labeled container so that containers would be opened and clothing reused only in an asbestos work area.

b) Eye protection: Provide eye protection to be worn as required by applicable safety regulations. Wear eye protection at all times within the asbestos work areas during all phases of work: preparation, removal, clean-up, encapsulation, waste handling, and similar operations. When appropriate, based on regulatory mandates, a full facepiece respirator may be worn to satisfy this requirement. Equipment shall conform with ANSI Z87.1. Use of contact lenses with respiratory protection is prohibited.

c) Head Protection: Provide hard hats or other head protection as required by applicable safety regulations, conforming with ANSI Z89.1, Class A or B.

d) Foot Protection: Provide nonskid footwear to all abatement workers, conforming to ANSI Z41.1, Class 75.

B. Minimum Protective Procedures for Lead-Related Work:

1. Follow, at the minimum, dust control procedures as outlined under Cal/OSHA regulation 8 CCR 1532.1 and Article 1.4 above.

2. Respiratory Protection: Comply with Cal/OSHA Regulations included in 8 CCR Section 1532.1 and ANSI Standard Z88.2, "Practices for Respiratory Protection."

a) Use respirators approved by the National Institute for Occupational Safety and Health (NIOSH).

b) Provide respiratory protection to employees involved with lead-based paint demolition and/or abatement elements or as required for demolition work where employees may be occupationally exposed to lead at or exceeding the Action Level (AL) at no cost to the employees or MRCA.

c) Workers shall wear appropriate respiratory protection during lead hazards work, unless initial testing verifies that employee exposures are below the Action Level.

3. Site security to assure that no member of the public is able to gain access to regulated work areas. Maintain access and egress routes at all times.

4. Worker training, respiratory protection, medical examinations, and blood lead monitoring to meet applicable regulations.

5. Activity Class I work areas, as a minimum, with a 2-stage decontamination assembly, including an equipment and contiguous clean room with bucket wash-up facilities positioned as follows:

a) Equipment Room shall have lockers or labeled bags and containers for storing contaminated protective clothing and equipment.

b) Clean Room shall have lockers or containers for storing employee's street clothes and personal items. Clean Room shall also contain a suitable supply of

potable water to permit each employee to wash their hair, hands, forearms, face and neck.

6. Sufficient sets of protective full-body clothing for workers to be worn in designated work area and/or whenever a potential airborne lead hazard exists. Clothing shall include, but not be limited to, full-body coveralls, headgear, eye protection, and gloves. Disposable-type protective clothing, headgear and footwear is acceptable.

7. Full-Body Clothing: Workers shall wear hoods covering their hair in the designated lead hazard work areas at all times.

   a) Wearing of protective clothing, in lieu of street cloths, outside the work area is not permitted.

   b) Non-disposable-type protective clothing and footwear shall be left in the Wash Room decontamination assembly for disposal.

   c) The use of cloth coveralls following the prescribed laundry procedures as identified in 8 CCR, 1532.1 is acceptable.

8. Eye Protection: Eye protection, conforming to ANSI Z87.1 shall be worn at all times within the lead hazard areas.

9. Head Protection: Hard hats or other head protection as required by applicable safety regulations and conforming to ANSI Z89.1, Class A or B.

10. Foot Protection: Construction workers shall use non-skid footwear conforming to ANSI Z41.1, Class 75.

C. Site Protective Controls:

1. Protect against unnecessary disturbances or damages to sensitive finishes or furnishings that will remain within the facility.

2. Locate temporary scaffolding and containment barriers, as required, and proceed with the construction or demolition, allowing for continued operation of any adjacent occupied areas, as applicable.

3. Protect existing furnishings and building finishes from water, lead dusts, or chemical strippers.

4. Erect temporary protective covers over pedestrian walkways and at points of passage for persons or vehicles that are to remain operational during the lead hazard work.

5. Exterior lead hazard operations shall utilize mini-containments, drop cloths, wet methods, and HEPA vacuums as outlined in Cal/OSHA regulation 8 CCR Section 1532.1 and the HUD Guidelines, Chapter 8.

6. The MRCA may evaluate the lead dust concentrations outside the work area on adjoining finishes during the work progress by collecting wipe samples to evaluate the integrity of the containment and to detect dust contamination.

a) Evaluation will review possible contamination resulting from:

(1) Failure to adequately cordon off or contain work area dusts, clean-up debris, and use approved work practices, such as wet wiping and HEPA vacuuming.

(2) Failure or breaches in the work area isolation containment.

(3) Failure or rupture in the negative pressurization/HEPA filtration system.

(4) Incomplete decontamination of personnel or equipment removed from the work area(s).

b) Perimeter wipe samples may be collected adjacent to each work area and compared to the pre-construction background concentrations. The wipe sample will be analyzed by the MRCA by flame atomic absorption per NIST Standard 1578.

c) The Contractor shall re-clean adjoining occupied areas with surface concentrations exceeding background level or 800 micrograms/ft^2 during the construction activities. The Contractor shall bear the costs (including engineering, administrative, housekeeping, analytical and the labor and materials costs of the MRCA's consultant(s)) to return surface lead concentrations in elevated areas to acceptable levels.

3.3 ASBESTOS ABATEMENT PROCEDURES

A. Notifications:

1. Notify, in writing, the SCAQMD 10 working days prior to commencement of any non-emergency asbestos project involving more than 100 linear feet (LF) or more than 100 square feet (SF) of asbestos materials.

2. Notify Cal/OSHA 24 hours in advance of any disturbances of any amount of friable or non-friable asbestos-containing materials, or prior to performing asbestos-related work.

B. Procedures:

1. Vinyl Floor Tiles and Mastics:

a) Remove the flooring and mastics as indicated on the Contract Drawings using full isolation procedures, satisfying the requirements of Cal/OSHA Regulation 8 CCR 1529, Work Class II.

b) Set-up critical barriers and splash guards and establish negative pressurization.

c) Remove the tiles using wet methods to minimize breakage and airborne fiber releases.

d) Remove the mastic using a mastic remover.

e) HEPA vacuum the contained area following abatement for clearance; minimize use of encapsulant on substrates to be retiled.

f) Provide a full decontamination system with shower for areas exceeding 25 SF.

g) Dispose of tiles and mastic as Category 1 non-friable waste.

3. Sheet Vinyl ("Linoleum") Flooring and Mastic:

a) Remove the flooring and mastics as indicated on the Contract Drawings using full isolation procedures, satisfying the requirements of Cal/OSHA Regulation 8 CCR 1529, Work Class II.

b) Set-up critical barriers and splash guards and establish negative pressurization.

c) Remove the sheet vinyl backing using wet methods to minimize breakage and airborne fiber releases.

d) Remove the mastic using an approved mastic remover.

e) HEPA vacuum the contained area following abatement for clearance; minimize use of encapsulant on substrates to be retiled.

f) Provide a full decontamination system with shower for areas exceeding 25 SF.

g) Dispose of sheet vinyl backing and mastics as friable asbestos waste.

4. Transite® (Asbestos Cement) Materials:

a) Remove interior materials as noted on the Contract Drawings using full isolation procedures satisfying the requirements of Cal/OSHA Regulation 8 CCR 1529, Work Class II.

b) Set-up critical barriers and establish negative pressurization.

c) Remove the exterior materials by cordoning off the work area, installing polyethylene drop cloths on the ground and nearby objects, and removing the Transite® intact, where feasible.

d) Remove the materials using wet methods, minimizing breakage and airborne fiber releases.

e) Abate all adjoining mastics or caulking as Category 1 non-friable waste.

f) HEPA vacuum the contained area following abatement for clearance.

g) Provide a full decontamination system with shower for areas exceeding 25 SF.

h) Dispose of Transite® as Category 2 non-friable waste, double wrapping intact segments in 6-mil polyethylene sheeting.

5. Roofing:

   a) Remove the roofing and flashing materials as indicated by the Contract Drawings.

   b) Cordon off the work area, installing critical barriers at the skylights, roof-level windows, and other penetrations, as applicable.

   c) Remove all 3-dimensional materials using wet methods per Cal/OSHA's Regulation 8 CCR 1529, Work Class II.

   d) Set-up drop cloths on the ground and nearby objects to contain falling materials the ground or public access areas surrounding the work area.

   e) HEPA vacuum the roof following abatement.

   f) Provide a full decontamination system with shower for areas exceeding 100 SF.

   g) Dispose of roofing as Category 1 non-friable waste.

   h) Use of disposal chutes shall be pre-approved by the MRCA, per the Contractor's Hazardous Materials Management Plan (HMMP) submittal. Chutes shall be leak-tight, using negative air and HEPA equipment. The bottom of the chute shall be continuously manned during use, by a worker in full PPE.

6. Gypsum Board Walls and Ceilings and Joint Compounds:

   a) Remove composite materials using full isolation or mini-containment procedures within occupied building per Cal/OSHA Regulation 8 CCR 1529, Work Class II.

   b) Use wet methods and HEPA vacuums, setting up critical barriers for occupied areas.

   c) For building demolition projects, cordon off the area and use dust control methods to minimize airborne fiber releases.

   d) Provide full decontamination system with shower for areas exceeding 100 SF.

   e) HEPA vacuum the entire contained area prior to clearances for renovation projects.

   f) Dispose of composite materials as "trace" (<1%) asbestos waste, unless otherwise contaminated with other asbestos or hazardous wastes.

7. Asbestos Plasters and Sprayed-on Surfacing Materials:

   a) Remove ACM as indicated on the Contract Drawings using full isolation or mini-containment procedures per Cal/OSHA Regulation 8 CCR 1529, Work Class I, minimum.

   b) Use wet methods and HEPA vacuums.

c) Set-up critical barriers for quantities greater than 25 LF.

d) Seal HVAC systems and install drop cloths below and over nearby objects. Ventilate away from the workers, using a HEPA filtration system.

e) Provide a full decontamination system with shower for abatement quantities exceeding 25 LF or as otherwise directed by the Contract Documents.

f) HEPA vacuum the entire contained area prior to clearance air testing.

g) Dispose of ACM in double goosenecked bags properly labeled as friable asbestos waste.

8. Perimeter Window and Door Caulking:

a) Remove the caulking as indicated by the Contract Drawings.

b) Cordon off the work area, installing critical barriers at the windows, doors, and other penetrations, as applicable.

c) Remove ACM using wet methods per Cal/OSHA's Regulation 8 CCR 1529, Work Class II.

d) Set-up drop cloths on the ground and nearby objects to contain falling materials on the ground or public access areas surrounding the work area.

e) HEPA vacuum the sills and frames following abatement.

f) Provide a full decontamination system with shower for areas exceeding 100 SF.

g) Dispose of caulking as Category 1 non-friable waste.

9. "Trace" Asbestos Materials (Except Gypsum Wallboard and Joint Compounds):

a) Remove composite materials as indicated on the Contract Drawings using full isolation or mini-containment procedures within occupied building per Cal/OSHA Regulation 8 CCR 1529, Work Class II.

b) Use wet methods and HEPA vacuums, setting up critical barriers for occupied areas.

c) Set-up critical barriers for occupied areas.

d) For building demolition projects, cordon off the area and use dust control methods to minimize airborne fiber releases.

e) HEPA vacuum the entire contained area prior to clearances for renovation projects.

f) Dispose of composite materials as "trace" (<1%) asbestos waste, unless otherwise contaminated with other asbestos or hazardous wastes.

10. Contaminated Non-Asbestos Materials:

a) Remove contaminated non-ACM substrates or underlying ceiling tiles, etc.

b) Use wet methods and HEPA-filtered vacuums to decontaminate, where feasible. Allow inspection of the decontaminated materials by the MRCA or it's Environmental Consultant prior to removal from the work area.

c) Contaminated waste shall be disposed in double goosenecked bags or burrito-wrapped, as friable asbestos waste.

d) Minimize excess waste quantities, where feasible.

C. Special Techniques and Procedures

1. Isolate HVAC system(s) to prevent contamination and fiber dispersal to other areas of the building.

a) Openings to ducts, fans, louvers, and plenums shall be sealed with two layers of polyethylene sheeting prior to the start of removal.

b) Provide caulked, rigid panels at the discretion of the MRCA.

c) Repair any damage to ductwork, grilles, dampers, louvers, or HVAC equipment at the completion of the abatement work.

d) Secure systems and equipment using OSHA lock-out and tag-out procedures, as applicable.

2. Ensure that all electrical power terminating in the work area, including but not limited to outlets and lights are disconnected and cannot be reenergized during the course of the work.

a) Ensure that all power lines which transit the work area and are necessary for the continued operation of services in areas outside the work area are identified and protected adequately in order not to pose a hazard to workers during the course of work.

b) Provide temporary power and lighting, and ensure safe installation of temporary sources and equipment per applicable electrical code requirements, and provide safety lighting and ground fault interrupter circuits as power source of electrical equipment.

c) Secure systems and equipment using OSHA lock-out and tag-out procedures, as applicable.

3. Construct critical barriers and decontamination enclosure systems, as applicable. Erect polyethylene sheeting to protect walls, windows, flooring, and fixed equipment, as applicable.

4. Provide differential air pressure systems for each work area in accordance with Appendix J of the EPA's "Guidance for Controlling Asbestos-Containing Materials in Buildings," EPA 560/5-85-024.

   a) Establish negative pressurization within all Asbestos Work Class 1and 2 interior areas, exhausting air to the exterior, unless otherwise approved by the MRCA.

   b) Do not locate outlets near or adjacent to other building intake vents or louvers or at the entrances to the building.

   c) Do not exhaust air into the building's interior spaces or within 50 feet of the building's supply air intakes without on-site DOP testing of all NPUs to show a filter efficiency of 99.97 percent minimum.

   d) Provide a minimum work area differential air pressure of -0.025 inch w.g. and 4 air changes per hour at all times for Asbestos Work Class 1 areas or as otherwise designated by the Contract Documents.

5. Remove ACM employing full isolation, glovebag, and glovebag with mini-containment procedures as designated by material quantities and work class under Cal/OSHA regulation 8 CCR Section 1529.

   a) Glovebag cut-out methods may be used for systems scheduled for demolition as outlined in the Demolition Plans.

   b) Use wet cleaning methods, HEPA vacuuming, and proper work practices.

   c) Mini-containments may not be required for glovebag removal in unoccupied zones provided the bag is evacuated with a HEPA-filtered vacuum prior to the removal of the element being stripped or unless otherwise indicated in the Contract Documents. All areas requiring aggressive clearance air sampling will require mini-containments or full containments and pre-cleaning throughout the isolated area using HEPA vacuums and wet methods.

6. As applicable to abatement of surfacing materials and non-glovebag thermal system insulation removal projects or for other work completed within full isolation containments, remove visible accumulations of asbestos material, debris, and dust from within the work area and its decontamination enclosure systems. Clean all surfaces within the work area.

7. Where encapsulation is required, encapsulate following the MRCA's pre- encapsulation inspection.

8. Minimize encapsulating of sensitive abated areas or surfaces, such as vinyl floor from wood or concrete substrates, so as not to affect the adhesion of replacement materials.

9. After encapsulation:

   a) Remove the inner layer of polyethylene sheeting from the floor, walls, and other equipment.

   b) Dispose as asbestos waste, as applicable.

c) Leave all critical barriers with one layer of polyethylene sheeting.

10. After removing the final layer of polyethylene sheeting (as appropriate):

a) Final-clean all surfaces, including the inner surface of the outer layer of polyethylene that serves as a critical barrier, any subfloor trenches, and similar locations.

b) Allow adequate time for settlement of dust, then repeat final cleaning operation.

c) Clean and remove all materials and equipment within the work area, using the equipment decontamination enclosure system.

11. Exterior Asbestos Work Class II abatement operations shall utilize critical barriers, drop cloths, wet methods, and HEPA vacuums as outlined under Cal/OSHA regulation 8 CCR Section 1529.

D. Field Quality Control

1. Site Tests: Clearance Criteria

a) Clearance air samples using aggressive air sampling techniques shall be collected for all abatement zones to be subsequently re-occupied, unless otherwise designated in the Contract Documents.

b) Phase Contrast Microscopy (PCM) Clearances: Areas cleared by PCM shall show an airborne concentration of total fibers for each sample at or below 0.01 fibers per cubic centimeter (f/cc) using the NIOSH 7400 A counting rules. Any sample result exceeding 0.01 fibers/cc shall require re-cleaning of the work area and retesting. The minimum number of samples shall be determined by the MRCA, based on the quantity and types of materials removed, configuration, and sequencing of the work areas, and similar considerations.

c) When Transmission Electron Microscopy (TEM) clearances are required, as designated by the Contract Documents, analysis shall be by the method described in 40 CFR Part 763, Appendix A, Subpart E (AHERA), with an analysis turn-around time of 24 hours, unless otherwise designated by the MRCA.

d) The MRCA shall pay the costs of the final round of visual inspections, aggressive air sampling, and PCM and/or TEM analyses that will meet the Specifications. All rounds of visual inspections, aggressive air sampling, and PCM and/or TEM analyses that fail to meet the contract criteria shall be borne by the Contractor. For the purpose of this paragraph, visual inspection includes the area isolation inspection, pre-encapsulation inspection, and final area cleanup inspection.

