-136123-201

October 14, 2008

TO: SCOTT DELLINGER, LOS ANGELES

FROM: DON GORDON, SAN DIEGO

SUBJECT: PENMAR WATER QUALITY IMPROVEMENTS – PHASE 1
50-PERCENT DESIGN COMPLETION
BASIS OF ESTIMATE OF PROBABLE CONSTRUCTION COST

The Basis of Estimate Report for the subject project is attached. Please call me if you have questions or need additional information.

DG:ua

Attachments
Summary Estimate
Detailed Estimate

cc: J. L. Matthews, Jacksonville

BASIS OF ESTIMATE REPORT

PENMAR WATER QUALITY IMPROVEMENT PROJECT – PHASE 1

Introduction

Brown and Caldwell (BC) is pleased to present this estimate of probable construction cost (estimate) prepared for the Penmar Water Quality Improvement Project, Phase 1, for the Los Angeles Bureau of Engineering, California.

Summary

This Basis of Estimate contains the following information:

- Scope of work
- Background of this estimate
- Class of estimate
- Estimating methodology
- Direct cost development
- Indirect cost development
- Bidding assumptions
- Estimating assumptions
- Estimating exclusions
- Contractor and other estimate markups
- Allowances for known but undefined work

Scope of Work

This project involves the construction of a storm water diversion pump station, 8-, 12-, and 30-inch forcemains, a buried 2.75 MG concrete reservoir, and sewer replacement in several locations in the project area.

Background of this Estimate

The attached estimate of probable construction cost is based on documents dated September 29, 2008, received by the estimating department. These documents are described as 50 percent complete based on the current design progression, additional or updated scope and/or quantities, and ongoing discussions with the project design team. Further information can be found in the detailed estimate reports.

Class of Estimate

In accordance with the Association for the Advancement of Cost Engineering International (AACE) criteria, this is a Class 2 estimate. A Class 2 estimate is defined as a Design Baseline Estimate or Control Estimate. Typically, engineering is from 30 percent to 70 percent complete. Class 2 Estimates are used to monitor design progression, evaluate design decisions and form the base work for the Class 1 Final Control Estimate.

Expected accuracy for Class 2 estimates typically ranges from -15 percent to +20 percent, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. In unusual circumstances, ranges could exceed those shown.

Estimating Methodology

This estimate was prepared using quantity take-offs, vendor quotes, and equipment pricing furnished either by the design team or by the estimator. The estimate includes direct labor costs, including a shift differential if applicable, and anticipated productivity adjustments to labor, and equipment. Where possible, estimates for work anticipated to be performed by specialty subcontractors have been used.

Construction labor crew and equipment hours were calculated from production rates contained in documents and electronic databases published by R.S. Means, Mechanical Contractors Association (MCA), National Electrical Contractors Association (NECA), and Rental Rate Blue Book for Construction Equipment (Blue Book).

This estimate was prepared using BC's estimating system, which consists of a Windows-based commercial estimating software engine using BC's material and labor database, historical project data, the latest vendor and material cost information, and other costs specific to the locale of the project.

Direct Cost Development

Costs associated with the General Provisions and the Special Provisions of the construction documents, which are collectively referred to as Contractor General Conditions (CGC), were based on the estimator's interpretation of the contract documents. The estimates for CGCs are divided into two groups: a time-related group (e.g., field personnel), and non-time-related group (e.g., bonds and insurance). Labor burdens such as health and welfare, vacation, union benefits, payroll taxes, and workers compensation insurance are included in the labor rates. No trade discounts were considered.

Indirect Cost Development

Local sales tax has been applied to material and equipment rentals. A percentage allowance for contractor's home office expense has been included in the overall rate markups. The rate is standard for this type of heavy construction and is based on typical percentages outlined in Means Heavy Construction Cost Data, 2008.

The contractor's cost for builders risk, general liability, and vehicle insurance has been included in this estimate. Based on historical data, this is typically two to four percent of the overall construction contract amount. These indirect costs have been included in this estimate as a percentage of the gross cost, and are added to the net totals after the net markups have been applied to the appropriate items.

Bidding Assumptions

The following bidding assumptions were considered in the development of this estimate.

1. Bidders must hold a valid, current California Contractor's license, applicable to the type of project.
2. Bidders will develop estimates with a competitive approach to material pricing and labor productivity, and will not include allowances for changes, extra work, unforeseen conditions, or any other unplanned costs.
3. Estimated costs are based on a minimum of four bidders. Actual bid prices may increase for fewer bidders or decrease for a greater number of bidders.

4. Bidders will account for General Provisions and Special Provisions of the contract documents and will perform all work except that which will be performed by traditional specialty subcontractors as identified here:
    - Electrical
    - Miscellaneous metalwork
    - Thermal/moisture proofing
    - Painting
    - Prestressed Concrete Reservoir
    - Pile Driving
    - Paving and traffic striping

Estimating Assumptions

As the design progresses through different completion stages, it is customary for the estimator to make assumptions to account for details that may not be evident from the documents. The following assumptions were used in the development of this estimate.

1. Contractor performs the work during normal daylight hours, nominally 7 a.m. to 5 p.m., Monday through Friday, in an 8-hour shift. No allowance has been made for additional shift work or weekend work.
2. Contractor has complete access for lay-down areas and mobile equipment.
3. Equipment rental rates are based on verifiable pricing from the local project area rental yards, Blue Book rates, and rates contained in the estimating database.
4. Contractor markup is based on conventionally accepted values that have been adjusted for project-area economic factors.
5. Major equipment costs are based on both vendor supplied price quotes obtained by the project design team and/or estimators, and on historical pricing of like equipment.
6. Process equipment vendor training using vendors' standard Operations and Maintenance (O&M) material, is included in the purchase price of major equipment items where so stated in that quotation.
7. Bulk material quantities are based on manual quantity take-offs that have been entered into the estimating program.
8. There is sufficient electrical power to feed the specified equipment. The local power company will supply power and transformers suitable for this facility.
9. Soils are of adequate nature to support the structures. No piles have been included in this estimate.
10. Trench pavement removal and repair is 4 inches of asphalt on 12 inches of crushed aggregate base.
11. Trench repair will be 1 foot wider than the trench width for the forcemain installation, and 2 feet wider for the 21 inch sewer replacement.
12. Excess dirt will be hauled offsite to a location within 20 miles. Tipping fees of $20 per ton are included.
13. Dewatering for the Fredrick Street pump station will be discharged to the storm drain.
14. Dewatering will not be required at the reservoir site.
15. Forcemains in Rose Avenue have an average depth of cover of 7 feet.
16. The estimate includes 700 feet of sewer replacement, although not all runs are indicated in the plans. Sewer replacement is assumed to be existing 16 inch, up-sized to 21 inch, with an average depth of cover of 6 feet.

17. The reservoir, inlet and outlet structures are located on the site to permit open cut excavation. No sheet piling is included.

Estimating Exclusions

The following estimating exclusions were assumed in the development of this estimate.

1. Hazardous materials remediation and/or disposal.
2. O&M costs for the project with the exception of the vendor supplied O&M manuals.
3. Utility agency costs for incoming power modifications.
4. Permits beyond those normally needed for the type of project and project conditions unless otherwise noted.
5. Dewatering discharge permits or fees.
6. Pretreatment of dewatering discharge, other than desilting measures.

Allowances for Known but Undefined Work

1. Prestressed concrete reservoir
2. Control valves, pipe and fittings at pump stations
3. Electrical and instrumentation

Contractor and Other Estimate Markups

Contractor markup is based on conventionally accepted values which have been adjusted for project-area economic factors. Estimate markups are shown in Table 1.

Table 1. Estimate Markups, October 2008

Item	Rate, percent
Prime Contractor	
Labor (employer payroll burden)	18
Materials and process equipment	15
Equipment (construction-related)	15
Subcontractor	5
Sales Tax (State and local for materials, process equipment and construction equipment rentals, etc.)	8.25
Startup, Training, O&M	1
Builder's Risk, Liability, and Vehicle Insurance	2.85
Material Shipping and Handling	4
Worker's Travel Subsistence	1
Earthquake Insurance (if applicable)	0.1

Table 1. Estimate Markups, October 2008

Item	Rate, percent
Subcontractor Markups	Same as Prime
Escalation to Midpoint of Construction – Labor	6
Escalation to Midpoint of Construction – Material	7
Escalation to Midpoint of Construction – Subcontractors, Construction Equipment, etc.	6
Undeveloped Design Contingency	20
Performance Bond	1
Payment Bond	1

Labor Markup. The labor rates used in the estimate were derived chiefly from the latest published State Prevailing Wage Rates. These rates include costs beyond raw labor for such items as Payroll Tax and Insurance (PT&I), FICA, and Workers Compensation Insurance. In addition to these markups, the General Contractor (GC) typically adds a percentage to each raw labor dollar to cover overhead and profit, payroll and accounting costs, additional insurance, retirement, 401k contributions, and sick leave/vacation cost.

Materials and Process Equipment Markup. This markup consists of the additional cost the contractor must bear beyond the raw dollar amount for material and process equipment. This includes shop drawing preparation, submittal and/or re-submittal cost, purchasing and scheduling materials and equipment, accounting charges including invoicing and payment, inspection of received goods, receiving, storage, overhead and profit.

Equipment (Construction) Markup. This markup consists of the costs associated with operating the construction equipment used in the project. Most GCs will rent rather than own the equipment and then charge each project for its equipment cost. The equipment rental cost does not include fuel, delivery and pick-up charges, additional insurance requirements on rental equipment, accounting costs related to home office receiving invoices and payment. However, the crew rates used in the estimate do account for the equipment rental cost. Occasionally, larger contractors will have some or all of the equipment needed for the job, but in order to recoup their initial purchasing cost they will charge the project an internal rate for equipment use which is similar to the rental cost of equipment. The GC will apply an overhead and profit percentage to each individual piece of equipment whether rented or owned.

Subcontractor Markup. This markup consists of the GC's costs for subcontractors who perform work on the site. This includes costs associated with shop drawings, review of subcontractor's submittals, scheduling of subcontractor work, inspections, processing of payment requests, home office accounting, and overhead and profit on subcontracts.

Sales Tax (Materials, Process Equipment and Construction Equipment). This is the tax that the contractor must pay according to state and local taxation laws. The percentage is applied to both the material and equipment the GC purchases as well as the cost for rental equipment. The percentage is based on the local rates in place at the time the estimate was prepared.

Contractor Startup, Training, and O&M Manuals. This cost markup is often confused with either vendor startup or owner startup. It is the cost the GC incurs on the project beyond the vendor startup and owner startup costs. The GC generally will have project personnel assigned to facilitate the installation, testing, startup, and O&M Manual preparation for equipment that is put into operation by either the vendor or owner. These project personnel often include an electrician, pipe fitter or millwright, and/or I&E technician. These personnel are not included in the basic crew makeup to install the equipment but are there to assist and trouble shoot the startup and proper running of the equipment. The GC also incurs a cost for startup for such things as consumables (oil, fuel, filters, etc.), startup drawings and schedules, startup meetings, and coordination with the plant personnel in other areas of the plant operation.

Builders Risk, Liability, and Vehicle Insurance. This percentage comprises all three items. There are many factors which make up this percentage, including the contractor's track record for claims in each of the categories. Another factor affecting insurance rates has been a dramatic price increase across the country over the past several years due to domestic and foreign influences. Consequently, in the construction industry we have observed a range of 0.5 to 1 percent for Builders Risk Insurance, 1 to 1.25 percent for General Liability Insurance, and 0.85 to 1 percent for Vehicle Insurance. Many factors affect each area of insurance, including project complexity, and contractor's requirements and history. Instead of using numbers from a select few contractors, we believe it is more prudent to use a combined 2.85 percent to better reflect the general costs across the country. Consequently, the actual cost could be higher or lower based on the bidder, region, insurance climate, and on the contractor's insurability at the time the project is bid.

Material Shipping and Handling. This can range from 2 percent to 6 percent, and is based on the type of project, material makeup of the project, and the region and location of the project. Material shipping and handling covers delivery costs from vendors, unloading costs (and in some instances loading and shipment back to vendors for rebuilt equipment), site paper work, and inspection of materials prior to unloading at the project site. BC typically adjusts this percentage by the amount of materials and whether vendors have included shipping costs in the quotes that were used to prepare the estimate. This cost also includes the GC's cost to obtain local supplies, e.g., oil, gaskets, and bolts that may be missing from the equipment or materials shipped.

Escalation to Midpoint for Labor, Materials and Subcontractors. In addition to contingency, it is customary for projects that will be built over several years to include an escalation to midpoint of anticipated construction to account for the future escalation of labor, material, and equipment costs beyond values at the time the estimate is prepared. For this project the anticipated rate of escalation is 5 percent per annum for labor and equipment, and 6 percent for material.

This project can reasonably be constructed within 12 months, exclusive of unusual weather or site conditions delays. Construction is anticipated to start June 1, 2009, and complete May 30, 2010. The escalation factors used in this estimate are calculated from the date the estimate is finalized to the anticipated midpoint of construction at approximately 14 months from the date of this estimate.

Undeveloped Design Contingency. The contingency factor covers unforeseen conditions, area economic factors, and general project complexity. This contingency is used to account for those factors that can not be addressed in each of the labor and/or material installation costs. Based on industry standards, completeness of the project documents, project complexity, the current design stage, and area factors, construction contingency can range from 10 percent to 50 percent.

Range of Accuracy. The amount of contingency in the estimate should not be confused with the accuracy of the estimate. The Expected Accuracy Range defines the window within which the bids are expected to fall based on the project complexity, information available during the estimate process, outside influences (wage rates, material, bidding climate), and includes a level of contingency appropriate to the project definition at the time the estimate was prepared. It is important to understand that AACEI, notes on its ranges of accuracy that,

"The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value [of the ranges] represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50 percent level of confidence) for given scope."

While a 50-percent level of confidence in the contingency may seem broad, typically this results in a 90-percent confidence that the actual cost will fall within the bounds of the low and high ranges.

The caution here is that these estimates are not what are often referred to as "bid quality," i.e., estimates prepared by contractors who are receiving competitive bids from subcontractors, equipment vendors, and materials suppliers. In general, we receive reasonable budget values from those willing to provide quotations.

Performance and Payment Bonds. Based on historical and industry data, this can range from 0.75 percent to 1.25 percent of the project total. There are several contributing factors including such items as size of the project, regional costs, contractor's historical record on similar projects, complexity, and current bonding limits. BC uses 1 percent for each bond which we have determined to be reasonable for most heavy construction projects.

BROWN AND CALDWELL

Environmental Engineers & Consultants

Summary Estimate Report

Location\Process Area

Tuesday, October 14, 2008 9:04:07 AM

Penmar Water Quality Improvements - Phase 1

50% Design

Project Number:: 136123-201-201
Client:: City of Los Angeles - Bureau of Engineering
Estimator(s):: D. Gordon, J. Warford
Estimating Office:: San Diego, Walnut Creek
Estimate Issue Number:: 01
Estimate Original Issue Date:: October 14, 2008
Estimate Revision Number::
Estimate Revision Date::
BC Project Manager:: Scott Dellinger
Estimate QA/QC Reviewer:: Butch Matthews
Estimate QA/QC Date:: October 10, 2008

PROJECT LOCATION / PROCESS AREA

1101 FREDRICK STREET PUMP STATION
1102 FREDRICK STREET DIVERSION STRUCTURE
1103 FREDRICK ST. SWR/WTR RELOCATION
1104 RESERVOIR INLET
1105 2.75 MG RESERVOIR
1106 RESERVOIR DISCHARGE (PUMP STATION)
1107 8-INCH FORCEMAIN
1108 12-INCH FORCEMAIN
1109 30-INCH FORCEMAIN
1110 21-INCH SANITARY SEWER

Description	Grand Total
--- Base Estimate ---	**13,592,166**
1101 - FREDRICK ST. PUMP STATION	
01 - GENERAL REQUIREMENTS	**82,093**
02 - SITE CONSTRUCTION	**641,037**
03 - CONCRETE	**691,670**
05 - METALS	**44,581**
08 - DOORS and WINDOWS	**26,510**
09 - FINISHES	**2,548**
11 - EQUIPMENT	**559,619**
15 - MECHANICAL	**260,917**
16 - ELECTRICAL	**448,319**
1101 - FREDRICK ST. PUMP STATION Total	*2,757,294*
1102 - FREDRICK ST. DIVERSION STRUCTURE	
01 - GENERAL REQUIREMENTS	**18,630**
02 - SITE CONSTRUCTION	**53,513**
03 - CONCRETE	**13,624**
15 - MECHANICAL	**9,980**
1102 - FREDRICK ST. DIVERSION STRUCTURE Total	*95,747*
1103 - FREDRICK ST. SWR/WTR RELOCATION	
01 - GENERAL REQUIREMENTS	**6,986**
02 - SITE CONSTRUCTION	**94,117**
15 - MECHANICAL	**18,730**
1103 - FREDRICK ST. SWR/WTR RELOCATION Total	*119,833*
1104 - RESERVOIR INLET VAULT	
01 - GENERAL REQUIREMENTS	**226**
02 - SITE CONSTRUCTION	**16,019**
03 - CONCRETE	**50,898**
08 - DOORS and WINDOWS	**10,012**
09 - FINISHES	**510**
15 - MECHANICAL	**147,226**
16 - ELECTRICAL	**8,151**
17 - INSTRUMENTATION	**50,200**
1104 - RESERVOIR INLET VAULT Total	*283,243*
1105 - 2.75 MG RESERVOIR	
02 - SITE CONSTRUCTION	**1,512,940**
03 - CONCRETE	**6,052,309**
07 - THERMAL/MOIST PROTECTION	**248,079**
15 - MECHANICAL	**100,367**

Description	Grand Total
16 - ELECTRICAL	**24,454**
1105 - 2.75 MG RESERVOIR Total	*7,938,149*
1106 - RESERVOIR DISCHARGE VAULT	
01 - GENERAL REQUIREMENTS	**226**
02 - SITE CONSTRUCTION	**68,107**
03 - CONCRETE	**50,898**
08 - DOORS and WINDOWS	**10,012**
09 - FINISHES	**510**
11 - EQUIPMENT	**128,432**
15 - MECHANICAL	**42,580**
16 - ELECTRICAL	**48,908**
17 - INSTRUMENTATION	**11,715**
1106 - RESERVOIR DISCHARGE VAULT Total	*361,387*
1107 - 8-INCH FORCEMAIN	
01 - GENERAL REQUIREMENTS	**17,416**
02 - SITE CONSTRUCTION	**65,805**
15 - MECHANICAL	**61,750**
1107 - 8-INCH FORCEMAIN Total	*144,971*
1108 - 12-INCH FORCEMAIN	
01 - GENERAL REQUIREMENTS	**20,135**
02 - SITE CONSTRUCTION	**101,609**
15 - MECHANICAL	**131,100**
1108 - 12-INCH FORCEMAIN Total	*252,844*
1109 - 30-INCH FORCEMAIN	
01 - GENERAL REQUIREMENTS	**52,242**
02 - SITE CONSTRUCTION	**326,661**
15 - MECHANICAL	**746,393**
1109 - 30-INCH FORCEMAIN Total	*1,125,296*
1110 - 21-INCH SEWER REPLACEMENT	
01 - GENERAL REQUIREMENTS	**53,388**
02 - SITE CONSTRUCTION	**215,559**
11 - EQUIPMENT	**56,809**
15 - MECHANICAL	**187,646**
1110 - 21-INCH SEWER REPLACEMENT Total	*513,402*

Penmar Water Quality Improvements - Phase 1

50% Design

Project Number::	136123-201-201
Client::	City of Los Angeles - Bureau of Engineering
Estimator(s)::	D. Gordon, J. Warford
Estimating Office::	San Diego, Walnut Creek
Estimate Issue Number::	01
Estimate Original Issue Date::	October 14, 2008
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BC Project Manager::	Scott Dellinger
Estimate QA/QC Reviewer::	Butch Matthews
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PROJECT LOCATION / PROCESS AREA

1101	FREDRICK STREET PUMP STATION
1102	FREDRICK STREET DIVERSION STRUCTURE
1103	FREDRICK ST. SWR/WTR RELOCATION
1104	RESERVOIR INLET
1105	2.75 MG RESERVOIR
1106	RESERVOIR DISCHARGE (PUMP STATION)
1107	8-INCH FORCEMAIN
1108	12-INCH FORCEMAIN
1109	30-INCH FORCEMAIN
1110	21-INCH SANITARY SEWER

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	— Base Estimate —												
	1101 - FREDRICK ST. PUMP STATION				370,982		705,234	319,046	63,211	29,275			1,487,748
01 - GENERAL REQUIREMENTS													
01090 - Scaffolding													
0790	Scaffold,h.d. shoring for suspended slab forms,fl area to 8'-2" H, 3 u	9.7	csf	50.35	488	10.45	101				60.8	csf	589
0790	Scaffold,h.d. shoring for suspended slab forms,fl area to 8'-2" H, 3 u	9.7	csf	50.35	488	10.45	101				60.8	csf	589
01220 - Wellpoint equipment rent													
0010	Rent 8" diam wellpoint discharge pipe	9,000.0	lf_dy					4,050			0.5	lf_dy	4,050
0040	Rent wellpoint header pipe, 6" diameter, 400 GPM	16,200.0	lf_dy					7,776			0.5	lf_dy	7,776
0100	Rent wellpoint 25' long w/fittings & riser pipe 1-1/2" or 2" suction	1,620.0	ea_dy					5,670			3.5	ea_dy	5,670
0120	Rent wellpoint pump, diesel, 30 HP, 6" suction	90.0	days			125.00	11,250	17,910			324.0	days	29,160
	GENERAL REQUIREMENTS Total				976		11,453	35,406					47,834
02 - SITE CONSTRUCTION													
02060 - Site demolition													
0030	Site dml, no hauling, remove existing catch basin or manhole	2.0	each	333.26	667				141		403.7	each	807
0170	Site dml, pavement removal, bituminous roads, 3" thick	167.0	sqyd	3.36	561				239		4.8	sqyd	800
0250	Site dml, curbs, conc, plain	60.0	lnft	3.70	222				47		4.5	lnft	269
0420	Site dml, pipe removal, stomr drain, no excavation, 27" dia	40.0	lnft	11.11	444				94		13.5	lnft	538
0430	Site dml, pipe removal, storm drain, no excavation, 51" dia	110.0	lnft	14.81	1,629				344		17.9	lnft	1,974
0540	Site dml, sidewalk removal, concrete, mesh reinforced, 4"	17.0	sqyd	8.89	151				32		10.8	sqyd	183
0650	Site dml, guard rail	25.0	lnft	15.67	392				24		16.6	lnft	416
02160 - Rubbish handling													
9999	Dump Charge, typical urban city, fees only, bldg constr mat'ls	75.0	ton							2,475	33.0	ton	2,475
9999	Dump Charge, tipping fee, dirt spoils	1,340.0	ton							26,800	20.0	ton	26,800
02170 - Saw cutting													
0010	Saw cutting, asphalt, up to 3" deep	60.0	lnft	0.89	54	0.30	18		21		1.5	lnft	93
0020	Saw cutting, asphalt, after 3" deep; each addl inch of depth	60.0	lnft	0.52	31	0.07	4		12		0.8	lnft	48
0060	Saw cutting, pipe	2.0	each	115.39	231				82		156.4	each	313
02260 - Wellpoints													
0020	Wellpoints, inst&rmv of sgl stage sys, L, 2.0 hours per L.F. header	180.0	lnft	103.34	18,601						103.3	lnft	18,601
0331	Wellpoints, pump operation, 2 cks @ 2 hr (night shift), per 24 hour day	90.0	days	411.38	37,025						411.4	days	37,025
02280 - Sheet piling													
0080	Sheet piling, stl, no wales, 25' exc, 38 PSF, drive, extrct&salvage	102.1	ton	408.07	41,647	450.45	45,973		31,006		1,162.3	ton	118,627
0170	Sheet piling, steel, rent steel sheet piling and wales, first month	123.1	ton			240.24	29,574				240.2	ton	29,574
0180	Sheet piling, steel, rent steel sheet piling and wales, per added mo	369.3	ton			24.02	8,872				24.0	ton	8,872

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0200	Sheet piling, stl, wales, connections & struts, 2/3 salvage	123.1	ton			245.25	30,190				245.2	ton	30,190
02310 - Fine grade													
0050	Fine grade, fine grade, for small irregular areas	317.0	sqyd	1.44	455				285		2.3	sqyd	740
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	910.0	cuyd	0.82	745				1,069		2.0	cuyd	1,814
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	819.0	cuyd	2.07	1,693				244		2.4	cuyd	1,937
02420 - Excavating, structural													
0040	Excavating, structural, mach excav, com earth, hyd backhoe, 1-1/2 CY b	1,800.0	cuyd	7.34	13,219				7,978		11.8	cuyd	21,197
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	1,340.0	cuyd	6.50	8,711				9,573		13.6	cuyd	18,284
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	50.0	cuyd	6.50	325				357		13.6	cuyd	682
0900	Loading Trucks, F.E. Loader, 3 C.Y.	1,340.0	cuyd	0.76	1,013				524		1.1	cuyd	1,538
0900	Loading Trucks, F.E. Loader, 3 C.Y.	50.0	cuyd	0.76	38				20		1.1	cuyd	57
02490 - Erosion control													
0040	Erosion control, silt fence, polypropylene, 3' high	200.0	lnft	0.87	174	1.00	200				1.9	lnft	374
0040	Erosion control, silt fence, polypropylene, 3' high-remove	200.0	lnft	0.87	174	0.34	68				1.2	lnft	242
02570 - Catch basins or manholes													
0010	Storm Drain, catch basins, manholes, conc	2.0	each	1,500.00	3,000	500.00	1,000		1,000		2,500.0	each	5,000
02600 - Base course													
0020	Base course, large areas, crushed 3/4" stone, compacted to 6" deep	317.0	sqyd	0.77	244	5.41	1,714		220		6.9	sqyd	2,178
0020	Base, gravel drive, 6"	44.0	sqyd	0.77	34	5.41	238		31		6.9	sqyd	302
02610 - Asphltc concrete pavement													
0020	Asphaltic conc pavement, binder course, 2" thick	317.0	sqyd	1.56	493	9.00	2,853		233		11.3	sqyd	3,579
0050	Asphaltic conc pavement, wearing course, 1" thick	317.0	sqyd	1.04	329	4.50	1,427		154		6.0	sqyd	1,909
02650 - Curbs													
0080	Curb & gutter, str, w/ 6"H curb & 6"T gutter,wd forms,30"W,0.066CY/LF	40.0	lnft	8.00	320	15.62	625				23.6	lnft	945
02660 - Sidwlks,drivwys,& patios													
0010	Sidewalks, conc, 3000 PSI, CIP w/ 6x6 mesh, broom fin, no base, 4"T	440.0	sqft	2.19	965	1.45	639				3.6	sqft	1,604
0030	Sidewalks, conc, 3000 PSI, CIP w/ 6x6 mesh, swales, drives, no base, 6"T	535.0	sqft	2.58	1,381	2.26	1,210				4.8	sqft	2,591
	SITE CONSTRUCTION Total				**134,968**		**124,603**		**53,730**	**29,275**			**342,576**
03 - CONCRETE													
03040 - Flp,elevated slabs													
0010	Forms in place, elev slab, flat plate plywd, to 15' high	969.0	sqft	5.24	5,076	4.53	4,385				9.8	sqft	9,461
0010	Forms in place, elev slab, flat plate plywd, to 15' high	969.0	sqft	5.24	5,076	4.53	4,385				9.8	sqft	9,461

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0050	Forms in place, elev slab, curb forms, wood, 6"-12" high	140.0	sfca	8.65	1,211	1.62	226				10.3	sfca	1,437
0050	Forms in place, elev slab, curb forms, wood, 6"-12" high	140.0	sfca	8.65	1,211	1.62	226				10.3	sfca	1,437
03090 - Forms place, slab grade													
0030	Forms in place, SOG, edge forms, over 12", wood	396.0	sfca	5.07	2,006	2.63	1,040				7.7	sfca	3,045
0030	Forms in place, SOG, edge forms, over 12", wood	41.7	sfca	5.07	211	2.63	109				7.7	sfca	320
03110 - Forms in place, walls													
0080	Forms in place, walls, job built plyform, 8-16' high	6,750.0	sfca	7.90	53,304	2.28	15,380				10.2	sfca	68,684
0080	Forms in place, walls, job built plyform, 8-16' high	2,430.0	sfca	7.90	19,189	2.28	5,537				10.2	sfca	24,726
03120 - Waterstop													
0020	Waterstop, PVC, ribbed 3/16" thick, 6" wide	150.0	lnft	3.12	469	1.58	236				4.7	lnft	705
0020	Waterstop, PVC, ribbed 3/16" thick, 6" wide	54.0	lnft	3.12	169	1.58	85				4.7	lnft	254
0030	Waterstop, PVC, ribbed, w/center bulb, 3/16" thick, 9" wide	132.0	lnft	3.36	443	12.97	1,712				16.3	lnft	2,155
0030	Waterstop, PVC, ribbed, w/center bulb, 3/16" thick, 9" wide	140.0	lnft	3.36	470	12.97	1,816				16.3	lnft	2,285
0030	Waterstop, PVC, ribbed, w/center bulb, 3/16" thick, 9" wide	140.0	lnft	3.36	470	12.97	1,816				16.3	lnft	2,285
03130 - Reinforcing in place													
0050	Reinforcing in place, A615 Gr 60, elevated slabs, #4 to #7	3.4	ton	722.43	2,453	1,250.00	4,245				1,972.4	ton	6,698
0050	Reinforcing in place, A615 Gr 60, elevated slabs, #4 to #7	3.4	ton	722.43	2,453	1,250.00	4,245				1,972.4	ton	6,698
0070	Reinforcing in place, A615 Gr 60, slab on grade, #3 to #7	0.3	ton	910.89	236	1,250.00	324				2,160.9	ton	560
0080	Reinforcing in place, A615 Gr 60, walls, #3 to #7	5.0	ton	698.35	3,475	1,250.00	6,220				1,948.3	ton	9,695
0080	Reinforcing in place, A615 Gr 60, walls, #3 to #7	21.4	ton	698.35	14,910	1,250.00	26,688				1,948.3	ton	41,598
0080	Reinforcing in place, A615 Gr 60, walls, #3 to #7	7.7	ton	698.35	5,399	1,250.00	9,664				1,948.3	ton	15,063
0080	Reinforcing in place, A615 Gr 60, walls, #3 to #7	1.2	ton	698.35	859	1,250.00	1,538				1,948.3	ton	2,396
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	2,594.1	lb	1.44	3,747	2.49	6,459				3.9	lb	10,206
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	6,884.5	lb	1.44	9,943	2.49	17,142				3.9	lb	27,085
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	1,407.1	lb	1.44	2,032	2.49	3,504				3.9	lb	5,536
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	1,407.1	lb	1.44	2,032	2.49	3,504				3.9	lb	5,536
0200	Reinforcing in place, unloading & sorting, add to above	6.3	ton	37.29	234				49		45.0	ton	283
0200	Reinforcing in place, unloading & sorting, add to above	24.8	ton	37.29	924				192		45.0	ton	1,117
0200	Reinforcing in place, unloading & sorting, add to above	7.7	ton	37.29	288				60		45.0	ton	348
0200	Reinforcing in place, unloading & sorting, add to above	1.2	ton	37.29	45				9		45.0	ton	54
0200	Reinforcing in place, unloading & sorting, add to above	4.1	ton	37.29	153				32		45.0	ton	185
0200	Reinforcing in place, unloading & sorting, add to above	4.1	ton	37.29	153				32		45.0	ton	185
0200	Reinforcing in place, unloading & sorting, add to above	0.3	ton	37.29	12				2		45.0	ton	14
0210	Reinforcing in place, crane cost for handling, add to above	6.3	ton	106.53	668				139		128.7	ton	807
0210	Reinforcing in place, crane cost for handling, add to above	24.8	ton	106.53	2,641				550		128.7	ton	3,191
0210	Reinforcing in place, crane cost for handling, add to above	7.7	ton	106.53	824				171		128.7	ton	995

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0210	Reinforcing in place, crane cost for handling, add to above	1.2	ton	106.53	128				27		128.7	ton	154
0210	Reinforcing in place, crane cost for handling, add to above	4.1	ton	106.53	437				91		128.7	ton	528
0210	Reinforcing in place, crane cost for handling, add to above	4.1	ton	106.53	437				91		128.7	ton	528
0210	Reinforcing in place, crane cost for handling, add to above	0.3	ton	106.53	34				7		128.7	ton	41
03150 - Concrete, ready mix													
0030	Concrete, ready mix, regular weight, 4000 psi	85.0	cuyd			125.00	10,625				125.0	cuyd	10,625
0030	Concrete, ready mix, regular weight, 4000 psi	187.5	cuyd			125.00	23,438				125.0	cuyd	23,438
0030	Concrete, ready mix, regular weight, 4000 psi	67.5	cuyd			125.00	8,438				125.0	cuyd	8,438
0030	Concrete, ready mix, regular weight, 4000 psi	15.0	cuyd			125.00	1,875				125.0	cuyd	1,875
0030	Concrete, ready mix, regular weight, 4000 psi	35.9	cuyd			125.00	4,486				125.0	cuyd	4,486
0030	Concrete, ready mix, regular weight, 4000 psi	35.9	cuyd			125.00	4,486				125.0	cuyd	4,486
0030	Concrete, ready mix, regular weight, 4000 psi	1.9	cuyd			125.00	231				125.0	cuyd	231
03160 - Concrete in place													
0010	Concrete in place, seal slab	33.0	cuyd	112.90	3,726	182.58	6,025		14		295.9	cuyd	9,765
03170 - Placing concrete													
0060	Placing conc, incl vib, elev slab, 6" to 10" thick, pumped	35.9	cuyd	21.88	785				172		26.7	cuyd	957
0060	Placing conc, incl vib, elev slab, 6" to 10" thick, pumped	35.9	cuyd	21.88	785				172		26.7	cuyd	957
0120	Placing conc, incl vib, slab on grade, slab over 6" thick, pumped	85.0	cuyd	18.92	1,608				353		23.1	cuyd	1,961
0120	Placing conc, incl vib, slab on grade, slab over 6" thick, pumped	1.9	cuyd	18.92	35				8		23.1	cuyd	43
0130	Placing conc, incl vib, walls, 8" thick, pumped	187.5	cuyd	35.01	6,564				1,439		42.7	cuyd	8,004
0130	Placing conc, incl vib, walls, 8" thick, pumped	67.5	cuyd	35.01	2,363				518		42.7	cuyd	2,881
0130	Placing conc, incl vib, walls, 8" thick, pumped	15.0	cuyd	35.01	525				115		42.7	cuyd	640
03180 - Finishing floors													
0030	Finishing floors, monolithic, screed, float & broom finish	765.0	sqft	0.71	546						0.7	sqft	546
0030	Finishing floors, monolithic, screed, float & broom finish	969.0	sqft	0.71	692						0.7	sqft	692
0030	Finishing floors, monolithic, screed, float & broom finish	969.0	sqft	0.71	692						0.7	sqft	692
0030	Finishing floors, monolithic, screed, float & broom finish	125.0	sqft	0.71	89						0.7	sqft	89
03190 - Finishing walls													
0010	Finishing walls, break ties & patch voids	3,375.0	sqft	0.83	2,809	0.03	106				0.9	sqft	2,915
0010	Finishing walls, break ties & patch voids	1,215.0	sqft	0.83	1,011	0.03	38				0.9	sqft	1,050
0020	Finishing walls, carborundum rub, wet rub	3,600.0	sqft	2.57	9,248	0.03	113				2.6	sqft	9,361
0020	Finishing walls, carborundum rub, wet rub	1,296.0	sqft	2.57	3,329	0.03	41				2.6	sqft	3,370
	CONCRETE Total				**178,629**		**180,388**		**4,243**				**363,261**
05 - METALS													
05010 - Misc Metals													
1670	Bar rack, manual, complete	72.0	sqft	13.42	966	141.39	10,180		65		155.7	sqft	11,211

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
05050 - Lightweight framing													
0110	Lightweight framing, angle, field fab, 3" x 3" x 3/8"	40.0	lnft	28.51	1,140	4.52	181		92		35.3	lnft	1,413
05120 - Grating frame													
0030	Checkered plate, pit or trench cov andFR, 1/4" plate	160.0	sqft	21.47	3,436	22.00	3,520		209		44.8	sqft	7,165
05270 - Stair													
0010	Stair, aluminum, saf nosing, strg, grating trd & pipe rail, 3'-6" W	10.0	risr	61.36	614	261.00	2,610		37		326.1	risr	3,261
	METALS Total				**6,156**		**16,491**		**402**				**23,049**
08 - DOORS and WINDOWS													
08060 - Floor, industrial													
0020	Floor, indl, steel 300 psf L.L., single leaf, 3' x 3' opening, 300#	6.0	opng	190.46	1,143	840.00	5,040				1,030.5	opng	6,183
0040	Floor, industrial, steel 300 psf L.L., dbl leaf, 6' x 6' opening, 645#	2.0	opng	232.78	466	1,750.00	3,500				1,982.8	opng	3,966
0090	Floor, indl, alum, 300 psf L.L., dbl leaf, 4' x 8' opening	1.0	opng	523.76	524	2,920.00	2,920				3,443.8	opng	3,444
	DOORS and WINDOWS Total				**2,132**		**11,460**						**13,592**
09 - FINISHES													
09000 - B & C Div 9 Coating Systems													
0030	Coatings & paints, B & C coating system E-3	1,000.0	sqft	0.46	464	0.86	860				1.3	sqft	1,324
	FINISHES Total				**464**		**860**						**1,324**
11 - EQUIPMENT													
11110 - Pumps submersible													
0035	Wastewater, submersible, 3000 GPM gpm,guide rails, base elbow	4.0	each	4,500.00	18,000	50,000.00	200,000		2,000		55,000.0	each	220,000
0035	Wastewater, submersible,1100 GPM gpm,guide rails, base elbow	2.0	each	2,500.00	5,000	30,000.00	60,000		500		32,750.0	each	65,500
	EQUIPMENT Total				**23,000**		**260,000**		**2,500**				**285,500**
15 - MECHANICAL													
15010 - Misc. Mechanical													
0010	Misc pipe, valve, fitting, coupling - allowance	1.0	each	10,000.00	10,000	40,000.00	40,000				50,000.0	each	50,000
0570	Support/Protect existing utilities - allowance	1.0	each	1,500.00	1,500	1,500.00	1,500				3,000.0	each	3,000
15030 - Pipe,watr dstr,ductl iron													
0031	Piping, water dist, DICL 18' L, mech jt, 8" dia class 350	60.0	lnft	17.00	1,020	23.12	1,387		79		41.4	lnft	2,486
0450B	Piping, water dist, DI, cement lined, 18' L, restrained jt, 30" dia	60.0	lnft	17.81	1,069	155.77	9,346		271		178.1	lnft	10,686
15031 - DIP Fittings													
0040	Piping, water dist, DI, fitting, 8" dia	3.0	each	164.68	494	350.00	1,050				514.7	each	1,544
2855B	Piping, fittings, wye or tee, 30" diameter	4.0	each	760.92	3,044	4,300.00	17,200		799		5,260.6	each	21,042
15055 - Pipe,watr dstr,plyv chlrd													
0090	PVC pipe, class 160, sdr 26, 8" diameter	100.0	lnft	5.13	513	14.38	1,438				19.5	lnft	1,951
15090 - Pipe,drng&sewage,concret													

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0100	Piping, bells, RCP, 48", connection to wetwell	2.0	ea	49.46	99	351.75	703		35		418.5	ea	837
0110	Piping, drainage & sewage, RCP, class 3, no gaskets, 51"	50.0	lnft	65.95	3,298	127.64	6,382		1,150		216.6	lnft	10,830
0210	Piping, water dist,conc pipe, gasket, 51"	6.0	each			20.50	123				20.5	each	123
15285 - Valves, steel													
0060	Valves, steel, cast, chk valve, swing type, 150 lb., flanged, 8" size	2.0	each	553.18	1,106	2,625.00	5,250				3,178.2	each	6,356
0070	Valves, st, cast, chk valve, swing type, 150 lb., flanged, 10" size	4.0	each	628.62	2,514	3,900.00	15,600				4,528.6	each	18,114
15515 - Misc HVAC													
0010	HVAC,ventilation allowance, $12.00/sf	720.0	sqft					8,640			12.0	sqft	8,640
	MECHANICAL Total				**24,657**		**99,980**	**8,640**	**2,335**				**135,611**
16 - ELECTRICAL													
16195 - Electrical & Instrument													
0101	Electrical & Instrumentation Allowance	1.0	lsum					275,000			275,000.0	lsum	275,000
	ELECTRICAL Total							**275,000**					**275,000**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1102 - FREDRICK ST. DIVERSION STRUCTURE				26,776		17,733		4,434	2,060			51,004
01 - GENERAL REQUIREMENTS													
01120 - Barricades													
0010	Traffic Control Devices, Signs, Barricades	10.0	day			200.00	2,000				200.0	day	2,000
0010	Traffic Control - Flagperson	20.0	day	380.64	7,613						380.6	day	7,613
01200 - General equipment rental													
0350	Rent trench box 8,000 pound 8 foot by 16 foot	2.0	day						374		187.2	day	374
	GENERAL REQUIREMENTS Total				7,613		2,000		374				9,987
02 - SITE CONSTRUCTION													
02060 - Site demolition													
B0171	Site dml, pavement removal, cold milling, 1" to 3", 5,000 to 10,000 sy	200.0	sqyd	0.53	105				235		1.7	sqyd	340
02080 - Cutout demolition													
0030	Cutout demo, conc, slab - rcb roof deck	25.0	sqft	56.22	1,405				237		65.7	sqft	1,642
0050	Cutout dml, conc, walls, bar reinforced - rcb walls	14.0	cuft	84.33	1,181				110		92.2	cuft	1,291
02160 - Rubbish handling													
9999	Dump Charge, tipping fee, dirt spoils	103.0	ton							2,060	20.0	ton	2,060
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	282.0	cuyd	0.82	231				331		2.0	cuyd	562
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	44.0	cuyd	8.89	391	32.03	1,409		83		42.8	cuyd	1,883
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	5.0	cuyd	2.07	10				1		2.4	cuyd	12
0030	Compaction, vibratory plate, 8" lifts, common fill	254.0	cuyd	2.07	525				76		2.4	cuyd	601
0040	Compaction, vibratory plate, 8" lifts, select fill	38.0	cuyd	1.91	73				10		2.2	cuyd	83
02450 - Excavating, trench													
0030	Excavate trench, common earth, 10'-14' deep, 1-1/2 CY hyd backhoe	309.0	cuyd	1.96	605				365		3.1	cuyd	970
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr - ac milling	66.7	cuyd	6.50	433				476		13.6	cuyd	910
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	103.0	cuyd	6.50	670				736		13.6	cuyd	1,405
0900	Loading Trucks, F.E. Loader, 3 C.Y.- ac milling	66.7	cuyd	0.76	50				26		1.1	cuyd	76
0900	Loading Trucks, F.E. Loader, 3 C.Y.	103.0	cuyd	0.76	78				40		1.1	cuyd	118
02570 - Catch basins or manholes													
0260	Catch bsns or manholes, frs and covs, hvy traffic, 36" diam, 1150 lb.	2.0	each	444.35	889	860.00	1,720		188		1,398.2	each	2,796
02600 - Base course													
0040	Base course, large areas, crushed 3/4" stone, compacted to 12" deep	200.0	sqyd	0.91	183	10.76	2,152		165		12.5	sqyd	2,500

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
02610 - Asphltc concrete pavement													
0110	Asphaltic conc pavement, pavement replacement over trench, 4" thick	200.0	sqyd	37.35	7,470	18.00	3,600		367		57.2	sqyd	11,437
	SITE CONSTRUCTION Total				14,299		8,882		3,447	2,060			28,687
03 - CONCRETE													
03130 - Reinforcing in place													
0140	Reinforcing, dowels, 12" long, 1/4"dia, cored, epoxy	50.0	each	14.96	748	2.10	105				17.1	each	853
03160 - Concrete in place													
0010	Concrete in place, "conc sleeve"Det. B/C-12	12.0	cuyd	112.90	1,355	182.58	2,191		5		295.9	cuyd	3,551
0010	Concrete in place, RCB Diversion Dams	7.4	cuyd	112.90	835	182.58	1,351		3		295.9	cuyd	2,190
0060	Concrete in place, thrust blocking-lug 48" RCP to RCB	3.0	cuyd	64.87	195	112.20	337		1		177.4	cuyd	532
	CONCRETE Total				3,133		3,984		9				7,126
15 - MECHANICAL													
15090 - Pipe,drng&sewage,concret													
0100	Piping, drainage & sewage, RCP, class 3, no gaskets, 48" dia	35.0	lnft	49.46	1,731	79.90	2,796		604		146.6	lnft	5,132
0200	Piping, water dist,conc pipe, gasket, 48" dia	5.0	each			14.35	72				14.4	each	72
	MECHANICAL Total				1,731		2,868		604				5,203

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1103 - FREDRICK ST. SWR/WTR RELOCATION				17,076		14,090	1,200	8,393	27,500			68,260
01 - GENERAL REQUIREMENTS													
01200 - General equipment rental													
0270	Rent trash pump, 6" diameter, diesel drive, hoses - swr bypass	10.0	day			100.00	1,000		2,500		350.0	day	3,500
0340	Trench box, 7200 lbs, 6'x 20'	1.0	day						142		141.6	day	142
	GENERAL REQUIREMENTS Total						1,000		2,642				3,642
02 - SITE CONSTRUCTION													
02060 - Site demolition													
0280	Site dml, pipe removal, sewer, no excavation, 8" dia	100.0	lnft	7.62	762				161		9.2	lnft	923
0280	Site dml, pipe removal, water, no excavation, 6" dia	120.0	lnft	7.62	914				193		9.2	lnft	1,107
02160 - Rubbish handling													
9999	Dump Charge, tipping fee, dirt spoils	1,340.0	ton							26,800	20.0	ton	26,800
9999	Dump Charge, tipping fee, dirt spoils	35.0	ton							700	20.0	ton	700
02240 - Dewatering													
0150	Sewer Bypass, pumping 8 hr, 8 hrs attended, 6" centrifugal pump	10.0	each	736.44	7,364				3,379		1,074.3	each	10,743
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	57.0	cuyd	0.82	47				67		2.0	cuyd	114
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	37.0	cuyd	0.82	30				43		2.0	cuyd	74
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	26.0	cuyd	8.89	231	32.03	833		49		42.8	cuyd	1,113
0010	Bedding, crushed stone 3/4" to 1/2"	27.0	cuyd	8.89	240	32.03	865		51		42.8	cuyd	1,155
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	5.0	cuyd	2.07	10				1		2.4	cuyd	12
0030	Compaction, vibratory plate, 8" lifts, common fill	51.0	cuyd	2.07	105				15		2.4	cuyd	121
0030	Compaction, vibratory plate, 8" lifts, common fill	6.0	cuyd	2.07	12				2		2.4	cuyd	14
0030	Compaction, vibratory plate, 8" lifts, common fill	34.0	cuyd	2.07	70				10		2.4	cuyd	80
0040	Compaction, vibratory plate, 8" lifts, select fill	22.0	cuyd	1.91	42				6		2.2	cuyd	48
0040	Compaction, vibratory plate, 8" lifts, select fill	23.0	cuyd	1.91	44				6		2.2	cuyd	50
02450 - Excavating, trench													
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	75.0	cuyd	1.96	147				89		3.1	cuyd	235
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	58.0	cuyd	1.96	114				69		3.1	cuyd	182
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	37.0	cuyd	6.50	241				264		13.6	cuyd	505
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	35.0	cuyd	6.50	228				250		13.6	cuyd	478
0900	Loading Trucks, F.E. Loader, 3 C.Y.	37.0	cuyd	0.76	28				14		1.1	cuyd	42

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0900	Loading Trucks, F.E. Loader, 3 C.Y.	35.0	cuyd	0.76	26				14		1.1	cuyd	40
02570 - Catch basins or manholes													
0020	CB or manholes, conc, precast, 4' ID, 6' deep	4.0	each	580.01	2,320	1,050.00	4,200		342		1,715.6	each	6,862
0240	Catch bsns or manholes, frs and covs, lt traffic, 36" diam, 900 lb.	4.0	each	229.83	919	540.00	2,160		194		818.4	each	3,274
	SITE CONSTRUCTION Total				**13,895**		**8,058**		**5,220**	**27,500**			**54,672**
15 - MECHANICAL													
15031 - DIP Fittings													
0260	Piping, fittings, 45< bend, 6" dia	4.0	each	137.28	549	224.00	896				361.3	each	1,445
15055 - Pipe,watr dstr,plyv chlrd													
0240	Piping, water dist, PVC, press pipe, class 200, SDR 21, 6"	130.0	lnft	4.62	601	5.20	676				9.8	lnft	1,277
15065 - PIPE, BLACK STEEL,WELDED													
0090	Piping, water dist, blk steel, pl end, welded, 5/16" wall, 12" dia- casing	65.0	lnft	8.46	550	30.50	1,983		532		47.1	lnft	3,064
15095 - Pipe,drng&sewg,plyv chlrd													
0040	Piping, drainage & sewage, PVC, 10' lengths, s.d.r. 35, 8" diam	110.0	lnft	3.98	438	8.13	894				12.1	lnft	1,332
15330 - Flexible connectors													
0220	Connectors, flex, Dresser type, 6" dia.	2.0	each	77.17	154	291.79	584				369.0	each	738
15715 - Piping, testing													
0050	Test, CATV, 8" Sewer	1.0	each	444.52	445			1,200			1,644.5	each	1,645
0050	Nondestructive pressure test, 6" Water	1.0	each	444.52	445						444.5	each	445
	MECHANICAL Total				**3,182**		**5,033**	**1,200**	**532**				**9,946**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1104 - RESERVOIR INLET VAULT				30,441		106,013	5,000	3,443	2,340			147,236
01 - GENERAL REQUIREMENTS													
01090 - Scaffolding													
0790	Scaffold,h.d. shoring for suspended slab forms,fl area to 8'-2" H, 3 u	2.0	csf	50.35	101	10.45	21				60.8	csf	122
	GENERAL REQUIREMENTS Total				101		21						122
02 - SITE CONSTRUCTION													
02160 - Rubbish handling													
9999	Dump Charge, tipping fee, dirt spoils	117.0	ton							2,340	20.0	ton	2,340
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	250.0	cuyd	0.82	205				294		2.0	cuyd	498
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	9.0	cuyd	8.89	80	32.03	288		17		42.8	cuyd	385
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	8.0	cuyd	2.07	17				2		2.4	cuyd	19
0030	Compaction, vibratory plate, 8" lifts, common fill	225.0	cuyd	2.07	465				67		2.4	cuyd	532
0040	Compaction, vibratory plate, 8" lifts, select fill	8.0	cuyd	1.91	15				2		2.2	cuyd	18
02420 - Excavating, structural													
0040	Excavating, structural, mach excav,com earth, hyd backhoe, 1-1/2 CY b	293.0	cuyd	7.34	2,152				1,299		11.8	cuyd	3,450
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	117.0	cuyd	6.50	761				836		13.6	cuyd	1,596
0900	Loading Trucks, F.E. Loader, 3 C.Y.	117.0	cuyd	0.76	88				46		1.1	cuyd	134
	SITE CONSTRUCTION Total				3,782		288		2,562	2,340			8,973
03 - CONCRETE													
03040 - Fip,elevated slabs													
0010	Forms in place, elev slab, flat plate plywd, to 15' high	200.0	sqft	5.24	1,048	4.53	905				9.8	sqft	1,953
0050	Forms in place, elev slab, curb forms, wood, 6"-12" high	40.0	sfca	8.65	346	1.62	65				10.3	sfca	411
03090 - Forms place, slab grade													
0030	Forms in place, SOG, edge forms, over 12", wood	40.0	sfca	5.07	203	2.63	105				7.7	sfca	308
03110 - Forms in place, walls													
0080	Forms in place, walls, job built plyform, 8-16' high	720.0	sfca	7.90	5,686	2.28	1,641				10.2	sfca	7,326
03130 - Reinforcing in place													
0050	Reinforcing in place, A615 Gr 60, elevated slabs, #4 to #7	0.5	ton	722.43	358	1,250.00	620				1,972.4	ton	978
0080	Reinforcing in place, A615 Gr 60, walls, #3 to #7	0.7	ton	698.35	508	1,250.00	909				1,948.3	ton	1,417
0080	Reinforcing in place, A615 Gr 60, walls, #3 to #7	1.3	ton	698.35	928	1,250.00	1,662				1,948.3	ton	2,590
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	568.2	lb	1.44	821	2.49	1,415				3.9	lb	2,236

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	757.7	lb	1.44	1,094	2.49	1,887				3.9	lb	2,981
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	387.3	lb	1.44	559	2.49	964				3.9	lb	1,524
0200	Reinforcing in place, unloading & sorting, add to above	1.0	ton	37.29	38				8		45.0	ton	46
0200	Reinforcing in place, unloading & sorting, add to above	1.7	ton	37.29	64				13		45.0	ton	77
0200	Reinforcing in place, unloading & sorting, add to above	0.7	ton	37.29	26				5		45.0	ton	31
0210	Reinforcing in place, crane cost for handling, add to above	1.0	ton	106.53	108				22		128.7	ton	130
0210	Reinforcing in place, crane cost for handling, add to above	1.7	ton	106.53	182				38		128.7	ton	220
0210	Reinforcing in place, crane cost for handling, add to above	0.7	ton	106.53	73				15		128.7	ton	89
03150 - Concrete, ready mix													
0030	Concrete, ready mix, regular weight, 4000 psi	4.9	cuyd			125.00	617				125.0	cuyd	617
0030	Concrete, ready mix, regular weight, 4000 psi	8.9	cuyd			125.00	1,111				125.0	cuyd	1,111
0030	Concrete, ready mix, regular weight, 4000 psi	4.9	cuyd			125.00	617				125.0	cuyd	617
03170 - Placing concrete													
0120	Placing conc, incl vib, slab on grade, slab over 6" thick, pumped	4.9	cuyd	18.92	93				20		23.1	cuyd	114
0130	Placing conc, incl vib, walls, 8" thick, pumped	8.9	cuyd	35.01	311				68		42.7	cuyd	379
03180 - Finishing floors													
0030	Finishing floors, monolithic, screed, float & broom finish	200.0	sqft	0.71	143						0.7	sqft	143
0030	Finishing floors, monolithic, screed, float & broom finish	200.0	sqft	0.71	143						0.7	sqft	143
03190 - Finishing walls													
0010	Finishing walls, break ties & patch voids	360.0	sqft	0.83	300	0.03	11				0.9	sqft	311
0020	Finishing walls, carborundum rub, wet rub	400.0	sqft	2.57	1,028	0.03	13				2.6	sqft	1,040
	CONCRETE Total				**14,058**		**12,541**		**191**				**26,790**
08 - DOORS and WINDOWS													
08060 - Floor, Industrial													
0080	Floor, indl, alum, 300 psf L.L., dbl leaf, 4' x 4' opening	1.0	opng	209.50	210	1,475.00	1,475				1,684.5	opng	1,685
0090	Floor, indl, alum, 300 psf L.L., dbl leaf, 4' x 8' opening	1.0	opng	523.76	524	2,920.00	2,920				3,443.8	opng	3,444
	DOORS and WINDOWS Total				**733**		**4,395**						**5,128**
09 - FINISHES													
09000 - B & C Div 9 Coating Systems													
0030	Coatings & paints, B & C coating system E-3	200.0	sqft	0.46	93	0.86	172				1.3	sqft	265
	FINISHES Total				**93**		**172**						**265**
15 - MECHANICAL													
15010 - Misc. Mechanical													
0010	Misc pipe, valve, fitting, coupling - allowance	1.0	each	250.00	250	1,500.00	1,500				1,750.0	each	1,750
15030 - Pipe,watr dstr,ductl iron													

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0450B	Piping, water dist, DI, cement lined, 18' L, restrained jt, 30" dia	20.0	lnft	17.81	356	155.77	3,115		90		178.1	lnft	3,562
15031 - DIP Fittings													
2855B	Piping, fittings, wye or tee, 30" diameter	3.0	each	760.92	2,283	4,300.00	12,900		599		5,260.6	each	15,782
15032 - DIP Flanges, Bolts and Gaskets													
0180	Pipe, st fitngs, gskt & bolt set, 150#, 30" pipe size	10.0	each	705.60	7,056	208.00	2,080				913.6	each	9,136
15315 - Expansion couplings													
0950	Pipe, ftngs, Dbl Ball Flex Tend, 30"	1.0	each	1,234.80	1,235	44,000.00	44,000				45,234.8	each	45,235
	MECHANICAL Total				**11,180**		**63,596**		**690**				**75,465**
16 - ELECTRICAL													
16195 - Electrical & Instrument													
0101	Electrical & Instrumentation Allowance	1.0	lsum					5,000			5,000.0	lsum	5,000
	ELECTRICAL Total							**5,000**					**5,000**
17 - INSTRUMENTATION													
17080 - FLOW INSTRUMENTS													
0100	Mag meter, flg., 30"	1.0	each	493.92	494	25,000.00	25,000				25,493.9	each	25,494
	INSTRUMENTATION Total				**494**		**25,000**						**25,494**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1105 - 2.75 MG RESERVOIR				363,056		87,668	3,727,500	213,355	396,320			4,787,898
02 - SITE CONSTRUCTION													
02160 - Rubbish handling													
9999	Dump Charge, tipping fee, dirt spoils	19,354.0	ton							387,080	20.0	ton	387,080
9999	Dump Charge, tipping fee, dirt spoils	160.0	ton							3,200	20.0	ton	3,200
9999	Dump Charge, tipping fee, dirt spoils	302.0	ton							6,040	20.0	ton	6,040
02310 - Fine grade													
0130	Fine grade, finishing grading slopes, gentle	6,667.0	sqyd	0.11	707				396		0.2	sqyd	1,103
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	11,621.0	cuyd	0.82	9,510				13,651		2.0	cuyd	23,161
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	198.0	cuyd	0.82	162				233		2.0	cuyd	395
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	143.0	cuyd	8.89	1,271	32.03	4,581		269		42.8	cuyd	6,120
0010	Bedding, crushed stone 3/4" to 1/2"	232.0	cuyd	8.89	2,062	32.03	7,431		436		42.8	cuyd	9,929
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	704.0	cuyd	2.07	1,455				210		2.4	cuyd	1,665
0030	Compaction, vibratory plate, 8" lifts, common fill	14,840.0	cuyd	2.07	30,671				4,423		2.4	cuyd	35,095
0030	Compaction, vibratory plate, 8" lifts, common fill	32.0	cuyd	2.07	66				10		2.4	cuyd	76
0030	Compaction, vibratory plate, 8" lifts, common fill	44.0	cuyd	2.07	91				13		2.4	cuyd	104
0030	Compaction, vibratory plate, 8" lifts, common fill	178.0	cuyd	2.07	368				53		2.4	cuyd	421
0040	Compaction, vibratory plate, 8" lifts, select fill	123.0	cuyd	1.91	235				34		2.2	cuyd	269
0040	Compaction, vibratory plate, 8" lifts, select fill	200.0	cuyd	1.91	383				55		2.2	cuyd	438
02390 - Excvtng,bulk bank measure													
0010	Excavating, bulk bank measure, backhoe, hyd, 1-1/2 CY cap. = 100 CY/hr	32,120.0	cuyd	1.32	42,456				25,623		2.1	cuyd	68,080
02450 - Excavating, trench													
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	128.0	cuyd	1.96	251				151		3.1	cuyd	402
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	400.0	cuyd	1.96	783				473		3.1	cuyd	1,256
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	19,354.0	cuyd	6.50	125,817				138,260		13.6	cuyd	264,077
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	160.0	cuyd	6.50	1,040				1,143		13.6	cuyd	2,183
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	302.0	cuyd	6.50	1,963				2,157		13.6	cuyd	4,121
0900	Loading Trucks, F.E. Loader, 3 C.Y.	19,354.0	cuyd	0.76	14,633				7,575		1.1	cuyd	22,208
0900	Loading Trucks, F.E. Loader, 3 C.Y.	160.0	cuyd	0.76	121				63		1.1	cuyd	184
0900	Loading Trucks, F.E. Loader, 3 C.Y.	302.0	cuyd	0.76	228				118		1.1	cuyd	347
02470 - Soil stabilization													

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0010	Soil stabilization, geotextile fabric, woven, 200 lb. tensil strength	461.0	sqyd	0.33	152	2.07	955				2.4	sqyd	1,108
02490 - Erosion control													
0040	Erosion control, silt fence, polypropylene, 3' high	1,200.0	lnft	0.87	1,044	1.00	1,200				1.9	lnft	2,244
0040	Erosion control, silt fence, polypropylene, 3' high-remove	1,200.0	lnft	0.87	1,044	0.34	408				1.2	lnft	1,453
02600 - Base course													
0020	Base course, large areas, crushed 3/4" stone, compacted to 6" deep	4,224.0	sqyd	0.77	3,254	5.41	22,832		2,929		6.9	sqyd	29,015
02840 - Landscaping													
0340	Seeding, hydro or air seeding for lg areas, W/ wood fiber mulch added	6,667.0	sqyd	0.16	1,046	0.22	1,482		410		0.4	sqyd	2,937
	SITE CONSTRUCTION Total				**240,815**		**38,890**		**198,683**	**396,320**			**874,708**
03 - CONCRETE													
03160 - Concrete in place													
0950	2.75 MG Reservoir - Complete - Subcontract	1.0	lsum					3,712,500			3,712,500.0	lsum	3,712,500
	CONCRETE Total							**3,712,500**					**3,712,500**
07 - THERMAL/MOIST PROTECTION													
07030 - Membrane waterproofing													
0900	Membrane waterproofing, polyethelene, 6 mils	38,013.0	sqft	1.31	49,706	0.17	6,462		5,160		1.6	sqft	61,328
0950	Membrane waterproofing, polyethelene, 30 mils	38,013.0	sqft	1.35	51,481	0.40	15,205		5,160		1.9	sqft	71,846
	THERMAL/MOIST PROTECTION Total				**101,187**		**21,667**		**10,321**				**133,175**
15 - MECHANICAL													
15030 - Pipe,watr dstr,ductl iron													
0230	Piping, pipe, D.I.C.L., tyton, 12" diameter	800.0	lnft	14.36	11,490	25.12	20,100		3,015		43.3	lnft	34,606
15031 - DIP Fittings													
0060	Piping, water dist, DI, 90< bend or elbow, 12" dia	12.0	each	218.24	2,619	350.00	4,200		687		625.5	each	7,506
15115 - Pipe,subdraing,plastic													
0020	Piping, subdrainage, perforated PVC, 6" dia	691.0	lnft	8.72	6,023	1.69	1,171		649		11.3	lnft	7,842
15255 - Valves, iron body													
0180	Valves, iron body, butterfly, lug type, 200 PSI, gear operated, 12"	2.0	each	460.99	922	820.00	1,640				1,281.0	each	2,562
	MECHANICAL Total				**21,054**		**27,111**		**4,351**				**52,516**
16 - ELECTRICAL													
16195 - Electrical & Instrument													
0101	Electrical & Instrumentation Allowance	1.0	lsum					15,000			15,000.0	lsum	15,000
	ELECTRICAL Total							**15,000**					**15,000**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1106 - RESERVOIR DISCHARGE VAULT				39,984		108,818	30,000	8,486	5,400			192,688
01 - GENERAL REQUIREMENTS													
01090 - Scaffolding													
0790	Scaffold,h.d. shoring for suspended slab forms,fl area to 8'-2" H, 3 u	2.0	csf	50.35	101	10.45	21				60.8	csf	122
	GENERAL REQUIREMENTS Total				101		21						122
02 - SITE CONSTRUCTION													
02160 - Rubbish handling													
9999	Dump Charge, tipping fee, dirt spoils	270.0	ton							5,400	20.0	ton	5,400
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	678.0	cuyd	0.82	555				796		2.0	cuyd	1,351
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	15.0	cuyd	8.89	133	32.03	480		28		42.8	cuyd	642
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	10.0	cuyd	2.07	21				3		2.4	cuyd	24
0030	Compaction, vibratory plate, 8" lifts, common fill	610.0	cuyd	2.07	1,261				182		2.4	cuyd	1,443
0040	Compaction, vibratory plate, 8" lifts, select fill	13.0	cuyd	1.91	25				4		2.2	cuyd	28
02420 - Excavating, structural													
0040	Excavating, structural, mach excav, com earth, hyd backhoe, 1-1/2 CY b	758.0	cuyd	7.34	5,567				3,360		11.8	cuyd	8,926
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	270.0	cuyd	6.50	1,755				1,929		13.6	cuyd	3,684
0900	Loading Trucks, F.E. Loader, 3 C.Y.	270.0	cuyd	0.76	204				106		1.1	cuyd	310
02570 - Catch basins or manholes													
0140	Wet Well, conc, precast, 10' I.D.	20.0	vlf	88.28	1,766	610.00	12,200		956		746.1	vlf	14,922
	SITE CONSTRUCTION Total				11,286		12,680		7,363	5,400			36,730
03 - CONCRETE													
03040 - Fip,elevated slabs													
0010	Forms in place, elev slab, flat plate plywd, to 15' high	200.0	sqft	5.24	1,048	4.53	905				9.8	sqft	1,953
0050	Forms in place, elev slab, curb forms, wood, 6"-12" high	40.0	sfca	8.65	346	1.62	65				10.3	sfca	411
03090 - Forms place, slab grade													
0030	Forms in place, SOG, edge forms, over 12", wood	40.0	sfca	5.07	203	2.63	105				7.7	sfca	308
03110 - Forms in place, walls													
0080	Forms in place, walls, job built plyform, 8-16' high	720.0	sfca	7.90	5,686	2.28	1,641				10.2	sfca	7,326
03130 - Reinforcing in place													
0050	Reinforcing in place, A615 Gr 60, elevated slabs, #4 to #7	0.5	ton	722.43	358	1,250.00	620				1,972.4	ton	978
0080	Reinforcing in place, A615 Gr 60, walls, #3 to #7	0.7	ton	698.35	508	1,250.00	909				1,948.3	ton	1,417

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0080	Reinforcing in place, A615 Gr 60, walls, #3 to #7	1.3	ton	698.35	928	1,250.00	1,662				1,948.3	ton	2,590
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	568.2	lb	1.44	821	2.49	1,415				3.9	lb	2,236
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	757.7	lb	1.44	1,094	2.49	1,887				3.9	lb	2,981
0130	Reinforcing in place, A615 Gr 60, dowels, longer and heavier dowels	387.3	lb	1.44	559	2.49	964				3.9	lb	1,524
0200	Reinforcing in place, unloading & sorting, add to above	1.0	ton	37.29	38				8		45.0	ton	46
0200	Reinforcing in place, unloading & sorting, add to above	1.7	ton	37.29	64				13		45.0	ton	77
0200	Reinforcing in place, unloading & sorting, add to above	0.7	ton	37.29	26				5		45.0	ton	31
0210	Reinforcing in place, crane cost for handling, add to above	1.0	ton	106.53	108				22		128.7	ton	130
0210	Reinforcing in place, crane cost for handling, add to above	1.7	ton	106.53	182				38		128.7	ton	220
0210	Reinforcing in place, crane cost for handling, add to above	0.7	ton	106.53	73				15		128.7	ton	89
03150 - Concrete, ready mix													
0030	Concrete, ready mix, regular weight, 4000 psi	4.9	cuyd			125.00	617				125.0	cuyd	617
0030	Concrete, ready mix, regular weight, 4000 psi	8.9	cuyd			125.00	1,111				125.0	cuyd	1,111
0030	Concrete, ready mix, regular weight, 4000 psi	4.9	cuyd			125.00	617				125.0	cuyd	617
03170 - Placing concrete													
0120	Placing conc, incl vib, slab on grade, slab over 6" thick, pumped	4.9	cuyd	18.92	93				20		23.1	cuyd	114
0130	Placing conc, incl vib, walls, 8" thick, pumped	8.9	cuyd	35.01	311				68		42.7	cuyd	379
03180 - Finishing floors													
0030	Finishing floors, monolithic, screed, float & broom finish	200.0	sqft	0.71	143						0.7	sqft	143
0030	Finishing floors, monolithic, screed, float & broom finish	200.0	sqft	0.71	143						0.7	sqft	143
03190 - Finishing walls													
0010	Finishing walls, break ties & patch voids	360.0	sqft	0.83	300	0.03	11				0.9	sqft	311
0020	Finishing walls, carborundum rub, wet rub	400.0	sqft	2.57	1,028	0.03	13				2.6	sqft	1,040
	CONCRETE Total				**14,058**		**12,541**		**191**				**26,790**
08 - DOORS and WINDOWS													
08060 - Floor, industrial													
0080	Floor, indl, alum, 300 psf L.L., dbl leaf, 4' x 4' opening	1.0	opng	209.50	210	1,475.00	1,475				1,684.5	opng	1,685
0090	Floor, indl, alum, 300 psf L.L., dbl leaf, 4' x 8' opening	1.0	opng	523.76	524	2,920.00	2,920				3,443.8	opng	3,444
	DOORS and WINDOWS Total				**733**		**4,395**						**5,128**
09 - FINISHES													
09000 - B & C Div 9 Coating Systems													
0030	Coatings & paints, B & C coating system E-3	200.0	sqft	0.46	93	0.86	172				1.3	sqft	265
	FINISHES Total				**93**		**172**						**265**
11 - EQUIPMENT													
11110 - Pumps submersible													

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0035	Wastewater, submersible,1100 GPM gpm,guide rails, base elbow	2.0	each	2,500.00	5,000	30,000.00	60,000		500		32,750.0	each	65,500
	EQUIPMENT Total				**5,000**		**60,000**		**500**				**65,500**
15 - MECHANICAL													
15010 - Misc. Mechanical													
0010	Misc pipe, valve, fitting, coupling - allowance	1.0	each	250.00	250	1,500.00	1,500				1,750.0	each	1,750
15030 - Pipe,watr dstr,ductl iron													
0020	Piping, water dist, DI, cement lined, CL 50, 18' L, mech jt, 6" dia	60.0	lnft	14.36	862	16.45	987		226		34.6	lnft	2,075
0051	Piping, water dist, DI, cement lined, CL 350, 18' L, mech jt, 12" dia	20.0	lnft	21.53	431	23.12	462		34		46.3	lnft	927
15031 - DIP Fittings													
0030	Piping, water dist, DI, 90< bend or elbow, 6" dia	10.0	each	137.28	1,373	72.60	726				209.9	each	2,099
0180	Piping, fittings, wye or tee, 12" diameter	2.0	each	327.36	655	1,500.00	3,000		172		1,913.3	each	3,827
15032 - DIP Flanges, Bolts and Gaskets													
0080	Stl ftg, gskt & bolt set, 150#, 6" pipe	28.0	each	82.32	2,305	13.55	379				95.9	each	2,684
15280 - Valves, plug													
0140	Valves, semi-steel, lubricated plug valve, flanged, 200 psi, 6" pipe	2.0	each	460.99	922	650.00	1,300				1,111.0	each	2,222
15285 - Valves, steel													
0050	Valves, steel, cast, chk valve, swing type, 150 lb., flanged, 6" size	2.0	each	460.99	922	1,600.00	3,200				2,061.0	each	4,122
15300 - Automatic air vent													
0120	Auto air vent, FS body, SS internals, float type, 1" inl, 1000 psi	2.0	each	74.09	148	1,150.00	2,300				1,224.1	each	2,448
	MECHANICAL Total				**7,867**		**13,855**		**432**				**22,153**
16 - ELECTRICAL													
16195 - Electrical & Instrument													
0101	Electrical & Instrumentation Allowance	1.0	lsum					30,000			30,000.0	lsum	30,000
	ELECTRICAL Total							**30,000**					**30,000**
17 - INSTRUMENTATION													
17080 - FLOW INSTRUMENTS													
0070	Mag Meters, 6"	1.0	each	845.84	846	5,154.06	5,154				5,999.9	each	6,000
	INSTRUMENTATION Total				**846**		**5,154**						**6,000**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1107 - 8-INCH FORCEMAIN				28,297		32,308		10,190	6,408			77,203
01 - GENERAL REQUIREMENTS													
01120 - Barricades													
0010	Traffic Control Devices, Signs, Barricades-common trench	4.0	day			200.00	800				200.0	day	800
0010	Traffic Control - Flagperson-common trench	8.0	day	380.64	3,045						380.6	day	3,045
0010	Traffic Control Devices, Signs, Barricades-street crossing	2.0	day			200.00	400				200.0	day	400
0010	Traffic Control - Flagperson-street crossing	4.0	day	380.64	1,523						380.6	day	1,523
01200 - General equipment rental													
0360	Rent trench box, 9500 lbs, 8'x 20'	3.0	day						720		240.0	day	720
0370	Rent trench box, 11,000 lbs, 8'x 24'	3.6	day						976		271.2	day	976
0390	8'X10' Trench Plate	10.0	mo						1,814		181.4	mo	1,814
	GENERAL REQUIREMENTS Total				4,568		1,200		3,511				9,278
02 - SITE CONSTRUCTION													
02060 - Site demolition													
B0171	Site dml, pavement removal, cold milling, 1" to 3", 5,000 to 10,000 sy	48.0	sqyd	0.53	25				56		1.7	sqyd	82
B0171	Site dml, pavement removal, cold milling, 1" to 3", 5,000 to 10,000 sy	90.7	sqyd	0.53	48				107		1.7	sqyd	154
02160 - Rubbish handling													
9999	Dump Charge, tipping fee, dirt spoils	17.0	ton							340	20.0	ton	340
9999	Dump Charge, tipping fee, dirt spoils	303.4	ton							6,068	20.0	ton	6,068
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	99.4	cuyd	0.82	81				117		2.0	cuyd	198
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	610.8	cuyd	0.82	500				717		2.0	cuyd	1,217
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	6.0	cuyd	8.89	53	32.03	192		11		42.8	cuyd	257
0010	Bedding, crushed stone 3/4" to 1/2"	166.3	cuyd	8.89	1,478	32.03	5,328		312		42.8	cuyd	7,118
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	4.0	cuyd	2.07	8				1		2.4	cuyd	9
0030	Compaction, vibratory plate, 8" lifts, common fill	89.6	cuyd	2.07	185				27		2.4	cuyd	212
0030	Compaction, vibratory plate, 8" lifts, common fill	40.6	cuyd	2.07	84				12		2.4	cuyd	96
0030	Compaction, vibratory plate, 8" lifts, common fill	545.4	cuyd	2.07	1,127				163		2.4	cuyd	1,290
0040	Compaction, vibratory plate, 8" lifts, select fill	6.0	cuyd	1.91	11				2		2.2	cuyd	13
0040	Compaction, vibratory plate, 8" lifts, select fill	149.6	cuyd	1.91	286				41		2.2	cuyd	328
02450 - Excavating, trench													
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	98.0	cuyd	1.96	192				116		3.1	cuyd	308
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	924.7	cuyd	1.96	1,810				1,092		3.1	cuyd	2,903

