APPENDIX H – GEOTECHNICAL REPORTS

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REPORT OF SUBSURFACE INVESTIGATION
DESCANSO AREA DEVELOPMENT
CUYAMACA RANCHO STATE PARK
SAN DIEGO COUNTY, CALIFORNIA

prepared for

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by

GEOTECHNICS INCORPORATED
Project No. 0730-020-00
Document No. 08-0028

January 18, 2008

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Project No. 0730-020-00
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Attention: Mr. Matt Dorman

SUBJECT: REPORT OF SUBSURFACE INVESTIGATION
Descanso Area Development
Cuyamaca Rancho State Park
San Diego County, California

Dear Mr. Dorman:

In accordance with your request, we have completed a subsurface investigation and geotechnical evaluation for the proposed Descanso Area Development in San Diego County, California. This report presents the results of our investigation and provides recommendations for earthwork construction, and for the design of structures and pavements. Based on the results of our investigation, we consider the proposed construction feasible from a geotechnical standpoint.

We appreciate this opportunity to provide our professional services. If you have any questions or require additional services, please do not hesitate to contact us.

Respectfully submitted,
GEOTECHNICS INCORPORATED

John R. Theissen, P.E.
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SAN DIEGO COUNTY, CALIFORNIA

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REPORT OF SUBSURFACE INVESTIGATION
DESCANSO AREA DEVELOPMENT
CUYAMACA RANCHO STATE PARK
SAN DIEGO COUNTY, CALIFORNIA

1 INTRODUCTION

This report presents the results of our subsurface investigation and geotechnical evaluation for the Descanso Area Development in Cuyamaca Rancho State Park, San Diego County, California. The purpose of the subsurface investigation was to evaluate the physical characteristics of the soils below and adjacent to the proposed improvements and provide geotechnical recommendations regarding earthwork construction, bearing capacity of pipelines and structures, pavement support, and evaluations of seismic hazards and obvious site contamination. Recommendations for support of seismic loads are also provided. The conclusions and recommendations presented in this report are based on the subsurface conditions encountered during our field explorations, laboratory testing of selected soil samples collected from the site, and engineering analysis.

2 SCOPE OF SERVICES

The scope of services provided during this investigation was generally as described in our Proposal No. 07-022, dated February 27 (Document No. 07-0063), and included the following items:

1. Reviewed available published geologic maps, topographic maps, aerial photographs, and other literature pertinent to the geotechnical conditions at the proposed day use area.

2. Conducted a reconnaissance of the site and marked out boring locations for State Parks personnel to identify any subsurface utilities in the area. Contacted Underground Services Alert (USA) and obtained a Digalert Ticket Number.

3. Investigated the soil/groundwater conditions in the area of the proposed improvements by drilling 10 borings within the planned improvement area. The borings were advanced to depths of up to 20 feet below existing ground surface using a jeep mounted, 6-inch diameter, solid-stem auger drill rig. Selected soil samples were collected for laboratory testing. The borings were backfilled with soil cuttings.

4. Conducted percolation testing at the site to obtain preliminary percolation rates for on-site sewage disposal system design per County of San Diego Department of Environmental Health guidelines. One boring was advanced to a depth of 20 feet below ground surface in each of the two potential leach field locations and a 2-inch diameter perforated pvc standpipe was installed to observe for shallow groundwater conditions. The preliminary percolation testing was performed in 8 shallow (36-inch deep) borings per County of San Diego guidelines for leach line septic systems.

5. Evaluation of the engineering properties of the soils likely to affect construction of the proposed improvements by performing laboratory tests on selected samples obtained from the borings. Laboratory testing included soil pH and resistivity, soluble sulfate and chloride content, shear strength, maximum density, R-value, and expansion index.

6. Evaluation of the potential geologic hazards that may affect the site, including groundwater conditions, faulting and seismicity, slope stability, settlement potential, and expansive soils.

7. Engineering and geologic analysis of the field and laboratory data in order to develop recommendations for site preparation within the improvement areas, including a discussion on the excavatibility of the soils that may be encountered, subgrade preparation, fill and backfill, grading for pavements, and foundation design parameters. In addition, we have also provided recommendations for pipeline design, considering vertical and lateral load supporting capacities, allowable soil bearing pressures and anticipated settlement and seismic design parameters, and recommendations for pavement sections based on R-value tests

8. Preparation of this report summarizing our findings, conclusions, and recommendations.

3 SITE DESCRIPTION AND PROPOSED IMPROVEMENTS

The proposed Descanso Area Development is located at the southern end of Cuyamaca Rancho State Park northeast of the town of Descanso, as shown on the Site Location Map, Figure 1. The roughly "L" shaped parcel is bound by Viejas Boulevard to the south, private residences to east and west, and undeveloped State Park property to the north. The southwest portion of the site borders Descanso Elementary School. The site lies within a portion of the Sweetwater River valley where the Sweetwater River and Descanso Creek join and flow south. The site is relatively flat topographically and gradually slopes southwest toward the Sweetwater River at a gradient of approximately 2 percent. Several shallow southwest flowing drainage courses cross the site and appear to be the result of storm water runoff as shown on the Geotechnical Map, Figure 2). Most of the site is covered with grass, while the north and east sides contain large

trees. The site is accessed through a locked gate at the end of a dirt driveway and parking area along the southeast corner of the property. Existing improvements include an old stone house near the parking area, and an abandoned well and small wood framed shed near the east-central portion of the site. A dirt riding and hiking trail traverses the site in a north-south direction along the eastern property line. Elevations at the site range from 3,430 feet above mean seal level (MSL) in the northern end to 3,403 feet MSL along Viejas Boulevard to the south.

We understand that the planned development of the site will include a new entrance driveway, parking area and a circular access road with day use facilities and overnight campsites. Associated improvements may include restrooms with on-site sewage disposal systems, utilities, trailer storage, RV parking, storage yards, equestrian rings/pens, trails, stables, waste areas, inlets, culverts, pipelines, detention basins, and earthen berms. We have assumed the design of any structures will be in accordance with the requirements of the 2007 California Building Code. We understand that a traditional bid type contract may be utilized for construction. The purpose of this investigation was to provide necessary information regarding the existing soil conditions that can be incorporated into the bid request.

4 GEOLOGY AND SUBSURFACE CONDITIONS

The site is located within the Peninsular Ranges Geomorphic Province of California. This province, which stretches from the Los Angeles basin to the tip of Baja California, is characterized as a series of northwest trending mountain ranges separated by subparallel fault zones, and a coastal plain of subdued landforms. The mountain ranges are underlain primarily by Mesozoic metamorphic rocks that were intruded by plutonic rocks of the southern California batholith, while the coastal plain is underlain by subsequently deposited marine and nonmarine sedimentary formations.

The subject site is located in the mountain ranges portion of the Peninsular Ranges Geomorphic Province. Specifically, the site is underlain at depth by Cretaceous-age granitic rock that is mantled by surficial deposits of alluvium associated with the Sweetwater River floodplain. Outcrops of granitic rock and “corestone” boulders were observed at ground surface in several areas around the site. Primary geotechnical concerns on site include the presence of compressible surficial soils, shallow groundwater, potentially liquefiable soils and the presence

of hard rock in areas of proposed improvements. The aerial extent of the geologic materials encountered at the site is shown on the Geotechnical Map, Figure 2. The approximate locations of the 10 exploratory borings conducted for this investigation are also shown on the Figure 2. Logs describing the subsurface conditions encountered in the explorations are presented in Appendix B. The geotechnical characteristics of the materials at the site are discussed below.

4.1 Granitic Rock (Map Symbol Kgr)

Undifferentiated granitic rock of Cretaceous age underlies the entire site at depth. The granitic rock was not encountered in any of the borings excavated at the site; however, shallow buried granitic rock may be encountered during site development in areas not explored. As observed in outcrops at the site, the granitic rock is generally light brown to brown in color, fine to coarse grained, and hard. Corestones (boulders or floaters) and outcrops of intact, slightly weathered granitic rock may be encountered in the north and eastern portions of the site. The granitic rock is characterized by high bearing capacity and low compressibility. If encountered during grading or in excavations, this material will likely require significant breaking and/or blasting to excavate.

4.2 Alluvium (Qal)

Quaternary age alluvial soils associated with the Sweetwater River and slopewash from the surrounding mountains covers the entire site. Alluvium was encountered in all of the borings excavated at the site, and generally consists of silty sand (Unified Soil Classification: SM) and sandy silt (ML). The alluvium is generally brown in color, fine to coarse grained, loose, and has a very low potential for expansion. The upper three feet generally contained a substantial amount of roots and organic materials. These materials are considered loose and not capable of supporting structural loads or pavements in their present condition.

4.3 Groundwater

Groundwater was encountered in two of the borings excavated at the site (B-2 and B-4) at depths of 15 to 18 feet below the ground surface. In addition, groundwater measurements taken in the abandoned well indicated a depth of 18 feet below ground surface. Groundwater depths at the site have been monitored since at least December 1990 by the County of San Diego (Figure 3, Historic Groundwater Levels). The depth of

groundwater levels fluctuate significantly over time, with an historic high of approximately 2 to 3 feet below ground surface (4/26/1996) to 25 feet below ground surface (2/27/2003). These fluctuations are likely associated with periods of drought and periods of heavy rainfall. Current groundwater depths of between 15 and 18 feet below ground surface will not adversely affect the planned site development. However, seasonal changes in rainfall, and changes in irrigation and drainage associated with site development, rainfall runoff, or broken pipes may result in elevated groundwater conditions within the soil underlying the site. Extremely shallow groundwater depths (such as the 2 to 3 feet below ground surface measurements from 4/26/1996) may impact the site significantly. Potentially shallow groundwater conditions may conflict with septic system requirements, may create difficult working conditions for heavy equipment, and may cause distress to site improvements such as buildings, roads, and utilities. Recommendations for mitigation of nuisance groundwater during construction are provided in this report. The hydrologic characteristics of the site including potential high groundwater levels, surface runoff, and impacts of development on local groundwater resources should be determined by a qualified professional prior to final design.

4.4 Photo-Ionization Detector Results

Soil Samples were scanned for volatile organic vapors using a Photo-Ionizing Detector (PID). Monitoring procedures are described in Appendix B. The monitoring results generally did not detect significant concentrations of volatile organic compounds from the samples. The test results are shown on the boring logs in Appendix B.

5 GEOLOGIC HAZARDS

This portion of Cuyamaca Rancho State Park is not located within an active faulting area, and no evidence of past faulting was found at the site, or in our review of geologic maps and literature. The geologic hazard that would most likely affect the site is strong ground shaking from seismic events on nearby active faults.

5.1 Seismicity and Ground Motion

According to the program TOPO!© (National Geographic Holdings, 2006), the site is located at a latitude of approximately 32.8619° north and a longitude of approximately 116.6131° west (Datum NAD83/WGS84). The Fault Location Map, Figure 4, shows the locations of known active faults within a 62.14-mile (100-km) radius of the site. Tables 1a through 2b, Regional Seismicity, show the properties of these faults at the site. The deterministic values of the faults shown in the table were developed using the program EQFAULT (Blake, 2000) and published attenuation relationships for soil and rock sites (Sadigh et al, 1997). The nearest known active fault is the Elsinore-Julian segment of the Elsinore fault zone located approximately 13.3 miles (21.4 km) northeast of the site.

The historical site seismicity was evaluated using the program EQSEARCH (Blake, 2000). This program creates a listing of the locations, dates, and magnitudes of historical earthquakes, which may have occurred within 100 kilometers of the site, along with an Earthquake Recurrence Curve, generated from this data. The results of the EQFAULT and EQSEARCH analyses are presented in Appendix D.

The program FRISKSP (Blake, 2000) was used to perform a probabilistic analysis of seismicity at the subject site based on the characteristic earthquake distribution of Youngs and Coppersmith (1985) and attenuation relationships for deep soil and rock (Sadigh et al, 1997). Based on the results of the probabilistic analysis, the Design Basis Earthquake defined as the motion having a 10 percent probability of being exceeded in a 50-year period (475-year return period) produces a ground acceleration of 0.24g for a soil site and 0.23g for a rock site. The Upper Bound Earthquake, defined as the motion having a 10 percent probability of being exceeded in a 100-year period (979-year Return Period), produces a ground acceleration of 0.28g for a soil site and 0.28g for a rock site. The Maximum Considered Earthquake, defined as the motion having a 2 percent probability of being exceeded in a 50-year period (2,475-year Return Period), produces a ground acceleration of 0.34g for a soil site and 0.34g for a rock site. The data from the seismic analyses is presented in Appendix D.