E. Waste Disposal and Manifesting:

1. Packing, labeling, transporting, and disposing of asbestos materials shall comply with Cal/EPA regulations under 22 CCR, including completion of the Uniform Hazardous

Waste Manifest Form (DTSC 8022A, 7/92, and EPA 8700-22), and the requirements of Article 3.4G - Waste Disposal and Manifesting, of this Section.

3.4 LEAD ABATEMENT AND HAZARD CONTROL

A. Notifications: Cordon off active lead hazard and abatement zone(s) and post with warning signs at entries to regulated areas bearing the following information:

Warning
Lead Work Area
No Smoking or Eating
Authorized Personnel Only

B. Procedures:

1. Abatement of lead-based paints and presumed lead-based paints as defined by HUD and as regulated under the California Department of Public Health's Title 17, California Code of Regulations (CCR), Division 1, Chapter 8, "Accreditation, Certification, and Work Practices in Lead-Related Construction," Article 1, Sections 35001 et al, and Article 16, Sections 36000 and 36100 shall:

a) Include posting and delivery of notifications prior to conducting abatement, including:

(1) Completing CDPH Form 8551 (12/97) and posting all entrances to the structure at least 5 days prior to conducting abatement. The posted form shall not be removed until abatement is completed and a clearance inspection has been conducted.

(2) Deliver of the completed CDPH Form 8551 to the Department of Public Health, c/o Notification at the Childhood Lead Prevention Program Branch, 850 Marina Bay Parkway, Building P, 3rd Floor, Richmond, CA 94804-6403.

(3) Retain records of notification for at least 3 years.

b) Be conducted only by a Certified Lead Supervisor or a Certified Lead Worker where abatement is designed to permanently eliminate or reduce lead hazards for public (non-industrial) buildings or to be effective for a period exceeding 20 years. The Certified Lead Supervisor shall be on-site during all work site preparation and during the post-abatement clean-up of work areas. At all other times when abatement is conducted, the Certified Lead Supervisor shall be on-site or available by telephone, pager or answering service, and able to be present at the work area in no more than 2 hours.

c) Be conducted using containment in a manner such as not to contaminate non-work areas with lead dust, soil, or paint debris.

d) Be conducted in accordance with procedures specified in the HUD Guidelines, Chapters 11 and 12.

2. Loose and Peeling Paint:

   a) Scrape loose and peeling paints using dust control procedures and procedures as outlined under Cal/OSHA Regulation 8 CCR 1532.1.

   b) Characterize the waste for possible disposal as a hazardous waste.

3. Lead Paint Abatement:

   a) Remove paints on structural steel components scheduled for welding or torching using a chemical stripper, needle gun or other approved methods as outlined in the approved Contractor's Hazardous Materials Management Plan (HMMP). Note that spot abatement of structural steel components does not eliminate the possible need for respiratory protection and hazard controls by the welder or torcher under 8 CCR 1529 due to unabated residues or paints on back-to-back components, which can not be accessed for abatement.

   b) Use drop cloths, polyethylene barriers, Hudson and airless sprayers and other methods as required for dust control.

   c) Characterize and dispose of paints, rags, etc., separately for possible disposal as a hazardous waste.

4. Lead Dust Clean-up:

   a) Clean-up background or construction-related dusts from demolition of lead-coated elements or other contaminant sources using wet methods and HEPA-filtered vacuums.

   b) Do not dry sweep.

5. Lead Hazard Control:

   a) Scrape loose and peeling paints and use dust controls for demolition of lead-coated architectural and structural elements as indicated by the Demolition Plans, following minimum procedures as outlined under Cal/OSHA Regulation 8 CCR 1532.1.

   b) Remove and dispose of intact lead-coated architectural and structural elements as non-hazardous waste.

   c) HEPA vacuum residual debris and wet wipe affected substrates as required for clearance inspection or testing.

C. Special Procedures and Techniques:

1. Cordon off the proximity (within approximately 20 feet) of Activity Class I work areas using construction tape, polyethylene dust barriers, or other appropriate means.

   a) Persons entering the regulated "cordoned" work area shall wear appropriate respiratory protection and full body coveralls.

b) Affix appropriate warning signs at the entry and approaches to the regulated area(s).

2. Lockout electrical and HVAC equipment within the regulated area as necessary.

3. Protect floors, landscaping, and other items with polyethylene drop cloths or other acceptable means to prevent contamination or damage to other building surfaces and finishes.

4. Apply chemical strippers and scrape following the manufacturer's recommended procedures. After scraping, remove remaining loose paint with a HEPA vacuum.

5. Maintain work area surfaces as free as practicable from accumulated dust or debris. Clean equipment, tools and containment structures within regulated areas, at a minimum, with HEPA vacuums or wet methods.

6. Conduct operations to prevent injury to adjoining facilities, persons, motor vehicles, and other items, as applicable.

   a) Prevent chemical cleaning agents from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other items and surfaces that could be injured or damaged by such contact.

   b) Do not spray or scrape outdoors during winds of sufficient force to spread cleaning agents to unprotected surfaces.

7. For areas where removal of loose and peeling paints only are required, the Contractor shall ensure that the paint that remains on walls, ceilings, eaves, and other surfaces in areas of active work, as applicable, shall be adhered to the substrate sufficiently to support eventual repainting. Paints that peel or loosen during wetting will become part of the scope of work scheduled for removal and disposal.

8. Where complete removal of lead coats is required, finished work shall show no signs of stains, scratches, streaks, or runs of discoloration from use of cleaners.

   a) Leave substrate surfaces neat and clean, including removal of primers in addition to finish coats. Surfaces shall be uniformly cleaned.

   b) Neutralize substrate using a mild detergent wash.

9. Avoid direct welding or cutting on surfaces containing lead in concentrations greater than 0.64 micrograms/cm^2 by mechanically or chemically removing the coating to a distance of at least six inches from the point at which heat is applied.

   a) If surface coatings are not removed prior to welding or cutting, provide local exhaust ventilation to capture the aerosolized lead, using HEPA filters.

   b) If surface coatings are not removed prior to torching or welding, provide upgraded welder's respiratory protection in compliance with Cal/OSHA regulation 8 CCR 1532.1.

10. Where mechanical removal of surface coatings constitutes a Level II activity, provide power tools, to the extent feasible, with local HEPA exhaust or dust collector systems to capture the aerosolized lead.

D. Demolition Procedures:

1. Removal of obstructing materials as needed for access to hazardous materials.

2. Removal of obstructing materials where hazardous materials contamination is known to exist.

3. Removal of obstructing materials where hazardous materials exposure is likely to result.

4. Follow, at the minimum, the protective procedures as outlined in Cal/OSHA regulation 8 CCR 1532.1.

5. Protection of Visitors and Other Site Personnel: Cordon off the abatement area(s) with appropriate signs, and provide temporary tunneling or scaffolding, as applicable.

6. Respiratory Protection: Comply with Cal/OSHA Regulation 8 CCR Section 1529 and ANSI Standard Z88.2, "Practices for Respiratory Protection." Use respirators approved by the National Institute for Occupational Safety and Health (NIOSH).

E. Prohibited Activities:

1. Workers shall decontaminate themselves and appropriate equipment prior to eating, drinking and smoking.

2. Clean debris and surfaces with HEPA-filtered vacuums or wet methods.

3. Shoveling, wet sweeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and are found to be ineffective.

F. Field Quality Control

1. Site Test: Monitoring and Clearance by the MRCA:

a) During lead hazard-related work, such as demolition, refinishing, or torching and welding activities, the MRCA may collect air samples for analysis by flame atomic absorption.

b) Air sampling results in excess of the Cal/OSHA "Project Action Level" of 30 micrograms per cubic meter within the construction zone may require isolation of the work area, upgrades in the required respiratory protection, amendment of work procedures, and/or clean-up of the affected area.

c) Air sampling results in excess of the EPA's National Ambient Air Quality Standard (NAAQS) of 1.5 micrograms/m^3 at the site's property line or at adjoining occupied non-construction areas may require isolation of the work area, amendment of work procedures, and clean-up of the affected area.

d) Re-sampling of the contaminated areas and handling, shipping, and analysis charges (including the MRCA's time and expenses) for additional sampling required to show background levels below these lead standards shall be borne by the Contractor.

2. Clearance Criteria -- Lead Abatement Zones:

a) The lead abatement zone shall remain secured until cleared by the MRCA.

b) Visual Inspection:

(1) When the Contractor considers the work or a designated portion of the work to be complete, the Contractor shall notify the Project Manager that the work is ready for abatement zone clearance inspection.

(2) Within a reasonable time after receiving notification from the Contractor, the MRCA will perform a visual inspection of the work area.

(3) Evidence of lead contamination identified during the inspection will necessitate further cleaning as specified herein.

c) Wipe Sample Clearance Criteria: The Contractor shall re-clean the area if surface concentrations exceed the following "EPA Clearance Dust Standards":

40 micrograms/ft^2	for floors
250 micrograms/ft^2	for interior window sills and stools
800 micrograms/ft^2	for exterior window sills and interior window wells
800 micrograms/ft^2	for exterior concrete or other rough surfaces
800 micrograms/ft^2	for attic and non-public spaces

d) Air Sample Clearance: Where lead hazard abatement occurs concurrent with asbestos abatement activities, the area may be cleared by aggressive air sampling, where airborne lead concentrations following the final visual inspection shall not exceed the EPA's NAAQS standard of 1.5 micrograms/m^3 as analyzed by NIOSH method 7082 (flame atomic absorption) or 7105 (graphite furnace atomic absorption).

e) Re-sampling of the contaminated areas and handling, shipping, analysis charges (including the MRCA's time and expenses) for additional sampling required to show background levels below these lead standards shall be borne by the Contractor.

G. Waste Disposal and Manifesting:

1. Comply with current federal, State and local regulations concerning the waste handling, containerization, transportation, and disposal of lead-based paint or lead-contaminated materials, and Article 3.10 of this Section.

2. Loose debris and scraped materials shall be treated as hazardous waste, unless otherwise approved by the MRCA. Construction waste coated with intact LBP may be disposed of

as construction debris in accordance with the Cal/EPA requirements (pending characterization of the waste).

3. Laboratory costs associated with analyses required for disposal, if required, shall be at the Contractor's expense.

4. Segregate, containerize, and characterize construction debris including rags, protective coveralls, polyethylene sheeting, and other consumable items. Waste shall be packaged in accordance with the applicable U. S. Department of Transportation regulations included in 49 CFR Parts 173, 178 and 179.

5. Profile waste with an approved landfill or incinerator by means of standard digestion and extraction tests (TCLP, WET, and SW846), as appropriate. Use the site's EPA Generator I.D. number on the "Waste Manifest." See additional requirements specified below in Article titled "Manifesting."

6. If debris is to be recycled, provide a bill of lading and a memorandum from the recycler acknowledging that lead may be present and work activities and disposal will comply with applicable regulations. Submit in accordance with procedures of Section 01300 - Submittals.

3.5 PCB BALLAST REMOVAL

A. Contractor shall ensure that PCB-containing lighting ballasts, are handled, containerized, secured, labeled, manifested, transported, and either reused, disposed, incinerated or recycled, as appropriate.

B. Generators of PCB ballasts who transport off-site no more than two 55-gallon drums per transportation vehicle shall be exempt from the standards set forth in Article 1, Article 2 and Article 4 of 22 CCR, Chapter 12 and 13 as follows:

1. Generators of PCB-containing light ballasts shall be exempt from filing an "Extremely Hazardous Waste Disposal Permit" as required by §67430.1.

2. A transporter of twelve or more non-leaking PCB-containing fluorescent light ballasts shall be exempt from provisions under 22 CCR, Chapter 13 provided the following conditions are met:

a) The transporter shall use a shipping paper that contains the information required pursuant to Title 49, Code of Federal Regulations, Part 172, Subpart C to document the transportation of the ballasts. The shipping paper or manifest shall accompany the shipments, with a legible copy maintained by the transporter for a minimum period of three years.

b) The total number of PCB-containing light ballasts being transported shall not exceed two 55 gallon drums of non-leaking ballasts per load and shall not contain any other hazardous wastes.

c) The transporting container shall meet applicable federal and state regulations.

d) Any discharges or spills of hazardous waste consisting of PCB-containing fluorescent light ballasts shall be reported and cleaned up as required in 22 CCR, Chapter 13, Article 3.

3. Transfer of hazardous waste consisting of PCB-containing light ballasts from one container to another shall not be subject to the requirements of 22 CCR provided the containers hold no other hazardous wastes.

C. Waste Characterization: The U. S. Environmental Protection Agency (EPA; 40 CFR 761.60 & 761.65) and the California Department of Public Health (CDPH; 22 CCR Section 66508) consider PCBs from ballasts as a hazardous waste. Disposal of the PCB-containing ballasts shall be in accordance with §66268.110 via incineration unless otherwise approved by the MRCA.

D. Pack ballasts marked as "containing PCB" or ballasts not specifically marked as "non-PCB" or "PCB free" as hazardous waste. Workers removing ballasts from fixtures shall wear protective clothing and nitrile or neoprene gloves. Those ballasts showing signs of overheating or leakage will require wipe-down of the fixture with clean paper towels after the unit has cooled to room temperature. This step shall be followed with additional wiping with an organic solvent, such as mineral spirits or isopropyl alcohol. The leaking ballasts and rags shall be placed in a plastic bag, tied off, and secured. Remaining PCB ballasts and bagged waste shall be placed in steel drums, sealed, labeled, and transported to an approved incinerator following required manifest procedures. Absorbent material, such as kitty litter, shall be used as a cushion and absorbent within the drums. Drum loading shall not exceed the incinerator's requirements (typically 350 to 500 pound limit per drum).

3.6 MERCURY-CONTAINING LAMP REMOVAL

A. Spent fluorescent and mercury vapor lamps contain mercury, which is considered a hazardous waste by the California Department of Public Health (CDPH; 22 CCR Section 66699(b)).

B. Ship lamps to a commercial recycler, (e.g., Mercury Technologies) where they are crushed and the mercury is reclaimed. The recycler shall comply with DOT requirements for manifests, etc., with evidence of proper disposal provided to the MRCA, including a log of shipment dates and quantities.

C. Quantities under 25 lamps per day may be disposed of as non-hazardous waste.

3.7 REMOVAL OF CONTAMINATED SOILS

A. Training Requirements:

1. Soils exceeding hazardous waste criteria (federal, state, and local) have been encountered at various locations throughout Los Angeles. Therefore, as part of this Contract, the Contractor shall provide a minimum of two (2) properly trained individual personnel to handle, excavate, and dispose of contaminated soils and contaminated and hazardous waste. Training shall include 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) Training and the associated 8-hour annual refresher in accordance with 29 CFR 1910.120, 29 CFR 1910.134, 8 CCR 5144, and 8 CCR 5192.

2. This training shall be required of all personnel who come in contact with or operate equipment that handles surface and subsurface contaminated materials when performing

their work. The Contractor shall comply with local requirements addressing hazardous materials.

3. No time extensions will be given for the Contractor's inability to supply the properly trained individuals for the Project. Therefore, at Notice to Proceed (NTP) the Contractor shall provide the Project Manager with written and valid certification of the above training for personnel on the job.

4. This training shall be considered as incidental work. The cost for having trained workers working in and around, excavating, and handling serpentine, contaminated, and hazardous soils shall be considered as incidental work.

B. Contaminated/Hazardous Soils:

1. All reference to hazardous waste and/or hazardous material and/or hazardous soil incorporate definitions of "hazardous pollutant," "hazardous contaminant," "hazardous material," "hazardous substance," "hazardous waste," and "toxic substance" applicable in accordance with all federal, state, regional, and local statutes, laws, regulations, and policies.

2. The Contractor is specifically alerted to and shall familiarize themselves with the liability statutes of:

   a) the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, found in 42 USC, Section 9601, *et seq.*, and

   b) the Superfund Amendments and Reauthorization Act (HSAA) of 1981, found in California Health and Safety Code, Section 25300, *et seq.*

3. If the Contractor encounters material in trenches or other excavation, reasoned or believed to be contaminated and/or hazardous wastes, the Contractor's Hazardous Materials Supervisor shall immediately notify the MRCA Project Manager.

4. If authorized by the Project Manager, excavation in the immediate area of the suspected hazardous material shall be suspended until the Project Manager authorizes resumption. If such suspension delays the current controlling operation, the Contractor will be granted an extension of time as provided in Section 107.10 and cost reimbursement in accordance with Section 112.05 of the General Conditions.

5. The MRCA reserves the right to use other forces for exploratory work to identify and determine the extent of the contaminated and/or hazardous waste and for removing such material from the site.