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	17.0	cuyd	6.50	111				121		13.6	cuyd	232
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr - ac milling	16.0	cuyd	6.50	104				114		13.6	cuyd	218
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	303.4	cuyd	6.50	1,972				2,167		13.6	cuyd	4,139
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr - ac milling	30.2	cuyd	6.50	197				216		13.6	cuyd	413
0900	Loading Trucks, F.E. Loader, 3 C.Y.	17.0	cuyd	0.76	13				7		1.1	cuyd	20
0900	Loading Trucks, F.E. Loader, 3 C.Y.- ac milling	16.0	cuyd	0.76	12				6		1.1	cuyd	18
0900	Loading Trucks, F.E. Loader, 3 C.Y.	303.4	cuyd	0.76	229				119		1.1	cuyd	348
0900	Loading Trucks, F.E. Loader, 3 C.Y.- ac milling	30.2	cuyd	0.76	23				12		1.1	cuyd	35
02600 - Base course													
0040	Base course, large areas, crushed 3/4" stone, compacted to 12" deep	48.0	sqyd	0.91	44	10.76	517		40		12.5	sqyd	600
0040	Base course, large areas, crushed 3/4" stone, compacted to 12" deep	90.7	sqyd	0.91	83	10.76	976		75		12.5	sqyd	1,134
02610 - Asphitc concrete pavement													
0110	Asphaltic conc pavement, pavement replacement over trench, 4" thick	48.0	sqyd	37.35	1,793	18.00	864		88		57.2	sqyd	2,745
0110	Asphaltic conc pavement, pavement replacement over trench, 4" thick	90.7	sqyd	37.35	3,388	18.00	1,633		167		57.2	sqyd	5,188
02640 - Lines on pav't													
0020	Lines on pvmt, acrylic waterborne, white or yellow, 6"wide	516.0	lnft	0.23	120	0.16	83		22		0.4	lnft	224
	SITE CONSTRUCTION Total				**13,978**		**9,592**		**5,928**	**6,408**			**35,907**
15 - MECHANICAL													
15010 - Misc. Mechanical													
0410	Connect to existing MH, 8" DIP	1.0	each	987.84	988	200.00	200		150		1,337.8	each	1,338
15030 - Pipe,watr dstr,ductl iron													
0031	Piping, water dist, DICL 18' L, mech jt, 8" dia class 350	907.0	lnft	8.50	7,710	23.12	20,965		601		32.3	lnft	29,276
15031 - DIP Fittings													
0040	Piping, water dist, DI, 90< bend or elbow, 8" dia	1.0	each	164.68	165	350.00	350				514.7	each	515
15715 - Piping, testing													
0100	Nondestructive hydraulic pressure test, 8"	1.0	each	889.04	889						889.0	each	889
	MECHANICAL Total				**9,751**		**21,515**		**751**				**32,017**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1108 - 12-INCH FORCEMAIN				**36,570**		**71,631**		**15,388**	**9,800**			**133,390**
01 - GENERAL REQUIREMENTS													
01120 - Barricades													
0010	Traffic Control Devices, Signs, Barricades - common trench	5.0	day			200.00	1,000				200.0	day	1,000
0010	Traffic Control - Flagperson - common trench	10.0	day	380.64	3,806						380.6	day	3,806
0010	Traffic Control Devices, Signs, Barricades-street crossing	2.0	day			200.00	400				200.0	day	400
0010	Traffic Control - Flagperson-street crossing	4.0	day	380.64	1,523						380.6	day	1,523
01200 - General equipment rental													
0360	Rent trench box, 9500 lbs, 8'x 20'	3.0	day						720		240.0	day	720
0370	Rent trench box, 11,000 lbs, 8'x 24'	5.4	day						1,464		271.2	day	1,464
0390	8'X10' Trench Plate	10.0	mo						1,814		181.4	mo	1,814
	GENERAL REQUIREMENTS Total				**5,329**		**1,400**		**3,999**				**10,728**
02 - SITE CONSTRUCTION													
02060 - Site demolition													
B0171	Site dml, pavement removal, cold milling, 1" to 3", 5,000 to 10,000 sy	83.0	sqyd	0.53	44				98		1.7	sqyd	141
B0171	Site dml, pavement removal, cold milling, 1" to 3", 5,000 to 10,000 sy	136.1	sqyd	0.53	72				160		1.7	sqyd	231
02160 - Rubbish handling													
9999	Dump Charge, tipping fee, dirt spoils	35.0	ton							700	20.0	ton	700
9999	Dump Charge, tipping fee, dirt spoils	455.0	ton							9,100	20.0	ton	9,100
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	169.4	cuyd	0.82	139				199		2.0	cuyd	338
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	916.3	cuyd	0.82	750				1,076		2.0	cuyd	1,826
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	14.0	cuyd	8.89	124	32.03	448		26		42.8	cuyd	599
0010	Bedding, crushed stone 3/4" to 1/2"	249.5	cuyd	8.89	2,217	32.03	7,991		468		42.8	cuyd	10,677
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	8.0	cuyd	2.07	17				2		2.4	cuyd	19
0030	Compaction, vibratory plate, 8" lifts, common fill	152.6	cuyd	2.07	315				45		2.4	cuyd	361
0030	Compaction, vibratory plate, 8" lifts, common fill	60.8	cuyd	2.07	126				18		2.4	cuyd	144
0030	Compaction, vibratory plate, 8" lifts, common fill	818.3	cuyd	2.07	1,691				244		2.4	cuyd	1,935
0040	Compaction, vibratory plate, 8" lifts, select fill	12.0	cuyd	1.91	23				3		2.2	cuyd	26
0040	Compaction, vibratory plate, 8" lifts, select fill	224.5	cuyd	1.91	430				62		2.2	cuyd	492
02450 - Excavating, trench													
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	175.0	cuyd	1.96	343				207		3.1	cuyd	549
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	1,387.0	cuyd	1.96	2,715				1,639		3.1	cuyd	4,354

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	35.0	cuyd	6.50	228				250		13.6	cuyd	478
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr - ac milling	27.7	cuyd	6.50	180				198		13.6	cuyd	378
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	455.0	cuyd	6.50	2,958				3,251		13.6	cuyd	6,209
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr - ac milling	45.4	cuyd	6.50	295				324		13.6	cuyd	619
0900	Loading Trucks, F.E. Loader, 3 C.Y.	35.0	cuyd	0.76	26				14		1.1	cuyd	40
0900	Loading Trucks, F.E. Loader, 3 C.Y.- ac milling	27.7	cuyd	0.76	21				11		1.1	cuyd	32
0900	Loading Trucks, F.E. Loader, 3 C.Y.	455.0	cuyd	0.76	344				178		1.1	cuyd	522
0900	Loading Trucks, F.E. Loader, 3 C.Y.- ac milling	45.4	cuyd	0.76	34				18		1.1	cuyd	52
02600 - Base course													
0040	Base course, large areas, crushed 3/4" stone, compacted to 12" deep	83.0	sqyd	0.91	76	10.76	893		68		12.5	sqyd	1,038
0040	Base course, large areas, crushed 3/4" stone, compacted to 12" deep	136.1	sqyd	0.91	124	10.76	1,464		112		12.5	sqyd	1,701
02610 - Asphltc concrete pavement													
0110	Asphaltic conc pavement, pavement replacement over trench, 4" thick	83.0	sqyd	37.35	3,101	18.00	1,494		152		57.2	sqyd	4,748
0110	Asphaltic conc pavement, pavement replacement over trench, 4" thick	136.1	sqyd	37.35	5,083	18.00	2,449		250		57.2	sqyd	7,782
02640 - Lines on pav't													
0020	Lines on pvmt, acrylic waterborne, white or yellow, 6"wide	774.0	lnft	0.23	179	0.16	124		33		0.4	lnft	337
	SITE CONSTRUCTION Total				**21,654**		**14,865**		**9,107**	**9,800**			**55,426**
15 - MECHANICAL													
15030 - Pipe,watr dstr,ductl iron													
0400B	Piping, water dist, DI, cement lined, 18' L, restrained jt, 12" dia	1,400.0	lnft	5.75	8,043	38.19	53,466		2,111		45.4	lnft	63,620
15031 - DIP Fittings													
0060	Piping, water dist, DI, 90< bend or elbow, 12" dia	2.0	each	218.24	436	700.00	1,400		115		975.5	each	1,951
0186B	Piping, fittings, 45< bend, 12" dia	1.0	each	218.24	218	500.00	500		57		775.5	each	776
15715 - Piping, testing													
0100	Nondestructive hydraulic pressure test, 12"	1.0	each	889.04	889						889.0	each	889
	MECHANICAL Total				**9,587**		**55,366**		**2,283**				**67,236**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1109 - 30-INCH FORCEMAIN				104,521		403,679		43,390	35,392			586,982
01 - GENERAL REQUIREMENTS													
01120 - Barricades													
0010	Traffic Control Devices, Signs, Barricades - common trench	21.0	day			200.00	4,200				200.0	day	4,200
0010	Traffic Control - Flagperson - common trench	42.0	day	380.64	15,987						380.6	day	15,987
01200 - General equipment rental													
0370	Rent trench box, 11,000 lbs, 8'x 24'	15.0	day						4,068		271.2	day	4,068
0390	8'X10' Trench Plate	20.0	mo						3,629		181.4	mo	3,629
	GENERAL REQUIREMENTS Total				15,987		4,200		7,697				27,884
02 - SITE CONSTRUCTION													
02060 - Site demolition													
B0171	Site dml, pavement removal, cold milling, 1" to 3", 5,000 to 10,000 sy	529.2	sqyd	0.53	278				622		1.7	sqyd	900
02160 - Rubbish handling													
9999	Dump Charge, tipping fee, dirt spoils	1,769.6	ton							35,392	20.0	ton	35,392
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	3,563.3	cuyd	0.82	2,916				4,186		2.0	cuyd	7,102
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	970.2	cuyd	8.89	8,622	32.03	31,077		1,822		42.8	cuyd	41,521
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	236.6	cuyd	2.07	489				71		2.4	cuyd	560
0030	Compaction, vibratory plate, 8" lifts, common fill	3,182.1	cuyd	2.07	6,577				948		2.4	cuyd	7,525
0040	Compaction, vibratory plate, 8" lifts, select fill	872.9	cuyd	1.91	1,671				241		2.2	cuyd	1,912
02450 - Excavating, trench													
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	5,393.9	cuyd	1.96	10,559				6,373		3.1	cuyd	16,932
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr	1,769.6	cuyd	6.50	11,504				12,642		13.6	cuyd	24,145
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 MI RT, 0.25 lds/hr - ac milling	176.4	cuyd	6.50	1,147				1,260		13.6	cuyd	2,407
0900	Loading Trucks, F.E. Loader, 3 C.Y.	1,769.6	cuyd	0.76	1,338				693		1.1	cuyd	2,031
0900	Loading Trucks, F.E. Loader, 3 C.Y.- ac milling	176.4	cuyd	0.76	133				69		1.1	cuyd	202
02600 - Base course													
0040	Base course, large areas, crushed 3/4" stone, compacted to 12" deep	529.2	sqyd	0.91	484	10.76	5,695		436		12.5	sqyd	6,614
02610 - Asphltc concrete pavement													
0110	Asphaltic conc pavement, pavement replacement over trench, 4" thick	529.2	sqyd	37.35	19,766	18.00	9,526		972		57.2	sqyd	30,263
02640 - Lines on pav't													
0020	Lines on pvmt, acrylic waterborne, white or yellow, 6"wide	3,010.0	lnft	0.23	698	0.16	482		129		0.4	lnft	1,309

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	SITE CONSTRUCTION Total				**66,181**		**46,780**		**30,462**	**35,392**			**178,815**
15 - MECHANICAL													
15030 - Pipe,watr dstr,ductl iron													
0450B	Piping, water dist, DI, cement lined, 18' L, restrained jt, 30" dia	2,225.0	lnft	8.91	19,814	155.77	346,599		5,032		166.9	lnft	371,445
15031 - DIP Fittings													
2855B	Piping, fittings,90 bend, 30" diameter	1.0	each	760.92	761	6,100.00	6,100		200		7,060.6	each	7,061
15715 - Piping, testing													
0100	Nondestructive hydraulic pressure test, 30"	1.0	each	1,778.08	1,778						1,778.1	each	1,778
	MECHANICAL Total				**22,353**		**352,699**		**5,231**				**380,284**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
	1110 - 21-INCH SEWER REPLACEMENT				109,370		83,818	53,550	24,826	8,299			279,863
01 - GENERAL REQUIREMENTS													
01120 - Barricades													
0010	Traffic Control Devices, Signs, Barricades	20.0	day			200.00	4,000				200.0	day	4,000
0010	Traffic Control - Flagperson	40.0	day	380.64	15,226						380.6	day	15,226
01200 - General equipment rental													
0350	Rent trench box 8,000 pound 8 foot by 16 foot	30.0	day						5,616		187.2	day	5,616
0390	8'X10' Trench Plate	20.0	mo						3,629		181.4	mo	3,629
	GENERAL REQUIREMENTS Total				15,226		4,000		9,245				28,470
02 - SITE CONSTRUCTION													
02060 - Site demolition													
0030	Site dml, manhole, 56103128	1.0	each	333.26	333				70		403.7	each	404
0410	Site dml, pipe removal, sewer, no excavation, 12"-16" VCP(90#/lf)	518.0	lnft	8.89	4,603				973		10.8	lnft	5,576
B0171	Site dml, pavement removal, cold milling, 1" to 3", 5,000 to 10,000 sy	403.0	sqyd	0.53	212				473		1.7	sqyd	685
02160 - Rubbish handling													
9999	Dump Charge, typical urban city, fees only, VCP	23.0	ton							759	33.0	ton	759
9999	Dump Charge, tipping fee, dirt spoils	377.0	ton							7,540	20.0	ton	7,540
02320 - Backfill													
0040	Backfill, dozer backfilling, trench, up to 300' haul, no compaction	669.0	cuyd	0.82	547				786		2.0	cuyd	1,333
02340 - Bedding													
0010	Bedding, crushed stone 3/4" to 1/2"	219.0	cuyd	8.89	1,946	32.03	7,015		411		42.8	cuyd	9,372
02360 - Compaction													
0030	Compaction, vibratory plate, 8" lifts, common fill	36.0	cuyd	2.07	74				11		2.4	cuyd	85
0030	Compaction, vibratory plate, 8" lifts, common fill	602.0	cuyd	2.07	1,244				179		2.4	cuyd	1,424
0040	Compaction, vibratory plate, 8" lifts, select fill	188.0	cuyd	1.91	360				52		2.2	cuyd	412
02450 - Excavating, trench													
0010	Excavate trench, cont ftg, no sht or dewtrg, 4'-6' D, 1-1/2 CY hyd bac	837.0	cuyd	1.96	1,638				989		3.1	cuyd	2,627
02460 - Hauling													
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 Mi RT, 0.25 lds/hr	377.0	cuyd	6.50	2,451				2,693		13.6	cuyd	5,144
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 Mi RT, 0.25 lds/hr-VCP	40.0	cuyd	6.50	260				286		13.6	cuyd	546
0060	Hauling, LCY, no loading, 20 c.y dump truck, 40 Mi RT, 0.25 lds/hr - ac milling	134.3	cuyd	6.50	873				960		13.6	cuyd	1,833
0900	Loading Trucks, F.E. Loader, 3 C.Y.	377.0	cuyd	0.76	285				148		1.1	cuyd	433
0900	Loading Trucks, F.E. Loader, 3 C.Y.-VCP	40.0	cuyd	0.76	30				16		1.1	cuyd	46
0900	Loading Trucks, F.E. Loader, 3 C.Y.- ac milling	134.3	cuyd	0.76	102				53		1.1	cuyd	154
02520 - Horizontal boring													

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit		Grand Total
0500	Pipebursting, replace with HDPE, 21" dia	182.0	lnft					50,050			275.0	lnft	50,050
0550	Pipebursting, mobilization	1.0	lsum					3,500			3,500.0	lsum	3,500
02570 - Catch basins or manholes													
0070	Manholes, concrete, precast, 5' I.D., 5' deep, replace 56103128	1.0	each	888.69	889	1,475.00	1,475		188		2,551.5	each	2,551
02600 - Base course													
0040	Base course, large areas, crushed 3/4" stone, compacted to 12" deep	403.0	sqyd	0.91	369	10.76	4,336		332		12.5	sqyd	5,037
02610 - Asphltc concrete pavement													
0110	Asphaltic conc pavement, pavement replacement over trench, 4" thick	403.0	sqyd	37.35	15,052	18.00	7,254		740		57.2	sqyd	23,046
02640 - Lines on pav't													
0020	Lines on pvmt, acrylic waterborne, white or yellow, 6"wide	700.0	lnft	0.23	162	0.16	112		30		0.4	lnft	304
	SITE CONSTRUCTION Total				**31,431**		**20,192**	**53,550**	**9,388**	**8,299**			**122,861**
11 - EQUIPMENT													
11100 - Pumps miscellaneous													
0270	Bypass pump, portable, diesel powered, 10" discharge-primary setup	4.0	week	4,445.20	17,781	1,352.85	5,411				5,798.1	week	23,192
0270	Bypass pump, portable, diesel powered, 10" discharge-standby	4.0	week	1,111.30	4,445	676.43	2,706				1,787.7	week	7,151
	EQUIPMENT Total				**22,226**		**8,117**						**30,343**
15 - MECHANICAL													
15010 - Misc. Mechanical													
0270	Misc. piping, fittings, valves, plug - sewer bypass	1.0	each	2,469.60	2,470	4,500.00	4,500				6,969.6	each	6,970
0270	Piping, connect to existing sewer manhole - 21" VCP - allowance	7.0	each	740.88	5,186	500.00	3,500				1,240.9	each	8,686
15060 - Pipe,hdpe butt fusn jnts													
0041	Piping, HDPE butt fusion jts, 10" dia - sewer bypass	2,000.0	lnft	7.18	14,358	10.55	21,100		3,239		19.3	lnft	38,697
15100 - Pipe,drng&sewg,vtrfd clay													
0080	Piping, VCP, no exc/bkfill, ex str, 21" dia	518.0	lnft	35.66	18,473	43.26	22,409		2,954		84.6	lnft	43,836
	MECHANICAL Total				**40,487**		**51,509**		**6,193**				**98,189**

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Total Price Per Unit	Grand Total
	Grand Total				1,127,073		1,630,993	4,136,296	395,116	522,794		7,812,272

Category	Percent	Amount	Hours
Labor	14.43 %	1,127,073	19,989.5
Material	20.88 %	1,630,993	
Equipment	5.06 %	395,116	7,499.3
Subcontractor	52.95 %	4,136,296	
Other	6.69 %	522,794	
Net Costs		7,812,272	
Labor Mark-up	18.00 %	202,873	
Material Mark-up	15.00 %	244,649	
Subcontractor Mark-up	5.00 %	206,815	
Equipment Mark-up	15.00 %	59,267	
Sales tax (material)	8.25 %	134,557	
Sales tax (equipment)	8.25 %	32,597	
Material Shipping & Handling	4.00 %	65,240	
Worker's Travel/Subsistence	1.00 %	11,271	
Escalation to midpoint Labor	6.00 %	67,624	
Escalation midpoint-material	7.00 %	114,169	
Escal Mid-point Subs, equip.	6.00 %	303,252	
Contractor's General Conditions	10.00 %	925,459	
Subtotal		10,180,045	
Start-up, training, O & M	1.00 %	101,800	
Subtotal		10,281,845	
Allowances	5.00 %	514,092	
Subtotal		10,795,938	
Undeveloped Design Contingency	20.00 %	2,159,188	
Subtotal		12,955,125	
Bldg Risk, Liability Auto Ins.	2.85 %	369,221	
Subtotal		13,324,346	
Performance Bond	1.00 %	133,243	
Subtotal		13,457,590	
Payment Bond	1.00 %	134,576	
Subtotal		13,592,166	
Total Estimate		13,592,166	

Initial Study/
Mitigated Negative Declaration
for
Penmar Water Quality Improvement Project
W.O. EW40019*

LA DPW
ENGINEERING
SERVING THE PRESENT; DESIGNING THE FUTURE

Bureau of Engineering
City of Los Angeles *Environmental Management Group*

May 15, 2009

TRANSMITTAL NO. 1

CITY OF LOS ANGELES

OFFICE OF THE CITY CLERK
ROOM 395, CITY HALL
LOS ANGELES, CALIFORNIA 90012

CALIFORNIA ENVIRONMENTAL QUALITY ACT

MITIGATED NEGATIVE DECLARATION

(Article I, City CEQA Guidelines)

LEAD CITY AGENCY AND ADDRESS:
Department of Public Works, Bureau of Engineering
1149 South Broadway, Suite 600, Los Angeles, CA 90015-2213

COUNCIL DISTRICT
11

PROJECT TITLE:
Penmar Water Quality Improvement Project (W.O. EW40019*)

T.G. 671-H4 to J4 & J5

PROJECT LOCATION: Penmar Recreation Center (1341 Lake Street), Penmar Golf Course, Frederick Street north of Rose Avenue, Rose Avenue from Frederick Street to just north of Penmar Avenue, Oakwood Avenue between Millwood Avenue and Rialto Court, Rialto Court south of Nowita Place, Crescent Place between Rialto Court and Palms Boulevard, and Abbot Kinney Boulevard at the intersection with Palms Boulevard, in the Los Angeles community of Venice.

DESCRIPTION: The proposed project consists of the construction of a stormwater diversion structure, primary and secondary pump station systems, a pretreatment system to screen trash, sediment, oil and grease; an underground detention reservoir, and three force mains for flow conveyance. Phase II of the project would provide further treatment for beneficial use for landscape irrigation at Penmar Golf Course, Penmar Recreation Center and/or Marine Park. Diverted flows would be conveyed to a pump station constructed within Frederick Street right-of-way northwest of the intersection with Rose Avenue. As sewer capacity allows, a portion of the diverted flow, including dry weather flow would be diverted directly to the sanitary sewer via a force main from the proposed pump station to the sanitary sewer and ultimately to the Hyperion Treatment Plant. Another portion of the wet weather flow would be diverted via a second force main to an approximately 2.75-million gallon reservoir beneath the Penmar Recreation Center Field 5. Stormwater stored in the reservoir would be held for approximately seventy-two (72) hours after a storm event passes and then discharged at a controlled rate to the sanitary sewer through a combined gravity and pump system that would be constructed adjacent to the reservoir. The project also includes minor sanitary sewer upgrades on Oakwood Avenue between Millwood Avenue and Rialto Court, on Rialto Court south of Nowita Place, Crescent Place between Rialto Court and Palms Boulevard, and on Abbot Kinney Boulevard at the intersection with Palms Boulevard. Implementation of this project would help the City meet Santa Monica Bay Beaches Dry & Wet Weather Bacteria Total Maximum Daily Loads (TMDLs) adopted by the Water Quality Control Board to protect the designated beneficial uses of the receiving waters. The project is funded by Proposition O, a $500 million Clean Water Bond Measure approved by voters November 5, 2004.

NAME AND ADDRESS OF APPLICANT IF OTHER THAN CITY AGENCY:

FINDING:
The **City Engineer** of the City of Los Angeles has determined that this project will not have a significant effect on the environment for the following reasons: **See attached initial study.**

SEE THE ATTACHED PAGES FOR ANY MITIGATION MEASURES IMPOSED

Any written objections received during the public review period are attached, together with the responses of the lead City agency.

THE INITIAL STUDY PREPARED FOR THIS PROJECT IS ATTACHED

PERSON PREPARING THIS FORM
Maria Martin
Environmental Supervisor

ADDRESS
1149 S. Broadway, Suite 600
Los Angeles, 90015-2213

TELEPHONE NUMBER
(213) 485-5753

SIGNATURE (Official)
Ara Kasparian, Ph.D., Manager
Environmental Management Group

DATE
5/18/09

:negdec.frm (1/94)

CITY OF LOS ANGELES
CALIFORNIA ENVIRONMENTAL QUALITY ACT

INITIAL STUDY

Council District: 11 Date: May 15, 2009

Lead City Agency: Department of Public Works, Bureau of Engineering

Project Title: Penmar Water Quality Improvement Project

I. INTRODUCTION

A. Purpose of an Initial Study

The California Environmental Quality Act (CEQA) was enacted in 1970 for the purpose of providing decision-makers and the public with information regarding environmental effects of proposed projects; identifying means of avoiding environmental damage; and disclosing to the public the reasons behind a project's approval even if it leads to environmental damage. The Bureau of Engineering Environmental Management Group (EMG) has determined the proposed project is subject to CEQA and no exemptions apply. Therefore, the preparation of an initial study is required.

An initial study is a preliminary analysis conducted by the lead agency, in consultation with other agencies (responsible or trustee agencies, as applicable), to determine whether there is substantial evidence that a project may have a significant effect on the environment. If the initial study concludes that the project, with mitigation, may have a significant effect on the environment, an environmental impact report should be prepared; otherwise the lead agency may adopt a negative declaration or mitigated negative declaration.

The Mitigated Negative Declaration (MND) and Initial Study (IS) contained herein have been prepared in accordance with CEQA (Public Resources Code §21000 et seq.), the State CEQA Guidelines (Title 14, California Code of Regulations, §15000 et seq.), and the City of Los Angeles CEQA Guidelines (1981, amended July 31, 2002).

B. Document Format

This MND is organized into eight sections as follows:

<u>Section I, Introduction:</u> provides an overview of the project and the CEQA environmental documentation process.

Section II, Project Description: provides a description of the project location, project background, and project components.

Section III, Existing Environment: provides a description of the existing environmental setting with focus on features of the environment which could potentially affect the proposed project or be affected by the proposed project.

Section IV, Environmental Effects/Initial Study Checklist: presents the City's Checklist for all impact areas and mandatory findings of significance. Includes discussion and identifies applicable mitigation measures.

Section V, Mitigation Measures: provides the mitigation measures that would be implemented to ensure that potential adverse impacts of the proposed project would be reduced to a less than significant level.

Section VI, Preparation and Consultation: provides a list of key personnel involved in the preparation of this report and key personnel consulted.

Section VII, Determination – Recommended Environmental Documentation: provides the recommended environmental documentation for the proposed project; and,

Section VIII, References: provides a list of reference materials used during the preparation of this report.

C. CEQA Process

Once the adoption of a negative declaration (or mitigated negative declaration) has been proposed, a public comment period opens for no less than twenty (20) days or thirty (30) days if there is state agency involvement. The purpose of this comment period is to provide public agencies and the general public an opportunity to review the initial study and comment on the adequacy of the analysis and the findings of the lead agency regarding potential environmental impacts of the proposed project. If a reviewer believes the project may have a significant effect on the environment, the reviewer should (1) identify the specific effect, (2) explain why it is believed the effect would occur, and (3) explain why it is believed the effect would be significant. Facts or expert opinion supported by facts should be provided as the basis of such comments.

After the close of the public review period, the Board of Public Works considers the negative declaration or mitigated negative declaration, together with any comments received during the public review process, and makes a recommendation to the City Council on whether or not to approve the project. One or more Council committees may then review the proposal and documents and make its own recommendation to the full City Council. The City Council is the decision-making body and also considers the negative declaration or mitigated negative declaration, together with any comments received during the public review process, in the final decision to approve or disapprove the project.   During the project approval process, persons and/or agencies may address either the Board of Public Works or the City Council regarding the project. Public notification of agenda items for the Board of Public Works, Council committees and City Council is posted 72 hours prior to the public meeting. The Council agenda can be obtained by visiting the Council and Public Services Division of the Office of the City Clerk at City Hall, 200 North Spring Street, Suite 395; by calling 213/978-1047, 213/978-1048 or TDD/TTY 213/978-1055; or via the internet at http://www.lacity.org/CLK/index.htm .

If the project is approved, the City will file a notice of determination with the County Clerk within 5 days. The notice of determination will be posted by the County Clerk within 24 hours of receipt. This begins a 30-day statute of limitations on legal challenges to the approval under CEQA. The ability to challenge the approval in court may be limited to those persons who objected to the approval of the project, and to issues which were presented to the lead agency by any person, either orally or in writing, during the public comment period.

As a covered entity under Title II of the Americans with Disabilities Act, the City of Los Angeles does not discriminate on the basis of disability and, upon request, will provide reasonable accommodation to ensure equal access to its programs, services, and activities.

II. PROJECT DESCRIPTION

A. Location

The main elements of the proposed project are located within Frederick Street north of Rose Avenue, Rose Avenue from Frederick Street to approximately 500 feet northeast of the intersection with Penmar Avenue, and within Penmar Recreation Center, a multi-use City of Los Angeles park located at 1341 Lake Street in the community of Venice. The project also includes minor sanitary sewer upgrades on Oakwood Avenue between Millwood Avenue and Rialto Court, on Rialto Court south of Nowita Place, Crescent Place (pedestrian walk) between Rialto Court and Palms Boulevard, and on Abbot Kinney Boulevard at the intersection with Palms Boulevard. Phase II proposes stormwater beneficial use at Penmar Golf Course, Penmar Recreation Center, and/or Marine Park. Refer to Figures 1 and 2.

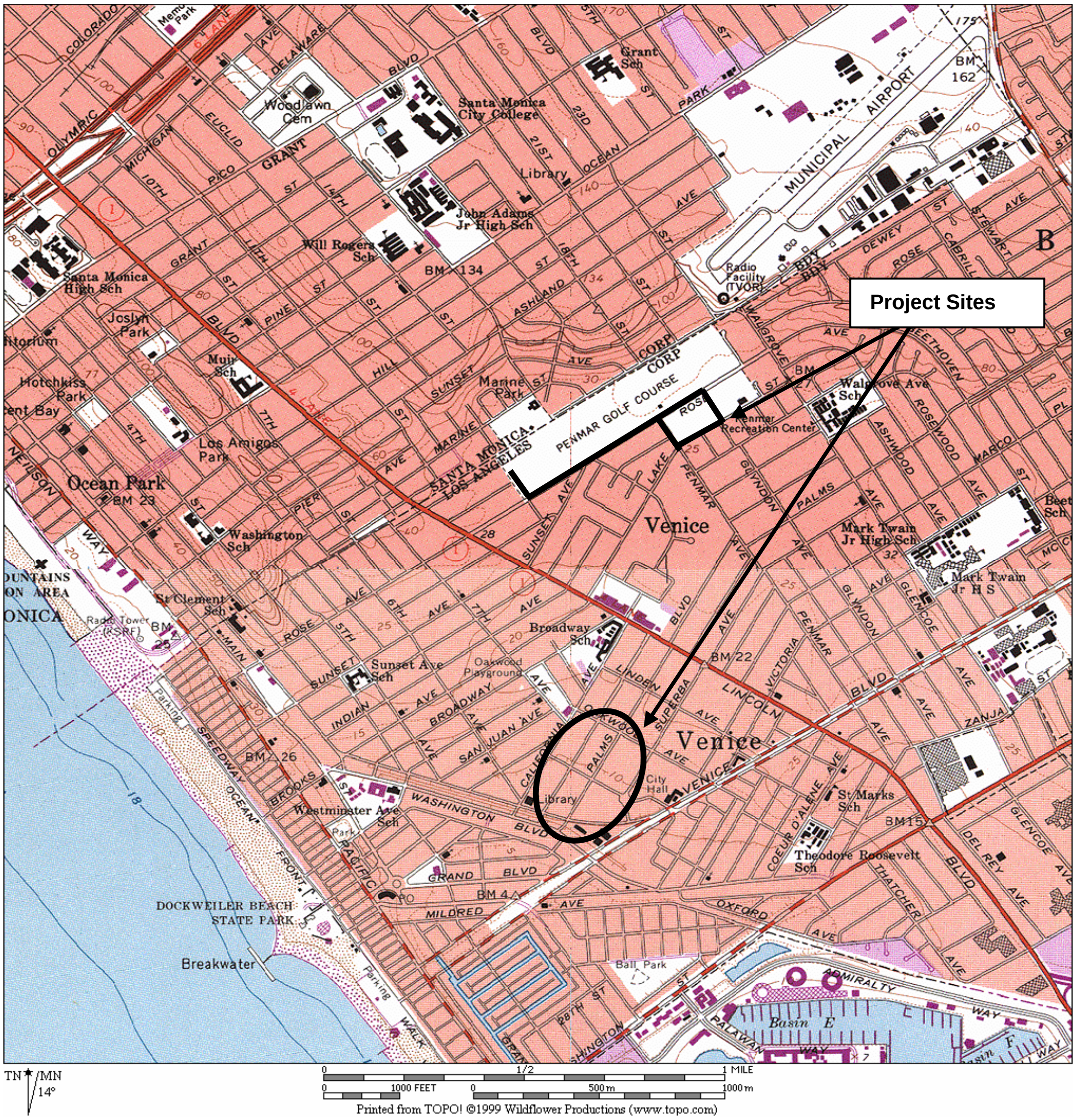


Figure 1: Project Vicinity

Figure 2: Project Location

Figure 3: Proposed Layout (Main Elements of Phase I)

B. Background

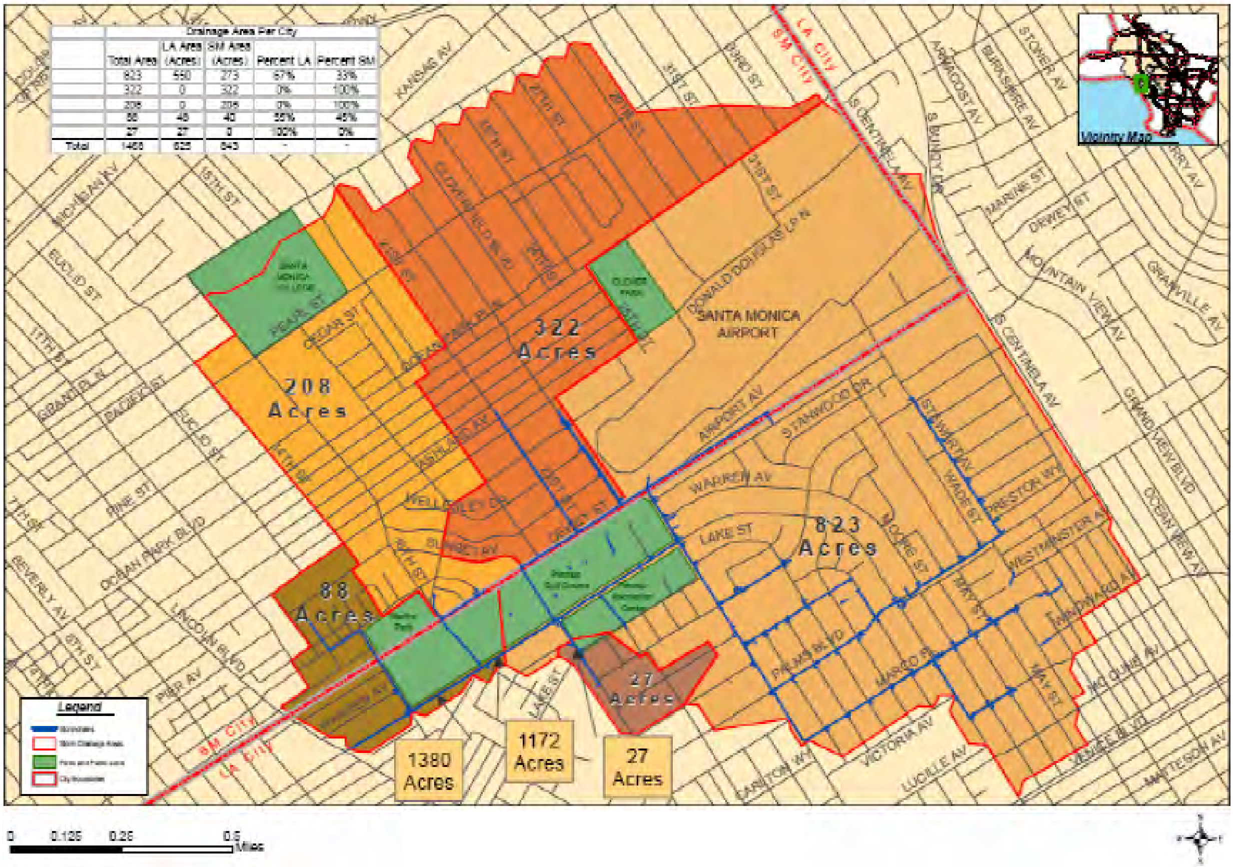
The Clean Water Act (CWA) of 1972 is the governing federal regulation for water quality in the United States. The CWA provides the legal framework for several water quality regulations, policies and programs, including National Pollutant Discharge Elimination System (NPDES), effluent limitations, water quality standards, pretreatment standards, anti-degradation policy, non-point source discharge regulation, and wetlands protection. The United States Environmental Protection Agency (USEPA) has delegated the responsibility for administration of portions of the CWA to the states, which are required to develop a list, known as the 303(d) List, of impaired water bodies within their jurisdictions and the pollutants for which they are impaired. The states must then establish a total maximum daily load (TMDL) (a maximum limit for a specific pollutant that a water body can receive and still meet water quality standards) for the listed pollutants of each impaired water body found within its region (Technical Steering Committee 2004).

The Santa Monica Bay beaches were designated as impaired and included on California's 1998 CWA 303(d) list of impaired waters due to excessive amounts of coliform bacteria. High bacteria concentrations in surface waters is an indication that water quality may not be sufficient to maintain the beneficial use of these waters for human body contact recreation (REC-1) (Technical Steering Committee 2004). The Santa Monica Bay Beaches Wet Weather Bacteria (SMBBWWB) TMDL adopted by the Los Angeles Regional Water Quality Control Board (LARWQCB) became effective July 15, 2003 and includes a number of interim compliance goals beginning in the fall of 2009. This TMDL was incorporated as an amendment to the regional Water Quality Control Plan (Basin Plan). The Basin Plan designates beneficial uses for surface and ground waters, sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's anti-degradation policy, and describes implementation programs to protect all waters in the Region.

The SMBBWWB TMDL encompasses 27 areas (sub-watersheds) that drain into the Santa Monica Bay. There are twenty-five (25) storm drains that discharge runoff from some portion of Los Angeles to Santa Monica Bay beaches. The City has embarked upon several projects to reduce the amount of bacteria-laden stormwater runoff that drains into Santa Monica Bay. The proposed project location was selected based upon project sites identified in the *Santa Monica Bay Beaches Wet Weather Bacterial TMDL Implementation Plan* (City of Los Angeles et al. 2005) and is one of various projects identified in the implementation plan intended to reduce bacteria levels along the local shoreline.

The proposed Penmar Water Quality Improvement Project is located within the Santa Monica Bay Watershed and targets a drainage area of approximately 1,468 acres (Figure 4) that drains into the existing Los Angeles County (the County) Storm Drain in Rose Avenue (henceforth referred to as the Rose Avenue Storm Drain) which ultimately drains to the Santa Monica Bay via an outlet located at the end of Rose Avenue at

Venice Beach. Urban runoff draining from this tributary area contains numerous pollutants with potential to degrade water quality and contribute to frequent exceedances of beach water quality standards that cause a significant number of beach closure days. Currently, the pollutants of primary concern are fecal indicator bacteria, which are believed to be an indicator of pathogens that pose potential human health risks in the receiving waters. The proposed project would assist in improving water quality and would support the City's efforts to comply with current and future stormwater regulations for Santa Monica Bay beaches.



Drainage Area Per City

	Total Area	LA Area (Acres)	SM Area (Acres)	Percent LA	Percent SM
	823	550	273	67%	33%
	322	0	322	0%	100%
	208	0	208	0%	100%
	88	48	40	55%	45%
	27	27	0	100%	0%
Total	1468	625	843	-	-

Figure 4: Penmar Water Quality Improvement Drainage Area

C. Purpose

The Penmar Water Quality Improvement project is funded by Proposition O, which was passed by the voters of the City of Los Angeles in 2004. Proposition O authorized the City of Los Angeles to issue a series of general obligation bonds for up to $500 million for projects to protect public health by cleaning up pollution, including bacteria and trash, in the City's watercourses, beaches and the ocean, in order to meet Federal Clean Water Act requirements. In addition, the measure provides funds for improvements to protect water quality, provide flood protection, and increase water conservation, habitat protection, and open space.

The main purpose of the proposed project is to reduce the amount of pollutants (including bacteria, oil and grease, and suspended solids) during both dry and wet weather and to improve water quality in the receiving waters. The main goals of the project are to increase the beneficial and recreational uses of the receiving waters, reduce potential risks to human safety and health, reduce beach closures, and preserve aquatic and marine habitat. Phase II of the project includes stormwater beneficial use for landscape irrigation.

D. Project Description

Project Overview and Background

Surface runoff from approximately 1,468 acres surrounding the project area (Figure 4) drains into the Rose Avenue Storm Drain and ultimately to the Santa Monica Bay via an outlet located at Venice Beach. This runoff has the potential of introducing pollutants (bacteria, oil and grease, suspended solids, metals, gasoline, and others) to the stormwater conveyance system and ultimately to the receiving waters.

Phase I of this project is designed to improve water quality by implementing Best Management Practices (BMPs) and phase II would implement water conservation through beneficial use for irrigation. Phase I of the proposed project consists of the construction of a stormwater diversion structure, a primary pump station system, an underground detention reservoir, a secondary pump system, three force mains for flow conveyance, and upgrade of four sanitary sewer segments southwest of the primary pump station (refer to Figure 2).

The proposed project would intercept and divert dry weather flow and portion of the wet weather stormwater flow from the Rose Avenue Storm Drain. Diverted flows would be conveyed to a pump station constructed within Frederick Street right-of-way northwest of the intersection with Rose Avenue. As sewer capacity allows, a portion of the flow, including dry weather flow would be diverted directly to the sanitary sewer via a force main from the proposed pump station to the sanitary sewer and ultimately to the Hyperion Treatment Plant. Portion of the wet weather flows would be diverted via a second force main to an approximately 2.75-million gallon underground reservoir that would be constructed beneath the Penmar Recreation Center Field 5. Stormwater stored in the reservoir would be held in the reservoir for approximately seventy-two (72) hours after a storm event passes and then discharged at a metered (controlled) rate to the sanitary sewer through a combined gravity and pump system that would be constructed adjacent to the reservoir.

Project Elements

Diversion Structure

The proposed project would construct a passive diversion structure to divert flow form the Rose Avenue Storm Drain within the vicinity of Frederick Street. The Rose Avenue Storm Drain consists of two 9-foot wide by 12-foot high reinforced concrete culvert boxes beneath the street right-of-way. The diversion structure would be designed to carry the required design flow and allow overflow to bypass the diversion structure. It is anticipated that a low concrete berm, approximately 2 feet high, would be constructed in a manner to ensure that it does not impede maintenance of the box culverts. An opening would be created in the interior wall, between the two box culverts, to allow stormwater to flow from one box to the other. The two-foot concrete berm would be angled at 45-degrees to direct the flow toward the openings of the box culvert walls. Two maintenance holes would be needed for access. The design of the connection to the County storm drain would be coordinated with Los Angeles County Department of Public Works. A storm drain transition structure would be constructed to divert stormwater flows to the primary pump station.

Primary Pump Station System

An underground wet well and pump station would be constructed within the Frederick Street right-of-way northwest of the intersection with Rose Avenue to lift stormwater runoff form the Rose Avenue Storm Drain to a detention reservoir beneath the Penmar Recreation Center fields. The wet well and pump station would be approximately 25 feet wide and 180-feet long. The wet well structure would be approximately 25 feet deep. The pump station would have an area designed for trash and debris removal. A bar screen would prevent trash and large debris from the Rose Avenue Storm Drain from entering the wet well area. Two access hatches would be located above this area to allow for maintenance and trash removal. The wet well is anticipated to house four constant speed pumps (five cubic feet per second (cfs) capacity each) and two discharge pumps. The four constant speed pumps would come on in sequence to pump storm flow to the underground detention reservoir. If flow continued to rise at a rate in excess of the pumping capacity, the wet well would reach capacity and excess flow would remain in the storm drain and continue to flow downstream to the current outfall. The temporary flow storage capacity within the wet well is estimated at 70,000 gallons. Maintenance access hatches would be located above the pump area.

Underground Detention Reservoir

The underground detention reservoir would be located beneath Field 5 at the southwestern area of the Penmar Recreation Center. The reservoir is anticipated to be a circular prestressed concrete reservoir approximately 180 feet in diameter and with approximately 2.75 million gallon (MG) storage capacity. The side wall depth is estimated at 17 feet. A 30-inch force main would convey flows from the primary pumping station at Frederick Street to the underground reservoir. A swing check valve on the 30-inch force main with a 12-inch tee fitting would allow a single inlet/outlet structure. A 12-inch connection would serve as a connection point to an adjacent secondary pump station system that would convey flows to a sanitary sewer line in Rose Avenue.

An inspection and maintenance access hatch and two air vents would be included in the reservoir design and sited in areas that would not interfere with the use of the field.

The reservoir design would also include an emergency overflow spillway, which would be connected to the Rose Avenue Storm Drain. The spillway would begin to receive overflow if the reservoir exceeded 16-foot depth and water began to encroach into a one-foot freeboard that would be included in the design capacity. The spillway would only come into service if the “reservoir full – pump shut off” sensor ever failed and the Primary Pumping Station on Frederick Street in turn did not shut off.

Secondary Pump Station System

An underground vault housing two pumps would be installed adjacent to reservoir. As indicated above, these pumps would convey flows from the underground detention reservoir to the sanitary sewer line in Rose Avenue. The pumps are currently estimated to have one cfs capacity each. These pumps are necessary to allow for removal of stormwater from the reservoir and “lifting” to a higher elevation for discharge into the sanitary sewer line. This pump station vault would likely consist of a pre-cast maintenance hole structure, approximately 10 feet in diameter.

Electrical Control Panel Boxes

A lockable electrical control panel box would be installed above ground in the shoulder of the Frederick Street right-of-way, adjacent to the Penmar Golf Course. The box would be a stainless steel enclosure, approximately four feet wide, two feet deep, and seven feet tall. It would house the electrical switchgear to activate the pumps within the Frederick Street Pump Station. Telemetry would also be located in this box to signal stormwater elevations and pump status to a remote facility which is staffed continuously.

A similar electrical control panel box would be installed above ground adjacent to the underground secondary pump station system by the Penmar Recreation Center Field 5.

Minor Sanitary Sewer Upgrades

The project also includes upgrading approximately 650 feet of trunk sanitary sewer west of the Rose Avenue Storm Drain Diversion. The upgrade would alleviate hydraulic constraints in the system to provide capacity on four segments of sewer pipe. Three of the four segments would be replaced with 21-inch diameter vitrified clay pipe (VCP) as follows: 250 feet of 16-inch pipe on Oakwood Avenue between Millwood Avenue and Rialto Court; 145 feet of 16-inch pipe on Rialto Court south of Nowita Place and 75 feet of 18-inch pipe on Abbot Kinney Boulevard at the intersection with Palms Boulevard. The fourth segment, 180 feet of 16-inch pipe on Crescent Place (pedestrian walk) between Rialto Court and Palms Boulevard, would be replaced with 21-inch high density polyethylene (HDPE) pipe using pipe reaming construction.

Penmar Recreation Center Field 5 Restoration

Excavated areas would be backfilled and ground cover installed after construction of the underground detention reservoir. Field 5 would be restored and the affected irrigation system would be replaced with an upgraded “smart irrigation system” that senses atmospheric conditions to prevent over-watering. Proposed landscape improvements are and would continue to be coordinated with the Department of Recreation and Parks. No tree removals are anticipated.

Phase II – Stormwater Beneficial Use for Irrigation

A disinfection system would be built within the vicinity of the underground detention reservoir to treat a portion of the stormwater flow. The treated water would be locally used for landscape irrigation at one or more of the following facilities: Penmar Golf Course, Penmar Recreation Center, and/or Marine Park. The specific treatment design and methodology would be selected during the pre-design and design stages for that phase. Disinfection would be accomplished through chlorine, ozone, or ultraviolet treatment to meet applicable RWQCB-LA and/or the Los Angeles County Public Health requirements. Depending on the disinfection methodology or technology used for bacteria treatment, additional CEQA review would be conducted prior to phase II final design.

Preliminary Construction Schedule

It is currently anticipated that Phase I construction would begin fall 2009 and Phase II construction is anticipated to begin summer 2011.

Operation and Maintenance

Operation and maintenance (O & M) would be the responsibility of the Department of Public Works Bureau of Sanitation (BOS) and Department of Recreation and Parks (RAP). The BOS would be responsible for the O & M of the BMP elements and it is anticipated that RAP would continue to maintain the park, including the landscape and the irrigation system after the improvements have been completed.

An Operations and Maintenance (O & M) program would be prepared for the Best Management Practices (BMP) and the landscape and irrigation as a part of the detailed construction phase. The program is anticipated to include maintenance recommendations provided by the manufacturers to ensure that the structural BMPs perform optimally. The proposed improvements would not change the existing use of the park or increase the park's overall size. O & M procedures would be performed in accordance with a Master Agreement between the Bureau of Engineering and BOS (Department of Public Works) and RAP for the construction and maintenance of Proposition O projects, as supplemented by the project-specific Memorandum of Understanding for this project.

Anticipated O & M activities would include, but not be limited to the following:

- Inspection and periodic trash removal from the pump station.
- Inspection and sediment removal from the tank and other system elements as applicable.
- Inspection and maintenance of the stormwater disinfection system.
- Water quality monitoring. Analytical results would help determine if modifications to the treatment systems or maintenance program were needed.

Project Actions and Approvals

The proposed project and environmental documentation, including this Initial Study/Mitigated Negative Declaration, would require approval by the City of Los Angeles Board of Public Works and City Council. Additional anticipated approvals or permits for the proposed project include, but are not limited to the following:

- State of California Coastal Commission, Coastal Development Permit
- State Water Resources Control Board/ RWQCB-LA, project review and NPDES General Construction Permit
- Los Angeles County Department of Public Works Flood Control District, permit for modification to storm drain system (under County jurisdiction)
- City of Los Angeles Department of Building and Safety, building and grading permits
- City of Los Angeles Department of Public Works, Bureau of Engineering, Local Coastal Development Permit
- City of Los Angeles Department of Transportation, Traffic Control Plan review
- City of Los Angeles Department of Recreation and Parks, project and design review

The analysis in this document assumes that, unless otherwise stated, the project will be designed, constructed and operated following all applicable laws, regulations, ordinances and formally adopted City standards (*e.g., Los Angeles Municipal Code* and Bureau of Engineering *Standard Plans*). Construction will follow the uniform practices established by the Southern California Chapter of the American Public Works Association (*e.g., Standard Specifications for Public Works Construction* and the *Work Area Traffic Control Handbook*) as specifically adapted by the City of Los Angeles (*e.g.,* The City of Los Angeles Department of Public Works Additions and Amendments to the Standard Specifications For Public Works Construction [AKA "The Brown Book," formerly Standard Plan S-610]).

III. EXISTING ENVIRONMENT

The proposed project is located within the Penmar Recreation Center and vicinity. The Penmar Recreation Center is a multi-use park located approximately twelve miles west of downtown Los Angeles at 1341 Lake Street in the Venice community. The facility is operated and maintained by the City of Los Angeles Department of Recreation and Parks (RAP). It offers seasonal sports, dance classes, cooking classes, and day camps. Existing facility features include an auditorium/gymnasium, picnic areas, tennis courts, handball courts, five (5) baseball diamonds (with associated multi-purpose fields), and lighted outdoor and indoor basketball courts. Permitted users for Field 5 include Pacific Coast Soccer Club, Venice Bulldog Pop Warner Football, Planet Social Sports, Santa Monica Rugby, and various groups from RAP Municipal Sports (Guzman 2009).

The Penmar Recreation Center and Golf Course are located within the Venice Community Plan area of the City of Los Angeles. Dewey Street marks the approximate boundary between the City of Los Angeles and the City of Santa Monica. Penmar Recreation Center is zoned for single family residential uses within a very limited height district (R1-IVLD) and the Penmar Golf Course is zoned for open space uses within a limited height district (OS-IXL)[1]. Both sites are designated for open space uses in the City's General Plan. Marine Park is located in the City of Santa Monica's designated parks (DP) zone and is designated for park uses[2]. Land uses within the proposed project site and vicinity consist primarily of open space (park and golf course areas), street right-of-way, single and multiple family residential, commercial, public facilities (schools), and airport uses (Santa Monica Municipal Airport).

Penmar Recreation Center is bounded on the northwest by Rose Avenue, Glenavon Avenue on the northeast, Penmar Avenue on the northwest, and Lake Street on the southwest. Penmar Golf Course is located on the opposite side of Rose Avenue across Penmar Recreation Center. Table 1 lists the major streets within the vicinity of the project area. Several freeways provide regional access to the project site. The Santa Monica Freeway (Interstate I-10) is approximately 1.3 miles to the north of the project site, the Santa Monica Freeway (Interstate I-405) is located approximately 2.0 miles to the east, and the Marina Expressway (SR-90) is located approximately 1.9 miles southeast from the project site.

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[1] Source: City of Los Angeles, DCP, Zone Information & Map Access System (ZIMAS) at http://zimas.lacity.org/

[2] Source: City of Santa Monica Online Property Information System (OPIS) at http://www01.smgov.net/isd/gis/interactive_maps/index.html

Table 1: Streets within the Vicinity of the Project Site

Street Name	Classification	Description	Average Daily Traffic (ADT) vehicles/day
Lincoln Blvd. bet Lake St. & Indiana Ct.	Major Highway	100 ft. ROW, 2 traffic lanes and one parking lane in each direction	53,246
Rose Ave. bet Lincoln Blvd. & Frederick St.	Secondary Highway	80 ft. or 83 ft. ROW; one traffic lane, bike lane, and parking lane in each direction plus a median lane and turn lane	11,045
Rose Ave. bet Penmar Ave. & Glenavon Ave.	Secondary Highway	80 ft. ROW; one traffic lane, bike lane, and parking lane in each direction plus a median lane and turn lane	11,720
Rose Ave. bet Walgrove Ave. & Morningside Ave.	Collector	84 ft. ROW, one lane in each direction	8,616
Penmar Ave bet Rose Ave & Lake St.	Collector	80 ft. ROW, one lane in each direction	3,842
Sunset Ave. bet Rose Ave & Flower St.	Local	60 ft. ROW, one lane in each direction at intersection only	1,187
Lake St. bet Penmar Ave. & Courtland St.	Local	50 ft. ROW, one lane in each direction	4,058
Courtland St. bet Rose Ave. & Indiana Ave.	Local	60 ft. ROW, no lane striping	642
Oakwood Ave. bet Palms Blvd. & Rialto Ct.	Local	50 ft. ROW, no lane striping	2,802
Rialto Ct. bet Shell Ave. & Crescent Ct.	Alley	15 ft. ROW	39
Crescent Pl.	“Paper” street	15 ft. ROW, no vehicular traffic, pedestrian walk	0
Palms Blvd. bet Electric Ct. & Shell Ave.	Collector	50 ft. ROW, no lane striping	1,669
Abbot Kinney Blvd. bet Palms Blvd. & Rialto Ct.	Secondary Highway	70 ft. ROW; one traffic lane and parking lane in each direction, plus median and turn lane	21,902

Source: *City of Los Angeles Penmar Water Quality and Runoff Reuse Project Negative Declaration Traffic Study* (FPL and Associates, Inc. 2009), Appendix A

The project site lies within the USGS Beverly Hills and Venice Topographic Quadrangles, and as indicated above, within the Santa Monica Bay Watershed. The Santa Monica Bay Watershed encompasses an area of approximately 414 square miles of land. It extends from the crest of the Santa Monica Mountains on the north to the Ventura-Los Angeles County line on the west to downtown Los Angeles on the southeast. From there, it extends south and west across the Los Angeles plain to include the area east of Ballona Creek and north of the Baldwin Hills (City of Los Angeles 2004). The proposed project targets a drainage area of approximately 1,468 acres that currently drains into the Rose Avenue Storm Drain (Figure 4) and ultimately to the Santa Monica Bay at an outlet at the end of Rose Avenue at Venice Beach.

The project site is located outside of the 100-year flood plain (per FEMA Community Panels No. 060137 0077 C and 060137 0083 D, dated February 4, 1987 and December 2, 1980).

The project site is located in a relatively flat, low-lying area that drains gently to the southwest. Ground surface elevations range from approximately 25 feet above mean sea level (MSL) along the southern limits of the project site to approximately 35 feet above MSL at the northeast corner of the Penmar Golf Course. Regional maps indicate the site is underlain by younger alluvial sediments consisting of unconsolidated gravel, sand, and silty clay with interbeds of gravelly and sandy stream deposits. A terrace of marine deposits consisting of sand, pebbly sand gravel and silt is identified just north of the project site. The southwesterly portions of the site are located in an area mapped as potentially susceptible to liquefaction during a strong earthquake event. No active or potentially active faults are mapped onsite and no landslides are known to exist on the site. Groundwater beneath the site is anticipated to be encountered at depths ranging from approximately 15 to 29 feet, but could be as shallow as ten (10) feet deep. Refer to Appendix B, *Geotechnical Evaluation Pemar Water Quality Improvement Project, Los Angeles California* (Ninyo & Moore 2008).

The project site and vicinity are located within a highly developed area of the City. The Penmar Recreation Center fields and Penmar Golf course contain landscaped lawn or turf areas and ornamental trees which are regularly trimmed and maintained.

The California Department of Fish and Game Natural Diversity Database identified six sensitive plant species and eight sensitive animal species within the Beverly Hills and Venice Quadrangles. (Refer to Appendix C for the database search report.) However, based on the highly developed nature of the project area and the habitat needs of the listed species, the project site is not considered suitable habitat for any of the listed species.

IV. ENVIRONMENTAL EFFECTS/INITIAL STUDY CHECKLIST

This section documents the screening process used to identify and focus upon environmental impacts that could result from this project. The Initial Study Checklist below follows closely the form prepared by the Governor's Office of Planning and Research and was used in conjunction with the City's *CEQA Thresholds Guide* and other sources to screen and focus upon potential environmental impacts resulting from this project. Impacts are separated into the following categories:

- No Impact. This category applies when a project would not create an impact in the specific environmental issue area. A "No Impact" finding does not require an explanation when the finding is adequately supported by the cited information sources (e.g., exposure to a tsunami is clearly not a risk for projects not near the coast). A finding of "No Impact" is explained where the finding is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

- Less Than Significant Impact. This category is identified when the project would result in impacts below the threshold of significance, and would therefore be less than significant impacts.

- Less Than Significant After Mitigation. This category applies where the incorporation of mitigation measures would reduce a "Potentially Significant Impact" to a "Less Than Significant Impact." The mitigation measures are described briefly along with a brief explanation of how they would reduce the effect to a less than significant level. Mitigation measures from earlier analyses may be incorporated by reference.

- Potentially Significant Impact. This category is applicable if there is substantial evidence that a significant adverse effect might occur, and no feasible mitigation measures could be identified to reduce impacts to a less than significant level. If there are one or more "Potentially Significant Impact" entries when the determination is made, an Environmental Impact Report (EIR) is required. There are no such impacts for the proposed project.

Sources of information that adequately support these findings are referenced following each question. All sources so referenced are available for review at the offices of the Bureau of Engineering, 1149 South Broadway, Suite 600, Los Angeles, California 90015. Please call Maria Martin at (213) 485-5753 for an appointment.

Issues	Potentially Significant Impact	Less Than Significant With	Less Than Significant	No Impact

1. AESTHETICS – Would the project:

a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐

Reference: *L.A. CEQA Thresholds Guide* (Sections A.1 and A.2), and *Venice Community Plan*

Comment: A scenic vista generally provides focal views of objects, settings, or features of visual interest; or panoramic views of large geographic areas of scenic quality, primarily from a given vantage point. A significant impact may occur if the proposed project introduced incompatible visual elements within a field of view containing a scenic vista or substantially altered a view of a scenic vista.

Both the Penmar Recreation Center and Golf Course are located within an urban setting and are surrounded by fencing. No scenic vistas are located within the vicinity of the proposed project. Most of the proposed project elements would be located below ground. Two electrical control panel boxes would be installed above ground adjacent to the Frederick Street right-of-way and adjacent to Penmar Recreation Center filed 5.

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒

Reference: California Scenic Highway Mapping System, *L.A. CEQA Thresholds Guide* (Sections A.1 and A.2) and *Venice Community Plan*

Comment: A significant impact may occur where scenic resources within a state scenic highway would be damaged or removed as a result of the proposed project.

No scenic state highways are located within the project site or vicinity.

c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐

Reference: *L.A. CEQA Thresholds Guide* (Sections A.1 and A.2)

Comment: A significant impact may occur if the proposed project introduced incompatible visual elements to the project site or visual elements that would be incompatible with the character of the area surrounding the project site.

See comment for 1 (a) above.

d) Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area?	☐	☐	☒	☐

Reference: *L.A. CEQA Thresholds Guide* (Section A.4)

Comment: A significant impact would occur if the proposed project caused a substantial increase in ambient illumination levels beyond the property line or caused new lighting to spill-over onto light-sensitive land uses such as residential, some commercial and institutional uses that require minimum illumination for proper function, and natural areas.

No new sources of light or glare would be built. Construction lighting would be used as necessary on a temporary basis and would be governed by Municipal Code and Standard Specifications designed to minimize impacts (*e.g.* it would be shielded and directed toward the construction, away from residences).

Issues	Potentially Significant Impact	Less Than Significant With	Less Than Significant	No Impact

2. AGRICULTURE RESOURCES – Would the project:

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use? ☐ ☐ ☐ ☒

Reference: CDC - Div. of Land Resource Protection, City of Los Angels General Plan Conservation Element, Zone Information & Map Access System (ZIMAS)

Comment: A significant impact may occur if the proposed project were to result in the conversion of state-designated agricultural land from agricultural use to a non-agricultural use.

No prime or unique farmland, or farmland of statewide importance, exists within the City of Los Angeles. The project site is not located on or near any property zoned or otherwise intended for agricultural uses.

b) Conflict with existing zoning for agricultural use, or a Williamson Act contract? ☐ ☐ ☐ ☒

Reference: CDC - Div. of Land Resource Protection, *City of Los Angels General Plan Conservation Element*, Zone Information & Map Access System (ZIMAS)

Comment: A significant impact may occur if the proposed project were to result in the conversion of land zoned for agricultural use, or indicated under a Williamson Act contract, from agricultural use to a non-agricultural use.

No land on or near the project site is zoned for or contains agricultural uses. The City of Los Angeles does not participate in the Williamson Act. Therefore, there are no Williamson Act properties in the City of Los Angeles.

c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland, to non-agricultural use? ☐ ☐ ☐ ☒

Reference: CDC - Div. of Land Resource Protection, , City of Los Angels General Plan Conservation Element, Zone Information & Map Access System (ZIMAS)

Comment: A significant impact may occur if a project results in the conversion of farmland to another non-agricultural use.
See Comments for 2 (a) and 2 (b) above.

3. AIR QUALITY – Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan? ☐ ☐ ☐ ☒

Reference: *L.A. CEQA Thresholds Guide* (Sections B1 and B2) and *Venice Community Plan*

Comment: The proposed project is located within the South Coast Air Basin which is under the jurisdiction South Coast Air Quality Management District (SCAQMD). The SCAQMD is the air pollution control district responsible for the Air Quality Management Plan (AQMP), which is a comprehensive air pollution control program for attaining state and federal ambient air quality standards. As part of its General Plan, the City adopted an Air Quality Element that contains policies and goals for attaining state and federal air quality standards, while simultaneously facilitating local economic growth and includes implementation strategies for local programs contained in the AQMP. A significant impact would occur if the project were not consistent with the AQMP or the City's General Plan.

The *Venice Community Plan* recognizes the need to ensure the availability of adequate public facilities. The proposed project would serve existing and intended land uses and would not include regional employment or population growth. The main objectives of the project are to meet regulatory requirements and improve water quality. Existing uses would not be changed. The project would also not result in a violation of air quality standards, as discussed in item 3(b) below. The project would therefore be consistent with the AQMP.

b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Sections B1 and B2)

Comment: A significant impact may occur if the proposed project violated any SCAQMD air quality standard. The SCAQMD has set thresholds of significance for reactive organic gases (ROG), nitrogen oxides (NOx), carbon monoxide (CO), sulfur dioxide ($S0_2$), and particulate matter (PM10) emissions resulting from construction and operation in the South Coast Air Basin. SCAQMD has also set interim CEQA greenhouse gase (GHG) thresholds for industrial projects.

Construction emissions have been estimated using the URBEMIS 2007 (Version 9.2.4) computer model recommended by the SCAQMD, see Appendix D for results. As shown below, daily construction emissions would not exceed SCAQMD significance thresholds.

	ROG lbs/day	NOX lbs/day	CO lbs/day	SOX lbs/day	PM10 lbs/day	PM2.5
Construction Peak Daily Emissions	7	84	41	0	76	18
SCAQMD Construction Emission Thresholds	75	100	550	150	150	55

Minimal emissions are anticipated as a result of operation and maintenance. The total emissions from worker vehicle exhaust are considered negligible and should not exceed SCAQMD daily operational emission thresholds or have a significant impact on air quality.

Although construction emission are anticipated to be below SCAQMD thresholds, contractors would be required to follow all applicable SCAQMD rules and regulations, including AQMD Rule 403 (Fugitive Dust) and 431 (Diesel Equipment), to minimize air quality impacts. Contractors, for example, would water dusty areas and minimize the tracking of soil from unpaved dirt areas to paved roads.

SCAQMD has recommended a greenhouse gas significance threshold of 10,000 metric tons per year of carbon dioxide equivalent (CO2e) for assessing the significance of potential GHG emissions. SCAQMD allows GHG emissions from construction to be amortized over 30 years. However, the assessment conducted for this project applied the threshold to the estimated total GHG emissions for a conservative assessment. CO2 construction emissions were estimated at 366 metric tons/project, which is below the recommended threshold.

c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Sections B1 and B2), 2006 State Area Designation Maps from http://www.arb.ca.gov/desig/adm/adm.htm#state

Comment: A significant impact would occur if the proposed project resulted in a cumulatively considerable net increase of a criteria pollutant for which the South Coast Air Basin exceeds federal and state ambient air quality standards and has been designated as an area of non-attainment by the USEPA and/or California Air Resources Board. The South Coast Air Basin is a non-attainment area for ozone, fine particulate matter (PM10), and carbon monoxide (federal only).

As indicated in item 3(b) above, construction and operational emissions of the project would not exceed the SCAQMD's thresholds of significance for criteria pollutants. For those emissions generated during construction, the minor generation of criteria pollutants would be temporary and short-term in nature.

d) Expose sensitive receptors to substantial pollutant concentrations? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Sections B1, B2, and B3)

Comment: A significant impact would occur if construction or operation of the proposed project generated pollutant concentrations to a degree that would significantly affect sensitive receptors.

As discussed above, the proposed project is not anticipated to result in substantial pollutant concentrations.

e) Create objectionable odors affecting a substantial number of people? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Sections B1 and B2)

Comment: A significant impact would occur if the project created objectionable odors during construction or operation that would affect a substantial number of people.

During construction, sources of odor are diesel emissions form construction equipment and volatile organic compounds from sealant applications or paving activities. However, these odors would be temporary and localized. Nonetheless, applicable best management practices such as those in SCAQMD Rule 431 (Diesel Equipment) would, in addition to minimizing air quality impacts, also help minimize potential construction odors.

Air emissions, including odors, during operation are anticipated to be absent or minimal. Project elements such as the detention reservoir and stormwater diversion structure are passive. The active components are the pump station systems that convey water through the force mains. The pump stations operate solely on electricity. Therefore, air emissions would not be produced. The only potential source of air emissions or odors would be the vent on the tank that is part of the reservoir system. There is a small potential for buildup of organic matter carried in the storwater in the tank. Under anaerobic conditions, odors and methane could be released and could pose an impact. However, the facility is designed with a sump and a bar screen to capture most of the organic matter being carried by the stormwater before entering the tank. In addition, the interior of the tank would be designed to be equalized with the atmosphere, therefore anaerobic conditions should not form. Additionally, regular inspection and cleaning should further reduce the potential for buildup of material that could release odors.

4. BIOLOGICAL RESOURCES – Would the project:

Issues	Potentially Significant Impact	Less Than Significant With	Less Than Significant	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☒	☐

Reference: CNDDB, City of Los Angeles General Plan, City of Los Angeles General Plan Conservation Element, *L.A. CEQA Thresholds Guide* (Section C), U.S. Fish and Wildlife Service Habitat Conservation Plan (HCP) Program, U.S. Fish and Wildlife Service Critical Habitat Database (http://crithab.fws.gov/)

Comment: A significant impact may occur if the proposed project would remove or modify habitat for any species identified or designated as a candidate, sensitive, or special status species in local or regional plans, policies, or regulation, or by the state or federal regulatory agencies cited.

The BMP elements and sewer upgrades, which constitute the major construction elements of the proposed project will occur within hardscape areas within the public right-of-way and beneath the Penmar Recreation Center Field 5. The site is heavily used and devoid of potential habitat for sensitive species. The lawn or turf grass on Field 5 would be removed and replace after installation of the detention tank. No removal of adjacent trees or other vegetation is anticipated.

The CNDD lists occurrences of the following plant and animal species which are federally and/or state listed as endangered or threatened plant species within the USGS Beverly Hills and Venice Quadrangles. However, none of the occurrences were listed for Penmar Recreation Center park or vicinity. See Appendix C for database search results.

Plants – Braunton’s milk-vetch, Ventura Marsh milk-vetch, coastal dunes milk-vetch, San Fernando Valley spineflower, salt marsh bird’s-beak, and beach spectaclepod. Due to the highly urbanized nature and high intensity of use of the site in addition to species habitat requirements, these species are not anticipated to occur within the project site.

Animals - western snowy plover, El Segundo blue butterfly, California black rail, Belding’s savannah sparrow, California brown pelican, Pacific pocket mouse, coastal California gnatcatcher, California least tern. Due to the highly urbanized nature and high intensity of use of the site in addition to species habitat requirements, these species are not anticipated to occur within the project site.