5.2 Surface Rupture

Surface rupture is the result of movement on an active fault reaching the surface. The site is shown in relation to known active faults in the region on the Fault Location Map, Figure 4. The nearest known active fault is the Elsinore-Julian segment of the Elsinore fault zone located approximately 13.3 miles (21.4 km) northeast of the site (CDMG, 1994; Jennings, 1994). There are no known active faults underlying the site or projecting toward the site. The site is not located within an Alquist-Priolo Earthquake Fault Zone. In our opinion, the probability of surface rupture due to faulting beneath the site is considered low. However, lurching and ground cracking are a possibility as a result of a significant seismic event on a nearby active fault.

5.3 Liquefaction and Dynamic Settlement

Liquefaction is a process in which soil grains in a saturated deposit lose contact due to earthquakes or other sources of ground shaking. The soil deposit temporarily behaves as a viscous fluid; pore pressures rise, and the strength of the deposit is greatly diminished. Liquefaction is often accompanied by sand boils, lateral spread, and post-liquefaction settlement as the pore pressures dissipate. Liquefiable soils typically consist of cohesionless sands and silts that are loose to medium dense, and saturated. Clayey soil deposits do not liquefy because the soil skeleton is not supported by grain-to-grain contact, and is therefore not subject to densification by shaking. To liquefy, soils must be subjected to a ground shaking of sufficient magnitude and duration. Given the location of the site in relation to known active faults, the presence of loose cohesionless alluvial soils, and the presence of a shallow groundwater table, it is our opinion that the potential for liquefaction from ground shaking is high.

Dynamic settlement is a process in which a deposit of loose soil densifies during the vibrations induced by the occurrence of earthquakes or other sources of ground shaking. Soils subject to dynamic settlement typically consist of cohesionless sands and silts, but such soils do not have to be saturated. To settle the soils must be subjected to ground shaking of sufficient magnitude and duration. The site is underlain by loose alluvial soils. In our opinion, there is potential for dynamic settlement to occur at the site.

Depending on the final location of the proposed structures, total settlement due to dynamic settlement and liquefaction may be on the order of ½ to 1 foot.

5.4 Subsidence

The subject site is not within an area known for commercial fluid extraction (oil or water), nor is the area known for past cases of subsidence due to fluid removal (Alfors, 1973). Although an abandoned water well exists on site, and the local aquifer likely provides water to the residences, no information was found regarding subsidence resulting from this activity. It is our opinion that subsidence due to the extraction of fluids is negligible.

5.5 Landslides and Lateral Spreads

Lateral spreading is the result of liquefaction or plastic deformation occurring on gently sloping ground during an earthquake. Typically, the event requires an unsupported, steep cut or scarp at the toe of the failure area that allows the initial lateral displacement. Evidence of ancient landslides or slope instabilities was not observed within the planned improvement area during our investigation. Accordingly, the potential for landslides or lateral spreads to significantly impact the site is considered negligible.

5.6 Tsunamis, Seiches, Earthquake Induced Flooding, and General Flooding

Given the distance between the subject site and the coast, and the site's elevation above sea level (above 3,400 feet), the potential for damage due to tsunamis (seismically induced waves) is considered negligible. The site is not located next to a lake or other large body of water; therefore, the potential for damage due to seiches or earthquake induced flooding is negligible. The site is located within the Sweetwater River floodplain, however, and portions of the site fall within the 100 and 500-year flood event according to the Flood Insurance Rate Map (Figure 5).

6 CONCLUSIONS

Based on the results of this investigation, it is our opinion that the proposed construction is feasible from a geotechnical standpoint provided the following recommendations and appropriate construction practices are followed. No geotechnical conditions were encountered that would preclude the proposed construction. Geotechnical design and construction considerations include the following:

- In general, excavations at the site should be achievable using standard heavy earthmoving equipment in good-working order with experienced operators. Granitic rock, if encountered may require rock breaking and/or blasting to excavate. If removal of trees is required, extra effort to remove all of the stump and roots may be necessary

- Groundwater was encountered in the exploratory borings conducted for this report at depths of 15 to 18 feet below ground surface. Historic groundwater records indicate that groundwater levels have risen to within 2 to 3 feet of the ground surface during extremely wet years. Extremely wet weather or significant changes in drainage at the site may result in shallow groundwater conditions that could adversely impact the proposed improvements, especially the planned septic system, building foundations and slabs, and road subgrade. If construction coincides with wet weather, shallow or perched groundwater may result in adverse conditions for heavy equipment operation requiring the use of specialty or low ground pressure tracked equipment.

- Loose, compressible alluvial soils are found over much of the site. These alluvial soils may settle under increased loads, or due to an increase in moisture content from changes in irrigation or site drainage. Consequently, the alluvial soils should be excavated and replaced as compacted fill in areas which will be subjected to fill or structural loads, and in pavement areas. Remedial grading recommendations are contained in the following sections of this report.

- In areas of loose, saturated alluvial soils, additional settlement due to dynamic densification or liquefaction of the alluvial soils may be anticipated. Because of the size of the proposed improvements, the cost of improving the underlying soils or placing the structures on deep foundations would probably be significantly more that the cost of the structures. Reinforced mat foundations and compacted soil pads may be used to reduce the adverse effects of seismically induced settlements.

7 RECOMMENDATIONS

The remainder of this report presents recommendations regarding earthwork construction as well as geotechnical recommendations for the design of the proposed structures and improvements. These recommendations are based on empirical and analytical methods typical of the standard-of-practice in southern California. If these recommendations appear not to address a specific feature of the project, please contact our office for additions or revisions to the recommendations.

7.1 Plan and Specification Review

Preliminary plans were not available at the time of this investigation. We recommend that improvement plans and specifications be reviewed by Geotechnics Incorporated prior to finalization to evaluate conformance of the plans with the intent of the recommendations of this report. Significant changes in the locations of the proposed improvements may require additional geotechnical evaluation.

7.2 Excavation and Grading Observation

Geotechnics Incorporated should provide observation and testing services continuously during earthwork construction. Such observations are considered essential to identify field conditions that differ from those anticipated by the investigation, to adjust designs to actual field conditions, and to determine that fill and/or backfill is placed in general accordance with the recommendations of this report. Recommendations presented in this report are contingent upon Geotechnics Incorporated performing such services. Our personnel should perform sufficient testing of fill during construction to support our professional opinion as to compliance with compaction recommendations.

7.3 Earthwork

Earthwork for the proposed development will include remedial grading of compressible soils, possible remedial grading of expansive soils, temporary trench excavations for underground utilities, and placement and compaction of fill, backfill, and pavement sections. Grading and earthwork should be conducted in accordance with the California Building Code (CBC), and with the recommendations of this report. The following recommendations are provided regarding specific aspects of the proposed earthwork

construction. These recommendations should be considered subject to revision based on field conditions observed by the geotechnical consultant during construction.

7.3.1 Site Preparation

General site preparation should include the removal of unsuitable and deleterious materials, existing structures or pipelines, or other improvements from areas that will be subjected to structural or fill loads. Clearing and grubbing should consist of the removal of vegetation including brush, grass, weeds, wood, tree roots, and otherwise deleterious materials from areas to be graded. Clearing and grubbing should extend to the limits of grading. Unsuitable materials include vegetation, trash, construction debris, highly organic soil, rocks more than 6 inches in greatest dimension, contaminated soils, or other undesirable materials. Removed materials should be hauled off-site and legally disposed.

The removal of unsuitable materials should be conducted under the observation of the geotechnical consultant to evaluate the competency of the exposed materials for support of structural and fill loads. The excavation of unsuitable materials should be conducted in a way that minimizes the disturbance of competent materials.

All facilities, structures, foundations, utilities (above and below ground), and any other man-made improvements within the grading limits, that are not to be saved for future use, should be demolished and legally disposed off-site. Subsurface improvements or obstructions that are to be removed should be excavated and hauled off-site. The resulting excavations should be backfilled and compacted in accordance with the recommendations of this report. *Demolition of pipelines may consist of capping or rerouting at the project perimeter, and removal within the project perimeter. If appropriate, abandoned pipelines may be filled with grout or slurry cement as recommended by, and under the observation of, the geotechnical consultant.* Man-made improvements to be saved should be protected from damage by the contractor.

7.3.2 Remedial Grading

<u>Compressible Soils</u>: In general, the existing alluvium is considered compressible and not suitable for the support of pavements and structural improvements such as

building foundations, retaining walls, and pipelines. Remedial grading is recommended if compressible soils are encountered within the proposed improvement areas or wherever the existing soils are disturbed due to demolition of existing structures or improvements, or tree removals. Alluvial soils should be removed and replaced as compacted fill to a depth of five feet below finish grade in the building areas, or at least three feet below bottom of footings, whichever is deepest. In addition, alluvial soils should be removed and replaced as compacted fill to a depth of at least three feet below existing grade in areas where new fills extend above existing grade. The removals should extend a minimum of five feet outside the building, pavement, or fill envelope. Alluvial soils in all other improvement areas, such as roads, parking areas, campsites, and utilities, should be removed and replaced as compacted fill to a depth of three feet below existing grade The excavation bottoms should be observed by Geotechnics Incorporated personnel to evaluate the need for additional removals.

Expansive Soils: The existing soils generally have a very low expansion potential. However, areas between borings, or areas not explored may contain moderately to highly expansive clays. If such soils are encountered, they should not be used in support of structures. We recommend that expansive materials be excavated and replaced with soils having a very low expansion potential (expansion index of 20 or less). The removals should extend to a minimum depth of five feet below finish grade in the building areas and to a depth of two feet below finish grade in the area of pavements. Any sand or gravel layers installed as part of a bedding layer or pavement subgrade may be incorporated as part of the low expansion soil layer.

The replacement material may consist of on-site or imported soil with an expansion index of 20 or less, based on the guidelines of ASTM D4829. The replacement material should be compacted as recommended in this report.

7.3.3 Excavatibility

Excavations in the alluvium at the site should generally be achievable using standard excavation equipment in good-working order with experienced operators. Rock breaking or blasting are not expected to be required unless shallow exposures of hard granitic rock are encountered. Material larger than 6 inches in maximum dimension is not considered suitable for use as fill. If

earthwork operations are conducted during the wet season, or after periods of heavy rainfall, low ground pressure and/or track mounted equipment may be required.

7.3.4 Temporary Excavations

Temporary excavations are anticipated to be less than 10 feet in depth and are expected to be stable provided they are laid back in accordance with our recommendations or shored. All excavations should conform to Cal-OSHA guidelines. Workers should be protected from falling rocks, caving soils, and flooding in accordance with Cal-OSHA requirements. Temporary excavations up to 10 feet deep should be laid back no steeper than 1:1 (horizontal:vertical), or shored, prior to allowing workers to enter. Where temporary excavations extend below a plane inclined at 1½:1 (horizontal:vertical) downward from the outside bottom edge of adjacent existing structures, shoring is recommended. Should deeper temporary excavations be required or should groundwater be encountered, Geotechnics should be notified so that additional recommendations may be provided.

For temporary excavations that will be shored, but not braced with struts, we recommend using a triangular pressure distribution for calculating earth pressures. Cantilevered shoring design may be based on an equivalent fluid pressure of 40 pcf above water level and 85 pcf below water level, plus surcharge loads resulting from loads placed above the excavation and within a 1:1 plane extending upward from the base of the excavation. For design of soldier piles, an allowable passive pressure of 250 psf per foot of embedment (over twice the pile width) up to a maximum of 5,000 psf may be used. Soldier piles should be spaced at least two pile diameters on center.

7.3.5 Dewatering and Groundwater Treatment

Standing groundwater is generally not expected to be encountered during construction; however, excavation for piping or other underground structures not identified at this time may encounter groundwater seepage or groundwater depending on the time of year and the depth of the excavation. This groundwater

seepage or standing groundwater is most likely to occur during the winter months and during periods of heavy precipitation.

Dewatering may include grading the excavations to low points and pumping from a sump with a submersible pump. It is anticipated that gravel and filter fabric drains at the bottom of the excavation will be required to reduce the potential for loss of soil and collapse of the excavation sidewalls if this method of dewatering is used. Shoring may also be required to reduce the potential for collapse of the excavation sidewalls if internal dewatering is used.

The discharge location for any pumping operation will depend on permit requirements and the water quality of the discharged water. Permits and possibly water treatment will be required for groundwater discharge.

7.3.6 Structural Fill Material

With the limitations noted below, the on-site materials may be used in the required structural fills, less any unsuitable or deleterious materials described previously. Soils that have an expansion index greater than 20 should not be used within a depth of five feet below finish grade in the building areas and within a depth of two feet below finish grade in the area of pavements. Imported fill sources, if needed, should be observed prior to hauling onto the site to determine their suitability for use. Representative samples of imported materials and on-site soils should be tested by the geotechnical consultant to evaluate their engineering properties for the planned use. Imported fill soils should have an expansion index of no more than 20. Geotechnics should be notified to evaluate the suitability of these soils for use as fill and as finish grade soils.