6. The Contractor shall arrange for the testing, hauling, and disposal of the contaminated/hazardous excavated soils. The Contractor shall be familiar with the acceptance and analytical testing criteria, methodology of the landfills/disposal facilities available and of the corresponding disposal fees and taxes. All such disposal activities shall require the approval of the Project Manager prior to actual testing, loading, and disposal.

7. All contaminated material and hazardous material shall be placed directly into the transport vehicle for transport to the disposal facility. Contaminated material and

hazardous material shall be transported separately, with no mixing of the different types of material.

8. The Contractor shall use only workers with the above-described training to work in and around, excavate, and handle serpentine-contaminated and/or hazardous soils.

C. Analytical Testing:

1. Analytical testing shall be performed by a California State-accredited laboratory (or an out-of-state accredited laboratory, if appropriate). The selected laboratory shall guarantee a maximum of ten (10) days' standard turnaround time at standard rates for results of analytical testing. All original copies of testing results shall be forwarded to the Project Manager. Faxed copies of results are acceptable as an interim step.

2. The Contractor shall be responsible for all necessary sample collections, laboratory coordination, and analytical testing done at the construction site. The testing criteria for each sample shall be set by the Project Manager at the time the sampling shall be based on the requirements of the designated landfills/disposal facilities. The Project Manager shall compare the analytical results with the acceptance criteria of the Contractor's designated landfills/disposal facilities.

3. The Contractor shall be responsible for forwarding the samples to the accredited laboratory. The Contractor shall furnish all labor, materials, equipment, sampling bottles, chain-of-custody forms, preservatives, shipping containers, and incidentals required to properly sample and transport the soil samples to an accredited laboratory.

4. The furnishing of all labor, materials, and equipment for sample collection, handling, and delivery to the testing laboratory; soil and groundwater laboratory analysis, and reporting of such testing and analysis will be paid as Incidental Work. Only laboratory analyses for soil and serpentine will be paid under the Force Account Cash Allowance.

D. Storage of Soils: For storage of excavated soil along the Project alignment, the following conditions shall apply:

1. The volume of the soil stockpile will be limited at the discretion of the Project Manager.

2. The location for soil storage shall be determined by the Project Manager.

3. The Project Manager retains the right to suspend the use of temporary stockpiling at any time. In such an event, the Contractor is directed to dispose of the stockpile within 48 hours.

4. All exposed stockpiles shall be kept wet using amended water. Dust control requirements shall be strictly enforced.

5. All stockpiles being stored overnight shall be placed on and shall be covered with 10-mil HDPE plastic sheets weighted down securely using tires and chains.

6. After a stockpile has been removed, the Contractor shall wet-sweep the area to remove any residual dirt.

7. All costs associated with temporary stockpiling shall be borne by the Contractor. No additional payment shall be made therefor. Such related costs include, but are not limited to, dust control measures, wet sweeping, covering of soils, multiple handling, multiple staging, work re-sequencing or rescheduling, time associated owing to duration of storage, and other MRCA requirements.

E. Contractor Responsibility for Handling, Transportation, and Disposal of All Soils and Serpentine:

1. The Contractor is responsible for the handling, transportation, and disposal of all excavated soils (including serpentine) meeting requirements of Class I, II, and III landfill or out-of-state landfill.

2. Excavated materials (i.e., bay mud, asphalt, concrete, wet material/slurry, wooden and metal debris, and other debris) shall be separated from the contaminated/hazardous soils and properly disposed by the Contractor.

F. Documentation of All Soils Disposed by the Contractor: The Contractor shall provide the Project Manager with the following documentation and information:

1. Name, address, and phone number of landfill; type of landfill; volume/weight of soils transported; date of transport; original location of excavated soils; and other requested information.

2. A copy of each bill of lading, certified weight ticket, and other indication of the weight of the shipment, which has been received at the disposal facility, to the Project Manager so that payment per bid item can be made, based on weight of the shipment.

3. Any other pertinent information.

4. The Contractor shall inform the MRCA, in writing, and obtain MRCA approval prior to any sale, supply, or offer to sell any excavated material. The Contractor in such a case, at its expense, shall perform any and all engineering and chemical testing as required by the MRCA and by federal, state, and local statutes, regulations, and policy.

5. All contaminated excavated material and unrestricted material shall be hauled off the site, using a bill of lading approved by the MRCA, to an approved treatment/disposal facility in accordance with all applicable federal, state, and local regulations.

6. For all contaminated excavated material and unrestricted material, the Contractor shall prepare a bill of lading for each shipment of material from the site. The bill of lading shall describe the contents of each truck carrying materials to the waste disposal site, including the address of the ultimate disposal site, the weight or yardage of the waste materials (as applicable), and an emergency phone number. The hauler shall sign and date the bill of lading, indicating that they have accepted the load described in the manifest on that particular day. The MRCA will sign the bill of lading and keep the appropriate number of copies and give the remaining copies to the hauler. Copies of bills of lading accepted by the treatment/disposal sites shall be provided to the Project Manager.

G. Backfill Material:

1. The Contractor shall maximize the use of any excavated backfill material. Soils removed from the construction excavation (except for contaminated and/or hazardous soils, and the clayey soils) may be used for backfill material, provided that it meets the requirements of LADPW Standard and as approved by the Project Manager.

2. Imported material for backfill shall meet the requirements of the LADPW.

H. Specification for Haulers: The Contractor shall ensure that his/her drivers, as well as the subcontractor drivers, have in their possession during the hauling of material and soil all applicable California State and local vehicle insurance requirements, valid driver's license, and vehicle registration and/or licensing. The Contractor shall be responsible for informing all drivers of haul vehicles about:

1. The nature of the haul material.

2. Any recommended routes.

3. Applicable city street excavation regulations and requirements and State of California, Department of Transportation (Caltrans) codes, regulations, and requirements.

4. The MRCA's requirement for proper handling and transportation of the soil.

I. Requirements for Proper Handling and Transportation of Soils:

1. The Contractor shall separate the excavated materials (i.e., bay mud, asphalt, concrete, wooden and metal debris, and other debris from other soils) and shall properly dispose of these materials.

2. The Contractor shall be responsible for the excavation and handling of contaminated and hazardous wastes.

3. Haul trucks carrying soil shall be loaded so that the soil does not extend above the walls of the truck bed.

4. The soil loads shall be tightly covered so as to prevent soils from spilling over the sides and backs of the haul trucks. In addition, any excavated serpentine soil shall be kept wet and covered.

J. Transportation of Hazardous Material/Waste: In the event that the hazardous waste is encountered and a Change Order is issued to the Contractor to handle and transport the hazardous waste, then the Contractor shall adhere to the following requirements:

1. Scope of Work:

a) The Contractor shall furnish all labor, materials, equipment, and incidentals required to transport those materials identified as hazardous waste for the purpose of disposal.

b) The Contractor shall comply with all the applicable regulatory requirements listed as well as other applicable federal (including DOT - HM - 181 in

accordance with 49 CFR Part 172), state, or local laws, codes, and ordinances that govern or regulate hazardous waste.

c) The Contractor shall obtain all the permits required and furnish all labor, materials, equipment, and incidentals required and provide surface cleanup, spillage, spillage, and ultimate disposal of contaminated materials found within the Project boundaries.

2. Hazardous Waste Manifest:

a) All excavated materials classified as hazardous waste shall be hauled off the site by the Contractor, using a licensed hazardous waste hauler and the uniform hazardous waste manifest form (DTSC Form 8022A and/or EPA Form 8700-22), to an approved waste disposal facility in accordance with all applicable federal, state, and local regulations.

b) The Contractor shall prepare the hazardous waste manifest for each shipment of hazardous wastes from the site.

c) The licensed hauler shall carry a hazardous waste manifest (shipping document) with each truckload.

d) The manifest shall describe the contents of each truck carrying materials to the waste disposal site, including, as applicable, the weight of the waste materials. The licensed hauler shall also sign and date the manifest, indicating that they have accepted the load described in the manifest on that particular day.

e) The Project Manager will sign the manifest and keep the Generator's copy (yellow) and the DTSC copy (blue) and give the remaining copies to the licensed hauler. Weight and not volume shall be used to measure waste quantities for manifest purposes.

f) The Project Manager will provide a hazardous waste generator identification number for use on the manifest while the Contractor shall provide the State Transporter's I.D. and Phone Number. Should any hazardous waste manifest not be returned within thirty-five (35) days of shipment, the Contractor shall initiate follow-up and shall document its follow-up effort, in writing, with an Exception Report in accordance with 40 CFR 262.42 and/or 22 CCR 66262.42 and provide a copy to the Project Manager.

g) A copy of the completed hazardous waste manifest shall be provided to the Project Manager indicating that each waste shipment has been received at the waste treatment or disposal facility within two (2) days of their return to the Contractor.

3. Preparation for Shipment: Marking, labeling, placarding, packaging, CAL-EPA registration, and manifesting wastes prior to transport shall be in accordance with all regulations and shall be the responsibility of the Contractor.

4. Transportation: Transportation of hazardous waste shall be carried out by a licensed hauler in accordance with the regulations. The Contractor shall be responsible for clean-up of any hazardous waste discharge/spill from this Project that occurs during

transportation. The Contractor shall also follow the applicable regulations under 40 CFR Part 263 and 22 CCR Section 66263, "Standards Applicable to Transporters of Hazardous Waste," including licensing, manifest system, recordkeeping, and discharges.

K. Weighing of Excavated Material: The Contractor shall provide a weight measurement of all excavated material produced, which shall correlate the measurement to either the vehicle's bill of lading number or the hazardous waste manifest number. The information shall show the date of loading, net weight of soil loaded to the appropriate vehicle, and an identification of the vehicle that has been loaded. All such information shall be given to the Project Manager in order to reconcile the Contractor's charges for hauling and disposal of contaminated excavated soils and bay mud.

L. Submittals: At the time of the Notice to Proceed to the Contractor, provide the following:

1. Proof of valid training records.

2. A list of Class I, II, and III landfills and/or disposal facilities and brokers that the Contractor proposes to use.

3. The name and rates of the accredited laboratory.

M. Payment:

1. The Contractor shall include a cash allowance of $50,000 (described below) as a stipulated force account bid amount in the Schedule of Bid Prices in the Proposal. This amount will be paid to the Contractor for work directed by the Project Manager on a force account basis. The General Conditions regarding compensation do not apply to work not directed by the Project Manager. No mark-ups or profit shall be paid to the Contractor on the unused portion of the allowance. In the event that the quantities increase or decrease for all excavated materials related to the cash allowance, Section 101.07 of the General Conditions shall not apply.

2. The cash allowance shall be used to provide services as requested by the Project Manager. Work described as incidental work in this Section and work already shown elsewhere in the Contract Documents shall not be part of this cash allowance. The unused portion of the cash allowance shall be credited to the MRCA.

3. The following costs of items shall be paid under this bid item plus any contaminated/hazardous waste miscellaneous work as directed by the Project Manager, except where indicated:

   a) Analytical testing of soil and groundwater.

   b) Any additional mitigation measures beyond the incidental work, as determined by the Project Manager.

   c) Any other work related to contaminated/hazardous waste, as directed by the Project Manager, that is not covered by the original Contract.

   d) Hauling and disposal of contaminated/hazardous waste to the appropriate landfill site. The Contractor shall be responsible for verifying the availability of various landfill sites to accept the different types of contaminated and hazardous

materials/waste. Payment of different soil classes shall be paid as separate items from the cash allowance.

e) Disposal of additional material resulting from the Contractor's option to slope the excavations in lieu of shoring at locations where this is possible and has been approved by the Project Manager or any other excavation operations outside structure excavation pay limits shall be at the Contractor's expense. This resultant material shall be treated as either contaminated or hazardous material if the test results for the location indicate that the material being excavated is contaminated or hazardous.

f) The cost of having trained workers handling and working in and around the excavation; excavating and handling non-hazardous soil, contaminated soil, and hazardous soils by trained workers; performing dust control procedures (misting, wet sweeping of streets); implementing and preparation of the Contractor's Safety Program (i.e., clean-up areas, respirators, medical surveillance, personal protective equipment and clothing, HDPE plastic liners, and similar considerations); implementing mitigation soil measures; documentation submittals; preparation of Hazardous Waste Manifest; and weighing of soils are all considered incidental work, and no additional payment(s) will be made therefor. Furthermore, when performing excavation/backfill, the Contractor shall have taken into account the productivity losses, if any, due to the use of respirators and personal protective equipment. No additional compensation will be paid for by the MRCA owing the use of respirators and personal protective equipment in the Project area.

g) The cost of the work of this Section, including but not limited to excavating, separating, and handling of Class I, II, and III soil from excavation in compliance with all federal, state, and MRCA regulations shall be performed as Incidental Work and included in the items of work to which they are appurtenant.

h) All other work related to the hazardous waste and not considered by the Project Manager to be incidental work shall be paid for under a negotiated price as extra work. For extra work relative to contaminated and hazardous waste/material, Section 101.07 of the General Conditions shall not apply. Mark-up for the cost of contaminated and hazardous waste/material soil and groundwater testing, transportation, disposal, and dump fees shall be limited to 1) 4 percent for the first $100,000.00 and 2) 2 percent thereafter for greater sums than $100,000.00 of the Contractor's actual costs for performing this work.

3.8 REMOVAL OF UNDERGROUND STORAGE TANKS (Not in scope.)

3.9 OTHER HAZARDOUS MATERIALS REMOVAL PROCEDURES (Not in scope.)

3.10 WASTE DISPOSAL AND MANIFESTING

A. Hazardous Waste Disposal:

1. Packing, labeling, transporting, and disposing of hazardous waste shall comply with Cal/EPA regulations under 22 CCR, including completion of the Uniform Hazardous Waste Manifest Form (DTSC 8022A and EPA 8700-22). Waste and glovebags shall be

properly labeled prior to their removal from the contained or regulated area, including all required asbestos warning labels.

2. Waste dumpsters shall be placarded, sealed, and locked overnight. Waste containers shall be stored to prevent public access or disturbances.

3. A "Waste Manifest" shall be completed for disposal of hazardous waste. The transporter shall posses a valid EPA Transporter I.D. number. The Contractor shall notify the Project Manager a least 48 hours prior to the time that the Manifest is required to be signed by the MRCA or its representatives.

4. Applicable information to be included in the "Waste Manifest" includes the following:

   a) EPA Generator I.D. Number: Verify with the MRCA Project Manager.

   b) Generators Name and Address:

      Mountains Recreation and Conservation Authority
      Los Angeles River Center and Gardens
      570 West Avenue 26, Suite 100
      Los Angeles, CA 90065

   c) Generator Tax I.D. Number: _____

3.11 FINAL PROJECT CLEAN-UP AND REOCCUPANCY CLEARANCE CRITERIA

A. Lead

1. Final Re-occupancy Cleaning:

   a) Final clean-up prior to re-occupancy shall include wet wiping using a mild detergent solution and HEPA vacuuming all suspect dust and debris areas.

2. Final Re-occupancy Clearance:

   a) Following the final clean-up, the MRCA may visually inspect for any loose dust or debris, followed by wipe sampling of the settled dust to document surface lead levels below the specified clearance levels. Samples will be collected using commercial wipes moistened with a non-alcohol wetting agent. A one-foot square area will be wiped in an "S" pattern, folding the wipe inward and placing it in a labeled sample container. The wipe sample(s) will be analyzed by flame atomic absorption.

   b) The Contractor shall re-clean the zone when surface concentrations exceed the following "EPA Dust Clearance Standards":

40 micrograms/SF	for floors
250 micrograms/SF	for interior window sills and stools
800 micrograms/SF	for exterior window sills and interior window wells
800 micrograms/SF	for concrete or other rough surfaces
800 micrograms/SF	for attic and non-public areas

c) Areas that do not comply with the "Final Re-occupancy Clearance Criteria" shall continue to be cleaned by and at the Contractor's expense until the specified criteria is achieved, as evidenced by results of inspections as previously specified.

END OF SECTION

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Geo-Logic ASSOCIATES
Geologists, Hydrogeologists and Engineers

March 15, 2012
Project No. 20012-0040

Ms. Laura Saltzman
Associate Landscape Architect
Mountains Recreation and Conservation Authority
570 West Avenue Twenty-six, Suite 100
Los Angeles, California 90065

GEOTECHNICAL REPORT UPDATE
PROPOSED MARSH PARK
LOS ANGELES, CALIFORNIA

1.0 INTRODUCTION

Geo**L**ogic **A**ssociates (**GLA**) is pleased to submit this Geotechnical Update Report to the Mountains Recreation and Conservation Authority (MRCA) for supplemental geotechnical design services pertinent to the planned Marsh Park improvements located at the northern terminus of Rosanna Street in Los Angeles, CA (see Vicinity Map, Figure 1).