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☐	☒

Reference: CNDDB, *City of Los Angeles General Plan Conservation Element*, *L.A. CEQA Thresholds Guide* (Section C), U.S. Fish and Wildlife Service Habitat Conservation Plan (HCP) Program, U.S. Fish and Wildlife Service Critical Habitat Database (http://crithab.fws.gov/)

Comment: A significant impact may occur if riparian habitat or any other sensitive natural community were to be adversely modified.
See comment for 4 (a).

c) Have a substantial adverse effect on federally protected wetlands as	☐	☐	☐	☒

defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?
Reference: CNDDB, *City of Los Angeles General Plan Conservation Element*, *L.A. CEQA Thresholds Guide* (Section C), U.S. Fish and Wildlife Service Habitat Conservation Plan (HCP) Program, U.S. Fish and Wildlife Service Critical Habitat Database (http://crithab.fws.gov/)
Comment: A significant impact may occur if federally protected wetlands, as defined by Section 404 of the Clean Water Act, would be modified or removed.

No wetlands are located within the project site.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites? ☐ ☐ ☒ ☐
Reference: *L.A. CEQA Thresholds Guide* (Section C)
Comment: A significant impact may occur if the proposed project interfered or removed access to a migratory wildlife corridor or impeded the use of native wildlife nursery sites.

The project area is highly urbanized and heavily used and does not provide significant habitat for wildlife. No tree removals are anticipated. The turf or lawn to be removed is within a field used for various sports. The project is not expected to have an impact on habitat suitable for wildlife movement or migration.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? ☐ ☐ ☐ ☒
Reference: *L.A. CEQA Thresholds Guide* (Section C)
Comment: A significant impact may occur if the proposed project would cause an impact that was inconsistent with local regulations pertaining to biological resources.

No impact to sensitive or protected tree species is anticipated. Other than removal and replacement of lawn or turf grass, no other vegetation removal is anticipated.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan? ☐ ☐ ☐ ☒
Reference: CNDDB, City of Los Angeles General Plan, City of Los Angeles General Plan Conservation Element, *L.A. CEQA Thresholds Guide* (Section C), U.S. Fish and Wildlife Service Habitat Conservation Plan (HCP) Program
Comment: A significant impact may occur if the proposed project would be inconsistent with the provisions of the adopted habitat conservation plans of the cited type.
See comments for 4 (a) through (e).

5. CULTURAL RESOURCES – Would the project:

a) Cause a substantial adverse change in the significance of a historical resource as defined in California Code of Regulations Section 15064.5? ☐ ☐ ☒ ☐
Reference: *Cultural Resources Survey Report Penmar Water Quality Improvement and Runoff Reuse Project; L.A. CEQA Thresholds Guide* (Section D.3), City of Los Angeles Cultural Heritage Commission “Historic-Cultural Monuments (HCM) Report by Planning Community”, *Venice Community Plan*

Comment: A significant impact may result if the proposed project caused a substantial adverse change to the significance of a historical resource (as identified above).

No historic resources were identified within the project area. The project passes through a residential area of late-historic period of local residential development (early 1900's to the latter half of the 20th Century): a mix of Ranch Style architecture (circa 1935-1960), California Ranch Bungalow style architecture, Colonial Revival, Craftsman Bungalow, Minimal Traditional and early Ranch transitional forms, Modern, National Folk, and Hipped Vernacular types (ArchaeoPaleo Resource Management Inc. 2009). However, with the exception of one dwelling adjacent to Rialto Court (discussed below), the other buildings and their settings are outside of the project's area of potential effect and are not anticipated to be adversely affected by the proposed project.

At Crescent Place between Rialto Court and Palms Boulevard, the project proposes to use pipe reaming construction method. The sewer line lies within City property beneath an area currently used as a yard for one of the adjacent dwellings. However, with the use of pipe reaming construction method, no significant impacts to the adjacent property are anticipated.

The cultural resource survey conducted for the proposed project indicates potential for recovery of cultural (archeological) resource materials. See discussion under 5 (b) below for additional information.

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to California Code of Regulations Section 15064.5? ☐ ☐ ☒ ☐

Reference: *Cultural Resources Survey Report Penmar Water Quality Improvement and Runoff Reuse Project, L.A. CEQA Thresholds Guide* (Section D.3), City of Los Angeles Cultural Heritage Commission "Historic-Cultural Monuments (HCM) Report by Planning Community", *Venice Community Plan*

Comment: A significant impact may occur if the proposed project were to cause a substantial adverse change in the significance of an archaeological resource which falls under the CEQA Guidelines section cited above.

The cultural resource survey conducted for the proposed project indicates the project site and vicinity are located in an area sensitive for historic and prehistoric cultural resources. The mitigation measures described below shall be implemented prior to and during construction, as applicable, to mitigate impacts to a less than significant level:

Mitigation Measure CUL1: Archaeological monitoring by a qualified archaeological monitor shall be conducted during all ground-disturbing activities in connection with the proposed project until the archeological monitor deems there is a low potential for finding cultural materials. The archaeological monitor responsible for monitoring the Rialto Court/Crescent Place project area shall also be familiar with historic architectural resources. Ground-disturbing activities include, but are not limited to, pavement/asphalt removal, boring, trenching, grading, excavating, and foundation demolition.

Mitigation Measure CUL2: Prior to the commencement of construction activities, a Cultural Resources Monitoring and Mitigation Plan (CRMMP) shall be prepared. The CRMMP shall include, but not be limited to, construction monitoring protocol of all ground-disturbing project related construction activities; a construction worker training protocol and program; and cultural resource recovery and processing protocol if cultural resources are discovered. As applicable, the archaeological monitor shall follow the plan during construction.

Mitigation Measure CUL3: Upon completion of all ground-disturbing activities associated with the project, an Archaeological Resources Monitoring Report shall be prepared, documenting activities carried out under the CRMPP.

c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature? ☐ ☐ ☒ ☐

Reference: *Integrated Resources Management Plan*, *L.A. CEQA Thresholds Guide* (Section D.1), *Standard Specification for Public Works Construction*

Comment: A significant impact may occur if grading or excavation activities associated with the proposed project would disturb unique paleontological resources or unique geologic features.

According to the Geotechnical evaluation conducted for this project, the materials encountered in the borings generally consisted of fill soils underlain by alluvial deposits to the depths explored of approximately 21 ½ to 51 ½ feet. Bellow the fill soil, alluvial soils were encountered to the depths explored. According the report, geologic maps of the area indicate the site is underlain by younger alluvium. The *L.A. CEQA Thresholds Guide* indicates paleontological potential for Quaternary (younger) alluvium is Low to High. The Environmental Impact Report for the *Integrated Resources Management Plan* indicates the project area is located in an area sensitive for paleontological resources. The mitigations measure identified below would be implemented to ensure potential adverse impacts would be reduced to a less than significant level.

Mitigation Measure CUL4: Prior to any excavation in undisturbed soils (undisturbed alluvial deposits), a qualified paleontologist shall be retained to develop a monitoring and fossil remains treatment plan for construction-related activities that could disturb potential unique paleontological resources within the project area. The plan shall be implemented during construction and include, but not be limited to, the following:

- Authority for the paleontologist to halt, temporarily divert, or redirect grading in the area of an exposed fossil to facilitate evaluation and, if necessary, salvage.
- Provision for fossil identification and cataloguing before being donated to their final repository.
- Provision for the preparation of a report detailing results of the monitoring and treatment efforts, listing the fossils collected, and naming the repository.

d) Disturb any human remains, including those interred outside of formal cemeteries? ☐ ☐ ☒ ☐

Reference: *Standard Specification for Public Works Construction*, *L.A. CEQA Thresholds Guide* (Section D.2)

Comment: A significant impact may occur if grading or excavation activities associated with the proposed project would disturb interred human remains.

No known burial sites are located within the project site. Should human remains be encountered during construction, per standard public works construction practice, work would be temporarily diverted from the vicinity of the find until the coroner is notified in accordance with the Health and Safety Code Section 7050.5. If the remains were determined to be of Native American descent, the coroner would have 24 hours to notify the Native American

Heritage Commission (NAHC). The NAHC would identify the person(s) thought to be the Most Likely Descendent, who would then help determine the appropriate course of action.

6. GEOLOGY AND SOILS – Would the project:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? ☐ ☐ ☒ ☐

Reference: CDC Publication 42; *Geotechnical Evaluation Penmar Water Quality Improvement Project, Los Angeles, California; L.A. CEQA Thresholds Guide* (Section E.1), *General Plan Safety Element*

Comment: A significant impact may occur if the proposed project were located within a state-designated Alquist-Priolo Zone or other designated fault zone and appropriate building practices were not followed.

The project site is not located within a State of California Earthquake Fault Zone (formerly known as an Alquist-Priolo Special Study Zone). As is most of southern California, the site is located in a seismically active area. However, no active faults are known to cross the project site. The closest active fault is the Santa Monica fault which is located 2.2 miles northeast of the project site (Ninyo & Moore 2008). The design peak ground acceleration for this project was estimated to be 0.45g (Ninyo & Moore 2008). Applicable building code requirements would be implemented. As part of building code (applicable California Building Code Seismic Design Criteria) and BOE Standard Project Specifications, construction measures are prescribed that enable safe and efficient project implementation within areas subject to seismic movement. Per standard practice, site-specific geotechnical and geological investigations that focus on these potential hazards are performed as part of project design studies and applicable recommendations incorporated.

ii) Strong seismic ground shaking? ☐ ☐ ☒ ☐

Reference: *Geotechnical Evaluation Penmar Water Quality Improvement Project, Los Angeles, California; L.A. CEQA Thresholds Guide* (Section E.1); Planning Department "Parcel Profile Report"

Comment: A significant impact may occur if the proposed project design did not comply with building code requirements intended to protect people from hazards associated with strong seismic ground shaking.

See comment 6(a)(i).

iii) Seismic-related ground failure, including liquefaction? ☐ ☐ ☒ ☐

Reference: CDC Publication 42; *Geotechnical Evaluation Penmar Water Quality Improvement Project, Los Angeles, California; L.A. CEQA Thresholds Guide* (Section E.1), *General Plan Safety Element*

Comment: A significant impact may occur if the proposed project would be located in an area identified as having a high risk of liquefaction and appropriate design measures required within such designated areas were not incorporated into the project.

The southwest approximate half of the site is located in an area mapped as potentially liquefiable (Ninyo & Moore 2008). An analysis of the earthquake-induced liquefaction potential at the site was performed. The results of the investigation indicate the soils between approximate depths of 35 and 40 feet below the surface are susceptible to liquefaction. However, the analysis indicates surface manifestation of dynamic settlement should not cause damage to shallow foundations and mat foundations (Ninyo & Moore 2008).

iv) Landslides?	☐	☐	☐	☒

Reference: General Plan (Landslide Inventory and Hillside Areas in the City of Los Angeles Map), *Geotechnical Evaluation Penmar Water Quality Improvement Project*, *Los Angeles, California;* Planning Department "Parcel Profile Report", *L.A. CEQA Thresholds Guide* (Section E.1);

Comment: No known landslide areas are identified on the project site. Additionally, given the relatively level topography of the site, landslides are not considered to be a potential hazard at the project site.

b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐

Reference: *L.A. CEQA Thresholds Guide* (Section E.2), Planning Department "Parcel Profile Report"

Comment: A significant impact may occur if the proposed project were to expose large areas to the erosion effects of wind or water for a prolonged period of time.

The project site is not located in a high wind area. Construction of the proposed project would result in ground surface disruption activities, such as site grading and excavation. These activities could result in the potential for erosion to occur at the proposed project site. However, soil exposure would be temporary and short-term in nature and applicable Department of Building and Safety erosion control techniques would limit potential erosion.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐

Reference: *Geotechnical Evaluation Penmar Water Quality Improvement Project*, *Los Angeles, California; L.A. CEQA Thresholds Guide* (Section C1), General Plan (Landslide Inventory and Hillside Areas in the City of Los Angeles Map), Planning Department "Parcel Profile Report"

Comment: A significant impact may occur if the proposed project were built in an unstable area without proper site preparation or design features to provide adequate foundations for project buildings, thus posing a hazard to life and property.

Per standard practice, a geotechnical evaluation is conducted which would prescribe methods, techniques, and specifications for: site preparation, treatment of undocumented fill and/or alluvial soils, fill placement on sloping ground, fill characteristics, fill placement and compactions, temporary excavations and shoring, permanent slopes, treatment of expansive soils, and treatment of corrosive soils. Design construction of the proposed project would conform to recommendations in the geotechnical evaluation. See comment for 6(a) (iii).

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☒	☐

Reference: *Geotechnical Evaluation Penmar Water Quality Improvement Project*, *Los Angeles, California;* Uniform Building Code

Comment: The geotechnical investigation recommends that the upper 2 feet of soil beneath the foundations be comprised of low-expansion potential material that is in accordance with the California Building Code. This measure would reduce adverse effects to the foundations by on-site expansive soils.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater? ☐ ☐ ☐ ☒

Reference:

Comment: A significant impact may occur if the proposed project were built on soils that were incapable of adequately supporting the use of septic tanks or alternative wastewater disposal system, and such a system were proposed.

No septic tanks or alternative wastewater disposal systems are proposed or needed.

7. HAZARDS AND HAZARDOUS MATERIALS – Would the project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? ☐ ☐ ☒ ☐

Reference: DTSC's EnviroStor Data Management System (http://www.envirostor.dtsc.ca.gov/public), *L.A. CEQA Thresholds Guide* (Sections F.1 & F.2), SWRCB LUST and UST listings on Geotracker (http:geotracker.swrcb.ca.gov)

Comment: Operation of the proposed facility would not routinely require transport, use, or disposal of significant quantities of hazardous materials, including, but not limited to oils, pesticides, or chemicals. Chlorine, anticipated in solid form, or ozone may be stored and used for disinfection during phase II project implementation. However, these chemicals would be stored in relatively small quantities in appropriate containers and handled per manufacturer's instructions to protect the health and safety of park employees and the public.

Construction activities would be short-term and limited in nature and may involve limited transport, storage, use or disposal of hazardous materials. Some examples of hazardous materials handling include fueling and servicing construction equipment on-site, and the transport of fuels, lubricating fluids, and solvents. These types of materials are not acutely hazardous, and all storage, handling, and disposal of these materials are regulated.

No sites with known hazardous materials releases were identified within the project area or immediate vicinity. The EnviroStor database identified eleven leaking underground fuel tank sites (LUFTs) and one "voluntary clean up site" within one quarter mile of the project site. Nine of the cases were closed. Lincoln Service Station, at 251 Lincoln Boulevard, is an open LUFT site under oversight by the RWQCB-LA. Soil appears to have been impacted at the site by petroleum hydrocarbons. The LUFT site is undergoing assessment. Combined Properties, at 201 Lincoln Avenue is a former dry cleaning site undergoing cleanup under Department of Toxic Substances Control Board (DTSC) oversight. Environmental Assessments have shown a release of tetrachloroethylene impacted soil at the site. Soil vapor extraction is being implemented at the site. Due to the type of media affected and distance from the project site, these two sites are not anticipated to have an impact on the proposed project site. Arco (Former), at 600 Venice Boulevard, is an open LUFT site under oversight by the RWQCB-LA. Groundwater appears to have been impacted at the site by petroleum hydrocarbons. The LUFT site is undergoing remediation. The project site is located upgradient from this site and is not anticipated to be affected by this LUFT.

The LUFT and clean up sites described above are not anticipated to have an impact on the proposed project. However, if unknown contamination were identified during project construction or a spill were to occur during construction, agencies with jurisdiction would be notified and immediate measures would be taken to ensure the health and safety of the public and workers and to protect the environment. Any excavation, treatment, and/or disposal of contaminated soils or water would be conducted to the satisfaction of the applicable regulatory agencies, which could include LAFD, LACoFD, LARWQCB and/or DTSC.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment? ☐ ☐ ☒ ☐

Reference: DTSC's EnviroStor Data Management System (http://www.envirostor.dtsc.ca.gov/public), *L.A. CEQA Thresholds Guide* (Sections F1 and F.2), SWRCB LUST and UST listings on Geotracker (http:geotracker.swrcb.ca.gov)

Comment: Refer to 7a) above.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Section F.2)

Comment: A significant impact may occur if the proposed project were located within one-quarter mile of an existing or proposed school site and were projected to release toxic emissions which pose a hazard beyond regulatory thresholds.

Four schools and one future school are located within the vicinity of the project site. Walgrove Elementary and Ocean Charter Elementary are located approximately 1,000 feet southeast of the project site and Broadway Elementary and Animo Venice Charter Public High School are located approximately 1,000 feet north of the sewer upgrade sites. First Lutheran School is located approximately 1,200 feet south of the sewer upgrade sites. As discussed in 7a) above, a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials is not anticipated as a result of the proposed project.

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment? ☐ ☐ ☐ ☒

Reference: DTSC's EnviroStor Data Management System (http://www.envirostor.dtsc.ca.gov/public), *L.A. CEQA Thresholds Guide* (Section F.2), SWRCB's GeoTracker, and USEPA's EnviroMapper

Comment: The project site is not listed in the State Water Resources Control Board GeoTracker system which includes leaking underground fuel tank sites and Spills, Leaks, Investigations, and Cleanups sites; or the Department of Toxic Substances Control EnviroStor Data Management System which includes CORTESE sites, or the Environmental Protection Agency's database of regulated facilities.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area? ☐ ☐ ☒ ☐

Reference: General Plan, *L.A. CEQA Thresholds Guide* (Section F.1), *Venice Community* Plan; The *Thomas Guide, Los Angeles County Street Guide* (2007)

Comment: A significant impact may occur if the proposed project site were located within a public airport land use plan area, or within two miles of a public airport, and would create a safety hazard.

The project site is not located within an airport land use plan. The Santa Monica Municipal Airport is located northeast of Penmar Golf Course. Safety hazards at airports are generally related with aircraft accidents, especially during take off or landing. Airport operation hazards include incompatible land uses, power transmission lines, wildlife hazards, and tall structures that can interfere with aircraft operations. The project consists of BMPs applicable to the City's stormwater infrastructure. Most of the project will be constructed below grade. The site surface would be returned to a condition similar to the pre-project condition. No obstruction to navigable airspace is anticipated.

f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area? ☐ ☐ ☐ ☒

Reference: *L.A. CEQA Thresholds Guide* (Section F.1), *San Pedro Community* Plan; The *Thomas Guide, Los Angeles County Street Guide* (2007)

Comment: The project site is not located within the vicinity of a private airstrip.

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Section F.1)

Comment: A significant impact may occur if the proposed project were to substantially interfere with roadway operations used in conjunction with an emergency response plan or evacuation plan or would generate sufficient traffic to create traffic congestion that would interfere with the execution of such plan.

The proposed project would not alter the adjacent street system. As applicable, any traffic detour plans during construction would address emergency response or emergency evacuation for implementation during construction.

h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands? ☐ ☐ ☐ ☒

Reference: General Plan, including *Venice Community* Plan; Planning Department "Parcel Profile Report"; NavigateLA

Comment: A significant impact may occur if the proposed project were located in a wildland area and poses a significant fire hazard, which could affect persons or structures in the area in the event of a fire.

The project site is not located in or adjacent to a wildland area or in a proposed Very High Fire Hazard Severity Zone.

8. HYDROLOGY AND WATER QUALITY – Would the project:

a) Violate any water quality standards or waste discharge requirements? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Section G.2)

Comment: A significant impact may occur if the proposed project discharged water which did not meet the quality standards of agencies which regulate surface water quality and water discharge into storm-water drainage systems. For example, if a project were not in compliance

with all applicable regulations with regard to surface water quality as governed by the State Water Resources Control Board (SWRCB). These regulations include compliance with the Standard Urban Storm Water Mitigation Plan (SUSMP) requirements to reduce potential water quality impacts.
The project's goals include improving water quality during operation. Short-term impacts to water quality due to construction activities would be regulated under California State Water Resources Control Board Water Quality Order No. 99-08-DWQ (General Construction Permit). Under this permit, the City of Los Angeles would implement a storm water pollution prevention plan and Best Management Construction Practices would be implemented to ensure no significant impacts to water quality occur during construction.

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Sections G.2 and G.3)

Comment: Groundwater is a major component of the water supply for many public water suppliers in the Los Angeles metropolitan area, and is also used by private industries, as well as a limited number of private agricultural and domestic users. A project would normally have a significant impact on groundwater supplies if it were to result in a demonstrable and sustained reduction of groundwater recharge capacity or change the potable water levels sufficiently that it would reduce the ability of a water utility to use the groundwater basin for public water supplies or storage of imported water, reduce the yields of adjacent wells or well fields, or adversely change the rate or direction of groundwater flow.

The proposed project would not use groundwater resources or alter ground water recharge potential. Changes to the groundwater supply are not anticipated as a result of the proposed project.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Sections G.1 and G2)

Comment: A significant impact may occur if the proposed project resulted in a substantial alteration of drainage patterns that resulted in a substantial increase in erosion or siltation during construction or operation of the project.

The proposed project would divert stormwater from a covered box culvert beneath Rose Avenue. Penmar Recreation Center Field 5 would be graded to minimize ponding. Surface drainage patterns would not be significantly altered.

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Section G.1)

Comment: A significant impact may occur if the proposed project resulted in increased runoff volumes during construction or operation of the proposed project that would result in flooding conditions affecting the project site or nearby properties.

The volume of stormwater reaching the outlet would be reduced. However, surface runoff volumes would not be significantly altered. Also, see comment for 8 (c) above.

e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff? ☐ ☐ ☐ ☒
Reference: *L.A. CEQA Thresholds Guide* (Section G.2)

Comment: A significant impact may occur if the volume of runoff were to increase to a level which exceeded the capacity of the storm drain system serving a project site. A significant impact may also occur if the proposed project would substantially increase the probability that polluted runoff would reach the storm drain system.

See comments for 8 (a-d) above.

f) Otherwise substantially degrade water quality? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Section G.3)
Comment: A significant impact may occur if a project included potential sources of water pollutants and potential to substantially degrade water quality.

The project's objective is to improve water quality and increase the beneficial and recreational uses of the receiving waters (the Santa Monica Bay) through BMPs within the park and vicinity. Phase II, beneficial reuse, would be designed and implemented in accordance with applicable RWQCB-LA and Los Angeles County Public Health requirements.

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map? ☐ ☐ ☐ ☒
Reference: FIRM FEMA Panel No 060137 0109 D, *L.A. CEQA Thresholds Guide* (Sections G.1 to G.3)
Comment: No housing is proposed as part of the proposed project.

h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows? ☐ ☐ ☐ ☒
Reference: FIRM FEMA Panel No. 060137 0077 C and 060137 0083 D, *L.A. CEQA Thresholds Guide (*Sections G.1 & G.3*)*
Comment: The project is located outside of the 100-year flood zone.

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam? ☐ ☐ ☐ ☒
Reference: *City of Los Angeles General Plan Safety Elemen*t, *L.A. CEQA Thresholds Guide* (Sections E.1 & G.3)
Comment: A significant impact may occur if the proposed project were located in an area where a dam or levee could fail, exposing people or structures to significant risk of loss, injury or death.

As indicated above, the proposed project site is located outside of the 100-year flood zone. Also, the Inundation and Tsunami Hazard Areas map (Exhibit G) of the Safety Element of the

Issues	Potentially Significant Impact	Less Than Significant With	Less Than Significant	No Impact

Los Angeles City General Plan (adopted by City Council November 26, 1996) identifies the project site as being located outside of an inundation area. No impacts related to flooding are anticipated.

j) Inundation by seiche, tsunami, or mudflow? ☐ ☐ ☐ ☒

Reference: *City of Los Angeles General Plan Safety Element*, *LA CEQA Thresholds Guide* (Section E.1)

Comment: A significant impact may occur if the proposed project would cause or accelerate geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

The Inundation and Tsunami Hazard Areas map (Exhibit G) of the Safety Element of the *Los Angeles City General Plan* (adopted by City Council November 26, 1996) indicates the project site is not located within a potential tsunami hazard area.

9. LAND USE AND PLANNING – Would the project:

a) Physically divide an established community? ☐ ☐ ☐ ☒

Reference: *City of Los Angeles General Plan*, *LA CEQA Thresholds Guide* (Section H.2)

Comment: Determination of impact is made based on several factors, including whether the proposed project is sufficiently large or otherwise configured in such a way as to create a physical barrier within an established community.

The proposed project involves mostly below ground improvements within an existing City park and adjacent areas and would not adversely impact land uses within the area or act as a physical barrier within the surrounding community.

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect? ☐ ☐ ☐ ☒

Reference: *City of Los Angeles General Plan*, *LA CEQA Thresholds Guide* (Sections H.1 & H.2)

Comment: A significant impact may occur if the proposed project were inconsistent with the General Plan, or other applicable plan, or with the site's zoning if designated to avoid or mitigate a significant potential environmental impact.

Land uses within the project site consist of open space and public right-of-way within adjacent streets. The proposed project consists of improvements to the stormwater infrastructure system to improve public health and safety. The project would not require changes in land use.

c) Conflict with any applicable habitat conservation plan or natural community conservation plan? ☐ ☐ ☐ ☒

Reference: *City of Los Angeles General Plan*, *LA CEQA Thresholds Guide* (Sections H.1 & H.2)

Comment: A significant impact may occur if the proposed project were located within an area governed by a habitat conservation plan or natural community conservation plan and would conflict with such plan.

No habitat conservation plan or natural community conservation plan is known to exist for the project site.

Issues	Potentially Significant Impact	Less Than Significant With	Less Than Significant	No Impact

10. MINERAL RESOURCES – Would the project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? ☐ ☐ ☐ ☒

Reference: *City of Los Angeles General Plan*, *L.A. CEQA Thresholds Guide* (Section E4)

Comment: No mineral resources are identified within the project area.

b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan? ☐ ☐ ☐ ☒

Reference: *City of Los Angeles General Plan*, *L.A. CEQA Thresholds Guide* (Sections H.1 & H.2)

Comment: Refer to 10 (a) above.

11. NOISE – Would the project result in:

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

Reference: *City of Los Angeles General Plan*, *City of Los Angeles Municipal Code, L.A. CEQA Thresholds Guide* (Section I), *Penmar Water Quality Improvement Project Construction Noise Impact Report*

Comment: A significant impact may occur if the project resulted in or exposed people to noise levels that exceeded the standards established by the general plan and and/or noise ordinance of the Municipal Code.

A baseline noise analysis indicates ambient noise levels within the project area vary ranging from 60.7 dBA* (within the vicinity of Oakwood Avenue and Palms Boulevard) to 70.6 dBA (within the vicinity of Palms Boulevard and Abbot Kinney Boulevard) (Behrens and Associates, Inc. 2009). Noise levels generated by construction equipment would vary based on several factors, including equipment type and models, operation being performed, and the condition of the equipment (refer to Appendix E for results of a noise impact evaluation). Assuming worst case scenario where all equipment are running simultaneously, construction activities are anticipated to generate noise levels ranging from 84 to 92 dBA. Construction noise is anticipated to be temporary, transient, and comply with applicable standards of the City's Noise Ordinance (LAMC Chapter XI). The following mitigation measure would be implemented to ensure compliance:

Mitigation Measure NOI1: The contractor shall monitor construction activity adjacent to residential uses. Prior to the start of construction the contractor shall submit a noise monitoring plan for review and approval of the project manager. The plan shall include potential noise reduction measures to be implemented if needed to ensure compliance with the City's Noise Ordinance. Such measures may include but not be limited to the following:

- Temporary sound walls (noise barriers) of a sufficient height, length and configuration so as to provide substantial noise reduction and effectively block the line-of-sight between nearby noise-sensitive receivers and the work zone, and
- Limiting the number of construction equipment operating at one time.

Operation noise is anticipated to be limited to noise from the maintenance equipment, including trash pick up trucks. However, these activities would be implemented in accordance with applicable standards of the City's Noise ordinance. Additionally, trash pick up is an existing activity in the area. Noise increase from project operation is anticipated to have less

Issues	Potentially Significant Impact	Less Than Significant With	Less Than Significant	No Impact

than a significant impact.

* A-weighted decibel (dBA): an overall frequency-weighted sound level in decibels which approximates the frequency response of the human ear.

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

Reference: *City of Los Angeles General Plan*, *City of Los Angeles Municipal Code, L.A. CEQA Thresholds Guide* (Section I)

Comment: A significant impact may occur if the project were to expose persons to or generate excessive groundborne vibration or groundborne noise levels.

Construction activities associated with the project could generate groundborne vibration from use of heavy equipment. However, typically, activities such as pile driving would generate excessive vibration. No pile driving is anticipated adjacent to the residential uses. Excessive groundborne vibration is not anticipated.

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

Reference: *City of Los Angeles General Plan*, *City of Los Angeles Municipal Code, L.A. CEQA Thresholds Guide* (Section I)

Comment: A significant impact may occur if the project were to substantially and permanently increase the ambient noise levels in the project vicinity above levels existing without the proposed project. See comments under 11 (a) above.

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

Reference: *L.A. CEQA Thresholds Guide* (Section I)

Comment: A significant impact may occur if the project were to create a substantial temporary or periodic increase in the ambient noise levels in the project vicinity above levels existing without the proposed project.

See comments under 11 (a) above.

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

Reference: General Plan, including the *Venice Community Plan; L.A. CEQA Thresholds Guide* (Section I); *The Thomas Guide, Los Angeles County Street Guide* (2007)

Comment: The project is not anticipated to result in excessive noise levels. Refer to discussion under 11(a) above.

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

Reference: General Plan, including the *Venice Community Plan; L.A. CEQA Thresholds Guide* (Section I); *The Thomas Guide, Los Angeles County Street Guide* (2007)

Comment: No private airstrips are located within the vicinity of the project area.

12. POPULATION AND HOUSING – Would the project:

a) Induce substantial population growth in an area, either directly (for ☐ ☐ ☐ ☒

example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?
Reference: General Plan, including the *Venice Community Plan, L.A. CEQA Thresholds Guide* (Section J.1)
Comment: A significant impact may occur if the proposed project induced substantial population and housing growth through new development in undeveloped areas or by introducing unplanned infrastructure that was not previously evaluated in the adopted community plan or general plan.

The proposed project would not promote population growth either directly or indirectly, since it consists of infrastructure upgrades to meet regulatory requirements in conformance with the needs projected in the adopted community and general plans.

b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere? ☐ ☐ ☐ ☒
Reference: *L.A. CEQA Thresholds Guide* (Sections J.1 and J.2)
Comment: No housing would be displaced or changed.

c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere? ☐ ☐ ☐ ☒
Reference:
Comment: See comment for 12 (b) above.

13. PUBLIC SERVICES –

a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

i) Fire protection? ☐ ☐ ☒ ☐

Reference: *City of Los Angeles General Plan* Safety Element, *L.A. CEQA Thresholds Guide* (Section K.2)
Comment: A significant impact may occur if the project required the addition of a new fire station or the expansion, consolidation or relocation of an existing facility to maintain service.

The proposed project would not require additional fire protection or emergency response services beyond what is currently provided. As per Bureau of Engineering Standard Project Specifications, construction activities would comply with applicable Fire Code requirements. The nearest local fire responders would be notified, as appropriate, of traffic control plans during construction so as to coordinate emergency response routing during construction work.

ii) Police protection? ☐ ☐ ☒ ☐

Reference: *City of Los Angeles General Plan Safety Element*, *L.A. CEQA Thresholds Guide* (Section K.1)
Comment: A significant impact may occur if the proposed project were to result in an increase in demand for police services that would exceed the capacity of the police

department responsible for serving the site.

The proposed project would not require additional police protection beyond what is currently provided. As per Bureau of Engineering Standard Project Specifications, construction activities would comply with applicable Municipal Code requirements. The nearest local police station would be notified, as appropriate, of traffic control plans during construction so as to coordinate emergency response routing during construction work.

iii) Schools? ☐ ☐ ☐ ☒

Reference: *L.A. CEQA Thresholds Guide* (Section K.3)
Comment: A significant impact may occur if the proposed project included substantial employment or population growth that could generate demand for school facilities that exceeded the capacity of the school district responsible for serving the project site.

The proposed project is not a growth inducing project, either directly or indirectly, and would therefore not increase the demand for schools in the area.

iv) Parks? ☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Section K.4)
Comment: A significant impact may occur if the recreation and park services available could not accommodate the population increase resulting from the implementation of the proposed project.

Operation of the proposed project is not a growth inducing project, either directly or indirectly, and would therefore not increase the demand for parks in the area.

During construction, one of the five baseball diamonds and associated field would be closed. The construction site would be isolated (e.g. temporary construction fencing) such that the other fields could be used. The temporary field closure (ten to twelve months) is anticipated to have minimal impact on Penmar Recreation Center activities (Guzman 2009). Several other organizations and clubs that use the facility would need to find temporary alternate locations. These organizations have been informed of the proposed project and have begun working together with the Penmar Recreation Center and other community members to find temporary locations for their activities. The project team will work with RAP to coordinate with the community and to keep them informed during the various stages for project implementation.

The field would be restored and the impact would be temporary.

v) Other public facilities? ☐ ☐ ☒ ☐

Reference:
Comment: Operation of the proposed project would not induce growth, either directly or indirectly, and is therefore not anticipated to increase the demand or use for other public facilities in the area. As discussed above, during construction several clubs and organizations that currently use Penmar Recreation Center Field 5 would need to find alternate locations. Other parks and facilities within the area are anticipated to accommodate these users temporarily.

14. RECREATION –

a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

☐ ☐ ☒ ☐

Reference: *L.A. CEQA Thresholds Guide* (Section K.4)

Comment: A significant impact may occur if the proposed project included substantial employment or population growth that generated demand for public park facilities that exceed the capacity of existing parks.

The proposed project is not a growth inducing project, either directly or indirectly, and would therefore not increase the demand for parks or other recreational facilities in the area. As indicated above, temporary impacts to Penmr Recreation Center and facilities within the vicinity would occur during construction. However, these would be temporary would be staged so as to minimize impacts.

b) Does the project include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?

☐ ☐ ☒ ☐

Reference:

Comment: The proposed project consists of improvements within an existing recreational facility and vicinity. A new facility, or expansion of the existing facility, is not proposed.

15. TRANSPORTATION/TRAFFIC – Would the project:

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

☐ ☐ ☒ ☐

Reference: *City of Los Angeles Penmar Water Quality and Runoff Reuse Project Negative Declaration Traffic Study, L.A. CEQA Thresholds Guide* (Section L.1 to L.4 and L.8)

Comment: A significant impact may occur if the proposed project caused an increase in traffic that would be substantial in relation to the existing traffic load and capacity of the street system.

The proposed project consists of improvements to an existing facility and adjacent stormdrain infrastructure. The project would generate a nominal number of vehicle trips during construction and operation.

Approximately 24,760 cubic yards of soil export are anticipated. Assuming trucks with 20 cubic yard capacity are used, approximately 1,240 truck trips would be generated. Haul routes and disposal locations would be determined by the construction contractor. Suitable soils may be used at other construction sites needing fill materials or may taken to disposal sites. Likely routes to be used include Rose Avenue, then south on Lincoln Boulevard to SR-90 or north on Lincoln Boulevard to the I-10 Freeway.

According to the traffic study conducted for this project, temporary construction impacts are anticipated. However, with implementation of the proposed traffic control plan for the main elements of the project, the same number of lanes would be maintained as such volume/capacity ratios are anticipated to be maintained. Concept control measures for the sewer rehabilitation are included in the recommendations of the traffic study. A traffic control plan for the sewer rehabilitation would also be developed in accordance with these recommendations to minimize potential impacts. Impacts would be temporary and are estimated to be less than significant.

b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways? ☐ ☐ ☒ ☐
Reference: See 15 (a).
Comment: See 15 (a).

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks? ☐ ☐ ☐ ☒
Reference:
Comment: The project does not involve any changes in air traffic patterns.

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)? ☐ ☐ ☐ ☒
Reference: *L.A. CEQA Thresholds Guide* (Section L.5)
Comment: A significant impact may occur if the proposed project substantially increased road hazards due to a design feature or incompatible uses.

The proposed project does not propose any permanent changes to the surrounding street system and would not introduce incompatible vehicles to surrounding roadways. Temporary traffic control elements would be subject to review, including safety, and approval by Los Angeles Department of transportation.

e) Result in inadequate emergency access? ☐ ☐ ☒ ☐
Reference: *L.A. CEQA Thresholds Guide* (Section L.5 and L.8)
Comment: A significant impact may occur if the proposed project resulted in inadequate emergency access.

The proposed project area is readily accessible from adjacent roadways. The project does not include any permanent changes or alterations to emergency access. As applicable, during construction, temporary lane changes would be subject to a traffic control plan, which would be subject to Los Angeles Department of Transportation review and approval, to ensure appropriate emergency access is maintained.

f) Result in inadequate parking capacity? ☐ ☐ ☒ ☐
Reference: *City of Los Angeles Penmar Water Quality and Runoff Reuse Project Negative Declaration Traffic Study, L.A. CEQA Thresholds Guide* (Sections L.7 & L.8)

Comment: No permanent impacts to parking are anticipated. In order to implement the proposed traffic control plan, temporary loss of parking adjacent to the construction area is anticipated. Along Rose Avenue, the temporary loss of parking spaces is anticipated to vary between 20 and 56 spaces as the construction progresses, see Appendix A for additional details. Along Oakwood Avenue, temporary loss of 16 to 26 parking spaces is anticipated for a period of three to six weeks. On Rialto Court, an estimated six houses may not have access to their garages for one to two nights during the sewer upgrade. Along Crescent Place at Palms Boulevard, a temporary loss of 11 parking spaces is anticipated for a period of two weeks. Along Abbot Kinney Boulevard at Palms Boulevard, temporary loss of six parking spaces is anticipated for a period of three to six weeks.

The loss of parking would only be temporary and is not anticipated to be substantial (FPl and Associates, Inc.). In accordance with standard construction practices, the temporary loss of parking would be posted in advance. Additionally, the following mitigation measure would be implemented:

Mitigation Measure TRA1: Contractor shall give advanced notice to the residences whose access to their garage will be impacted.

g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)? ☐ ☐ ☒ ☐
Reference:
Comment: A significant impact may occur if the proposed project were to conflict with adopted policies, plans, or programs supporting alternative transportation.

The designated bike lane along Rose Avenue would be temporarily removed as construction progresses. According to the traffic control plan, bicyclists would use the general purpose lane in the area impacted by construction. No other impacts are anticipated.

16. UTILITIES AND SERVICE SYSTEMS – Would the project:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board? ☐ ☐ ☐ ☒
Reference: *L.A. CEQA Thresholds Guide* (Section M.2)
Comment: A significant impact may occur if the proposed project exceeded wastewater treatment requirements of the local regulatory governing agency.

The Hyperion Treatment Plan is located on a 144-acre site adjacent to the Santa Monica Bay, southwest of the Los Angeles International Airport. The drainage area served by the plant is approximately 328,000 acres. Sewage from five major interceptor sewer systems, including the Venice Coastal Interceptor Sewer that serves the project area, is received and treated at this plant. According to the City's Bureau of Sanitation, the plant has sufficient capacity to accommodate the diverted stormwater flows.

b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects? ☐ ☐ ☒ ☐
Reference: *L.A. CEQA Thresholds Guide* (Sections M.1 and M.2)
Comment: A significant impact may occur if the proposed project resulted in the need for new construction or expansion of water or wastewater treatment facilities that could result in an adverse environmental effect that could not be mitigated.

The proposed phase II of the project includes a disinfection system to treat a portion of the stormwater flow.

c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause ☐ ☐ ☒ ☐

significant environmental effects?
Reference: *L.A. CEQA Thresholds Guide* (Section M.2)

Comment: A significant impact may occur if the volume of storm water runoff from the proposed project increases to a level exceeding the capacity of the storm drain system serving the project site.

The proposed project includes improvements to the existing stormwater infrastructure. The specific treatment design and methodology would be selected during the pre-design and design stages for that phase. Disinfection would be accomplished through chlorine, ozone, or ultraviolet treatment to meet applicable RWQCB-LA and/or the Los Angeles County Public Health requirements. No significant impacts are anticipated as a result of phase II implementation which is currently at a conceptual stage.

d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed? ☐ ☐ ☒ ☐
Reference: *L.A. CEQA Thresholds Guide* (Section M.1)
Comment: A significant impact may occur if the proposed project's water demands would exceed the existing water supplies that serve the site.

The City of Los Angeles Department of Water and Power provides potable water to the project area and vicinity. Other than temporary construction water use, the proposed project would not include new water uses.

e) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments? ☐ ☐ ☒ ☐
Reference:
Comment: Refer to 16 (a) above.

f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs? ☐ ☐ ☒ ☐
Reference: IRP EIR, *L.A. CEQA Thresholds Guide* (Section M.3)
Comment: A significant impact may occur if the proposed project were to increase solid waste generation to a degree that existing and projected landfill capacities would be insufficient to accommodate the additional waste.

Demolition debris would be recycled at aggregate-base facilities, with residual debris disposed at inert landfills, the Bradley West landfill (which as of 2002 had 4,725,968 cubic yards capacity left) or Sunshine Canyon landfill (which as of 2001 had 16,000,000 cubic yards capacity left). It is anticipated that most of the excavated soil would be suitable for backfill. Unsuitable soil and soil that could not be used at other construction sites would be disposed at these landfills, where some of the soil may be suitable for use as needed daily cover.

During operation, trash and debris collected in the system would be removed an estimated three to six times a year. This would be a nominal volume and existing landfills have sufficient capacity to accommodate it.

g) Comply with federal, state, and local statutes and regulations related to ☐ ☐ ☐ ☒

solid waste?
Reference: *L.A. CEQA Thresholds Guide* (Section M.3)

Comment: A significant impact may occur if the proposed project would generate solid waste that was in excess of or was not disposed of in accordance with applicable regulations.

Solid waste disposal during construction and operation would comply with federal, state, local statutes and regulations related to solid waste.

17. MANDATORY FINDINGS OF SIGNIFICANCE

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory? ☐ ☒ ☐ ☐

Reference: Preceding analyses

Comment: Construction may have a short-term, less than significant impact with implementation of mitigation as described above.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)? ☐ ☐ ☒ ☐

Reference: Preceding analyses, *Santa Monica Airport Watershed Management Project*

Comment: BOE has not discovered any evidence that any impact of the proposed project could be significant when viewed in connection with the effects of other past, current, or future projects.

The City of Santa Monica is in the planning stage for several potential future projects within the Santa Monica Airport Watershed, which is part of the Rose Avenue Storm Drain drainage area, as described in the *Santa Monica Airport Watershed Management Project* report. BMPs and treatment trains including Airport Avenue landscaping, underground retention at three potential locations, Zinc Hangar runoff management, landscape modification in residential areas, and porous pavement on Pico Boulevard are included as potential projects. The Airport Watershed is one of the tributary areas of the proposed project.

The BMPs identified on the *Santa Monica Airport Watershed Management Project* report would improve the storm water quality closer to the pollutant source and could be considered related projects for the purposes of CEQA. However, due to the current status of these projects, which are in the very early planning stages and have not been approved for implementation, it is uncertain which of those projects are probable. As planning progresses, the City of Santa Monica would incorporate the proposed project into future analysis or evaluations of these BMPs. These Santa Monica BMP projects are not anticipated to overlap with the construction of the proposed project. Additionally, mitigation measures would be implemented, as applicable, to minimize impacts. The proposed project is not anticipated to result or contribute to cumulative impacts.

Issues	Potentially Significant Impact	Less Than Significant With	Less Than Significant	No Impact
c) Does the project have the potential to achieve short-term environmental goals to the disadvantage of long-term environmental goals? Reference: Preceding analyses Comment: The purpose of the proposed project is to improve both the short-term and long-term water quality of the receiving waters. The project is anticipated to have positive long term impacts to water quality.	☐	☐	☒	☐
d) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly? Reference: Preceding analyses Comment: With implementation of the mitigation measures listed below, the proposed project is not anticipated to have significant impacts that would cause substantial adverse effects on human beings, either directly or indirectly.	☐	☐	☒	☐

V. MITIGATION MEASURES

The following mitigation measures form the foundation of a mitigation monitoring program (MMP) for the proposed project. CEQA requires public agencies to adopt a reporting or monitoring program for the changes to the project that have been adopted to mitigate or avoid significant effects on the environment (Public Resources Code Section 21081.6). The program must be adopted by the public agency at the time findings are made regarding the project. The State CEQA Guidelines allow public agencies to choose whether its program will monitor mitigation, report on mitigation, or both (14 CCR Section 15097(c)).

The mitigation measures described herein are supplemental to those required as standard procedure for the City and its contractors. The City and its contractors are the parties responsible for: (1) the necessary implementing actions; (2) verifying that the necessary implementing actions are taken; and (3) the primary record documenting the necessary implementing actions.

The mechanisms for verifying that mitigation measures have been implemented include design drawings, project plans and specifications, construction documents intended for use by construction contractors and construction managers, field inspections, field reports, and other periodic or special reports. All records pertaining to this mitigation program will be maintained and made available for inspection by the public in accordance with the City’s records management systems.

Cultural Resources:

Mitigation Measure CUL1: Archaeological monitoring by a qualified archaeological monitor shall be conducted during all ground-disturbing activities in connection with the proposed project until the archeological monitor deems there is a low potential for finding cultural materials. The archaeological monitor responsible for monitoring the Rialto Court/Crescent Place project area shall also be familiar with historic architectural resources. Ground-disturbing activities include, but are not limited to, pavement/asphalt removal, boring, trenching, grading, excavating, and foundation demolition.

Mitigation Measure CUL2: Prior to the commencement of construction activities, a Cultural Resources Monitoring and Mitigation Plan (CRMMP) shall be prepared. The CRMMP shall include, but not be limited to, construction monitoring protocol of all ground-disturbing project related construction activities; a construction worker training protocol and program; and cultural resource recovery and processing protocol if cultural resources are discovered. As applicable, the archaeological monitor shall follow the plan during construction.

Mitigation Measure CUL3: Upon completion of all ground-disturbing activities associated with the project, an Archaeological Resources Monitoring Report shall be prepared, documenting activities carried out under the CRMPP.

Mitigation Measure CUL4: Prior to any excavation in undisturbed soils (undisturbed alluvial deposits), a qualified paleontologist shall be retained to develop a monitoring and fossil remains treatment plan for construction-related activities that could disturb potential unique paleontological resources within the project area. The plan shall be implemented during construction and include, but not be limited to, the following:

- Authority for the paleontologist to halt, temporarily divert, or redirect grading in the area of an exposed fossil to facilitate evaluation and, if necessary, salvage.
- Provision for fossil identification and cataloguing before being donated to their final repository.
- Provision for the preparation of a report detailing results of the monitoring and treatment efforts, listing the fossils collected, and naming the repository.

Noise:

Mitigation Measure NOI1: The contractor shall monitor construction activity adjacent to residential uses. Prior to the start of construction the contractor shall submit a noise monitoring plan for review and approval of the project manager. The plan shall include potential noise reduction measures to be implemented if needed to ensure compliance with the City's Noise Ordinance. Such measures may include but not be limited to the following:

- Temporary sound walls (noise barriers) of a sufficient height, length and configuration so as to provide substantial noise reduction and effectively block the line-of-sight between nearby noise-sensitive receivers and the work zone, and
- Limiting the number of construction equipment operating at one time.

Transportation/Traffic:

Mitigation Measure TRA1: Contractor shall give advanced notice to the residences whose access to their garage will be impacted.

VI. PREPARATION AND CONSULTATION

A. Preparer

Maria E. Martin
Environmental Supervisor I
Environmental Management Group
Bureau of Engineering
Department of Public Works

Under Supervision of Jim Doty
Environmental Supervisor II
Environmental Management Group
Bureau of Engineering
Department of Public Works

B. Coordination and Consultation

City of Los Angeles:
Department of Public Works
  Bureau of Engineering
  Proposition O Bond Program
  Edgar Mercado, Project Manager

  Bureau of Sanitation
  Peter Tonthat

  Brown and Caldwell
  (Design Consultant)
    Bob Finn, P.E.
    John R. Biggs, P.E.

Department of Recreation and Parks
  Paul Davis
  Juan Guzman

VII. DETERMINATION - RECOMMENDED ENVIRONMENTAL DOCUMENTATION

A. Summary

The City of Los Angeles is proposing to construct a stormwater diversion structure, primary and secondary pump station systems, a pretreatment system to screen trash, sediment, oil and grease; an underground detention reservoir, three force mains for flow conveyance within and adjacent to the Penmar Recreation Center in the Community of Venice. Minor upgrades to four sanitary sewer segments southwest of the recreation center are also proposed. Phase II of the project would provide further treatment for beneficial use. The proposed project would intercept and divert dry weather flows and portion of the wet weather stormwater flow from the existing Los Angeles County Storm Drain in Rose Avenue. Diverted flows would be conveyed to a pump station constructed within Frederick Street right-of-way northwest of the intersection with Rose Avenue. As sewer capacity allows, portion of the flow, including dry weather flow would be diverted directly to the sanitary sewer via a force main from the proposed pump station to the sanitary sewer and ultimately to the Hyperion Treatment Plant. Portion of the wet weather flow would be diverted via a second force main to an approximately 2.75-million gallon reservoir that would be constructed beneath the Penmar Recreation Center Field 5. Stormwater stored in the reservoir would be held in the reservoir for approximately seventy-two (72) hours after a storm event passes and then discharged at a controlled rate to the sanitary sewer through a combined gravity and pump system that would be constructed adjacent to the reservoir.

The minor sanitary sewer upgrades are proposed on Oakwood Avenue between Millwood Avenue and Rialto Court, on Rialto Court south of Nowita Place, Crescent Place (undeveloped street) between Rialto Court and Palms Boulevard, and on Abbot Kinney Boulevard at the intersection with Palms Boulevard. Phase II of the project would consist of disinfection to treat a portion of the stormwater flow for beneficial use for landscape irrigation at Pemar Golf Course, Penmar Recreation Center, and/or Marine Park.

Implementation of this project would help the City meet Santa Monica Bay Beaches Dry & Wet Weather Bacteria Total Maximum Daily Loads (TMDLs) adopted by the Water Quality Control Board to protect the designated beneficial uses of the receiving waters. The project is funded by Proposition O, a $500 million Clean Water Bond Measure approved by voters November 5, 2004. The main goals of the project are to increase the beneficial and recreational uses of the receiving waters, reduce potential risks to human safety and health, reduce beach closures, and preserve aquatic and marine habitat.

B. Recommended Environmental Documentation

On the basis of this initial evaluation, I find that the project could not have a significant effect on the environment, and a **Mitigated Negative Declaration** should be adopted.

Original Signed by
Prepared by: ______________________________
Maria E. Martin
Environmental Supervisor I

Original Signed by
Reviewed by: ______________________________
James E. Doty
Environmental Supervisor II

Original Signed by
Approved by: ______________________________
Ara Kasparian, Ph.D., Manager
Environmental Management Group

AK/MM/CEQA IS20090515.doc

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APPENDICES

APPENDIX A

City of Los Angeles Penmar Water Quality and Runoff Reuse Project Negative Declaration Traffic Study

April 15, 2009

City of Los Angeles Penmar Water Quality and Runoff Reuse Project
Negative Declaration
Traffic Study

Submitted to

Brown and Caldwell

Submitted by

FPL and Associates, Inc.

April 15, 2009

Table of Contents

1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The proposed project is an effort to improve the water quality discharged into the Santa Monica Bay. The project is designed to intercept and treat the storm water runoff and dry weather flows from the existing Los Angeles County Storm Drain at Rose Avenue. The project consists of construction of a storm water diversion structure, a primary pump station system, a detention reservoir, a secondary pump system, three force mains for flow conveyance, and an upgrade of several sanitary sewer segments south of the primary pump station.

The County Storm Drain flow will be diverted to a pump station constructed within the Frederick Street right-of-way northwest of the intersection with Rose Avenue. A portion of the County Storm Drain flow, including dry weather flow, will be diverted via a force main from the proposed pump station through the sanitary sewer to the Hyperion Treatment Plant. Additional wet weather flow will be diverted via a second force main to an approximately 2.75-million gallon reservoir that would be constructed in the Penmar Recreation Center fields. Storm water stored in the reservoir would be held for 72 hours after a storm and then discharged at a metered rate to the sanitary sewer through a combination gravity-and-pump system that would be constructed adjacent to the reservoir.

The project also includes minor sanitary sewer upgrades on Oakwood Avenue between Millwood Avenue and Rialto Court, on Rialto Court south of Nowita Place, on Crescent Place (an undeveloped “paper” street) between Rialto Court and Palms Boulevard, and on Abbot Kinney Boulevard at its intersection with Palms Boulevard.

Implementation of this project would help the City meet Santa Monica Bay Beaches’ Dry & Wet Weather Bacteria Total Maximum Daily Loads (TMDL’s) adopted by the Water Quality Control Board to protect the receiving waters. The project is funded by Proposition O, a $500 million Clean Water Bond Measure approved by voters on November 5, 2004.

1.2 PROJECT LOCATION

The project is located in the Venice area (page T671, Thomas Guide), immediately north of Marina Del Rey. Most project components, including the pump stations, diversion structure, reservoir, storm water force mains, and a portion of sewers, are located near the Penmar Golf Course, which is east of Lincoln Boulevard. Lincoln Boulevard (State Route Highway 1), a major north-south arterial, runs north-west and south-east in the project vicinity.

The proposed sewer rehabilitation requires a capacity upgrade of four segments of sewers along the existing sewer line from Penmar Golf Course to the Hyperion Treatment Plant. The sewer rehabilitation work is located west of Lincoln Boulevard, in a beach community residence, which is typified by dense and narrow streets, short street blocks, and crowded street parking.

Figure 1 shows the project location and project components.

1.3 PURPOSE OF TRAFFIC STUDY

The traffic study discusses the potential impacts on traffic that would be caused by the proposed project, as well as mitigation measures to reduce such traffic impacts. There are two categories of traffic impacts: Permanent Impact and Construction Impact.

Permanent Impact refers to street capacity reduced by the project after construction. Changes to street features either reduce traffic lanes or vehicular/pedestrian capacity, or increase vehicular/ pedestrian demand. Per engineering plans prepared by Brown and Caldwell, all of the project components will be built underground, which will not cause any street capacity reduction. Also, the anticipated operation and maintenance traffic generated by the project will be minimal. The only above-ground construction item is the proposed reservoir in the Penmar Recreation Center, which will not impact the circulation of traffic. Therefore, there will be no permanent traffic impact by this project.

However, there will be temporary Construction Impact. Construction of this project will cause the number of traffic lanes to be temporarily reduced and thus disturb street traffic. Project components that will cause construction traffic impacts are listed below:

- Diversion structure and pump station at the intersection of Rose Avenue and Frederick Street
- Storm water force mains on Rose Avenue’s southbound parking lane

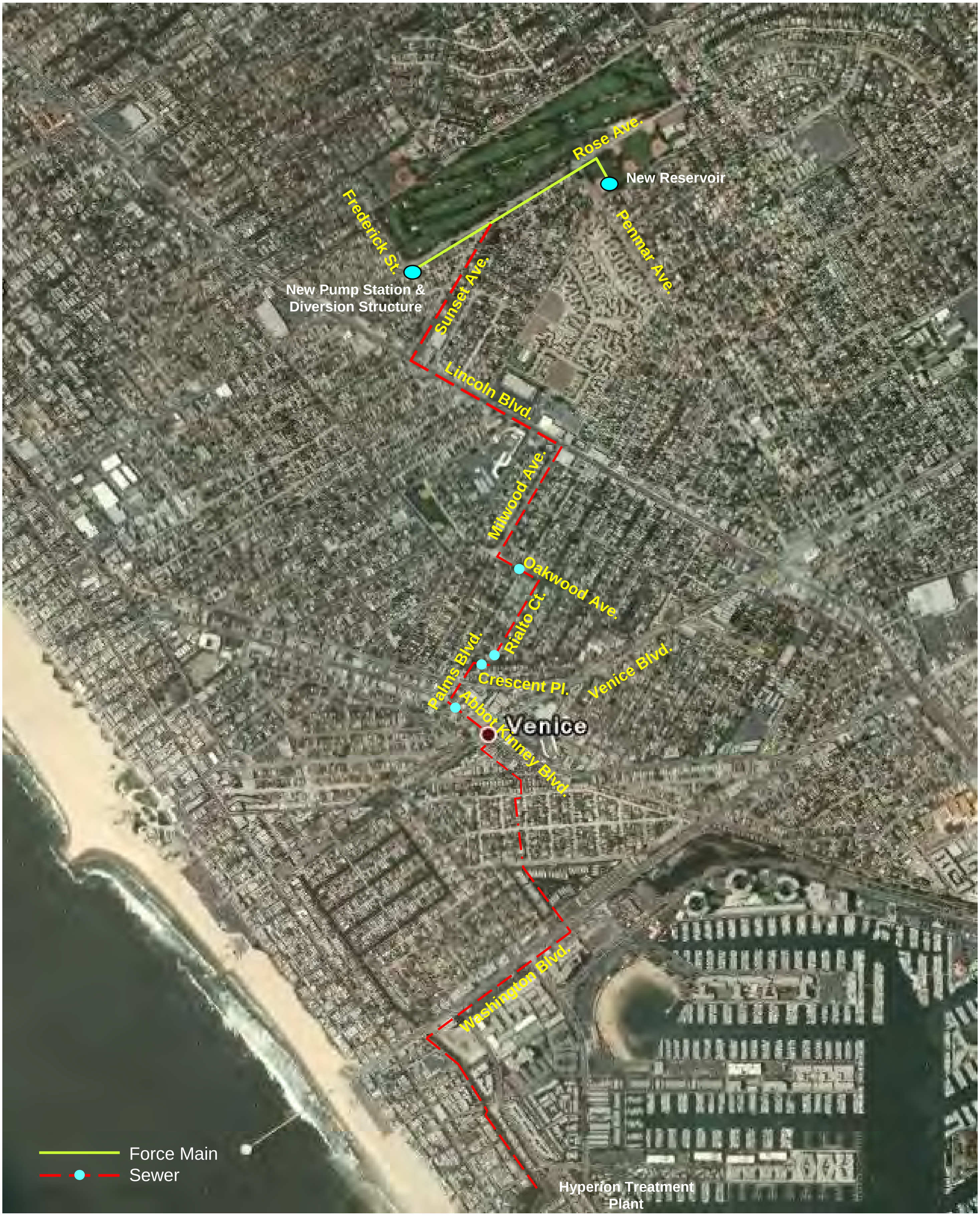


Figure 1 Project Components and Locations

City of Los Angeles Penmar Water Quality Improvement and Runoff Reuse Project	*FPL* and Associates, Inc.

- Storm water force mains crossing Rose Avenue to the reservoir at the Penmar Recreation Center
- Connection of the storm water force mains with the existing sanitary sewer system at the intersection of Rose Avenue and Sunset Avenue
- Rehabilitation of the sewer on Oakwood Avenue, approximately 250 feet in length
- Rehabilitation of the sewer on Rialto Court, approximately 145 feet in length
- Rehabilitation of the 180 feet sewer on Crescent Avenue: 160 feet on walkway and 20 feet at Palms Boulevard intersection
- Rehabilitation of the sewer on Abbott Kinney Boulevard, approximately 75 feet in length

2. EXISTING CIRCULATION SYSTEM

2.1 REGIONAL ROADWAY NETWORK

Several freeways provide regional access to the project site: Santa Monica Freeway (Interstate I-10), San Diego Freeway (Interstate I-405), and Marina Expressway (SR-90). Each freeway relies on Lincoln Boulevard for access to the project site.

- The Santa Monica Freeway is a 6-lane roadway for east-west traffic between Santa Monica and downtown Los Angeles (plus areas further east), and is 1.3 miles from the Penmar Golf Course.

- The San Diego Freeway is a 10-lane roadway that connects the coastal areas in Los Angeles and Orange Counties, and is 2.0 miles from the Penmar Golf Course.

- The Marina Expressway is a 6-lane roadway linking Marina Del Rey and the I-405 Freeway, and is 1.9 miles from the Penmar Golf Course.

2.2 LOCAL ROADWAY NETWORK

The study area for traffic analysis is located in the Venice area, from the Penmar Golf Course to Marina Del Rey. The study focused on two sub-areas: streets near the Penmar Golf Course and the four segments of sewers west of Lincoln Boulevard. Streets near the Penmar Golf Course that were studied include:

- **Lincoln Boulevard –** Lincoln Boulevard is State Route 1 and is classified by the City as a "Scenic Highway," carrying 53,000 vehicles daily in the project vicinity. Lincoln Boulevard has 2 traffic lanes running in each direction, in addition to a median, a turn lane, and street parking on both sides.

- **Rose Avenue –** Rose Avenue is classified as a "Secondary Highway," carrying 11,000 vehicles daily in the project vicinity. Rose Avenue has a traffic lane, a bike lane, and a parking lane running in each direction, in addition to a median and a turn lane on both sides. Rose Avenue north of Walgrove Avenue is reduced from 60' to 36' with respect to curb-to-curb width, with only one lane running in each direction. The road classification north of Walgrove Avenue changes to "Collector Street"; the daily traffic is 8,600 vehicles.

- **Penmar Avenue** – Penmar Avenue is a "Collector Street," terminating at Rose Avenue. It has a 50' curb-to-curb width, is striped so that one lane runs in each direction, and carries 3,800 vehicles daily.

- **Sunset Avenue –** Sunset Avenue is a "Local Street," diagonally terminating at Rose Avenue. It has a 36' curb-to-curb width, is striped so that one lane runs in each direction *only at the intersection*, and carries 1,900 vehicles daily.

Streets involving the four sewer segments west of Lincoln Boulevard are listed below:

- **Oakwood Avenue –** Oakwood Avenue is a "Local Street," is 34' wide curb-to-curb, has no lane striping, and carries 2,800 vehicles daily.

- **Rialto Court –** Rialto Court is an alley for garage access, is approximately 14' wide, has no lane striping, and carries 39 vehicles daily.

- **Palms Boulevard –** Palms Boulevard is a "Collector Street," is 32' wide curb-to-curb, has no lane striping, and carries 1,700 vehicles daily.

- **Abbot Kinney Boulevard –** Abbot Kinney Boulevard is a "Secondary Highway," is 51' wide curb-to-curb, has one traffic lane and one parking lane running in each direction, in addition to a median and a turn lane on both sides. It carries 22,000 vehicles daily.

- **Crescent Place –** Crescent Place is a pedestrian walk; it has no vehicular traffic.

Table 1 details the street system in the study area.

2.3 EXISTING TRANSIT SERVICE

There is no bus operation on Rose Avenue between Lincoln Boulevard and Walgrove Avenue.

There is no bus operation on Abbot Kinney Boulevard in the vicinity of the street's intersection with Palms Boulevard.

2.4 EXISTING STREET PARKING

Street parking is permitted along Rose Avenue between Lincoln Boulevard and Walgrove Avenue.

Street parking is also permitted along Oakwood Avenue, Palms Boulevard, and Abbot Kinney Boulevard in the sewer rehabilitation work area.

2.5 EXISTING BIKE LANE

A bike lane runs in both directions along Rose Avenue between Lincoln Boulevard and Walgrove Avenue.

3. EXISTING TRAFFIC CHARACTERISTICS

3.1 EXISTING TRAFFIC VOLUMES

Traffic counts were conducted in February 2009. Machine counts were set on the aforementioned streets to tabulate the average daily traffic (ADT) volume and their peak hourly and directional distribution. The ADT counts show the traffic loading between streets. The ADT traffic volumes of streets in the vicinity of the Penmar Golf Course construction site follow:

- **Lincoln Boulevard**: 53,000 vehicles/day

Table 1 - Street System in the Study Area

Project Locations	**Classification***	**ROW width**	**curb-curb width**	**Number of Lanes**	**ADT**
Lincoln Blvd. bet Lake St. & Indiana Ct. (N-S)	Scenic Major Highway - Class 2	100'	76'	2 traffic lanes and a left turn lane in each direction, street parking on both sides	53,246
Rose Ave. bet Lincoln Blvd. & Frederick St. (E-W)	Secondary Highway	83' or 80'	60'	one traffic lane, bike lane, and parking lane in each direction, plus a median and turn lane	11,045
Rose Ave. bet Penmar Ave. & Glenavon Ave. (E-W)	Secondary Highway	80'	60'	one traffic lane, bike lane, and parking lane in each direction, plus a median and turn lane	11,720
Rose Ave. bet Walgrove Ave. & Morningside Ave. (E-W)	Collector Street	84'	36'	one lane each direction	8,616
Penmar Ave. bet Rose Ave. & Lake St. (N-S)	Collector Street	80'	50'	one lane each direction	3,842
Sunset Ave. bet Rose Ave. & Flower St. (E-W)	Local Street	60'	36'	one lane in each direction at intersection only	1,187
Lake **St.** bet Penmar Ave. & Courtland St. (E-W)	Local Street	50'	35'	one lane each direction	4,058
Courtland St. bet Rose Ave. & Indiana Ave. (N-S)	Local Street	60'	36'	no lane striping	642
Oakwood Ave. bet Palms Blvd. & Rialto Ct. (E-W)	Local Street	50'	34'	no lane striping	2,802
Rialto Ct. bet Shell Ave. & Crescent Ct. (N-S)	Local Street	15'	n/a	Alley, no lane striping	39
Crescent Place. - An walk alley, no vehicular traffic	"Paper" Street	15'	n/a	pedestrian walk	0
Palms Blvd. bet Electric Ct. & Shell Ave. (N-S)	Collector Street	50'	32'	no lane striping	1,669
Abbot Kinney Blvd. bet Palms Blvd. & Rialto Ct. (E-W)	Secondary Highway	70'	51'	one traffic lane, and parking lane in each direction, plus a median and turn lane	21,902

*: LADOT Road Classification

- **Rose Avenue**: 11,000 vehicles/day
- **Penmar Avenue**: 3,800 vehicles/day
- **Sunset Avenue**: 1,180 vehicles/day

The ADT traffic volumes of streets in the vicinity of the sewer rehabilitation sites follow:

- **Oakwood Avenue**: 2,800 vehicles/day
- **Rialto Court**: 39 vehicles/day
- **Palms Boulevard**: 1,700 vehicles/day
- **Abbot Kinney Boulevard**: 22,000 vehicles/day

Table 2 lists the ADT volumes and the peak hour directional flows along the street system in the study area.

3.2 EXISTING INTERSECTION OPERATIONS

Three intersections were selected to count intersection turn movements during peak hours in order to document the intersection level of service (LOS). The three intersections are:

- Rose Avenue at Lincoln Boulevard, which is approximately 800 feet west of the diversion structure construction at the Rose / Frederick intersection,

- Rose Avenue at Walgrove Avenue, which is approximately 1,600 feet east of the force mains that cross Rose Avenue to the proposed reservoir at Penmar Recreation Center fields, and

- Abbot Kinney Boulevard at Palms Boulevard / Rialto Court, which is controlled by STOP signs at side streets.

The methodology used to evaluate the level of service for signalized intersection is that of the City of Los Angeles Department of Transportation (LADOT) CalcaDB model.

The efficiency of traffic operations at an intersection is measured in terms of Level of Service (LOS). It is based on volume-to-capacity (V/C) ratio, determined by dividing the volume of the traffic turn movements at the intersection during the hour by the total capacity (the maximum traffic volume that the intersection is capable of handling during an hour). LOS ranges from A to F with A representing excellent (free-flow) conditions and F representing traffic congestion. The relationship of LOS and V/C and the associated interpretation is listed in Table 3.

Table 2 - Existing Traffic Volumes

Project Locations	ADT	AM Peak Hour Directional Flow		AM Peak Hour Other Directional Flow		PM Peak Hour Directional Flow		PM Peak Hour Other Directional Flow	
		Direction	PHV	Direction	PHV	Direction	PHV	Direction	PHV
Lincoln Blvd. bet Lake St. & Indiana Ct. (N-S)	53,246	NB	1,168	SB	2,022	NB	1,879	SB	1,728
Rose Ave. bet Lincoln Blvd. & Frederick St. (E-W)	11,045	EB	303	WB	549	EB	625	WB	367
Rose Ave. bet Penmar Ave. & Glenavon Ave. (E-W)	11,720	EB	356	WB	448	EB	634	WB	388
Rose Ave. bet Walgrove Ave. & Morningside Ave. (E-W)	8,616	EB	246	WB	670	EB	552	WB	332
Penmar Ave. bet Rose Ave. & Lake St. (N-S)	3,842	NB	207	SB	74	NB	144	SB	204
Sunset Ave. bet Rose Ave. & Flower St. (E-W)	1,187	EB	49	WB	28	EB	72	WB	25
Lake St. bet Penmar Ave. & Courtland St. (E-W)	4,058	EB	172	WB	105	EB	173	WB	179
Courtland St. bet Rose Ave. & Indiana Ave. (N-S)	642	NB	36	SB	10	NB	25	SB	31
Oakwood Ave. bet Palms Blvd. & Rialto Ct. (E-W)	2,802	EB	80	WB	130	EB	192	WB	118
Rialto Ct. bet Shell Ave. & Crescent Ct. (N-S)	39	NB	1	SB	0	NB	1	SB	4
Crescent Ct. - An alley, not a through traffic									
Palms Blvd. bet Electric Ct. & Shell Ave. (N-S)	1,669	NB	38	SB	17	NB	106	SB	43
Abbot Kinney Blvd. bet Palms Blvd. & Rialto Ct. (E-W)	21,902	EB	504	WB	924	EB	1,206	WB	757

Table 3 – Levels of Service Interpretation by TRB and Intersection Criteria by LADOT

LOS	Interpretation	Volume/Capacity Ratio
A	Excellent operation. All approaches to the intersection appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation.	0.000 – 0.600
B	Very good operation. Many drivers begin to feel somewhat restricted within platoons of vehicles. This represents stable flow. An approach to an intersection may occasionally be fully utilized and traffic queues start to form.	0.601 – 0.700
C	Good operation. Occasionally backups may develop behind turning vehicles. Most drivers feel somewhat restricted.	0.701 – 0.800
D	Fair operation. There are no long-standing traffic queues. This level is typically associated with design practice for peak periods.	0.801 – 0.900
E	Poor operation. Some long-standing vehicular queues develop on critical approaches.	0.901 – 1.000
F	Forced flow. Represents jammed conditions. Backups from locations downstream or on the cross street may restrict or prevent movements of vehicles out of the intersection approach lanes; therefore, volume carried are not predictable. Potential for stop and go type traffic flow.	Over 1.000

Source: Highway Capacity Manual, Special Report 209. Transportation Research Board, Washington DC, 1997

The LADOT criteria to define a significant intersection impact are based on the following relationship between intersection V/C ratio with projected traffic and increase in V/C ratio:

LADOT INTERSECTION CRITERIA

Intersection V/C Ratio with Projected Traffic	Significant Increase in V/C Ratio
0.000 – 0.700	< 0.060
0.701 - 0.800	< 0.040
0.801 – 0.900	< 0.020
0.901 or greater	< 0.010

Source: City of Los Angeles, Department of Transportation, 2002

Table 3 lists the interpretation of level of service issued by the Transportation Research Board, Washington, D. C., and the traffic impact criteria defined by the LADOT.

At the intersection of Rose Avenue and Lincoln Boulevard, turn movements from any direction are significant. “Through movements” are significant not only on Lincoln Boulevard, but also on Rose Avenue. At the intersection, Rose Avenue has both a right turn lane and a left turn lane for each direction. Rose Avenue has a dominant through movement heading towards the coast during A.M. hours and a dominant through movement returning from the coast during P.M. hours. The LOS at the Rose / Lincoln intersection is “D” during A.M. peak hours and “E” during P.M. peak hours.

Meanwhile, the intersection of Rose Avenue and Walgrove Avenue is notable given that Walgrove Avenue runs towards the City of Santa Monica and provides I-10 Freeway eastbound access. Traffic coming from the project area, turning left from Rose Avenue onto Walgrove Avenue, is heavy during both the morning and the evening. Walgrove Avenue traffic is also directional; in the morning, traffic heading towards the I-10 Freeway is heavy, while in the evening, it is the reverse. Due to the limited intersection lane geometrics and to the significant volume of turn movements, the LOS at the Walgrove / Rose intersection is “F” during both A.M. and P.M. peak hours.

However, closure of Rose Avenue is not feasible. There are no immediate parallel streets that can handle the detour traffic (11,000 vehicles per day), should Rose Avenue be closed due to construction. Traffic in the project vicinity is generally heavy on the few arterial streets, as illustrated by the two aforementioned Rose Avenue intersections.

Therefore, a worksite traffic control plan is required in order to accommodate the daily traffic flow of 11,000 vehicles on Rose Avenue.