7.3.7 Fill Compaction

After making the recommended removals and prior to fill placement, the exposed ground surface should be observed by Geotechnics. Any remaining disturbed, loose, or soft materials should also be removed until a stable, unyielding condition under equipment loads is achieved. The exposed soil should then be scarified to a depth of approximately 8 inches, brought to slightly above optimum moisture content, and compacted as recommended in this report.

All fill and backfill should be placed at slightly above optimum moisture content using equipment that is capable of producing a uniformly compacted product throughout the entire fill lift. Fill materials at less than optimum moisture should have water added and the fill mixed to result in material that is uniformly above optimum moisture content. Fill materials that are too wet should be aerated or mixed with drier material to achieve uniformly moisture-conditioned soil. Flooding or jetting should not be permitted as a method of compacting fill or backfill.

The fill and backfill should be placed in horizontal lifts at a thickness appropriate for the equipment spreading, mixing, and compacting the material, but generally should not exceed 8 inches in loose thickness. The minimum relative compaction recommended for fill and backfill is 90 percent of maximum dry density based on the guidelines of ASTM D1557. Sufficient observation and testing should be performed by Geotechnics Incorporated so that an opinion can be rendered as to the compaction achieved.

7.3.8 Bulk/Shrink Estimates

Based on our experience with similar materials, the alluvial soils are anticipated to shrink between about 5 to 20 percent when excavated and compacted. However, it should be noted, that bulking and shrinking potential can vary considerably based on the variability of the in-situ densities of the materials in question.

7.3.9 Slopes

All slopes should be inclined no steeper than 2:1 (horizontal:vertical). The surficial slope stability may be enhanced by providing good site drainage. The site should be graded so that water from the surrounding areas is not allowed to flow over the top of the slope. Diversion structures should be provided where necessary. Surface runoff should be confined to gunite-lined swales or other appropriate devices to reduce the potential for erosion.

We recommend that slopes be planted with vegetation that will increase their stability. Ice plant is generally not recommended. We recommend that vegetation include woody plants, along with ground cover. All plants should be adapted for growth in semi-arid climates with little or no irrigation. A landscape architect should be consulted in order to develop a specific planting palate suitable for slope stabilization.

It should be recognized that the outer few feet of all slopes are susceptible to gradual down-slope movements due to slope creep. This will affect hardscape such as concrete slabs. We recommend that settlement sensitive hardscape not be constructed within 5 feet of the top of slopes.

7.4 Surface Drainage

Foundation and slab performance depends greatly on how well the runoff waters drain from the site. This is true both during construction and over the entire life of the structure. The ground surface around structures should be graded so that water flows rapidly away from the structures without ponding. The surface gradient needed to achieve this depends on the prevailing landscape. In general, we recommend that pavement and lawn areas within five feet of buildings slope away at gradients of at least 2 percent. Densely vegetated areas should have minimum gradients of at least 5 percent away from buildings in the first five feet. Densely vegetated areas are considered those in which the planting type and spacing are such that the flow of water is impeded.

Planters should be built so that water from them will not seep into the foundation, slab, or pavement areas. Roof drainage should be channeled by pipe to storm drains, or discharged at least ten feet from buildings. Site irrigation should be limited to the minimum necessary to sustain plants. Should excessive irrigation, surface water intrusion, water line breaks, or unusually high rainfall occur, saturated zones or "perched" groundwater may develop in the underlying soils.

7.5 Foundation Recommendations

The foundation recommendations provided herein are considered generally consistent with methods typically used in southern California. Other alternatives may be available. Our recommendations are only minimum criteria based on anticipated geotechnical factors and should not be considered a structural design, or to preclude more restrictive criteria of governing agencies or by the structural engineer. The design of the foundation system should be performed by the project structural engineer, incorporating the geotechnical parameters described herein and the requirements of applicable building codes.

As currently planned, the proposed structures may be supported on conventional shallow footings, mat foundations, or drilled piers. It is anticipated the combination building and comfort station building may be supported on mat foundations bearing on compacted fill. Foundations may be designed to bear the anticipated total settlement and differential settlement estimated for the design earthquake event. In the event of settlement, the foundations might then be releveled. It is suggested that the piping for such a design be connected to the outside of the structures with flexible connections for easier access and repairs. Foundation excavations should be observed by Geotechnics Incorporated to evaluate the suitability of the bearing materials for conformance with these recommendations.

The following design parameters assume that the foundations for the proposed structures will consist of shallow footings or mat foundations bearing entirely on compacted fill soils, recompacted alluvial soils, or drilled piers bearing on dense undisturbed formational soils. They also assume that the bearing materials will have a very low expansion potential (Expansion Index of 20 or less).

7.5.1 Shallow Footings or Mat Foundations

Allowable Soil Bearing:	2,000 psf for foundations bearing on engineered low expansion fill, compacted as recommended herein, with an increase in allowable bearing of 200 psf for each foot of embedment below the recommended minimum embedment to a maximum allowable soil bearing of 3,000 psf. Allow a one-third increase in the allowable bearing for short-term wind or seismic loads

Minimum Footing Width:	24 inches.
Minimum Footing Depth:	24 inches below lowest adjacent compacted soil, slab, or pavement grade.
Passive Pressure:	The passive resistance of engineered low expansion fill, compacted as recommended herein may be assumed to be equal to the pressure developed by an equivalent fluid with a density of 300 pcf above standing groundwater. A one-third increase in the passive values may be used for seismic loads. The passive resistance of the materials may be combined with the frictional resistance without reduction in evaluating the total lateral resistance.
Coefficient of Friction:	0.30
Minimum Reinforcement:	Two No. 4 bars at both top and bottom in continuous footings.
Differential Settlement:	Foundations should be designed for ½-inch of static differential settlement and at least 6 inches of dynamic differential settlement.

7.5.2 Drilled Pier Foundations

Allowable Soil Bearing:	2,000 psf for drilled piers bearing on engineered low expansion fill, compacted as recommended herein, with an increase in allowable bearing of 200 psf for each foot of embedment below the recommended minimum embedment to a maximum allowable soil bearing of 3,000 psf . Allow a one-third increase in the allowable bearing for short-term wind or seismic loads
Minimum Drilled Pier Diameter:	18 inches.
Minimum Drilled Pier Depth:	48 inches below lowest adjacent compacted soil, slab, or pavement grade.
Soil Unit Weight:	90 lbs/ft^3.

Frictional Pier Uplift:	100 lbs/ft^2 along perimeter of pier below a depth of 2 feet.
Passive Pressure:	300 lbs/ft^2 per foot of embedment based on an estimated lateral deflection up to ½-inch.
Differential Settlement:	Drilled Piers should be designed for ½-inch of differential settlement.

7.6 Earth-Retaining Structures

For cantilever retaining walls, where the backfill is level or nearly level, an active earth pressure approximated by an equivalent fluid pressure of 35 pcf may be used above water level and 80 pcf below water level. The active pressure should be used for walls free to yield at the top at least 0.2 percent of the wall height. For below grade walls restrained so that such movement is not permitted, an equivalent fluid pressure of 55 pcf may be used above water level and 90 pcf below water level, based on at-rest soil conditions with level backfill.

In addition to the recommended earth pressure, walls adjacent to vehicular traffic should be designed to resist a uniform lateral pressure of 100 psf, acting as a result of an assumed 300 psf surcharge behind the wall. If the traffic is kept back at least ten feet from the walls, the traffic surcharge may be neglected.

Backfilling retaining walls with expansive soils can increase lateral pressures well beyond the active or at-rest pressures indicated above. We recommend that retaining walls be backfilled with free-draining, cohesionless soil having an Expansion Index of 20 or less. The active and at-rest pressures indicated above assume the walls are backfilled with such materials possessing an angle of friction of at least 32 degrees. The backfill area should include the zone defined by a 1:1 plane projected upward from the heel of the wall. Retaining wall backfill should be compacted to at least 90 percent relative compaction, based on ASTM D1557 guidelines. Backfill should not be placed until walls have achieved adequate structural strength. Heavy compaction equipment, which could cause distress to walls, should not be used.

7.7 Slope Setback

It should be recognized that the outer few feet of all slopes are susceptible to gradual down-slope movements due to slope creep. Foundation setbacks should conform to Figure 18-I-1 of the 2001 CBC or Figure 1805.3.1 of the 2007 CBC. In general, the foundations for all structures should be setback from descending slopes a minimum of eight feet measured horizontally from the outside bottom edge of the footing to the slope face. The recommended foundation setback for structures located near the tops of slopes may be achieved by deepening the foundation. A five-foot foundation setback may be used for utility structures situated near minor slopes less than four feet in height and for screen wall foundations.

7.8 CBC Seismic Parameters for Structures

Due to the potential for liquefaction, the subject site would be classified as Site Class F in the 2007 CBC. Per Table 1613.5.3 of the 2007 CBC, a *site specific* evaluation is required in accordance with Section 11.4.7 of ASCE 7 due to the potential for liquefaction. However, Section 11.4.7 of ASCE 7 refers to an exception to the *site specific* analysis requirement, which is provided in Section 20.3.1 of ASCE 7. Section 20.3.1 indicates that a *site specific* response analysis is not required for liquefiable sites if the fundamental period of vibration is less than or equal to 0.5 seconds. Rather, the site may be classified per Section 20.3, and the values F_a and F_v determined from Tables 11.4-1 and 11.4-2. This procedure is employed in the following paragraph.

If we neglect the potential for liquefaction at the site, using the exception in Section 20.3 as described above, the site would be classified as 2007 CBC Site Class D. That is the default classification used where soil properties are not investigated in sufficient detail to confirm the Site Class and is consistent with the classification of similar alluvial sites investigated by Geotechnics Incorporated in eastern San Diego County. Since the soil properties were not investigated in sufficient detail to confirm the Site Class, the following default seismic parameters may be used for the onsite soils in accordance with Section and Table 1613.5.2 (Site Class Definitions) of the 2007 CBC.

2007 CBC

Site Class: D

Site Coefficients,	F_a:	1.014	
	F_v:	1.58	
Mapped MCE Spectral Accelerations,		S_S:	1.215
		S_1:	0.420
Adjusted MCE Spectral Accelerations,		S_{MS}:	1.232
		S_{M1}:	0.664
Design Spectral Accelerations,		S_{DS}:	0.821
		S_{D1}:	0.443

The following Seismic Design Categories may be used for structural design in accordance with S_{DS} and S_{D1} for Site Class D and Tables 1613.5.6 (1) and 1613.5.6 (2) of the Section 1613.5.6 of the 2007 CBC. Alternatively, the Seismic Design Categories may be determined in accordance with the Procedures described in Sections 1613.5.6 1 and 1613.5.6 2 of the 2007 CBC.

2007 CBC

Occupancy Category: All Categories (I through IV)
Seismic Design Category: D

7.9 On-Grade Slabs

7.9.1 Interior Slabs

On-grade building slabs should be supported on either compacted fill prepared as recommended in this report or on dense undisturbed alluvial soils. The subgrade soils should have a very low expansion potential (Expansion Index less than 20). Slabs should be designed for the anticipated loading. If an elastic design is used for slabs constructed on-grade, a modulus of subgrade reaction of 250 lbs/in^3 may be used. Slab thickness, control joints, and reinforcement should be designed by the project structural engineer for soils exposed at slab and foundation subgrade in conformance with the requirements of the 2001 CBC and the recommendations contained in the current American Concrete Institute (ACI) *Guide for Concrete Floor and Slab Construction* (ACI 302.1R-04). We recommend that on-grade building slabs be at least 5 inches in thickness and be reinforced with at least No. 4 bars spaced 18 inches on center, each way. Reinforcing bars should be placed

within the upper 1/3 of the slab thickness with a minimum cover of 1½ inches below the top of the slab and 2 inches above the bottom of the slab.

7.9.2 Moisture Protection for Interior Slabs

Concrete slabs constructed on soil ultimately cause the moisture content to rise in the underlying soil. This results from continued capillary rise and the termination of normal evapotranspiration. Because normal concrete is permeable, the moisture will eventually penetrate the slab. Excessive moisture may cause mildewed carpets, lifting or discoloration moisture sensitive floor coverings such as vinyl, or water-based adhesive degradation. Wood flooring may swell and dome if exposed to excessive moisture transmission. To decrease the likelihood of problems related to damp slabs, suitable moisture protection measures should be used where moisture sensitive floor coverings, moisture sensitive equipment, or other factors warrant.