GLA has previously prepared a geotechnical design report for the Marsh Park Project in 2006 titled:

GeoLogic Associates, 2006, Geotechnical Design Report, Proposed Phase III Marsh Street Park, Northeast of Rosanna Street, Los Angeles, California: consultant report prepared for Mountains Recreation and Conservation Authority, 16 p., attachments (Job No. 2006-177; dated December 4, 2006).

The current plan for the park is referenced below:

Melendrez, 2011, Marsh Park, dated 12/16/2011

Based on review of the current plan for the Park (above), we understand that the current concept is generally similar to the concept proposed in 2006. However, changes to the building structure locations are planned, as are revisions to the parking lot location and ingress egress routes. The currently planned location for restroom is in the location of our boring B-1 but the proposed location of the Picnic Shelter is in the footprint of an existing building, west of the area investigated in our 2006 report. Changes in hardscape and landscaping locations are also planned.

Based on review of the current improvement plan (dated 12 16 2011) for the site, it is our opinion that the conclusions and recommendations contained in GLA s referenced 2006 geotechnical report (above) remains pertinent and applicable to the proposed construction except as updated below in the following sections which supersede the recommendations presented in our earlier 2006 report for the site. The following contain the updated sections.

2.0 SEISMICITY

This discussion of faults on the site is prefaced with a discussion of California legislation and policies concerning the classification and land-use criteria associated with faults. By definition of the California Geological Survey, an active fault is a fault that has had surface displacement within Holocene time (about the last 11,000 years).

The state geologist has defined a potentially active fault as any fault considered to have been active during Quaternary time (last 1,600,000 years). This definition is used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Geologic Hazards Zones Act of 1972 and as subsequently revised in 1975, 1985, 1990, 1992, and 1994. The intent of this act is to assure that unwise urban development and certain habitable structures do not occur across the traces of active faults.

The subject site is not included within any Earthquake Fault Zones as created by the Alquist-Priolo Act, however, our review of available geologic literature (Section 8.0) indicates that there are two known active thrust faults below the site and several known major active faults in the immediate vicinity of the site.

2.1 Historic Seismicity

Reasonably well-established historic records of earthquakes in southern California have been kept for the past two-hundred years. More accurate instrument measurements have been available since 1933. Based on recorded earthquake magnitudes and locations, the subject site appears to have experienced seismic exposure typical of the southern California area during historic time.

The project site is not located within a currently established Earthquake Fault Zone (formerly known as Alquist-Priolo Special Studies Zone). Neither the field observations nor literature review disclosed an active fault trace crossing the project site, however several blind thrust faults underlie the site. In **GLA**'s opinion, the potential is low to moderate for ground or fault rupture to occur at the site during the design life of the proposed structures. In addition, the site is located within close proximity to the Hollywood and Raymond faults which are capable of generating significant ground shaking.

2.2 Regional Seismicity

The site can be considered to lie within a seismically active region, as can all of Southern California. From a deterministic standpoint, Table 1 identifies potential seismic events that could be produced by the maximum credible earthquake event.

The maximum credible earthquake is defined by the State of California as the maximum earthquake that appears capable of occurring under the presently understood tectonic framework. Site-specific seismic parameters included in Table 1 are the distances to the causative faults, earthquake magnitudes (Mw), and expected ground accelerations, which were determined with

EQFAULT software (Blake, 2000a) from attenuation relationships for underlying geologic conditions that are similar to the subject site.

Table 1
Seismic Parameters for Active Faults

Fault Zone (Seismic Source)	Distance to Site (miles)	Maximum Credible Earthquake Event		2010 CBC Maximum Considered Earthquake Event
		Moment Magnitude	Peak Horizontal Ground Acceleration (g)	Peak Horizontal Ground Acceleration (g)
Puente Hills Blind Thrust	0.0	7.1	0.79	0.94
Upper Elysian Park Blind Thrust	0.0	6.4	0.55	
Hollywood	0.7	6.4	0.54	
Raymond	1.7	6.5	0.53	
Verdugo	3.5	6.9	0.54	
Sierra Madre	7.9	7.2	0.41	
Newport-Inglewood	9.3	7.1	0.29	
Santa Monica	10.0	6.6	0.25	

As indicated in Table 1, the Puente Hills Blind Thrust Fault is the active fault considered to have the most significant effect at the site from a design standpoint. The maximum earthquake from the fault has a 7.1 moment magnitude, generating a peak horizontal ground acceleration of 0.79g at the project site. Secondary effects associated with severe ground shaking following a relatively large earthquake on a regional fault that may affect the site include ground lurching and shallow ground rupture, soil liquefaction, seiches and tsunamis. These secondary effects of seismic shaking are discussed in the following sections.

From a probabilistic standpoint (considering all the faults in the vicinity of the site and their respective return periods), the Maximum Considered Earthquake or the design ground motion (in accordance with the 2010 California Building Code, (CBC)) is defined as the ground motion having a 2 percent probability of being exceeded in 50 years (2,475-year return period). This ground motion is referred to as the design earthquake. The design earthquake ground motion at the site is predicted to be 0.94g (Blake, 2000b). The results of our seismic analyses are presented in Appendix A.

The effect of seismic shaking may be mitigated by adhering to the CBC and state-of-the-art seismic design parameters of the Structural Engineers Association of California.

2.3 2010 CBC Seismic Criteria

The soil parameters in accordance with the 2010 CBC are as follows:

Table 2
2010 CBC Seismic Design Parameters

IBC Section	Factor/Class	Value
Table 1613.5.2	Site Classification	D
Section 1613.5.1	S_S, Short Period Spectral Acceleration*	2.142g
Section 1613.5.1	S_1, 1-Second Period Spectral Acceleration*	0.792g
Table 1613.5.3(1)	F_a	1.0
Table 1613.5.3(2)	F_v	1.5
Section 1613.5.3	S_{MS}	2.142g
Section 1613.5.3	S_{M1}	1.188g
Section 1613.5.4	S_{DS}	1.428g
Section 1613.5.4	S_{D1}	0.792

* From USGS, Earthquake Ground Motion Parameters, Version 5.1.0, for CBC (2010), IBC (2009).

2.4 Lurching and Shallow Ground Rupture

Soil lurching refers to the rolling motion on the ground surface by the passage of seismic surface waves. Effects of this nature are likely to be significant where the thickness of soft sediments vary appreciably under structures and at the interface of sediments of varying densities. Damage to the proposed development should not be significant since a relatively large differential fill/alluvium thickness is not known to exist below the site. Since there are known buried thrust faults underlying the site, the possibility of the ground rupture on-site during the design earthquake event is low to moderate.

2.5 Liquefaction Potential

Liquefaction is likely to occur when loose sandy soils are saturated and subjected to seismic forces. During a seismic event, excess pore water pressures can increase and result in a loss of shear strength of the foundation soils. The project site is located within a currently established Seismic Hazard Zone for liquefaction (CDMG, 1999). Although groundwater was noted in the borings at a depth of about 38.5 feet below the ground surface at the time of drilling, CDMG (1998) has designated the historic highest (near-surface) groundwater level at about 25 feet below the existing ground surface.

The Standard Penetration Test and dynamic cone blow counts indicate that the soils below a depth of 25 feet generally consist of dense sands with minor intervals of clayey deposits. Such soils are not typically known to be subject to significant liquefaction effects under seismic shaking of the design earthquake event, and as a result, the potential for liquefaction at this site to effect the proposed at-grade, lightly-loaded site improvements is considered to be low.

2.6 Tsunamis and Seiches

A tsunami is a sea wave generated by submarine earthquakes, landslides or volcanic activity which displaces a relatively large volume of water in a very short period of time. Seiches are defined as oscillations in a semi-confined body of water due to earthquake shaking or fault rupture. Due to the elevation of the site (approximately 360 feet mean sea level) and the distance from the Pacific Ocean or other large bodies of water, the potential for tsunamis and seiches at the site is considered very low.

3.0 EARTHWORK RECOMMENDATIONS

3.1 Site Demolition

Pre-grading activities at the site will include demolition of existing structures and pavement. In addition, any existing utility lines, foundations, floor slabs, underground storage tanks, or other subsurface structures which are not to be utilized should be removed, destroyed or abandoned in compliance with current governmental regulations and with approval from the geotechnical engineer.

3.2 Deleterious Materials

Prior to any grading, all trash, surface structures, debris and vegetation should be removed and disposed off-site. The site should be adequately cleared to allow for unrestricted earthwork to commence. Existing fill that has been dumped in the northwest part of the site should be evaluated for suitability.

3.3 Soil Removal and Replacement

In order to enhance the uniformity of surficial conditions, it is recommended that removals be performed so that a minimum of 12 inches of compacted fill is placed for the support of footings, floor slabs, pavement, and hardscape. These depths of removal and subgrade treatment should occur beneath the bottom of slabs and footings. The removal and recompaction should extend a minimum horizontal distance of 10 feet beyond the building perimeter and 2 feet beyond the limits of pavement and hardscape. After removal, the exposed surface should then be moisture conditioned to a minimum of 110 percent of maximum dry density and be compacted to not less than 90 percent of maximum dry density (ASTM D1557). Minor fill that may be necessary to establish final grade should be placed to the same standard.

3.4 Use of On-site Soils

In general, on-site soils (if evaluated to be free of organics, contamination, expansive soils, trash, or other deleterious materials) can be used for grading at this site. The results of laboratory tests on selected samples suggest that the existing surficial fills have moisture contents that are considerably below optimum moisture content. Therefore, moisture addition may be necessary (during certain times of the year) to achieve and the recommended soil moisture content of 110 percent of optimum moisture content. The dumped fill in the northwesterly part of the site

should be evaluated for suitability prior to placement as compacted fill. All fill soils used below structures and pavement areas should have an expansion index less than or equal to 20 (as tested in accordance with ASTM D4829).

3.5 Import Soils

If import soil material is necessary to reach design grades, the fill should have the following characteristics:

- free of organics, contamination, trash, or other deleterious materials
- granular material
- a maximum particle size of 1 inch
- low corrosion potential
- low soluble sulfate content
- expansion index less than or equal to 20 (as tested in accordance with ASTM D4829).

All soils that are planned to be used as an import source for the site should be tested for suitability, and approved by the geotechnical engineer, prior to hauling to the site. The contractor should provide ample time (at least one week) for a sample of the planned import soils to be tested for soluble sulfate potential, metallic corrosion potential, expansion potential, and other engineering properties pertinent to site conditions.

3.6 Moisture Conditions

The site should be protected from softening due to ponding resulting from rainfall, and from desiccation due to exposure during warm weather. Sprinkling or provision of a protective cover should be provided as necessary to maintain recommended moisture conditions. Specific provisions should be made for confirmatory testing for moisture content just before any slabs or foundations are constructed.

4.0 FOUNDATION DESIGN RECOMMENDATIONS

4.1 Bearing Capacity and Settlement

Conventional spread or continuous footings should be founded on recompacted soils, which are prepared as recommended within this report. Spread footings should have a minimum width of 18 inches (minimum width of 24 inches for isolated spread footings) and minimum embedment of 18 inches below the lowest adjacent soil grade. It is recommended that continuous footings be reinforced (as a minimum) with four No. 5 bars (two near the top and two near the base of the footing).

For loads of up to 20 kips for columns and 5 kips/foot for walls, footings constructed in accordance with the foregoing recommendations may be sized to support a maximum net allowable bearing pressure of 2,000 pounds per square foot (psf). The allowable value may be increased by one-third for short-term loading including dead plus live seismic or wind loading.

Total and differential settlement under static loading for these conditions and where provisions are made to control changes in soil moisture content, are expected to less than 1 inch and 1 2-inch, respectively.

4.2 Resistance to Lateral Loads

Lateral loads may be resisted by friction between the supporting soils and the bottom of footings and or by lateral passive resistance acting against the sides of footings. An allowable coefficient of friction of 0.38 is considered applicable for concrete against compacted on-site soils. The recommended lateral passive resistance for compacted fills is 180 psf per foot of depth of embedment. The values for the coefficient of friction and passive resistance include factors of safety of 1.5 and 2.0, respectively.

If the allowable frictional resistance and allowable passive resistance are combined, the allowable passive resistance should be reduced by an additional 50 percent. For purposes of design, the total allowable static lateral resistance may be increased by one-third for transient loading including dead plus live, seismic or wind loading.

4.3 Site Drainage

Drainage at the site should be directed away from foundations, collected and tightlined to appropriate discharge points. We recommend collecting roof drainage by eave gutters and directing accumulated precipitation away from foundations to the storm drain or street via non-erosive devices. Water, either natural or from irrigation, should not be permitted to pond and saturate the subsurface soils. Landscape requiring a heavy irrigation schedule should not be planted adjacent to foundations or paved areas.

5.0 CONSTRUCTION OBSERVATION

The conclusions and recommendations in this report are based in part upon data that were obtained from a limited number of observations, site visits, excavations, samples, and tests. The nature of many sites is such that differing geotechnical or geological conditions can occur within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, the findings, conclusions, and recommendations presented in this report can be relied upon only if further evaluation is conducted in the field during construction by a representative of the geotechnical engineer, in order to confirm that our preliminary findings are representative for the site.

6.0 LIMITATIONS

This report has not been prepared for use by parties or projects other than those named or described above. It may not contain sufficient information for other parties or other purposes. This report has been prepared in accordance with generally accepted geotechnical practices and makes no other warranties, either express or implied, as to the professional advice or data contained herein.

This report is valid for a period of two years from the date of publication. A review of the findings and recommendations contained in this report is required if construction is delayed beyond the two-year period.

We recommend that this office have an opportunity to review the final grading and foundation plans in order to provide additional site-specific recommendations, as necessary.

7.0 CLOSING

We appreciate this opportunity to be of service. If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Geo-**L**ogic **A**ssociates

Joseph G. Franzone, GE 2189
Supervising Geotechnical Engineer

Distribution: Laura Saltzman, Addressee (1 via e-mail: laura.Saltzman@mrca.ca.gov)

Attachments: References
Figure 1 □Vicinity Map
Appendix A □Seismic Analysis

8.0 REFERENCES

Blake, Thomas F., 2000a, EQFAULT, Version 3.00b, Deterministic Estimation of Peak Acceleration from Digitized Faults, updated 2004.

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Hart, E. W., and Bryant, W. A., 1997, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps: CDMG Special Publication 42.

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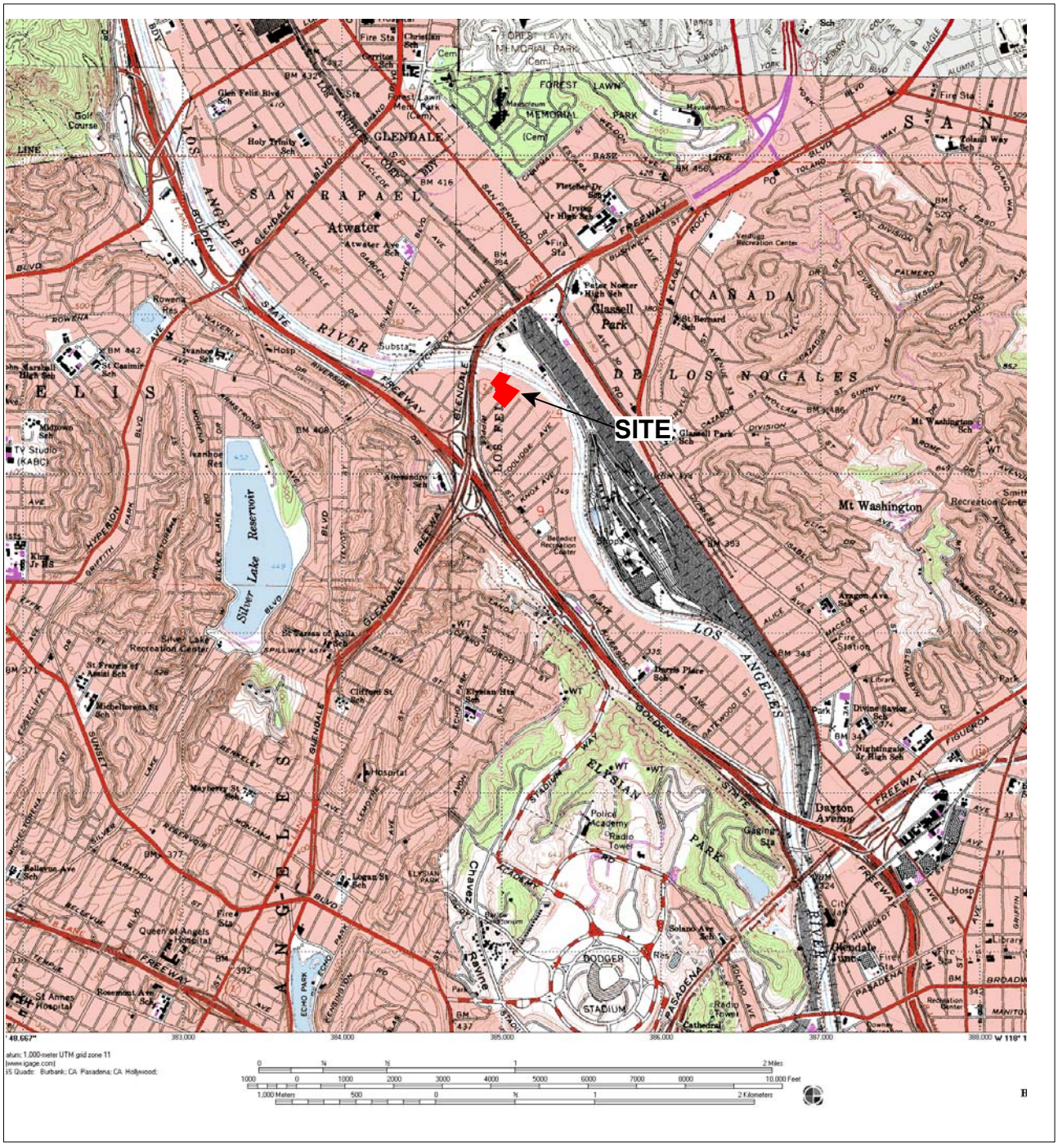


REFERENCE: U.S.G.S.,1966, 7.5 Minute Topographic Series, Los Angeles, revised 1994.