The intersection of Abbot Kinney Boulevard at Palms Boulevard / Rialto Court is non-signalized. Per LADOT, the lane capacity is 1,200 vehicles per lane per green hour for a non-signalized intersection, versus 1,500 vehicles per lane per green hour for a signalized intersection. The LOS at the Abbot Kinney / Palms - Rialto intersection is “A” during A.M. peak hours and “C” during P.M. peak hours. (It should be noted Rialto Court was under construction when traffic count was conducted. Therefore, no actual traffic data on Rialto Court was procured. However, the traffic volume on Rialto Court was observed very light.)

Figure 2 traces the morning peak hour intersection turn movements and shows hourly direction flow determined by ADT counts.

Figure 3 traces the evening peak hour intersection turn movements and shows hourly direction flow determined by ADT counts.

3.3 CONGESTION MANAGEMENT PROGRAM (CMP)

Under the Los Angeles County Congestion Management Program, designated monitoring stations are required for review of potential impacts. Los Angeles County Metropolitan Transportation Authority, Metro, 2004 identifies the CMP designated monitoring station in the project vicinity as the intersection of Lincoln Boulevard and Venice Boulevard (State Route 187).

The proposed project will not add traffic to the CMP designated monitoring station. The project itself will not generate any traffic. Moreover, a worksite traffic control plan has been prepared in order to accommodate vehicles during construction; traffic will not be detoured. Given that the project will not add traffic, the CMP is not discussed any further.

4. CONSTRUCTION IMPACTS AND MITIGATION

4.1 POTENTIAL TRAFFIC IMPACT SCENARIOS

As discussed above in the Introduction, construction traffic impact is the only potential traffic impact. The project will not generate permanent traffic impact.

Potential construction traffic impact was first identified when the project was proposed for open cut-and-cover construction. Although the construction duration is limited and any associated impact would be short term, a worksite traffic control plan is recommended to mitigate the construction impact.

4.2 DIVERSION STRUCTURE CONSTRUCTION

The proposed diversion structure will be built underneath the existing intersection of Rose Avenue and Frederick Street. The duration of construction is estimated to be in the range of three to four months.

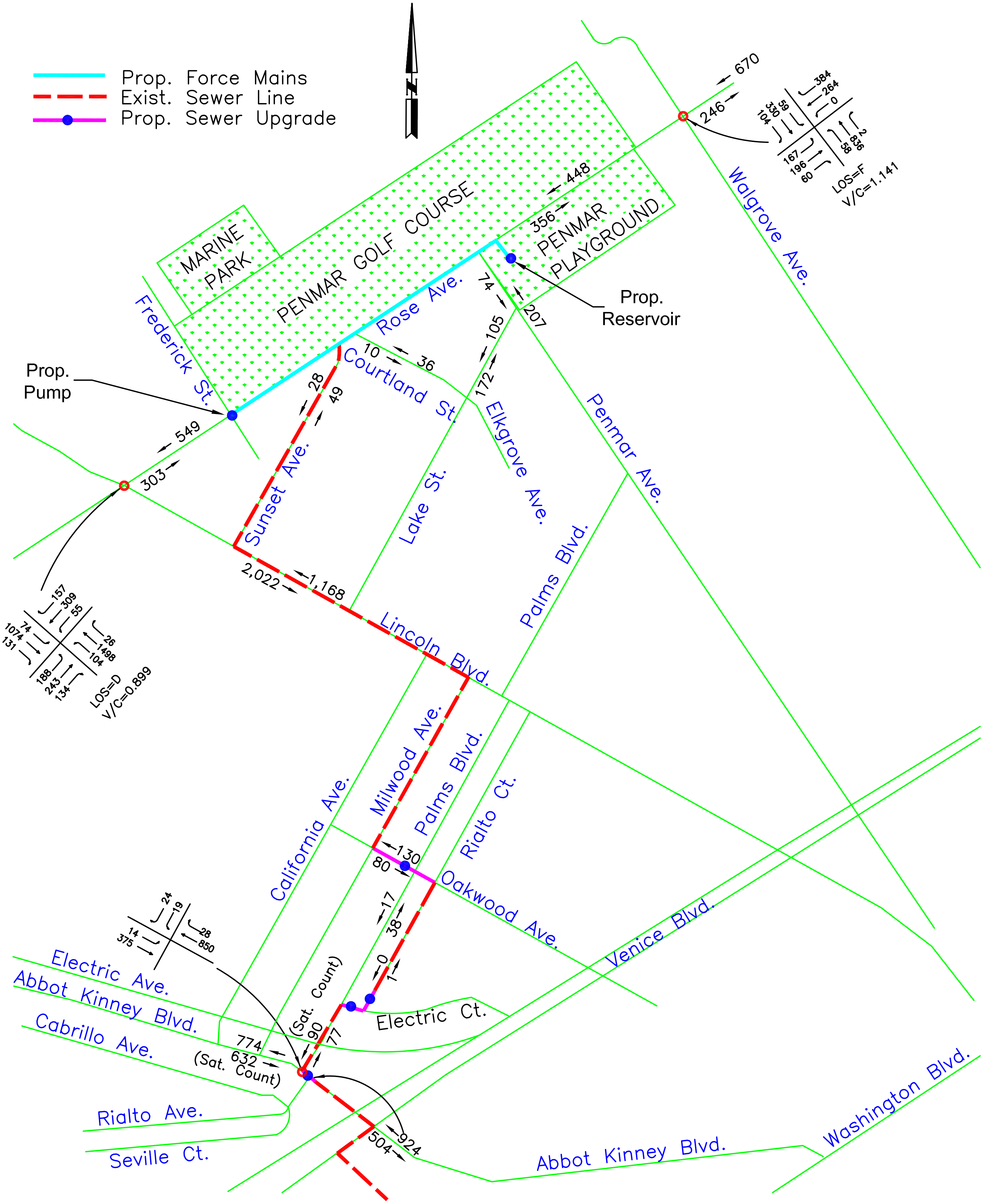


FIGURE 2 AM Peak Hour Traffic

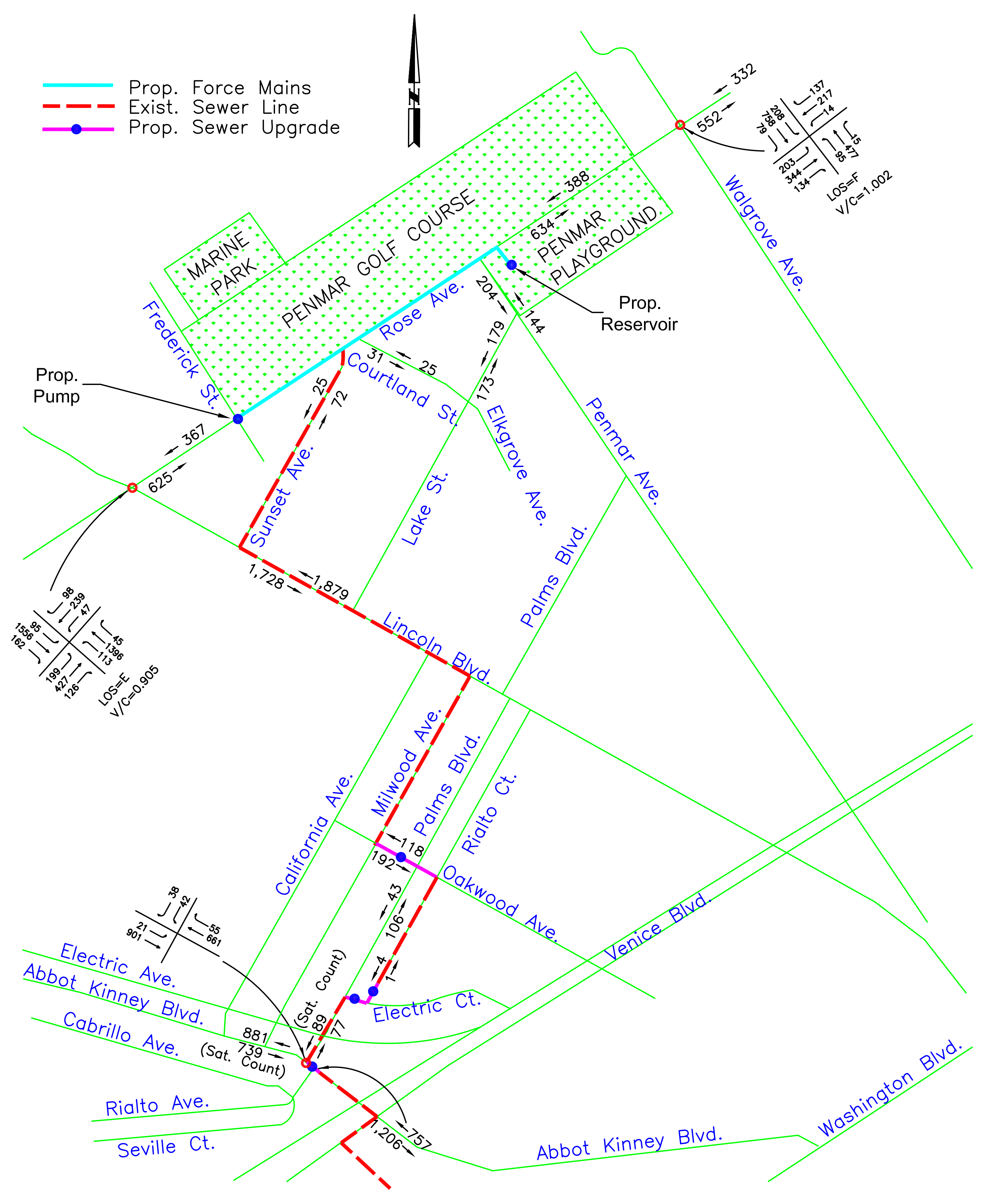


FIGURE 3 PM Peak Hour Traffic

In the initial stage of project development, plans involved closing the entire intersection during construction, which would require detouring Rose Avenue traffic and cause CMP intersections to be impacted. However, traffic counts have revealed that closure of Rose Avenue is not feasible.

4.3 FORCE MAINS CONSTRUCTION

Two new force mains will be constructed in the westbound parking lane of Rose Avenue, roughly from Frederick Street to Penmar Avenue. Both force mains will be installed in the same trench: one 30” pipe and one 12” pipe. Street parking and westbound traffic on Rose Avenue will be impacted by the force mains construction. The duration of construction is estimated to be in the range of four to six weeks.

4.4 FORCE MAINS CROSSING AT PENMAR AVENUE

The aforementioned force mains will cross Rose Avenue to the proposed reservoir at Penmar Recreation Center. Rose Avenue traffic will be impacted by the crossing construction.

4.5 FORCE MAINS CROSSING AT SUNSET AVENUE

The aforementioned force mains will cross Rose Avenue to join the existing sewer system. Rose Avenue traffic will be impacted by the crossing construction.

4.6 SEWER REHABILITATION: OAKWOOD AVENUE

The proposed 250 feet sewer rehabilitation work on Oakwood Avenue between Millwood Avenue and Rialto Court is approximately 7 feet north of the centerline of Oakwood Avenue and approximately 8 feet below ground surface, and will impact traffic flow on Oakwood Avenue and Palms Boulevard.

4.7 SEWER REHABILITATION: RIALTO COURT AT CRESCENT PLACE

The proposed 145 feet sewer rehabilitation work on Rialto Court is approximately 2.5 feet east of the centerline of Rialto Court and approximately 6 feet below ground surface. This stretch of Rialto Court is the only access to the garage of the few houses along the subject sewer alignment. A proposed open cut construction will impact vehicular access of these houses (estimated about 6 houses). Concerning the impact of disruption to private properties, Brown and Caldwell is proposing alternative construction methods such as micro tunneling or pipe reaming.

4.8 SEWER REHABILITATION: CRESCENT PLACE AT PALMS BOULEVARD

The 180 feet proposed sewer rehabilitation includes 160 feet section in Crescent Place, which is a vacated street serving as a walkway, and a 20 feet section at the intersection with Palms Boulevard. The walkway is approximately 6 to 8 feet in width with a 6 feet concrete path bordered by well-established real estate on both sides with walls and hedges. The rehabilitation work is approximately 6 feet below ground surface. Construction methods such as micro tunneling or pipe reaming, instead of open cut is considered for the walkway segment. The proposed 20 feet sewer rehabilitation work at Palms Boulevard if using the open cut construction will impact traffic flow on Palms Boulevard.

4.9 SEWER REHABILITATION: ABBOT KINNEY BOULEVARD AT PALMS BOULEVARD

The proposed 75 feet sewer rehabilitation work on Abbot Kinney Boulevard at Palms Boulevard and two manhole replacements will impact traffic flow on Abbot Kinney Boulevard and Palms Boulevard.

5. TRAFFIC MITIGATIONS

5.1 WORKSITE TRAFFIC CONTROL PLANS ALONG ROSE AVENUE

A worksite traffic control plan has been prepared to mitigate the construction impact to traffic on Rose Avenue. The construction items along Rose Avenue will be sequenced to maintain the same number of traffic lanes for vehicular movements during construction.

Stage One is for construction of the storm drain diversion structure in the middle of the intersection of Rose Avenue and Frederick Street. One traffic lane on each side of the construction will be maintained on Rose Avenue with k-rail placed around the construction area. Temporary striping will be installed along Rose Avenue to provide for tapering of the traffic lanes (using temporary striping) around the construction area. Northbound Frederick Street will be limited to right turns only during this stage. Parking along the north and south sides of Rose Avenue within approximately 300 feet of the Frederick intersection will be prohibited during construction. Duration of Stage One is estimated to last two to three months.

The dominant peak hour direction flow is in the evening: 625 vehicles going eastbound on Rose Avenue. The corresponding V/C (volume/capacity ratio) is 0.417. Due to the fact the same number of travel lanes are maintained, the V/C between pre-construction and construction conditions are unchanged. During Stage 1, approximately 600 feet parking (24 parking spaces) will be temporarily removed. Bicyclists will use the general purpose lane in the stretch because bike lane stripe will be temporarily removed.

Stage Two is for construction of the northern portion of the storm drain diversion structure, the pump station and reservoir south of Penmar Golf Course (no impact to travelled lanes), and construction of the force mains along the Rose Avenue westbound parking lane. K-rails and temporary striping will be installed on Rose Avenue from Frederick Street to approximately 400 feet east of Penmar Avenue. Traffic lanes will be shifted to the east side of Rose Avenue. One lane in each direction with a two-way left turn lane will be maintained. The majority of the south side curb parking will be maintained. Existing parking on the north side of Rose Avenue will be temporarily removed. The existing westbound and eastbound bicycle lanes will need to be temporarily removed and the bicyclists will share the travelled way with vehicular traffic. Duration of Stage Two is estimated to last three to four months.

The corresponding V/C (volume/capacity ratio) is still 0.417 because the same number of travel lanes are maintained. During Stage 2, approximately 1400 feet parking (56 parking spaces) will be temporarily removed. Bicyclists will use the general purpose lane in the stretch.

The restoration Striping will be installed after the completion of Stage 2.

Stages Three and Four are for the construction of the force main crossings across Rose Avenue. Two sanitary sewer crossings will be constructed at Sunset Avenue. Three additional crossings, one for the sanitary sewer, one for the force main, and one for a storm drain lateral will be constructed just east of Penmar Avenue. The crossings will connect to the reservoir in the Penmar Recreation Center. Stage 3 is to construct the north half of each crossing. Stage 4 is to construct the south half. Traffic cones, instead of temporary striping, will be used to guide traffic as work will be allowed during off-peak daytime hours only with all vehicular lanes, bicycle lanes, and parking being restored for use during peak hours and overnight. Duration of Stages 3 and 4 is anticipated to last no more than one week per crossing.

During Stage 3 and Stage 4, the same number of travel lanes are maintained as pre-construction. Approximately 1200 feet parking (48 parking spaces) will be temporarily removed in each stage. Motorists and bicyclists will use the lanes channelized by traffic cones.

The project will not cause significant in-street construction traffic impacts on Rose Avenue. The loss of parking and bike lanes will only be temporary and will not be substantial. The comparison of pre-construction traffic and construction traffic conditions for project construction on Rose Avenue are shown in Table 4.

The LOS at the adjacent intersections: Rose and Lincoln and Rose and Walgrove will not be affected by the project construction on Rose Avenue because of the distance from construction to the aforementioned intersections.

Please see Figure 4 for the worksite traffic control plan. The content of Figure 4 is shown in Appendix D due to its size.

Table 4 shows the comparison of pre-construction traffic and construction traffic conditions for construction of force mains, pumps, diversion structure, and pipe crossings on Rose Avenue. The same number of travel lanes are provided; therefore, the V/C ratio will be the same. There will be temporary loss of parking spaces. The worksite traffic control addressed in Figure 4 will mitigate the construction traffic impact to a less than significant level.

5.2 TRAFFIC CONTROL CONCEPT PLANS FOR SPOT SEWER REHABILITATION

A concept traffic control plan was designed to maintain existing traffic circulation during sewer rehabilitation to illustrate the mitigated negative declaration situation. However, a worksite traffic control plan was not prepared due to budget constraints. Contractor for sewer rehabilitation will be responsible for the preparation and approval of the worksite traffic control plan.

Table 4 – Comparison of Pre-Construction Traffic and Construction Traffic Conditions of Construction of Force Mains, Pumps, Diversion Structure, and Pipe Crossings on Rose Avenue

	Pre-Construction	Construction conditions	Comparison
Stage 1 – Pumps, Diversion Structure	One lane each direction, V/C = 0.417	One lane each direction, V/C = 0.417	Same number of travel lanes provided during construction. Temporary loss of 20 parking spaces.
Stage 2 – Force Mains, Pumps, Diversion Structure	One lane each direction, V/C = 0.417	One lane each direction, V/C = 0.417	Same number of travel lanes provided during construction. Temporary loss of 56 parking spaces.
Stage 3 – 1st half Pipe Crossings	One lane each direction, V/C = 0.417	One lane each direction, V/C = 0.417	Same number of travel lanes provided during construction. Temporary loss of 48 parking spaces day time only.
Stage 4 – 2nd half Pipe Crossings	One lane each direction, V/C = 0.417	One lane each direction, V/C = 0.417	Same number of travel lanes provided during construction. Temporary loss of 48 parking spaces day time only.

Table 5 – Comparison of Pre-Construction Traffic and Construction Traffic Conditions of Sewer Rehabilitation at Various Locations

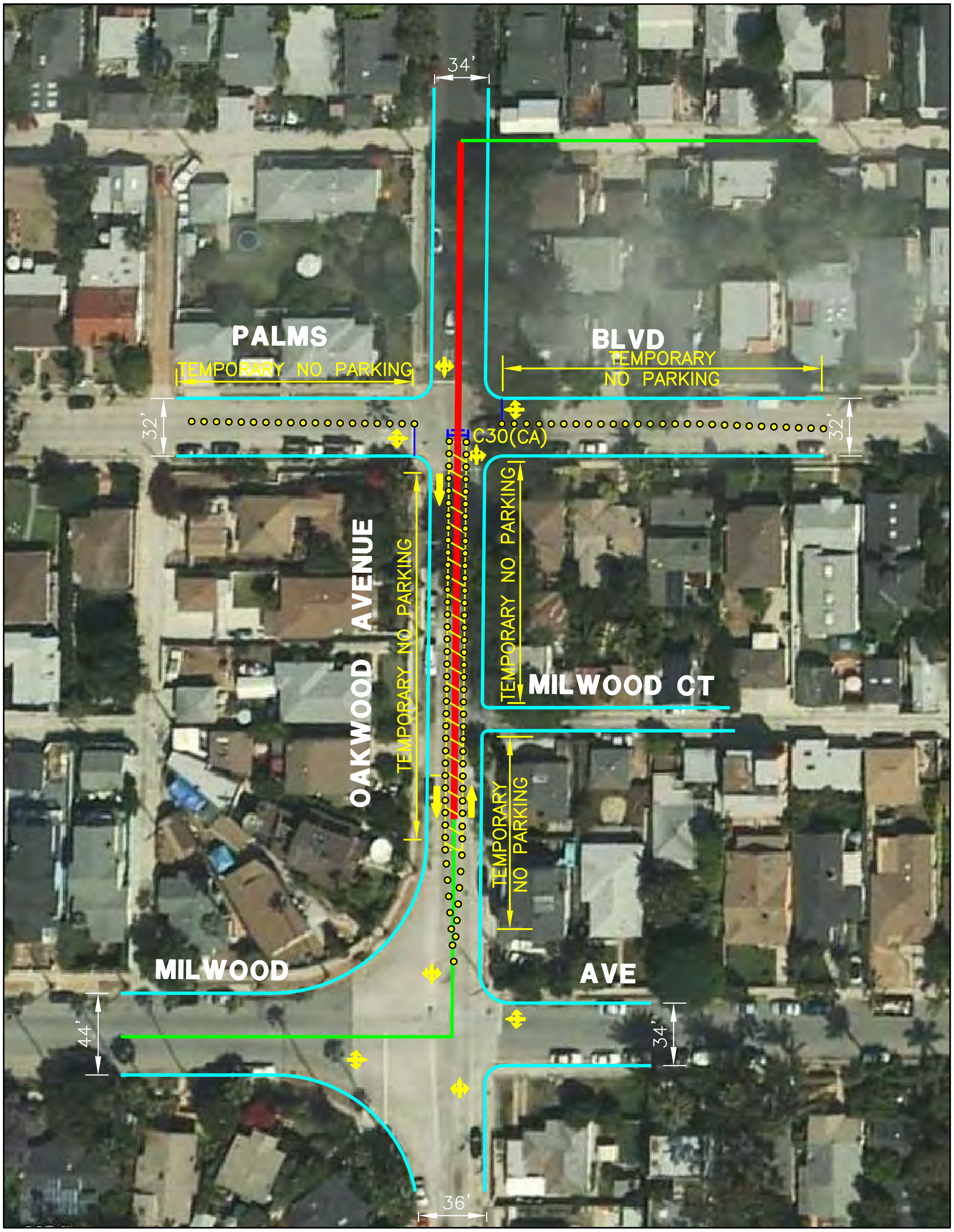
	Pre-Construction	Construction conditions	Comparison
Oakwood Avenue	One lane each direction, V/C = 0.160	One lane each direction, V/C = 0.160	Same number of travel lanes provided during construction. Temporary loss of 16 to 26 parking spaces
Rialto Court	One lane in total, ADT = 39	One lane in total, ADT = 39 or less	Estimated six houses will not be able to park vehicles in their garages for one to two nights
Crescent Place at Palms Boulevard	One lane each direction, V/C = 0.075	One lane each direction, V/C = 0.075	Same number of travel lanes provided during construction. Temporary loss of 11 parking spaces
Abbot Kinney Boulevard at Palms Boulevard	One lane each direction, V/C = 0.417	One lane each direction, V/C = 0.417	Same number of through movement lanes provided during construction. Turns at intersection might be restricted at different stages. Temporary loss of 6 parking spaces at 2 stages.

Oakwood Avenue between Millwood Avenue and Rialto Court – The proposal is that the 270' sewer rehabilitation will take place in three stages. During Stage 1, the part of the sewer west of the intersection of Oakwood Avenue and Palms Boulevard (along Oakwood Avenue) would be rehabilitated. There will be about 200 feet of street parking, both directions on Oakwood Avenue, 16 spaces in total, be temporarily disallowed. During Stage 2, the part of the sewer at the intersection itself would be rehabilitated. There will be about 320 feet of street parking, both directions on Palms Boulevard, 26 spaces in total, be temporarily disallowed. During Stage 3, the part of the sewer east of the intersection would be rehabilitated. There will be about 200 feet of street parking, both directions on Oakwood Avenue, 16 spaces in total, be temporarily disallowed. Each stage is estimated to take approximately one to two weeks considering there may be conflicting utilities for relocation. The dominant peak hour direction flow is in the evening 192 vehicles going eastbound. The corresponding V/C (volume/capacity ratio) is 0.160. Due to the fact the same number of travel lanes are maintained, the V/C between pre-construction and construction conditions are unchanged.

Figures 5-1, 5-2, and 5-3 show the construction area and traffic lane designations at each stage.

Rialto Court at Crescent Place – The proposal is that City should have a clause in the construction bid document to identify the construction method and require contractor to coordinate with each house being impacted about the construction schedule to minimize the inconvenience impact. The duration of work is estimated one to two weeks in total. Contractor should notify which of the houses (estimated six) that their car garage will be impacted next day so they can park their vehicles on adjacent streets for a day or two. The ADT in the pre-construction condition is 39 vehicles daily and is expected to be less during the construction conditions.

Crescent Place at Palms Boulevard – For the 160 feet sewer rehabilitation under the walkway, City has decided to use the pipe reaming method. Contractor should coordinate with the houses on both sides of the walkway about the construction schedule to minimize the inconvenience impact. The reaming machine and equipment will be set up at the manholes at each end. One manhole is on Palms Boulevard. The other one is on Crescent Place. The manholes at each end will be replaced after the reaming and slip lining operation is completed. The duration to work on Palms Boulevard is estimated about two weeks. There will be about 280 feet of street parking, both directions on Palms Boulevard, 11



LEGEND

- 🟥 Proposed Sewer Rehabilitation
- 🟩 Existing Sewer
- ⊢⊣ Barricade With Sign
- — Curb Line
- ▨ Work Zone
- ● 28" Traffic Channelizer with Reflective Marker
- ⇨ Direction of Traffic

NOTE: All Dimensions Shown here are Approximate

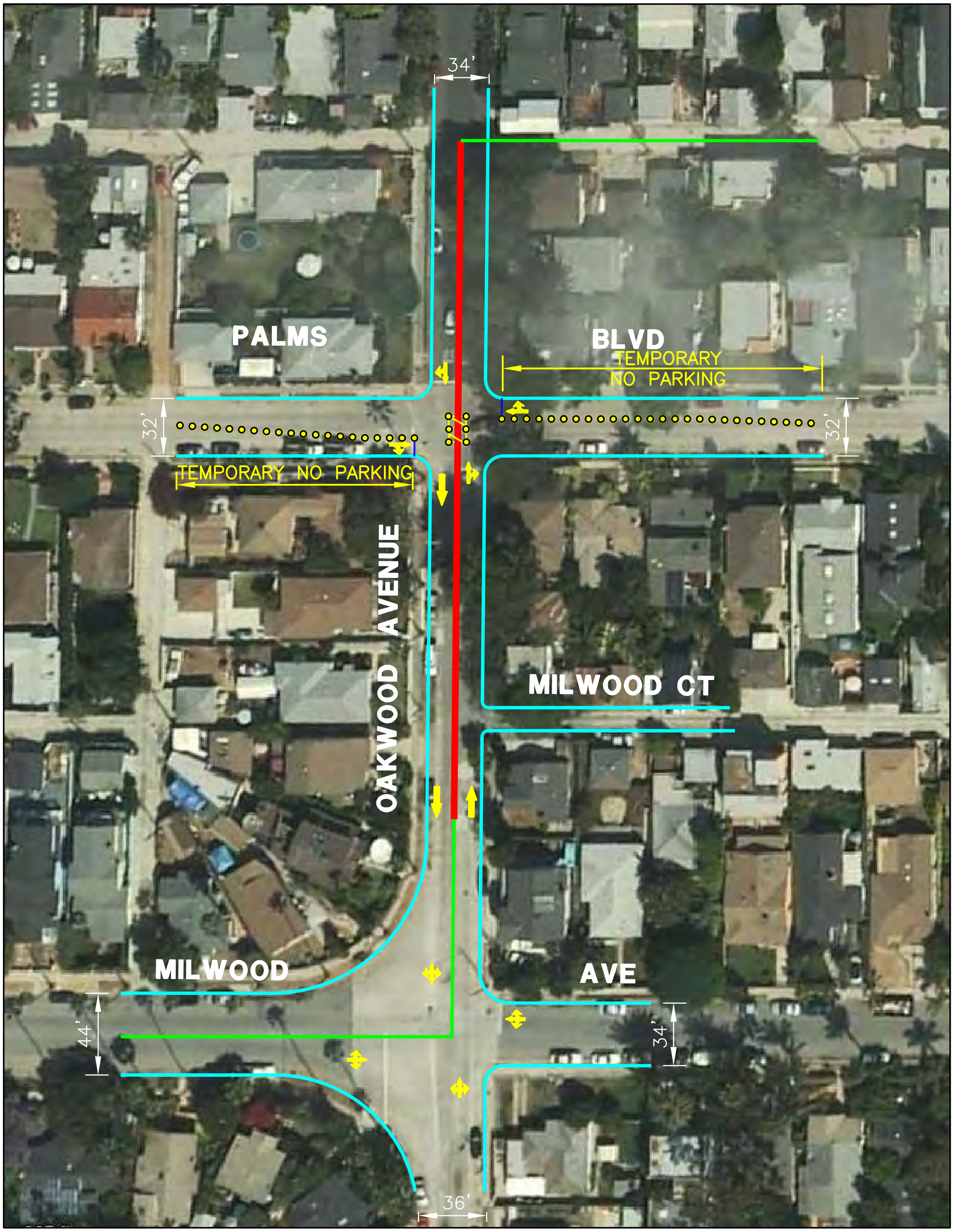
NOT TO SCALE

FIGURE 5-1 Oakwood Avenue Traffic Control Concept

Stage 1

City of Los Angeles Penmar Water Quality Improvement and Runoff Reuse Project

FPL and Associates, Inc.



LEGEND

- 🟥 Proposed Sewer Rehabilitation
- 🟩 Existing Sewer
- ⊢⊣ Barricade With Sign
- — Curb Line
- ▨ Work Zone
- ○ 28" Traffic Channelizer with Reflective Marker
- ⇨ Direction of Traffic

NOTE: All Dimensions Shown here are Approximate

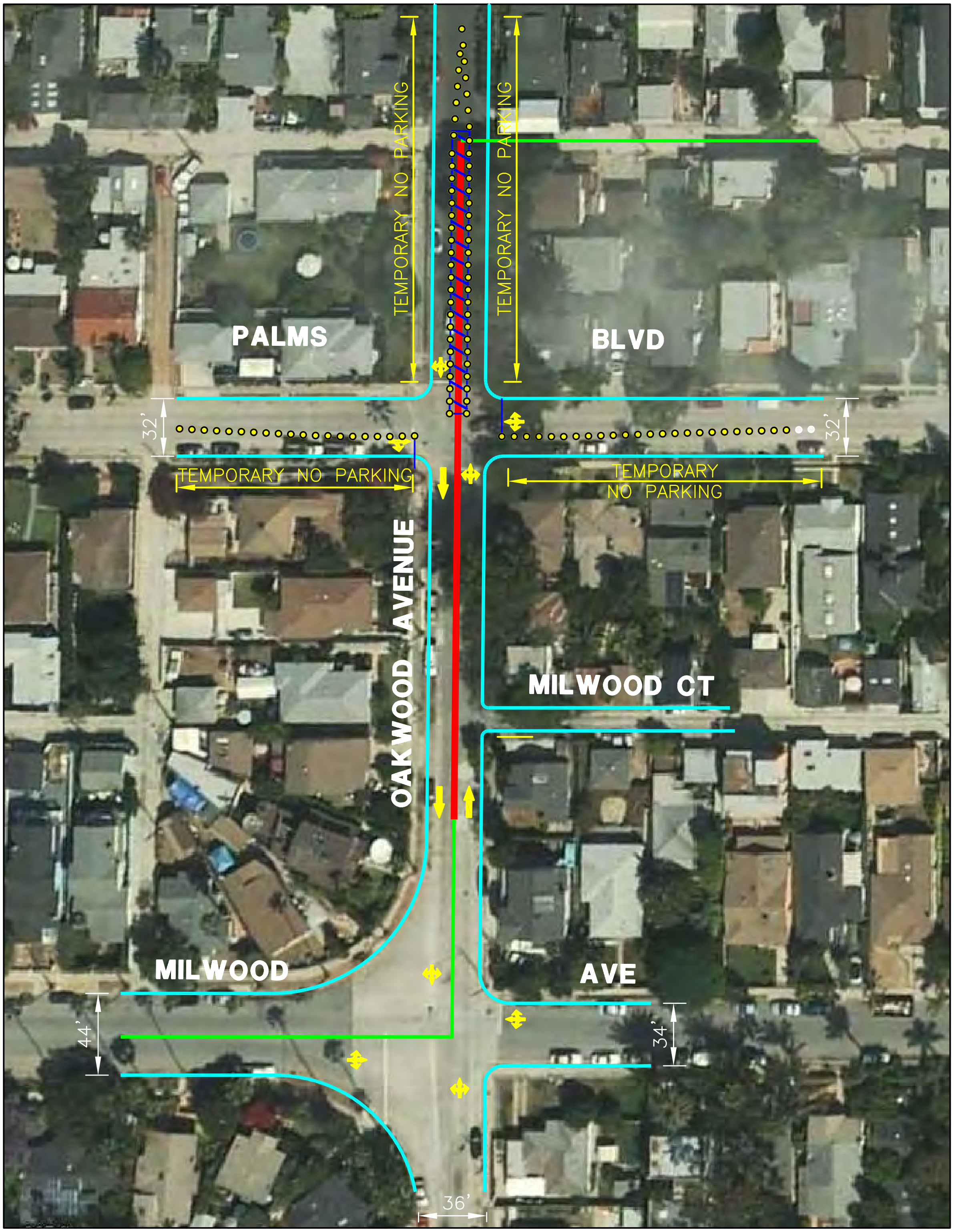
NOT TO SCALE

FIGURE 5-2 Oakwood Avenue Traffic Control Concept

Stage 2

City of Los Angeles Penmar Water Quality Improvement and Runoff Reuse Project

FPL and Associates, Inc.



LEGEND

🟥 Proposed Sewer Rehabilitation
🟩 Existing Sewer
⊢⊣ Barricade With Sign
— Curb Line

▨ Work Zone
○ 28" Traffic Channelizer with Reflective Marker
⇨ Direction of Traffic

NOTE: All Dimensions Shown here are Approximate

NOT TO SCALE

FIGURE 5-3 Oakwood Avenue Traffic Control Concept

Stage 3

City of Los Angeles Penmar Water Quality Improvement and Runoff Reuse Project

FPL and Associates, Inc.

spaces in total, be temporarily disallowed. The dominant peak hour direction flow is in the evening 90 vehicles, V/C = 0.075.

Figures 6-1 shows the construction area and traffic lane designations on Palms Boulevard.

Abbot Kinney Boulevard at Palms Boulevard – The proposal is that the 75' sewer rehabilitation will take place in three stages. During Stage 1, the part of the sewer in the middle of Abbot Kinney Boulevard would be rehabilitated together with the manhole replacement. Northbound left turns from Rialto Court, and about 80 feet of street parking both directions (6 cars parking) on Abbot Kinney Boulevard, would be prohibited during this first stage. During Stage 2, the part of the sewer in the northern portion of Abbot Kinney Boulevard would be rehabilitated and about 80 feet of street parking both directions on Abbot Kinney Boulevard would be prohibited (6 cars parking). During Stage 3, the part of the sewer in the southern portion of Palms Boulevard would be rehabilitated together with the manhole replacement. Eastbound left turns and westbound rights from Abbot Kinney Boulevard will be temporarily prohibited. Each stage is estimated to take approximately two weeks.

Figures 7-1, 7-2, and 7-3 show the construction area and traffic lane designations at each stage.

Table 5 shows the comparison of pre-construction traffic and construction traffic conditions for construction of sewer rehabilitation at the four aforementioned locations. The same number of travel lanes or through movement lanes are provided by the conceptual traffic control plans; therefore, the V/C ratio will be the same. There will be temporary loss of parking spaces and restriction of turns at the intersection per the aforementioned conceptual traffic control addressed in Figures 5, 6 and 7. The loss of access and parking will only be temporary and will not be substantial.

6. CONCLUSION

Construction traffic impact identified in the Initial Study of this subject project will be mitigated by the aforementioned traffic control measures to a less than significant level.

NOTE: All Dimensions Shown here are Approximate

FIGURE 6-1 Palms Boulevard and Crescent Place Traffic Control Concept

City of Los Angeles Penmar Water Quality Improvement and Runoff Reuse Project

FPL and Associates, Inc.

LEGEND

🟥 Proposed Sewer Rehabilitation
🟩 Existing Sewer
⊢⊣ Barricade With Sign
— Curb Line

▨ Work Zone
○ 28" Traffic Channelizer with Reflective Marker
⇨ Direction of Traffic

NOTE: All Dimensions Shown here are Approximate

NOT TO SCALE

FIGURE 7-1 Palms Boulevard and Abbot Kinney Boulevard Traffic Control Concept Stage 1

City of Los Angeles Penmar Water Quality Improvement and Runoff Reuse Project

FPL and Associates, Inc.

LEGEND

🟥	Proposed Sewer Rehabilitation
🟩	Existing Sewer
⊢⊣	Barricade With Sign
—	Curb Line
▨	Work Zone
▫	18" Traffic Cone
●	28" Traffic Channelizer with Reflective Marker
⇨	Direction of Traffic

NOTE: All Dimensions Shown here are Approximate

NOT TO SCALE

FIGURE 7-2 Palms Boulevard and Abbot Kinney Boulevard Traffic Control Concept Stage 2

City of Los Angeles Penmar Water Quality Improvement and Runoff Reuse Project

FPL and Associates, Inc.

LEGEND

- ▬ Proposed Sewer Rehabilitation
- ▬ Existing Sewer
- ⊢⊣ Barricade With Sign
- ▬ Curb Line
- ▨ Work Zone
- ● 28" Traffic Channelizer with Reflective Marker
- ⇨ Direction of Traffic

NOTE: All Dimensions Shown here are Approximate

NOT TO SCALE

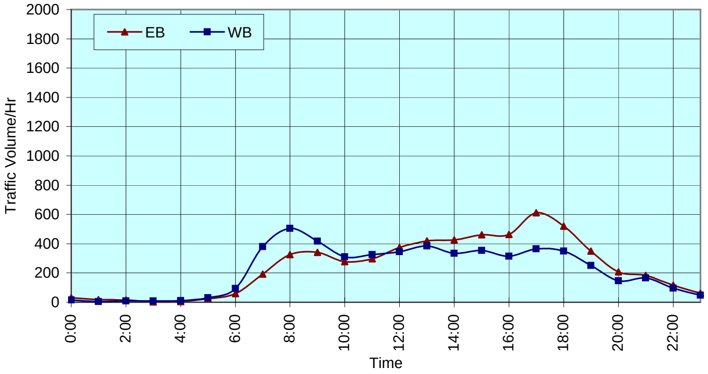
FIGURE 7-3 Palms Boulevard and Abbot Kinney Boulevard Traffic Control Concept Stage 3

City of Los Angeles Penmar Water Quality Improvement and Runoff Reuse Project

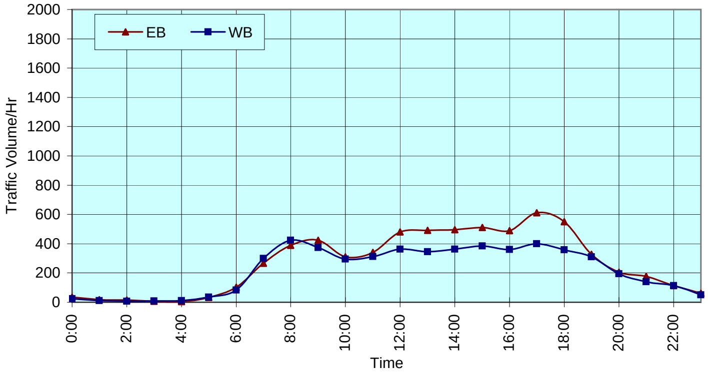
FPL and Associates, Inc.

Appendix A – ADT Charts and Counts

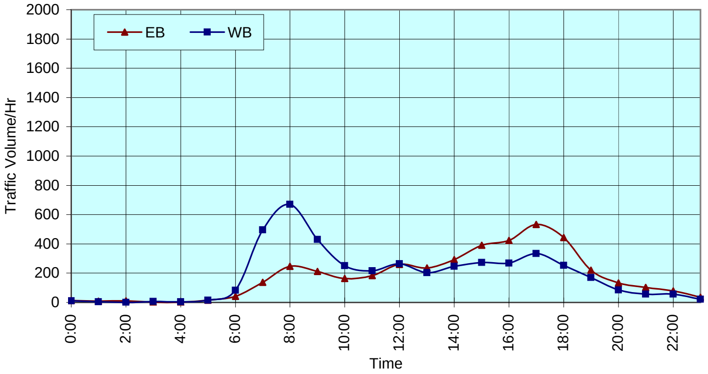
Penmar Park 24-Hour ADT Counts, 02/11/09, Wednesday



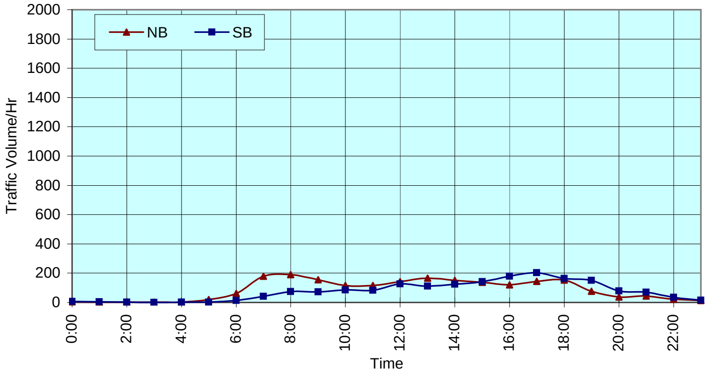
24-Hour ADT Counts - Rose Ave. bet Lincoln Blvd. & Frederick St.



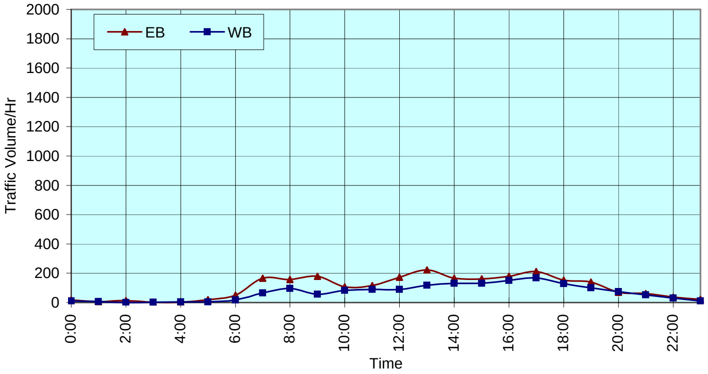
24-Hour ADT Counts - Rose Ave. bet Penmar Ave. & Glenavon Ave.



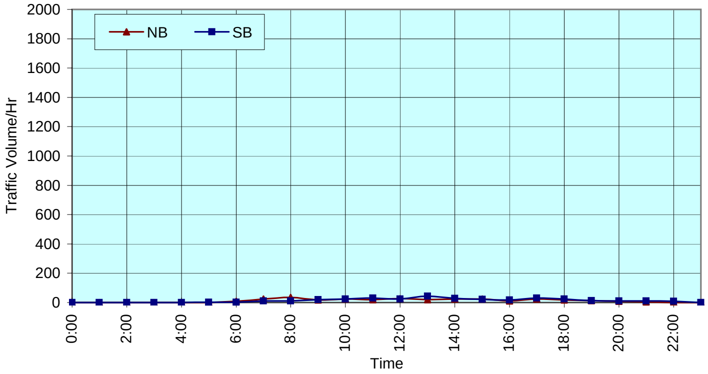
24-Hour ADT Counts - Rose Ave. bet Walgrove Ave. & Morningside Ave St.



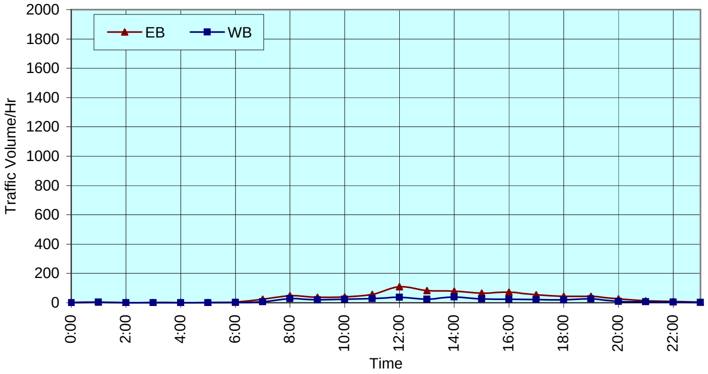
24-Hour ADT Counts - Penmar Ave. bet Rose Ave. & Lake St.



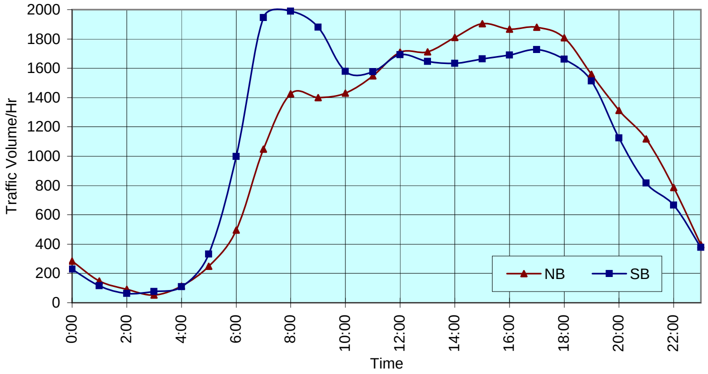
24-Hour ADT Counts - Lake St. bet Penmar Ave. & Courtland St.



24-Hour ADT Counts - Courtland St. bet Rose Ave. & Indiana Ave.

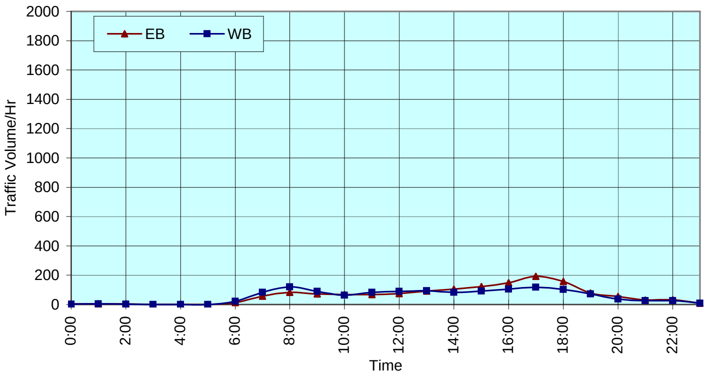


24-Hour ADT Counts - Sunset Ave. bet Rose Ave. & Flower St.

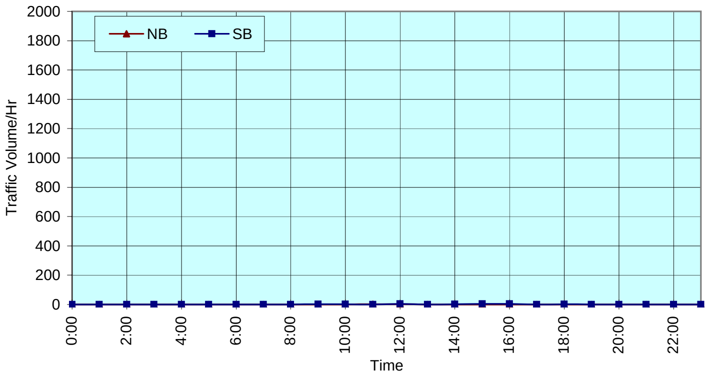


24-Hour ADT Counts - Lincoln Blvd. bet Lake St. & Indiana Ct.

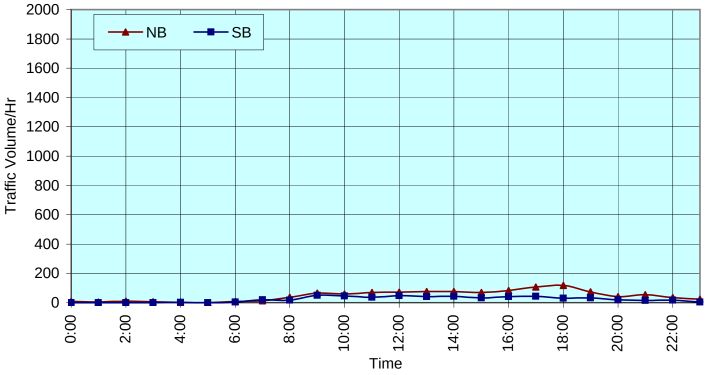
Penmar Park 24-Hour ADT Counts, 02/11/09, Wednesday



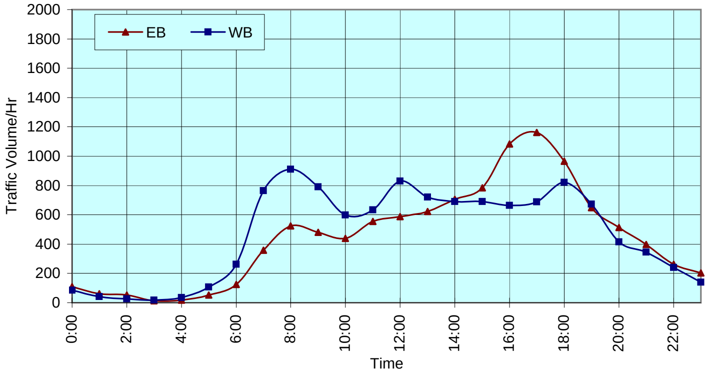
24-Hour ADT Counts - Oakwood Ave. bet Palms Blvd. & Rialto Ct.



24-Hour ADT Counts - Rialto Court. bet Shell Ave. & Crescent Court

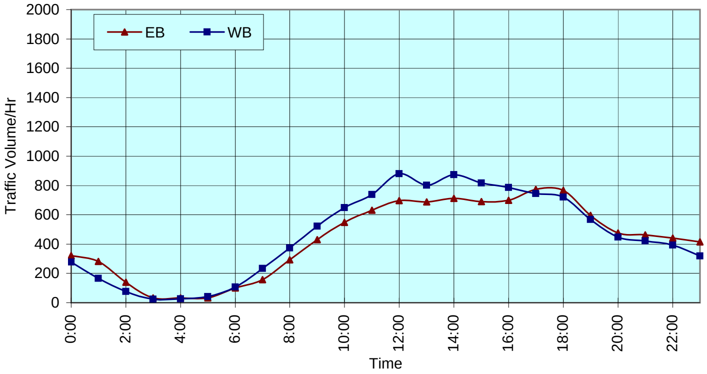


24-Hour ADT Counts - Palms Blvd. bet Electric Court & Shell Ave.

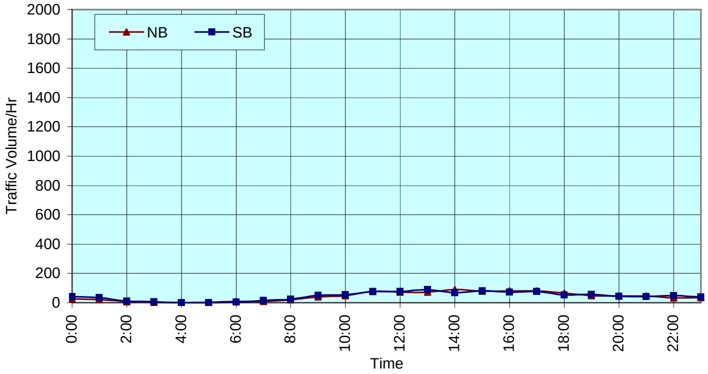


24-Hour ADT Counts - Abbot Kinney bet Palms Blvd. & Rialto Court

Penmar Park 24-Hour ADT Counts, 02/28/09, Saturday



24-Hour ADT Counts - Abbott Kinney Blvd. bet Milwood Ave. & Palms Blvd.



24-Hour ADT Counts - Palms Blvd. bet Abbot Kinney Blvd. & Electric Ave.

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-001

Location: Rose Ave btwn Lincoln Blvd & Frederick St

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			11		2			12:00			106		65		
00:15			9		3			12:15			107		94		
00:30			3		5			12:30			64		94		
00:45			7	30	5	15	45	12:45			97	374	93	346	720
01:00			9		1			13:00			87		94		
01:15			4		1			13:15			122		98		
01:30			2		1			13:30			115		90		
01:45			3	18	1	4	22	13:45			95	419	102	384	803
02:00			7		3			14:00			104		95		
02:15			3		2			14:15			111		78		
02:30			2		1			14:30			108		74		
02:45			3	15	2	8	23	14:45			103	426	86	333	759
03:00			0		1			15:00			107		98		
03:15			0		1			15:15			112		71		
03:30			3		3			15:30			119		84		
03:45			0	3	4	9	12	15:45			123	461	100	353	814
04:00			1		1			16:00			129		75		
04:15			2		0			16:15			120		90		
04:30			0		5			16:30			106		77		
04:45			2	5	5	11	16	16:45			108	463	72	314	777
05:00			5		6			17:00			134		89		
05:15			4		2			17:15			148		78		
05:30			6		8			17:30			144		103		
05:45			9	24	14	30	54	17:45			186	612	94	364	976
06:00			9		14			18:00			147		92		
06:15			11		18			18:15			142		91		
06:30			20		26			18:30			116		84		
06:45			20	60	36	94	154	18:45			115	520	82	349	869
07:00			28		47			19:00			111		67		
07:15			33		72			19:15			78		73		
07:30			65		91			19:30			88		62		
07:45			67	193	171	381	574	19:45			73	350	50	252	602
08:00			71		141			20:00			54		47		
08:15			82		129			20:15			64		36		
08:30			83		108			20:30			44		31		
08:45			89	325	127	505	830	20:45			45	207	32	146	353
09:00			78		100			21:00			55		52		
09:15			83		109			21:15			49		56		
09:30			82		96			21:30			41		38		
09:45			97	340	112	417	757	21:45			39	184	21	167	351
10:00			71		86			22:00			27		31		
10:15			65		80			22:15			38		26		
10:30			73		73			22:30			24		22		
10:45			69	278	70	309	587	22:45			26	115	18	97	212
11:00			66		84			23:00			18		11		
11:15			69		70			23:15			17		18		
11:30			81		85			23:30			12		11		
11:45			82	298	87	326	624	23:45			15	62	9	49	111
Total Vol.				1589		2109	**3698**					4193		3154	**7347**

Daily Totals

NB	SB	Combined	EB	WB
		11045	5782	5263

	AM			PM		
Split %	43.0%	57.0%	**33.5%**	57.1%	42.9%	**66.5%**
Peak Hour	11:30	07:45	**07:45**	17:15	13:15	**17:30**
Volume	376	549	**852**	625	385	**999**
P.H.F.	0.88	0.80	**0.89**	0.84	0.94	**0.89**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-002

Location: Rose Ave btwn Penmar Ave & Glenavon Ave

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			15		6			12:00			119		87		
00:15			8		4			12:15			132		96		
00:30			4		9			12:30			101		93		
00:45			8	35	4	23	58	12:45			128	480	87	363	843
01:00			9		2			13:00			114		81		
01:15			2		3			13:15			146		88		
01:30			4		1			13:30			121		75		
01:45			3	18	4	10	28	13:45			110	491	100	344	835
02:00			7		2			14:00			114		113		
02:15			4		2			14:15			140		80		
02:30			3		0			14:30			119		81		
02:45			2	16	2	6	22	14:45			123	496	89	363	859
03:00			0		1			15:00			123		103		
03:15			1		1			15:15			116		73		
03:30			3		3			15:30			122		95		
03:45			2	6	4	9	15	15:45			149	510	114	385	895
04:00			1		2			16:00			138		95		
04:15			1		0			16:15			123		81		
04:30			1		4			16:30			110		91		
04:45			2	5	6	12	17	16:45			119	490	94	361	851
05:00			6		3			17:00			135		97		
05:15			5		6			17:15			148		100		
05:30			5		7			17:30			146		104		
05:45			16	32	18	34	66	17:45			183	612	98	399	1011
06:00			17		19			18:00			157		86		
06:15			19		19			18:15			147		93		
06:30			31		21			18:30			128		90		
06:45			35	102	25	84	186	18:45			118	550	90	359	909
07:00			56		44			19:00			102		78		
07:15			59		59			19:15			66		99		
07:30			79		67			19:30			93		76		
07:45			73	267	130	300	567	19:45			67	328	57	310	638
08:00			101		117			20:00			55		60		
08:15			88		106			20:15			67		45		
08:30			94		95			20:30			42		46		
08:45			105	388	105	423	811	20:45			41	205	43	194	399
09:00			85		89			21:00			54		41		
09:15			115		90			21:15			41		45		
09:30			113		88			21:30			39		30		
09:45			111	424	107	374	798	21:45			42	176	24	140	316
10:00			79		74			22:00			29		40		
10:15			78		90			22:15			32		31		
10:30			80		62			22:30			23		27		
10:45			72	309	68	294	603	22:45			30	114	15	113	227
11:00			77		88			23:00			19		9		
11:15			73		59			23:15			16		20		
11:30			94		84			23:30			11		10		
11:45			96	340	82	313	653	23:45			16	62	12	51	113
Total Vol.				1942		1882	**3824**					4514		3382	**7896**

Daily Totals

NB	SB	Combined	EB	WB
		11720	6456	5264

	AM			PM		
Split %	50.8%	49.2%	**32.6%**	57.2%	42.8%	**67.4%**
Peak Hour	11:45	07:45	**08:00**	17:15	17:00	**17:15**
Volume	448	448	**811**	634	399	**1022**
P.H.F.	0.85	0.86	**0.93**	0.87	0.96	**0.91**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-003

Location: Rose Ave btwn Walgrove Ave & Morningside Ave

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			5		4			12:00			65		61		
00:15			2		1			12:15			79		60		
00:30			2		5			12:30			57		77		
00:45			4	13	2	12	25	12:45			58	259	67	265	524
01:00			3		2			13:00			61		41		
01:15			4		0			13:15			61		49		
01:30			1		2			13:30			65		53		
01:45			1	9	1	5	14	13:45			48	235	60	203	438
02:00			6		0			14:00			68		61		
02:15			3		1			14:15			72		59		
02:30			1		0			14:30			65		56		
02:45			2	12	0	1	13	14:45			88	293	71	247	540
03:00			1		2			15:00			95		79		
03:15			0		1			15:15			88		50		
03:30			1		3			15:30			101		66		
03:45			0	2	1	7	9	15:45			107	391	79	274	665
04:00			0		1			16:00			105		68		
04:15			0		0			16:15			105		58		
04:30			2		1			16:30			119		62		
04:45			1	3	2	4	7	16:45			94	423	81	269	692
05:00			7		4			17:00			117		68		
05:15			2		0			17:15			141		103		
05:30			3		4			17:30			124		83		
05:45			3	15	8	16	31	17:45			151	533	81	335	868
06:00			7		12			18:00			136		65		
06:15			7		13			18:15			118		63		
06:30			13		25			18:30			107		67		
06:45			15	42	33	83	125	18:45			83	444	58	253	697
07:00			15		72			19:00			72		49		
07:15			31		120			19:15			58		49		
07:30			39		131			19:30			49		44		
07:45			53	138	173	496	634	19:45			41	220	28	170	390
08:00			65		190			20:00			37		27		
08:15			69		149			20:15			38		21		
08:30			45		156			20:30			28		18		
08:45			67	246	175	670	916	20:45			31	134	20	86	220
09:00			50		127			21:00			28		19		
09:15			59		97			21:15			27		13		
09:30			54		106			21:30			25		13		
09:45			49	212	100	430	642	21:45			23	103	12	57	160
10:00			51		67			22:00			26		24		
10:15			32		76			22:15			15		12		
10:30			37		54			22:30			16		12		
10:45			43	163	54	251	414	22:45			22	79	8	56	135
11:00			46		46			23:00			12		3		
11:15			37		43			23:15			9		6		
11:30			46		60			23:30			5		7		
11:45			54	183	67	216	399	23:45			10	36	6	22	58
Total Vol.				1038		2191	**3229**					3150		2237	**5387**

Daily Totals

NB	SB		EB	WB
		Combined	4188	4428
		8616		

	AM			PM		
Split %	32.1%	67.9%	**37.5%**	58.5%	41.5%	**62.5%**
Peak Hour	11:45	08:00	**08:00**	17:15	16:45	**17:15**
Volume	255	670	**916**	552	335	**884**
P.H.F.	0.81	0.88	**0.90**	0.91	0.81	**0.91**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-004

Location: Penmar Ave btwn Rose Ave & Lake St

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	3		3					12:00	26		32				
00:15	0		2					12:15	47		39				
00:30	2		1					12:30	32		26				
00:45	0	5	1	7			12	12:45	38	143	29	126			269
01:00	0		1					13:00	39		24				
01:15	0		3					13:15	38		25				
01:30	1		0					13:30	41		30				
01:45	1	2	1	5			7	13:45	47	165	32	111			276
02:00	1		3					14:00	32		38				
02:15	1		0					14:15	44		27				
02:30	1		0					14:30	41		33				
02:45	0	3	0	3			6	14:45	34	151	26	124			275
03:00	1		0					15:00	33		42				
03:15	0		0					15:15	33		31				
03:30	1		0					15:30	36		34				
03:45	1	3	0	0			3	15:45	36	138	36	143			281
04:00	0		1					16:00	33		49				
04:15	1		0					16:15	41		46				
04:30	1		0					16:30	22		43				
04:45	0	2	1	2			4	16:45	23	119	41	179			298
05:00	2		0					17:00	27		53				
05:15	2		1					17:15	37		56				
05:30	4		0					17:30	43		46				
05:45	11	19	1	2			21	17:45	37	144	49	204			348
06:00	8		0					18:00	47		48				
06:15	13		0					18:15	38		45				
06:30	15		5					18:30	34		35				
06:45	26	62	8	13			75	18:45	33	152	36	164			316
07:00	32		5					19:00	24		42				
07:15	40		9					19:15	19		40				
07:30	39		10					19:30	15		30				
07:45	68	179	17	41			220	19:45	18	76	39	151			227
08:00	59		18					20:00	9		27				
08:15	35		16					20:15	11		24				
08:30	45		23					20:30	7		16				
08:45	50	189	18	75			264	20:45	10	37	12	79			116
09:00	34		17					21:00	17		25				
09:15	46		20					21:15	11		15				
09:30	37		12					21:30	10		15				
09:45	39	156	23	72			228	21:45	5	43	14	69			112
10:00	27		23					22:00	10		8				
10:15	26		15					22:15	4		17				
10:30	36		22					22:30	3		8				
10:45	26	115	25	85			200	22:45	5	22	3	36			58
11:00	33		20					23:00	5		4				
11:15	25		20					23:15	4		5				
11:30	38		23					23:30	1		5				
11:45	20	116	19	82			198	23:45	3	13	1	15			28
Total Vol.		851		387			**1238**			1203		1401			**2604**

Daily Totals

NB	SB		EB	WB
2054	1788	Combined		
		3842		

	AM			PM		
Split %	68.7%	31.3%	**32.2%**	46.2%	53.8%	**67.8%**
Peak Hour	07:45	11:45	**07:45**	13:00	17:00	**17:15**
Volume	207	116	**281**	165	204	**363**
P.H.F.	0.76	0.74	**0.83**	0.97	0.91	**0.96**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-005

Location: Lake St btwn Penmar Ave & Courtland St

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			6		3			12:00			43		21		
00:15			3		5			12:15			36		23		
00:30			4		2			12:30			28		15		
00:45			4	17	1	11	28	12:45			65	172	31	90	262
01:00			3		5			13:00			56		23		
01:15			1		0			13:15			55		23		
01:30			2		2			13:30			55		23		
01:45			0	6	0	7	13	13:45			56	222	48	117	339
02:00			3		0			14:00			40		39		
02:15			5		0			14:15			43		33		
02:30			2		0			14:30			51		38		
02:45			3	13	0	0	13	14:45			31	165	21	131	296
03:00			0		1			15:00			24		32		
03:15			1		1			15:15			37		34		
03:30			0		0			15:30			52		32		
03:45			1	2	1	3	5	15:45			48	161	34	132	293
04:00			0		1			16:00			55		30		
04:15			2		1			16:15			43		37		
04:30			1		2			16:30			37		41		
04:45			0	3	0	4	7	16:45			44	179	43	151	330
05:00			1		0			17:00			49		58		
05:15			3		0			17:15			50		31		
05:30			3		2			17:30			55		38		
05:45			13	20	2	4	24	17:45			57	211	42	169	380
06:00			10		2			18:00			42		44		
06:15			14		3			18:15			37		35		
06:30			9		5			18:30			44		17		
06:45			18	51	8	18	69	18:45			30	153	33	129	282
07:00			30		7			19:00			45		33		
07:15			28		15			19:15			36		29		
07:30			48		14			19:30			33		15		
07:45			61	167	29	65	232	19:45			25	139	23	100	239
08:00			48		30			20:00			18		23		
08:15			33		27			20:15			23		24		
08:30			30		19			20:30			16		14		
08:45			47	158	19	95	253	20:45			13	70	14	75	145
09:00			29		15			21:00			15		18		
09:15			58		18			21:15			18		7		
09:30			46		5			21:30			18		14		
09:45			45	178	19	57	235	21:45			11	62	13	52	114
10:00			24		24			22:00			8		5		
10:15			25		15			22:15			9		13		
10:30			34		18			22:30			16		8		
10:45			25	108	27	84	192	22:45			5	38	5	31	69
11:00			26		24			23:00			7		1		
11:15			24		22			23:15			6		2		
11:30			37		18			23:30			3		2		
11:45			29	116	26	90	206	23:45			6	22	5	10	32
Total Vol.				839		438	**1277**					1594		1187	**2781**

Daily Totals

NB	SB		EB	WB
		Combined	2433	1625
		4058		

	AM			PM		
Split %	65.7%	34.3%	**31.5%**	57.3%	42.7%	**68.5%**
Peak Hour	07:30	07:45	**07:30**	12:45	16:15	**17:00**
Volume	190	105	**290**	231	179	**380**
P.H.F.	0.78	0.88	**0.81**	0.89	0.77	**0.89**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-006

Location: Courtland St btwn Rose Ave & Indiana Ave

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	0		1					12:00	2		5				
00:15	0		0					12:15	12		4				
00:30	0		0					12:30	5		9				
00:45	0	0	0	1			1	12:45	7	26	5	23			49
01:00	0		0					13:00	3		7				
01:15	0		0					13:15	2		12				
01:30	0		0					13:30	5		12				
01:45	0	0	0	0				13:45	10	20	13	44			64
02:00	0		0					14:00	9		7				
02:15	0		0					14:15	5		9				
02:30	0		0					14:30	4		6				
02:45	0	0	0	0				14:45	6	24	7	29			53
03:00	0		0					15:00	10		12				
03:15	0		0					15:15	8		6				
03:30	0		0					15:30	4		1				
03:45	0	0	0	0				15:45	1	23	3	22			45
04:00	0		0					16:00	1		7				
04:15	0		0					16:15	3		4				
04:30	0		0					16:30	2		3				
04:45	0	0	1	1			1	16:45	6	12	3	17			29
05:00	0		0					17:00	5		7				
05:15	0		1					17:15	5		6				
05:30	0		0					17:30	12		12				
05:45	1	1	1	2			3	17:45	3	25	6	31			56
06:00	3		1					18:00	2		4				
06:15	2		0					18:15	7		8				
06:30	0		1					18:30	5		7				
06:45	4	9	0	2			11	18:45	3	17	6	25			42
07:00	8		2					19:00	2		6				
07:15	7		2					19:15	7		4				
07:30	6		4					19:30	3		1				
07:45	4	25	3	11			36	19:45	2	14	2	13			27
08:00	6		1					20:00	3		2				
08:15	8		4					20:15	1		3				
08:30	12		2					20:30	2		4				
08:45	10	36	3	10			46	20:45	2	8	3	12			20
09:00	3		5					21:00	0		0				
09:15	5		2					21:15	1		4				
09:30	3		3					21:30	1		5				
09:45	7	18	9	19			37	21:45	2	4	3	12			16
10:00	5		7					22:00	0		4				
10:15	7		6					22:15	0		3				
10:30	9		7					22:30	0		1				
10:45	3	24	4	24			48	22:45	0	0	0	8			8
11:00	2		4					23:00	0		0				
11:15	4		10					23:15	1		0				
11:30	6		7					23:30	0		0				
11:45	7	19	9	30			49	23:45	0	1	0	0			1
Total Vol.		132		100			**232**			174		236			**410**

Daily Totals

NB	SB		EB	WB
306	336	Combined		
		642		

	AM			PM		
Split %	56.9%	43.1%	**36.1%**	42.4%	57.6%	**63.9%**
Peak Hour	08:00	11:15	**09:45**	13:30	13:00	**13:15**
Volume	36	31	**57**	29	44	**70**
P.H.F.	0.75	0.78	**0.89**	0.83	0.85	**0.76**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-007

Location: Sunset Ave btwn Rose Ave & Flower St

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			1		0			12:00			31		9		
00:15			0		1			12:15			24		10		
00:30			0		0			12:30			29		13		
00:45			1	2	0	1	3	12:45			26	110	6	38	148
01:00			2		1			13:00			21		7		
01:15			1		1			13:15			32		6		
01:30			2		0			13:30			14		5		
01:45			0	5	3	5	10	13:45			17	84	6	24	108
02:00			1		0			14:00			18		12		
02:15			0		0			14:15			20		10		
02:30			0		0			14:30			23		9		
02:45			0	1	1	1	2	14:45			17	78	8	39	117
03:00			0		0			15:00			26		4		
03:15			1		0			15:15			11		7		
03:30			0		0			15:30			12		10		
03:45			1	2	0	0	2	15:45			17	66	6	27	93
04:00			0		0			16:00			14		4		
04:15			0		0			16:15			23		4		
04:30			0		0			16:30			17		8		
04:45			0	0	0	0		16:45			18	72	9	25	97
05:00			0		0			17:00			23		6		
05:15			0		0			17:15			10		1		
05:30			0		0			17:30			10		6		
05:45			2	2	0	0	2	17:45			11	54	9	22	76
06:00			2		1			18:00			10		4		
06:15			1		0			18:15			11		4		
06:30			1		2			18:30			12		7		
06:45			1	5	0	3	8	18:45			11	44	4	19	63
07:00			2		0			19:00			9		7		
07:15			5		0			19:15			9		7		
07:30			9		1			19:30			16		7		
07:45			7	23	6	7	30	19:45			9	43	5	26	69
08:00			15		15			20:00			7		2		
08:15			13		4			20:15			8		3		
08:30			9		7			20:30			7		3		
08:45			12	49	2	28	77	20:45			4	26	1	9	35
09:00			11		6			21:00			4		2		
09:15			12		4			21:15			5		3		
09:30			7		6			21:30			2		1		
09:45			7	37	4	20	57	21:45			2	13	0	6	19
10:00			18		10			22:00			3		0		
10:15			6		4			22:15			1		3		
10:30			8		4			22:30			1		1		
10:45			8	40	7	25	65	22:45			4	9	0	4	13
11:00			13		9			23:00			2		0		
11:15			13		4			23:15			0		1		
11:30			11		11			23:30			3		1		
11:45			19	56	5	29	85	23:45			0	5	1	3	8
Total Vol.				222		119	**341**					604		242	**846**

Daily Totals

NB	SB		EB	WB
		Combined	826	361
		1187		

	AM			PM		
Split %	65.1%	34.9%	**28.7%**	71.4%	28.6%	**71.3%**
Peak Hour	11:45	11:45	**11:45**	12:00	14:00	**12:00**
Volume	103	37	**140**	110	39	**148**
P.H.F.	0.83	0.71	**0.83**	0.89	0.81	**0.88**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-008