A commonly used moisture protection in southern California consists of about 2 inches of clean sand covered by at least 10-mil plastic sheeting. In addition, 2 inches of clean sand are placed over the plastic to decrease concrete curing problems associated with placing concrete directly on an impermeable membrane. However, it has been our experience that such systems will transmit from approximately 6 to 12 pounds of moisture per 1,000 square feet per day. This may be excessive for some applications, particularly for sheet vinyl, wood flooring, vinyl tiles, or carpeting with impermeable backing that use water-soluble adhesives. *The commonly used moisture protection system described above is provided only as an example, and is not intended as a recommendation for a specific moisture protection system. Such a system will probably not meet the current requirements for moisture protection systems or manufacturers' warranties*

The current ACI *Guide for Concrete Floor and Slab Construction*, ACI 302.1R-04, provides detailed recommendations regarding moisture protection systems. In general, ACI 302-1R-04 defines a vapor retarder as having a water transmission rate of less then 0.3 perms when tested in accordance with ASTM E 96, and

defines a vapor barrier as having a water transmission rate of 0.00 perms. In addition, the vapor retarder should conform to the ASTM E1745 guidelines and if a polyethylene plastic sheeting is used, it should be a minimum of 10-mil.

Based on a review of ACI 302-1R-04, the moisture protection may consist of placing a 10-mil polyethylene plastic sheeting vapor retarder over 4 inches of a granular base material. The vapor retarder should be placed in accordance with ASTM E1643 guidelines. All laps or seams should be overlapped a minimum of 6 inches or as recommended by the manufacturer. Joints and pipe or utility penetrations should be sealed with the manufacturer's recommended adhesive, pressure sensitive tape or both. The granular base material should be a clean, fine graded material with at least 10 to 30% of particles passing No. 100 sieve but not contaminated with clay, silt, or organic material. The granular material should be compacted and proof-rolled prior to placement of the vapor retarder. The vapor retarder should be protected from puncture and if damaged be repaired per the manufacturer's recommendations. It should be noted that placing concrete directly on a low permeable membrane may result in finishing delays.

The project architect should review the ACI 302.1R-04 document along with the moisture requirements of the proposed flooring system and incorporate an appropriate level of moisture protection based on the allowable moisture transmission rate for the flooring to be used and the manufacturer's warranty. Depending on the floor covering used, it may be necessary to utilize a vapor barrier (with a maximum water vapor transmission rate of 0 perms) and/or waterproof the slab instead of using a vapor retarder.

Additional reduction in vapor transmission through concrete floor slabs may be achieved by the placement of a dense concrete section without cracks. Achieving such a concrete section may be facilitated by the use of low water-cement ratios and a low slump concrete mix with thorough curing. For slab on grade floors, it is recommended that the water-cement ratio of the concrete as placed not exceed 0.45 by weight and the slump of the concrete not exceed 4½ inches. The concrete should incorporate a well-graded, sound aggregate mix meeting the minimum requirements of Section 26 of the 2001 CBC and should have at least 560 pounds

of cement per cubic yard of concrete. High-end water reducing admixtures are not recommended; however, fly ash, not exceeding 15 percent of the total cementitious material by weight may be added to improve workability and reduce shrinkage. In order to decrease permeability, silica fume may be added to the concrete; however, the amount of silica fume should not exceed 10 percent of the total cementitious material by weight. The concrete slab should be thoroughly cured for at least seven days using an accepted curing compound or water. *No surfacing should be placed on the slab until the excess water within the slab has been dissipated. We recommend that vapor transmission tests be performed on the slab surface after operation of HVAC systems and prior to placing floor surfaces to confirm that excessive moisture is not still present within the slab.*

7.9.3 Exterior Slabs

Exterior slabs should be supported by subgrade soils that have a low expansion potential. Exterior slabs should be at least 4 inches thick and should be reinforced with at least 6-inch by 6-inch, W2.9 by W2.9 welded wire fabric placed at slab mid-height. Crack control joints should be used on all exterior slabs, with a maximum spacing of 5-foot centers each way for sidewalks and 10-foot centers each way for slabs. Actual crack control joint spacing should be designed by the project structural engineer in conformance with the requirements of the 2001 CBC and the current PCA Engineering Bulletin for Concrete Floors on Ground. Differential movement between buildings and exterior slabs or between sidewalks and curbs may be decreased by doweling the slabs, hardscaping, or sidewalks into the foundations or curbs.

7.10 Pipelines

Geotechnical aspects of pipeline design include soil bearing and lateral resistance for thrust blocks, modulus of soil reaction, and pipe bedding. Because of the potential for significant total settlement and differential settlement to occur in event of an earthquake, we recommend that flexible piping and joints be used and that flexible connections be used to connect piping to structures.

7.10.1 Thrust Blocks

For design of thrust blocks, the following design parameters may be used for thrust blocks embedded in compacted fill or recompacted alluvial materials.

Allowable Soil Bearing:	2,000 psf (allow a one-third increase for short-term wind or seismic loads).
Coefficient of Friction:	0.30
Passive Pressure:	300 psf per foot of embedment above standing groundwater and 150 psf per foot of embedment below standing groundwater (allow a one-third increase for short-term wind or seismic loads).

7.10.2 Modulus of Soil Reaction

The modulus of soil reaction (*E'*) is used to characterize the stiffness of soil backfill placed along the sides of buried flexible pipelines. For the purpose of evaluating deflection due to the load associated with trench backfill over the pipe, a value of 1,500 lbs/in^2 may be used assuming granular bedding material is placed adjacent to the pipe.

7.10.3 Pipe Bedding

Typical pipe bedding as specified in the "GREENBOOK" may be used. As a minimum, we recommend that pipes be supported on at least 4 inches of granular bedding material. Where pipeline or trench excavation inclinations exceed 15 percent, we do not recommend that open graded rock be used for pipe bedding or backfill because of the potential for piping and internal erosion of the overlying backfill. The recommended bedding is coarse sand having a sand equivalent greater than 30. Alternatively, sand-cement slurry can be used for the bedding. The slurry should consist of at least a 2-sack mix having a slump no greater than 5 inches. If the sand-cement slurry is used for the pipe bedding to at least 1 foot over the top of the pipe, cut-off walls may not be considered necessary. This recommendation should be further evaluated by the project civil engineer designing the pipe system.

7.11 Pavements

Preliminary pavement sections are provided for new pavements that will be associated with the proposed improvements. Final pavement design should be based on R-value test results of the finish pavement subgrade soils. Subgrade preparation should be conducted immediately prior to the placement of the pavement section. The upper 12 inches of pavement subgrade should be scarified, brought to about optimum moisture content, and compacted to at least 95 percent of maximum dry density based on ASTM D1557 guidelines. Aggregate base should conform to the specifications for crushed aggregate base, crushed miscellaneous base, or processed miscellaneous base as defined in Section 200-2 of the "GREENBOOK." Alternatively, base material may conform to Class 2 aggregate base as defined in Section 26 of the latest edition of the Caltrans Standard Specifications. Aggregate base should be compacted to at least 95 percent of maximum dry density based on ASTM D1557 guidelines.

7.11.1 Asphalt Concrete

Alternative paving sections for the access road and parking lot were established using the design criteria of Caltrans Topic 608.4. For this project, it was assumed that the parking lots may be designed for a maximum average daily traffic of 100 vehicles and no trucks or recreational vehicles (Maximum Traffic Index = 4.5) or for a maximum average daily traffic of 200 vehicles with less than 10 percent trucks or recreational vehicles (Maximum Traffic Index = 5.0). It was assumed that access roads may be designed for a maximum average daily traffic of 700 vehicles with less than 10 percent trucks or recreational vehicles (Maximum Traffic Index = 5.5). The civil engineer should determine the anticipated daily traffic for design. R-Value testing performed on samples of the near surface alluvial soils indicate that the alluvial soils have R-Values of between 19 and 60. An R-Value of 19 was used for design. The actual subgrade R-Value should be confirmed during construction. Based on the indicated Traffic Indexes and a design R-value of 19, the following pavement sections were calculated in accordance with the Caltrans design method.

	Caltrans Design	
Traffic Index	**Asphalt**	**Aggregate Base**
4.5	3 inches	6 inches
5.0	3 inches	8 inches
5.5	3 inches	10 inches

Asphalt concrete should conform to "GREENBOOK" specifications. Asphalt concrete should be compacted to at least 95 percent based on the Hveem unit weight.

7.11.2 Portland Cement Concrete

Concrete pavement design was conducted in accordance with the simplified design procedure of the Portland Cement Association. This methodology is based on a 20-year design life. For design, it was assumed that aggregate interlock would be used for load transfer across control joints. The Portland cement concrete was assumed to have a minimum 28-day flexural strength of 600 psi. A "medium" subgrade support (corresponding to a modulus of subgrade reaction between 130 and 170 pci) was assumed for design purposes. Based on these assumptions, we recommend that the pavement section consist of 6 inches of Portland cement concrete on 4 inches of aggregate base over the compacted subgrade.

Crack control joints should be placed on at least 10-foot centers, each way. During construction, the flexural strength of the concrete should be evaluated by making beams in accordance with ASTM C31 and testing for flexural strength in accordance with ASTM C78. Concentrated truck traffic areas should be reinforced with at least number 4 bars on 18-inch centers, each way.

7.12 Soil Corrosivity

Selected soil samples were evaluated for water-soluble sulfate content to assess the general degree of sulfate exposure of concrete in contact with the site soils. The test

results are presented in Appendix C. The project design engineer may use the test results in conjunction with Table 4.3.1 of ACI 318 to specify a suitable cement type, water cement ratio, and minimum compressive strength for concrete used on site that will be in direct contact with soil, including all foundations and slabs. The sulfate content test results are believed to represent the existing soil conditions at the site. Additional testing of the finish grade materials should be performed to evaluate the final as-graded condition of the site. It should be noted that soluble sulfate in the irrigation water supply, and/or the use of fertilizer may cause the sulfate content in the surficial soils to increase significantly with time. This may result in a higher sulfate exposure than that indicated by the test results reported herein. Studies have shown that the use of improved cements in the concrete, and a low water-cement ratio will improve the resistance of the concrete to sulfate exposure.

Based on the resistivity test results, the on-site soils appear mildly to moderately corrosive to buried ferrous metals. Based on the results of the soluble chloride test results, the on-site soils do not appear corrosive to other buried metals. Based on the results of the pH test results, the on-site soils appear acidic and may be corrosive to metals. If additional recommendations are required for the design of buried piping, we recommend a Corrosion Engineer be retained to provide recommendations for the project.

8 LIMITATIONS OF INVESTIGATION

This report has been prepared for the exclusive use of Winzler & Kelly Consulting Engineers for specific application to the project described herein. The recommendations provided in this report are based on our understanding of the described project information and on our interpretation of the data collected during the subsurface exploration. The recommendations apply only to the specific project described in this report. In the event that any changes in the nature, design, or location of the facilities are planned from those described herein, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by Geotechnics Incorporated. Geotechnics Incorporated is not responsible for any claims, damages, or liability

associated with interpretation of subsurface data or reuse of the subsurface data or engineering analyses without the express written authorization of Geotechnics Incorporated.

This investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No warranty, express or implied, is made as to the conclusions and professional opinions included in this report.

The analyses and recommendations contained in this report are based on the data obtained from the referenced subsurface explorations. The samples taken and used for testing and the observations made are believed representative of the locations sampled; however, borings indicate subsurface conditions only at the specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between such locations. Soil and geologic conditions can vary significantly between field explorations. The validity of the recommendations is based in part on assumptions about the stratigraphy made by the geotechnical engineer. Such assumptions may be confirmed only during construction operations. In many projects, conditions revealed by excavation may be at variance with preliminary findings. If this occurs, the changed conditions must be evaluated by Geotechnics Incorporated and additional recommendations made, if warranted.

This report is issued with the understanding that it is the responsibility of the Winzler & Kelly Consulting Engineers, or of their designated representative, to ensure that the information and recommendations contained herein are incorporated into the plans, and the necessary steps are taken to see that the contractors carry out such recommendations in the field.

Changes in the condition of a property can occur with the passage of time, whether due to natural processes or the work of man on this or adjacent properties. In addition, changes in applicable or appropriate standards of practice may occur from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

During final design, Geotechnics Incorporated should review the construction documents and specifications for the proposed project to assess their conformance with the intent of our

recommendations. If changes are made in the project documents, the conclusions and represented in this report may not be applicable. Therefore, Geotechnics Incorporated should review any changes to assess whether the conclusions and recommendations are valid and modify them if required.