N

FIGURE 1

GEOTECHNICAL UPDATE REPORT
MARSH PARK
LOS ANGELES, CALIFORNIA

VICINITY MAP

Geo-Logic ASSOCIATES

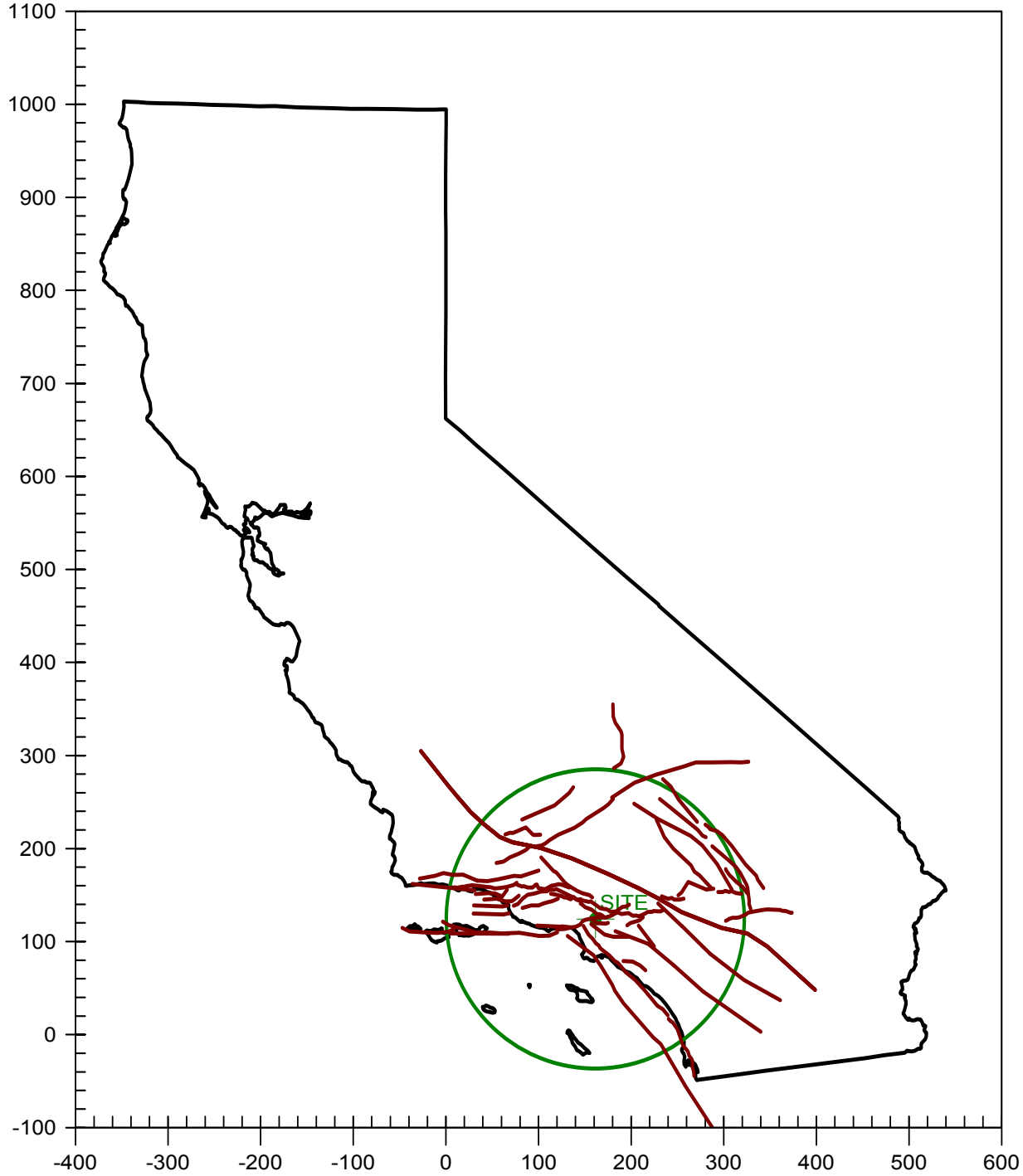
Draft: JGF	Date: 03-12	Project No. 2012-0040

APPENDIX A

SEISMIC ANALYSIS

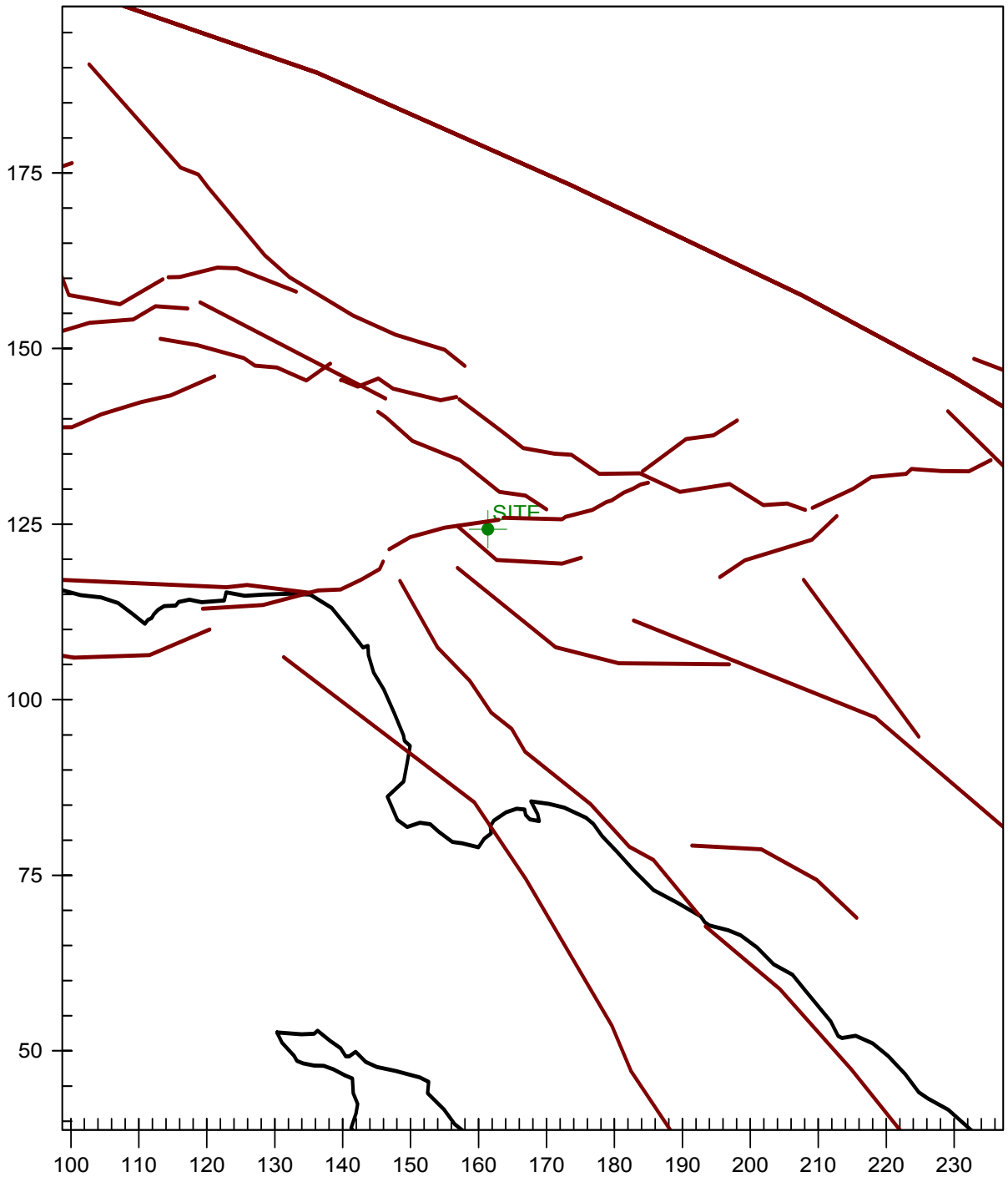
CALIFORNIA FAULT MAP

Marsh Street Park



CALIFORNIA FAULT MAP

Marsh Street Park



****
*   *
* E Q F A U L T *
*   *
* Version 3.00 *
*   *
****

DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 2012-0040

DATE: 03-07-2012

JOB NAME: Marsh Street Park

CALCULATION NAME: MCE Analysis

FAULT-DATA-FILE NAME: C:\Program Files\EQFAULT1\CGSFLTE_MCE_new.DAT

SITE COORDINATES:
SITE LATITUDE: 34.1073
SITE LONGITUDE: 118.2477

SEARCH RADIUS: 100 mi

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
DISTANCE MEASURE: cd_2drp
SCOND: 0
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: C:\Program Files\EQFAULT1\CGSFLTE_MCE_new.DAT

MINIMUM DEPTH VALUE (km): 0.0

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

Page 1

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
PUENTE HILLS BLIND THRUST	0.0(0.0)	7.1	0.790	XI
UPPER ELYSIAN PARK BLIND THRUST	0.0(0.0)	6.4	0.547	X
HOLLYWOOD	0.7(1.1)	6.4	0.538	X
RAYMOND	1.7(2.8)	6.5	0.528	X
VERDUGO	3.5(5.6)	6.9	0.542	X
SIERRA MADRE	7.9(12.7)	7.2	0.410	X
NEWPORT-INGLEWOOD (L.A.Basin)	9.3(14.9)	7.1	0.287	IX
SANTA MONICA	10.0(16.1)	6.6	0.254	IX
SIERRA MADRE (San Fernando)	12.1(19.5)	6.7	0.234	IX
NORTHRIDGE (E. Oak Ridge)	13.6(21.9)	7.0	0.252	IX
CLAMSHELL-SAWPIT	14.5(23.3)	6.5	0.185	VIII
SAN GABRIEL	14.7(23.6)	7.2	0.218	IX
WHITTIER	15.3(24.7)	6.8	0.171	VIII
MALIBU COAST	16.3(26.3)	6.7	0.188	VIII
SAN JOSE	20.1(32.4)	6.4	0.137	VIII
PALOS VERDES	20.3(32.6)	7.3	0.181	VIII
SANTA SUSANA	20.6(33.2)	6.7	0.158	VIII
HOLSER	25.8(41.6)	6.5	0.120	VII
CHINO-CENTRAL AVE. (Elsinore)	26.3(42.4)	6.7	0.131	VIII
ANACAPA-DUME	26.9(43.3)	7.5	0.197	VIII
CUCAMONGA	27.9(44.9)	6.9	0.139	VIII
SIMI-SANTA ROSA	28.5(45.9)	7.0	0.144	VIII
SAN ANDREAS - Whole M-1a	30.9(49.8)	8.0	0.189	VIII
SAN ANDREAS - Mojave M-1c-3	30.9(49.8)	7.4	0.138	VIII
SAN ANDREAS - 1857 Rupture M-2a	30.9(49.8)	7.8	0.170	VIII
SAN ANDREAS - Cho-Moj M-1b-1	30.9(49.8)	7.8	0.170	VIII
OAK RIDGE (Onshore)	31.9(51.4)	7.0	0.132	VIII
SAN JOAQUIN HILLS	33.7(54.2)	6.6	0.103	VII
SAN CAYETANO	37.2(59.8)	7.0	0.118	VII
ELSINORE (GLEN IVY)	39.1(62.9)	6.8	0.084	VII
NEWPORT-INGLEWOOD (Offshore)	40.5(65.1)	7.1	0.096	VII
SAN JACINTO-SAN BERNARDINO	43.4(69.8)	6.7	0.073	VII
SAN ANDREAS - Carrizo M-1c-2	43.5(70.0)	7.4	0.106	VII
SAN ANDREAS - SB-Coach. M-2b	44.7(71.9)	7.7	0.122	VII
SAN ANDREAS - San Bernardino M-1	44.7(71.9)	7.5	0.109	VII
SAN ANDREAS - SB-Coach. M-1b-2	44.7(71.9)	7.7	0.122	VII
CLEGHORN	47.0(75.6)	6.5	0.062	VI
SANTA YNEZ (East)	49.0(78.8)	7.1	0.083	VII
VENTURA - PITAS POINT	53.7(86.4)	6.9	0.084	VII
OAK RIDGE(Blind Thrust Offshore)	56.1(90.3)	7.1	0.090	VII

DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
NORTH FRONTAL FAULT ZONE (West)	57.8(93.1)	7.2	0.093	VII
CHANNEL IS. THRUST (Eastern)	58.2(93.6)	7.5	0.108	VII
M.RIDGE-ARROYO PARIDA-SANTA ANA	58.2(93.7)	7.2	0.093	VII
SAN JACINTO-SAN JACINTO VALLEY	58.3(93.9)	6.9	0.065	VI
OAK RIDGE MID-CHANNEL STRUCTURE	59.7(96.0)	6.6	0.066	VI
ELSINORE (TEMECULA)	60.6(97.6)	6.8	0.060	VI
CORONADO BANK	60.8(97.8)	7.6	0.091	VII
GARLOCK (West)	60.9(98.0)	7.3	0.077	VII
PLEITO THRUST	61.8(99.4)	7.0	0.080	VII
RED MOUNTAIN	62.4(100.5)	7.0	0.079	VII
BIG PINE	65.7(105.8)	6.9	0.059	VI
HELENDALE - S. LOCKHARDT	70.6(113.6)	7.3	0.069	VI
SANTA CRUZ ISLAND	72.9(117.4)	7.0	0.070	VI
WHITE WOLF	74.4(119.8)	7.3	0.081	VII
LENWOOD-LOCKHART-OLD WOMAN SPRGS	79.3(127.7)	7.5	0.070	VI
SAN JACINTO-ANZA	80.2(129.1)	7.2	0.059	VI
GARLOCK (East)	82.3(132.4)	7.5	0.068	VI
NORTH FRONTAL FAULT ZONE (East)	82.6(132.9)	6.7	0.054	VI
ROSE CANYON	82.8(133.2)	7.2	0.058	VI
NORTH CHANNEL SLOPE	83.4(134.2)	7.4	0.078	VII
SANTA YNEZ (West)	83.4(134.2)	7.1	0.055	VI
ELSINORE (JULIAN)	86.8(139.7)	7.1	0.053	VI
PINTO MOUNTAIN	87.4(140.7)	7.2	0.055	VI
GRAVEL HILLS - HARPER LAKE	89.9(144.7)	7.1	0.052	VI
LANDERS	92.6(149.0)	7.3	0.056	VI
JOHNSON VALLEY (Northern)	93.8(151.0)	6.7	0.040	V
BLACKWATER	94.7(152.4)	7.1	0.049	VI
SANTA ROSA ISLAND	95.1(153.0)	7.1	0.060	VI
CALICO - HIDALGO	97.6(157.0)	7.3	0.054	VI
So. SIERRA NEVADA	98.4(158.4)	7.3	0.065	VI