Location: Lincoln Blvd btwn Lake St & Indiana Ct

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	98		80					12:00	429		471				
00:15	81		71					12:15	408		440				
00:30	54		42					12:30	439		382				
00:45	50	283	37	230			513	12:45	434	1710	399	1692			3402
01:00	49		28					13:00	413		418				
01:15	41		36					13:15	434		391				
01:30	27		24					13:30	442		409				
01:45	31	148	28	116			264	13:45	422	1711	428	1646			3357
02:00	28		23					14:00	426		410				
02:15	27		18					14:15	452		387				
02:30	17		11					14:30	468		418				
02:45	20	92	12	64			156	14:45	463	1809	418	1633			3442
03:00	16		14					15:00	473		407				
03:15	10		15					15:15	483		411				
03:30	21		22					15:30	459		392				
03:45	6	53	26	77			130	15:45	488	1903	453	1663			3566
04:00	20		20					16:00	484		429				
04:15	23		20					16:15	462		410				
04:30	32		25					16:30	457		437				
04:45	38	113	44	109			222	16:45	464	1867	415	1691			3558
05:00	46		57					17:00	500		424				
05:15	56		58					17:15	466		457				
05:30	61		92					17:30	435		435				
05:45	85	248	124	331			579	17:45	478	1879	412	1728			3607
06:00	105		147					18:00	455		410				
06:15	100		175					18:15	441		391				
06:30	134		289					18:30	466		418				
06:45	157	496	386	997			1493	18:45	446	1808	442	1661			3469
07:00	212		416					19:00	417		376				
07:15	250		488					19:15	383		420				
07:30	283		536					19:30	379		344				
07:45	302	1047	505	1945			2992	19:45	379	1558	373	1513			3071
08:00	333		493					20:00	358		328				
08:15	325		476					20:15	333		253				
08:30	385		488					20:30	313		287				
08:45	383	1426	533	1990			3416	20:45	308	1312	257	1125			2437
09:00	347		485					21:00	274		234				
09:15	325		439					21:15	300		225				
09:30	351		522					21:30	271		192				
09:45	376	1399	434	1880			3279	21:45	273	1118	166	817			1935
10:00	378		438					22:00	242		177				
10:15	341		360					22:15	204		205				
10:30	383		393					22:30	194		164				
10:45	328	1430	388	1579			3009	22:45	146	786	120	666			1452
11:00	401		393					23:00	144		114				
11:15	354		378					23:15	97		107				
11:30	377		405					23:30	69		77				
11:45	415	1547	401	1577			3124	23:45	85	395	80	378			773
Total Vol.		8282		10895			**19177**			17856		16213			**34069**

Daily Totals

NB	SB		EB	WB
26138	27108	Combined		
		53246		

	AM			PM		
Split %	43.2%	56.8%	**36.0%**	52.4%	47.6%	**64.0%**
Peak Hour	11:45	07:15	**08:15**	15:15	16:30	**15:45**
Volume	1691	2022	**3422**	1914	1733	**3620**
P.H.F.	0.96	0.94	**0.93**	0.98	0.95	**0.96**

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-009

Location: Oakwood Ave btwn Palms Blvd & Rialto Ct

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			4		2			12:00			20		21		
00:15			1		1			12:15			21		19		
00:30			0		0			12:30			19		26		
00:45			0	5	0	3	8	12:45			15	75	23	89	164
01:00			0		1			13:00			27		19		
01:15			2		0			13:15			28		24		
01:30			2		0			13:30			22		26		
01:45			0	4	3	4	8	13:45			15	92	25	94	186
02:00			2		0			14:00			28		18		
02:15			1		0			14:15			29		21		
02:30			0		1			14:30			24		28		
02:45			1	4	1	2	6	14:45			24	105	16	83	188
03:00			0		0			15:00			29		29		
03:15			0		0			15:15			29		19		
03:30			1		0			15:30			34		18		
03:45			0	1	1	1	2	15:45			30	122	26	92	214
04:00			0		0			16:00			28		26		
04:15			0		0			16:15			33		23		
04:30			1		0			16:30			35		29		
04:45			0	1	0	0	1	16:45			53	149	27	105	254
05:00			0		0			17:00			45		39		
05:15			0		1			17:15			47		29		
05:30			0		0			17:30			48		22		
05:45			0	0	0	1	1	17:45			52	192	28	118	310
06:00			0		1			18:00			40		30		
06:15			4		7			18:15			47		29		
06:30			4		4			18:30			40		27		
06:45			5	13	9	21	34	18:45			31	158	17	103	261
07:00			4		16			19:00			28		23		
07:15			14		15			19:15			17		20		
07:30			22		30			19:30			17		20		
07:45			17	57	23	84	141	19:45			16	78	10	73	151
08:00			24		24			20:00			19		11		
08:15			10		32			20:15			12		11		
08:30			22		35			20:30			10		6		
08:45			27	83	30	121	204	20:45			14	55	9	37	92
09:00			21		33			21:00			15		5		
09:15			14		28			21:15			2		14		
09:30			20		17			21:30			4		2		
09:45			16	71	12	90	161	21:45			9	30	6	27	57
10:00			18		18			22:00			12		7		
10:15			13		13			22:15			7		10		
10:30			15		14			22:30			5		5		
10:45			22	68	19	64	132	22:45			8	32	4	26	58
11:00			13		19			23:00			2		3		
11:15			12		14			23:15			1		3		
11:30			20		31			23:30			2		1		
11:45			23	68	20	84	152	23:45			4	9	1	8	17
Total Vol.				375		475	**850**					1097		855	**1952**

Daily Totals

NB	SB		EB	WB
		Combined	1472	1330

2802

	AM			PM		
Split %	44.1%	55.9%	**30.3%**	56.2%	43.8%	**69.7%**
Peak Hour	08:30	08:15	**08:15**	16:45	16:30	**16:45**
Volume	84	130	**210**	193	124	**310**
P.H.F.	0.78	0.93	**0.92**	0.91	0.79	**0.92**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-010

Location: Rialto Court btwn Shell Ave & Crescent Court

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	0		0					12:00	0		0				
00:15	0		0					12:15	0		2				
00:30	0		0					12:30	2		2				
00:45	0	0	0	0				12:45	1	3	0	4			7
01:00	0		0					13:00	0		0				
01:15	0		1					13:15	0		0				
01:30	0		0					13:30	1		1				
01:45	0	0	0	1			1	13:45	0	1	0	1			2
02:00	0		0					14:00	0		0				
02:15	0		0					14:15	0		1				
02:30	0		0					14:30	0		0				
02:45	0	0	0	0				14:45	0	0	2	3			3
03:00	0		0					15:00	0		0				
03:15	0		0					15:15	0		2				
03:30	0		0					15:30	0		1				
03:45	0	0	0	0				15:45	0	0	1	4			4
04:00	0		0					16:00	0		1				
04:15	0		0					16:15	1		0				
04:30	0		0					16:30	0		3				
04:45	0	0	0	0				16:45	0	1	0	4			5
05:00	0		0					17:00	0		0				
05:15	0		0					17:15	1		0				
05:30	0		0					17:30	0		0				
05:45	0	0	0	0				17:45	0	1	0	0			1
06:00	0		0					18:00	0		0				
06:15	0		0					18:15	0		1				
06:30	0		0					18:30	0		1				
06:45	0	0	0	0				18:45	1	1	0	2			3
07:00	0		0					19:00	0		0				
07:15	0		0					19:15	0		0				
07:30	0		0					19:30	0		0				
07:45	1	1	0	0			1	19:45	0	0	0	0			
08:00	0		0					20:00	0		0				
08:15	0		0					20:15	0		0				
08:30	0		0					20:30	0		1				
08:45	0	0	0	0				20:45	0	0	0	1			1
09:00	0		1					21:00	0		1				
09:15	0		1					21:15	0		0				
09:30	0		0					21:30	0		0				
09:45	1	1	0	2			3	21:45	0	0	0	1			1
10:00	0		1					22:00	0		1				
10:15	0		0					22:15	0		0				
10:30	0		0					22:30	0		0				
10:45	1	1	1	2			3	22:45	0	0	0	1			1
11:00	0		0					23:00	0		0				
11:15	1		1					23:15	0		0				
11:30	1		0					23:30	0		0				
11:45	0	2	0	1			3	23:45	0	0	0	0			
Total Vol.		5		6			**11**			7		21			**28**

Daily Totals

NB	SB	EB	WB
12	27		

Combined

39

	AM			PM		
Split %	45.5%	54.5%	**28.2%**	25.0%	75.0%	**71.8%**
Peak Hour	10:45	11:45	**11:45**	12:00	14:45	**12:00**
Volume	3	4	**6**	3	5	**7**
P.H.F.	0.75	0.50	**0.38**	0.50	0.63	**0.44**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-012

Location: Palms Blvd btwn Electric Court & Shell Ave

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	1		0					12:00	17		6				
00:15	3		1					12:15	20		13				
00:30	2		0					12:30	17		16				
00:45	2	8	0	1			9	12:45	17	71	14	49			120
01:00	1		0					13:00	12		12				
01:15	3		0					13:15	24		8				
01:30	1		0					13:30	14		12				
01:45	0	5	0	0			5	13:45	26	76	9	41			117
02:00	4		0					14:00	24		10				
02:15	3		0					14:15	23		14				
02:30	2		0					14:30	12		11				
02:45	2	11	0	0			11	14:45	18	77	9	44			121
03:00	1		0					15:00	19		8				
03:15	1		0					15:15	26		9				
03:30	4		0					15:30	16		4				
03:45	1	7	0	0			7	15:45	9	70	11	32			102
04:00	1		0					16:00	16		5				
04:15	1		0					16:15	19		15				
04:30	0		1					16:30	20		12				
04:45	0	2	1	2			4	16:45	29	84	9	41			125
05:00	0		0					17:00	27		10				
05:15	0		0					17:15	32		17				
05:30	0		1					17:30	25		7				
05:45	1	1	0	1			2	17:45	22	106	9	43			149
06:00	1		0					18:00	27		6				
06:15	0		1					18:15	32		6				
06:30	2		0					18:30	28		11				
06:45	5	8	4	5			13	18:45	30	117	7	30			147
07:00	3		6					19:00	17		11				
07:15	1		6					19:15	21		7				
07:30	4		3					19:30	16		8				
07:45	6	14	5	20			34	19:45	20	74	7	33			107
08:00	6		7					20:00	13		8				
08:15	10		3					20:15	7		6				
08:30	8		5					20:30	8		4				
08:45	14	38	2	17			55	20:45	13	41	1	19			60
09:00	18		11					21:00	17		2				
09:15	13		10					21:15	21		3				
09:30	17		13					21:30	9		5				
09:45	18	66	17	51			117	21:45	8	55	5	15			70
10:00	16		13					22:00	10		3				
10:15	6		12					22:15	6		4				
10:30	19		10					22:30	11		7				
10:45	18	59	11	46			105	22:45	8	35	3	17			52
11:00	21		9					23:00	6		1				
11:15	11		11					23:15	6		1				
11:30	23		10					23:30	6		2				
11:45	15	70	8	38			108	23:45	6	24	1	5			29
Total Vol.		289		181			**470**			830		369			**1199**

Daily Totals

NB	SB		EB	WB
1119	550	Combined		
		1669		

	AM			PM		
Split %	61.5%	38.5%	**28.2%**	69.2%	30.8%	**71.8%**
Peak Hour	11:30	09:30	**09:00**	18:00	12:15	**16:30**
Volume	75	55	**117**	117	55	**156**
P.H.F.	0.82	0.81	**0.84**	0.90	0.86	**0.80**

Prepared by NDS/ATD

Volumes for: Wednesday, February 11, 2009 **City:** Venice **Project #:** 09-5052-013

Location: Abbot Kinney btwn Plams Blvd & Rialto Court

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			31		19			12:00			136		208		
00:15			31		23			12:15			139		205		
00:30			20		22			12:30			152		215		
00:45			28	110	21	85	195	12:45			161	588	202	830	1418
01:00			17		13			13:00			171		210		
01:15			13		11			13:15			155		165		
01:30			8		6			13:30			144		169		
01:45			23	61	11	41	102	13:45			153	623	177	721	1344
02:00			22		11			14:00			174		189		
02:15			12		10			14:15			148		156		
02:30			11		5			14:30			198		170		
02:45			7	52	1	27	79	14:45			185	705	174	689	1394
03:00			2		3			15:00			186		160		
03:15			4		3			15:15			190		158		
03:30			3		3			15:30			196		200		
03:45			4	13	8	17	30	15:45			212	784	171	689	1473
04:00			3		6			16:00			285		177		
04:15			6		8			16:15			304		155		
04:30			4		12			16:30			225		167		
04:45			5	18	8	34	52	16:45			269	1083	164	663	1746
05:00			10		17			17:00			272		153		
05:15			10		14			17:15			315		158		
05:30			16		36			17:30			332		182		
05:45			17	53	40	107	160	17:45			243	1162	194	687	1849
06:00			16		37			18:00			316		223		
06:15			25		41			18:15			211		204		
06:30			35		85			18:30			226		182		
06:45			48	124	100	263	387	18:45			213	966	212	821	1787
07:00			65		144			19:00			181		162		
07:15			68		169			19:15			166		192		
07:30			111		198			19:30			147		165		
07:45			113	357	253	764	1121	19:45			154	648	154	673	1321
08:00			164		236			20:00			136		110		
08:15			117		213			20:15			120		98		
08:30			110		222			20:30			133		116		
08:45			132	523	240	911	1434	20:45			124	513	90	414	927
09:00			115		197			21:00			108		94		
09:15			119		191			21:15			112		96		
09:30			128		191			21:30			89		63		
09:45			119	481	211	790	1271	21:45			89	398	91	344	742
10:00			109		161			22:00			69		63		
10:15			107		141			22:15			60		64		
10:30			111		133			22:30			76		63		
10:45			112	439	163	598	1037	22:45			58	263	50	240	503
11:00			116		147			23:00			56		40		
11:15			149		136			23:15			47		33		
11:30			144		141			23:30			53		40		
11:45			145	554	209	633	1187	23:45			48	204	26	139	343
Total Vol.				2785		4270	**7055**					7937		6910	**14847**

Daily Totals

NB	SB		EB	WB
		Combined	10722	11180
		21902		

	AM			PM		
Split %	39.5%	60.5%	**32.2%**	53.5%	46.5%	**67.8%**
Peak Hour	11:15	07:45	**08:00**	17:15	12:15	**17:15**
Volume	574	924	**1434**	1206	832	**1963**
P.H.F.	0.96	0.91	**0.90**	0.91	0.97	**0.91**

Prepared by NDS/ATD

Volumes for: Saturday, February 28, 2009 **City:** Venice **Project #:** 09-5076-001

Location: Abbot Kinney Blvd btwn Milwood Ave & Palms Blvd

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			88		77			12:00			152		194		
00:15			84		83			12:15			175		206		
00:30			67		51			12:30			191		237		
00:45			81	320	67	278	598	12:45			179	697	244	881	1578
01:00			64		46			13:00			172		201		
01:15			69		43			13:15			188		197		
01:30			65		41			13:30			165		198		
01:45			83	281	35	165	446	13:45			163	688	205	801	1489
02:00			64		35			14:00			158		215		
02:15			38		12			14:15			198		201		
02:30			21		16			14:30			175		234		
02:45			17	140	13	76	216	14:45			181	712	224	874	1586
03:00			5		11			15:00			174		211		
03:15			8		3			15:15			154		218		
03:30			9		7			15:30			170		207		
03:45			11	33	4	25	58	15:45			191	689	181	817	1506
04:00			5		4			16:00			177		200		
04:15			5		4			16:15			179		195		
04:30			8		8			16:30			157		198		
04:45			14	32	11	27	59	16:45			185	698	193	786	1484
05:00			6		10			17:00			188		187		
05:15			6		8			17:15			215		194		
05:30			6		6			17:30			170		168		
05:45			15	33	18	42	75	17:45			201	774	196	745	1519
06:00			20		16			18:00			192		173		
06:15			15		20			18:15			223		177		
06:30			27		30			18:30			159		201		
06:45			38	100	42	108	208	18:45			192	766	170	721	1487
07:00			32		47			19:00			156		134		
07:15			26		46			19:15			159		142		
07:30			39		48			19:30			137		154		
07:45			60	157	92	233	390	19:45			143	595	138	568	1163
08:00			67		73			20:00			121		128		
08:15			61		81			20:15			120		109		
08:30			70		110			20:30			123		119		
08:45			95	293	109	373	666	20:45			112	476	92	448	924
09:00			108		110			21:00			133		117		
09:15			100		105			21:15			115		119		
09:30			105		120			21:30			104		91		
09:45			118	431	186	521	952	21:45			111	463	95	422	885
10:00			132		161			22:00			107		100		
10:15			140		132			22:15			117		116		
10:30			120		160			22:30			116		88		
10:45			157	549	195	648	1197	22:45			102	442	89	393	835
11:00			172		179			23:00			103		84		
11:15			158		200			23:15			111		82		
11:30			146		180			23:30			94		90		
11:45			156	632	180	739	1371	23:45			106	414	63	319	733
Total Vol.				3001		3235	**6236**					7414		7775	**15189**

Daily Totals

NB	SB	Combined	EB	WB
		21425	10415	11010

	AM			PM		
Split %	48.1%	51.9%	**29.1%**	48.8%	51.2%	**70.9%**
Peak Hour	11:45	11:45	**11:45**	17:30	12:15	**12:30**
Volume	674	817	**1491**	786	888	**1609**
P.H.F.	0.88	0.86	**0.87**	0.88	0.91	**0.94**

Prepared by NDS/ATD

Volumes for: Saturday, February 28, 2009 **City:** Venice **Project #:** 09-5076-002

Location: Palms Blvd btwn Abbot Kinney Blvd & Electric Ave

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	6		10					12:00	8		14				
00:15	8		10					12:15	18		15				
00:30	11		13					12:30	22		27				
00:45	1	26	8	41			67	12:45	25	73	20	76			149
01:00	6		8					13:00	19		27				
01:15	5		11					13:15	17		16				
01:30	6		10					13:30	15		25				
01:45	4	21	6	35			56	13:45	20	71	21	89			160
02:00	4		6					14:00	16		18				
02:15	2		1					14:15	23		19				
02:30	0		2					14:30	21		13				
02:45	1	7	2	11			18	14:45	30	90	17	67			157
03:00	0		2					15:00	21		17				
03:15	0		0					15:15	23		14				
03:30	1		1					15:30	21		23				
03:45	2	3	3	6			9	15:45	13	78	26	80			158
04:00	0		0					16:00	20		12				
04:15	1		0					16:15	23		25				
04:30	0		0					16:30	20		16				
04:45	0	1	0	0			1	16:45	18	81	20	73			154
05:00	0		0					17:00	20		17				
05:15	1		0					17:15	18		23				
05:30	0		0					17:30	25		21				
05:45	1	2	0	0			2	17:45	18	81	15	76			157
06:00	3		1					18:00	18		14				
06:15	2		1					18:15	16		8				
06:30	1		0					18:30	17		17				
06:45	2	8	3	5			13	18:45	15	66	14	53			119
07:00	1		2					19:00	17		8				
07:15	3		3					19:15	8		13				
07:30	3		5					19:30	8		15				
07:45	2	9	6	16			25	19:45	15	48	20	56			104
08:00	6		7					20:00	14		14				
08:15	4		7					20:15	11		14				
08:30	3		6					20:30	11		13				
08:45	6	19	4	24			43	20:45	10	46	3	44			90
09:00	10		12					21:00	3		7				
09:15	8		13					21:15	6		3				
09:30	10		13					21:30	17		13				
09:45	12	40	13	51			91	21:45	19	45	18	41			86
10:00	11		12					22:00	15		10				
10:15	15		17					22:15	5		13				
10:30	8		10					22:30	6		10				
10:45	13	47	15	54			101	22:45	6	32	15	48			80
11:00	20		19					23:00	8		13				
11:15	20		22					23:15	14		7				
11:30	18		21					23:30	8		9				
11:45	19	77	15	77			154	23:45	6	36	11	40			76
Total Vol.		260		320			**580**			747		743			**1490**

Daily Totals

NB	SB		EB	WB
1007	1063	Combined		
		2070		

	AM			PM		
Split %	44.8%	55.2%	**28.0%**	50.1%	49.9%	**72.0%**
Peak Hour	11:00	10:45	**11:00**	14:15	12:30	**12:15**
Volume	77	77	**154**	95	90	**173**
P.H.F.	0.96	0.88	**0.92**	0.87	0.83	**0.88**

Appendix B – Intersection Turning Movements

Intersection Turning Movement

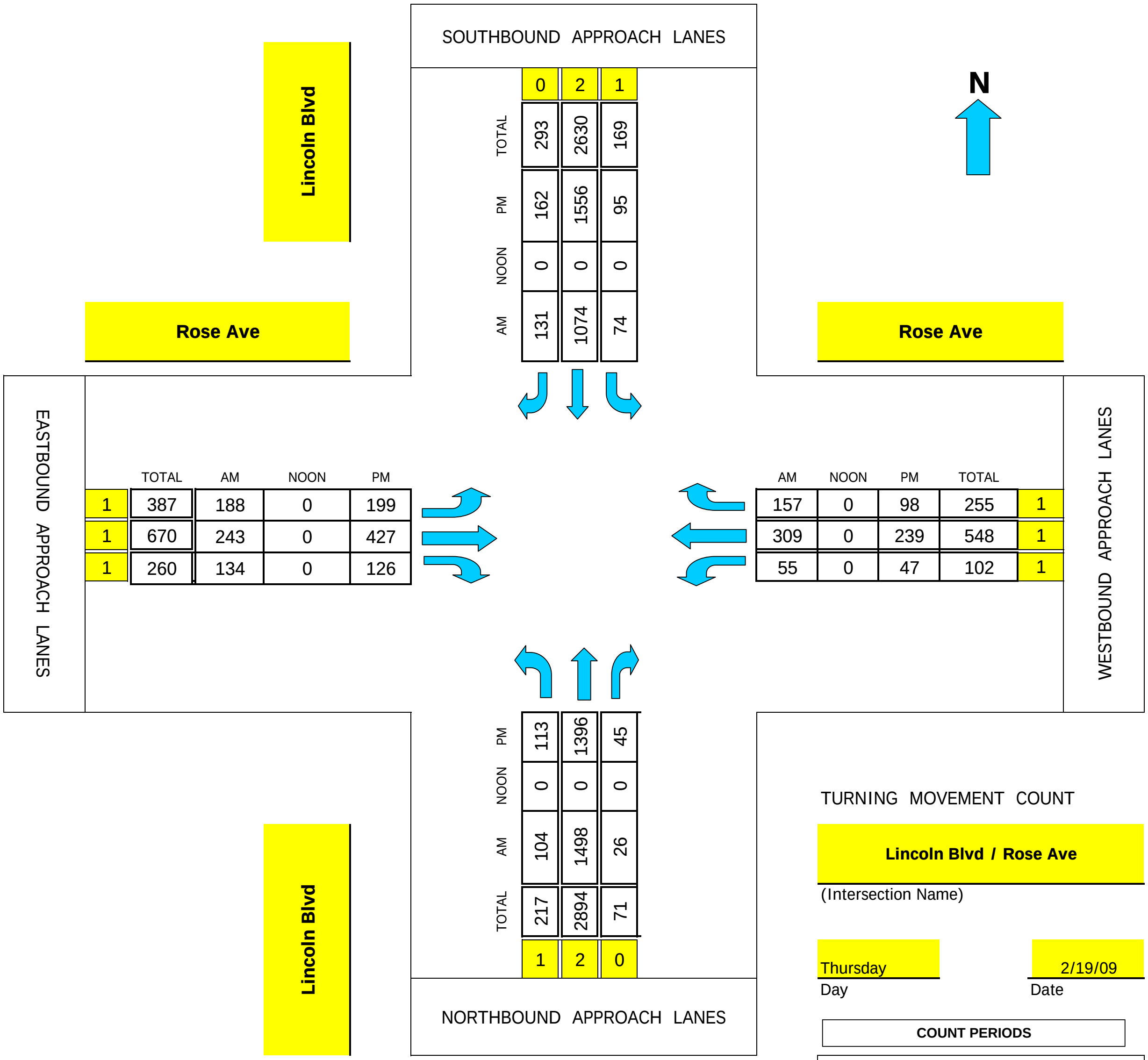
Prepared by:

NDS

National Data & Surveying Services

TMC Summary of Lincoln Blvd/Rose Ave

Project #: 09-5064-001



SOUTHBOUND APPROACH LANES

	0	2	1
TOTAL	293	2630	169
PM	162	1556	95
NOON	0	0	0
AM	131	1074	74

EASTBOUND APPROACH LANES

	TOTAL	AM	NOON	PM
1	387	188	0	199
1	670	243	0	427
1	260	134	0	126

WESTBOUND APPROACH LANES

AM	NOON	PM	TOTAL	
157	0	98	255	1
309	0	239	548	1
55	0	47	102	1

NORTHBOUND APPROACH LANES

PM	113	1396	45
NOON	0	0	0
AM	104	1498	26
TOTAL	217	2894	71
	1	2	0

TURNING MOVEMENT COUNT

Lincoln Blvd / Rose Ave

(Intersection Name)

Thursday
Day

2/19/09
Date

COUNT PERIODS

am	7:00 AM	-	9:00 AM
noon		-	
pm	4:00 PM	-	6:00 PM

CONTROL: Signalized

AM PEAK HOUR 800 AM

NOON PEAK HOUR 0 AM

PM PEAK HOUR 500 PM

Intersection Turning Movement

Prepared by:

NDS

National Data & Surveying Services

TMC Summary of Walgrove Ave/Rose Ave

Project #: 09-5064-002

Walgrove Ave

SOUTHBOUND APPROACH LANES

	0	1	1
TOTAL	183	1088	267
PM	79	758	208
NOON	0	0	0
AM	104	330	59

N

Rose Ave

Rose Ave

EASTBOUND APPROACH LANES

	TOTAL	AM	NOON	PM
1	370	167	0	203
1	540	196	0	344
1	194	60	0	134

WESTBOUND APPROACH LANES

AM	NOON	PM	TOTAL	
384	0	137	521	0
264	0	217	481	1
0	0	14	14	0

PM	95	477	15
NOON	0	0	0
AM	58	836	2
TOTAL	153	1313	17
	1	1	0

NORTHBOUND APPROACH LANES

Walgrove Ave

TURNING MOVEMENT COUNT

Walgrove Ave / Rose Ave

(Intersection Name)

Thursday

Day

2/19/09

Date

COUNT PERIODS

am	7:00 AM	-	9:00 AM
noon		-	
pm	4:00 PM	-	6:00 PM

CONTROL: Signalized

AM PEAK HOUR 800 AM

NOON PEAK HOUR 0 AM

PM PEAK HOUR 500 PM

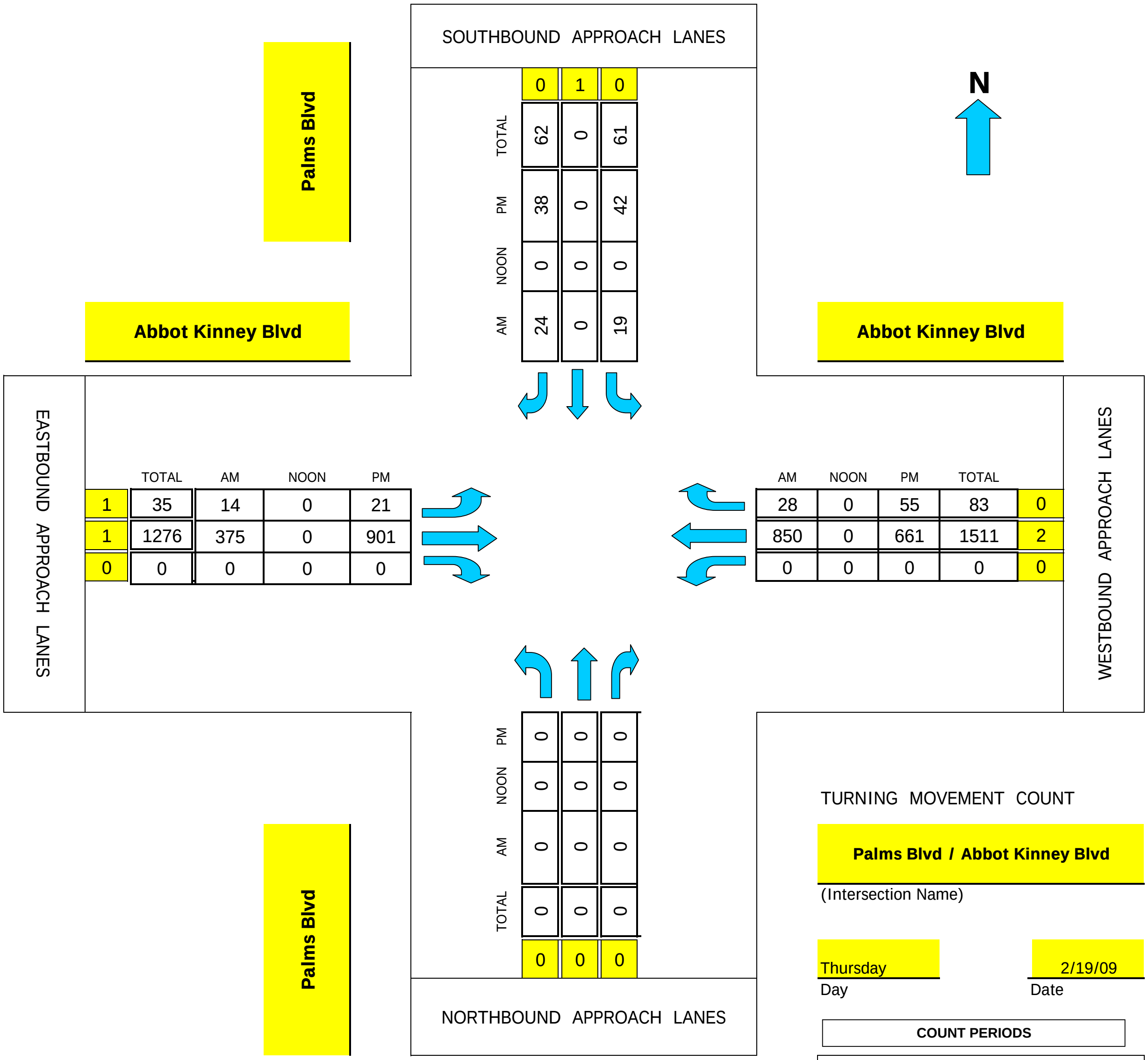
Intersection Turning Movement

Prepared by:

National Data & Surveying Services

TMC Summary of Palms Blvd/Abbot Kinney Blvd

Project #: 09-5064-003



SOUTHBOUND APPROACH LANES

	0	1	0
TOTAL	62	0	61
PM	38	0	42
NOON	0	0	0
AM	24	0	19

EASTBOUND APPROACH LANES

	TOTAL	AM	NOON	PM
1	35	14	0	21
1	1276	375	0	901
0	0	0	0	0

WESTBOUND APPROACH LANES

AM	NOON	PM	TOTAL	
28	0	55	83	0
850	0	661	1511	2
0	0	0	0	0

NORTHBOUND APPROACH LANES

PM	0	0	0
NOON	0	0	0
AM	0	0	0
TOTAL	0	0	0
	0	0	0

TURNING MOVEMENT COUNT

Palms Blvd / Abbot Kinney Blvd
(Intersection Name)

Thursday
Day

2/19/09
Date

COUNT PERIODS

am	7:00 AM	-	9:00 AM
noon		-	
pm	4:00 PM	-	6:00 PM

CONTROL: 1-Way Stop (SB)

AM PEAK HOUR 745 AM

NOON PEAK HOUR 0 AM

PM PEAK HOUR 500 PM

Appendix C – CalcaDB LOS Analysis

CalcaDB

February 27, 2009 ,Friday 01:08:42 PM

INTERSECTION DATA SUMMARY SHEET

N/S: LINCOLN BLVD **W/E:** ROSE AV **I/S No:** 20980

AM/PM: AM **Comments:** Counts collected on 02/19/09

COUNT DATE: **STUDY DATE:** **GROWTH FACTOR:**

Volume/Lane/Signal Configurations

	NORTHBOUND			SOUTHBOUND			WESTBOUND			EASTBOUND		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
EXISTING	104	1498	26	74	1074	131	55	309	157	188	243	134
AMBIENT												
RELATED												
PROJECT												
TOTAL	104	1498	26	74	1074	131	55	309	157	188	243	134

	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱
LANE NORTHBOUND	1	0	1	0	1	0	0
LANE SOUTHBOUND	1	0	1	0	1	0	0
LANE WESTBOUND	1	0	1	0	0	1	0
LANE EASTBOUND	1	0	1	0	0	1	0

	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR
SIGNAL	Perm	Auto	Perm	Auto	Perm	Auto	Perm	Auto

Critical Movements Diagram

SouthBound
A: 603
B: 74

EastBound
A: 243
B: 188

WestBound
A: 309
B: 55

NorthBound
A: 762
B: 104

A = Adjusted Through/Right Volume
B = Adjusted Left Volume
* = ATSAC Benefit

V/C RATIO	LOS
0.00 - 0.60	A
0.61 - 0.70	B
0.71 - 0.80	C
0.81 - 0.90	D
0.91 - 1.00	E

Results

North/South Critical Movements = A(N/B) + B(S/B)

West/East Critical Movements = A(W/B) + B(E/B)

$$V/C = \frac{762 + 74 + 309 + 188}{*1500} = 0.819$$

LOS = D

Developed by Chun Wong, 12/94

PENMARA

February 27, 2009 ,Friday 01:08:42 PM

CalcaDB

INTERSECTION DATA SUMMARY SHEET

N/S: WALGROVE AV

W/E: ROSE AV

I/S No:

AM/PM: **AM**

Comments: Count collected on 02/19/09

COUNT DATE:

STUDY DATE:

GROWTH FACTOR:

Volume/Lane/Signal Configurations

	NORTHBOUND			SOUTHBOUND			WESTBOUND			EASTBOUND		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
EXISTING	58	836	2	59	330	104	0	264	384	167	196	60
AMBIENT												
RELATED												
PROJECT												
TOTAL	58	836	2	59	330	104	0	264	384	167	196	60

	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱
LANE NORTHBOUND	1				1		
LANE SOUTHBOUND	1				1		
LANE WESTBOUND				1			
LANE EASTBOUND	1		1			1	

	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR
SIGNAL	Perm	Auto	Perm	Auto	Perm	Auto	Perm	Auto

Critical Movements Diagram

	A:	B:
SouthBound	434	59
EastBound	196	167
WestBound	648	0
NorthBound	838	58

V/C RATIO	LOS
0.00 - 0.60	A
0.61 - 0.70	B
0.71 - 0.80	C
0.81 - 0.90	D
0.91 - 1.00	E

A = Adjusted Through/Right Volume
B = Adjusted Left Volume
* = ATSAC Benefit

Results

North/South Critical Movements = A(N/B) + B(S/B)

West/East Critical Movements = A(W/B) + B(E/B)

$$V/C = \frac{838 + 59 + 648 + 167}{1500} = 1.141$$

LOS = F

Developed by Chun Wong, 12/94

CalcaDB

February 27, 2009 ,Friday 01:08:42 PM

INTERSECTION DATA SUMMARY SHEET

N/S: PALMS BLVD
W/E: ABBOT KINNEY BLVD
I/S No:
AM/PM: AM
Comments: Counts collected on 02/19/09
COUNT DATE:
STUDY DATE:
GROWTH FACTOR:

Volume/Lane/Signal Configurations

	NORTHBOUND			SOUTHBOUND			WESTBOUND			EASTBOUND		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
EXISTING				19		24		850	28	14	375	
AMBIENT												
RELATED												
PROJECT												
TOTAL	0	0	0	19	0	24	0	850	28	14	375	0

	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱
LANE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	1	0	0	0	0

	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR
SIGNAL	<none>	<none>	Perm	Auto	<none>	Auto	Perm	Auto

Critical Movements Diagram

SouthBound
A: 43
B: 19

EastBound
A: 375
B: 14

↑

WestBound
A: 439
B: 0

NorthBound
A: 0
B: 0

A = Adjusted Through/Right Volume
B = Adjusted Left Volume
* = ATSAC Benefit

V/C RATIO	LOS
0.00 - 0.60	A
0.61 - 0.70	B
0.71 - 0.80	C
0.81 - 0.90	D
0.91 - 1.00	E

Results

North/South Critical Movements = A(N/B) + A(S/B)

West/East Critical Movements = A(W/B) + A(E/B)

V/C = (0 + 43 + 439 + 375) / ~~*1500~~ 1200 = ~~0.261~~ 0.33 LOS = A

Non - signalized

PENMARP

CalcaDB

February 27, 2009 ,Friday 02:43:48 PM

INTERSECTION DATA SUMMARY SHEET

N/S: LINCOLN BLVD **W/E:** ROSE AV **I/S No:** 20980

AM/PM: PM **Comments:** Counts Collected on 02/19/09

COUNT DATE: **STUDY DATE:**   **GROWTH FACTOR:**

Volume/Lane/Signal Configurations

	NORTHBOUND			SOUTHBOUND			WESTBOUND			EASTBOUND		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
EXISTING	113	1396	45	95	1556	162	47	239	98	199	427	126
AMBIENT												
RELATED												
PROJECT												
TOTAL	113	1396	45	95	1556	162	47	239	98	199	427	126

	NB							SB							WB							EB						
	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱
LANE	1	0	1	0	1	0	0	1	0	1	0	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	1	0

	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR
SIGNAL	Perm	OLA	Perm	Auto	Perm	Auto	Perm	Auto

Critical Movements Diagram

SouthBound
A: 859
B: 95

EastBound
A: 277
B: 199

↑

WestBound
A: 169
B: 47

NorthBound
A: 721
B: 113

A = Adjusted Through/Right Volume
B = Adjusted Left Volume
* = ATSAC Benefit

V/C RATIO	LOS
0.00 - 0.60	A
0.61 - 0.70	B
0.71 - 0.80	C
0.81 - 0.90	D
0.91 - 1.00	E

Results

North/South Critical Movements = B(N/B) + A(S/B)

West/East Critical Movements = A(W/B) + B(E/B)

$$V/C = \frac{113 + 859 + 169 + 199}{*1375} = 0.905$$

LOS = E

Developed by Chun Wong, 12/94

PENMARP

CalcaDB

February 27, 2009 ,Friday 02:43:48 PM

INTERSECTION DATA SUMMARY SHEET

N/S: WALGROVE AV

W/E: ROSE AV

I/S No:

AM/PM: PM

Comments: Counts Collected on 02/19/09

COUNT DATE:

STUDY DATE:

GROWTH FACTOR:

Volume/Lane/Signal Configurations

	NORTHBOUND			SOUTHBOUND			WESTBOUND			EASTBOUND		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
EXISTING	95	477	15	208	758	79	14	217	137	203	344	134
AMBIENT												
RELATED												
PROJECT												
TOTAL	95	477	15	208	758	79	14	217	137	203	344	134

	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱
LANE NORTHBOUND	1				1		
LANE SOUTHBOUND	1				1		
LANE WESTBOUND				1			
LANE EASTBOUND	1		1			1	

	NORTHBOUND Phasing	NORTHBOUND RTOR	SOUTHBOUND Phasing	SOUTHBOUND RTOR	WESTBOUND Phasing	WESTBOUND RTOR	EASTBOUND Phasing	EASTBOUND RTOR
SIGNAL	Perm	Auto	Perm	Auto	Perm	Auto	Perm	Auto

Critical Movements Diagram

SouthBound
A: 837
B: 208

EastBound
A: 344
B: 203

WestBound
A: 368
B: 14

NorthBound
A: 492
B: 95

A = Adjusted Through/Right Volume
B = Adjusted Left Volume
* = ATSAC Benefit

V/C RATIO	LOS
0.00 - 0.60	A
0.61 - 0.70	B
0.71 - 0.80	C
0.81 - 0.90	D
0.91 - 1.00	E

Results

North/South Critical Movements = B(N/B) + A(S/B)

West/East Critical Movements = A(W/B) + B(E/B)

$$V/C = \frac{95 + 837 + 368 + 203}{1500} = 1.002$$

LOS = F

Developed by Chun Wong, 12/94

PENMARP

CalcaDB

February 27, 2009 ,Friday 02:43:48 PM

INTERSECTION DATA SUMMARY SHEET

N/S: PALMS BLVD
W/E: ABBOT KINNEY BLVD
I/S No:

AM/PM: **PM**
Comments: Counts Collected on 02/19/09

COUNT DATE:
STUDY DATE:
GROWTH FACTOR:

Volume/Lane/Signal Configurations

	NORTHBOUND			SOUTHBOUND			WESTBOUND			EASTBOUND		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
EXISTING				42		38		850	28	21	901	
AMBIENT												
RELATED												
PROJECT												
TOTAL				42	0	38	0	850	28	21	901	0

	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱	↰	↰↑	↑	↰↑↱	↑↱	↱	↰↱
LANE														1			1		1			1		1				

	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR	Phasing	RTOR
SIGNAL	Perm	Auto	Perm	Auto	Perm	Auto	Perm	Auto

Critical Movements Diagram

SouthBound
A: 80
B: 42

EastBound
A: 901
B: 21

↑

WestBound
A: 439
B: 0

NorthBound
A: 0
B: 0

A = Adjusted Through/Right Volume
B = Adjusted Left Volume
* = ATSAC Benefit

V/C RATIO	LOS
0.00 - 0.60	A
0.61 - 0.70	B
0.71 - 0.80	C
0.81 - 0.90	D
0.91 - 1.00	E

Results

North/South Critical Movements = B(N/B) + A(S/B)

West/East Critical Movements = B(W/B) + A(E/B)

0.818

V/C = (0 + 80 + 0 + 901) / ~~1500~~ 1200 = ~~0.654~~

LOS = ~~B~~ C

Non - signalized

Developed by Chun Wong, 12/94

Appendix D – Figure 4: Worksite Traffic Control Plan along Rose Avenue

WORKSITE TRAFFIC CONTROL PLAN NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LABOR AND MATERIAL INVOLVED IN THE REMOVAL, INSTALLATION, AND MAINTENANCE OF ALL STRIPING, PAVEMENT MARKINGS, SIGNING, BARRICADING, DELINEATORS, ETC., SHOWN ON THESE WORKSITE TRAFFIC CONTROL PLANS (WTCP) AND AS CONSTRUCTION STAGING NECESSITATES. CONFLICTING STRIPING AND PAVEMENT MARKINGS SHALL BE REMOVED BY WET SANDBLASTING/GRINDING IN ACCORDANCE WITH THE CITY OF LOS ANGELES DEPARTMENT OF TRANSPORTATION (LADOT) SPECIFICATION NO. 79–016–10. PAINTING THE EXISTING STRIPING OVER WITH BLACK PAINT IS NOT PERMITTED. TEMPORARY REFLECTIVE PAVEMENT MARKERS (SEE LADOT STANDARD PLAN S–453.0) SHALL BE MAINTAINED BY THE CONTRACTOR ADJACENT TO THE SCAR OF THE SANDBLASTED CENTERLINE OR TAPED–OVER CENTERLINE. CONFLICTING RAISED PAVEMENT MARKERS SHALL BE REMOVED. THERMOPLASTIC SHALL BE USED FOR ALL ROUGH AND UNEVEN SURFACES AND AS REQUIRED BY THE LADOT ENGINEER. PAINT MAY BE USED ON SMOOTH SURFACES. DETOUR TAPE IS NOT PERMITTED.

2. THE CONTRACTOR SHALL PERFORM WORK IN ONLY ONE STAGE AT A TIME. THE CONTRACTOR SHALL ONLY UTILIZE THAT PORTION OF THE DESIGNATED "WORK AREA" WHICH IS NEEDED FOR CONSTRUCTION AT ANY GIVEN TIME.

3. THE CONTRACTOR SHALL CONTACT LADOT CENTRAL DISTRICT SECTION AT (213) 972–4990 AT LEAST FIVE (5) WORKING DAYS (TO INSPECT MARK OUT) PRIOR TO THE INSTALLATION OF ANY TEMPORARY STRIPING FOR ALL CONSTRUCTION STAGES. LADOT RESERVES THE RIGHT TO OBSERVE THESE WORKSITE TRAFFIC CONTROL PLANS IN USE AND TO MAKE NECESSARY CHANGES AS FIELD CONDITIONS WARRANT. ANY CHANGES SHALL SUPERSEDE THESE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PLACEMENT OF ANY ADDITIONAL TRAFFIC CONTROL DEVICES NECESSARY TO ASSURE PUBLIC SAFETY AT ALL TIMES DURING CONSTRUCTION.

4. ALL CONSTRUCTION RELATED WARNING SIGNS SHALL BE IN BLACK LEGEND WITH ORANGE BACKGROUND AND IN CONFORMANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) (LATEST EDITION) AND THE MUTCD CALIFORNIA SUPPLEMENT.

5. THE STRIPING AND SIGNING SHOWN FOR REMOVAL ON THESE PLANS MAY BE DIFFERENT THAN WHAT EXISTS AT TIME OF INSTALLATION OF A CONSTRUCTION STAGE. THE CONTRACTOR SHALL REMOVE ALL CONFLICTING SIGNING AND STRIPING, WHETHER OR NOT IT IS DEPICTED ACCURATELY. EXISTING SIGNS THAT ARE IN CONFLICT WITH THESE PLANS SHALL BE REMOVED OR COVERED BY THE CONTRACTOR AND RESTORED UPON REMOVAL OF THE WTCP.

6. FOR OTHER REQUIREMENTS RELATED TO TRAFFIC CONTROL PLANS AND WORK AREA MAINTENANCE, THE CONTRACTOR SHALL FOLLOW THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (CALIFORNIA MUTCD) (LATEST EDITION), THE "WORK AREA TRAFFIC CONTROL HANDBOOK" (WATCH MANUAL) (LATEST EDITION), AND ALL RELATED SECTIONS OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, INCLUDING SECTION 7–10 "PUBLIC CONVENIENCE AND SAFETY," AND 302–4.4 "PUBLIC CONVENIENCE AND TRAFFIC CONTROL."

7. THE CROSSWALKS ACROSS THREE LEGS OF ANY SIGNALIZED INTERSECTION SHALL BE MAINTAINED AT ALL TIMES. "NO PED CROSSING" (R9–3a) SIGNS SHALL BE INSTALLED WHEN A PAINTED CROSSWALK IS UNAVAILABLE FOR USE DUE TO CONSTRUCTION AND AFFECTED PEDESTRIAN SIGNAL HEADS SHALL BE COVERED OR REMOVED.

8. THE CONTRACTOR SHALL INSTALL R3–18 (NO LEFT AND NO U–TURN) SIGNS AT INTERSECTIONS WHERE THE LEFT TURN LANE HAS BEEN CLOSED FOR CONSTRUCTION. SIGNS SHOULD BE INSTALLED ON TRAFFIC SIGNAL MAST ARMS AND FAR LEFT OF THE INTERSECTION OR AT LOCATIONS WHERE THEY WILL BE CLEARLY VISIBLE BY THE THRU TRAFFIC.

9. THE CONTRACTOR SHALL NOTIFY M.T.A. AT (213) 922–4632 OR ANY OTHER AFFECTED TRANSIT SERVICES AT LEAST FIVE (5) WORKING DAYS PRIOR TO CONSTRUCTION.

10. ALL TRAFFIC CONTROL DEVICES SHALL BE KEPT IN THEIR PROPER POSITION AT ALL TIMES, AND SHALL BE REPAIRED, REPLACED, OR CLEANED AS NECESSARY TO PRESERVE THEIR APPEARANCE AND CONTINUITY.

11. THE CONTRACTOR SHALL PROVIDE FLAGGERS AS DEEMED NECESSARY BY LADOT. A FLAGGER SHALL USE ONLY THE APPROVED OCTAGONAL STOP/SLOW PADDLE, SHALL WEAR AN ORANGE SAFETY VEST (PADDLE AND VEST MUST BE REFLECTORIZED FOR NIGHT WORK), AND HARD HAT, AS REQUIRED BY THE WATCH MANUAL, AND MUST BE PROPERLY TRAINED BY THE CONTRACTOR IN PERFORMING THE WORK SAFELY. APPROPRIATE ADVANCE SIGNS MUST BE INSTALLED, PER THE WATCH MANUAL.

12. TEMPORARY TRAFFIC CONTROL DEVICES SHALL BE REMOVED FOLLOWING COMPLETION OF EACH CONSTRUCTION STAGE AND THE PERMANENT TRAFFIC CONTROL DEVICES SHALL BE RESTORED BY THE CONTRACTOR UPON REMOVAL OF WTCP STRIPING AND SIGNING.

13. SIGNS, DELINEATORS, BARRICADES, ETC., SHALL CONFORM TO THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (CALIFORNIA MUTCD) (LATEST EDITION) AND THE BROWN BOOK (LATEST EDITION).

14. THE CONTRACTOR SHALL NOTIFY LADOT'S SIGNAL MAINTENANCE SUPERVISOR AT (213) 485–7721 FIVE (5) WORKING DAYS PRIOR TO ANY EXCAVATION OR CONSTRUCTION WITHIN 10 FEET OF EXISTING TRAFFIC SIGNAL DETECTOR LOOPS, CONDUIT, INTERCONNECTS, OR ATSAC FIBER OPTIC CABLE.

15. ANY DAMAGE TO TRAFFIC SIGNAL DETECTOR LOOPS, CONDUITS, INTERCONNECTS, OR FIBER OPTIC CABLE SHALL BE REPAIRED IMMEDIATELY BY THE CONTRACTOR AT THEIR OWN EXPENSE. DELAYS IN REPAIR OF INTERCONNECT OR ATSAC FIBER OPTIC CABLE WILL REQUIRE THE PAYMENT OF LIQUIDATION DAMAGES TO THE CITY OF LOS ANGELES DEPARTMENT OF TRANSPORTATION. IMMEDIATELY NOTIFY LADOT SIGNAL REPAIR PERSONNEL AT (213) 485–7721 OF ANY DAMAGES.

16. FOR THE TEMPORARY "TOW AWAY NO STOPPING ANY TIME" SIGNS, THE CONTRACTOR SHALL CONTACT THE LADOT SPECIAL TRAFFIC CONTROLS OFFICE AT (213) 485–2298 AT LEAST FIVE (5) WORKING DAYS IN ADVANCE OF EACH NEW CONSTRUCTION STAGE. THE INSTALLATION OF THE TEMPORARY "TOW AWAY NO STOPPING ANY TIME" SIGNS AT PARKING METER ZONES SHALL INCLUDE COVERING METER HEADS AND THE ASSOCIATED PARKING RESTRICTION.

17. PRIOR TO THE REMOVAL OF AN EXISTING CURB/SIDEWALK IN A PARKING METER ZONE, THE CONTRACTOR SHALL CONTACT LADOT THE PARKING METER SUPERVISOR AT (213) 485–4230 FOR METER HEAD REMOVAL.

18. THERE SHALL BE NO STORAGE OF CONSTRUCTION MATERIALS OR EQUIPMENT OUTSIDE THE DESIGNATED WORK AREA INDICATED IN THE WTCP. STORAGE OF CONSTRUCTION MATERIALS OR EQUIPMENT WITHIN THE DESIGNATED AREA SHALL BE DONE IN A MANNER SO AS NOT TO CREATE VISIBILITY OBSTRUCTIONS TO THE MOTORING PUBLIC.

19. THE CONTRACTOR SHALL MAINTAIN ACCESS TO ALL FUNCTIONAL DRIVEWAYS AT ALL TIMES AND SHALL COORDINATE WITH RESIDENTS AND BUSINESSES ANY CLOSURE OR LIMITED ACCESS RESTRICTION TO THEIR DRIVEWAYS. IF CONSTRUCTION NECESSITATES, THE CONTRACTOR SHALL REVISE THE WORKSITE TRAFFIC CONTROL PLANS TO CHANGE THE SETUP AND ALLOW ACCESS TO A DRIVEWAY THAT IS SHOWN TO BE BLOCKED ON THE BID DOCUMENTS. REVISED WORKSITE TRAFFIC CONTROL PLANS SHALL BE PREPARED PER LADOT STANDARDS, SIGNED AND SEALED BY A REGISTERED TRAFFIC AND CIVIL ENGINEER, AND SUBMITTED TO LADOT FOR APPROVAL.

20. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE RESTORATION OF STRIPING AND PAVEMENT MARKINGS TO THE ORIGINAL CONDITION USING THERMOPLASTIC MATERIALS, UNLESS OTHERWISE INSTRUCTED BY LADOT. LADOT WILL INSPECT AND APPROVE ANY CONTRACTOR MARKOUT BEFORE THE FINAL INSTALLATION OF STRIPING BY THE CONTRACTOR. THE CONTRACTOR SHALL NOTIFY LADOT CENTRAL DISTRICT AT (213) 972–4990 FIVE (5) WORKING DAYS PRIOR TO PROJECT COMPLETION DATE.

21. LOCATION AND SPACING OF TEMPORARY SIGNS AND DELINEATORS SHALL CONFORM TO THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (CALIFORNIA MUTCD) (LATEST EDITION), OR AS DIRECTED BY THE LADOT ENGINEER.

22. THE CONTRACTOR SHALL PROVIDE CHANGEABLE MESSAGE SIGNS AS FIELD CONDITIONS/DETOURS WARRANT, AND AS DEEMED NECESSARY BY LADOT, EVEN IF THEY ARE NOT SHOWN ON THESE PLANS.

23. THE CONTRACTOR SHALL REFER TO THE TEMPORARY TRAFFIC SIGNAL PLANS FOR ADDITIONAL WORK TO BE COMPLETED PRIOR TO IMPLEMENTING THE WTCP STAGES OR CONCURRENTLY WITH THE WTCP STAGES, AS DETERMINED BY LADOT.

24. IMPLEMENTATION OF ALL WORK SHOWN ON THE WORKSITE TRAFFIC CONTROL PLANS, INCLUDING INSTALLATION AND REMOVAL OF SIGNING AND STRIPING, PAVEMENT MARKINGS, TRAFFIC CONTROL EQUIPMENT, AND ANY TRAFFIC SIGNAL WORK SHALL NOT BE PERFORMED DURING PEAK TRAFFIC HOURS. THE CONTRACTOR SHALL ONLY PERFORM SUCH WORK BETWEEN THE HOURS OF 9 AM AND 3 PM. ANY ADDITIONAL LANE CLOSURE NOT INDICATED ON THESE PLANS MUST BE APPROVED BY LADOT. APPROVED LANE CLOSURES, OTHER THAN THOSE SHOWN ON THESE PLANS, WILL NOT BE PERMITTED DURING PEAK TRAFFIC HOURS.

25. CONSTRUCTION FENCE GATES SHALL BE INSTALLED TO BE OPENED INWARD, AWAY FROM THE SIDEWALK AND STREET, AND BE SECURELY FASTENED WITH LIMITERS IN PLACE TO PREVENT ACCIDENTAL OR UNINTENTIONAL OPENING INTO THE SIDEWALK OR STREET. GATES WIDER THAN 10 FEET SHALL BE SLIDING GATES.

26. A FLAGGER SHALL BE STATIONED AT EACH CONSTRUCTION FENCE GATE WHILE IT IS OPEN DURING CONSTRUCTION ACTIVITY TO ASSIST THE MOVEMENT OF PEDESTRIANS, CONSTRUCTION VEHICLES, AND EQUIPMENT INTO CITY STREETS.

27. THE TRAFFIC SIGNAL CONTROLLER, SIGNAL STANDARDS, AND OTHER ASSOCIATED SIGNAL EQUIPMENT, INCLUDING TRAFFIC SIGNAL PULL BOXES, MUST BE ACCESSIBLE AT ALL TIMES TO LADOT TRAFFIC SIGNAL REPAIR (TSR) PERSONNEL. FENCES AND WALLS MUST BE INSTALLED TO PERMIT ACCESS BY TSR PERSONNEL AT ALL TIMES.

28. UNLESS K–RAILS AND CRASH CUSHIONS ARE INSTALLED, THE CONTRACTOR SHALL PROVIDE A MINIMUM 5' SHOULDER FROM ANY OPEN EXCAVATION.

29. K–RAIL ENDS, TRAFFIC SIGNAL PLATFORMS, AND FIXED OBJECTS SHALL BE PROTECTED BY CRASH CUSHIONS OR BY A QUADGUARD SYSTEM, UNLESS THEY ARE LOCATED MINIMUM 15' AWAY FROM THE TRAVELED WAY. FOR A 20' K–RAIL SECTION, THE HORIZONTAL TAPER SHALL NOT EXCEED 5' PER K–RAIL (MAXIMUM TAPER RATE 4:1).

LEGEND

1. ⇨ = EXISTING STRIPING & MARKINGS TO REMAIN
   ⇨ = EXISTING STRIPING & MARKINGS TO BE REMOVED
   ➡ = PROPOSED STRIPING & MARKINGS
2. = EXISTING SIGN AND POST
   = EXISTING SIGN AND POST TO BE REMOVED OR RELOCATED
   = PROPOSED SIGN AND POST
3. Ⓢ = SIGNALIZED INTERSECTION
4. R/C = EXISTING RED CURB MARKINGS TO REMAIN
   R/C = EXISTING RED CURB MARKINGS TO BE REMOVED
   R/C = PROPOSED RED CURB MARKINGS
5. ● 28" TRAFFIC CONE WITH 13" REFLECTIVE MARKER
6. ◉ 28" CHANNELIZER WITH 13" REFLECTIVE MARKER (SURFACE MOUNTED WITH FLEXIBLE BASE)
7. TYPE II BARRICADE
8. TYPE II BARRICADE WITH SIGN
9. TYPE III BARRICADE
10. TYPE III BARRICADE WITH SIGN
11. CRASH CUSHION ARRAY "TS11" PER CALTRANS STD. PLAN T1A
12. 20' LONG CONCRETE K–RAIL BARRIER
13. 10' LONG CONCRETE K–RAIL BARRIER
14. QUADGUARD CZ CRASH CUSHION SYSTEM, OR APPROVED EQUAL CONTACT: TRAFFIC CONTROL SERVICE, INC. (800–222–8274)
15. FLASHING ARROW BOARD (BATTERY OPERATED)
16. ○—○ TEMPORARY CHAIN LINK FENCE
17. ▨ WORK ZONE LIMITS

RESTORATION STRIPING NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LABOR AND MATERIAL INVOLVED IN THE MARKOUT, AND INSTALLATION OF ALL RESTORATION STRIPING/PAVEMENT MARKINGS.

   THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR REMOVAL OF ALL CONFLICTING DETOUR STRIPING, SIGNING, AND OTHER DETOUR–RELATED TRAFFIC CONTROL DEVICES PRIOR TO THE INSTALLATION OF THE FINAL STRIPING.

   IF THERE IS NO RESTORATION PLAN IN THIS PACKAGE, THE CONTRACTOR SHALL CONTACT LADOT GEOMETRIC DESIGN FOR THE LATEST STRIPING PLANS.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAINTING OF ALL EXISTING STRIPING THAT HAS BEEN DAMAGED DURING THE CONSTRUCTION PROCESS.

3. WHEN THE EXISTING LANE(S) WILL REMAIN OPEN AFTER THE MARKOUT IS ACCOMPLISHED, THE MARKOUT SHALL CONSIST ONLY OF MARKED CONTROL POINTS. WHEN THE MARKOUT WILL BE DONE AS PART OF A CONTINUOUS OPERATION TO MODIFY STRIPING, THEN THE MARKOUT SHALL BE BY HEAVY PAINT BRUSH MARKINGS OVER A PULLED ROPE IN THE RESPECTIVE WHITE AND YELLOW COLORS OF THE PROPOSED STRIPING.

   STRIPING AND PAVEMENT MARKINGS SHALL BE IN HOT APPLIED ALKYD THERMOPLASTIC IN ACCORDANCE WITH LADOT SPECIFICATION NOS. 51–005–10 AND 76–012–15. PRIMER AND SEALERS ARE REQUIRED AND SHALL CONFORM TO LADOT SPECIFICATION NO. 76–012–15.

4. THE CONTRACTOR SHALL CONTACT LADOT CENTRAL DISTRICT OFFICE AT (213) 580–3777 AT LEAST 5 WORKING DAYS BEFORE BEGINNING MARKOUT. THE CONTRACTOR SHALL CORRECT ALL ERRORS IN MARKOUT REQUESTED BY LADOT. THE INSTALLATION OF THERMOPLASTIC STRIPING MAY PROCEED ONLY AFTER APPROVAL OF MARKOUT BY THE LADOT DISTRICT ENGINEER.

5. TEMPORARY REFECTIVE RAISED PAVEMENT MARKERS SHALL BE MAINTAINED ADJACENT TO ANY TEMPORARY CENTERLINE, MARKOUT CENTERLINE OR SCAR OF A SANDBLASTED CENTER, AS APPLICABLE, AS PER LADOT STANDARD PLAN NO. S–453.0.

PLAN PREPARED BY:

NAME DATE

FPL and Associates, Inc.
Traffic • Transportation • Civil • CAD
10 Corporate Park, Suite 310
Irvine, California 92606
(949) 252–1688

ALEXANDER D. ZUPANSKI
No. C 59351
Exp. 06–30–09
CIVIL

ALEXANDER D. ZUPANSKI
No. TR 2400
Exp. 06–30–09
TRAFFIC

CONSULTANT BUSINESS TAX REGISTRATION NUMBER : 217989–0001–1

1"=20'	20	10	0	20	40	60	80	100 FEET
ORIGINAL MAP SCALE 1"=40'	40	20	0	40	80	120	160	200 FEET

SCALES
HORIZ. 1"=40'
VERT. 1"=

SCALE: 1"=40'

WORKSITE TRAFFIC CONTROL PLANS – CONSTRUCTION NOTES
PENMAR WATER QUALITY IMPROVEMENT PROJECT – PHASE 1
W.O. EW40019F

TC–1

REVIEWED ______ 20 ___
Transportation Engineer

RECOMMENDED ______ 20 ___
Senior Transportation Engineer

ACCEPTED ______ 20 ___
Principal Transportation Engineer

INSTALLATION DATES
MARKOUT BEGAN: ______
MARKOUT COMPLETED: ______
STRIPING COMPLETED: ______
References:

CITY OF LOS ANGELES
DEPARTMENT OF TRANSPORTATION
RITA L. ROBINSON, GENERAL MANAGER

TITLE SHEET

Thomas Guide	District
671–J4	W

PROJECT NO. XXXXX
DRAWING NO. XXXXX
— / —

SHEET **OF**

INDEX NUMBER

DATE
BY
SUPERVISOR DISTRICT SIGNALS
DATE
BY
BASE CHECK DESIGN

DATE
PRINCIPAL T.E.
T.E./SR. T.E.
REVISION DESCRIPTION
NO.

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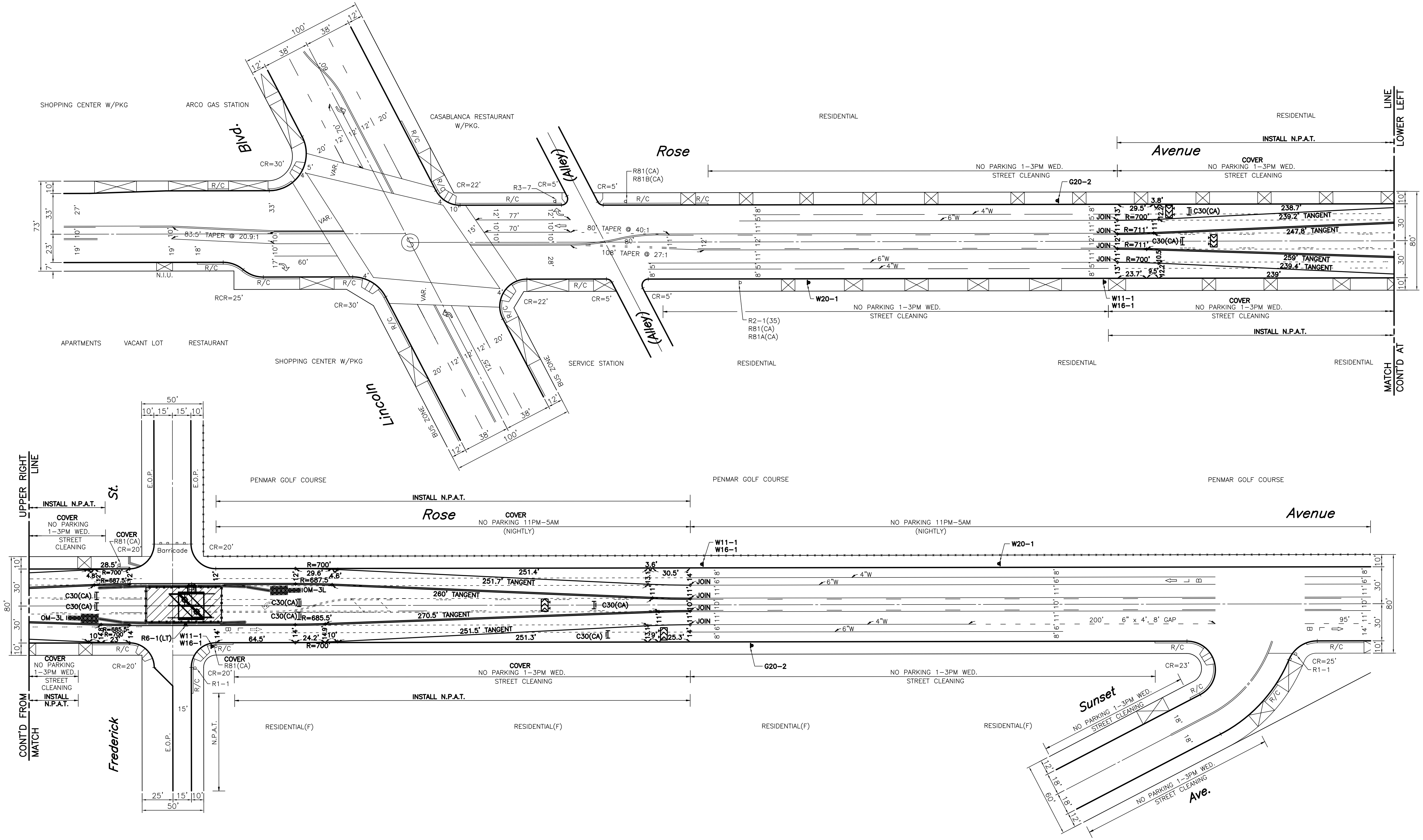

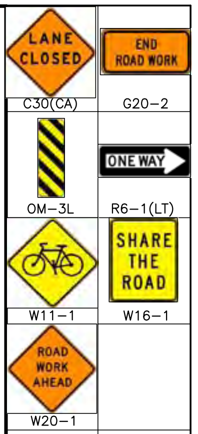

SCALE: 1"=40'

WORKSITE TRAFFIC CONTROL PLAN (STAGE 1)
PENMAR WATER QUALITY IMPROVEMENT PROJECT – PHASE 1
W.O. EW40019F

TC–2

REVIEWED ______________ 20 ____
Transportation Engineer

RECOMMENDED ______________ 20 ____
Senior Transportation Engineer

ACCEPTED ______________ 20 ____
Principal Transportation Engineer

INSTALLATION DATES

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Thomas Guide	District
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CITY OF LOS ANGELES
DEPARTMENT OF TRANSPORTATION
RITA L. ROBINSON, GENERAL MANAGER

ROSE AVENUE

LINCOLN BLVD. TO SUNSET AVE.

PROJECT NO. XXXXX

DRAWING NO. XXXXX

– / –

SHEET OF

INDEX NUMBER

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SUPERVISOR	DISTRICT	SIGNALS	
BASE	CHECK	DESIGN	

DATE	PRINCIPAL T.E.	T.E./SR. T.E.	REVISION DESCRIPTION	NO.

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NAME ______________ DATE ______________

FPL and Associates, Inc.
Traffic • Transportation • Civil • CAD
10 Corporate Park, Suite 310
Irvine, California 92606
(949) 252–1688

ALEXANDER D. ZUPANSKI
No. C 59351
Exp. 06–30–09
CIVIL

ALEXANDER D. ZUPANSKI
No. TR 2400
Exp. 06–30–09
TRAFFIC

CONSULTANT BUSINESS TAX REGISTRATION NUMBER : 217989–0001–1

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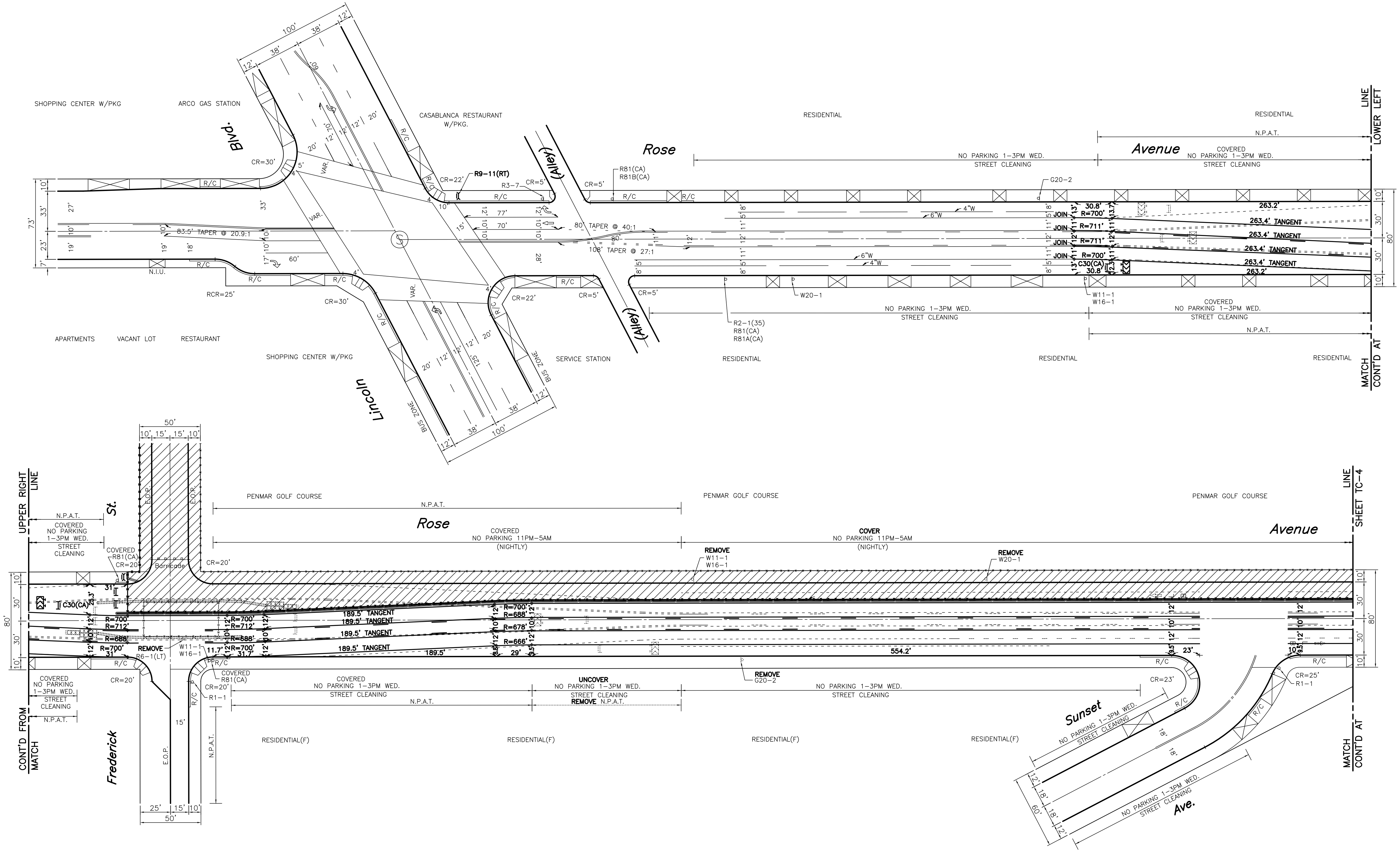

WORKSITE TRAFFIC CONTROL PLAN (STAGE 2)
PENMAR WATER QUALITY IMPROVEMENT PROJECT – PHASE 1
W.O. 40019F

TC–3

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Transportation Engineer	Senior Transportation Engineer	Principal Transportation Engineer

INSTALLATION DATES

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STRIPING COMPLETED: ____

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Field Check

Thomas Guide	District
671–J4	W

CITY OF LOS ANGELES
DEPARTMENT OF TRANSPORTATION
RITA L. ROBINSON, GENERAL MANAGER

ROSE AVENUE

LINCOLN BLVD. TO GLENAVON AVE.