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FAULT[1]	DISTANCE TO SITE [KM]	ESTIMATED PEAK GROUND ACCELERATION[2]	MAXIMUM EARTHQUAKE MAGNITUDE[3,5]	ESTIMATED FAULT AREA[4] [CM^2]	SHEAR MODULUS[4] [$DYNE/CM^2$]	ESTIMATED SLIP RATE[4] [MM/YEAR]
Elsinore (Julian)	21	0.20	7.1	1.14E+13	3.30E+11	5.0
Elsinore (Coyote Mountain)	26	0.15	6.8	5.85E+12	3.30E+11	4.0
Earthquake Valley	30	0.11	6.5	3.00E+12	3.30E+11	2.0
San Jacinto-Coyote Creek	54	0.07	6.8	6.15E+12	3.30E+11	4.0
Rose Canyon	54	0.09	7.2	9.10E+12	3.30E+11	1.5
San Jacinto - Borrego	54	0.06	6.6	3.48E+12	3.30E+11	4.0
San Jacinto-Anza	62	0.08	7.2	1.64E+13	3.30E+11	12.0
San Jacinto-Superstition Mtn.	66	0.04	6.6	2.88E+12	3.30E+11	5.0
Elsinore (Temecula)	68	0.05	6.8	6.45E+12	3.30E+11	5.0
Laguna Salada	70	0.06	7.0	1.01E+13	3.30E+11	3.5
San Jacinto-Superstition Hills	73	0.04	6.6	3.89E+12	3.30E+11	4.0
Elmore Ranch (West)	73	0.04	6.6	3.48E+12	3.30E+11	1.0
Coronado Bank	74	0.08	7.6	2.41E+13	3.30E+11	3.0
Elmore Ranch (East)	76	0.04	6.6	3.48E+12	3.30E+11	1.0
Newport-Inglewood (Offshore)	83	0.05	7.1	8.58E+12	3.30E+11	1.5
San Diego Trough	90	0.07	7.7	3.00E+13	3.30E+11	2.0

1. Fault activity determined by Blake (2000), CDMG (1992), Wesnousky (1986), and Jennings (1994).

2. Median peak horizontal ground accelerations (in g's) from Sadigh et al (1997) for Soil Sites for the Maximum Earthquake Magnitude.

3. Moment magnitudes determined from CDMG (2003), Blake (2000), Wesnousky (1986) and Anderson (1984).

4. Estimated fault areas, shear moduli, and slip rates after fault data for EQFAULT and FRISKSP, Blake (2000).

5. The Maximum Earthquake Magnitude is the estimated median moment magnitude that appears capable of occuring given rupture of the entire estimated fault area.

Geotechnics Incorporated

REGIONAL SEISMICITY

Project No. 0730-020-00
Document No. 08-0028
TABLE 1a

FAULT[1]	DISTANCE TO SITE [KM]	ESTIMATED PEAK GROUND ACCELERATION[2]	MAXIMUM EARTHQUAKE MAGNITUDE[3,5]	ESTIMATED FAULT AREA[4] [CM^2]	SHEAR MODULUS[4] [$DYNE/CM^2$]	ESTIMATED SLIP RATE[4] [MM/YEAR]
San Andreas - Sb-Coach. M-1B-2	98	0.06	7.7	2.43E+13	3.30E+11	27.0
San Andreas - Whole M-1A	98	0.08	8.0	6.86E+13	3.30E+11	30.0
San Andreas - Sb-Coach. M-2B	98	0.06	7.7	2.43E+13	3.30E+11	24.0
San Andreas - Coachella M-1C-5	98	0.04	7.2	1.15E+13	3.30E+11	25.0
Brawley Seismic Zone	99	0.02	6.4	2.52E+12	3.30E+11	25.0
Imperial (Model A)	100	0.04	7.0	7.92E+12	3.30E+11	20.0

1. Fault activity determined by Blake (2000), CDMG (1992), Wesnousky (1986), and Jennings (1994).
2. Median peak horizontal ground accelerations (in g's) from Sadigh et al (1997) for Soil Sites for the Maximum Earthquake Magnitude.
3. Moment magnitudes determined from CDMG (2003), Blake (2000), Wesnousky (1986) and Anderson (1984).
4. Estimated fault areas, shear moduli, and slip rates after fault data for EQFAULT and FRISKSP, Blake (2000).
5. The Maximum Earthquake Magnitude is the estimated median moment magnitude that appears capable of occuring given rupture of the entire estimated fault area.

Geotechnics Incorporated

REGIONAL SEISMICITY

Project No. 0730-020-00
Document No. 08-0028
TABLE 2a

FAULT[1]	DISTANCE TO SITE [KM]	ESTIMATED PEAK GROUND ACCELERATION[2]	MAXIMUM EARTHQUAKE MAGNITUDE[3,5]	ESTIMATED FAULT AREA[4] [CM^2]	SHEAR MODULUS[4] [$DYNE/CM^2$]	ESTIMATED SLIP RATE[4] [MM/YEAR]
Elsinore (Julian)	21	0.21	7.1	1.14E+13	3.30E+11	5.0
Elsinore (Coyote Mountain)	26	0.15	6.8	5.85E+12	3.30E+11	4.0
Earthquake Valley	30	0.10	6.5	3.00E+12	3.30E+11	2.0
San Jacinto-Coyote Creek	54	0.06	6.8	6.15E+12	3.30E+11	4.0
Rose Canyon	54	0.08	7.2	9.10E+12	3.30E+11	1.5
San Jacinto - Borrego	54	0.05	6.6	3.48E+12	3.30E+11	4.0
San Jacinto-Anza	62	0.06	7.2	1.64E+13	3.30E+11	12.0
San Jacinto-Superstition Mtn.	66	0.04	6.6	2.88E+12	3.30E+11	5.0
Elsinore (Temecula)	68	0.04	6.8	6.45E+12	3.30E+11	5.0
Laguna Salada	70	0.04	7.0	1.01E+13	3.30E+11	3.5
San Jacinto-Superstition Hills	73	0.03	6.6	3.89E+12	3.30E+11	4.0
Elmore Ranch (West)	73	0.03	6.6	3.48E+12	3.30E+11	1.0
Coronado Bank	74	0.07	7.6	2.41E+13	3.30E+11	3.0
Elmore Ranch (East)	76	0.03	6.6	3.48E+12	3.30E+11	1.0
Newport-Inglewood (Offshore)	83	0.04	7.1	8.58E+12	3.30E+11	1.5
San Diego Trough	90	0.05	7.7	3.00E+13	3.30E+11	2.0

1. Fault activity determined by Blake (2000), CDMG (1992), Wesnousky (1986), and Jennings (1994).

2. Median peak horizontal ground accelerations (in g's) from Sadigh et al (1997) for Rock Sites for the Maximum Earthquake Magnitude.

3. Moment magnitudes determined from CDMG (2003), Blake (2000), Wesnousky (1986) and Anderson (1984).

4. Estimated fault areas, shear moduli, and slip rates after fault data for EQFAULT and FRISKSP, Blake (2000).

5. The Maximum Earthquake Magnitude is the estimated median moment magnitude that appears capable of occuring given rupture of the entire estimated fault area.

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Project No. 0730-020-00
Document No. 08-0028
TABLE 1b

FAULT[1]	DISTANCE TO SITE [KM]	ESTIMATED PEAK GROUND ACCELERATION[2]	MAXIMUM EARTHQUAKE MAGNITUDE[3,5]	ESTIMATED FAULT AREA[4] [CM^2]	SHEAR MODULUS[4] [$DYNE/CM^2$]	ESTIMATED SLIP RATE[4] [MM/YEAR]
San Andreas - Sb-Coach. M-1B-2	98	0.05	7.7	2.43E+13	3.30E+11	27.0
San Andreas - Whole M-1A	98	0.06	8.0	6.86E+13	3.30E+11	30.0
San Andreas - Sb-Coach. M-2B	98	0.05	7.7	2.43E+13	3.30E+11	24.0
San Andreas - Coachella M-1C-5	98	0.03	7.2	1.15E+13	3.30E+11	25.0
Brawley Seismic Zone	99	0.02	6.4	2.52E+12	3.30E+11	25.0
Imperial (Model A)	100	0.03	7.0	7.92E+12	3.30E+11	20.0

1. Fault activity determined by Blake (2000), CDMG (1992), Wesnousky (1986), and Jennings (1994).
2. Median peak horizontal ground accelerations (in g's) from Sadigh et al (1997) for Rock Sites for the Maximum Earthquake Magnitude.
3. Moment magnitudes determined from CDMG (2003), Blake (2000), Wesnousky (1986) and Anderson (1984).
4. Estimated fault areas, shear moduli, and slip rates after fault data for EQFAULT and FRISKSP, Blake (2000).
5. The Maximum Earthquake Magnitude is the estimated median moment magnitude that appears capable of occuring given rupture of the entire estimated fault area.

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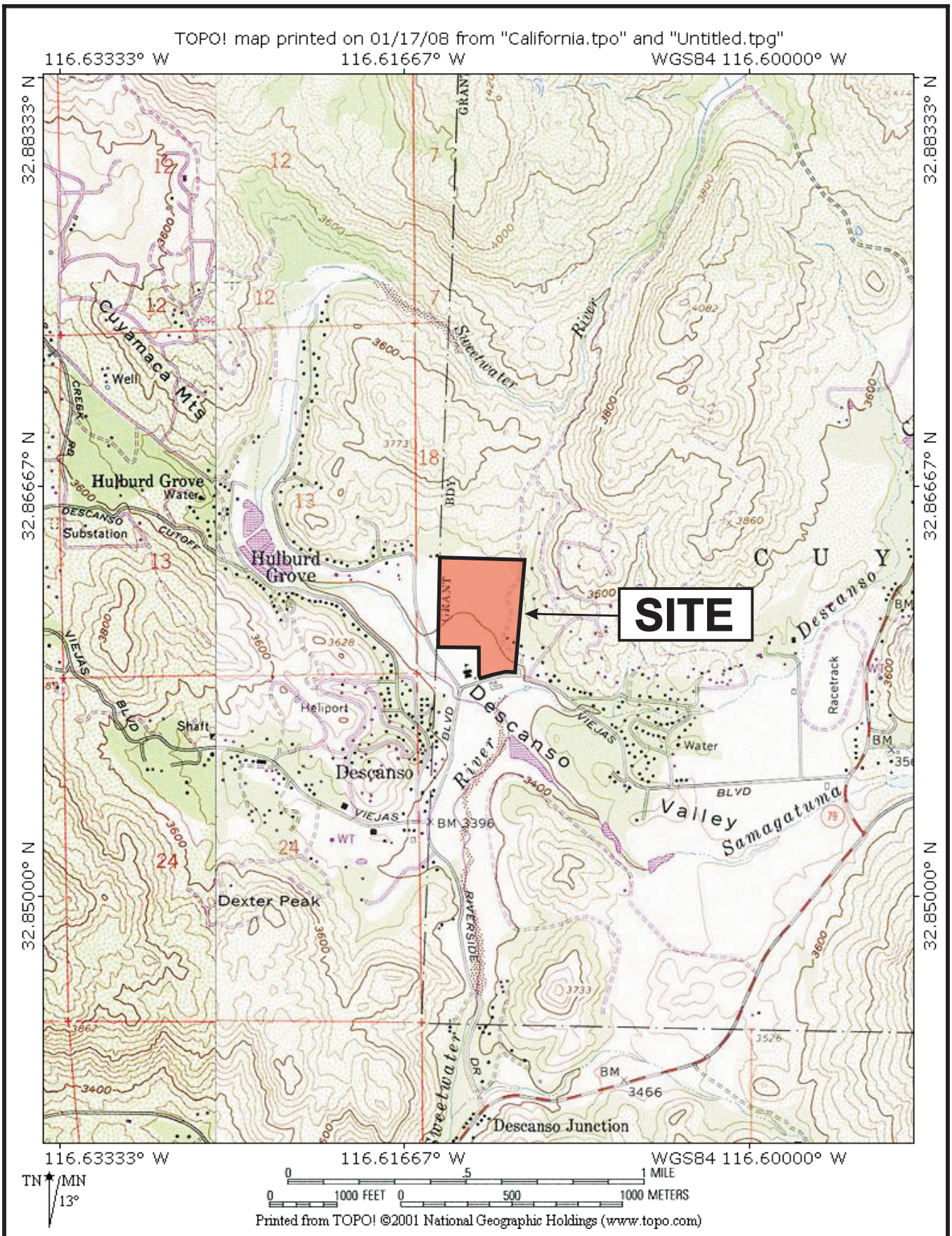
REGIONAL SEISMICITY