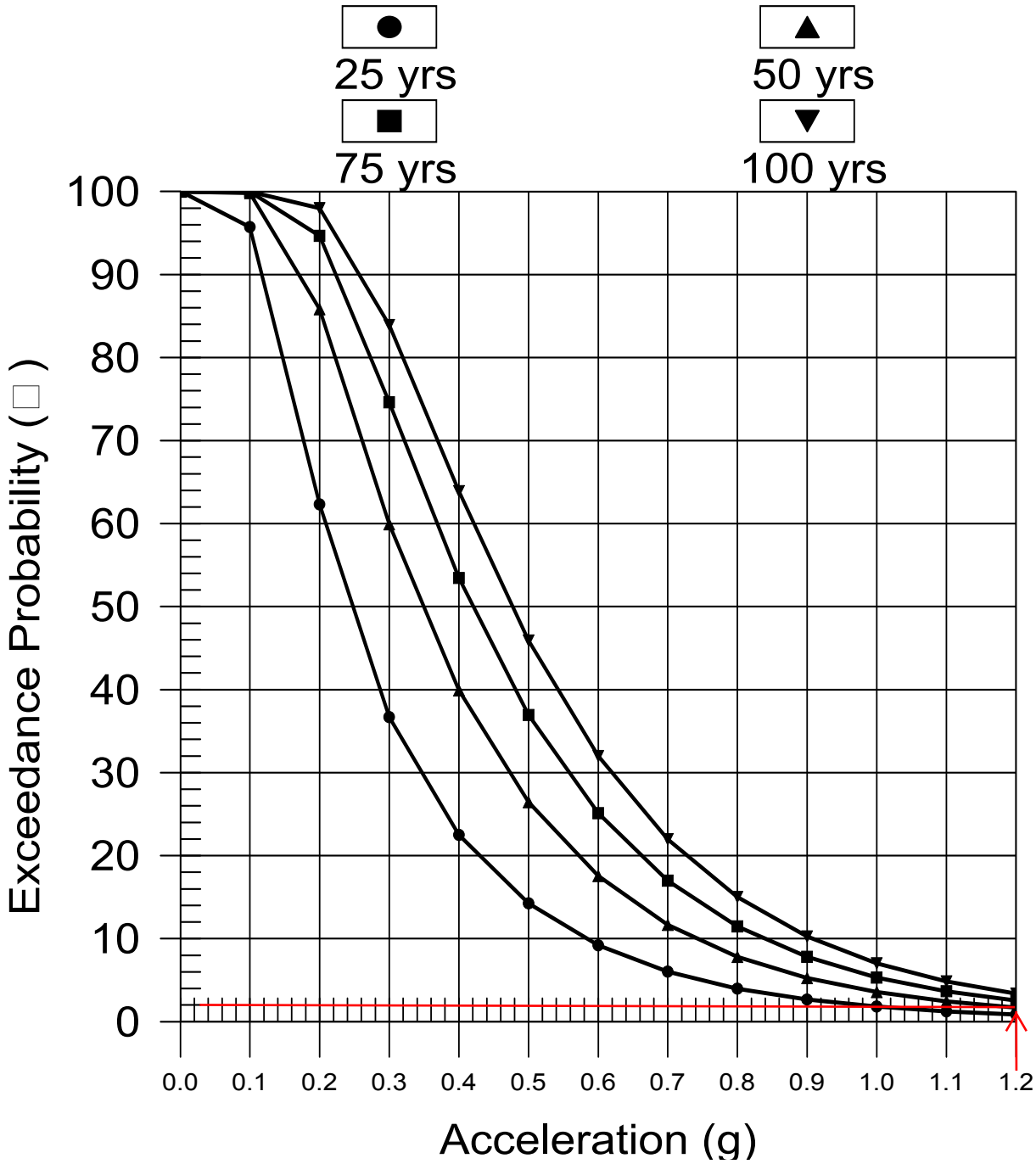
-END OF SEARCH- 70 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE UPPER ELYSIAN PARK BLIND THRUST FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 0.0 MILES (0.0 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.7903 g

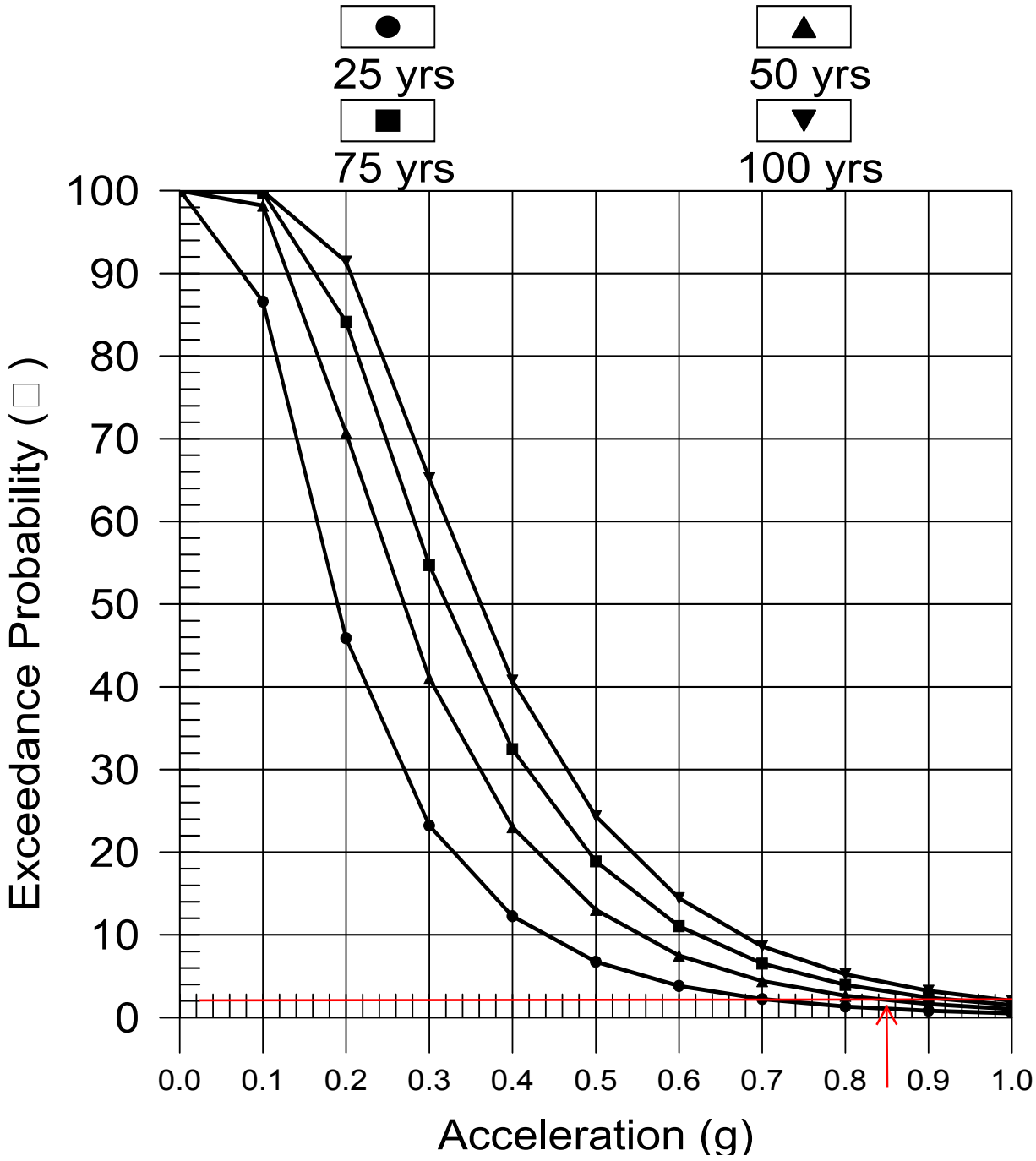
PROBABILITY OF EXCEEDANCE_Marsh Street Park

BOORE ET AL(1997) NEHRP D (250)1



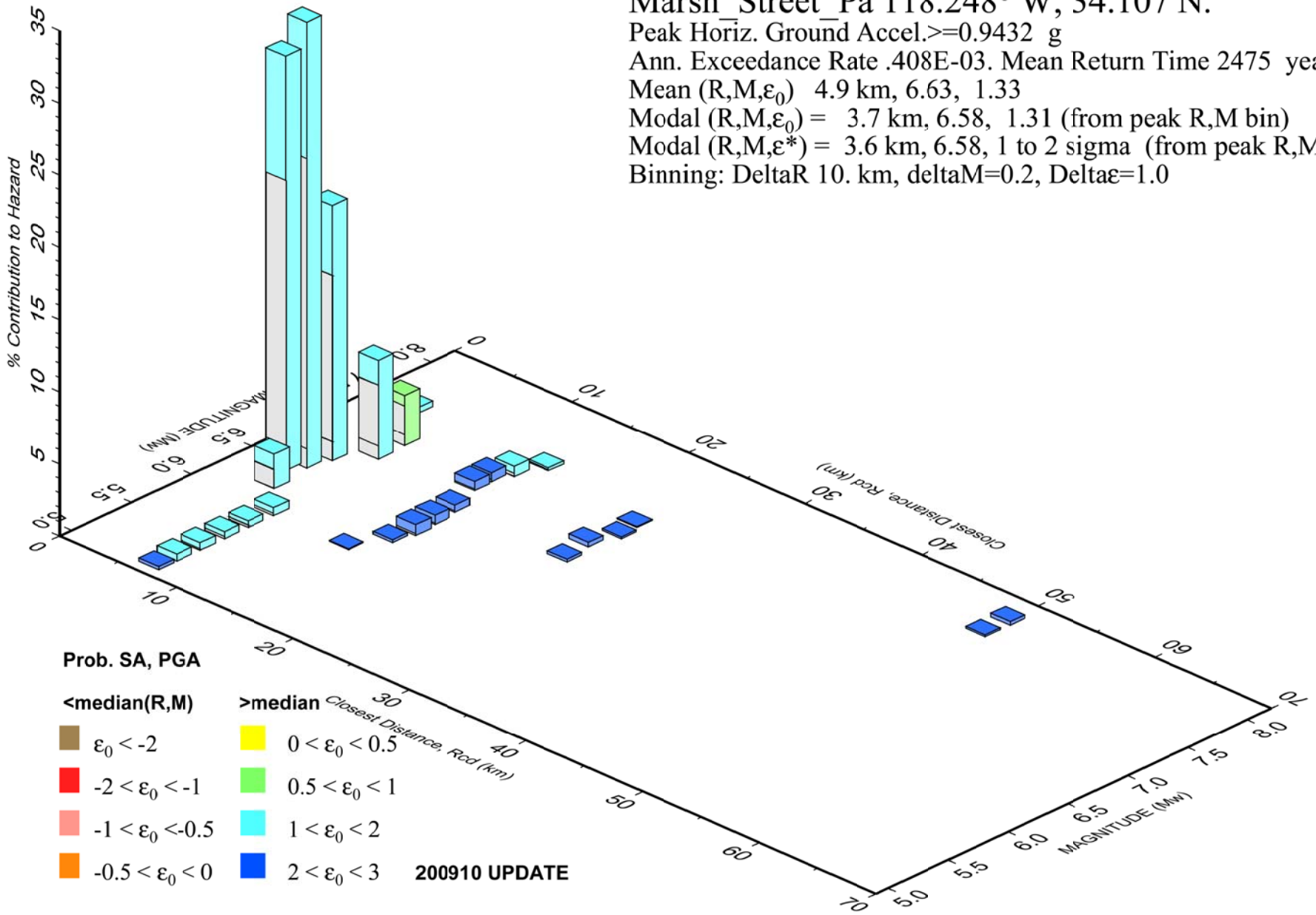
PROBABILITY OF EXCEEDANCE_Marsh Street Park

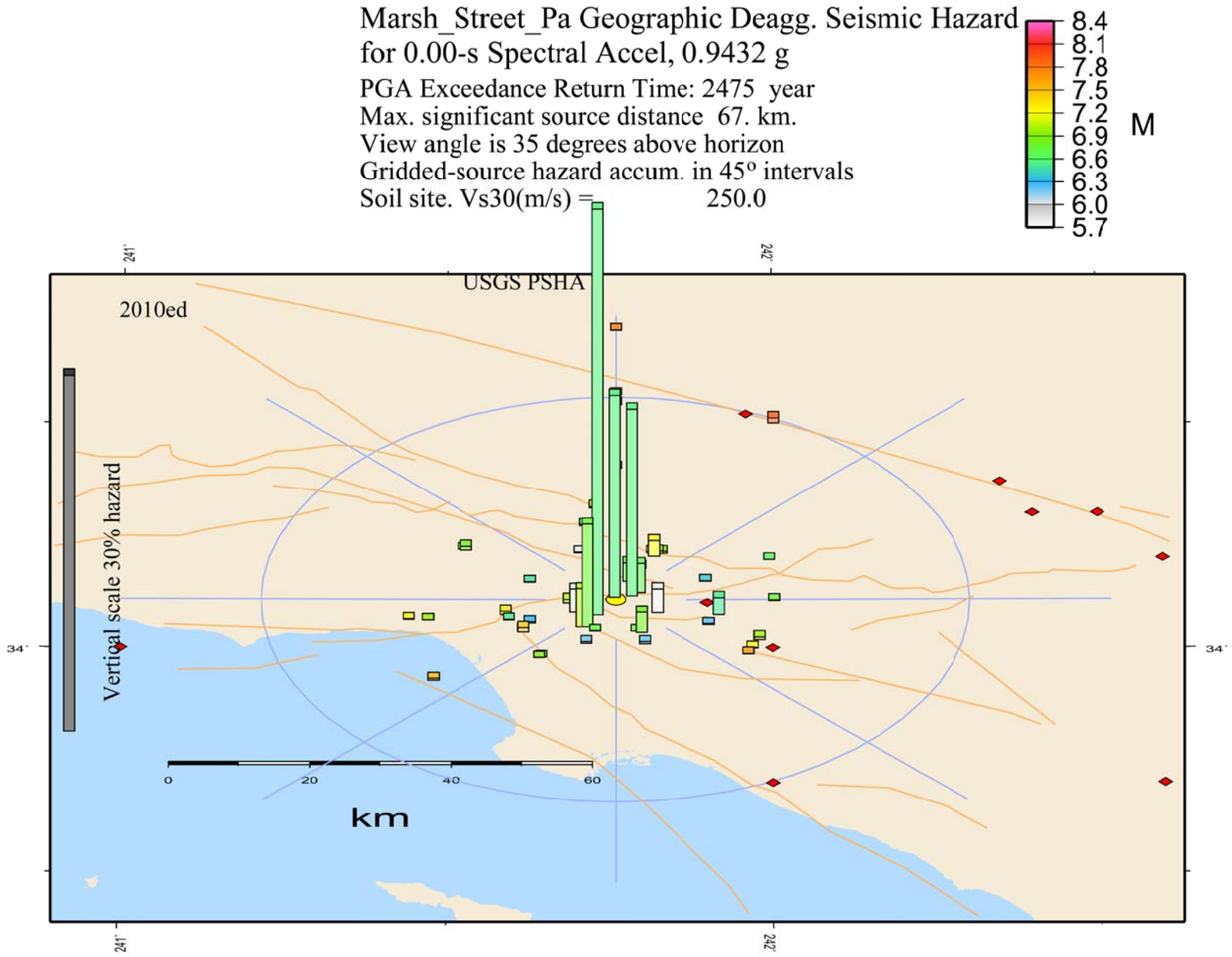
BOORE ET AL(1997) NEHRP D (250)2



PSH Deaggregation on NEHRP D soil
Marsh_Street_Pa 118.248° W, 34.107 N.

Peak Horiz. Ground Accel.>=0.9432 g
Ann. Exceedance Rate .408E-03. Mean Return Time 2475 years
Mean (R,M,ε_0) 4.9 km, 6.63, 1.33
Modal (R,M,ε_0) = 3.7 km, 6.58, 1.31 (from peak R,M bin)
Modal (R,M,ε^*) = 3.6 km, 6.58, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0





GMT 2012 Mar 8 01:57:40 Site Coords:-118.247 34.1073 (yellow disk) Vs30= 250.0. Max annual ExcdRate .1395E-03 (column height prop. to ExRate). Red diamonds: historical earthquakes, M>6

HYDROLOGY AND HYDRAULICS REPORT

MARSH PARK
KPFF Job # 108247

January 8, 2013

OWNER:

Mountains Recreation & Conservation Authority
LA River Center and Gardens
570 West Avenue 26, Suite 100
Los Angeles, CA 90065
(323) 221-9944

PREPARED BY:

KPFF Consulting Engineers
6080 Center Drive, Suite 700
Los Angeles, CA 90045
(310) 665-2800

TABLE OF CONTENTS

Page No.

LIST OF EXHIBITS

APPENDICES

The Los Angeles County of Department Public Works has developed a time of concentration calculator (TC Calculator) as a tool for calculating the time of concentration and peak runoff rates and volumes. The TC Calculator uses the modified rational method as outlined in the Hydrology Manual. The input requirements for the TC Calculator include the watershed area, soil type, percent imperviousness, length of flow path, slope of flow path, and rainfall isohyets. The TC Calculator can provide results for a range of storm events. Information such as soil type and rainfall isohyets was taken from the Hydrology Manual. Please refer to Appendix A for the Soil Classification Map for the project site.

The hydrologic cycle and proposed storm drain system for the project site has been designed for a 50 year – 24 hour storm event.