PROJECT NO. XXXXX

DRAWING NO. XXXXX

– / –

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SHEET **OF**

INDEX NUMBER

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PLAN PREPARED BY:

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No. C 59351
Exp. 06–30–09
CIVIL

ALEXANDER D. ZUPANSKI
No. TR 2400
Exp. 06–30–09
TRAFFIC

CONSULTANT BUSINESS TAX REGISTRATION NUMBER : 217989–0001–1

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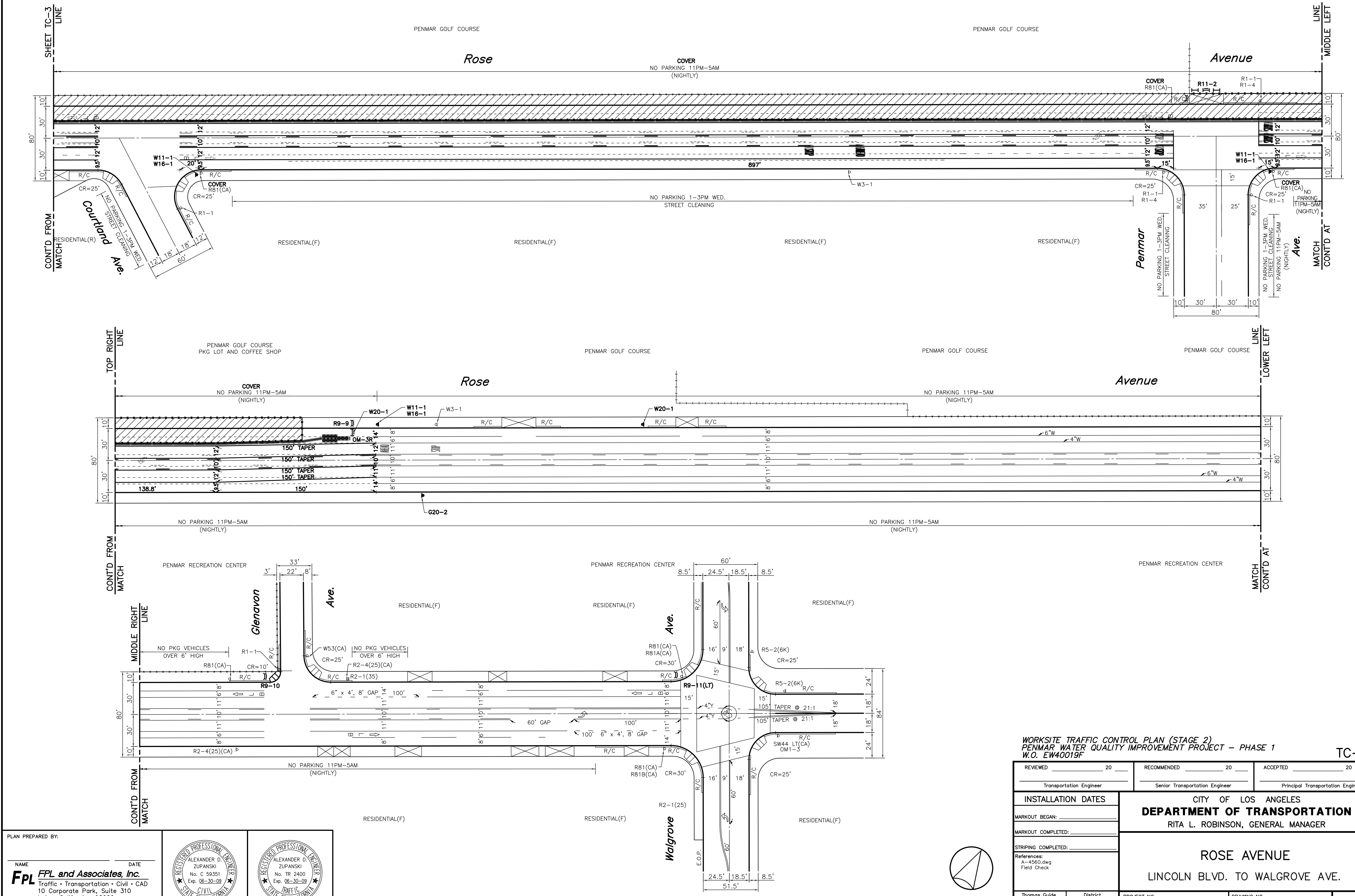

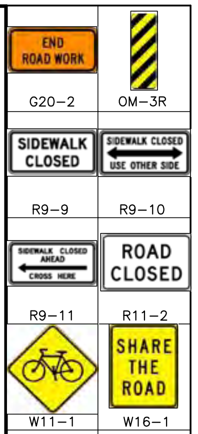

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W.O. EW40019F

TC–4

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INSTALLATION DATES

MARKOUT BEGAN: ________

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References:
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Thomas Guide	District
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CITY OF LOS ANGELES
DEPARTMENT OF TRANSPORTATION
RITA L. ROBINSON, GENERAL MANAGER

ROSE AVENUE

LINCOLN BLVD. TO WALGROVE AVE.

PROJECT NO. XXXXX

DRAWING NO. XXXXX

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T.E./SR. T.E.

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ALEXANDER D. ZUPANSKI
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Exp. 06–30–09
CIVIL

ALEXANDER D. ZUPANSKI
No. TR 2400
Exp. 06–30–09
TRAFFIC

CONSULTANT BUSINESS TAX REGISTRATION NUMBER : 217989–0001–1

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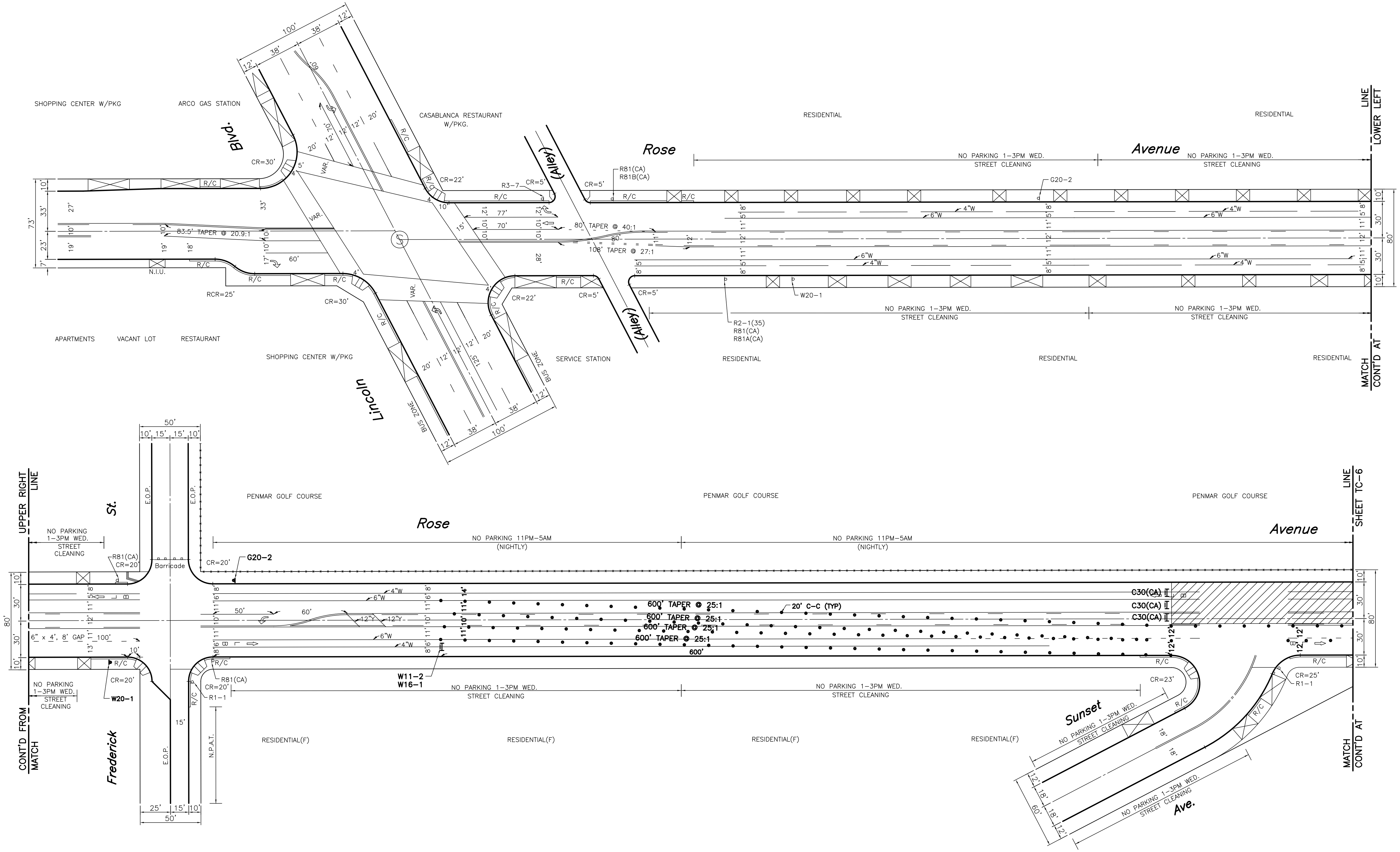

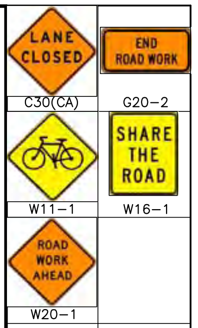

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WORKSITE TRAFFIC CONTROL PLAN (STAGE 3)
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W.O. EW40019F

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References:
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Thomas Guide	District
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CITY OF LOS ANGELES
DEPARTMENT OF TRANSPORTATION
RITA L. ROBINSON, GENERAL MANAGER

ROSE AVENUE
LINCOLN BLVD. TO GLENAVON AVE.

PROJECT NO. XXXXX
DRAWING NO. XXXXX
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Irvine, California 92606
(949) 252–1688

REGISTERED PROFESSIONAL ENGINEER
ALEXANDER D. ZUPANSKI
No. C 59351
Exp. 06–30–09
CIVIL

REGISTERED PROFESSIONAL ENGINEER
ALEXANDER D. ZUPANSKI
No. TR 2400
Exp. 06–30–09
TRAFFIC

CONSULTANT BUSINESS TAX REGISTRATION NUMBER : 217989–0001–1

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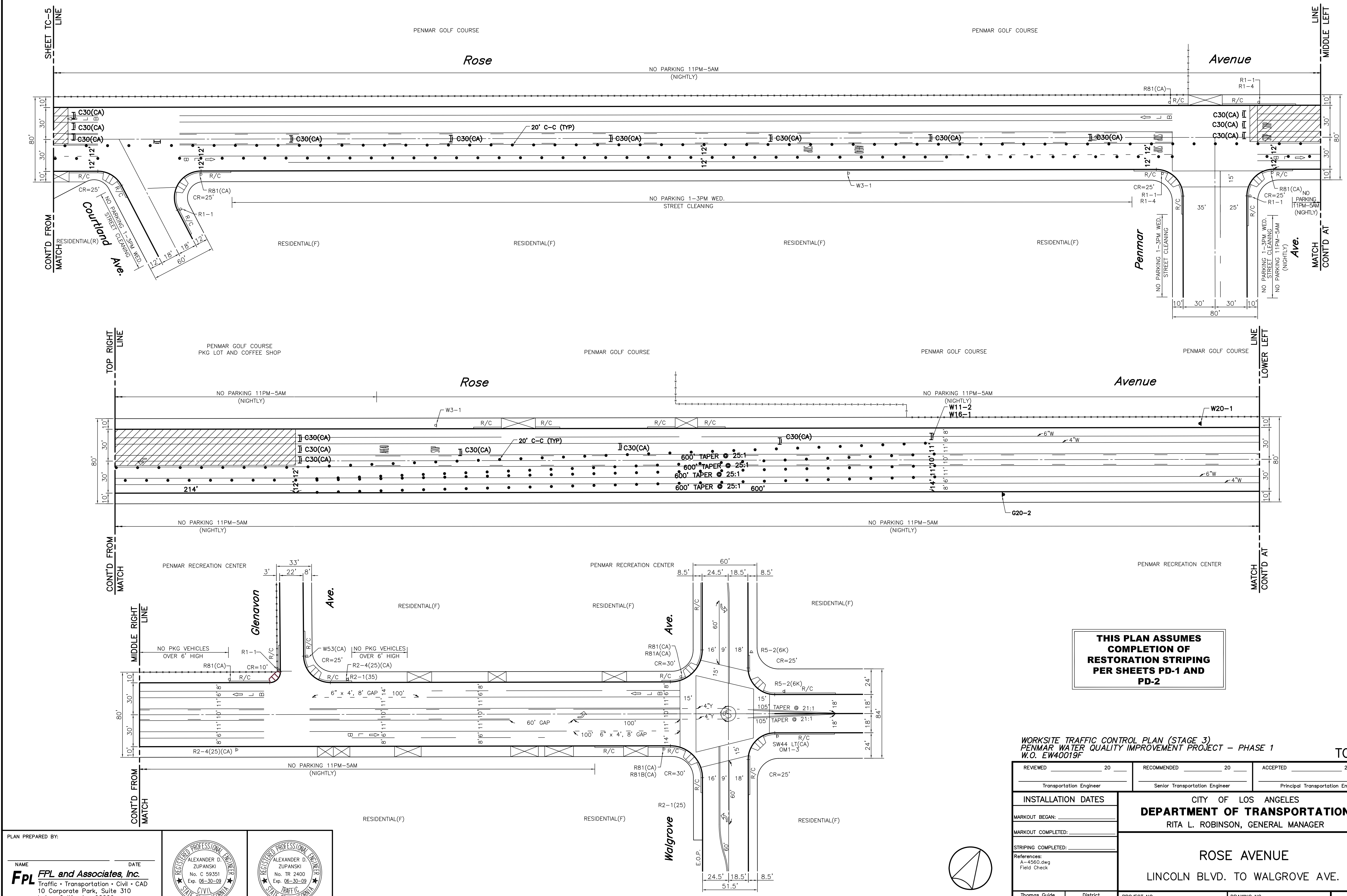

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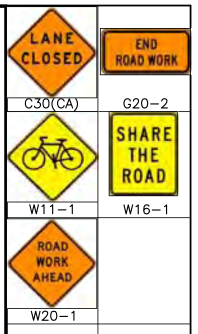

WORKSITE TRAFFIC CONTROL PLAN (STAGE 3)
PENMAR WATER QUALITY IMPROVEMENT PROJECT – PHASE 1
W.O. EW40019F

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INSTALLATION DATES
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CITY OF LOS ANGELES
DEPARTMENT OF TRANSPORTATION
RITA L. ROBINSON, GENERAL MANAGER

ROSE AVENUE
LINCOLN BLVD. TO WALGROVE AVE.

Thomas Guide	District	PROJECT NO.	DRAWING NO.	
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ALEXANDER D. ZUPANSKI No. TR 2400 Exp. 06–30–09 TRAFFIC

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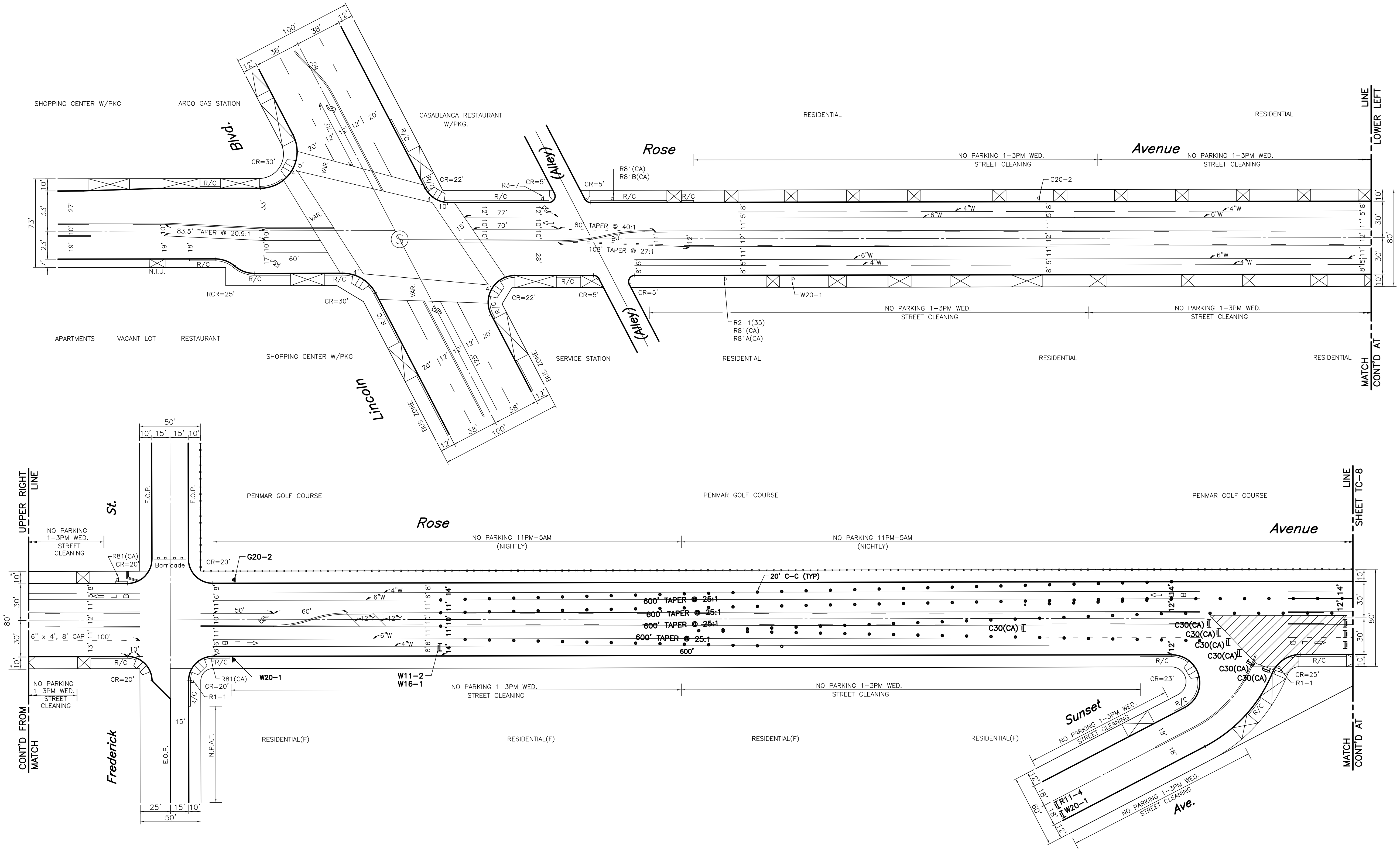

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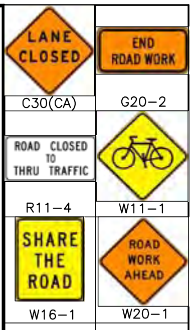

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W.O. E40019F

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CITY OF LOS ANGELES
DEPARTMENT OF TRANSPORTATION
RITA L. ROBINSON, GENERAL MANAGER

ROSE AVENUE

LINCOLN BLVD. TO GLENAVON AVE.

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PRINCIPAL T.E.
T.E./SR. T.E.
REVISION DESCRIPTION
NO.

PLAN PREPARED BY:

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Irvine, California 92606
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CIVIL

ALEXANDER D. ZUPANSKI
No. TR 2400
Exp. 06–30–09
TRAFFIC

CONSULTANT BUSINESS TAX REGISTRATION NUMBER : 217989–0001–1

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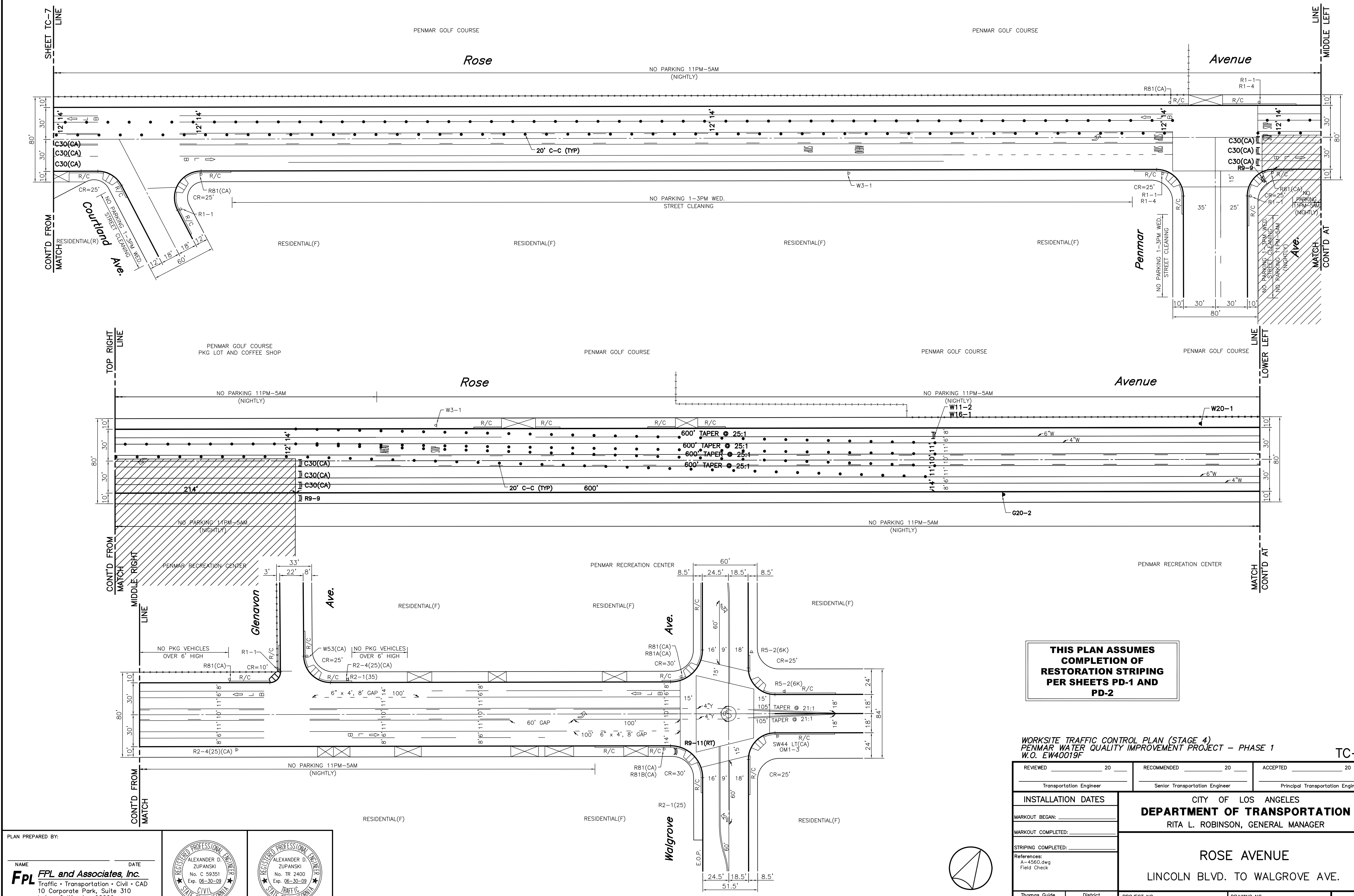

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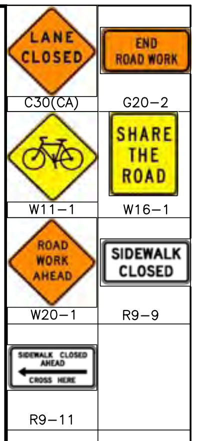

WORKSITE TRAFFIC CONTROL PLAN (STAGE 4)
PENMAR WATER QUALITY IMPROVEMENT PROJECT – PHASE 1
W.O. EW40019F

TC–8

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Transportation Engineer	Senior Transportation Engineer	Principal Transportation Engineer

INSTALLATION DATES
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CITY OF LOS ANGELES
DEPARTMENT OF TRANSPORTATION
RITA L. ROBINSON, GENERAL MANAGER

ROSE AVENUE
LINCOLN BLVD. TO WALGROVE AVE.

Thomas Guide	District
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DATE	BY		DATE	BY	
		SUPERVISOR DISTRICT SIGNALS			BASE CHECK DESIGN

NO.	REVISION DESCRIPTION	T.E./SR. T.E.	PRINCIPAL T.E.	DATE

PLAN PREPARED BY:
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CONSULTANT BUSINESS TAX REGISTRATION NUMBER : 217989–0001–1

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APPENDIX B

Geotechnical Evaluation Penmar Water Quality Improvement Project
Los Angeles, California

June 13, 2008

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

GEOTECHNICAL EVALUATION
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PREPARED FOR:
Brown and Caldwell
11111 Santa Monica Boulevard, Suite 750
Los Angeles, California 90025

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
475 Goddard, Suite 200
Irvine, California 92618

June 13, 2008
Project No. 207328001

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

June 13, 2008
Project No. 207328001

Mr. Scott Dellinger
Brown and Caldwell
801 South Figueroa Street, Suite 950
Los Angeles, California 90017

Subject: Geotechnical Evaluation
Penmar Water Quality Improvement Project
Los Angeles, California

Dear Mr. Dellinger:

In accordance with your request and authorization, we have performed a geotechnical evaluation for the proposed Penmar Water Quality Improvement Project in Los Angeles, California. The purpose of this study was to evaluate the subsurface soil and geologic conditions and to provide conclusions and recommendations regarding the geotechnical aspects of the proposed design and construction of the project.

We appreciate the opportunity to be of service on this project. Should you have any questions or comments regarding this report, please contact the undersigned at your convenience.

Sincerely,
NINYO & MOORE

Greg M. Corson, C.E.G.
Project Geologist

PROFESSIONAL GEOLOGIST
GREGORY M. CORSON
No. 2310
CERTIFIED ENGINEERING GEOLOGIST
Exp. 10-31-08
STATE OF CALIFORNIA

Daniel Chu, P.h.D., G.E.
Chief Geotechnical Engineer

Lawrence Jansen, C.E.G.
Principal Geologist

REGISTERED PROFESSIONAL ENGINEER
DANIEL B. CHU
No. GE2096
Exp. 03/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

WY/GMC/LTJ/DC/mlc

Distribution: (4) Addressee

475 Goddard ▪ Suite 200 ▪ Irvine, California 92618 ▪ Phone (949) 753-7070 ▪ Fax (949) 753-7071
San Diego ▪ Irvine ▪ Rancho Cucamonga ▪ Los Angeles ▪ Oakland ▪ Las Vegas ▪ Phoenix ▪ Denver ▪ El Paso

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Appendices

1. INTRODUCTION

In accordance with your request, we have performed a geotechnical evaluation for the proposed Penmar Water Quality Improvement Project located at 1233 Rose Avenue in Venice, California (Figure 1). The project is a joint collaboration between the City of Los Angeles and City of Santa Monica to improve water quality of the Santa Monica Bay and Pacific Ocean. The water quality will be improved through the use of Best Management Practices (BMPs) to reduce the introduction of pollutants associated with stormwater runoff into the stormwater conveyance system. The project will target a drainage area of approximately 1,468 acres. The purpose of our study was to evaluate the subsurface soil and geologic conditions of the project site and to provide geotechnical recommendations for the design and construction of the proposed BMPs. Our evaluation was performed in generally accordance with our proposal dated August 27, 2007. This report presents our findings, conclusions, and recommendations based on our background review, site reconnaissance, subsurface evaluation, laboratory testing, and geotechnical analyses.

2. SCOPE OF SERVICES

The scope of our geotechnical services included the following:

- Review of readily available geologic maps, published literature, stereoscopic aerial photographs, and in-house information.
- Review of seismic data, including fault hazard maps, seismic hazards maps, and other readily available data regarding geologic and seismic hazards within the project areas.
- Performance of a site reconnaissance to evaluate the existing site conditions and mark proposed boring locations for utility clearance.
- Subsurface exploration consisting of the drilling, logging, and sampling of eight hollow-stem auger borings to depths of up to approximately 51½ feet. The borings were logged by a representative of our firm. Bulk and relatively undisturbed soil samples were collected at selected intervals for laboratory testing.
- Infiltration testing at four boring locations to evaluate the percolation rates of the subsurface soils.
- Laboratory testing of selected soil samples to evaluate in-situ moisture and dry density, sieve analysis, Atterberg Limits, expansion index, consolidation, and corrosivity.

- Compilation and geotechnical analysis of background information and field and laboratory data.

- Preparation of this geotechnical report presenting our findings, conclusions, and recommendations regarding the proposed project.

3. SITE DESCRIPTION

The project is generally located within the Penmar Golf Course and Penmar Recreation and Park in the City of Los Angeles (Figure 1). The golf course is bounded by Dewey Street on the northwest, Glenavon Avenue on the northeast, a closed portion of Frederick Street on the southwest, and Rose Avenue on the southeast. Penmar Park is located on the opposite side of Rose Avenue near the middle of the golf course. Dewey Street marks the approximate boundary between Los Angeles and Santa Monica. Land use bordering the golf course and park includes light commercial, industrial, and high-density residential.

The project site is located in a relatively flat, low-lying area that drains gently to the southwest. Ground surface elevations range from approximately 25 feet above mean sea level (MSL) along the southern limits of the project area to approximately 35 feet MSL at the northeast corner of the Penmar Golf Course. A terrace is located north and northwest of the site with an elevation of approximately 100 feet MSL. Historical topographic maps of this area indicate that a wetlands or marshy area was present in the southwesterly portions of the project site (USGS, 1913). Personnel from the golf course indicated that the area was historically used as a dump site.

4. PROPOSED CONSTRUCTION

Based on our review of the Phase 1 Design Elements prepared for the project dated April 3, 2008, structures associated with the project include new BMPs for treating stormwater runoff, including a diversion structure, pump station, underground reservoir, and underground force main piping (Figure 2). The project includes relocating existing utilities along Frederick Street and the rehabilitation of an existing sewer along Lincoln Boulevard. Generalized descriptions of each structure are provided below.

- **Diversion Structure** – The new diversion structure will connect to two existing approximately 10-feet by 14-feet box culverts in Rose Avenue and divert stormwater flow to the

new pump station. Diversion of the flow will be passive and routed by gravity to the pump station. The structure will have an opening size of approximately 10 feet by 5 feet with a point of connection at the lower floor of box the culverts.

- **Pump Station** – The new pump station will be approximately 180 feet by 25 feet with a maximum depth of approximately 30 feet below the ground surface. The storage capacity will be approximately 200,000 gallons. The station will include 2 pumps that connect to the sewer system and 4 pumps that connect to the new underground reservoir. The pump station will include trash racks/screens constructed of stainless steel and removable by a hoist.

- **Underground Reservoir** – The new reservoir will hold approximately 4 million gallons (MG). The reservoir will have an approximately 210-feet diameter and total depth of approximately 24 feet below the ground surface. The reservoir will be constructed with cast-in-place concrete and will have approximately 15-feet high inner walls, an approximately 1-foot-thick floor, and approximately 2-feet-thick roof. The roof will be covered by approximately 3 feet of ground cover.

- **Force Mains** – Two new force mains will be constructed between the underground reservoir and the pump station. The pipe diameter, material types, and length are still to be determined.

- **Frederick Street Utilities Relocation** – Existing utilities within Frederick Street will be relocated as part of the project.

- **Sewer Rehabilitation (Lincoln Boulevard)** - An existing sewer pipeline(s) will be rehabilitated as a part of the project.

5. SUBSURFACE EXPLORATION AND LABORATORY TESTING

Our subsurface evaluation was conducted on December 21 and 27, 2007, and included the drilling, logging, and sampling of eight small-diameter borings with a truck-mounted drill rig utilizing 8-inch-diameter hollow-stem augers. The approximate locations of the borings are presented on the Boring Location Map (Figure 2). The borings were explored to depths ranging from approximately 21½ to 51½ feet below the ground surface and were logged by a representative of our firm. Bulk and relatively undisturbed soil samples were obtained at selected depths for laboratory testing. The logs of the exploratory borings are presented in Appendix A.

Laboratory testing of representative soil samples was performed to evaluate in-situ moisture content and dry density, gradation analysis, percentage of particles finer than the No. 200 sieve, Atterberg Limits, expansion index, consolidation potential, collapse potential, and soil corrosiv-

ity. The results of our in-situ moisture content and dry density evaluation are presented on the borings log in Appendix A. The remaining laboratory testing results are presented in Appendix B.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The subject site is located in the northwestern portion of the Los Angeles Basin, which is situated at the northwest end of the Peninsular Ranges geomorphic province of southern California. The Los Angeles Basin has been divided into four structural blocks, which are generally bounded by prominent northwest trending fault systems: the Northwestern Block, the Southwestern Block, the Central Block, and the Northeastern Block (Norris and Webb, 1990). The site is located in the Southwestern Block, which is bounded by the Newport-Inglewood fault to the northeast and the Palos Verdes Hills fault to the southwest, the Santa Monica Mountains to the northwest, and the Pacific Ocean to the south and southeast. The block is underlain by up to approximately 20,500 feet of Miocene-age or younger marine deposits over basement rock consisting of the Catalina Schist.

According to Dibblee (1991), the site is underlain by younger alluvium consisting of unconsolidated gravel, sand, and silty clay with interbeds of gravelly and sandy stream deposits (Figure 3) associated with the Ballona Creek drainage. The State of California (1998) maps the site as being underlain by younger alluvium consisting of alternating beds of silt, clay, and fine to medium sand with some gravelly layers. Dibblee (1991) maps the terrace north of the project site as marine deposits consisting of sand, pebbly sand gravel and silt. Our review of geologic literature and stereoscopic aerial photographs did not indicate the presence of landslides or active faulting at the site.

The materials encountered in the borings generally consisted of surficial fill soils underlain by alluvial deposits to the depths explored of approximately 21½ to 51½ feet. Fill soils generally consist of loose to medium dense, silty sand and clayey sand and stiff to very stiff sandy clay to depths up to approximately 10 feet. Below the fill, alluvial soils generally consisting of stiff to very stiff sandy clay and silty clay interbedded with clayey silt, silty sand and poorly graded sand were encountered in our exploratory borings to the depths explored of 51½ feet. More detailed descriptions of the subsurface materials are presented on the boring logs in Appendix A.

7. FIELD PERCOLATION TESTING

Percolation testing was performed on December 27 and 28, 2007 at borings B-1, B-5, B-6 and B-7 to evaluate the percolation rate of the on-site soils. The testing was performed for the purpose of evaluating an infiltration system as part of the project. At each of these boring locations, a separate percolation test hole was drilled to depths of approximately 10 to 15 feet. The infiltration tests were performed at a depth interval of approximately 5 to 10 feet for B-6 and a depth interval of approximately 5 to 15 feet for B-1, B-5 and B-7. Preparation of the borings for percolation testing included placing a 2-inch-diameter PVC pipe in the borings, backfilling around the lower approximate 5 feet of pipe with clean sand, and placing a bentonite cap above the sand. The lower approximately 5 feet of PVC pipe within the sand zone was slotted. The infiltration zone was pre-soaked on December 27, 2007. Percolation testing was conducted on December 28, 2007 by placing water in the PVC pipe to establish a head of water. The drop in water level was measured over time. The results of our percolation testing are presented in Table 1.

Table 1 – Percolation Test Results

Test Hole	Coefficient of Permeability (ft/day)
B-1 (5-15 feet)	0.05
B-5 (5-15 feet)	0.15
B-6 (5-10 feet)	No Percolation Over 28 Hours
B-7 (5-15 feet)	0.014

Notes:
ft/day – feet per day

8. GROUNDWATER

Groundwater was encountered in our exploratory borings ranging from approximately 16 to 29 feet below ground surface. Based on review of the State of California Seismic Hazard Evaluation (1998), the historical high groundwater level mapped at the site ranges from approximately 30 feet below the ground surface at the northwest corner of the site to less than 10 feet at the southwest corner. It should be noted that fluctuations in the level of groundwater at the subject site may occur due to variations in ground surface topography, groundwater pumping, subsurface

stratification, rainfall, irrigation practices, and other factors which may not have been evident at the time of our evaluation.

9. FAULTING AND SEISMICITY

The subject site is not located within a State of California Earthquake Fault Zone (EFZ), formerly Alquist-Priolo Special Studies Zone (Hart and Bryant, 1997). However, the site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed structure. Figure 4 shows the approximate site location relative to the major faults in the region. Table 1 lists selected principal known active faults that may affect the subject site and the maximum moment magnitude (Mmax) as published for the California Geological Survey (CGS) by Cao, et al. (2003). The approximate fault to site distance was calculated by the computer program FRISKSP (Blake, 2001a).

Table 2 – Principal Active Faults

Fault	Approximate Fault to Site Distance in miles (km)	Maximum Moment Magnitude[1] (Mmax)
Santa Monica	2.2 (3.6)	6.6
Malibu Coast	4.4 (7.1)	6.7
Newport-Inglewood (L.A. Basin)	4.8 (7.8)	7.1
Hollywood	6.2 (10.0)	6.4
Palos Verdes	7.3 (11.7)	7.3
Upper Elysian Park Blind Thrust	11.9 (19.2)	6.4
Anacapa-Dume	13.4 (21.6)	7.5
San Andreas-1857 Rupture	42.5 (68.4)	7.8

Notes:
[1] Cao, et al., 2003.

The principal seismic hazard considerations at the site are ground shaking and surface ground rupture. A brief description of the hazards and the potential for their occurrence on site are presented below.

9.1. Surface Ground Rupture

The potential for surface ground rupture at the project site is considered low due to the lack of known active faults crossing the site. The site is not located within an EFZ. Surface ground cracking related to shaking from distant events is not considered a significant hazard, although it is a possibility.

9.2. Ground Motion

Our evaluation of the ground shaking hazard at the site included review of a probabilistic seismic hazard assessment that consisted of statewide estimates of peak horizontal ground accelerations conducted for California (Peterson, et al., 1996). In addition, for the purposes of evaluating seismically induced geotechnical hazards at the site, a site-specific probabilistic seismic hazard analysis was performed to evaluate anticipated peak ground accelerations (PGAs) using the computer program FRISKSP developed by Blake (2001a). A probabilistic analysis incorporates uncertainties in time, recurrence intervals, size, and location (along faults) of hypothetical earthquakes. This method thus accounts for likelihood (rather than certainty) of occurrence and provides levels of ground acceleration that might be more reasonably hypothesized for a finite exposure period. FRISKSP calculates the probability of experiencing various ground accelerations at a site over a period of time and the probability of exceeding expected ground accelerations within the lifetime of the proposed structure from the significant earthquakes within a specific radius of search. For the present case, a search radius of 62 miles (i.e., 100 kilometers) was selected. The earthquake magnitudes used in this program are based on the current CGS fault model.

The 2007 California Building Code (CBC) recommends that the design of structures be based on the peak horizontal ground acceleration having a 2 percent probability of exceedance in 50 years which is defined as the Maximum Considered Earthquake (MCE). The statistical return period for PGA_{MCE} is approximately 2,475 years. In evaluating the seismic hazards associated with the subject site, we have used the United States Geological Survey (USGS, 2008) ground motion calculator (web-based). The design PGA for the site

was calculated as 0.45g. These estimates of ground motion do not include near-source factors that may be applicable to the design of structures on site.

9.3. Liquefaction and dynamic Settlement of Saturated Soils

Liquefaction is the phenomenon in which loosely deposited granular soils with fines (i.e., silts and clays) content less than approximately 35 percent and located below the water table undergo rapid loss of shear strength when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid rise in pore water pressure causing the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking. Groundwater was encountered at depths of approximately 16 to 29½ feet. Historic high groundwater for the site ranges from approximately 10 feet at the southwest corner of the site to approximately 30 feet at the northeast corner (CDMG, 1998).

The southwest approximate half of the site is located in an area mapped as potentially liquefiable (CDMG, 1999)(Figure 5), and our site-specific investigation revealed the presence of saturated, cohesionless and loose to medium dense soils in a zones between approximately 35 to 40 feet below the ground surface. As a result, an evaluation of the liquefaction potential of the soil layers located below the groundwater was performed. Evaluations of the liquefaction potential of soil layers located below the historic high groundwater level of 10 feet was performed. An idealized soil profile was established for the site based on the subsurface information obtained from our exploratory borings.

An analysis of the earthquake-induced liquefaction potential at the site was performed utilizing the LIQUEFY2 Computer Program (Blake, 2001b). The liquefaction evaluation, assuming the historic groundwater level of 10 feet, indicates that the alluvial sediments between depths of approximately 35 and 40 feet below the surface are susceptible to

liquefaction and liquefaction-related seismic hazards (e.g., dynamic settlement and/or ground subsidence) during the design seismic event.

9.4. Dynamic Settlement of Saturated Soils

Based on our analysis of the site's liquefaction potential, the proposed improvements may be subject to liquefaction-induced dynamic settlement. In order to estimate the amount of post-earthquake settlement, the method proposed by Tokimatsu and Seed (1987) was used in which the seismically induced cyclic stress ratios and corrected N-values are related to the volumetric strain of the soil. The amount of soil settlement during a strong seismic event depends on the thickness of the liquefiable layers and the density and/or consistency of the soils. Under the historic high groundwater condition, a total post-earthquake settlement of approximately 3 inches is estimated for the site. It is our opinion that the differential settlement should not exceed approximately 1 inch in 40 feet. However, based on the depths and thicknesses of the liquefiable soil layers and the very dense overlying non-liquefiable layers, we estimate that the surface manifestation of dynamic settlement will not cause damage to shallow foundations and mat foundations based on the study by Ishihara (1995).

10. CONCLUSIONS

Based on the results of our geotechnical evaluation, it is our opinion that the proposed Penmar Water Quality Improvement project is feasible from a geotechnical standpoint, provided the recommendations in this report are incorporated into the design and construction of the subject project. Geotechnical conditions that affect the design and construction of the project include:

- Based on our exploratory borings, existing undocumented fill overlying the native alluvium is present at the site. The existing fill extends to a depth of up to approximately 10 feet at the locations explored. We recommend that the near surface fill soils be overexcavated and recompacted in areas underlying proposed at-grade improvements.
- Excavations during site grading should be feasible with earthmoving equipment in good working order. We anticipate that the near-surface soils should be generally suitable for use as compacted fill (except for structure backfill). However, the moisture contents of clay and silt materials encountered in our borings ranged from approximately 18 to 34 percent. Prior to using clay or silt as backfill, the clay and silt will need to be dried to slightly above opti-

mum moisture content. In addition, material excavated from below the groundwater table will be in a wet condition and will involve processing prior to use as compacted fill.

- Groundwater was encountered during our evaluation at depths of approximately 16 to 29 feet. Historic high groundwater is mapped at a depth ranging from approximately 10 to 30 feet below the ground surface. Consequently, groundwater should be expected to impact excavations deeper than approximately 10 feet and dewatering should be anticipated. Grading equipment should be used that limits the potential for soil pumping during grading and fill compaction. Groundwater levels are subject to variation due to seasonal precipitation, subsurface conditions, irrigation, groundwater pumping, and other factors.

- The reported historic shallow groundwater levels on site are approximately 10 to 30 feet below grade. When evaluating potential uplift effects on buried structures and for construction, we recommend that a groundwater level of 10 feet below the ground surface be considered. An appropriate factor of safety should also be utilized in the design for resisting the uplift force.

- The site is located in an area mapped as potentially liquefiable (CDMG, 1998). Our liquefaction evaluation of site soils below the historic high groundwater indicates that the soils between approximate depths of 35 and 40 feet below the surface are susceptible to liquefaction. We have calculated approximately 3 inches of liquefaction-induced dynamic settlement. Our analysis indicated that the surface manifestation of dynamic settlement should not cause damage to shallow foundations.

- Some of the proposed structures and pipelines will extend to or below the water table. Accordingly, considerations for the construction sequence should include: 1) installation of the sheet piles to create a cofferdam-type structure to facilitate dewatering and excavation, 2) consideration of the stability of the excavation by applying appropriate bracing systems during construction, and 3) dewatering of the area contained by the cofferdams.

- The on-site materials should be considered Type C soils in accordance with Occupational Safety and Health Administration (OSHA) soil classifications. It is anticipated that these soils will be exposed during project excavations. Temporary vertical excavations over approximately 4 feet in height will involve shoring, or, as an alternative to shoring, should be sloped back at an inclination of 1½:1 (horizontal to vertical) in accordance with OSHA regulations. Appropriate shoring systems for these types of materials should be considered during planning.

- The subject site is not located within a State of California EFZ. The probability of surface fault rupture at the site is considered to be low.

- The design PGA was estimated to be 0.45g based on the USGS (2008) ground motion calculator (web-based).

- Our limited laboratory corrosion testing indicates that the near-surface site soils can be classified as non-corrosive based on California Department of Transportation (Caltrans, 2003) corrosion guidelines.
- Coefficient of permeability for the site soils ranged from approximately less than 0.014 to 0.15 feet/day.

11. RECOMMENDATIONS

The following sections include our geotechnical recommendations for construction of the proposed Penmar Water Quality Improvement project. These recommendations are based on our evaluation of the site geotechnical conditions and our understanding of the planned construction. The proposed construction should also be performed in accordance with the requirements of applicable governing agencies.

As indicated in Section 12 of this report, we recommend additional exploratory borings to confirm the subsurface conditions and our design assumptions. The locations of our borings were based on the conceptual design of the project and were located to provide preliminary subsurface information for the project. Subsequent detailed project design information indicates that the proposed pump station is approximately 200 feet south of the nearest boring, B-8. We have provided our recommendations below assuming similar material types are present.

11.1. Earthwork

Earthwork will generally include the removal of below-grade improvements, including existing underground utilities, excavations to construct the diversion structure, pump station, and underground reservoir, and installation of underground utilities. Earthwork recommendations presented in the following sections are based on the assumption that grading to achieve the finish grades at the site will be relatively minor. Earthwork should be performed in accordance with the requirements of applicable agencies, and the recommendations presented herein.

11.1.1. Construction Plan Review and Pre-Construction Conference

We recommend that the grading and foundation plans be submitted to Ninyo & Moore for review to check for conformance to the recommendations provided in this report. We further recommend that a pre-construction conference be held in order to discuss the grading recommendations presented in this report. The owner and/or their representative, the governing agencies' representatives, the civil engineer, Ninyo & Moore, and the contractor should be in attendance to discuss the work plan, project schedule, and earthwork requirements.

11.1.2. Clearing and Grubbing

Prior to commencing earthwork operations, deleterious materials, including vegetation, pavement, and/or other site improvements should be cleared from the site. Debris from the clearing operations should be disposed off-site. Resulting holes due to removal of obstructions that extend below grade, such as foundations or underground utilities, should be removed and filled with compacted fill per Sections 11.1.8 and 11.1.9 of this report.

11.1.3. Pump Station and Underground Reservoir Pad Preparation

Based on our exploratory borings, relatively dense, granular, alluvial soils are anticipated at the bottom of the pump station and reservoir excavations that should be suitable for support of the structures. We recommend that the structure pads be over-excavated approximately 1½ feet, and replaced with compacted aggregate base material, such as Class 2 aggregate base or crushed miscellaneous base (CMB) wrapped in filter fabric. The actual limits and methods to stabilize the subgrade should be based on evaluation of the subgrade conditions in the field at the time of construction. The excavation bottom should be evaluated by our representative during the excavation work. Prior to placement of the foundation, the bottom should be scarified to a depth of approximately 12 inches, moisture conditioned, and compacted.

11.1.4. Treatment of Near Surface Soils for At-Grade Structures

In order to provide suitable support for at-grade structures we recommend that undocumented fill beneath the structures be removed and recompacted to provide approximately 3 feet or more compacted fill beneath the bottom of the foundations. The overexcavation should expose relatively dense alluvial deposits. Additional overexcavation of loose, soft, and/or wet areas may be appropriate. The limits of the excavation should extend laterally so that the bottom of the excavation is approximately 5 feet beyond the perimeter of the structure or a distance equal to the depth of the overexcavation, whichever is farther. The excavation bottom should be evaluated by our representative during the excavation work. The exposed subgrade should be scarified to approximately 6 inches deep, moisture conditioned, and compacted prior to the placement of fill. To reduce the adverse effect to the foundation caused by the on-site expansive soils, we recommend that the upper 2 feet of soil beneath the foundations be comprised of low-expansion potential material that is in accordance with the CBC (2007). On-site and imported soils should be compacted to 90 percent or more relative compaction as evaluated by the latest edition of ASTM D 1557.

11.1.5. Excavation Characteristics

We anticipate that excavation within the fill and alluvial materials present on site may be accomplished with grading equipment in good operating condition. Based on the results of our subsurface exploration, we anticipate that the subsurface soils encountered will generally consist of sand, silty sand, clayey sand, silt, and clay. Although oversize materials were not encountered in our borings, oversize materials may be encountered during excavation, including debris in the undocumented fills. The contractor should be prepared to take appropriate measures to address the presence of oversize materials.

11.1.6. Shoring

Where excavations extend below the water table or where temporary slopes are not possible, shoring will be involved. Shoring systems will be constructed through fill and alluvial deposits. The types of shoring systems for the project are unknown at this time.

We anticipate that braced driven sheet pile shoring systems will be appropriate for the project to excavation depths up to approximately 30 feet. Cantilevered shoring systems (if used) should be limited to retain excavation heights of up to 10 feet due to soft clay/loose sand conditions. The braced sheet pile shoring systems should be designed using the lateral earth pressure values provided on Figure 6. Tieback-anchored shoring system may be used in lieu of braced shoring, provided the easements for tiebacks are available. Tieback anchor constraints include conflicts with existing structures, underground utilities, and remnant foundation systems. In addition, tieback anchors that are embedded in loose sand or soft clay below groundwater may not provide the desired bond strength even under the temporary loading condition, and may need to be lengthened. The shoring systems planned for the project should be reviewed by our office to evaluate the design considerations and geotechnical parameters used.

The recommended design pressures are based on the assumptions that the shoring system is constructed without raising the ground surface elevation behind the shoring system, that there are no surcharge loads, such as soil stockpiles, construction materials, construction equipment, or vehicular traffic, and that no loads act above a 1:1 (horizontal to vertical) plane extending up and back from the base of the shoring system. For shoring system subjected to the above-mentioned surcharge loads, the contractor should include the effect of these loads on the lateral pressures against the shoring system.

Ground settlement may occur behind the shoring system wall during excavation. The amount of settlement depends heavily on the type of shoring system, the contractor's workmanship, and soil conditions. Based on our experience, we anticipate that sheet pile driving may cause settlement and possible impact to structures within distances of up to approximately 25 feet from the sheet pile operation. We recommend that structures/improvements in the vicinity of the planned shoring installation be reviewed with regard to foundation support and tolerance to settlement. To reduce the potential for distress to adjacent structures, we recommend that the shoring system be designed to limit the ground settlement behind the shoring system to ½ inch or less, which would equal

approximately ½ inch of deflection. Possible causes of settlement that should be addressed include settlement during installation of the sheet piling, excavation for structure construction, construction vibrations, dewatering, and removal of the support system. The vibrations from the driving of sheet piles may result in some dynamic settlement of granular soils that may affect the adjacent structures. We recommend that shoring installation be evaluated carefully by the contractor prior to construction and that ground vibration and settlement monitoring be performed during construction. Vibration and settlement monitoring should be performed during pile driving. If settlement is detected or peak particle velocities of approximately 0.2 inches per second or more are measured adjacent to existing improvements, the pile driving should be stopped and evaluated. The evaluation may include changing the hammer vibration frequency and monitoring for settlement and vibrations. To reduce the potential for settlement associated with sheet pile removal, sheet piles may be left in place. In the event excessive settlement or other damage occurs associated with the pile driving operations, it may be appropriate to perform grouting beneath nearby structure(s) to mitigate the pile driving effects.

The contractor should retain a licensed, qualified and experienced engineer to design the shoring system. The shoring parameters presented in this report are minimum requirements, and the contractor should evaluate the adequacy of these parameters and make the required modifications for their design. We recommend that the contractor take appropriate measures to protect workers. OSHA requirements pertaining to worker safety should be observed.

11.1.7. Construction Dewatering

The project site is underlain by relatively shallow groundwater, and dewatering is anticipated for deeper excavations so that work can be performed in a dry condition. The depth to groundwater was variable at the time of our field exploration. Groundwater depths are anticipated to range from approximately 16 to 29 feet, but could be as shal-

low as 10 feet deep (historical shallow groundwater data). The pump system design should be performed by a specialty dewatering contractor.

Lowering the water table during dewatering activities will result in an increase in effective stresses and may induce settlements of the soils underlying adjacent structures. Based on the anticipated depths of excavations (approximately 30 feet or less), we anticipate that the potential for settlement associated with construction dewatering is low. We recommend that the dewatering be performed such that the groundwater level be lowered no more than approximately 3 feet below the depths of excavations. Monitoring wells should be installed outside of the excavation to monitor the impact of dewatering to the groundwater. Existing structures in the vicinity of planned excavations should be evaluated with regard to foundation type and potential for settlement. Settlement monuments should be provided to monitor settlement-sensitive structures. Disposal of groundwater should be performed in accordance with guidelines of the Regional Water Quality Control Board (RWQCB). Design of the groundwater control system is the responsibility of the contractor.

11.1.8. Fill Material

In general, the on-site earth materials should be suitable for reuse as general fill and trench backfill. The on-site clay and silt materials are generally above optimum moisture content and will need to be processed prior to placing as fill to reduce the moisture content of these materials to slightly above optimum moisture content. In addition, debris may be encountered in the existing undocumented fill. On-site and imported fill soils should be free of trash, debris, roots, vegetation, or deleterious materials. Fill should generally be free of rocks or hard lumps of materials more than approximately 4 inches in diameter. Rocks or hard lumps larger than about 4 inches in diameter should be broken into smaller pieces or should be removed from the site. Imported materials should consist of clean, granular materials with a low expansion potential, corresponding to an expansion index of 50 or less as evaluated in accordance with ASTM D4829-07. Imported materials should be submitted to the project geotechnical consultant for

review prior to their importation to the site. The corrosion potential of proposed imported soils should also be evaluated if structures will be in contact with the imported soils. The contractor should be responsible for the uniformity of imported materials brought to the site.

We recommend that structural backfill material as specified in "Greenbook" Standard Specifications for Public Works Construction (Building News, 2003) be used to backfill behind the proposed retaining walls, including walls for the pump station and underground reservoir.

11.1.9. Fill Placement and Compaction

Fill, structure backfill, and trench backfill should be compacted in uniform horizontal lifts to a relative compaction of 90 percent or more as evaluated by ASTM D 1557-00. Fill soils should be placed at near optimum moisture content as evaluated by ASTM D 1557-00. The optimum lift thickness of fill will depend on the type of compaction equipment used, but generally should not exceed 8 inches in loose thickness. Special care should be taken to avoid pipe damage when compacting trench backfill above the pipe. Placement and compaction of the fill soils should be in general accordance with local grading ordinances and good construction practice.

11.1.10. Pipe Bedding

We recommend that bedding material be placed around pipe zones 1 foot or more above the top of the pipe. The bedding material should be classified as sand, be generally free of organic material, and have a sand equivalent (SE) of 30 or more. We do not recommend crushed rock be used for bedding material because of the fine grain nature of the subsurface material. It has been our experience that the voids within a crushed rock material are sufficiently large to allow fines to migrate into the voids, thereby creating the potential for sinkholes and depressions to develop at the ground surface. Where soft, wet soil conditions are encountered, the trench excavation should be excavated ap-

proximately 1 to 2 feet or more below the pipe invert and should be backfilled with gravel wrapped in filter fabric.

Special care should be taken not to allow voids beneath and around the pipe. Compaction of the bedding material and backfill should proceed uniformly up both sides of the pipe. Trench backfill, including bedding material, should be placed in accordance with the recommendations presented in the preceding section.

11.1.11. Modulus of Soil Reaction for Pipe Design

The modulus of soil reaction is used to characterize the stiffness of soil backfill placed at the sides of buried flexible pipelines for the purpose of evaluating deflection caused by the weight of the backfill above the pipe. We recommend that a modulus of soil reaction of 1,000 pounds per square inch (psi) be used for design, provided that granular bedding material be placed adjacent to the pipe, as recommended in the previous section.

11.2. Seismic Design Considerations

Design of the proposed improvements should comply with design for structures located in Seismic Zone 4 and should be designed in accordance with the requirements of governing jurisdictions and applicable building codes. Table 2 presents the seismic design parameters for the site in accordance with CBC (2007) guidelines and mapped spectral acceleration parameters (United States Geological Survey [USGS], 2008).

Table 3 – 2007 California Building Code Seismic Design Criteria

Seismic Design Factors	Value
Site Class	D
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.5
Mapped Spectral Acceleration at 0.2-second Period, S_s	1.566 g
Mapped Spectral Acceleration at 1.0-second Period, S_1	0.600 g
Adjusted MCE Spectral Response Acceleration at 0.2-second Period, S_{MS}	1.566 g

Table 3 – 2007 California Building Code Seismic Design Criteria

Seismic Design Factors	Value
Adjusted MCE Spectral Response Acceleration at 1.0-second Period, S_{M1}	0.900 g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	1.044 g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.600 g

11.3. Mat Foundations

Based on our analysis, it is our opinion that the proposed underground reservoir and pump station can be supported by mat foundations. Mat foundations may be designed assuming the allowable bearing capacities presented in Table 4. The anticipated total and differential settlements corresponding to these allowable bearing loads is estimated to be approximately 1 inch and ½ inch, respectively. Mat foundations typically experience some deflection due to loads placed on the mat and the reaction of the soils directly underlying the mat. Table 4 presents the design modulus of subgrade reaction that may be used for evaluating such deflections for each structure.

We recommend that a 1½-foot-thick gravel mat be placed in the bottom of the excavations prior to construction of the structure floors to provide a suitable working surface. The gravel should be clean ¾-inch to 1½-inch rock, underlain by non-woven filter fabric (Mirafi 140N or approved equivalent).

Table 4 – Soil Design Parameters for Mat Foundations

Structures	Approximate Depth of Structure Below Grade (feet)	Net Allowable Bearing Capacity (psf)*	Modulus of Subgrade Reaction (kcf)
Underground Reservoir	24	5,000	500
Pump Station	30	5,000	350

Notes:
psf – pounds per square foot
kcf – kips per cubic foot
* The net allowable bearing capacity, means the weight of the mat and soil backfill may be ignored in calculating foundation loads.

11.4. Footing Foundations

Footings bearing in soils of low expansion potential should extend 18 inches or more below the lowest adjacent finished grade. Continuous footings should have a width of 24 inches or more. Isolated footings should have a width of 24 inches or more. Continuous footings should be reinforced with two No. 5 steel reinforcing bars, one placed near the top and one placed near the bottom of the footings, and further detailed in accordance with the recommendations of the structural engineer.

Footings, as described above and bearing on compacted fill, may be designed using a net allowable bearing capacity of 2,500 psf. (weight of footings and soil backfill may be ignored when calculating footing loads). Total and differential settlements for footings designed in accordance with the above recommendations are estimated to be less than approximately 1 inch and ½ inch, respectively.

Foundations bearing in compacted fill may be designed using a coefficient of friction of 0.35, where the total frictional resistance equals the coefficient of friction times the dead load. Foundations may be designed using a passive resistance value of 300 psf per foot of depth, with a maximum value of 3,000 psf. The allowable lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided the passive resistance does not exceed two-thirds of the total allowable resistance. The passive resistance (including the maximum value) may be increased by one-third when considering loads of short duration such as wind or seismic forces.

11.5. Floor Slabs

Floor slabs should have a thickness of 5 inches or more and be reinforced with No. 4 steel reinforcing bars placed 18 inches on-center (each way) in the middle one-third of the slab height. The proper placement of the reinforcement in the slab is vital for satisfactory performance. The floor slab and foundations should be tied together by extending the slab reinforcement into the footings. Floor slabs should be underlain by a 2-inch layer of clean sand, underlain by a polyethylene vapor retarder, 10-mil or thicker, underlain by a 4-inch

layer of gravel with a particle size up to approximately $^3/_8$ inch. The vapor retarder is recommended in areas where moisture sensitive floor coverings are anticipated. Soils underlying the slabs should be moisture conditioned and compacted in accordance with the recommendations contained in this report prior to concrete placement. Joints should be constructed at intervals designed by the structural engineer to help reduce random cracking of the slab. Floor slabs subject to heavy wheel loads should be evaluated on a case-by-case basis by the structural engineer.

11.6. Earth Pressures

Walls for below grade facilities when constructed as recommended above, including structural backfill per "Greenbook," may be designed for lateral pressures represented by the pressure diagram on Figure 7. The exterior of underground walls should be carefully waterproofed. We recommend that horizontal and vertical construction joints of underground structures have water stops to reduce the likelihood of water infiltration. For pipe penetrating into the structures, standard "water-tight" penetration design should be utilized. To reduce the potential for pipe-to-wall differential settlement, which could cause pipe shearing, we recommend that a flexible pipe joint be located close to the exterior of the wall. The type of joint should be such that minor relative movement can be accommodated without distress. The pipe connections should be sufficiently flexible to withstand differential settlement of approximately ½ inch. The amount of differential settlement is from static loading of the structure. Dynamic settlement of up to approximately 3 inches during a design earthquake may occur. However, our analysis also indicated that the surface manifestation of dynamic settlement will not cause damage to shallow foundations. Repairs to connections may be required after strong seismic events.

The dynamic lateral earth pressures presented in Figure 7 apply to retaining walls that are more than 12 feet in height in accordance with the 2007 CBC. Retaining walls may be supported by conventional mat foundations and shallow foundations, using the design parameters presented in Section 11.3 and 11.4 of this report, respectively.

11.7. Lateral Pressures for Thrust Blocks

Thrust restraint for buried pipelines may be achieved by transferring the thrust force to the soil outside the pipe through a thrust block. Thrust blocks may be designed using the lateral passive earth pressures presented on Figure 8. Thrust blocks should be backfilled with granular backfill material, compacted as outlined in Section 11.1.9.

11.8. Uplift Considerations

For structures that will extend below the water table, uplift force will need to be considered. Hydrostatic uplift forces should be evaluated for a potential shallow groundwater condition of approximately 10 feet below the ground surface. The resistance to uplift may then be taken as the sum of the weight of the structure and the uplift resistance of the sidewalls.

We recommend that the concrete mat foundation and structure be designed to resist hydrostatic uplift. Two alternatives for resisting the anticipated uplift pressures are: 1) constructing a thicker concrete mat foundation, or 2) extending the mat foundation a selected distance outside the exterior walls of the structure (flanges). The resistance to uplift may then be taken as the sum of the weight of the structure and the weight of the wedge of soil within the zone of influence (Figure 9).

11.9. Corrosivity

Laboratory testing was performed on representative samples of near-surface soil to evaluate soil pH, electrical resistivity, water-soluble chloride content, and water-soluble sulfate content. The soil pH and electrical resistivity tests were performed in general accordance with California Test Method (CT) 643. Chloride content tests were performed in general accordance with CT 422. Sulfate testing was performed in general accordance with CT 417. The laboratory test results are presented in Appendix B.

The soil pH was measured to be approximately 6.5 and 6.7. The electrical resistivity was measured to be approximately 670 and 2,345 ohm-centimeters. The chloride content of the samples were approximately 115 and 150 ppm. The sulfate content of the tested samples

were approximately 0.015 and 0.004 percent by weight (i.e., 150 and 40 ppm, resepectively). Based on the laboratory test results and Caltrans (2003) corrosion criteria, the project site can be classified as a non-corrosive site, which is defined as having earth materials with less than 500 ppm chlorides, less than 0.20 percent sulfates (i.e., 2,000 ppm), or a pH of 5.5 or less.

11.10. Concrete Placement

Concrete in contact with soil or water that contains high concentrations of soluble sulfates can be subject to chemical and/or physical deterioration. Based on the UBC criteria (UBC, 1997), the potential for sulfate attack is negligible for water-soluble sulfate contents in soil ranging from 0.00 to 0.10 percent by weight (0 to 1,000 ppm). As indicated above, the soil samples tested for this evaluation indicate water-soluble sulfate contents of 0.015 and 0.004 percent by weight (i.e., 150 and 40 ppm, respectively). Accordingly, the on-site soils are considered to have a negligible potential for sulfate attack. However, due to the potential variability in soil conditions across the site and the possible use of reclaimed water, we recommend that Type V cement with a water/cement ratio of 0.45 or less be considered for the project.

In order to reduce the potential for shrinkage cracks in the concrete during curing, we recommend that the concrete be placed with a slump of 4 inches based on ASTM C 143. The slump should be checked periodically at the site prior to concrete placement. We also recommend that crack control joints be provided in sidewalks and exterior hardscape in accordance with the recommendations of the project structural engineer to reduce the potential for distress due to minor soil movement and concrete shrinkage. The project structural engineer should be consulted for additional concrete specifications.

11.11. Drainage

Proper surface drainage is imperative for satisfactory site performance. Positive drainage should be provided and maintained to direct surface water away from foundations and off-site. Positive drainage is defined as a slope of 2 percent or more for a distance of 5 feet

or more away from foundations and tops of slopes. Runoff should then be directed by the use of swales or pipes into a collective drainage system. Surface waters should not be allowed to pond adjacent to footings. We recommend that structures have roof drains and downspouts installed to collect runoff. Surface water should not be allowed to flow over slope faces or pond adjacent to footings. Area drains for landscaped and paved areas are recommended.

11.12. Landscaping

Project landscaping should consist of drought tolerant plants. Landscape irrigation should be kept to a level just sufficient to maintain plant vigor. Overwatering should not be permitted.

12. ADDITIONAL EXPLORATION

Our subsurface exploration was based on conceptual design information provided prior to the detailed information and at the locations requested by the client. One boring was performed at the site of the underground reservoir. We recommend that two additional borings be performed in the footprint of the reservoir to confirm our design assumptions. We also recommend that one boring be performed at the location of the pump station to confirm our design assumptions. Additional borings should also be considered along the new force main alignments to evaluate trenching and pipe support conditions.

13. CONSTRUCTION OBSERVATION

The conclusions and recommendations presented in this report are based on analysis of observed conditions in widely spaced exploratory borings. If conditions are found to vary from those described in this report, Ninyo & Moore should be notified and additional recommendations will be provided upon request. Ninyo & Moore should observe and test fill placement and compaction. Project plans should also be reviewed by Ninyo & Moore prior to the start of construction.

The recommendations provided in this report are based on the assumption that Ninyo & Moore will provide geotechnical observation and testing services during construction. In the event that

the Irvine Ranch Water District decides not to utilize the services of Ninyo & Moore during construction, we request that the selected consultant provide the Irvine Ranch Water District with a letter (with a copy to Ninyo & Moore) indicating that they fully understand Ninyo & Moore's recommendations and that they are in full agreement with the design parameters and recommendations contained in this report.

14. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

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Source	Scale	Date	Flight	Numbers
USDA	1:20,000	11-4-52	AXJ-3K	128 & 129

REFERENCE: 2005 THOMAS GUIDE FOR LOS ANGELES/ORANGE COUNTIES, STREET GUIDE AND DIRECTORY

APPROXIMATE SCALE IN FEET

0 2400 4800

N

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

Map © Rand McNally, R.L.07-S-129

207328-A1.DWG

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PROJECT NO.	DATE
207328001	6/08

SITE LOCATION MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

1

REFERENCE: GOOGLE EARTH

LEGEND

B-8 ● TD=31.5	APPROXIMATE LOCATION OF EXPLORATORY BORING TD=TOTAL DEPTH IN FEET

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PROJECT NO.	DATE
207328001	6/08

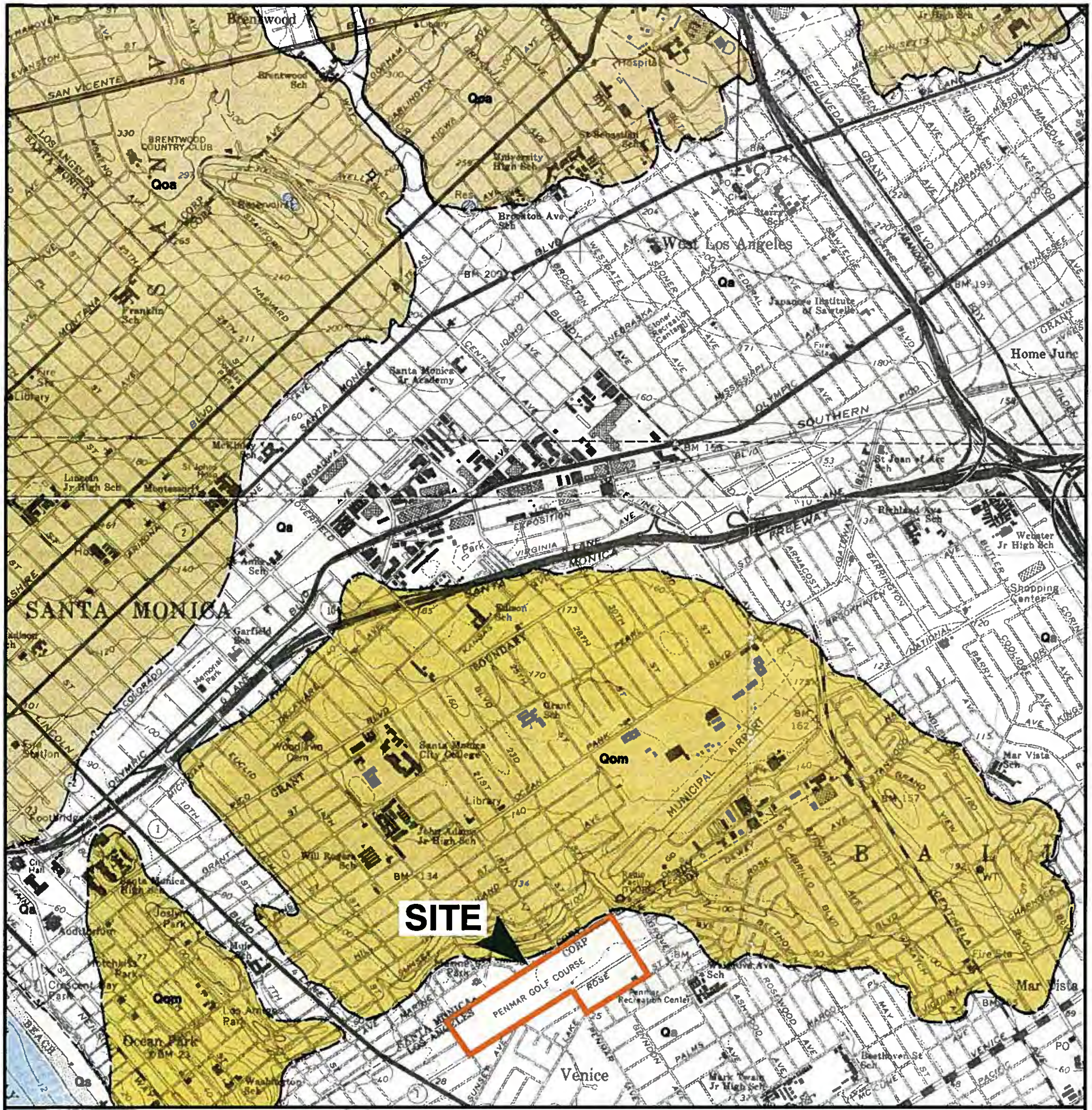
BORING LOCATION MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

2

207328-A2.dwg



REFERENCE: GEOLOGICAL MAP OF BEVERLY HILLS AND VAN NUYS (SOUTH 1/2) QUADRANGLES BY THOMAS W. DIBBLEE, JR., 1991.