Project No. 0730-020-00
Document No. 08-0028
TABLE 2b



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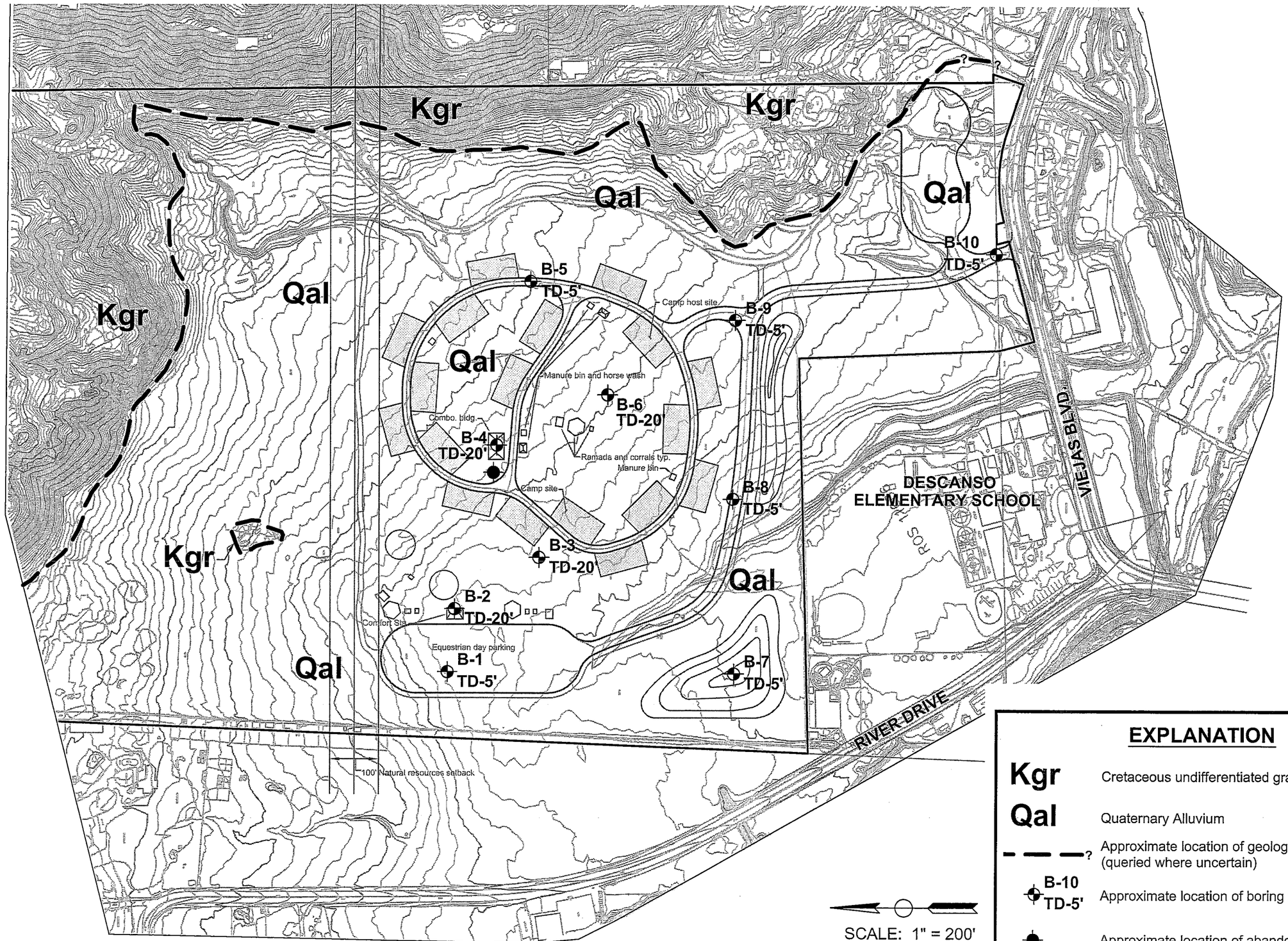
SITE LOCATION MAP

Project No. 0730-020-00
Document No. 08-0028

FIGURE 1



EXPLANATION

Kgr	Cretaceous undifferentiated granitic rock
Qal	Quaternary Alluvium
— — —?	Approximate location of geologic contact (queried where uncertain)
B-10 TD-5'	Approximate location of boring (TD-Total Depth)
●	Approximate location of abandoned well

Reference: X-CB-DESCANSO.dwg and X-TOPO-MERIGAN.dwg, provided by WINZLER & KELLY.

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Document No. 08-0028

FIGURE 2

GEOTECHNICAL MAP

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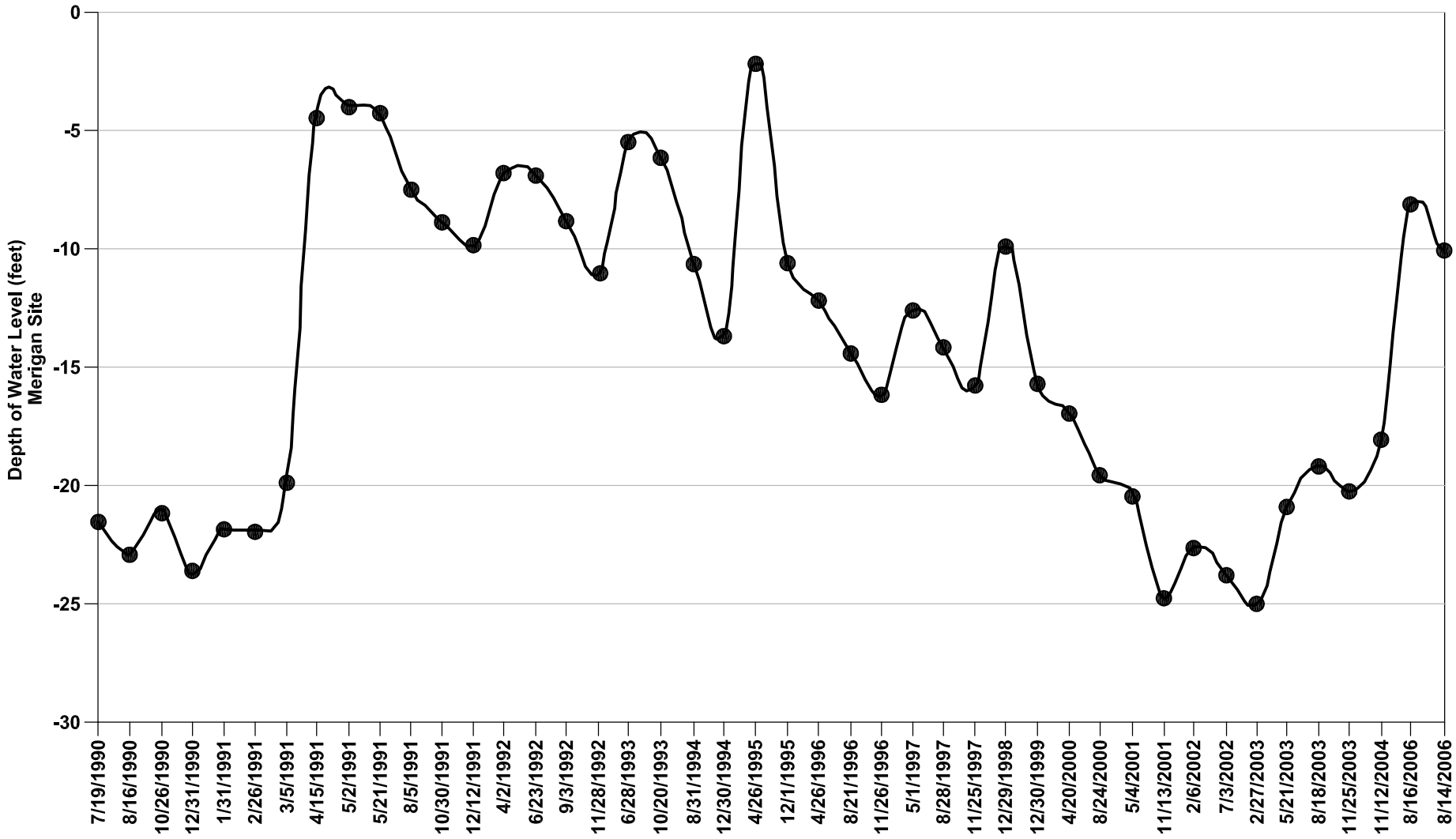

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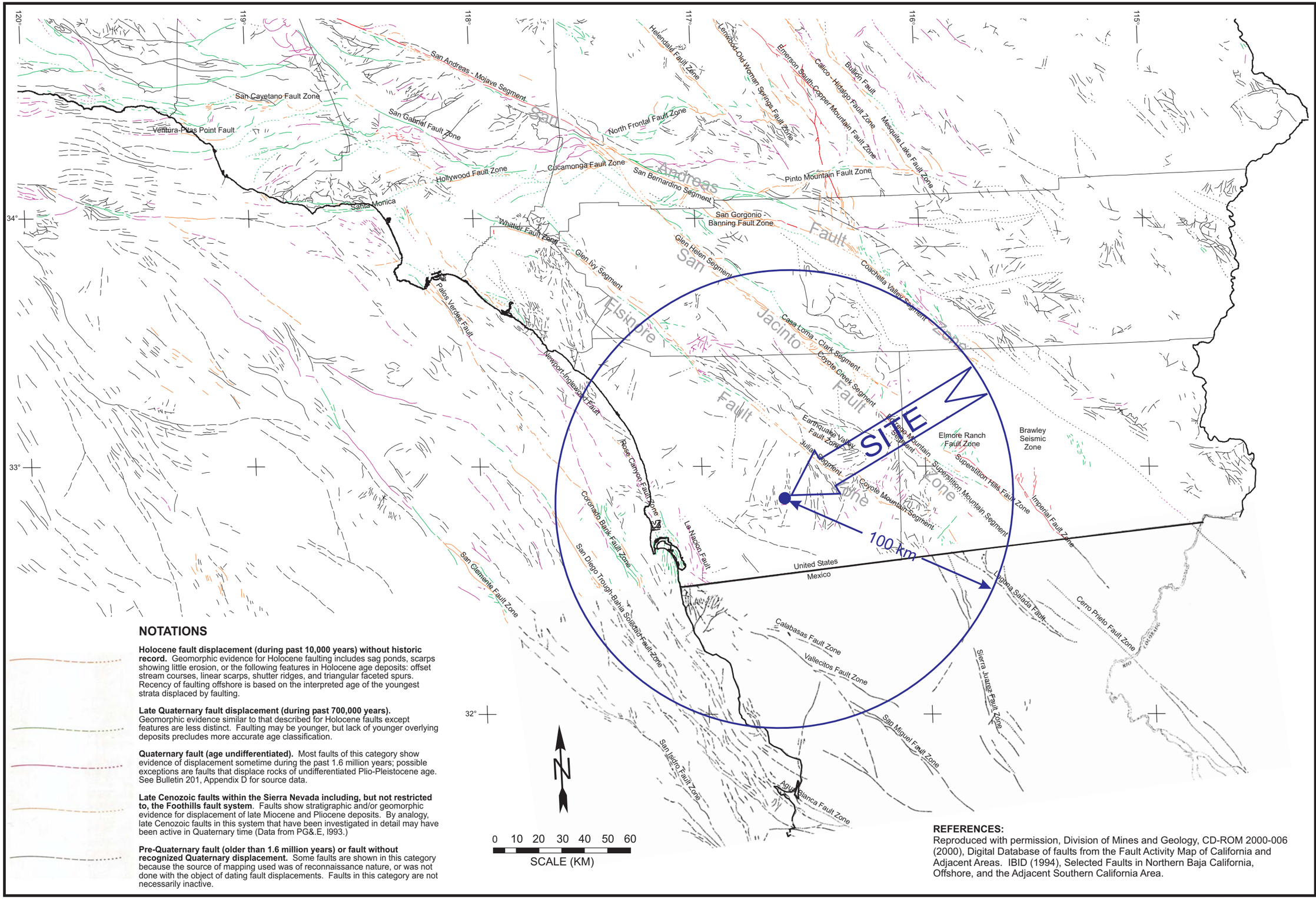
HISTORIC GROUND WATER LEVELS

Project No. 0730-020-00
Document No. 08-0028

FIGURE 3



NOTATIONS

Holocene fault displacement (during past 10,000 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults that displace rocks of undifferentiated Plio-Pleistocene age. See Bulletin 201, Appendix D for source data.

Late Cenozoic faults within the Sierra Nevada including, but not restricted to, the Foothills fault system. Faults show stratigraphic and/or geomorphic evidence for displacement of late Miocene and Pliocene deposits. By analogy, late Cenozoic faults in this system that have been investigated in detail may have been active in Quaternary time (Data from PG&.E, I993.)

Pre-Quaternary fault (older than 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissance nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

REFERENCES:
Reproduced with permission, Division of Mines and Geology, CD-ROM 2000-006 (2000), Digital Database of faults from the Fault Activity Map of California and Adjacent Areas. IBID (1994), Selected Faults in Northern Baja California, Offshore, and the Adjacent Southern California Area.