The runoff from the picnic pavilion roof was calculated using the Uniform Plumbing Code. The roof runoff was calculated for the 60 minute duration, 100 year return rainfall rate for Los Angeles as listed in Appendix D, and table D-1 of the Uniform Plumbing Code, 2003 edition.

Input parameters and calculations specific to the project site are shown in Appendix C. These calculations can be referenced with Exhibit 1.

IV. HYDRAULICS CALCULATIONS DESIGN CRITERIA

A. Onsite Storm Drain Pipe Sizing

The onsite storm drain system is designed to capture the runoff from the 19 subareas as well as site run-on from Gleneden Street. Runoff from the 19 subareas is essentially the runoff from the hardscaped and landscaped areas of the park. This runoff is captured by area drains (or roof drains, for the picnic pavilion) and connected to a storm drain pipe network. Surface run-on from Gleneden Street is intercepted by a trench drain and also connected to the storm drain pipe network.

Runoff collected from the various subareas discharges into the Los Angeles River. The net runoff from the proposed onsite subareas is 6.78 cfs. With the addition of 6.89 cfs of run-on, a total of 13.67 cfs is anticipated to be discharged through the existing outlet. A 50 year isohyet of 6.30 inch is used for the hydrograph calculation per the *Los Angeles County Public Works Department Hydrology Manual, January 2006.*

The computer software *Flow Master* (Haestad Methods) is used to calculate the pipe size for the drainage system.

As noted in the Hydrology Manual, section 4.3 Urban Flood Protection, the storm drain system should have enough capacity to convey runoff from at least the 10-year storm event. The computer software *Flow Master* was used to size the onsite storm drain pipe network for the runoff quantities calculated in Appendix C. The results of the analyses indicate that the proposed pipe sizes are designed to convey the runoff from the project site without flooding the site. Worksheets for the onsite storm drain system sizing from

Flow Master can be found in Appendix D. These calculations can be referenced with Exhibit 1.

V. RESULTS

The proposed 3.3-acre public park land development at the terminals of Gleneden Street and Rosanna Street has been shown to reduce the overall discharge from the project site. The overall drainage direction and discharge point will remain unchanged. Due to an increase in vegetative/pervious cover and the addition of vegetated swales, the proposed site has been shown to discharge approximately 13.67 cubic feet per second (cfs) during a 50-year storm. This is a 0.77 cfs flow reduction compared to the outlet discharge expected for a 50-year storm in existing conditions (14.44 cfs). Furthermore, the proposed storm drain pipe network has been shown to adequately convey the flows produced by the design storm (see Appendix D).

VI. REFERENCES

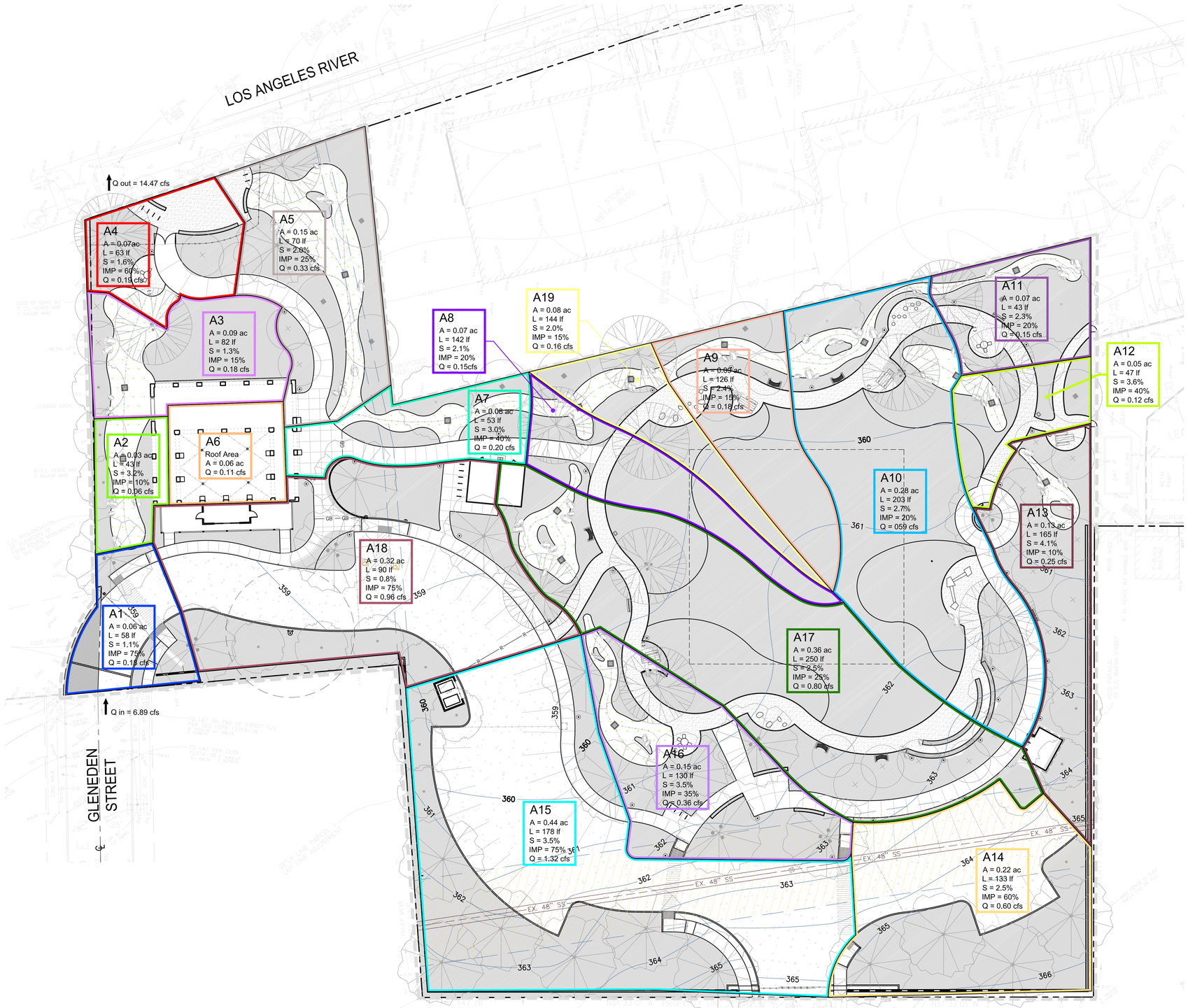
Los Angeles County Public Works Department Hydrology Manual, January 2006

Uniform Plumbing Code, 2003 edition

LEED Reference Guide, version 2.0, published by United States Green Building Council

EXHIBIT 1

Proposed Drainage Area Map



TOTAL DRAINAGE AREA = 3.05 AC
Q GLENEDEN STREET = 6.89 cfs
Q ONSITE (PRE) = 7.55 cfs
Q ONSITE (POST)= 6.78 cfs
Q OUT (PRE) = 14.44 cfs
Q OUT (POST) = 13.67 cfs

PLAN
SCALE: 1" = 20'-0"
0 10' 20' 40'
GRAPHIC SCALE

MARSH PARK
Phase II

OWNER
MOUNTAINS RECREATION & CONSERVATION AUTHORITY
LA RIVER CENTER AND GARDENS
570 WEST AVENUE 26, SUITE 100
LOS ANGELES, CA 90065
T: (323) 221-9944
F: (323) 221-9934

LANDSCAPE ARCHITECT
MELENDREZ
617 S. OLIVE STREET, 11TH FLOOR
LOS ANGELES, CA 90014
T: (213) 673-4400
F: (213) 673-4410

CIVIL / STRUCTURAL ENGINEERS
KPFF
6080 CENTER DRIVE, SUITE 700
LOS ANGELES, CA 90045
T: (310) 665-2800
F: (310) 665-9075

ARCHITECT
ERW DESIGN
6624 DUME DRIVE
MALIBU, CA 90265
T: (310) 457-1809

ELECTRICAL ENGINEER
MDC ENGINEERS INC.
200 N. BERRY STREET, BLDG. 'B'
BREA, CA 92821
T: (213) 746-2844
F: (213) 746-6463

PLUMBING ENGINEER
SOUTH COAST ENGINEERING GROUP, INC.
5000 N. PARKWAY CALABASAS, SUITE 307
CALABASAS, CA 91302
T: (818) 224-2700
F: (818) 224-2711

MELÉNDREZ

REGISTERED PROFESSIONAL ENGINEER
THOMAS GISELL
No. C34734
Exp. 9/30/13
CIVIL
STATE OF CALIFORNIA

REV	DATE	ISSUE
	05.25.12	50% CONST DOCS.
	08.28.12	PERMIT SUBMITTAL

kpff Consulting Engineers
6080 Center Dr. Suite 700
Los Angeles, California 90045
(310) 665-2800 Fax (310) 665-9075

MARSH PARK
2944 GLENEDEN STREET
LOS ANGELES,
CALIFORNIA 90039

DWG TITLE:
DRAINAGE AREA MAP

DATE:

SCALE: AS NOTED ON PLAN

DRAWN: GW

JOB NO.: 108247

SHEET:
EXBT-1

__ OF __ SHEETS

APPENDIX A

Soil Classification Map

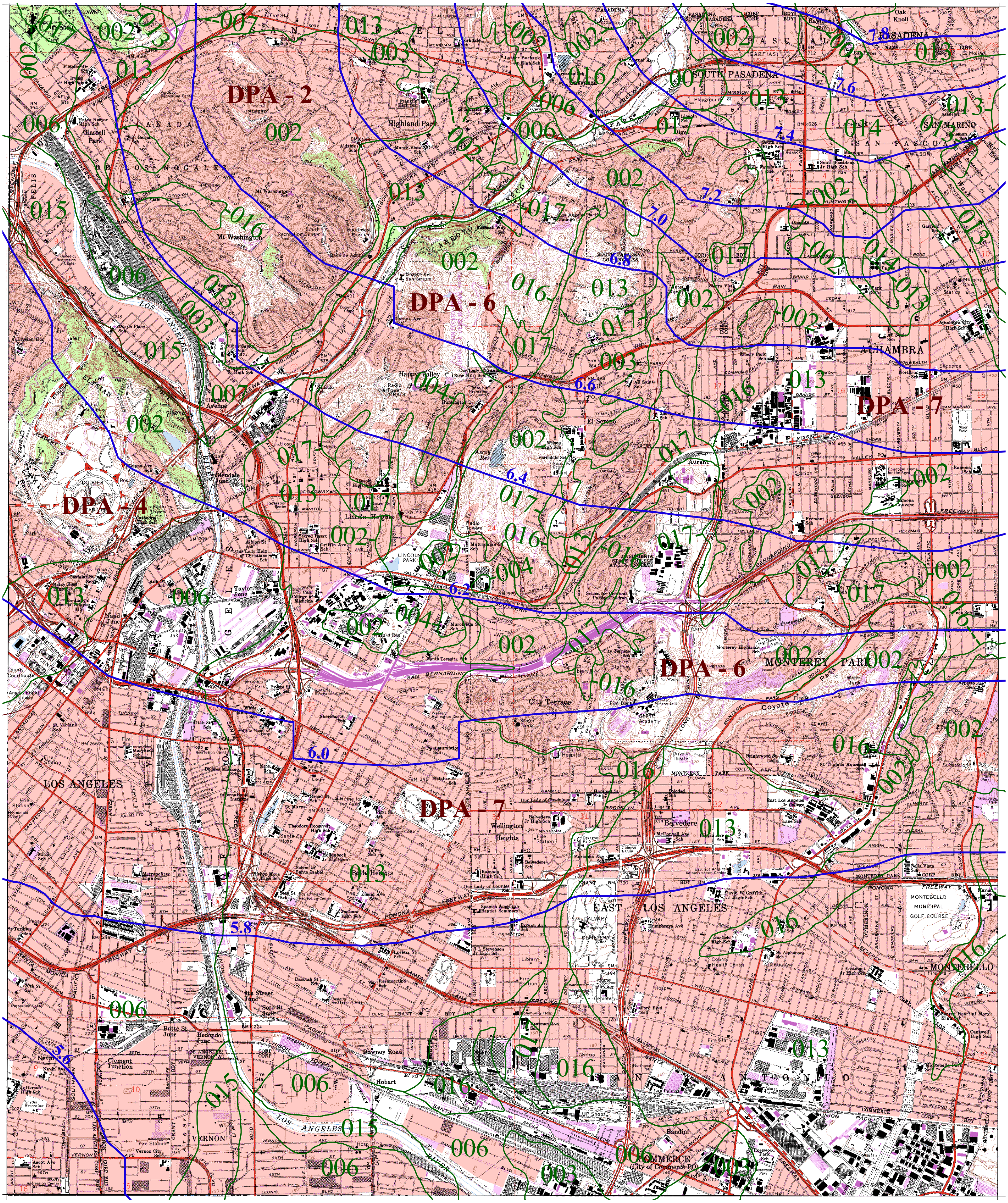
34º 07' 30''

PASADENA 1-H1.29

-118º 15' 00''

HOLLYWOOD 1-H1.18

EL MONTE 1-H1.20



-118º 07' 30''

SOUTH GATE 1-H1.9

34º 00' 00''

016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

1 0 1 2 Miles

N S W E

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878

10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

LOS ANGELES
50-YEAR 24-HOUR ISOHYET

1-H1.19

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

APPENDIX B

Project Soils Percolation Test Report

1080247 10d130

1.7

GeoLogic Associates
Geologists, Hydrogeologists and Engineers

GEOTECHNICAL DESIGN REPORT
PROPOSED PHASE III MARSH STREET PARK
NORTHEAST OF ROSANNA STREET
LOS ANGELES, CALIFORNIA

Prepared For:

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The alluvial soils consisted mainly of fine to medium grained silty sand with lesser amounts of interbedded sandy silt, clayey sand and sandy clay. Some gravel and coarser sand was also present locally. The sands tended to be medium dense to a depth of about 25 feet and became denser at greater depths. Most of the soils found above groundwater at a depth of 38.5 feet were in a damp condition, however, it appeared that clayey intervals were restricting infiltration at some locations resulting in a moist condition.

3.3 GROUNDWATER

Groundwater was observed at a depth of 38.5 feet in Boring, B-1. Historically high groundwater in the vicinity, as reported by the State of California Seismic Hazards Zone Report 29 (Open File Report 98-20) for the Los Angeles Quadrangle, is about 25 feet below the ground surface.

Fluctuation of the groundwater level may occur due to seasonal rainfall, changes with irrigation, construction activities on this or adjacent portions of the site, and other factors not evident at the time of this evaluation.

4.0 EVALUATIONS AND DESIGN RECOMMENDATIONS

4.1 GENERAL

From a geotechnical perspective, the proposed improvements are considered feasible. The available data suggest favorable foundation conditions and a limited need for removals for site preparation. The majority of the on-site soils have a very low to low expansion potential, and although clayey zones with higher swelling potential may be present, no special measures are required to deal with expansive soils. Permeability testing suggests relatively slow seepage rates which may impact the design of the detention basins. In addition, the soils at the site are highly erodible and protection will be necessary during construction and over the long term.

4.2 ENGINEERING SEISMOLOGY

4.2.1 Historic Seismicity

Reasonably well-established historic records of earthquakes in southern California have been kept for the past two-hundred years. More accurate instrument measurements have been available since 1933. Based on recorded earthquake magnitudes and locations, the subject site appears to have experienced seismic exposure typical of the southern California area during historic time.

The project site is not located within a currently established Earthquake Fault Zone (formerly known as Alquist-Priolo Special Studies Zone). Neither the field observations nor literature review disclosed an active fault trace on the project site. In **GLA**'s opinion, it is unlikely that ground or fault rupture will occur at the site during the design life of the proposed structures. The site is, however, located within close proximity to the Hollywood fault (approximately 1.2 km per CBC), which is capable of generating significant ground shaking.

TABLE 3

GRADING REQUIREMENTS FOR JOINT SAND FOR INTERLOCKING CONCRETE PAVEMENT

Sieve Size	Percent Passing
No. 4	100
No. 8	95 to 100
No. 16	70 to 100
No. 30	40 to 100
No. 50	20 to 40
No. 100	10 to 25
No. 200	0 to 10

4.8 DETENTION BASINS

Grading for the proposed detention basins in the northeast and northwest parts of the site will involve cuts of up to about 4 feet. The boring logs suggest that the exposed native soils will be predominantly fine silty sand. Constructed slopes for the proposed detention basins should not be steeper than 3:1 (horizontal:vertical). Once final grades are achieved the exposed surface should be scarified to a minimum of 6 inches and be compacted to not less than 90 percent of maximum dry density, at or near optimum moisture content. Due to the lack of cohesion of the on-site soils they will be easily eroded. Appropriate protection should be provided with particular attention at inlets and outlets.