N

APPROXIMATE SCALE IN FEET

0 2400 4800

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE

LEGEND

Qa af Qa	ALLUVIUM
Qoa Qop Qoa	OLDER ALLUVIUM
Qom Qop Ql	MARINE DEPOSITS

207328-A3.DWG

Ninyo & Moore

PROJECT NO.	DATE
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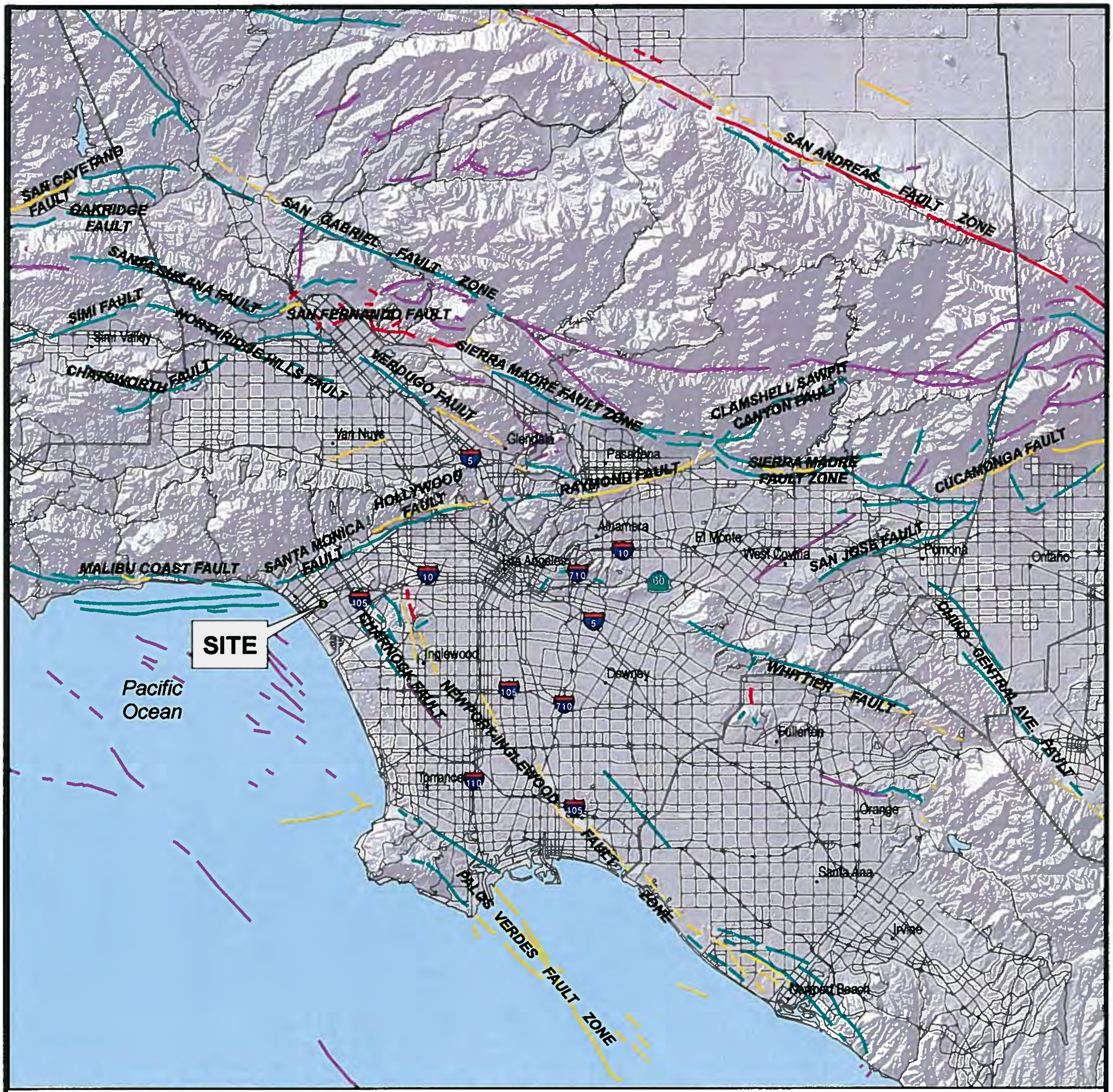
REGIONAL GEOLOGIC MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

3



GIS DATA SOURCE: CALIFORNIA GEOLOGICAL SURVEY (CGS); ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE (ESRI)
REFERENCE: JENNINGS, 1994, FAULT ACTIVITY MAP OF CALIFORNIA AND ADJACENT AREAS

LEGEND

FAULT ACTIVITY:

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- COUNTY BOUNDARIES
- LATE QUATERNARY
- QUATERNARY

N

10 0 10

Miles

NOTE: ALL DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE

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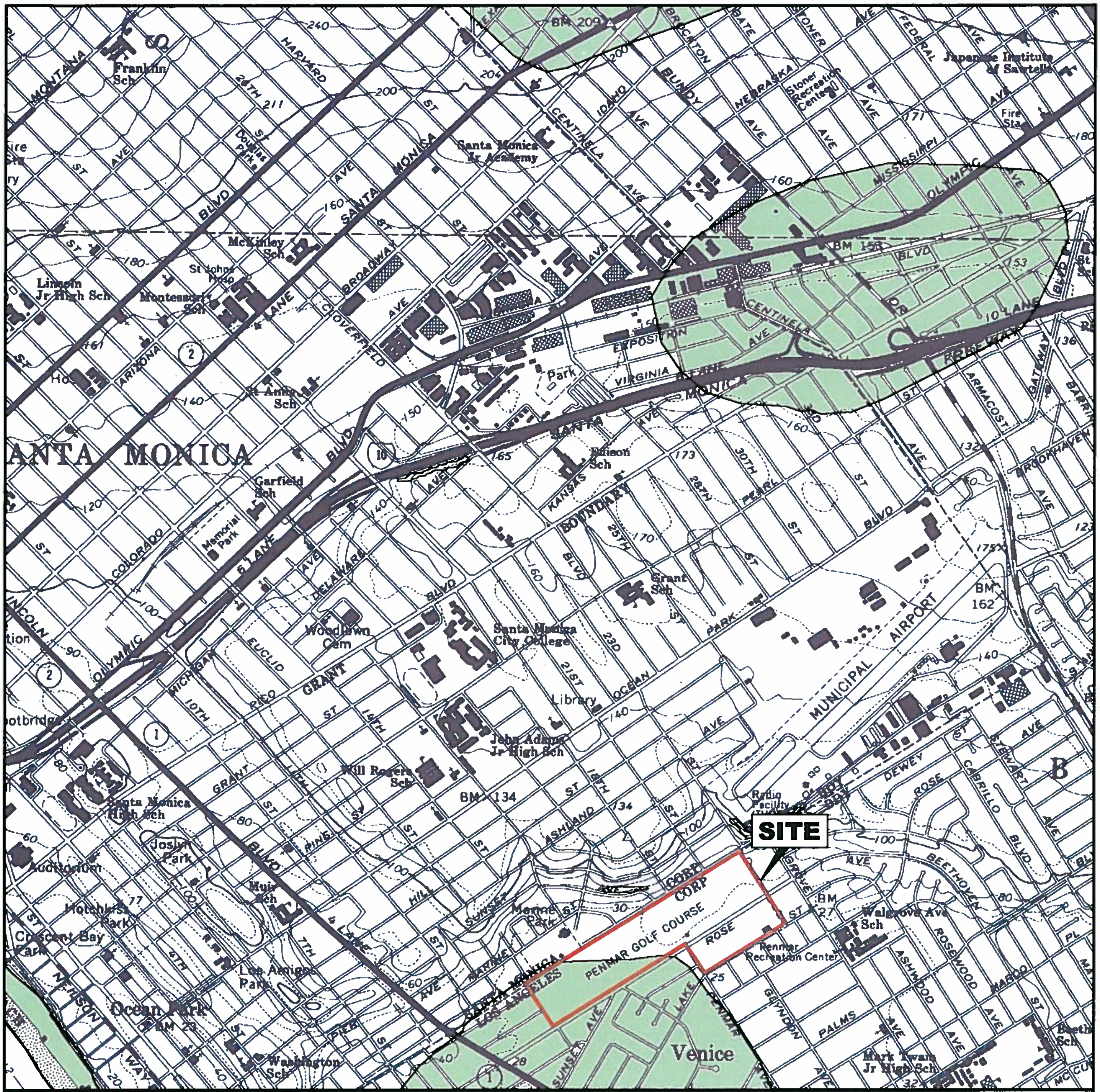
PROJECT NO.	DATE
207328001	6/08

FAULT LOCATION MAP

PENNMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

4



REFERENCES: STATE OF CALIFORNIA SPECIAL STUDIES ZONES, BEVERLY HILLS QUADRANGLE, 3-25-1999.

N

APPROXIMATE SCALE

0 2,000 4,000 FEET

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

🟩 **Liquefaction**

Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

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SEISMIC HAZARDS ZONES MAP

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE
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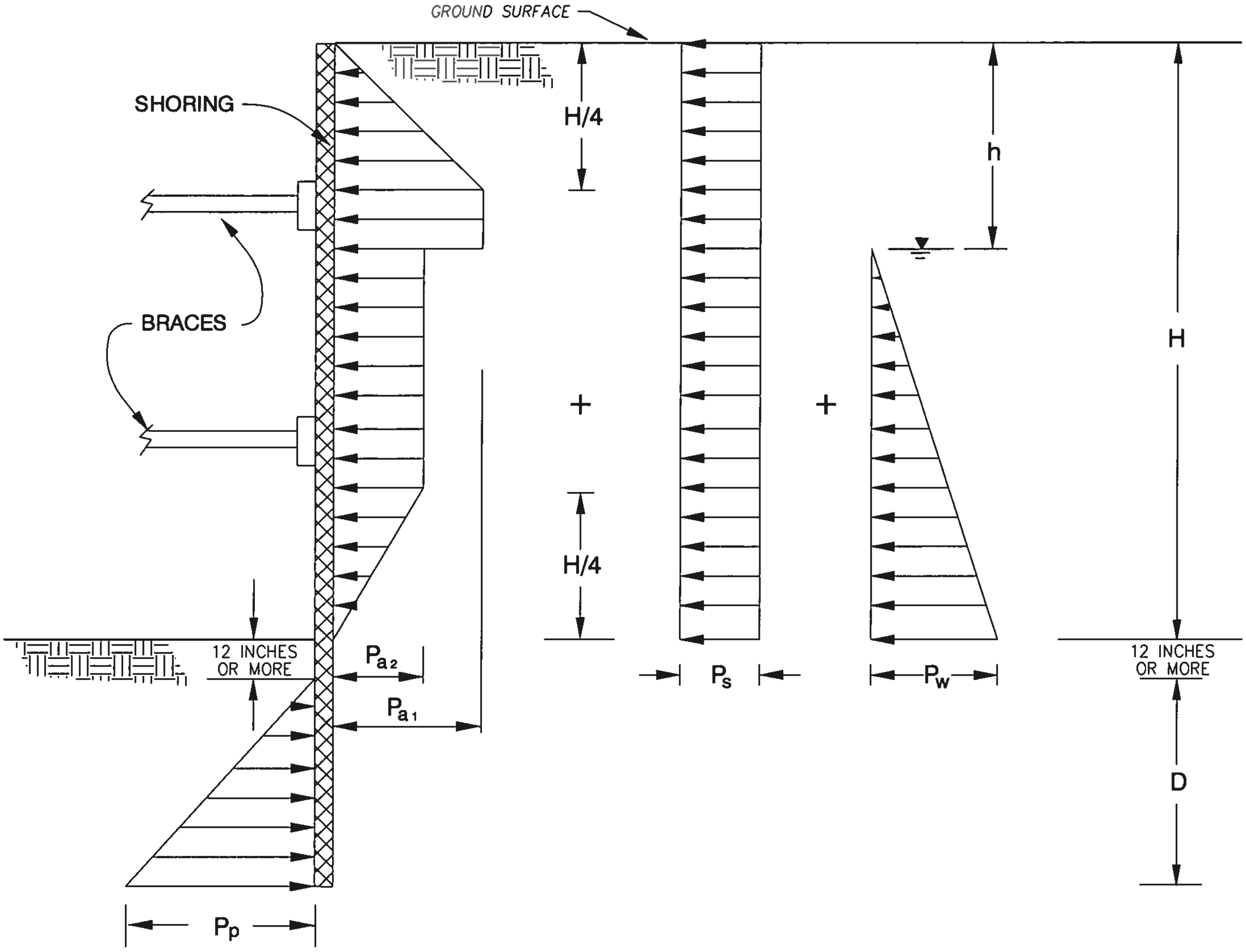
FIGURE

5



NOTES:

1. APPARENT LATERAL EARTH PRESSURE, P_a
   P_{a1} = 48 H psf; P_{a2} = 24 H psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
   P_s = 120 psf
3. HYDROSTATIC PRESSURE, P_w
   P_w=62.4 (H - h) psf
4. PASSIVE LATERAL EARTH PRESSURE, P_p
   P_p = 200 D
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H, h AND D ARE IN FEET
7. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328-A6.DWG

Ninyo & Moore

LATERAL EARTH PRESSURES FOR BRACED EXCAVATION BELOW GROUNDWATER (STIFF CLAY)

PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

PROJECT NO.	DATE
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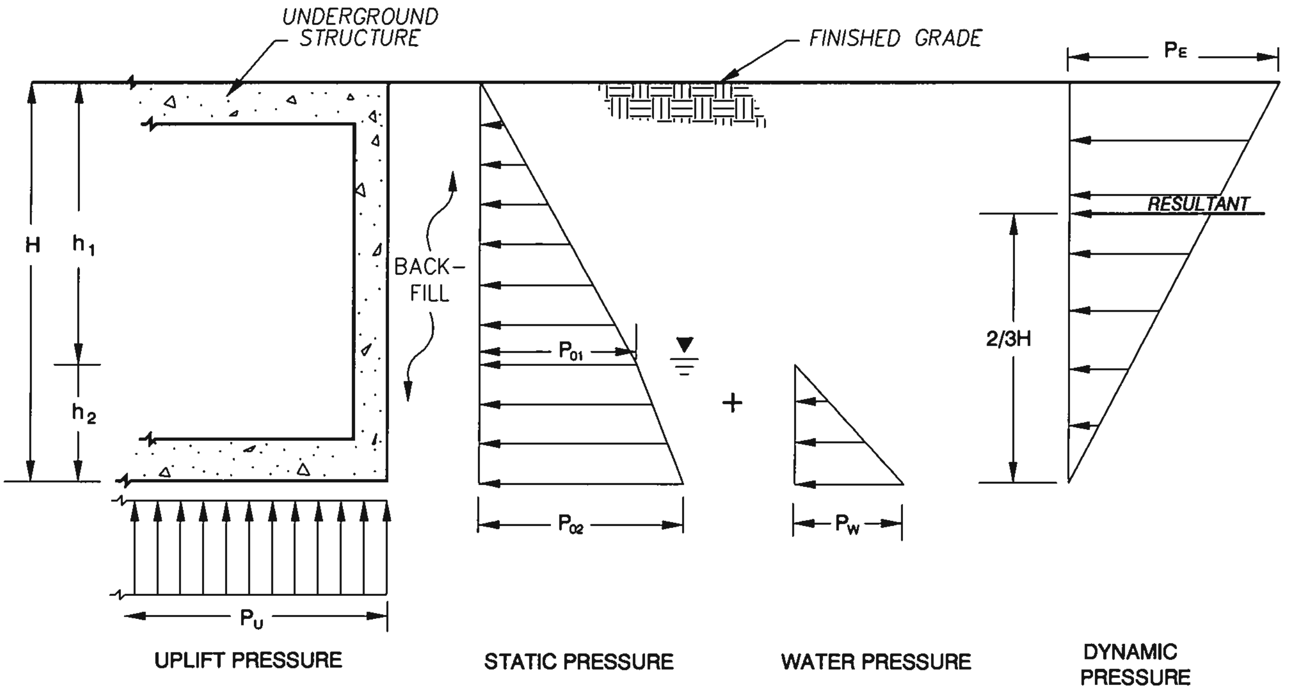
FIGURE

6



NOTES:

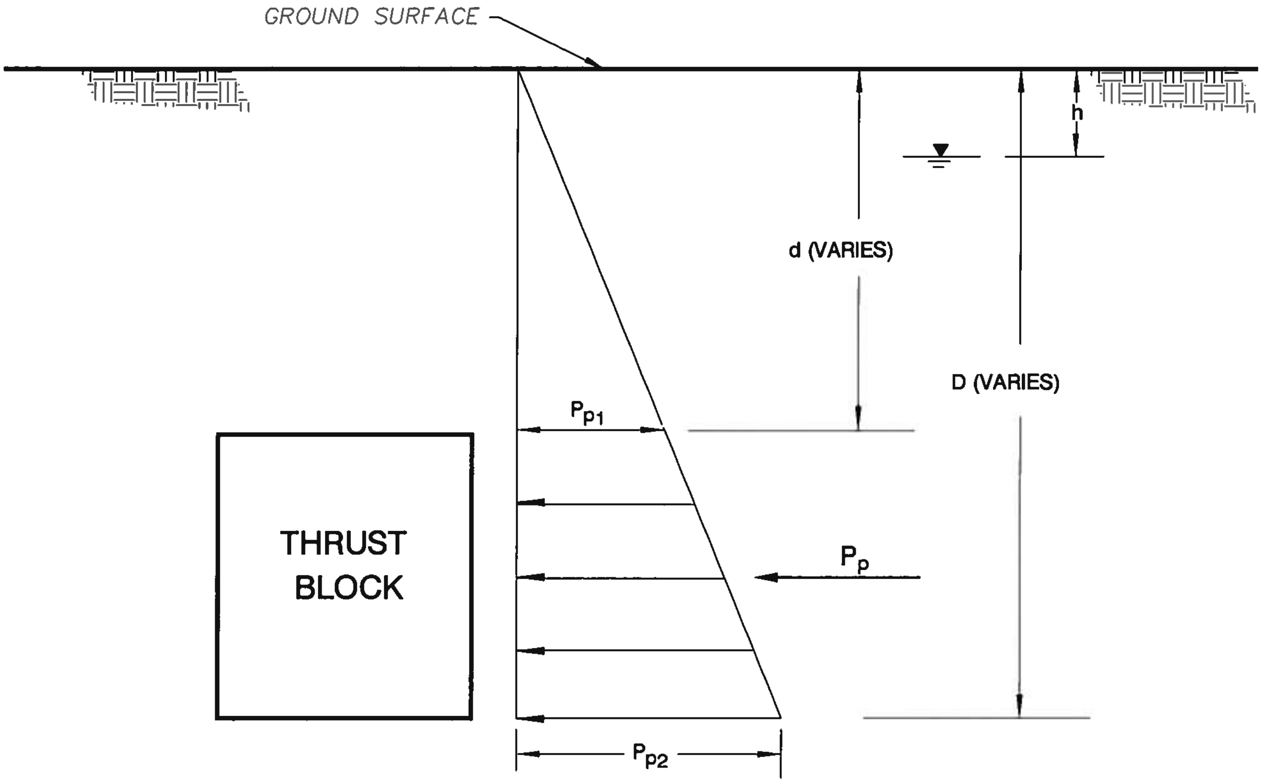
1. APPARENT LATERAL EARTH PRESSURES, P_{01} AND P_{02}
   $P_{01} = 60\ h_1$ psf
   $P_{02} = 60\ h_1 + 29\ h_2$ psf
2. WATER PRESSURE, P_W
   $P_W = 62.4\ h_2$ psf
3. DYNAMIC LATERAL EARTH PRESSURE IS BASED ON A PEAK GROUND ACCELERATION OF 0.45 g
   $P_E = 17\ H$ psf
4. UPLIFT PRESSURE, P_u
   $P_u = 62.4\ h_2$ psf
5. SURCHARGE PRESSURES CAUSED BY VEHICLES OR NEARBY STRUCTURES ARE NOT INCLUDED
6. H, h_1 AND h_2 ARE IN FEET
7. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328-A6.DWG

Ninyo & Moore

		LATERAL EARTH PRESSURES FOR UNDERGROUND STRUCTURES (SAND)	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	**7**
207328001	6/08		



NOTES:

1. GROUNDWATER BELOW BLOCK
   $P_p = 200\ (D^2\text{-}d^2)$ lb/ft
2. GROUNDWATER ABOVE BLOCK
   $P_p = 1.6\ (D - d)[\ 124.8h + 60\ (D+d)]$ lb/ft
3. ASSUMES BACKFILL IS GRANULAR MATERIAL
4. ASSUMES THRUST BLOCK IS ADJACENT TO COMPETENT MATERIAL
5. D, d AND h ARE IN FEET
6. ▼ GROUNDWATER TABLE

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NOT TO SCALE

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THRUST BLOCK LATERAL EARTH PRESSURE DIAGRAM

PROJECT NO.	DATE
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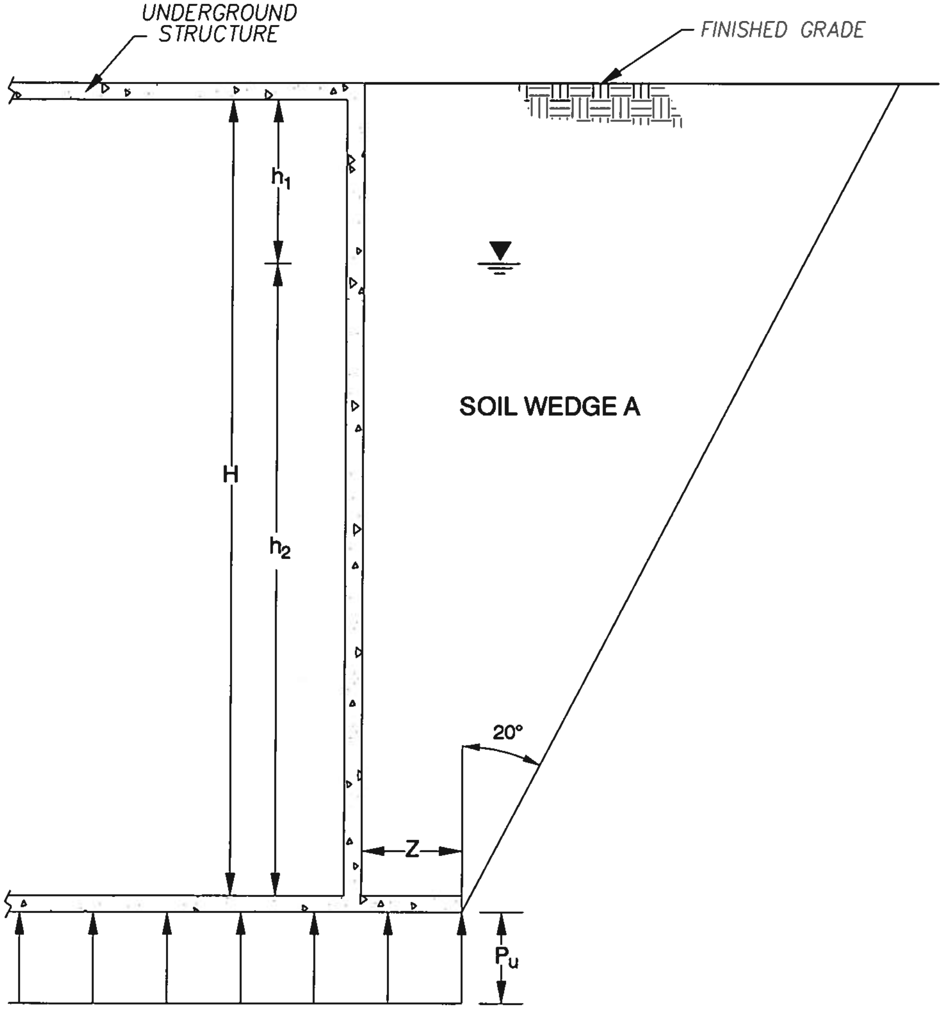
PENMAR WATER QUALITY IMPROVEMENT PROJECT
LOS ANGELES, CALIFORNIA

FIGURE

8



RESISTANCE TO UPLIFT = WEIGHT OF STRUCTURE + WEIGHT OF SOIL WEDGE A

NOTES:

1. UNIT WEIGHT OF SOILS, γ OR γ_b
   γ = 120 pcf ABOVE GROUNDWATER TABLE
   γ_b = 58 pcf BELOW GROUNDWATER TABLE
2. UPLIFT PRESSURE, P_u
   $P_u = 62.4\ h_2$ psf
3. H, Z, h_1 AND h_2 ARE IN FEET
4. ▼ GROUNDWATER TABLE

NOT TO SCALE

207328-A8.DWG

Ninyo & Moore		UPLIFT RESISTANCE DIAGRAM FOR UNDERGROUND STRUCTURES (MAT)	FIGURE
PROJECT NO.	DATE	PENMAR WATER QUALITY IMPROVEMENT PROJECT LOS ANGELES, CALIFORNIA	9
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APPENDIX C

California Department of Fish and Game
Natural Diversity Database Report
Sensitive Listed Plants, Animals and Communities for Beverly Hills and Venice Quads

March 25, 2009

Astragalus brauntonii

Braunton's milk-vetch

Element Code: PDFAB0F1G0

Status		**NDDB Element Ranks**		**Other Lists**	
Federal:	Endangered	**Global:**	G2	**CNPS List:**	1B.1
State:	None	**State:**	S2.1		

Habitat Associations

General: CLOSED-CONE CONIFEROUS FOREST, CHAPARRAL, COASTAL SCRUB, VALLEY AND FOOTHILL GRASSLAND.

Micro: RECENT BURNS OR DISTURBED AREAS; IN STIFF GRAVELLY CLAY SOILS OVERLYING GRANITE OR LIMESTONE. 4-640M.

Occurrence No. 1 **Map Index:** 41758 **EO Index:** 41758

Occ Rank: None
Origin: Natural/Native occurrence
Presence: Possibly Extirpated
Trend: Unknown

Dates Last Seen
Element: 1908-XX-XX
Site: 1908-XX-XX

Record Last Updated: 2002-07-03

Quad Summary: Beverly Hills (3411814/111C), Hollywood (3411813/111D)

County Summary: Los Angeles

Lat/Long: 34.10523º / -118.38512º
UTM: Zone-11 N3774689 E372240
Radius: 1 mile
Elevation: 700 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 01S
Range: 14W
Section: 07 **Qtr:** XX
Meridian: S

Location: FOOTHILLS NEAR SHERMAN.

Location Detail: SHERMAN WAS A POWER STATION ON THE OLD 'RED CAR' RAIL LINES. WEST HOLLYWOOD IS LOCATED AT ABOUT THE SAME SITE AS SHERMAN. MAPPED IN HILLS ABOVE SHERMAN.

General: TWO COLLECTIONS FROM SHERMAN AND ONE FROM 'SANTA MONICA HILLS' ARE ATTRIBUTED TO THIS SITE. PRESUMABLY EXTIRPATED ACCORDING TO FOTHERINGHAM.

Owner/Manager: UNKNOWN

Occurrence No. 34 **Map Index:** 59493 **EO Index:** 69243

Occ Rank: None
Origin: Natural/Native occurrence
Presence: Possibly Extirpated
Trend: Unknown

Dates Last Seen
Element: 1930-05-21
Site: 1930-05-21

Record Last Updated: 2007-04-04

Quad Summary: Beverly Hills (3411814/111C)

County Summary: Los Angeles

Lat/Long: 34.05399º / -118.47475º
UTM: Zone-11 N3769123 E363890
Radius: 1 mile
Elevation: 330 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 01S
Range: 15W
Section: 29 **Qtr:** XX
Meridian: S

Location: BRENTWOOD, LOS ANGELES COUNTY.

Location Detail: EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS A BEST GUESS AT THE NEIGHBORHOOD OF BRENTWOOD, LAX COUNTY. (NOT THE CITY OF BRENTWOOD, WHICH IS IN CONTRA COSTA COUNTY)

Ecological: CANYON.

Threat: MUCH OF THIS REGION HAS BEEN CONVERTED INTO URBAN SPRAWL.

General: ONLY SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 1930 COLLECTION BY DAVIDSON. NEEDS FIELDWORK.

Owner/Manager: UNKNOWN

Astragalus pycnostachyus var. lanosissimus

Ventura Marsh milk-vetch

Element Code: PDFAB0F7B1

Status		**NDDB Element Ranks**		**Other Lists**	
Federal:	Endangered	**Global:**	G2T1	**CNPS List:**	1B.1
State:	Endangered	**State:**	S1.1		

Habitat Associations

General: COASTAL SALT MARSH.

Micro: WITHIN REACH OF HIGH TIDE OR PROTECTED BY BARRIER BEACHES, MORE RARELY NEAR SEEPS ON SANDY BLUFFS. 1-35M.

Occurrence No. 3 **Map Index:** 01228 **EO Index:** 19296

Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1882-10-XX
Site: 196X-XX-XX

Record Last Updated: 1989-08-11

Quad Summary: Topanga (3411815/112D), Beverly Hills (3411814/111C)

County Summary: Los Angeles

Lat/Long: 34.02251º / -118.50842º
UTM: Zone-11 N3765677 E360731
Radius: 1 mile
Elevation: 5 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 02S
Range: 16W
Section: XX **Qtr:** XX
Meridian: S

Location: MEADOW NEAR SEASHORE, SANTA MONICA.

Ecological: MEADOW.

General: THREE COLLECTIONS BY PARISH AND PARISH ATTRIBUTED TO THIS SITE AND ONE BY L. GREATA. BARNEBY (1964) SEARCHED MARSHES IN THIS AREA AND CONSIDERED THIS POPULATION TO BE EXTIRPATED.

Owner/Manager: UNKNOWN

Occurrence No. 4 **Map Index:** 01453 **EO Index:** 19295

Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1902-09-09
Site: 1981-XX-XX

Record Last Updated: 1993-10-04

Quad Summary: Venice (3311884/090B), Beverly Hills (3411814/111C)

County Summary: Los Angeles

Lat/Long: 33.98612º / -118.45702º
UTM: Zone-11 N3761573 E365419
Radius: 1 mile
Elevation: 5 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 02S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: BALLONA MARSHES AND RANCHO.

Location Detail: VICINITY IS PRESENTLY MARINA DEL REY & THE SOUTH PART OF VENICE. THIS SITE INCLUDES COLLECTIONS FROM "BALLONA HARBOR", "PLAYA DEL REY", "NEAR PALMS", & COLLECTIONS FROM THE GENERAL VICINITY OF "LOS ANGELES COUNTY".

Threat: MARSHES NOW DRAINED.

General: NINE COLLECTIONS MADE BETWEEN 1888 AND 1902 ARE ATTRIBUTED TO THIS SITE. AREA SEARCHED BY BARNEBY (1964) AND SCHREIBER (1981); HISTORIC POPULATIONS ARE PRESUMED EXTIRPATED.

Owner/Manager: UNKNOWN

Astragalus tener var. titi

coastal dunes milk-vetch

Element Code: PDFAB0F8R2

Status

Federal: Endangered
State: Endangered

NDDB Element Ranks

Global: G1T1
State: S1.1

Other Lists

CNPS List: 1B.1

Habitat Associations

General: COASTAL BLUFF SCRUB, COASTAL DUNES.
Micro: MOIST, SANDY DEPRESSIONS OF BLUFFS OR DUNES ALONG AND NEAR THE PACIFIC OCEAN; ONE SITE ON A CLAY TERRACE. 1-50M.

Occurrence No. 3 **Map Index:** 35233 **EO Index:** 42743
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Possibly Extirpated
Trend: Unknown

Dates Last Seen
Element: XXXX-XX-XX
Site: XXXX-XX-XX

Record Last Updated: 2000-04-12

Quad Summary: Beverly Hills (3411814/111C), Topanga (3411815/112D)
County Summary: Los Angeles

Lat/Long: 34.01962º / -118.48594º
UTM: Zone-11 N3765326 E362802
Radius: 1 mile
Elevation: 100 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 02S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: SANTA MONICA.

Location Detail: EXACT LOCATION NOT KNOWN. MAPPED IN THE VICINITY OF SANTA MONICA.

General: MAIN SOURCE OF INFORMATION FOR THIS SITE IS UNDATED COLLECTION BY HASSE. R. BARNEBY (1964) BELIEVES THIS SITE IS PROBABLY EXTIRPATED.

Owner/Manager: UNKNOWN

Occurrence No. 4 **Map Index:** 42744 **EO Index:** 42744
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Possibly Extirpated
Trend: Unknown

Dates Last Seen
Element: 1903-04-12
Site: 1903-04-12

Record Last Updated: 2000-04-12

Quad Summary: Hollywood (3411813/111D), Beverly Hills (3411814/111C), Inglewood (3311883/090A), Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.97672º / -118.37467º
UTM: Zone-11 N3760426 E373012
Radius: 5 mile
Elevation: 150 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 02S
Range: 14W
Section: 20 **Qtr:** XX
Meridian: S

Location: HYDE PARK (NEAR PRESENT DAY INGLEWOOD).

Location Detail: EXACT LOCATION NOT KNOWN. MAPPED IN THE GENERAL VICINITY OF INGLEWOOD.

General: MAIN SOURCE OF INFORMATION FOR THIS SITE IS 1903 COLLECTION BY L. ABRAMS. R. BARNEBY (1964) BELIEVES THIS SITE IS PROBABLY EXTIRPATED.

Owner/Manager: UNKNOWN

Charadrius alexandrinus nivosus

western snowy plover

Element Code: ABNNB03031

Status
Federal: Threatened
State: None

NDDB Element Ranks
Global: G4T3
State: S2

Other Lists
CDFG Status: SC

Habitat Associations
General: SANDY BEACHES, SALT POND LEVEES & SHORES OF LARGE ALKALI LAKES.
Micro: NEEDS SANDY, GRAVELLY OR FRIABLE SOILS FOR NESTING.

Occurrence No. 36 **Map Index:** 01488 **EO Index:** 7920
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1914-XX-XX
Site: 1914-XX-XX
Record Last Updated: 2007-12-07

Quad Summary: Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.95266º / -118.44858º
UTM: Zone-11 N3757852 E366147
Area:
Elevation: 10 ft
Mapping PrecisionNON-SPECIFIC
Symbol Type:POLYGON
Township: 02S
Range: 15W
Section: 33 **Qtr:** XX
Meridian: S

Location: PLAYA DEL REY.

General: ONE EGG SET COLLECTED IN 1914 BY U.S. NATIONAL MUSEUM.

Owner/Manager: DPR-DOCKWEILER SB

Occurrence No. 37 **Map Index:** 36797 **EO Index:** 21223
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1904-XX-XX
Site: 1904-XX-XX
Record Last Updated: 2007-12-07

Quad Summary: Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.96645º / -118.45814º
UTM: Zone-11 N3759393 E365285
Area:
Elevation: 10 ft
Mapping PrecisionNON-SPECIFIC
Symbol Type:POLYGON
Township: 02S
Range: 15W
Section: 28 **Qtr:** XX
Meridian: S

Location: BALLONA BEACH (DOCKWEILER STATE BEACH).

Location Detail:MAPPED AT THE BEACH NORTH OF BALLONA CREEK.

General: FORTY-SIX EGG SETS COLLECTED BY THE NATIONAL MUSEUM OF NATURAL HISTORY BETWEEN 1894-1904.

Owner/Manager: DPR-DOCKWEILER SB

Chorizanthe parryi var. fernandina

San Fernando Valley spineflower

Element Code: PDPGN040J1

Status		NDDB Element Ranks		Other Lists	
Federal:	Candidate	**Global:**	G2T1	**CNPS List:**	1B.1
State:	Endangered	**State:**	S1.1		

Habitat Associations

General: COASTAL SCRUB.

Micro: SANDY SOILS. 3-1035M.

Occurrence No. 9 **Map Index:** 23785 **EO Index:** 41266

Occ Rank: None
Origin: Natural/Native occurrence
Presence: Possibly Extirpated
Trend: Unknown

Dates Last Seen
Element: 1901-04-01
Site: 1901-04-01

Record Last Updated: 2008-09-29

Quad Summary: Venice (3311884/090B)

County Summary: Los Angeles

Lat/Long: 33.97291º / -118.44837º
UTM: Zone-11 N3760097 E366198
Radius: 1 mile
Elevation: 5 ft

Mapping Precision NON-SPECIFIC
Symbol Type: POINT

Township: 02S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: BALLONA HARBOR.

Location Detail: MAPPED IN VICINITY OF THE MOUTH OF BALLONA CREEK & MARINA DEL REY.

Threat: MUCH OF THE SUITABLE HABITAT IN THIS AREA HAS BEEN DEVELOPED.

General: ONLY SOURCE OF INFORMATION FOR THIS SITE IS 1901 COLLECTION BY ABRAMS. NEEDS FIELDWORK.

Owner/Manager: DFG-BALLONA WETLANDS, PVT

Cordylanthus maritimus ssp. maritimus

salt marsh bird's-beak

Element Code: PDSCR0J0C2

Status		NDDB Element Ranks		Other Lists	
Federal:	Endangered	**Global:**	G4?T2	**CNPS List:**	1B.2
State:	Endangered	**State:**	S2.1		

Habitat Associations

General: COASTAL SALT MARSH, COASTAL DUNES.

Micro: LIMITED TO THE HIGHER ZONES OF THE SALT MARSH HABITAT. 0-30M.

Occurrence No. 14 **Map Index:** 35233 **EO Index:** 34955

Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: XXXX-XX-XX
Site: 1981-XX-XX

Record Last Updated: 1998-10-16

Quad Summary: Beverly Hills (3411814/111C), Topanga (3411815/112D)

County Summary: Los Angeles

Lat/Long: 34.01962º / -118.48594º
UTM: Zone-11 N3765326 E362802
Radius: 1 mile
Elevation: 100 ft

Mapping Precision NON-SPECIFIC
Symbol Type: POINT

Township: 02S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: NEAR SANTA MONICA.

Location Detail: EXACT LOCATION NOT KNOWN; MAPPED IN GENERAL VICINITY OF SANTA MONICA.

General: UNKNOWN WHEN COLLECTED BY HASSE. AREA SEARCHED IN 1980, 1981; NO PLANTS OBSERVED. SPECIES IS PROBABLY EXTIRPATED AT THIS SITE (FOX AND KNUDSEN, 1982; P. ALLEN, 1974).

Owner/Manager: UNKNOWN

Dithyrea maritima

beach spectaclepod

Element Code: PDBRA10020

Status
Federal: None
State: Threatened

NDDB Element Ranks
Global: G2
State: S2.1

Other Lists
CNPS List: 1B.1

Habitat Associations
General: COASTAL DUNES, COASTAL SCRUB. FORMERLY MORE WIDESPREAD IN COASTAL HABITATS IN SO. CALIF.
Micro: SEA SHORES, ON SAND DUNES, AND SANDY PLACES NEAR THE SHORE. 3-50M.

Occurrence No. 2 **Map Index:** 01655 **EO Index:** 20545
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1902-05-25
Site: 1998-07-01
Record Last Updated: 2002-05-06

Quad Summary: Redondo Beach (3311874/090C), Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.86695º / -118.40396º
UTM: Zone-11 N3748290 E370140
Radius: 1 mile
Elevation: 20 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 03S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: HERMOSA BEACH, 2.0 MILES NORTH OF REDONDO.

Ecological: IN SAND DUNES.

General: EXTIRPATED AT THIS SITE ACCORDING TO P. AIGNER, SURVEYED FROM PLAYA DEL REY TO PALOS VERDES PENINSULA. ONLY POTENTIAL HABITAT REMAINING IS EL SEGUNDO BLUE BUTTERFLY PRESERVE AT LAX, NO ACCESS, NO PLANTS OBS THRU FENCE (1998).

Owner/Manager: PVT

Occurrence No. 3 **Map Index:** 01557 **EO Index:** 20552
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1932-04-23
Site: 1998-07-01
Record Last Updated: 2002-05-06

Quad Summary: Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.91505º / -118.42810º
UTM: Zone-11 N3753655 E367981
Radius: 1 mile
Elevation: 10 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 03S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: EL SEGUNDO.

Ecological: IN ESTABLISHED SAND DUNES.

General: EXTIRPATED AT THIS SITE ACCORDING TO P. AIGNER, SURVEYED FROM PLAYA DEL REY TO PALOS VERDES PENINSULA. ONLY POTENTIAL HABITAT REMAINING IS EL SEGUNDO BLUE BUTTERFLY PRESERVE AT LAX, NO ACCESS, NO PLANTS OBS THRU FENCE (1998).

Owner/Manager: UNKNOWN

Occurrence No. 4 **Map Index:** 23785 **EO Index:** 35194
Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

Dates Last Seen
Element: 1903-04-XX
Site: 1903-04-XX
Record Last Updated: 1998-11-17

Quad Summary: Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.97291º / -118.44837º
UTM: Zone-11 N3760097 E366198
Radius: 1 mile
Elevation: 5 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 02S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: BALLONA.

Location Detail: EXACT LOCATION NOT KNOWN, MAPPED IN THE VICINITY OF BALLONA MARSHES, NEAR MARINA DEL REY.

General: ONLY SOURCE OF INFORMATION FOR THIS SITE IS 1903 COLLECTION BY BRAUNTON.

Owner/Manager: DFG-BALLONA WETLANDS, PVT

Dithyrea maritima

beach spectaclepod

Element Code: PDBRA10020

Status		**NDDB Element Ranks**		**Other Lists**	
Federal:	None	**Global:**	G2	**CNPS List:**	1B.1
State:	Threatened	**State:**	S2.1		

Habitat Associations

General: COASTAL DUNES, COASTAL SCRUB. FORMERLY MORE WIDESPREAD IN COASTAL HABITATS IN SO. CALIF.

Micro: SEA SHORES, ON SAND DUNES, AND SANDY PLACES NEAR THE SHORE. 3-50M.

Occurrence No. 11 **Map Index:** 40194 **EO Index:** 35196

Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

Dates Last Seen
Element: 1884-07-XX
Site: 1884-07-XX

Record Last Updated: 1998-11-17

Quad Summary: Topanga (3411815/112D), Venice (3311884/090B), Beverly Hills (3411814/111C)

County Summary: Los Angeles

Lat/Long: 34.01281º / -118.49073º
UTM: Zone-11 N3764578 E362349
Radius: 1 mile
Elevation: 20 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 02S
Range: 15W
Section: 07 **Qtr:** XX
Meridian: S

Location: DUNES OF COAST NEAR SANTA MONICA.

Location Detail: EXACT LOCATION NOT KNOWN; MAPPED NEAR THE BEACHES WEST OF SANTA MONICA.

Ecological: DUNES.

General: ONLY SOURCE OF INFORMATION FOR THIS SITE IS 1884 SIGHTING (COLLECTION?) BY W.S. LYON REPORTED BY MAJOR (1979).

Owner/Manager: UNKNOWN

Euphilotes battoides allyni

El Segundo blue butterfly

Element Code: IILEPG201B

Status		**NDDB Element Ranks**		**Other Lists**	
Federal:	Endangered	**Global:**	G5T1	**CDFG Status:**	
State:	None	**State:**	S1		

Habitat Associations

General: RESTRICTED TO REMNANT COASTAL DUNE HABITAT IN SOUTHERN CALIFORNIA.

Micro: HOSTPLANT IS ERIOGONUM PARVIFOLIUM; LARVAE FEED ONLY ON THE FLOWERS AND SEEDS; USED BY ADULTS AS MAJOR NECTAR SOURCE.

Occurrence No. 1 **Map Index:** 01535 **EO Index:** 14469

Occ Rank: Fair
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Stable

Dates Last Seen
Element: 2005-08-13
Site: 2005-08-13

Record Last Updated: 2007-09-06

Quad Summary: Venice (3311884/090B)

County Summary: Los Angeles

Lat/Long: 33.93791º / -118.43366º
UTM: Zone-11 N3756197 E367502
Area: 119.4 acres
Elevation: 100 ft
Mapping Precision SPECIFIC
Symbol Type: POLYGON
Township: 03S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: EL SEGUNDO DUNES, JUST WEST OF LOS ANGELES INTERNATIONAL AIRPORT.

Location Detail: 70% OF AN ESTIMATED 756 ERIOGONUM PARVIFOLIUM PLANTS APPEAR TO BE STRESSED (1984). TWO OF THE 16 ERIOGONUM PATCHES SUPPORT 75% OF THE EL SEGUNDO BLUE POPULATION (1984). IN 1988, FOUND ON ONLY 20 ACRES, <3 ACRES WITH HIGH DENSITY.

Ecological: LARVAL FOOD PLANT IS ERIOGONUM PARVIFOLIUM. IN 1988 LAX AIRPORT BOARD AUTHORIZED A CONTINUING 3 YR PROGRAM OF HABITAT RESTORATION. HABITAT QUALITY WAS POOR DUE TO EXOTIC PLANTS STABILIZING THE SAND BUT IS NOW IMPROVING..

Threat: IN 1984 POPULATION NUMBERS WERE LOW ENOUGH TO POSSIBLY CAUSE GENETIC PROBLEMS. INVASIVE NON-NATIVE PLANTS.

General: POPULATION EST: 1984: 750; 1986: 800; 1987: 1600; 1988: 2500 (1029 ADULTS OBS); 1990: 5000 FLYING. JUN-AUG 2004: TRANSECT COUNTS, 2123 ADULTS; BLOCK COUNTS (JUL), 2645 ADULTS. JUN-AUG '05: TRANSECT COUNTS, 2623; BLOCK COUNTS (JUL), 5560.

Owner/Manager: LA/EL SEGUNDO DUNES ESHA

Occurrence No. 2 **Map Index:** 01586 **EO Index:** 23047

Occ Rank: Good
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Stable

Dates Last Seen
Element: 2005-08-18
Site: 2005-08-18

Record Last Updated: 2007-09-05

Quad Summary: Venice (3311884/090B)

County Summary: Los Angeles

Lat/Long: 33.91611º / -118.42147º
UTM: Zone-11 N3753764 E368596
Radius: 1/5 mile
Elevation: 150 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POINT
Township: 03S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: EL SEGUNDO DUNES-CHEVRON REFINERY BUTTERFLY PRESERVE.

Location Detail: PRESERVE CONTAINS REMNANT DUNE HABITAT ON REFINERY PROPERTY

Ecological: ERIOGONUM PARVIFOLIUM IS THE MAJOR FOOD PLANT AND IT IS BEING REASTABLISHED, WEEDY PLANTS REMOVED. POPULATION IS NOW REBOUNDING.

Threat: 1984: NON-NATIVE PLANTS OUT-COMPETING NATIVE DUNE PLANTS. POP NUMBERS LOW ENOUGH TO POSSIBLY CAUSE GENETIC PROBLEMS.

General: POPULATION HAD DECLINED DRAMATICALLY OVER THE 8 YEARS THAT ARNOLD ANALYZED IT. 1984: POP EST 420 INDIVIDUALS. 1986: POP EST 357. JUN- AUG 2004: 2,383 ADULTS OBS, 3 TRANSECTS. JUN- AUG 2005: 2,023 ADULTS, TRANSECT COUNTS.

Owner/Manager: PVT-CHEVRON

Laterallus jamaicensis coturniculus

California black rail

Element Code: ABNME03041

Status

Federal: None
State: Threatened

NDDB Element Ranks

Global: G4T1
State: S1

Other Lists

CDFG Status:

Habitat Associations

General: INHABITS FRESHWATER MARTSHES, WET MEADOWS & SHALLOW MARGINS OF SALTWATER MARSHES BORDERING LARGER BAYS.

Micro: NEEDS WATER DEPTHS OF ABOUT 1 INCH THAT DOES NOT FLUCTUATE DURING THE YEAR & DENSE VEGETATION FOR NESTING HABITAT.

Occurrence No. 68 **Map Index:** 01488 **EO Index:** 17538

Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

Dates Last Seen
Element: 1928-02-25
Site: 1928-02-25

Record Last Updated: 2007-11-27

Quad Summary: Venice (3311884/090B)

County Summary: Los Angeles

Lat/Long: 33.95266º / -118.44858º
UTM: Zone-11 N3757852 E366147
Area:
Elevation: 10 ft

Mapping PrecisionNON-SPECIFIC
Symbol Type:POLYGON

Township: 02S
Range: 15W
Section: 33 **Qtr:** XX
Meridian: S

Location: PLAYA DEL REY.

General: ONE RAIL FOUND DEAD.

Owner/Manager: DPR-DOCKWEILER SB

Passerculus sandwichensis beldingi

Belding's savannah sparrow

Element Code: ABPBX99015

Status

Federal: None
State: Endangered

NDDB Element Ranks

Global: G5T3
State: S3

Other Lists

CDFG Status:

Habitat Associations

General: INHABITS COASTAL SALT MARSHES, FROM SANTA BARBARA SOUTH THROUGH SAN DIEGO COUNTY.

Micro: NESTS IN SALICORNIA ON AND ABOUT MARGINS OF TIDAL FLATS.

Occurrence No. 7 **Map Index:** 01492 **EO Index:** 14649
Occ Rank: Fair
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Decreasing

Dates Last Seen
Element: 2001-05-09
Site: 2001-05-09

Record Last Updated: 2002-09-24

Quad Summary: Venice (3311884/090B)

County Summary: Los Angeles

Lat/Long: 33.96461º / -118.44425º
UTM: Zone-11 N3759171 E366565
Area: 113.2 acres
Elevation: 3 ft

Mapping PrecisionSPECIFIC
Symbol Type:POLYGON

Township: 02S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: PLAYA DEL REY; SOUTH SIDE BALLONA CREEK WEST OF CULVER BLVD-JEFFERSON BLVD INTERSECTION.

Location Detail: 1991: ALL TERRITORIES FOUND IN NON-TIDALLY INFLUENCED AREA ADJACENT TO THE CHANNELIZED BALLONA CREEK, INLAND FROM THE CHANNEL. 2001: ALL BIRDS IN WETLAND BETWEEN CULVER BLVD & BALLONA CREEK.

Ecological: 101 HA SALTMARSH WITH LITTLE TIDAL INFLUENCE. SOME OF THE PICKLEWEED DESSICATING IN 1991. RESTORATION POTENTIAL IS HIGH, AREA NEEDS TIDAL ACTION AND ACTIVE PREDATOR MANAGEMENT.

Threat: EXOTIC RED FOX, FERAL CAT AND DOG SIGN OBS WITHIN MARSH, HUMAN DISTURBANCE, AIRPORT AND HWY NOISE.

General: POPULATION ESTIMATES: 1973: 25 PRS; 1977: 37 PRS; 1979: 21 PRS; 1980: 18 PRS; 1981: 13 PRS; 1986: 32 PRS; 1987: 29-30 PRS; 1989: 31 PRS; 1990: 12 PRS; 1991: 5 PRS. 1996: 37 PRS. 2001: 13 PRS.

Owner/Manager: DFG-BALLONA WETLANDS

Occurrence No. 37 **Map Index:** 01504 **EO Index:** 14647
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1981-XX-XX
Site: 1981-XX-XX

Record Last Updated: 1998-10-15

Quad Summary: Venice (3311884/090B)

County Summary: Los Angeles

Lat/Long: 33.97347º / -118.43949º
UTM: Zone-11 N3760147 E367019
Area: 143.5 acres
Elevation: 15 ft

Mapping PrecisionSPECIFIC
Symbol Type:POLYGON

Township: 02S
Range: 15W
Section: 27 **Qtr:** XX
Meridian: S

Location: BALLONA AREA. PARCEL BOUNDED ON E BY HWY 1, ON S BY BALLONA CRK, ON N & W BY FIJI WAY.

Location Detail: SMALL BREEDING POPS IN HOMOGENEOUS STANDS OF SALICORNIA THROUGHOUT THIS PARCEL.

Ecological: SUBSEQUENT TO 1987 THIS POPULATION WAS EXTIRPATED. THIS AREA IS NOW INVADED BY UPLAND PLANTS AND IS PROPOSED FOR DEVELOPMENT.

Owner/Manager: PVT-SUMMA CORP

Pelecanus occidentalis californicus

California brown pelican

Element Code: ABNFC01021

Status
Federal: Endangered
State: Endangered

NDDB Element Ranks
Global: G4T3
State: S1S2

Other Lists
CDFG Status:

Habitat Associations
General: COLONIAL NESTER ON COASTAL ISLANDS JUST OUTSIDE THE SURF LINE.
Micro: NESTS ON COASTAL ISLANDS OF SMALL TO MODERATE SIZE WHICH AFFORD IMMUNITY FROM ATTACK BY GROUND-DWELLING PREDATORS. ROOST

Occurrence No. 16
Map Index: 63568
EO Index: 63663
Occ Rank: Excellent
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

Dates Last Seen
Element: 2000-07-09
Site: 2000-07-09

Record Last Updated: 2006-01-04

Quad Summary: Venice (3311884/090B)
County Summary:

Lat/Long: 33.96092º / -118.46304º
UTM: Zone-11 N3758787 E364823
Area: 32.2 acres
Elevation: 0 ft
Mapping Precision SPECIFIC
Symbol Type: POLYGON
Township: 99X
Range: 99X
Section: UN
Qtr: XX
Meridian: X

Location: MARINA DEL REY BREAKWATER.

Location Detail: ROOST NUMBER LA 12.0

Ecological: BREAKWATER IS 0.8 KM LONG.

Threat: POTENTIAL THREAT FROM WATERCRAFT USING THE HARBOR. PELICANS APPEAR TOLERANT OF ALL BUT THE CLOSEST APPROACHES.

General: MAJOR DAY & NIGHT ROOST. THIS IS 2ND LARGEST ROOST ON SOUTHERN CALIFORNIA COAST. SUMMARY OF 1986-87, 1992-93 & 1998-2000 DIURNAL COUNTS: RANGE 31-640 BIRDS, MEAN 323.1 BIRDS. 601-1,642 BIRDS IN NIGHT COUNTS BETWEEN 1991 & 2000.

Owner/Manager: MARINA DEL REY, DOD-COE

Perognathus longimembris pacificus

Pacific pocket mouse

Element Code: AMAFD01042

Status
Federal: Endangered
State: None

NDDB Element Ranks
Global: G5T1
State: S1

Other Lists
CDFG Status: SC

Habitat Associations
General: INHABITS THE NARROW COASTAL PLAINS FROM THE MEXICAN BORDER NORTH TO EL SEGUNDO, LOS ANGELES CO.
Micro: SEEMS TO PREFER SOILS OF FINE ALLUVIAL SANDS NEAR THE OCEAN, BUT MUCH REMAINS TO BE LEARNED.

Occurrence No. 2 **Map Index:** 39858 **EO Index:** 34860
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1938-06-XX
Site: 1938-06-XX

Record Last Updated: 2003-04-10

Quad Summary: Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.93139º / -118.42565º
UTM: Zone-11 N3755463 E368233
Area:
Elevation: 100 ft
Mapping Precision NON-SPECIFIC
Symbol Type: POLYGON
Township: 03S
Range: 15W
Section: 11 **Qtr:** XX
Meridian: S

Location: MARINA DEL REY/EL SEGUNDO AREA.

Location Detail: COLLECTION LOCALITIES INCLUDEL: DEL REY, PLAYA DEL REY, PALISADES DEL REY, DEL REY HILLS NEAR LOYOLA UNIVERSITY, HYPERION, & 1 MILE NORTH & 1/2 MILE NW OF EL SEGUNDO.

General: HISTORIC SITE. 118 SPECIMENS COLLECTED BETWEEN NOV 1918 AND JUN 1938. SPECIMENS ARE DEPOSITED IN SBMNH, LACM, SDMNH, MVZ, AND UA.

Owner/Manager: UNKNOWN

Polioptila californica californica

coastal California gnatcatcher

Element Code: ABPBJ08081

Status		**NDDB Element Ranks**		**Other Lists**	
Federal:	Threatened	**Global:**	G3T2	**CDFG Status:**	SC
State:	None	**State:**	S2		

Habitat Associations

General: OBLIGATE, PERMANENT RESIDENT OF COASTAL SAGE SCRUB BELOW 2500 FT IN SOUTHERN CALIFORNIA.

Micro: LOW, COASTAL SAGE SCRUB IN ARID WASHES, ON MESAS & SLOPES. NOT ALL AREAS CLASSIFIED AS COASTAL SAGE SCRUB ARE OCCUPIED.

Occurrence No. 35
Map Index: 01722
EO Index: 25112
Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

Dates Last Seen
Element: 1980-XX-XX
Site: 1980-XX-XX

Record Last Updated: 1989-08-10

Quad Summary: Beverly Hills (3411814/111C), Hollywood (3411813/111D), Inglewood (3311883/090A), Venice (3311884/090B)

County Summary: Los Angeles

Lat/Long: 33.99055º / -118.38285º
UTM: Zone-11 N3761970 E372277
Radius: 1 mile
Elevation: 200 ft
Mapping PrecisionNON-SPECIFIC
Symbol Type:POINT
Township: 02S
Range: 14W
Section: 18 **Qtr:** SE
Meridian: S

Location: BALDWIN HILLS, VICINITY CULVER CITY

Ecological: HABITAT IS COASTAL SAGE SCRUB, DOMINATED BY ARTEMISIA CALIFRONICA, ERIOGONUM FASCICULATUM, AND SALVIA MELLIFERA.

Threat: THREATENED BY ONGOING URBAN DEVELOPMENT, AS MANY MAJOR HABITAT AREAS ARE OWNED BY LAND COMPANIES.

General: ONE INDIVIDUAL OBSERVED; 1-3 PAIRS ESTIMATED.

Owner/Manager: UNKNOWN

Sternula antillarum browni

California least tern

Element Code: ABNNM08103

Status

Federal: Endangered
State: Endangered

NDDB Element Ranks

Global: G4T2T3Q
State: S2S3

Other Lists

CDFG Status:

Habitat Associations

General: NESTS ALONG THE COAST FROM SAN FRANCISCO BAY SOUTH TO NORTHERN BAJA CALIFORNIA.
Micro: COLONIAL BREEDER ON BARE OR SPARSELY VEGETATED, FLAT SUBSTRATES: SAND BEACHES, ALKALI FLATS, LAND FILLS, OR PAVED AREAS.

Occurrence No. 12 **Map Index:** 01439 **EO Index:** 25699
Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Stable

Dates Last Seen
Element: 1996-XX-XX
Site: 1996-XX-XX
Record Last Updated: 1998-10-21

Quad Summary: Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.96777º / -118.45888º
UTM: Zone-11 N3759541 E365219
Area:
Elevation: 10 ft
Mapping PrecisionNON-SPECIFIC
Symbol Type:POLYGON
Township: 02S
Range: 15W
Section: 28 **Qtr:** XX
Meridian: S

Location: VENICE BEACH SITE. SOUTHERN END OF VENICE BEACH, NORTH OF BALLONA CREEK, PART OF DOCKWEILER STATE BEACH.

Location Detail: HISTORICALLY, BIRDS NESTED ALONG THIS ENTIRE BEACH STRAND. RECORDS FROM "DEL REY", "MARINA DEL REY" AND "DEL REY LAGOON". BIRDS ALSO NESTED ON FILL SITE FOR HARBOR. UCLA #32595. NESTING RECORDS FROM VENICE BEACH GO BACK TO 1898.

Ecological: PRIOR TO THE 1988 SEASON, NEST SITE WAS ENLARGED, AND A NEW FENCE ELIMINATED MUCH OF THE PREDATION AND DISTURBANCE.

Threat: 1990 CAT PREDATION, ATTEMPTS MADE TO TRAP. VEGETATION OVERGROWTH. NESTING FAILURE DUE TO LOCAL FOOD SHORTAGE.

General: 1973-84: MEAN OF 106 PR/YR, GOOD FLEDGING; 1985: 107 NESTS, 113 FLEDGED; 1987: 109 PR, 82 FLEDGED. 1988: 165 PR, 192 FLEDGED. 1990: 206 PR, 279 FLEDGED. 1991: 198 PR, 200 FLEDGED, 1992: 229 PR, 245 FLEDGED. 1996: 271 PR, 92 FLEDGED.

Owner/Manager: DPR-DOCKWEILER SB

Occurrence No. 13 **Map Index:** 01562 **EO Index:** 25698
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Extirpated
Trend: Unknown

Dates Last Seen
Element: 1977-XX-XX
Site: 1978-XX-XX
Record Last Updated: 1998-10-21

Quad Summary: Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.97988º / -118.42637º
UTM: Zone-11 N3760842 E368241
Area:
Elevation: 10 ft
Mapping PrecisionNON-SPECIFIC
Symbol Type:POLYGON
Township: 02S
Range: 15W
Section: 23 **Qtr:** XX
Meridian: S

Location: BEETHOVEN ST FILL. BALLONA CR.

Ecological: NESTING AREA TRIANGULARLY BORDERED BY BALLONA CREEK, FLOOD CONTROL CHANNEL, AND A FENCE. SUBSTRATE IS LIGHT COLORED, SANDY DREDGE MATERIAL WITH SPARSE VEGETATION COVER.

General: FIRST YEAR OF CONFIRMED NESTING HERE; POTENTIAL GOOD, EVEN THOUGH 3 PAIR FLEDGED 0. IN 1978 LARGE MOUNDS OF SANDY DREDGE MATERIAL WERE PLACED ON THE SITE RENDERING THE AREA UNSUITABLE FOR NESTING.

Owner/Manager: DFG-BALLONA WETLANDS

Occurrence No. 14 **Map Index:** 01492 **EO Index:** 13026
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Possibly Extirpated
Trend: Unknown

Dates Last Seen
Element: 1981-XX-XX
Site: 1987-XX-XX
Record Last Updated: 2006-10-20

Quad Summary: Venice (3311884/090B)
County Summary: Los Angeles

Lat/Long: 33.96461º / -118.44425º
UTM: Zone-11 N3759171 E366565
Area: 113.2 acres
Elevation: 3 ft
Mapping PrecisionSPECIFIC
Symbol Type:POLYGON
Township: 02S
Range: 15W
Section: XX **Qtr:** XX
Meridian: S

Location: PLAYA DEL REY. MARSH BOUNDED BY CULVER BLVD & VISTA DEL MAR RD & BALLONA CR.

Location Detail: 1965 OBSERVATION FROM MARINA DEL REY NEAR HARBOR AREA & BALLONA CREEK. IN 1970'S-80'S TERNS USED SALT/MUD FLATS WITHIN MARSH. BREEDING AREAS ARE SUBJECT TO FLOODING IF BALLONA CREEK TIDE GATES ARE OPENED DURING BREEDING SEASON.

Ecological: TERNS NEST AND ROOST ON SALT/MUD FLATS; FEED IN THE MARINA, BALLONA CREEK, BALLONA LAGOON, AND CANALS IN THE AREA.

Threat: EQUESTRIANS, MOTORCYCLES, FLOODING OF NESTING AREAS.

General: 1965: BIRDS OBS. 1973-75 & 79-84: MEAN OF 11 PRS/YR. 1976: SITE ABANDONED. 1977: NO NESTING. 1978: 25-30 PRS, 30 FLEDGED. 1981-82: BREEDING AREA FLOODED. 1987: NO NESTING. NO MENTION OF THIS AREA IN MONITORING REPORTS AFTER 1987.

Owner/Manager:

Sternula antillarum browni

California least tern

Element Code: ABNNM08103

Status

Federal: Endangered
State: Endangered

NDDB Element Ranks

Global: G4T2T3Q
State: S2S3

Other Lists

CDFG Status:

Habitat Associations

General: NESTS ALONG THE COAST FROM SAN FRANCISCO BAY SOUTH TO NORTHERN BAJA CALIFORNIA.

Micro: COLONIAL BREEDER ON BARE OR SPARSELY VEGETATED, FLAT SUBSTRATES: SAND BEACHES, ALKALI FLATS, LAND FILLS, OR PAVED AREAS.

DFG-BALLONA WETLANDS

APPENDIX D

Technical Memorandum: Air Quality Impact Assessment Using URBEMIS Modeling for Penmar Water Quality Improvement Project

May 7, 2009

BROWN AND CALDWELL

801 South Figueroa Street #950
Los Angeles, California 90017
Tel: 213-271-2300
Fax: 213-271-2320

Technical Memorandum

Prepared for: City of Los Angeles

Project Title: Penmar Water Quality Improvement Project

Project No: 136123-406-402

Technical Memorandum

Subject: Air Quality Impact Assessment Using URBEMIS Modeling

Date: May 7, 2009

To: Edgar Mercado, Project Engineer

From: Donald C Trueblood

Copy to: File

Prepared by: ______________________

Donald C Trueblood, Managing Scientist

Reviewed by: ______________________

John R. Biggs, PE

Limitations:

This document was prepared solely for the City of Los Angeles in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Los Angeles and Brown and Caldwell dated March 7, 2008. This document is governed by the specific scope of work authorized by the City of Los Angeles; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Los Angeles and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

1. INTRODUCTION

Brown and Caldwell was engaged by the City of Los Angeles (City) to perform an air quality impact assessment using the URBEMIS emission estimating model. The information in this assessment is intended to be used to support a Mitigated Negative Declaration being prepared by the City for the Penmar Water Quality Improvement Project (Project).

The purpose of the Project is to intercept and divert storm water runoff and dry weather flows from an existing Los Angeles County storm drain to the sanitary sewer, when capacity allows, or to a detention reservoir, when necessary.

Air quality impacts can occur during operation of the facility and during construction. Impacts during operations are generally scrutinized the most closely because they occur over the entire life of the project. Construction impacts typically occur over a short term.

The Project activities consist of construction and operation of the following major features:

- Primary and secondary pump station systems;
- A storm water diversion structure;
- A detention reservoir;
- Three force mains for water conveyance; and
- An upgrade of four sanitary sewer segments

1.1 Operational Impacts

Air emissions, including odors, during operation of the Project should be absent or minimal. Most of the Project facilities are passive in operation, such as the detention reservoir, storm water diversion structure, and the storm sewer. The active components are the pump station systems that convey water through the force mains. The pump stations operate solely on electricity; therefore, air emissions would not be produced.

The only potential source of air emissions or odors would be the pressure release vent on a tank that is part of the reservoir system. There is a small potential for buildup of organic matter carried in the storm water in the tank. Under anaerobic conditions, odors and methane could be released and could pose an impact. However, the system is designed with a sump and a bar screen to capture most of the organic matter being carried by the storm water before entering the tank. In addition, the interior of the tank is designed to be equalized with the atmosphere, therefore, anaerobic conditions should not form. Finally, the potential for buildup of the material that could release odors and methane will be further mitigated by regular inspection and cleaning.

Based on those considerations, it is concluded that potential impacts from air emissions during operation of the Project will be less than significant.

1.2 Construction Impacts

Construction activities generate air emissions of various air pollutants from earthmoving as well as combustion of fuels by construction equipment. In order to evaluate potential air quality impacts, Brown and Caldwell estimated emissions from the activities and compared them to Mass Daily Thresholds established by the South Coast Air Quality District (SCAQMD).

Pollutants evaluated for this assessment were:

- Volatile Organic Gases (VOC) estimated as Reactive Organic Gases (ROG)
- Nitrogen Oxides (NOx)
- Carbon Monoxide (CO)
- Sulfur Dioxide (SO_2)
- Particulate Matter 10 microns and smaller (PM10) from dust and diesel exhaust
- Particulate Matter 2.5 microns and smaller (PM2.5) from dust and diesel exhaust
- Greenhouse Gases (GHG) as Carbon Dioxide (CO_2)

1.2.1 Significance Thresholds

SCAQMD has established a set of Air Quality Significance Thresholds for use in evaluating potential impacts of projects to air quality. In addition, SCAQMD has recommended a greenhouse gas significance threshold of 10,000 metric tons per year of carbon dioxide equivalent (CO_2e) for assessing the significance of potential impacts of greenhouse gas emissions. Although SCAQMD allows greenhouse gas emissions from construction to be amortized over 30 years, this assessment will apply the significance of threshold to total greenhouse gas emissions from construction activities, thus resulting in a more conservative assessment.

1.2.2 Emission Estimates

Emissions were estimated for the pollutants listed above using the model URBEMIS 2007, version 9.2.4. In order to accommodate varying construction schedules in the model, the project was divided into five phases:

- Pump Station
- Diversion Structure
- Reservoir
- Force Mains
- Sewer Replacements

Major construction equipment, sizes, and corresponding usage rates (Table 1) were entered into the URBEMIS model and project emissions were estimated separately for each phase. Emissions estimates for each phase were summed to provide total project emissions.

Table 1. Equipment Information

Phase/Equipment	Phase Duration work days	Equipment Usage hours/day	Equipment Notes
Pump Station (0.44 acres)			Total Duration = 4 Months
Excavation, Jan-Feb	40		
1 Cranes (399 hp)		5.4	—
1 Excavators (200 hp)		1.3	300 Series excavator
1 Generator Sets (549 hp)		0.3	—
1 Other Equipment (190 hp)		2.6	Vibratory hammer
1 Pumps (53 hp)		0.2	—
1 Tractors/Loaders/Backhoes (108 hp)		0.7	Rubber tired backhoe

Table 1. Equipment Information

Phase/Equipment	Phase Duration work days	Equipment Usage hours/day	Equipment Notes
Backfill, Nov-Dec	40		
1 Crawler Tractors (147 hp)		1	Bulldozer
1 Generator Sets (549 hp)		0.3	—
1 Pumps (53 hp)		0.2	—
1 Rollers (95 hp)		4.1	Compactor
1 Sweeper/Scrubber (91 hp)		1	Road Sweeper
1 Tractors/Loaders/Backhoes (750 hp)		2.6	900 Series loader
Diversion Structure (0.19 acres)			Total Duration = 3 Months
Excavation, Jan-Feb	40		
1 Cranes (399 hp)		5.4	—
1 Excavators (200 hp)		1.3	300 Series excavator
1 Generator Sets (549 hp)		0.3	—
1 Other Equipment (190 hp)		2.6	Vibratory hammer
1 Pumps (53 hp)		0.2	—
1 Sweeper/Scrubber (91 hp)		1	Road Sweeper
1 Tractors/Loaders/Backhoes (108 hp)		0.7	Rubber tired backhoe
Backfill, Apr	20		
1 Crawler Tractors (147 hp)		1	Bulldozer
1 Generator Sets (549 hp)		0.3	—
1 Pumps (53 hp)		0.2	—
1 Rollers (95 hp)		4.1	Compactor
1 Sweeper/Scrubber (91 hp)		1	Road Sweeper
1 Tractors/Loaders/Backhoes (750 hp)		2.6	900 Series loader
Reservoir (9.6 acres)			Total Duration = 5 Months
Excavation, Jan-Mar	60		
1 Cranes (399 hp)		5.4	—
1 Excavators (200 hp)		1.3	300 Series excavator
1 Generator Sets (549 hp)		0.3	—
1 Other Equipment (190 hp)		2.6	Vibratory hammer
1 Pumps (53 hp)		0.2	—
1 Sweeper/Scrubber (91 hp)		1	Road Sweeper
1 Tractors/Loaders/Backhoes (108 hp)		0.7	Rubber tired backhoe
Backfill, Nov-Dec	40		
1 Crawler Tractors (147 hp)		1	Bulldozer
1 Excavators (168 hp)		1.3	Backfill excavator
1 Generator Sets (549 hp)		0.3	—
1 Pumps (53 hp)		0.2	—
1 Rollers (95 hp)		4.1	Compactor
1 Sweeper/Scrubber (91 hp)		1	Road Sweeper
1 Tractors/Loaders/Backhoes (750 hp)		2.6	900 Series loader

Table 1. Equipment Information

Phase/Equipment	Phase Duration work days	Equipment Usage hours/day	Equipment Notes
Force Main (8.8 acres) Excavation and backfill are concurrent			Total Duration = 4 Months
Excavation, Feb-May	80		
1 Excavators (200 hp)		1.3	300 Series excavator
1 Sweeper/Scrubber (91 hp)		1	Road Sweeper
1 Tractors/Loaders/Backhoes (108 hp)		0.7	Rubber tired backhoe
Backfill, Feb-May	80		
1 Crawler Tractors (147 hp)		1	Bulldozer
1 Excavators (168 hp)		1.3	Backfill excavator
1 Tractors/Loaders/Backhoes (108 hp)		0.7	Rubber tired backhoe
Sewer Replacement (1.92 acres)			Total Duration = 5 Months
Excavation, Jan-Feb	40		
1 Excavators (200 hp)		1.3	300 Series excavator
1 Sweeper/Scrubber (91 hp)		1	Road Sweeper
1 Tractors/Loaders/Backhoes (108 hp)		0.7	Rubber tired backhoe
Backfill Sept-Oct	60		
1 Crawler Tractors (147 hp)		1	Bulldozer
1 Excavators (168 hp)		1.3	Backfill excavator
1 Sweeper/Scrubber (91 hp)		1	Road Sweeper
1 Tractors/Loaders/Backhoes (108 hp)		0.7	Rubber tired backhoe

Note: Total duration includes only duration of active work. Waiting time between activities is not includes.

URBEMIS allows certain mitigation measures to be selected and applies a control efficiency to the estimated emissions. Mitigation measures selected were those that are required by SCAQMD Rule 403. Specifically, the following mitigation measures were selected in URBEMIS:

- Replace ground cover in disturbed areas quickly;
- Water exposed surfaces; and
- Reduce speed on unpaved roads to less than 15 miles per hour.

Both mitigated and unmitigated emissions are shown in Table 2. Model runs for each phase are included in Appendix A.

Table 2. Penmar Water Quality Improvement Project
Estimated Annual Emissions, short tons/project

					PM10			PM2.5			
Phase	ROG	NOx	CO	SO_2	Dust	Exhaust	Total	Dust	Exhaust	Total	CO_2
UNMITIGATED CONSTRUCTION EMISSION ESTIMATES											
Pump Station	0.06	0.58	0.29	0.00	0.10	0.03	0.12	0.02	0.02	0.04	68.94
Diversion Structure	0.04	0.35	0.19	0.00	0.30	0.02	0.05	0.01	0.01	0.02	42.16
Reservoir	0.14	1.58	0.71	0.00	2.60	0.07	2.67	0.54	0.06	0.61	193.06
Force Main	0.04	0.34	0.22	0.00	3.74	0.02	3.76	0.78	0.02	0.80	43.10
Sewer Replacement	0.02	0.15	0.11	0.00	0.41	0.01	0.42	0.09	0.01	0.09	19.11
TOTAL	0.30	3.00	1.52	0.00	7.15	0.15	7.02	1.44	0.12	1.56	366.37
MITIGATED CONSTRUCTION EMISSION ESTIMATES											
Pump Station	0.06	0.58	0.29	0.00	0.04	0.03	0.07	0.01	0.02	0.03	68.94
Diversion Structure	0.04	0.35	0.19	0.00	0.01	0.02	0.03	0.00	0.01	0.02	42.16
Reservoir	0.14	1.58	0.71	0.00	1.18	0.07	1.25	0.25	0.06	0.31	193.06
Force Main	0.04	0.34	0.22	0.00	1.70	0.02	1.72	0.36	0.02	0.37	43.10
Sewer Replacement	0.02	0.15	0.11	0.00	0.19	0.01	0.20	0.04	0.01	0.05	19.11
TOTAL	0.30	3.00	1.52	0.00	3.12	0.15	3.27	0.66	0.12	0.78	366.37

Notes:

The model only shows 2 decimal places (zeros represent vlaues less than 0.00)

URBEMIS produces estimates of total project emissions. These were converted to daily estimates by dividing each sub-phase by the number of days over which it is estimated to occur. Peak project-wide daily emissions were estimated by totaling sub-phase estimates where the sub-phases overlap. Table 3 on the following pages shows the mitigated project estimates, daily estimates and peak daily estimates.