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FIGURE 4

FAULT LOCATION MAP

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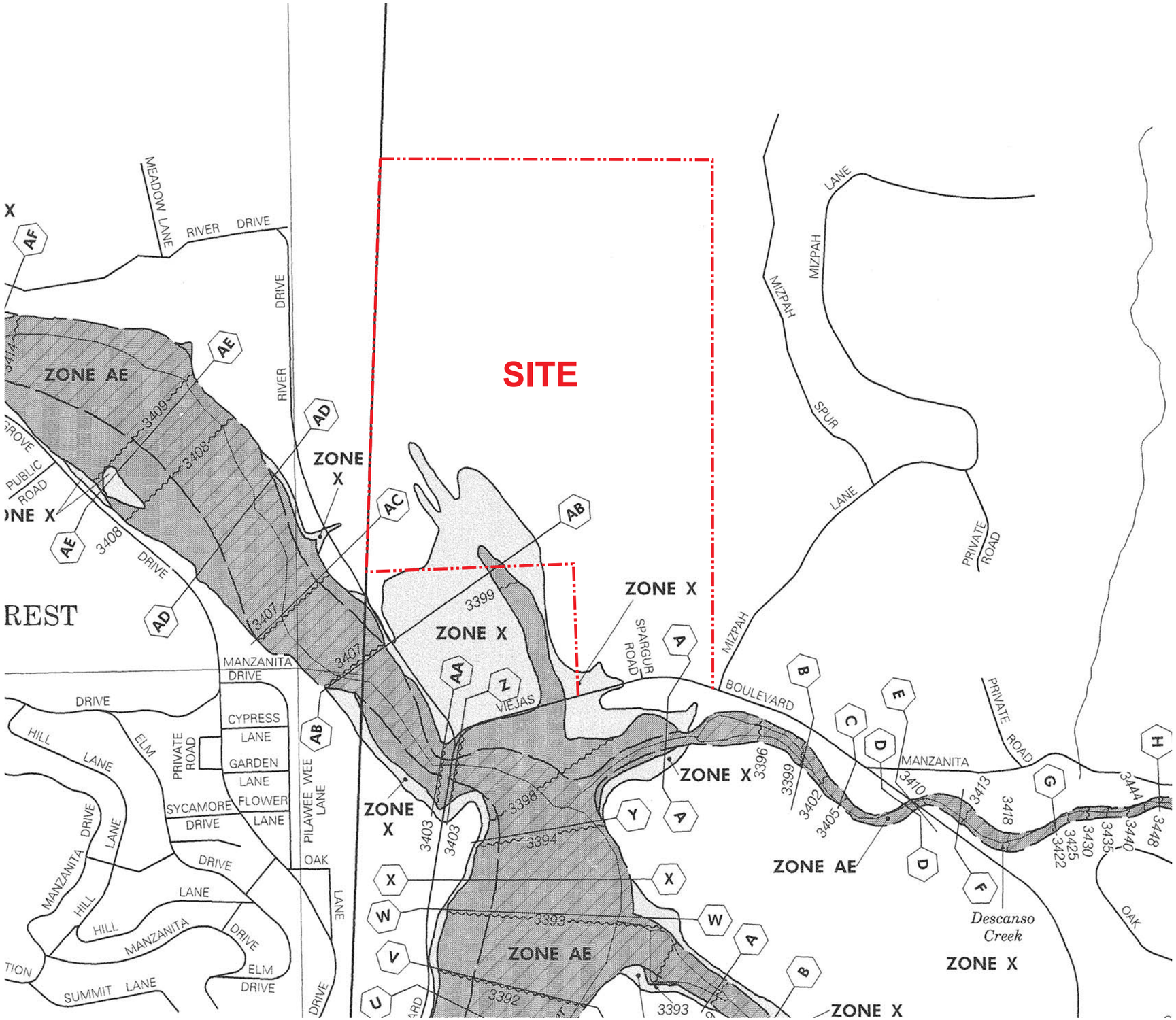
\Drafting\CorelDraw\Fault-SD Rev. 09/03



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100–YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 To be protected from 100–year flood by Federal flood protection system under construction ; no base flood elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500–year flood; areas of 100–year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100–year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500–year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 × — Elevation Reference Mark

● M2 — River Mile

97°07′30″, 32°22′30″ — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

APPROXIMATE SCALE IN FEET

500 0 500

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FIGURE 5

FLOOD INSURANCE RATE MAP

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\Drafting\CorelDraw\Brd11x17-h Rev. 6/99

APPENDIX A

REFERENCES

Alfors, J.T., Burnett, J.L, Gay, T.E. (1973), Urban Geology: Master Plan for California, California Division of Mines and Geology Notes, Bulletin 198.

American Society for Testing and Materials (2006), ASTM Standards on Disc, Volume 04.08, Soil and Rock (I): D420 - D5779.

Anderson, J. G. (1984), Synthesis of Seismicity and Geological Data in California, U.S. Geological Survey Open-File Report 84-424, 186 pp.

Blake, T.F. (2000), EQFAULT, EQSEARCH, and FRISKSP: Computer Programs for Estimation of Peak Horizontal Acceleration from Southern California Historical Earthquakes.

California Department of Conservation, Division of Mines and Geology (CDMG) (1992), Fault Rupture Hazard Zones in California, Alquist-Priolo Special Studies Zone Act of 1972: California Division of Mines and Geology, Special Publication 42.

California Department of Conservation, Division of Mines and Geology (1994). Fault Activity Map of California and Adjacent Areas, Revised Official Map.

California Department of Conservation, Division of Mines and Geology (CDMG) (1998), Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, Second Printing, August 1997.

California Department of Transportation (2006). Standard Specifications dated July 2006.

Geotechnics Incorporated (2007). *Revised Proposal for Subsurface Investigation and Geotechnical Evaluation, Equestrian Facilities Project, Merigan Ranch site and Paso Picacho Site, Cuyamaca Rancho State Park, San Diego County, California, For State Department of Parks and Recreation,* Proposal No. 07-022R, Document No. 07-0063R, February 27.

Hart, E. W. (1990). Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act of 1972 with index to Special Studies Zones maps (revised 1999): California Division of Mines and Geology Special Publication 42.

International Conference of Building Officials (1997), 2001 California Building Code.

Jennings, C. W. (1975), Fault Map of California: California Division of Mines and Geology, California Geologic Data Map Series.

APPENDIX A

REFERENCES (Continued)

Jennings, C. W. (1994), Fault Activity Map of California and Adjacent Areas: California Division of Mines and Geology, California Geologic Data Map Series.

Mualchin, L. and Jones, A.L. (1992), Peak Accelerations from Maximum Credible Earthquakes in California (Soil sites): California Division of Mines and Geology, Open-File Report, 92-1.

National Geographic Holdings, Inc. (2006), TOPO!, Seamless USGS Topographic Maps on CD-ROM: San Francisco, California.

Public Works Standards, Inc. (2006), "GREENBOOK," Standard Specifications for Public Works Construction, 2006 Edition.

Sadigh et al. (1997), Attenuation Coefficients for Soil Conditions.

Wesnousky, S. G. (1986), Earthquakes, Quaternary Faults, and Seismic Hazard in California: Journal of Geophysical Research, v. 91, no. B12, p. 12587-12631.

Youngs, R.R. and Coppersmith, K.J. (1985), Implications of Fault Slip Rates and Earthquake Recurrence Models to Probabilistic Seismic Hazard Estimates, Bulletin of the Seismological Society of America, vol. 75, no. 4, pp. 939-964.

APPENDIX B

SUBSURFACE EXPLORATION

Our field exploration consisted of drilling 10 exploratory borings with a jeep-mounted, solid-stem, continuous flight drill rig. Our field exploration was performed on December 27, 2007. The borings were approximately 6 inches in diameter and were drilled to a maximum depth of approximately 20 feet below existing grade. Bulk soil samples were collected from each boring, sealed in plastic bags, and returned to the laboratory for testing. Bulk soil samples are indicated on the logs with shading. The approximate boring locations are shown on the Geotechnical Map, Figure 2. Logs describing the subsurface conditions encountered are presented on Figures B-1 through B-10.

To assess potential soil contamination on the site, samples obtained from the field exploration program were monitored for volatile organic compounds by taking headspace readings of bagged samples using a Photovac 2020 P.I.D. detector. Readings were taken by inserting the instrument probe into the bagged sample and monitoring until a stable reading was obtained. The instrument has a listed range of 0.5 to 2,000 parts per million (ppm) with a resolution of 1 ppm. The results of the monitoring are shown on the boring logs in Appendix B.

Boring locations were established in the field by taping distances from landmarks shown on the site plan and topographic map provided by Winzler & Kelly Consulting Engineers. The locations shown should not be considered more accurate than is implied by the method of measurement used. The lines designating the interface between soil units on the boring logs are determined by interpolation and are therefore approximations. The transition between the materials may be abrupt or gradual. Further, soil conditions at locations between the borings may be substantially different from those at the specific locations explored. It should be recognized that the passage of time can result in changes in the soil conditions reported in our logs.

LOG OF EXPLORATION BORING NO. 1

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3413' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Silty sand (SM), brown, fine, moist, loose.	
2						Photoionization Detector (PID) = 0.0	R-Value
3							
4							
5							
6						Total depth: 5 feet No groundwater encountered	
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
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28							
29							
30							

LOG OF EXPLORATION BORING NO. 2

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3412' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Silty sand (SM), brown, fine, moist, loose.	Sulfate Content Chloride Content pH & Resistivity Expansion Index
2							
3						PID = 0.0	
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15						Groundwater encountered at 15 feet below ground surface.	
16							
17							
18							
19							
20							
21						Total depth: 20 feet Groundwater encountered at 15 feet 2-inch perforated pvc casing installed to 20 feet	
22							
23							
24							
25							
26							
27							
28							
29							
30							

LOG OF EXPLORATION BORING NO. 3

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3412' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Sandy silt (ML), brown, moist, soft.	
2							Sulfate Content Chloride Content pH & Resistivity Expansion Index
3						PID = 0.0	
4							
5							
6						Total depth: 5 feet No groundwater encountered	
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
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25							
26							
27							
28							
29							
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LOG OF EXPLORATION BORING NO. 4

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3417' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Silty sand (SM), brown, fine, moist, loose.	
2						PID = 0.0	
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18						▽ Groundwater encountered at 18 feet below ground surface.	
19							
20							
21						Total depth: 20 feet Groundwater encountered at 18 feet	
22							
23							
24							
25							
26							
27							
28							
29							
30							

LOG OF EXPLORATION BORING NO. 5

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3420' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Silty sand (SM), brown, fine, moist, loose.	
2							
3						PID = 0.0	
4							
5							
6						Total depth: 5 feet No groundwater encountered	
7							
8							
9							
10							
11							
12							
13							
14							
15							
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LOG OF EXPLORATION BORING NO. 6

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3415' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Silty sand (SM), brown, fine, moist, loose.	
2							
3						PID = 0.0	
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21						Total depth: 20 feet No groundwater encountered 2-inch perforated pvc casing installed to 20 feet	
22							
23							
24							
25							
26							
27							
28							
29							
30							

LOG OF EXPLORATION BORING NO. 7

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3410' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Sandy silt/silty sand (ML/SM), brown, moist, soft.	
2							Maximum Density Optimum Moisture Direct Shear
3						PID = 0.0	
4							
5							
6						Total depth: 5 feet No groundwater encountered	
7							
8							
9							
10							
11							
12							
13							
14							
15							
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26							
27							
28							
29							
30							

LOG OF EXPLORATION BORING NO. 8

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3407' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Sandy silt (ML), brown, moist, soft.	
2							R-Value
3						PID = 0.0	
4							
5							
6						Total depth: 5 feet No groundwater encountered	
7							
8							
9							
10							
11							
12							
13							
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LOG OF EXPLORATION BORING NO. 9

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3412' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM:** Sandy silt (ML), brown, moist, soft.	
2							
3						PID = 0.0	
4						Silty sand (SM), brown, fine, moist, loose.	
5							
6						Total depth: 5 feet No groundwater encountered	
7							
8							
9							
10							
11							
12							
13							
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29							
30							

LOG OF EXPLORATION BORING NO. 10

Logged by: JCS | **Date Drilled:** 12/27/2007

Method of Drilling: 6-inch diameter solid-stem auger | **Elevation:** 3406' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
1						**ALLUVIUM**: Sandy silt (ML), dark brown, moist, soft.	
2							R-Value
3						PID = 0.0	
4							
5							
6						Total depth: 5 feet No groundwater encountered	
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
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APPENDIX C

LABORATORY TESTING

Selected samples of soils encountered during the investigation were tested using generally accepted testing standards. The soils selected for testing are believed to be generally representative of the materials encountered during the investigation at the site; however, variations may occur in the soils at the site, and the materials tested may not be representative of the materials encountered during construction.