Constant head permeability testing was performed on two remolded samples of on-site soils compacted to 90 percent of maximum dry density (ASTM D1557). The resulting coefficients of permeability of 5.6×10^{-6} cm/sec and 9.9×10^{-6} cm/sec suggest relatively slow infiltration rates. Without allowances for evaporation and absorption, it is estimated that percolation for a pond area of 2,500 square feet with a 4-foot initial head would take place at a rate of about 100 to 150 cubic feet per day. Actual percolation rates may differ due to variations in the composition and conditions of the pond soils.

4.9 SURFACE DRAINAGE

The long term performance of the building will be significantly enhanced by attention to the provision and maintenance of proper surface drainage. In addition, the soils at the site are prone to erosion. The intent of the following recommendations is to provide general information regarding the control of surface water around the perimeter of the structures.

1. Ponding and areas of low flow gradients should be avoided.

EXPANSION INDEX (UBC 18-2 & ASTM D4829)
PERCENT PASSING THE NUMBER 200 SIEVE (ASTM D1140)

Boring No. / Sample No.	Sample Depth (feet)	% Passing No. 200	Expansion Index	UBC Table 18-I-B
B-1/4	0 – 5	15	--	--
B-1/8*	20 – 21.5	57	--	--
B-1/11*	35 – 36.5	14	--	--
B-2/3	0 – 5	28	--	--
B-3/4	0 – 5	25	--	--
B-4/3	0 – 5	49	20	Very Low Potential
B-5/3	0 – 5	39	--	--

* From Grain-size distribution ASTM D422

SOLUBLE SULFATE CONTENT (CA STM 417)
METALLIC CORROSION (CA STM 643)

Boring No. / Sample No.	Sample Depth (feet)	Concrete	Metallic	
		Soluble Sulfates ppm (percent)	pH	Electrical Resistivity (ohm-cm)
B-1/4	0 – 5	53 (0.0053)	--	--
B-3/4	0 – 5	49 (0.0049)	7.5	2,475

R-VALUE (CA STM 301)

Boring No. / Sample No.	Sample Depth (feet)	R-Value
B-4/3	0 – 5	49

CONSTANT-HEAD PERMEABILITY TEST (ASTM 2434)

Boring No. / Sample No.	Sample Depth (feet)	Coefficient of Permeability (cm/sec)
B-2/3	0 – 5	5.6×10^{-6}
B-4/3	0 – 5	9.9×10^{-6}

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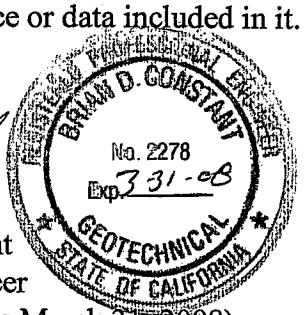
GeoLogic Associates



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APPENDIX C

Hydrology Calculations

Marsh Park
KPFF Project No: 108247

Pre-Construction Conditions Hydrology Summary

Subarea	Area (acres)	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.)	Tc-calculated (min.)	Intensity (in./hr)	Cu	Cd	Flow rate (cfs)	Fire Factor	Volume (acre-ft)
1	0.76	0.95	50	15	240	0.014	6.3	5	3.76	0.48	0.88	2.51	1	0.34
2	2.32	0.4	50	15	320	0.02	6.3	6	3.45	0.45	0.63	5.04	1	0.52
												7.55	**cfs**	
									(Run-on from Gleneden St.) ->		+	6.89		
												14.44	**cfs**	

Marsh Park
KPFF Project No: 108247

Post-Construction Conditions Hydrology Summary

Subarea	Area (acres)	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.)	Tc-calculated (min.)	Intensity (in./hr)	Cu	Cd	Flow rate (cfs)	Fire Factor	Volume (acre-ft)
1	0.06	0.75	50	15	58	0.011	6.3	5	3.76	0.48	0.8	0.18	1	0.02
2	0.03	0.1	50	15	43	0.032	6.3	5	3.76	0.48	0.52	0.06	1	0
3	0.09	0.15	50	15	82	0.013	6.3	5	3.76	0.48	0.54	0.18	1	0.01
4	0.07	0.6	50	15	63	0.011	6.3	5	3.76	0.48	0.73	0.19	1	0.02
5	0.15	0.25	50	15	70	0.02	6.3	5	3.76	0.48	0.59	0.33	1	0.02
7	0.08	0.4	50	15	53	0.03	6.3	5	3.76	0.48	0.65	0.2	1	0.02
8	0.07	0.2	50	15	142	0.021	6.3	5	3.76	0.48	0.56	0.15	1	0.01
9	0.09	0.15	50	15	126	0.024	6.3	5	3.76	0.48	0.54	0.18	1	0.01
10	0.28	0.2	50	15	203	0.027	6.3	5	3.76	0.48	0.56	0.59	1	0.04
11	0.07	0.2	50	15	43	0.023	6.3	5	3.76	0.48	0.56	0.15	1	0.01
12	0.05	0.4	50	15	47	0.036	6.3	5	3.76	0.48	0.65	0.12	1	0.01
13	0.13	0.1	50	15	165	0.041	6.3	5	3.76	0.48	0.52	0.25	1	0.01
14	0.22	0.6	50	15	133	0.025	6.3	5	3.76	0.48	0.73	0.6	1	0.07
15	0.44	0.75	50	15	178	0.035	6.3	5	3.76	0.48	0.8	1.32	1	0.16
16	0.15	0.35	50	15	130	0.035	6.3	5	3.76	0.48	0.63	0.36	1	0.03
17	0.36	0.25	50	15	250	0.025	6.3	5	3.76	0.48	0.59	0.8	1	0.06
18	0.32	0.75	50	15	90	0.008	6.3	5	3.76	0.48	0.8	0.96	1	0.12
19	0.08	0.15	50	15	144	0.02	6.3	5	3.76	0.48	0.54	0.16	1	0.01
												6.78	**cfs**	
									(Run-on from Gleneden St.) ->		+	6.89		
												13.67	**cfs**	

SIZING STORM WATER DRAINAGE SYSTEMS

D 1 Roof Drainage.

The rainfall rates in Table D-1 should be used for design unless higher values are established locally.

D 2 Sizing by Flow Rate.

Storm drainage systems can be sized by storm water flow rates, using the appropriate GPM/square foot of rainfall listed in Table D-1 for the local area. Multiplying the listed GPM/square foot by the roof area being drained by each inlet (in square feet) produces the gallons per minute (GPM) of required flow for sizing each drain inlet. The flow rates (GPM) can then be added to determine the flows in each section of the drainage system. Required pipe sizes for various flow rates (GPM) are listed in Table 11-1 and Table 11-2.

D 3 Sizing by Roof Area.

Storm drainage systems can be sized using the roof area served by each section of the drainage system. Maximum allowable roof areas with various rainfall rates are listed in Table 11-1 and Table 11-2, along with the required pipe sizes. Using this method, it may be necessary to interpolate between two listed rainfall rate columns (inches per hour). To determine the allowable roof area for a listed pipe size at a listed slope, divide the allowable square feet of roof for a one (1) inch (25.4 mm/h) rainfall rate by the listed rainfall rate for the local area. For example, the allowable roof area for a six (6) inch (152 mm) drain at one-eighth (1/8) inch (3.2 mm) slope with a rainfall rate of 3.2 inches (81 mm/h) is 21,400/3.2 = 6688 square feet (621.3 m^2).

D 4 Capacity of Rectangular Scuppers.

Table D-2 lists the discharge capacity of rectangular roof scuppers of various widths with various heads of water. The maximum allowable level of water on the roof should be obtained from the structural engineer, based on the design of the roof.

TABLE D-1
Maximum Rates of Rainfall for Various Cities

The rainfall rates in this table are based on U.S. Weather Bureau Technical Paper No. 40, Chart 14: 100-Year 60-Minute Rainfall (inches).

States and Cities	Storm Drainage 60-Minute Duration, 100-Year Return	
	Inches/Hour	GPM/Square Foot
ALABAMA		
Birmingham	3.7	0.038
Huntsville	3.3	0.034
Mobile	4.5	0.047
Montgomery	3.8	0.039
ALASKA		
Aleutian Islands	1.0	0.010
Anchorage	0.6	0.006
Bethel	0.8	0.008
Fairbanks	1.0	0.010
Juneau	0.6	0.006
ARIZONA		
Flagstaff	2.3	0.024
Phoenix	2.2	0.023
Tucson	3.0	0.031

TABLE D-1 Continued

States and Cities	Storm Drainage 60-Minute Duration, 100-Year Return	
	Inches/Hour	GPM/Square Foot
ARKANSAS		
Eudora	3.8	0.039
Ft. Smith	3.9	0.041
Jonesboro	3.5	0.036
Little Rock	3.7	0.038
CALIFORNIA		
Eureka	1.5	0.016
Lake Tahoe	1.3	0.014
Los Angeles	2.0	0.021
Lucerne Valley	2.5	0.026
Needles	1.5	0.016
Palmdale	3.0	0.031
Redding	1.5	0.016
San Diego	1.5	0.016
San Francisco	1.5	0.016
San Luis Obispo	1.5	0.016
COLORADO		
Craig	1.5	0.016
Denver	2.2	0.023
Durango	1.8	0.019
Stratton	3.0	0.031
CONNECTICUT		
Hartford	2.8	0.029
New Haven	3.0	0.031
DELAWARE		
Dover	3.5	0.036
Rehobeth Beach	3.6	0.037
DISTRICT OF COLUMBIA		
Washington	4.0	0.042
FLORIDA		
Daytona Beach	4.0	0.042
Ft. Myers	4.0	0.042
Jacksonville	4.3	0.045
Melbourne	4.0	0.042
Miami	4.5	0.047
Palm Beach	5.0	0.052
Tampa	4.2	0.044
Tallahassee	4.1	0.043
GEORGIA		
Atlanta	3.5	0.036
Brunswick	4.0	0.042
Macon	3.7	0.038
Savannah	4.0	0.042
Thomasville	4.0	0.042

APPENDIX D

Onsite Pipe Network Sizing

Marsh Park

KPFF Project No.: 108247

Pipe #	Friction Method	Roughness Coefficient	Channel Slope (ft/ft)	Normal Depth (ft)	Diameter (ft)	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Top Width (ft)	Critical Depth (ft)
P1	Manning Formula	0.01	0.01	0.21	0.5	0.26	0.08	0.7	0.11	0.49	0.26
P2	Manning Formula	0.01	0.01	0.15	0.5	0.15	0.05	0.59	0.09	0.46	0.19
P3	Manning Formula	0.01	0.01	0.17	0.5	0.18	0.06	0.62	0.09	0.47	0.21
P4	Manning Formula	0.01	0.01	0.35	0.67	0.87	0.19	1.09	0.17	0.67	0.44
P5	Manning Formula	0.01	0.01	0.27	0.5	0.41	0.11	0.82	0.13	0.5	0.33
P6	Manning Formula	0.01	0.01	0.19	0.5	0.22	0.07	0.66	0.1	0.48	0.24
P7	Manning Formula	0.01	0.01	0.33	0.67	0.76	0.17	1.03	0.16	0.67	0.41
P8	Manning Formula	0.01	0.01	0.16	0.5	0.16	0.05	0.6	0.09	0.47	0.2
P9	Manning Formula	0.01	0.01	0.18	0.5	0.2	0.06	0.64	0.1	0.48	0.22
P10	Manning Formula	0.01	0.01	0.18	0.5	0.21	0.07	0.65	0.1	0.48	0.23
P11	Manning Formula	0.01	0.01	0.13	0.5	0.11	0.04	0.54	0.08	0.44	0.16
P12	Manning Formula	0.01	0.01	0.12	0.5	0.09	0.04	0.51	0.07	0.43	0.15
P13	Manning Formula	0.01	0.01	0.39	0.67	1.03	0.21	1.17	0.18	0.66	0.48
P14	Manning Formula	0.01	0.01	0.42	0.83	1.46	0.28	1.32	0.21	0.83	0.54
P15	Manning Formula	0.01	0.01	0.29	0.67	0.63	0.15	0.97	0.15	0.66	0.37
P16	Manning Formula	0.01	0.01	0.52	1	2.49	0.41	1.61	0.26	1	0.68
P17	Manning Formula	0.01	0.01	0.63	1	3.32	0.52	1.83	0.28	0.97	0.78
P18	Manning Formula	0.01	0.01	0.39	0.83	1.28	0.25	1.26	0.2	0.83	0.51
P19	Manning Formula	0.01	0.01	0.46	1	2.04	0.36	1.5	0.24	1	0.61
P20	Manning Formula	0.01	0.01	0.49	1	2.2	0.38	1.54	0.25	1	0.63
P21	Manning Formula	0.01	0.01	0.74	1.25	5.52	0.76	2.19	0.34	1.23	0.95
P22	Manning Formula	0.01	0.01	0.76	1.25	5.72	0.78	2.23	0.35	1.22	0.97
P23	Manning Formula	0.01	0.01	0.74	1.5	6.75	0.88	2.35	0.37	1.5	1.01
P24	Manning Formula	0.01	0.01	0.77	1.5	7.12	0.91	2.39	0.38	1.5	1.03
P25	Manning Formula	0.01	0.01	1	2	14.62	1.56	3.14	0.5	2	1.38
P26	Manning Formula	0.01	0.01	0.77	1.5	7.09	0.91	2.39	0.38	1.5	1.03
P27	Manning Formula	0.01	0.01	0.77	1.5	7.18	0.92	2.4	0.38	1.5	1.04
P28	Manning Formula	0.01	0.01	0.78	1.5	7.29	0.93	2.42	0.38	1.5	1.05
P29	Manning Formula	0.01	0.01	0.79	1.5	7.5	0.95	2.44	0.39	1.5	1.06

Percent Full (%)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Maximum Discharge (ft^3/s)	Discharge Full (ft^3/s)	Slope Full (ft/ft)	Flow Type
41.2	0.00463	3.41	0.18	0.39	1.52	0.78	0.73	0.00127	SuperCritical
30.8	0.00427	2.92	0.13	0.29	1.54	0.78	0.73	0.00042	SuperCritical
33.8	0.00433	3.08	0.15	0.32	1.55	0.78	0.73	0.00061	SuperCritical
52.7	0.00503	4.62	0.33	0.68	1.53	1.71	1.59	0.00299	SuperCritical
53.6	0.00548	3.82	0.23	0.5	1.45	0.78	0.73	0.00316	SuperCritical
37.7	0.00446	3.25	0.16	0.35	1.53	0.78	0.73	0.00091	SuperCritical
48.6	0.0047	4.46	0.31	0.64	1.56	1.71	1.59	0.00228	SuperCritical
31.8	0.00428	2.98	0.14	0.3	1.55	0.78	0.73	0.00048	SuperCritical
35.7	0.00439	3.17	0.16	0.34	1.54	0.78	0.73	0.00075	SuperCritical
36.7	0.00444	3.21	0.16	0.34	1.54	0.78	0.73	0.00083	SuperCritical
26.3	0.00418	2.67	0.11	0.24	1.54	0.78	0.73	0.00023	SuperCritical
23.7	0.0042	2.53	0.1	0.22	1.54	0.78	0.73	0.00015	SuperCritical
58.6	0.0056	4.8	0.36	0.75	1.48	1.71	1.59	0.00419	SuperCritical
51.1	0.00463	5.26	0.43	0.85	1.6	3.03	2.82	0.00268	SuperCritical
43.7	0.00439	4.25	0.28	0.57	1.59	1.71	1.59	0.00157	SuperCritical
52.2	0.00453	6	0.56	1.08	1.64	4.98	4.63	0.00289	SuperCritical
62.7	0.00566	6.41	0.64	1.27	1.54	4.98	4.63	0.00514	SuperCritical
47.3	0.00435	5.08	0.4	0.79	1.63	3.03	2.82	0.00206	SuperCritical
46.4	0.00409	5.71	0.51	0.97	1.68	4.98	4.63	0.00194	SuperCritical
48.5	0.00423	5.82	0.53	1.01	1.67	4.98	4.63	0.00226	SuperCritical
59.2	0.00502	7.3	0.83	1.57	1.64	9.03	8.4	0.00432	SuperCritical
60.5	0.00519	7.36	0.84	1.6	1.63	9.03	8.4	0.00464	SuperCritical
49.7	0.00392	7.71	0.92	1.67	1.78	14.69	13.65	0.00244	SuperCritical
51.3	0.00404	7.81	0.95	1.72	1.77	14.69	13.65	0.00272	SuperCritical
49.8	0.00368	9.34	1.36	2.35	1.86	31.63	29.41	0.00247	SuperCritical
51.1	0.00403	7.8	0.95	1.71	1.77	14.69	13.65	0.0027	SuperCritical
51.5	0.00407	7.82	0.95	1.72	1.76	14.69	13.65	0.00276	SuperCritical
52	0.00411	7.85	0.96	1.74	1.76	14.69	13.65	0.00285	SuperCritical
52.9	0.00419	7.91	0.97	1.77	1.75	14.69	13.65	0.00302	SuperCritical