Table 3. Penmar Water Quality Improvement Project Estimated Mitigated Emissions

	Start	End	Number						PM10			PM2.5		
Phase	Date	Date	of Days	ROG	NOx	CO	SO_2	Dust	Exhaust	Total	Dust	Exhaust	Total	CO_2
MITIGATED CONSTRUCTION EMISSION ESTIMATES, short tons/project														
Pump Station														
Mass Grading	1/1/2009	2/28/2009	40	0.03	0.33	0.16	0.00	0.02	0.01	0.04	0.00	0.01	0.02	39.70
Fine Grading	11/1/2009	12/31/2009	40	0.03	0.25	0.13	0.00	0.02	0.01	0.03	0.00	0.01	0.02	29.24
Diversion Structure														
Mass Grading	1/1/2009	2/28/2009	40	0.02	0.23	0.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	27.55
Fine Grading	4/1/2009	4/30/2009	20	0.01	0.13	0.07	0.00	0.01	0.01	0.01	0.00	0.01	0.01	14.61
Reservoir														
Mass Grading	1/1/2009	3/31/2009	60	0.11	1.30	0.56	0.00	0.70	0.05	0.76	0.15	0.05	0.20	159.84
Fine Grading	11/1/2009	12/31/2009	40	0.03	0.28	0.15	0.00	0.48	0.01	0.50	0.10	0.01	0.11	33.23
Force Main														
Mass Grading	2/1/2009	5/31/2009	80	0.02	0.24	0.13	0.00	0.85	0.01	0.86	0.18	0.01	0.19	30.40
Fine Grading	2/1/2009	5/31/2009	80	0.01	0.10	0.09	0.00	0.85	0.01	0.86	0.18	0.01	0.18	12.70
Sewer Replacement														
Mass Grading	1/1/2009	2/28/2009	40	0.01	0.08	0.05	0.00	0.09	0.00	0.10	0.02	0.00	0.02	10.93
Fine Grading	9/1/2009	10/31/2009	40	0.01	0.07	0.06	0.00	0.10	0.00	0.10	0.02	0.00	0.02	8.18

Table 3. Penmar Water Quality Improvement Project Estimated Mitigated Emissions

		Start	End	Number					PM10			PM2.5			
Phase		Date	Date	of Days	ROG	NOx	CO	SO_2	Dust	Exhaust	Total	Dust	Exhaust	Total	CO_2
MITIGATED CONSTRUCTION EMISSION ESTIMATES, pounds/day															
Pump Station															
Mass Grading	a	1/1/2009	2/28/2009	40	1.50	16.50	8.00	0.00	1.00	0.50	2.00	0.00	0.50	1.00	1985.00
Fine Grading	b	11/1/2009	12/31/2009	40	1.50	12.50	6.50	0.00	1.00	0.50	1.50	0.00	0.50	1.00	1462.00
Diversion Structure															
Mass Grading	c	1/1/2009	2/28/2009	40	1.00	11.50	6.00	0.00	0.50	0.50	1.00	0.00	0.50	0.50	1377.50
Fine Grading	d	4/1/2009	4/30/2009	20	1.00	13.00	7.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1461.00
Reservoir															
Mass Grading	e	1/1/2009	3/31/2009	60	3.67	43.33	18.67	0.00	23.33	1.67	25.33	5.00	1.67	6.67	5328.00
Fine Grading	f	11/1/2009	12/31/2009	40	1.50	14.00	7.50	0.00	24.00	0.50	25.00	5.00	0.50	5.50	1661.50
Force Main															
Mass Grading	g	2/1/2009	5/31/2009	80	0.50	6.00	3.25	0.00	21.25	0.25	21.50	4.50	0.25	4.75	760.00
Fine Grading	h	2/1/2009	5/31/2009	80	0.25	2.50	2.25	0.00	21.25	0.25	21.50	4.50	0.25	4.50	317.50
Sewer Replacement															
Mass Grading	i	1/1/2009	2/28/2009	40	0.50	4.00	2.50	0.00	4.50	0.00	5.00	1.00	0.00	1.00	546.50
Fine Grading	j	9/1/2009	10/31/2009	40	0.50	3.50	3.00	0.00	5.00	0.00	5.00	1.00	0.00	1.00	409.00
Peak, pounds per day															
a+c+e+g+h+i					7	84	41	0	72	3	76	15	3	18	10315
b+f					3	27	14	0	25	1	27	5	1	7	3124
d+g+h					2	22	13	0	44	2	44	9	2	10	2539

Note:

The model only shows 2 decimal places (zeros represent vlaues less than 0.00)

Formulas:

pounds/day = short tons x 2000 pounds/1 short ton / number of days

1 short ton = 2000 pounds

Number of days = 20 working days per month

1.2.3 Impact Analysis

In order to determine the significance of potential air quality impacts, the peak daily emission estimates were compared to the thresholds of significance described above. For CO_2, total project emissions were compared to the relevant significance threshold. Table 4 reflects those comparisons. No emission estimates were greater than the respective significance thresholds. Therefore, it is concluded that potential air quality impacts from construction activities will be Less Than Significant.

Table 4. Penmar Water Quality Improvement Project Comparison of Estimated Mitigated Emissions to Regulatory Thresholds

					PM10			PM2.5			
Phase	ROG	NOx	CO	SO_2	Dust	Exhaust	Total	Dust	Exhaust	Total	CO_2
MITIGATED CONSTRUCTION EMISSION ESTIMATES, metric tons/project											
Peak											366
Threshold											10,000
MITIGATED CONSTRUCTION EMISSION ESTIMATES, pounds/day											
Peak	7	84	41	0	72	3	76	15	3	18	
Mass Daily Thresholds for Construction	75	100	550	150	—	—	150	—	—	55	

Note:

The model only shows 2 decimal places (zeros represent vlaues less than 0.00)

Source for Mass Daily Thresholds

South Coast Air Quality Management District, SCAQMD Air Quality Significance Thresholds, July 2008

Source for CO_2 Threshold

South Coast Air Quality Management District Policy

APPENDIX A: URBEMIS MODELING OUTPUT

URBEMIS Modeling Output Files

Pump Station
Diversion Structure
Reservoir
Force Main
Sewer Replacement

4/15/2009 9:27:59 AM

Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: P:\136000\136123 - Penmar\URBEMIS\Penmar-Pump Station.urb924

Project Name: Penmar

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (tons/year unmitigated)	0.06	0.58	0.29	0.00	0.10	0.03	0.12	0.02	0.02	0.04	68.94
2009 TOTALS (tons/year mitigated)	0.06	0.58	0.29	0.00	0.04	0.03	0.07	0.01	0.02	0.03	68.94
Percent Reduction	0.00	0.00	0.00	0.00	53.98	0.00	42.28	53.67	0.00	24.27	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

2009	0.06	0.58	0.29	0.00	0.10	0.03	0.12	0.02	0.02	0.04	68.94
Mass Grading 01/01/2009-02/28/2009	0.03	0.33	0.16	0.00	0.05	0.01	0.06	0.01	0.01	0.02	39.70
Mass Grading Dust	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.01	0.00	0.01	0.00
Mass Grading Off Road Diesel	0.02	0.22	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	21.94
Mass Grading On Road Diesel	0.01	0.11	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.19
Mass Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.57
Fine Grading 11/01/2009-12/31/2009	0.03	0.25	0.13	0.00	0.05	0.01	0.06	0.01	0.01	0.02	29.24
Fine Grading Dust	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.01	0.00	0.01	0.00
Fine Grading Off Road Diesel	0.03	0.25	0.09	0.00	0.00	0.01	0.01	0.00	0.01	0.01	25.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Fine Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.11

Phase Assumptions

Phase: Fine Grading 11/1/2009 - 12/31/2009 - Default Fine Site Grading/Excavation Description

Total Acres Disturbed: 0.44

Maximum Daily Acreage Disturbed: 0.11

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0.46

Off-Road Equipment:

1 Crawler Tractors (147 hp) operating at a 0.64 load factor for 1 hours per day

1 Generator Sets (549 hp) operating at a 0.74 load factor for 0.3 hours per day

1 Pumps (53 hp) operating at a 0.74 load factor for 0.2 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 4.1 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (750 hp) operating at a 0.55 load factor for 2.6 hours per day

Phase: Mass Grading 1/1/2009 - 2/28/2009 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 0.44

Maximum Daily Acreage Disturbed: 0.11

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 148.24

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 5.4 hours per day

1 Excavators (200 hp) operating at a 0.57 load factor for 1.3 hours per day

1 Generator Sets (549 hp) operating at a 0.74 load factor for 0.3 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 2.6 hours per day

1 Pumps (53 hp) operating at a 0.74 load factor for 0.2 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0.7 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

2009	0.06	0.58	0.29	0.00	0.04	0.03	0.07	0.01	0.02	0.03	68.94
Mass Grading 01/01/2009-02/28/2009	0.03	0.33	0.16	0.00	0.02	0.01	0.04	0.00	0.01	0.02	39.70
Mass Grading Dust	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00
Mass Grading Off Road Diesel	0.02	0.22	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	21.94
Mass Grading On Road Diesel	0.01	0.11	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.19
Mass Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.57
Fine Grading 11/01/2009-12/31/2009	0.03	0.25	0.13	0.00	0.02	0.01	0.03	0.00	0.01	0.02	29.24
Fine Grading Dust	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.03	0.25	0.09	0.00	0.00	0.01	0.01	0.00	0.01	0.01	25.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Fine Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.11

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 11/1/2009 - 12/31/2009 - Default Fine Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Mass Grading 1/1/2009 - 2/28/2009 - Default Mass Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

4/15/2009 9:27:59 AM

PM10: 44% PM25: 44%

4/14/2009 12:12:35 PM

Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: P:\136000\136123 - Penmar\URBEMIS\Penmar-Diversion Structure.urb924

Project Name: Penmar

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (tons/year unmitigated)	0.04	0.35	0.19	0.00	0.03	0.02	0.05	0.01	0.01	0.02	42.16
2009 TOTALS (tons/year mitigated)	0.04	0.35	0.19	0.00	0.01	0.02	0.03	0.00	0.01	0.02	42.16
Percent Reduction	0.00	0.00	0.00	0.00	53.88	0.00	36.03	53.47	0.00	16.90	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

2009	0.04	0.35	0.19	0.00	0.03	0.02	0.05	0.01	0.01	0.02	42.16
Mass Grading 01/01/2009-02/28/2009	0.02	0.23	0.12	0.00	0.02	0.01	0.03	0.00	0.01	0.01	27.55
Mass Grading Dust	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00
Mass Grading Off Road Diesel	0.02	0.22	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	21.94
Mass Grading On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04
Mass Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.57
Fine Grading 04/01/2009-04/30/2009	0.01	0.13	0.07	0.00	0.01	0.01	0.02	0.00	0.01	0.01	14.61
Fine Grading Dust	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.12	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	12.55
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Fine Grading Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05

Phase Assumptions

Phase: Fine Grading 4/1/2009 - 4/30/2009 - Default Fine Site Grading/Excavation Description

Total Acres Disturbed: 0.19

Maximum Daily Acreage Disturbed: 0.05

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0.32

Off-Road Equipment:

1 Crawler Tractors (147 hp) operating at a 0.64 load factor for 1 hours per day

1 Generator Sets (549 hp) operating at a 0.74 load factor for 0.3 hours per day

1 Pumps (53 hp) operating at a 0.74 load factor for 0.2 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 4.1 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (750 hp) operating at a 0.55 load factor for 2.6 hours per day

Phase: Mass Grading 1/1/2009 - 2/28/2009 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 0.19

Maximum Daily Acreage Disturbed: 0.05

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 11.67

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 5.4 hours per day

1 Excavators (200 hp) operating at a 0.57 load factor for 1.3 hours per day

1 Generator Sets (549 hp) operating at a 0.74 load factor for 0.3 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 2.6 hours per day

1 Pumps (53 hp) operating at a 0.74 load factor for 0.2 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0.7 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

2009	0.04	0.35	0.19	0.00	0.01	0.02	0.03	0.00	0.01	0.02	42.16
Mass Grading 01/01/2009-02/28/2009	0.02	0.23	0.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	27.55
Mass Grading Dust	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Mass Grading Off Road Diesel	0.02	0.22	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	21.94
Mass Grading On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04
Mass Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.57
Fine Grading 04/01/2009-04/30/2009	0.01	0.13	0.07	0.00	0.01	0.01	0.01	0.00	0.01	0.01	14.61
Fine Grading Dust	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.12	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	12.55
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Fine Grading Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 4/1/2009 - 4/30/2009 - Default Fine Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Mass Grading 1/1/2009 - 2/28/2009 - Default Mass Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

4/14/2009 12:12:35 PM

PM10: 44% PM25: 44%

4/15/2009 9:11:14 AM

Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: P:\136000\136123 - Penmar\URBEMIS\Penmar-Reservoir.urb924

Project Name: Penmar

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (tons/year unmitigated)	0.14	1.58	0.71	0.00	2.60	0.07	2.67	0.54	0.06	0.61	193.06
2009 TOTALS (tons/year mitigated)	0.14	1.58	0.71	0.00	1.18	0.07	1.25	0.25	0.06	0.31	193.06
Percent Reduction	0.00	0.00	0.00	0.00	54.37	0.00	52.97	54.32	0.00	48.64	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

2009	0.14	1.58	0.71	0.00	2.60	0.07	2.67	0.54	0.06	0.61	193.06
Mass Grading 01/01/2009-03/31/2009	0.11	1.30	0.56	0.00	1.54	0.05	1.59	0.32	0.05	0.37	159.84
Mass Grading Dust	0.00	0.00	0.00	0.00	1.54	0.00	1.54	0.32	0.00	0.32	0.00
Mass Grading Off Road Diesel	0.03	0.33	0.12	0.00	0.00	0.01	0.01	0.00	0.01	0.01	33.42
Mass Grading On Road Diesel	0.07	0.96	0.37	0.00	0.00	0.04	0.04	0.00	0.04	0.04	119.44
Mass Grading Worker Trips	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.97
Fine Grading 11/01/2009-12/31/2009	0.03	0.28	0.15	0.00	1.06	0.01	1.07	0.22	0.01	0.23	33.23
Fine Grading Dust	0.00	0.00	0.00	0.00	1.06	0.00	1.06	0.22	0.00	0.22	0.00
Fine Grading Off Road Diesel	0.03	0.27	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	27.05
Fine Grading On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39
Fine Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.79

Phase Assumptions

Phase: Fine Grading 11/1/2009 - 12/31/2009 - Default Fine Site Grading/Excavation Description

Total Acres Disturbed: 9.6

Maximum Daily Acreage Disturbed: 2.4

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 14.92

Off-Road Equipment:

1 Crawler Tractors (147 hp) operating at a 0.64 load factor for 1 hours per day

1 Excavators (168 hp) operating at a 0.57 load factor for 1.3 hours per day

1 Generator Sets (549 hp) operating at a 0.74 load factor for 0.3 hours per day

1 Pumps (53 hp) operating at a 0.74 load factor for 0.2 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 4.1 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (750 hp) operating at a 0.55 load factor for 2.6 hours per day

Phase: Mass Grading 1/1/2009 - 3/31/2009 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 9.6

Maximum Daily Acreage Disturbed: 2.4

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 880.66

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 5.4 hours per day

1 Excavators (200 hp) operating at a 0.57 load factor for 1.3 hours per day

1 Generator Sets (549 hp) operating at a 0.74 load factor for 0.3 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 2.6 hours per day

1 Pumps (53 hp) operating at a 0.74 load factor for 0.2 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0.7 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

2009	0.14	1.58	0.71	0.00	1.18	0.07	1.25	0.25	0.06	0.31	193.06
Mass Grading 01/01/2009-03/31/2009	0.11	1.30	0.56	0.00	0.70	0.05	0.76	0.15	0.05	0.20	159.84
Mass Grading Dust	0.00	0.00	0.00	0.00	0.70	0.00	0.70	0.15	0.00	0.15	0.00
Mass Grading Off Road Diesel	0.03	0.33	0.12	0.00	0.00	0.01	0.01	0.00	0.01	0.01	33.42
Mass Grading On Road Diesel	0.07	0.96	0.37	0.00	0.00	0.04	0.04	0.00	0.04	0.04	119.44
Mass Grading Worker Trips	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.97
Fine Grading 11/01/2009-12/31/2009	0.03	0.28	0.15	0.00	0.48	0.01	0.50	0.10	0.01	0.11	33.23
Fine Grading Dust	0.00	0.00	0.00	0.00	0.48	0.00	0.48	0.10	0.00	0.10	0.00
Fine Grading Off Road Diesel	0.03	0.27	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	27.05
Fine Grading On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39
Fine Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.79

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 11/1/2009 - 12/31/2009 - Default Fine Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Mass Grading 1/1/2009 - 3/31/2009 - Default Mass Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

4/15/2009 9:11:14 AM

PM10: 44% PM25: 44%

4/14/2009 12:01:22 PM

Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: P:\136000\136123 - Penmar\URBEMIS\Penmar-Force Main.urb924

Project Name: Penmar

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (tons/year unmitigated)	0.04	0.34	0.22	0.00	3.74	0.02	3.76	0.78	0.02	0.80	43.10
2009 TOTALS (tons/year mitigated)	0.04	0.34	0.22	0.00	1.70	0.02	1.72	0.36	0.02	0.37	43.10
Percent Reduction	0.00	0.00	0.00	0.00	54.45	0.00	54.19	54.44	0.00	53.30	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

2009	0.04	0.34	0.22	0.00	3.74	0.02	3.76	0.78	0.02	0.80	43.10
Fine Grading 02/01/2009-05/31/2009	0.01	0.10	0.09	0.00	1.87	0.01	1.88	0.39	0.01	0.40	12.70
Fine Grading Dust	0.00	0.00	0.00	0.00	1.87	0.00	1.87	0.39	0.00	0.39	0.00
Fine Grading Off Road Diesel	0.01	0.10	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	8.20
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53
Fine Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.97
Mass Grading 02/01/2009-05/31/2009	0.02	0.24	0.13	0.00	1.87	0.01	1.88	0.39	0.01	0.40	30.40
Mass Grading Dust	0.00	0.00	0.00	0.00	1.87	0.00	1.87	0.39	0.00	0.39	0.00
Mass Grading Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	7.96
Mass Grading On Road Diesel	0.01	0.15	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.48
Mass Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.97

Phase Assumptions

Phase: Fine Grading 2/1/2009 - 5/31/2009 - Default Fine Site Grading/Excavation Description

Total Acres Disturbed: 8.8

Maximum Daily Acreage Disturbed: 2.2

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 2.97

Off-Road Equipment:

1 Crawler Tractors (147 hp) operating at a 0.64 load factor for 1 hours per day

1 Excavators (168 hp) operating at a 0.57 load factor for 1.3 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0.7 hours per day

Phase: Mass Grading 2/1/2009 - 5/31/2009 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 8.8

Maximum Daily Acreage Disturbed: 2.2

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 102.58

Off-Road Equipment:

1 Excavators (200 hp) operating at a 0.57 load factor for 1.3 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0.7 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009	0.04	0.34	0.22	0.00	1.70	0.02	1.72	0.36	0.02	0.37	43.10
Fine Grading 02/01/2009-05/31/2009	0.01	0.10	0.09	0.00	0.85	0.01	0.86	0.18	0.01	0.18	12.70
Fine Grading Dust	0.00	0.00	0.00	0.00	0.85	0.00	0.85	0.18	0.00	0.18	0.00
Fine Grading Off Road Diesel	0.01	0.10	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	8.20
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53
Fine Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.97
Mass Grading 02/01/2009-05/31/2009	0.02	0.24	0.13	0.00	0.85	0.01	0.86	0.18	0.01	0.19	30.40
Mass Grading Dust	0.00	0.00	0.00	0.00	0.85	0.00	0.85	0.18	0.00	0.18	0.00
Mass Grading Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	7.96
Mass Grading On Road Diesel	0.01	0.15	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.48
Mass Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.97

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 2/1/2009 - 5/31/2009 - Default Fine Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Mass Grading 2/1/2009 - 5/31/2009 - Default Mass Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: P:\136000\136123 - Penmar\URBEMIS\Penmar-Sewer Replacement.urb924

Project Name: Penmar

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (tons/year unmitigated)	0.02	0.15	0.11	0.00	0.41	0.01	0.42	0.09	0.01	0.09	19.11
2009 TOTALS (tons/year mitigated)	0.02	0.15	0.11	0.00	0.19	0.01	0.20	0.04	0.01	0.05	19.11
Percent Reduction	0.00	0.00	0.00	0.00	54.42	0.00	53.25	54.38	0.00	49.60	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

2009	0.02	0.15	0.11	0.00	0.41	0.01	0.42	0.09	0.01	0.09	19.11
Mass Grading 01/01/2009-02/28/2009	0.01	0.08	0.05	0.00	0.20	0.00	0.21	0.04	0.00	0.05	10.93
Mass Grading Dust	0.00	0.00	0.00	0.00	0.20	0.00	0.20	0.04	0.00	0.04	0.00
Mass Grading Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.93
Mass Grading On Road Diesel	0.00	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.04
Mass Grading Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.96
Fine Grading 09/01/2009-10/31/2009	0.01	0.07	0.06	0.00	0.21	0.00	0.22	0.04	0.00	0.05	8.18
Fine Grading Dust	0.00	0.00	0.00	0.00	0.21	0.00	0.21	0.04	0.00	0.04	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.41
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Fine Grading Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.74

Phase Assumptions

Phase: Fine Grading 9/1/2009 - 10/31/2009 - Default Fine Site Grading/Excavation Description

Total Acres Disturbed: 1.92

Maximum Daily Acreage Disturbed: 0.48

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0.37

Off-Road Equipment:

1 Crawler Tractors (147 hp) operating at a 0.64 load factor for 1 hours per day

1 Excavators (168 hp) operating at a 0.57 load factor for 1.3 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0.7 hours per day

Phase: Mass Grading 1/1/2009 - 2/28/2009 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 1.92

Maximum Daily Acreage Disturbed: 0.48

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 56.67

Off-Road Equipment:

1 Excavators (200 hp) operating at a 0.57 load factor for 1.3 hours per day

1 Sweepers/Scrubbers (91 hp) operating at a 0.68 load factor for 1 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0.7 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009	0.02	0.15	0.11	0.00	0.19	0.01	0.20	0.04	0.01	0.05	19.11
Mass Grading 01/01/2009-02/28/2009	0.01	0.08	0.05	0.00	0.09	0.00	0.10	0.02	0.00	0.02	10.93
Mass Grading Dust	0.00	0.00	0.00	0.00	0.09	0.00	0.09	0.02	0.00	0.02	0.00
Mass Grading Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.93
Mass Grading On Road Diesel	0.00	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.04
Mass Grading Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.96
Fine Grading 09/01/2009-10/31/2009	0.01	0.07	0.06	0.00	0.10	0.00	0.10	0.02	0.00	0.02	8.18
Fine Grading Dust	0.00	0.00	0.00	0.00	0.10	0.00	0.10	0.02	0.00	0.02	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.41
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Fine Grading Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.74

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 9/1/2009 - 10/31/2009 - Default Fine Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Mass Grading 1/1/2009 - 2/28/2009 - Default Mass Site Grading/Excavation Description

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

APPENDIX E

Penmar Water Quality Improvement Project Construction Noise Impact Evaluation Report

March 27, 2009

Behrens and Associates, Inc.
Acoustics, Noise and Vibration Consultants

March 27, 2009

Brown and Caldwell
801 South Figueroa Street, Suite 950
Los Angeles, CA 90017

Attention: Scott Dellinger, P. E.

Subject: Penmar Water Quality Improvement Project Construction Noise Impact Evaluation Report

Dear Mr. Dellinger,

We have completed a construction noise impact evaluation of the Penmar Water Quality Improvement Project including the completion of pre-construction ambient sound level surveys at five construction locations, and completed preliminary construction noise level impact prediction and developed noise mitigation recommendation for each of the construction projects.

Penmar Water Quality Improvement Project Description

The proposed project consists of construction of a storm water diversion structure, a primary pump station system, a detention reservoir, a secondary pump system, three force mains for flow conveyance, and the upgrade of four sanitary sewer segments west of the primary pump station. The proposed project would intercept and divert storm water runoff and dry weather flows from the existing Los Angeles County Storm Drain in Rose Avenue. Diverted flows would be conveyed to a pump station constructed within Frederick Street right-of-way northwest of the intersection with Rose Avenue. As sewer capacity allows, portion of the flow, including dry weather flow would be diverted directly to the sanitary sewer via a force main from the proposed pump station to the sanitary sewer and ultimately to the Hyperion Treatment Plant. Wet weather flows would be diverted via a second force main to an approximately 2.75-million gallon reservoir that would be constructed beneath the Penmar Recreation Center fields. Storm water stored in the reservoir would be held in the reservoir for seventy-two (72) hours after a storm event passes and then discharged at a metered rate to the sanitary sewer through a combined gravity and pump system that would be constructed adjacent to the reservoir. The project also includes minor sanitary sewer upgrades on Oakwood Avenue between Millwood Avenue and Rialto Court, on Rialto Court south of Nowita Place, Crescent Place (undeveloped "paper" street) between Rialto Court and Palms Boulevard, and on Abbot Kinney Boulevard at the intersection with Palms Boulevard.

Penmar Water Quality Improvement Ambient Sound Level Surveys

To establish and document the current pre-construction ambient conditions, a total of five, one-hour continuous ambient sound surveys were completed on March 5, 2009 between 10:00 AM and 3:00 PM at each of the project construction locations on Rose Avenue and Palms Boulevard. The sound level measurements were recorded with Quest SoundPro SE/DL Sound Level Meters at each of the monitoring locations as shown in the aerial maps included as Attachment 1 and Attachment 2 of this report.

Construction Sound Prediction Methodology

To evaluate the off-site construction noise impact potential of each construction element, a simple computer noise impact model was developed. The noise prediction modeling was completed with the Brüel & Kjær Predictor Version 6.1 Release 4 software which meets ISO 9613.1/2 compliance requirements (an EU certified model). Typical construction equipment and machinery operational sound levels were used as the foundation of the noise levels for each model.

For each construction project listed, a brief work description is followed by the current pre-construction ambient sound level survey results with a chart showing the predicted construction sound level impact along with the CEQA noise limit. A listing of the anticipated construction equipments and the corresponding noise level at distance is also presented and followed by a predicted construction noise and vibration impact at adjacent residence property line.

Mitigation Potential

For optimum construction noise impact mitigation, we recommend a sound barrier to be installed at each construction project location.

Please contact the undersigned with any questions or comments that may arise.

Very truly yours,

Don Behrens
President
95-4460624

Attachments

Behrens and Associates, Inc.
Acoustics, Noise and Vibration Consultants

Ambient Sound Level Monitoring Locations on Rose Avenue
Attachment 1

Ambient Sound Level Monitoring Locations on Palms Boulevard
Attachment 2

Construction Projects

A- Diversion Structure and Primary Pump Station

1- General Construction Description

i) Diversion Structure

The proposed project would construct a passive diversion structure to divert flow from the Rose Avenue Storm Drain within the vicinity of Frederick Street. The Rose Avenue Storm Drain consists of two 9-foot wide by 12-foot high reinforced concrete culvert boxes beneath the street right-of-way. The diversion structure would be designed to carry the required design flow and allow overflow to bypass the diversion structure. It is anticipated that a low concrete barrier, approximately 2 feet high, would be constructed in a manner to ensure that it does not impede maintenance of the box culverts. An opening would be created in the wall between the two box culverts to allow storm water to flow from one box to the other. The concrete barrier would be angled at 45-degrees to direct the flow toward the openings of the box culvert walls. Two maintenance holes would be needed for access. The design of the connection to the County storm drain would be coordinated with Los Angeles County Department of Public Works. A storm drain transition structure would be constructed to convey storm water flows to the primary pump station.

ii) Primary Pump Station System

An underground wet well and pump station would be constructed within the Frederick Street right-of-way northwest of the intersection with Rose Avenue to lift storm water runoff from the Rose Avenue Storm Drain to a detention reservoir beneath the Penmar Recreation Center fields. The wet well and pump station would be approximately 25 feet wide and 180-feet long. The wet well structure would be approximately 25 feet deep. The pump station would have an area designed for trash and debris removal. A bar screen would prevent trash and large debris from the Rose Avenue Storm Drain from entering the wet well area. Two access hatches would be located above this area to allow for maintenance and trash removal. The wet well is anticipated to house four constant speed pumps (five cubic feet per second (cfs) each) and two discharge pumps. The four constant speed pumps would come on in sequence to pump storm flow to the underground detention reservoir. If flow continued to rise at a rate in excess of the pumping capacity, the wet well would reach capacity and excess flow would remain in the storm drain and continue to flow downstream to the current outfall. The temporary flow storage capacity within the wet well is estimated at 70,000 gallons. Maintenance access hatches would be located above the pump area.

2- Preconstruction Ambient Sound Conditions

To establish the current pre-construction ambient sound level at the site, one hour continuous ambient sound survey was completed at the intersection of Rose Avenue and Frederick Street on March 5, 2009 between 10:40 AM and 11:40 AM. The sound monitoring location is shown in the aerial map included as Attachment 1. The measured hourly average midday ambient sound level at the Rose Avenue and Frederick Street intersection was 69 dBA.

3- Construction Elements

List of the equipment anticipated to be used in the Construction of the Diversion Structure and the Primary Pump Station System and the corresponding noise levels generated at distance are tabulated below.

i) Diversion Structure

Equipment	Noise Generated at Distance
Crane	*83 dBA at 5 ft*
Excavator	*85 dBA at 25 ft*
Front Loader	*80 dBA at 10 ft*
Backhoe	*80 dBA at 10ft*
forklift	*85 dBA at 50ft*
Two Dump Trucks	*75 dBA at 10 ft (Each)*
Compaction Machine	*82 dBA at 50ft*
Paving Machine	*89 dBA at 50ft*

ii) Primary Pump Station System

Equipment	Noise Generated at Distance
Crane	*83 dBA at 5 ft*
Excavator	*85 dBA at 25 ft*
Front Loader	*80 dBA at 10 ft*
Backhoe	*80 dBA at 10ft*
forklift	*85 dBA at 50ft*
Two Dump Trucks	*75 dBA at 10 ft (Each)*
Compaction Machine	*82 dBA at 50ft*

4- Noise Impact Potential

At nearby residences, assuming worst case scenario where all equipment is operating simultaneously, the un-mitigated construction noise levels are projected to range from 89 dBA to 92 dBA for the Diversion Structure and from 85 dBA to 88 dBA for the Primary Pump Station System.

5- Mitigation Potential

Based on the utilization of 10 foot high temporary construction sound walls positioned along the perimeter of the Diversion Structure work area, the predicted mitigated construction sound levels are anticipated to be 82 dBA at 50 feet. Based on the utilization of 16 foot high temporary construction sound walls positioned along the perimeter of the Diversion Structure work area, the predicted mitigated construction sound levels are anticipated to be 78 dBA at 50 feet.

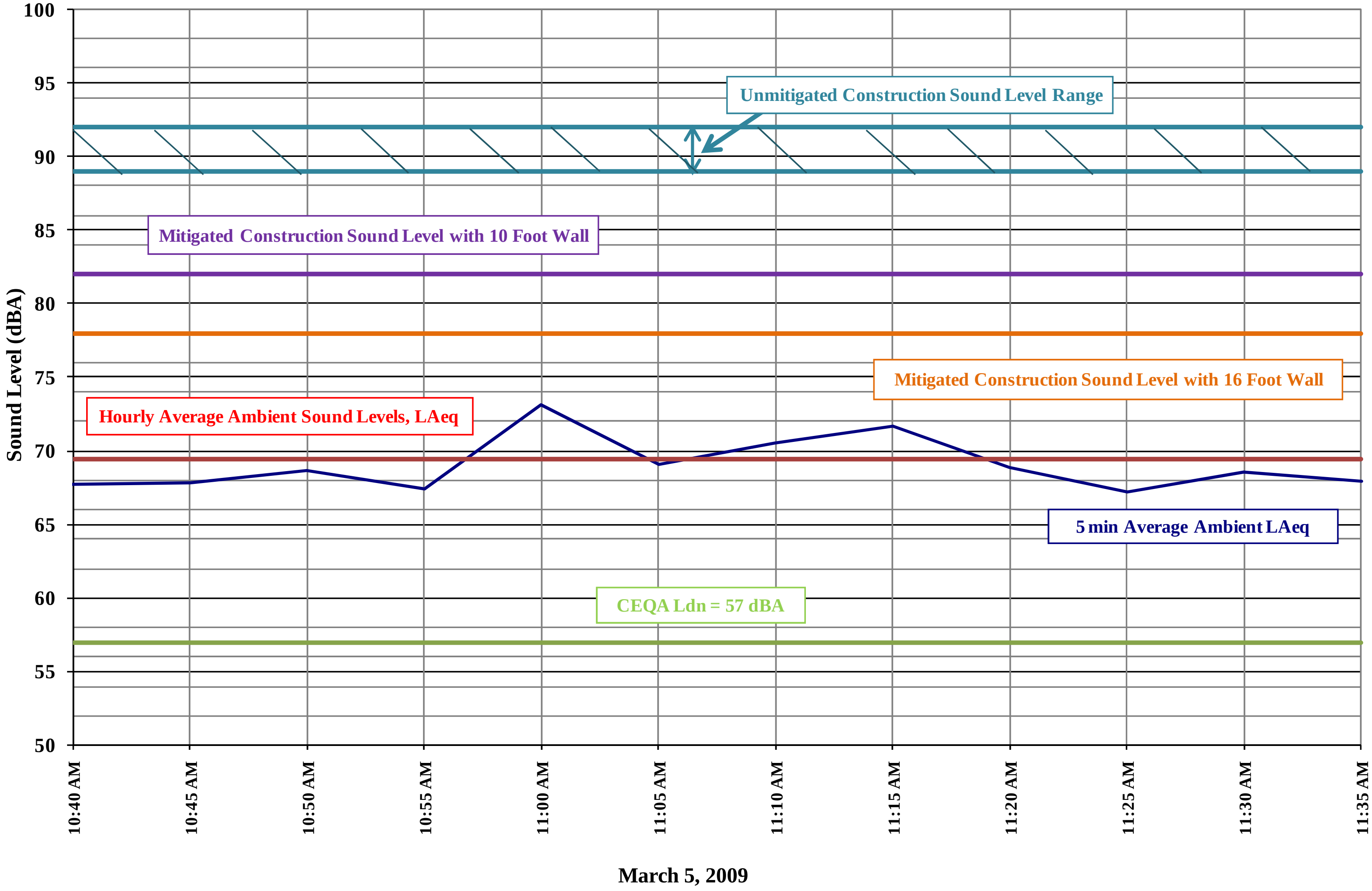
Predicted unmitigated Diversion Structure construction noise levels is shown in the graph in Attachment 3 along with the 10 foot and 16 foot sound wall mitigated construction noise levels, five-minute and hourly average ambient sound levels and the CEQA limit.

Based on the utilization of 10 foot high temporary construction sound walls positioned along the perimeter of the Primary Pump Station System work area, the predicted mitigated construction sound levels are anticipated to be 79 dBA at 50 feet. Based on the utilization of 16 foot high temporary construction sound walls positioned along the perimeter of the Primary Pump Station System work area, the predicted mitigated construction sound levels are anticipated to be 75 dBA at 50 feet.

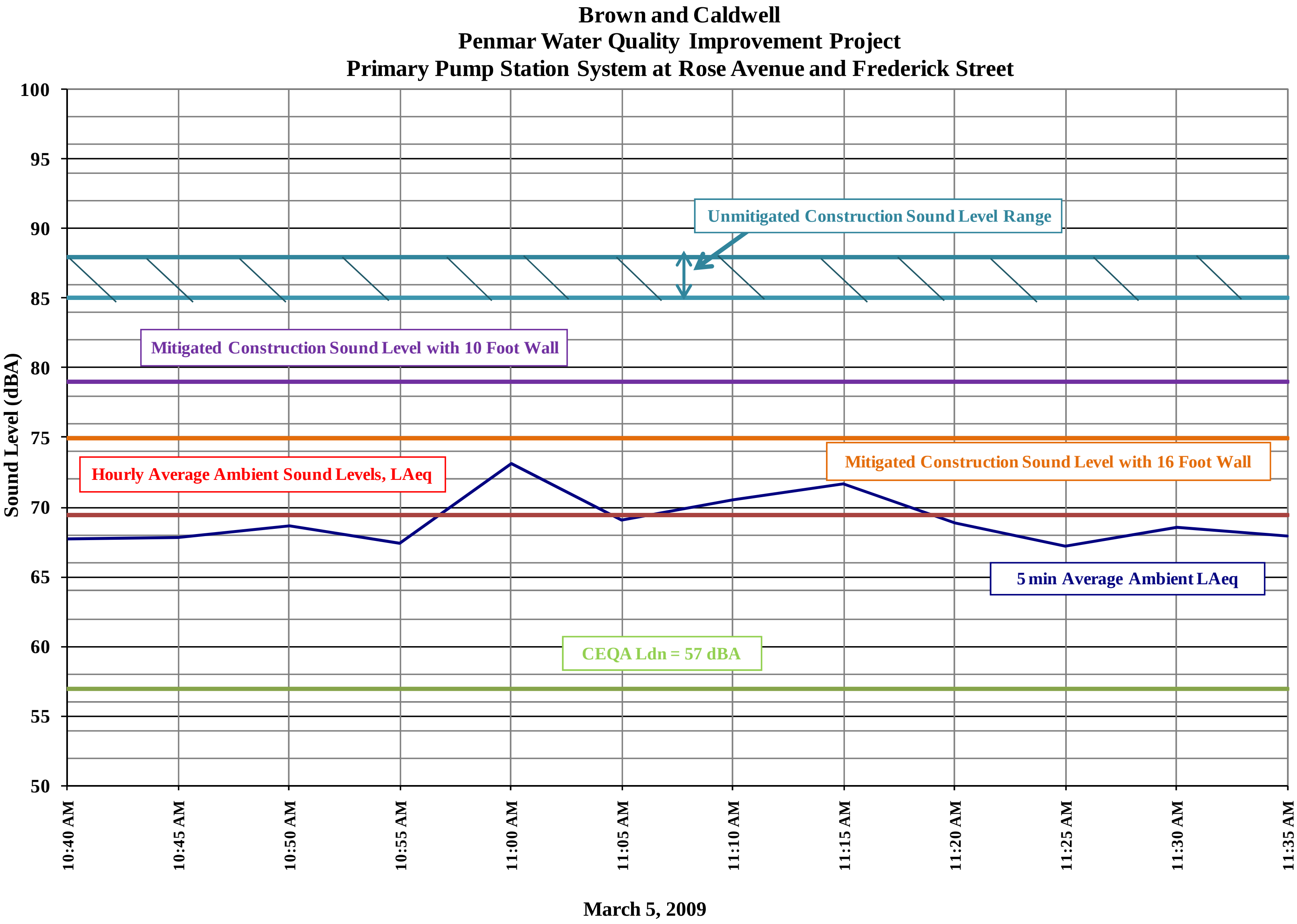
Predicted unmitigated Primary Pump Station System construction noise levels is shown in the graph in Attachment 4 along with the 10 foot and 16 foot sound wall mitigated construction noise levels, five-minute and hourly average ambient sound levels and the CEQA limit.

Behrens and Associates, Inc.
Acoustics, Noise and Vibration Consultants

Brown and Caldwell
Penmar Water Quality Improvement Project
Diversion Structure at Rose Avenue and Frederick Street



Attachment 3



Attachment 4

B- Underground Detention Reservoir, Penmar Recreation Center Field Restoration, and Secondary Pump Station System

1- General Construction Description

i) Underground Detention Reservoir

The underground detention reservoir would be located beneath the fields at the southwestern area of the Penmar Recreation Center. The reservoir is anticipated to be a circular prestressed concrete reservoir approximately 180-foot in diameter with approximately 2.75 million gallon (MG) storage capacity. The side wall depth is estimated at 17 feet. A 30-inch force main would convey flows from the primary pumping station at Frederick Street to the underground reservoir. A swing check valve on the 30-inch force main with a 12-inch tee fitting would allow a single inlet/outlet structure. A 12-inch connection would serve as a connection point to an adjacent secondary pump station system that would convey flows to a sanitary sewer line in Rose Avenue.

The reservoir design would include an emergency overflow spillway, which would be connected to the Rose Avenue Storm Drain. The spillway would begin to receive overflow if the reservoir exceeds 16-foot depth and water begins to encroach into a one-foot freeboard that would be included in the design capacity. The spillway would only come into service if the “reservoir full – pump shut off” sensor ever failed and the Primary Pumping Station on Frederick Street in turn did not shut off.

ii) Penmar Recreation Center Field Restoration

Excavated areas would be backfilled and ground cover installed after construction of the underground detention reservoir. The fields and any affected irrigation system would be restored and replaced. Any landscape improvements would be coordinated with the Department of Recreation and Parks.

iii) Secondary Pump Station System

An underground vault housing two pumps would be installed adjacent to reservoir. As indicated above, these pumps would convey flows from the underground detention reservoir to the sanitary sewer line in Rose Avenue. The pumps are currently estimated to have one cfs capacity. These pumps are necessary to allow for removal of storm water from the reservoir and “lifting” them to a higher elevation for discharge into the sanitary sewer line. This pump station vault will likely consist of a pre-cast maintenance hole structure, approximately 10’ in diameter.

2- Preconstruction Ambient Sound Conditions

To measure the current ambient sound levels, one hour continuous ambient sound survey was completed at the Penmar Recreation Center West Baseball Field along Rose Avenue between 10:30 AM and 11:30 AM. Monitoring location is shown in the aerial map included as Attachment 1. The measured hourly average midday ambient sound level at the Penmar Recreation Center on Rose Avenue is 67 dBA.

3- Construction Elements

List of the equipments to be used in the Construction of the Underground Detention Reservoir and the three Force Mains, and the Secondary Pump Station System and the corresponding noise levels generated at distance are tabulated below.

i) 2.75 MG Reservoir

Equipment	Noise Generated at Distance
Crane	*83 dBA at 5 ft*
Excavator	*85 dBA at 25 ft*
Front Loader	*80 dBA at 10 ft*
Backhoe	*80 dBA at 10ft*
forklift	*85 dBA at 50ft*
Two Dump Trucks	*75 dBA at 10 ft (Each)*
Compaction Machine	*80 BA at 50ft*

ii) 8 Inch, 12 Inch and 30 Inch Force Mains

Equipment	Noise Generated at Distance
Excavator	*85 dBA at 25 ft*
Backhoe	*80 dBA at 10 ft*
Front Loader	*80 dBA at 10 ft*
Paving Machine	*89 dBA at 50ft*
Dump Truck	*75 BA at 10 ft*

iii) Secondary Pump Station System

Equipment	Noise Generated at Distance
Crane	*83 dBA at 5 ft*
Excavator	*85 dBA at 25 ft*
Front Loader	*80 dBA at 10 ft*
Backhoe	*80 dBA at 10ft*
forklift	*85 dBA at 50ft*
Two Dump Trucks	*75 dBA at 10 ft (Each)*
Compaction Machine	*81 BA at 50ft*

4- Noise Impact Potential

Assuming worst case scenario where all equipments are running simultaneously, construction noise levels are projected to range from 85 dBA to 89 dBA for the Underground Detention Reservoir construction, 84 dBA to 87 dBA for the three Force Mains construction, and 85 dBA to 88 dBA for the Secondary Pump Station System.

5- Mitigation Potential

Based on the utilization of 10 foot high temporary construction sound walls positioned along the perimeter of the 2.75 MG Detention Reservoir work area, the predicted mitigated construction sound levels are anticipated to be 79 dBA at 50 feet. Based on the utilization of 16 foot high temporary construction sound walls positioned along the perimeter of the Detention Reservoir, the predicted mitigated construction sound levels are anticipated to be 75 dBA at 50 feet.

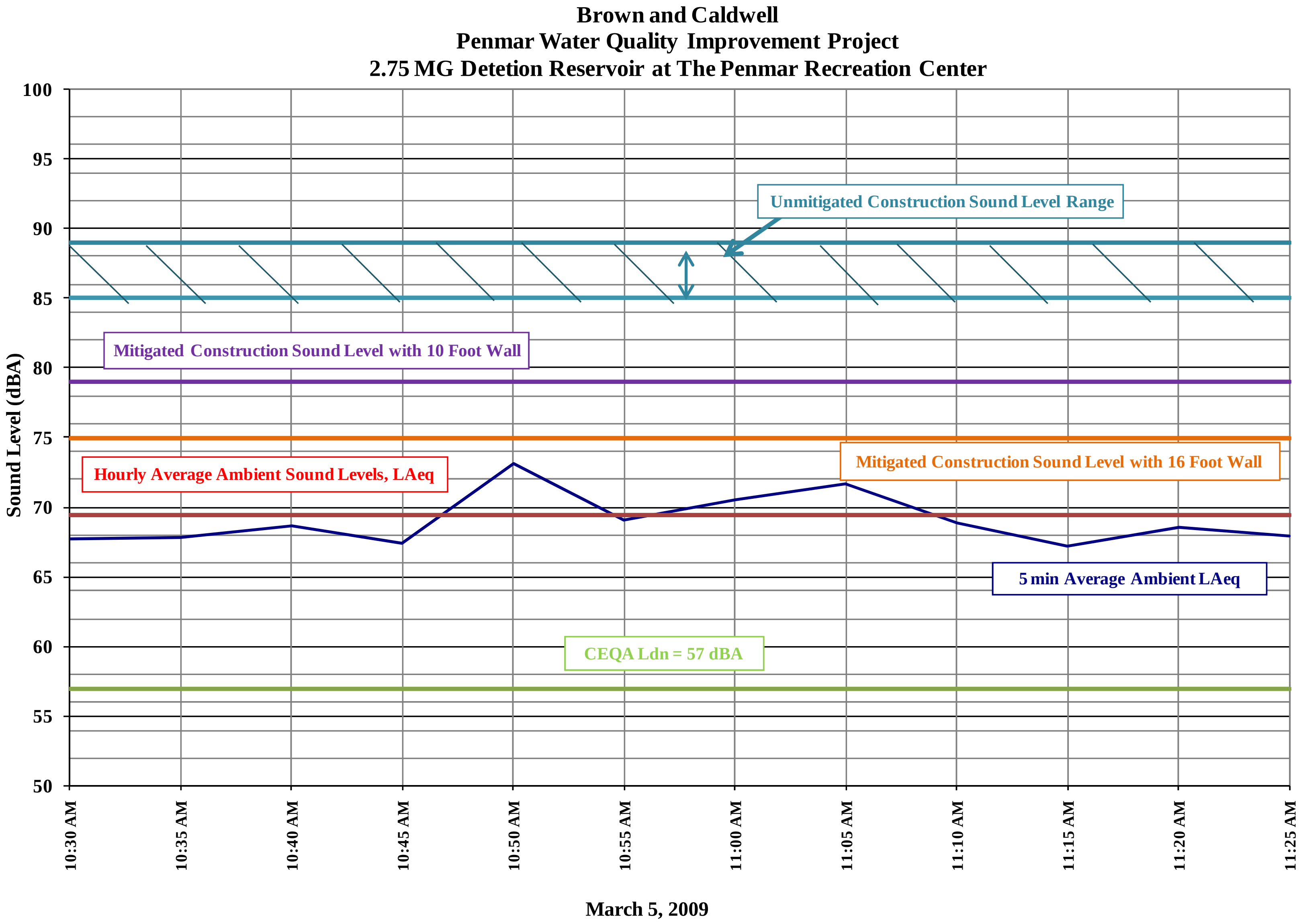
Predicted unmitigated 2.75 MG Detention Reservoir construction noise levels is shown in the graph in Attachment 5 along with the 10 foot and 16 foot sound wall mitigated construction noise levels, five-minute and hourly average ambient sound levels and the CEQA limit.

Based on the utilization of 10 foot high temporary construction sound walls positioned along the perimeter of the Inch, 12 Inch and 30 Inch Force Mains work area, the predicted mitigated construction sound levels are anticipated to be 80 dBA at 50 feet. Based on the utilization of 16 foot high temporary construction sound walls positioned along the perimeter of the Primary Pump Station System work area, the predicted mitigated construction sound levels are anticipated to be 77 dBA at 50 feet.

Predicted unmitigated 12 Inch and 30 Inch Force Mains construction noise levels is shown in the graph in Attachment 6 along with the 10 foot and 16 foot sound wall mitigated construction noise levels, five-minute and hourly average ambient sound levels and the CEQA limit.

Based on the utilization of 10 foot high temporary construction sound walls positioned along the perimeter of the Secondary Pump Station System work area, the predicted mitigated construction sound levels are anticipated to be 79 dBA at 50 feet. Based on the utilization of 16 foot high temporary construction sound walls positioned along the perimeter of the Secondary Pump Station System work area, the predicted mitigated construction sound levels are anticipated to be 75 dBA at 50 feet.

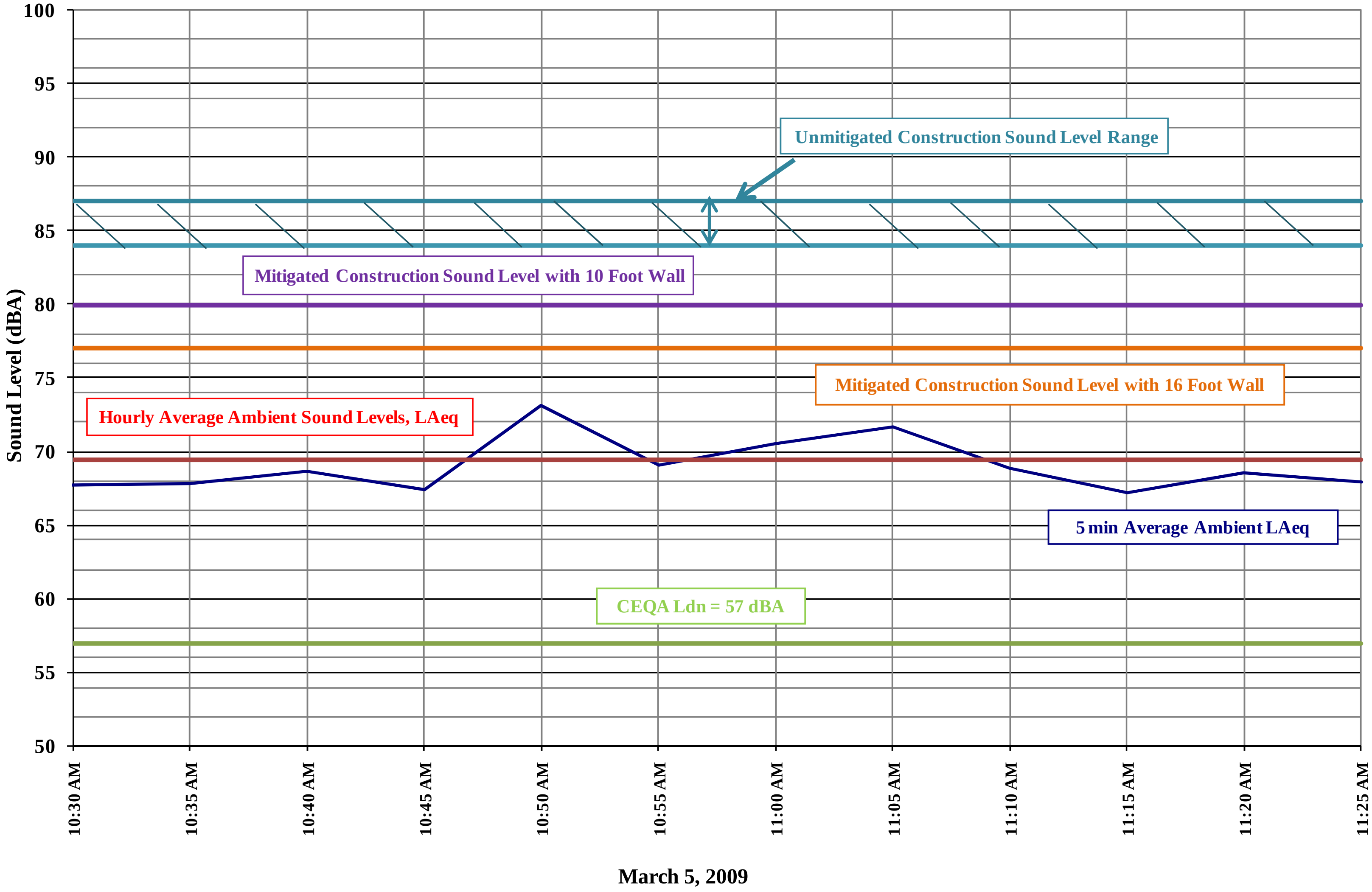
Predicted unmitigated Secondary Pump Station System construction noise levels is shown in the graph in Attachment 7 along with the 10 foot and 16 foot sound wall mitigated construction noise levels, five-minute and hourly average ambient sound levels and the CEQA limit.



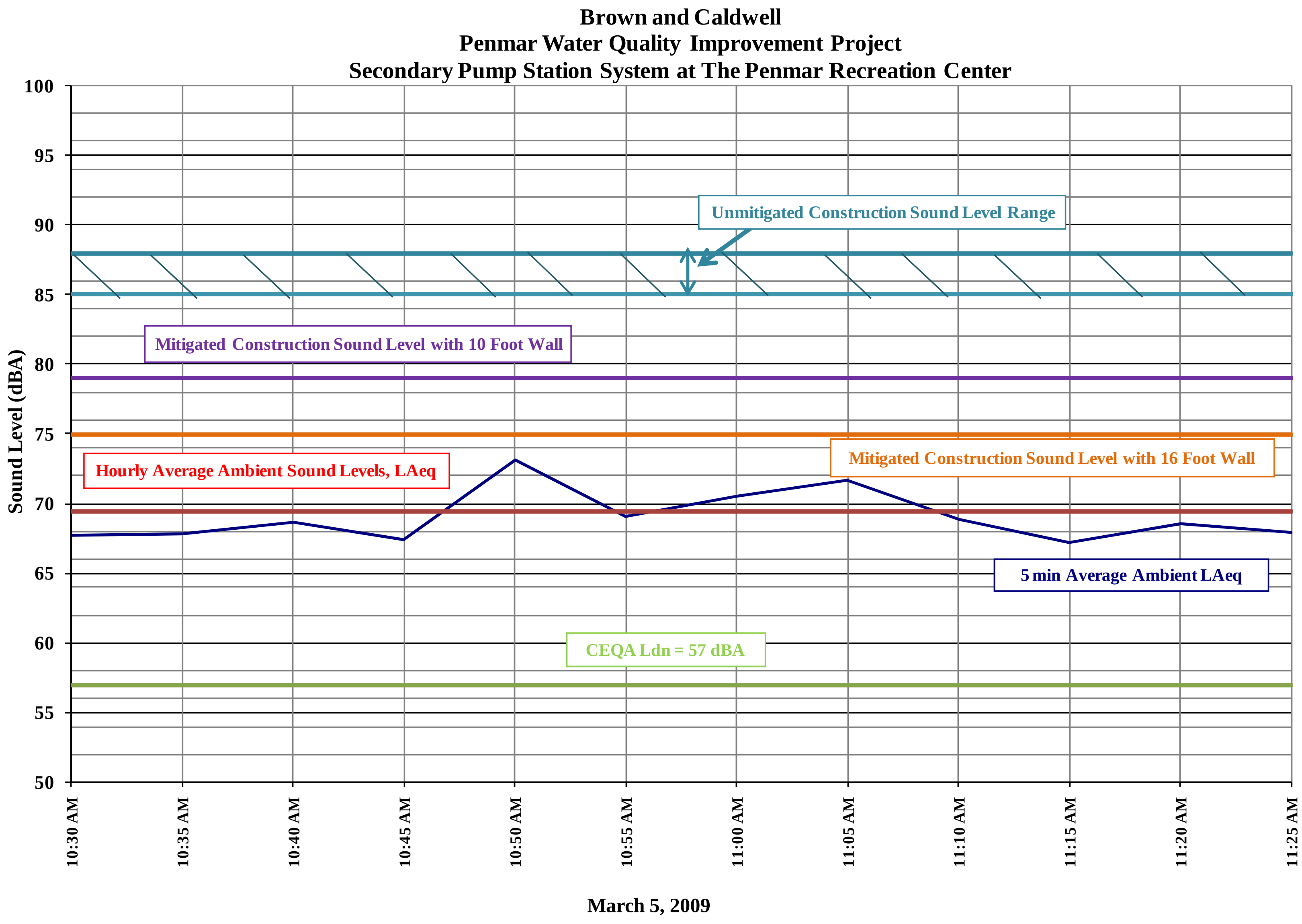
Attachment 5

Behrens and Associates, Inc.
Acoustics, Noise and Vibration Consultants

Brown and Caldwell
Penmar Water Quality Improvement Project
8 in, 12 in, 30 in Force Mains at The Penmar Recreation Center



Attachment 6



Brown and Caldwell
Penmar Water Quality Improvement Project
Secondary Pump Station System at The Penmar Recreation Center

Attachment 7

C- Minor Sanitary Sewer Upgrades

1- General Construction Description

The project also includes upgrade of approximately 650 feet of trunk sanitary sewer west of the Rose Avenue Storm Drain Diversion. The upgrade would occur to create sufficient additional hydraulic capacity on four sections of sewer pipe would be replaced with 21-inch diameter VCP as follows: 250 feet of 16-inch pipe on Oakwood Avenue between Millwood Avenue and Rialto Court; 145 feet of 16-inch pipe on Rialto Court south of Nowita Place; 180 feet of 16-inch pipe on Crescent Place (undeveloped "paper" street) between Rialto Court and Palms Boulevard; and 75 feet of 18-inch pipe on Abbot Kinney Boulevard at the intersection with Palms Boulevard.

2- Preconstruction Ambient Sound Conditions

To establish the current ambient conditions, one hour continuous ambient sound survey was completed on March 5, 2009 at the intersection of Oakwood Avenue and Palms Boulevard at 1:15 PM, on Crescent Place and Palms Boulevard at 1:05 PM, and the intersection of Palms Boulevard and Abbot Kinney Boulevard at 1:10 PM. The monitoring location shown in the aerial map included as Attachment 2. Measured hourly midday ambient sound levels at the intersection of Palms Boulevards and Oakwood Avenue, Palms Boulevard and Crescent Place, and Palms Boulevard and Abbot Kinney Boulevard were 60.7 dBA, 61.6 dBA, and 70.6 dBA respectively.

3- Construction Elements

List of the equipments to be used in the minor Sanitary Sewer Upgrades and the corresponding noise levels generated at distance are tabulated below.

Equipment	Noise Generated at Distance
Excavator	*85 dBA at 25 ft*
Rubber tire Backhoe/loader	*80 dBA at 10 ft*
Paving Machine	*89 dBA at 50 ft*
Dump Truck	*75 dBA at 10 ft*

4- Noise Impact Potential

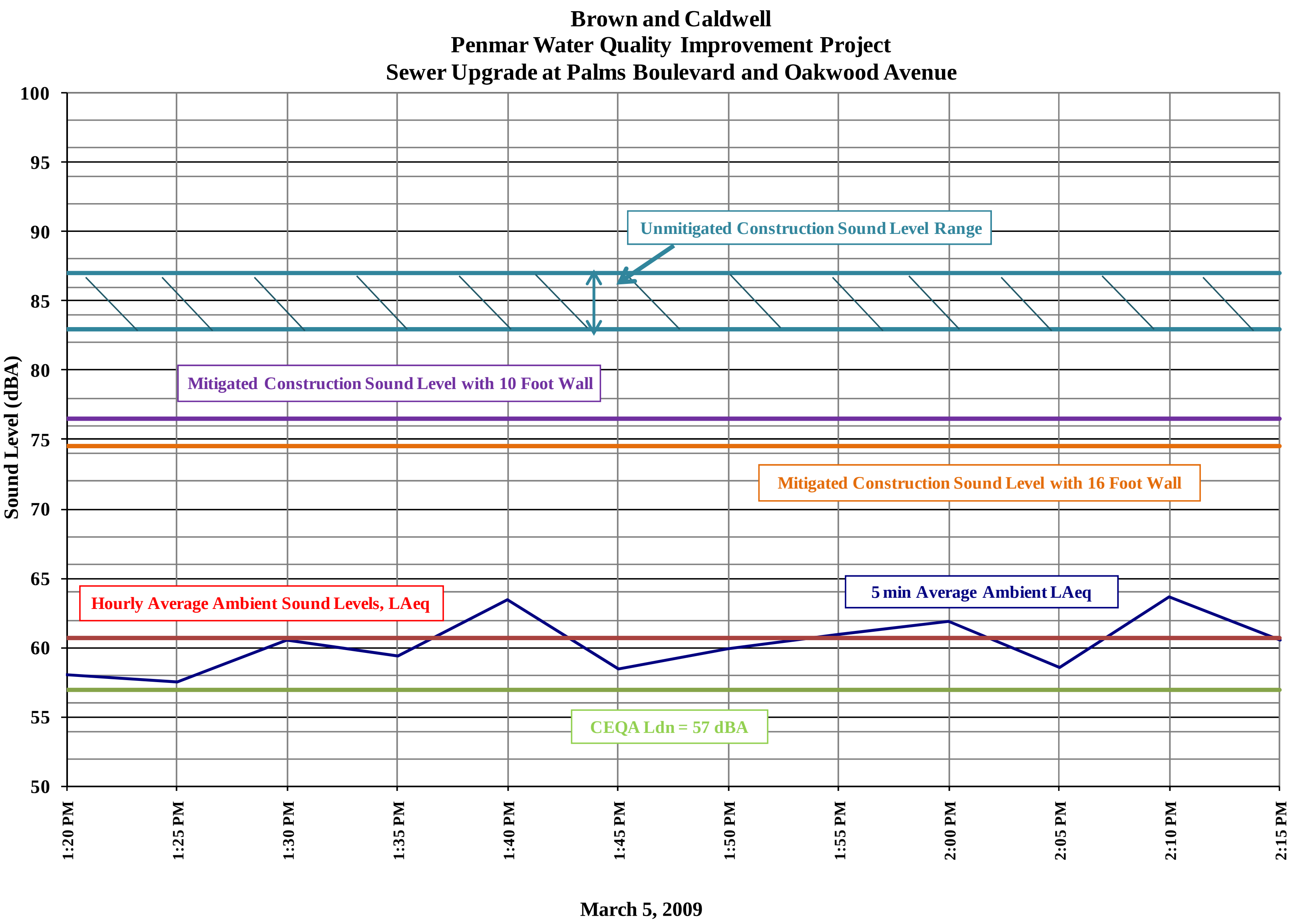
For the Sanitary Sewer Upgrades construction at the intersection of Palms Boulevards and Oakwood Avenue, Palms Boulevard and Crescent Place, and

Palms Boulevard and Abbot Kinney Boulevard the projected noise levels range from 83 dBA to 87 dBA at nearby residences.

5- Mitigation Potential

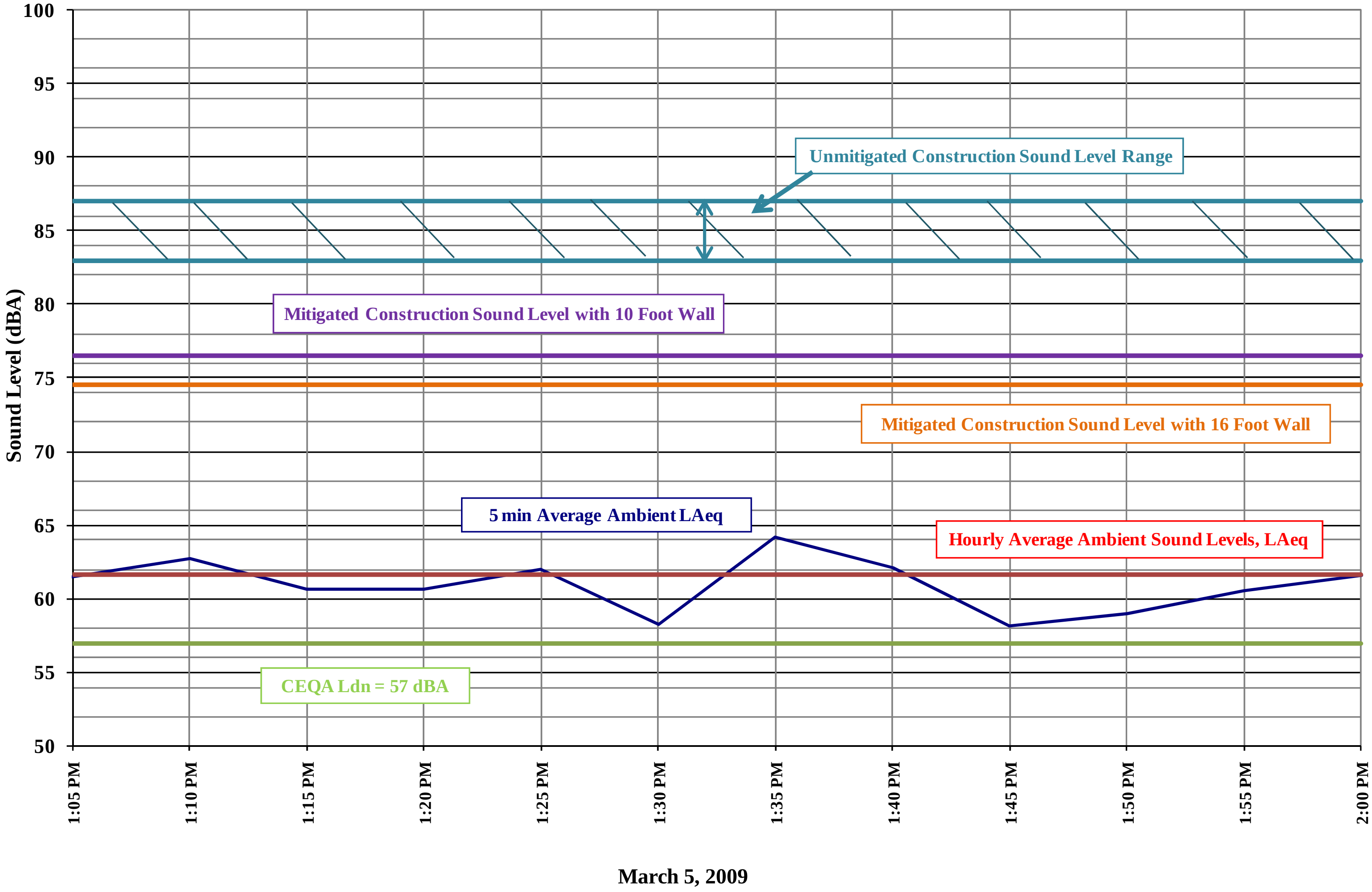
Based on the utilization of 10 foot high temporary construction sound walls positioned along the perimeter of the Minor Sanitary Sewer Upgrades work area, the predicted mitigated construction sound levels at all three sewer upgrades locations are anticipated to be 76.5 dBA at 50 feet. Based on the utilization of 16 foot high temporary construction sound walls positioned along the perimeter of the Minor Sanitary Sewer Upgrades, the predicted mitigated construction sound levels are anticipated to be 74.5 dBA at 50 feet levels at all three sewer upgrades locations.

Predicted unmitigated Minor Sanitary Sewer Upgrades construction noise levels at the intersection of Palms Boulevards and Oakwood Avenue, Palms Boulevard and Crescent Place, and Palms Boulevard and Abbot Kinney Boulevard are shown in the graph in Attachment 8, 9 and 10 respectively along with the 10 foot and 16 foot sound wall mitigated construction noise levels, five-minute and hourly average ambient sound levels and the CEQA limit.



Attachment 8

Brown and Caldwell
Penmar Water Quality Improvement Project
Sewer Upgrade at Palms Boulevard and Crescent Place

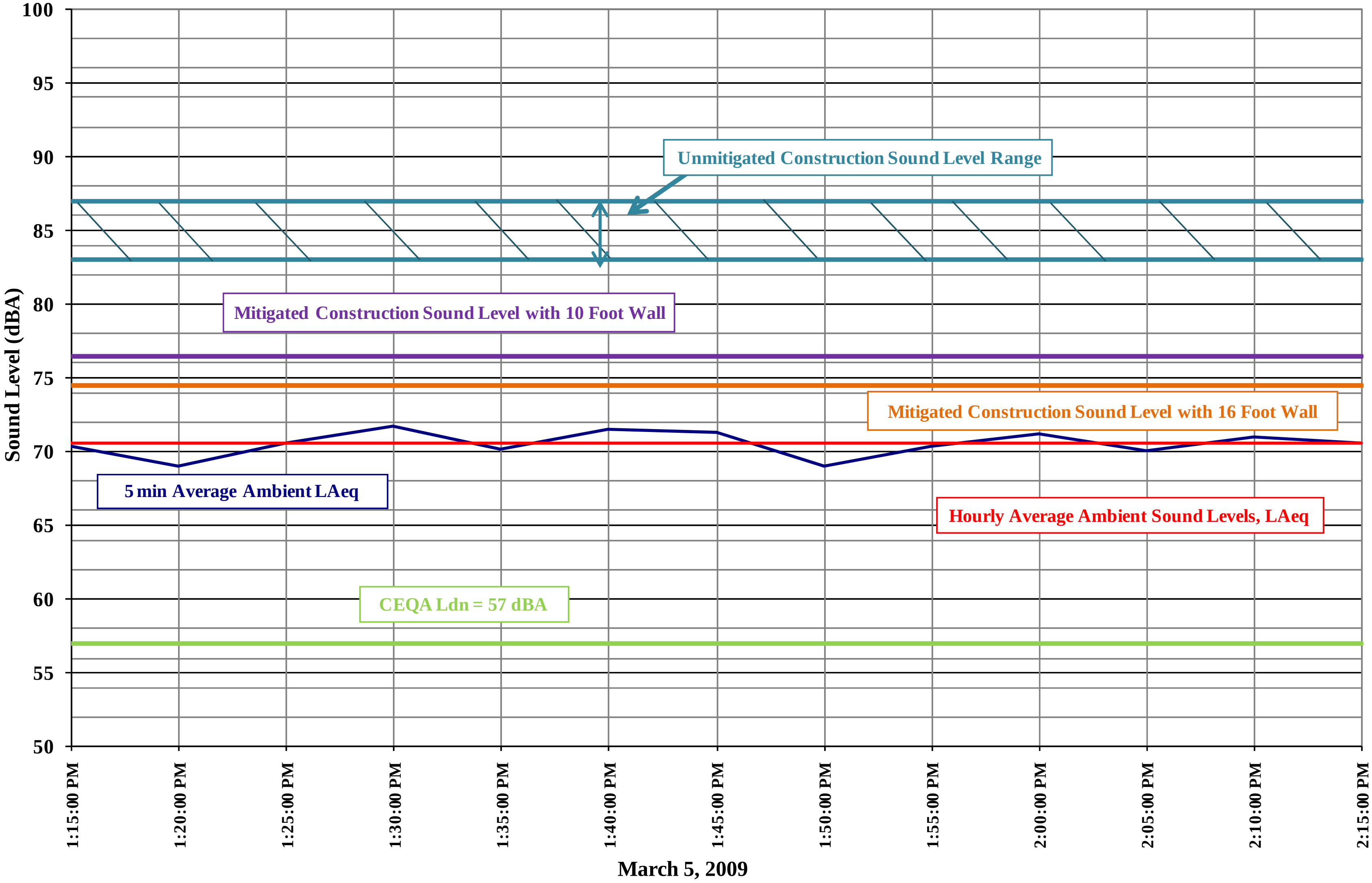


Attachment 9

Behrens and Associates, Inc.

Acoustics, Noise and Vibration Consultants

Brown and Caldwell
Penmar Water Quality Improvement Project
Sewer Upgrade at Palm Boulevard & Abbot Kinney Boulevard



Attachment 10