Laboratory testing was conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions and in the same locality. No warranty, express or implied, is made as to the correctness or serviceability of the test results or the conclusions derived from these tests. Where a specific laboratory test method has been referenced, such as ASTM or Caltrans, the reference applies only to the specified laboratory test method and not to associated referenced test method(s) or practices, and the test method referenced has been used only as a guidance document for the general performance of the test and not as a "Test Standard." A brief description of the tests performed follows:

Classification: Soils were classified visually according to the Unified Soil Classification System as described in ASTM D2488. Visual classification was supplemented by laboratory testing of selected soil samples and classification in general accordance with the laboratory soil classification tests outlined in ASTM D2487. The resultant soil classifications are shown on the boring logs in Appendix B.

Maximum Density Optimum Moisture: The maximum dry density and optimum moisture content for a selected soil sample was estimated in general accordance with the laboratory procedures outlined in ASTM test method D1557, modified Proctor. The test results are summarized in Figure C-1.

Expansion Index: The expansion potential of selected soil samples was estimated in general accordance with the laboratory procedures outlined in ASTM D4829. The test results are given in Figure C-1.

R-Value: R-Value tests were performed on selected pavement area materials in general accordance with the laboratory procedures outlined in ASTM test method D2844. The results are presented on Figure C-1.

APPENDIX C

LABORATORY TESTING (Continued)

Sulfate Content: To assess the potential for reactivity with below grade concrete, selected soil samples were tested for water-soluble sulfate content. The water-soluble sulfate was extracted under vacuum from the soil using a 10:1 (water to dry soil) dilution ratio. The extracted solution was then tested for water-soluble sulfate in general accordance with ASTM D516. The results are presented on Figure C-2.

pH and Resistivity: To assess the potential for reactivity with buried metal pipe and below grade ferrous materials, a selected soil sample was tested for pH and resistivity in general accordance with the laboratory procedures outlined in Caltrans test method 643. The results are shown on Figure C-2.

Chloride Content: Selected soil samples were evaluated for water-soluble chloride content in general accordance with the Standard Method for Evaluation of Waste Water Test SMEWW4500CL$^-$C, which is conducted in general conformance with EPA Test Method 375.4. The test results are given in Figure C-2.

Remolded Direct Shear: The shear strength of a selected recompacted soil sample was assessed through direct shear testing performed in general accordance with the laboratory procedures outlined in ASTM test method D3080. The sample was fabricated by compacting bulk samples of the onsite soils to approximately 90 percent of maximum dry density as determined in general accordance with the laboratory procedures outlined in ASTM test method D1557, modified Proctor. The sample was confined under vertical pressures in the laboratory approximately equal to the anticipated range of design effective overburden pressures. The sample was then inundated under water and sheared at a strain rate selected to approximate drained shear conditions. The results are summarized in Figure C-3.

MAXIMUM DENSITY/OPTIMUM MOISTURE CONTENT
(ASTM D1557)

SAMPLE NO.	SAMPLE DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE (%)
B-7 @ 0-5 feet	Brown sandy SILT/silty SAND	123	11

EXPANSION INDEX TESTS
(ASTM D4829)

SAMPLE NO.	SAMPLE DESCRIPTION	EXPANSION INDEX	EXPANSION POTENTIAL
B-2 @ 0-5 feet	Dark brown silty SAND	0	VERY LOW
B-3 @ 0-5 feet	Brown sandy SILT	12	VERY LOW

1997 UBC TABLE NO. 18-I-B, CLASSIFICATION OF EXPANSIVE SOIL

EXPANSION INDEX	POTENTIAL EXPANSION
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

R-VALUE TEST RESULTS
(ASTM D2844)

SAMPLE NO.	SAMPLE DESCRIPTION	R-VALUE
B-1 at 0 to 5 feet	Dark brown silty SAND	60
B-8 at 0 to 5 feet	Dark brown sandy SILT	19
B-10 at 0 to 5 feet	Dark brown sandy SILT	20

pH, RESISTIVITY, SULFATE AND CHLORIDE TEST RESULTS

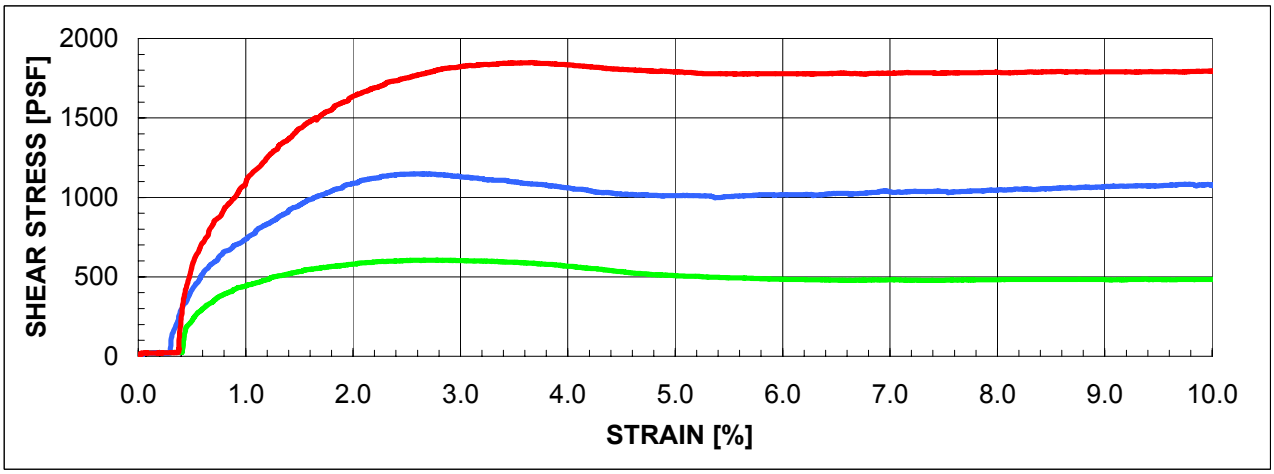
SAMPLE NO.	WATER-SOLUBLE SULFATE CONTENT (% of Dry Soil Weight) [ASTM D 516]	PH [CALTRANS 643]	RESISTIVITY (ohm-cm) [CALTRANS 643]	WATER-SOLUBLE CHLORIDE CONTENT (% of Dry Soil Weight) [SMEWW4500CL⁻C]
B-2 at 0 to 5 feet	<0.01	6.55	4954.6	<0.01
B-3 at 0 to 5 feet	<0.01	6.79	4065.3	<0.01

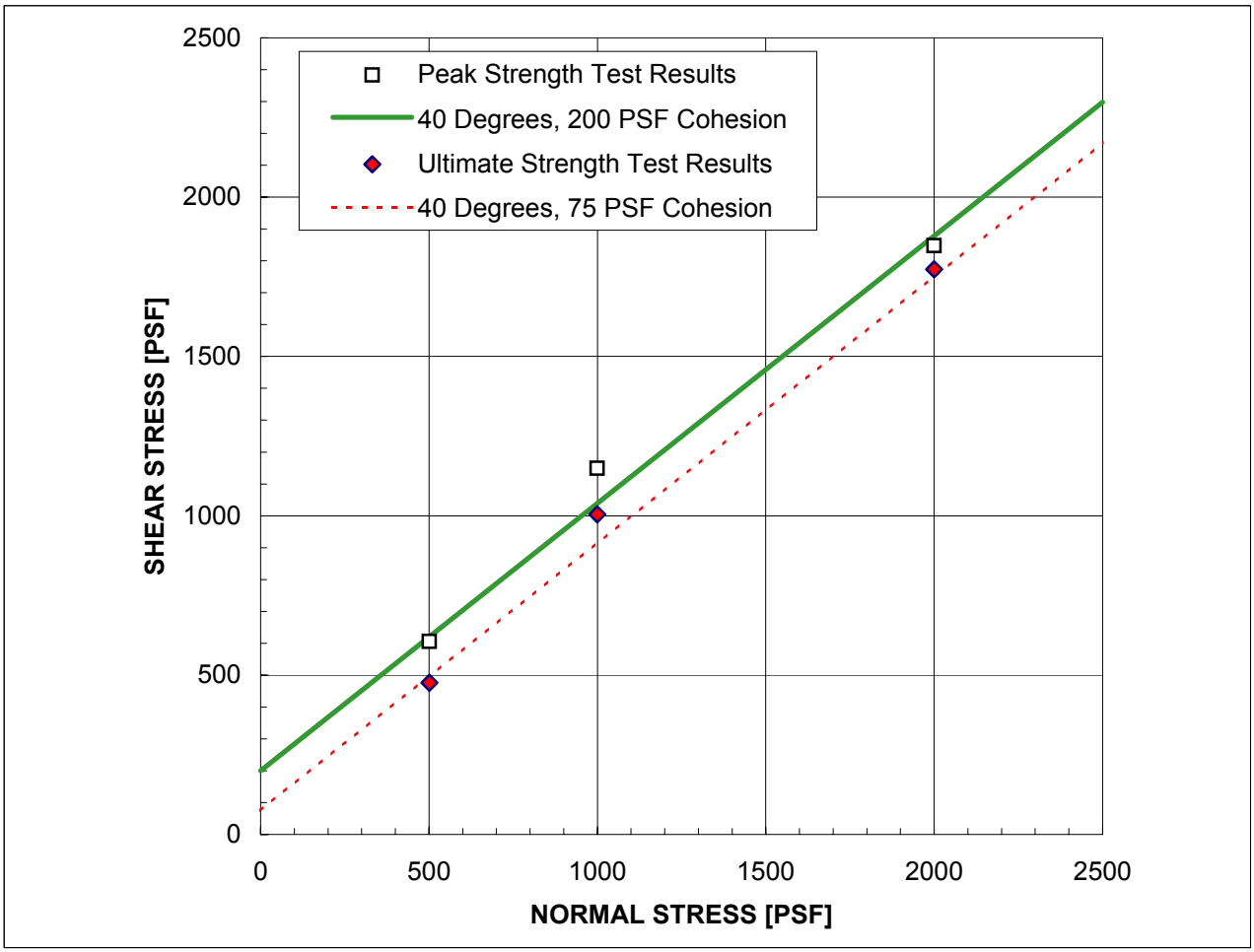
Soil Resistivity in ohm-cm	General Degree of Corrosivity to Ferrous Metal
0 to 1,000	Very Corrosive
1,000 to 2,000	Corrosive
2,000 to 5,000	Moderately Corrosive
5,000 to 10,000	Mildly Corrosive
Greater than 10,000	Slightly Corrosive

Water Soluble Chloride (Cl) Content in % of Dry Soil Weight	General Degree of Corrosivity to Metal
Over 0.15 %	Severely Corrosive
0.15 % to 0.03 %	Corrosive
0.03 % to 0.00 %	Negligible

Water Soluble Sulfate (SO_4) Content in % of Dry Soil Weight	General Degree of Reactivity with Concrete
Over 2.00 %	Very Severely Reactive
2.00 % to 0.20 %	Severely Reactive
0.20 % to 0.10 %	Moderately Reactive
0.10 % to 0.00 %	Negligible

Reference: 1997 UBC, Table 19-A-4





SAMPLE: B-7 at 0-5 ft.

ALLUVIUM: Silty Sand (SM)
(sample compacted to 90% ASTM D1557)

	PEAK	ULTIMATE
ϕ'	40 °	40 °
C'	200 PSF	75 PSF

STRAIN RATE: 0.0040 IN/MIN
(Sample was inundated, consolidated, and drained)

	IN-SITU	AS-TESTED
γ_d	110.4 PCF	110.4 PCF
w_c	11.3 %	19.5 %

Geotechnics Incorporated

DIRECT SHEAR TEST RESULTS

Project No.0730-020-00
Document No. 08-0028
FIGURE C-3

APPENDIX D

SEISMIC DATA

Seismic analysis was conducted for the subject site in order to develop parameters for structural design. This appendix presents the raw data from our analysis from three commercially available computer programs, EQFAULT, EQSEARCH, and FRISKSP (Blake, 2000). All three analyses used the same published attenuation relationships for soil and rock sites (Sadigh et. al., 1997).

EQFAULT: The program EQFAULT was used to develop the deterministic peak ground acceleration as presented in Regional Seismicity, Table 1a through 2b. The results are presented in Appendix D.

EQSEARCH: The program EQSEARCH was used to generate a table of estimated characteristics of nearby seismic events, which were recorded between 1800 and 2005. This table is presented in Appendix D, and shows the epicenters, magnitudes, and dates of these nearby earthquakes, along with the estimated peak ground acceleration for the site, and a recurrence curve generated from the data.

FRISKSP: The program FRISKSP was used to perform a probabilistic analysis of seismicity at the subject site based on the characteristic earthquake distribution of Youngs and Coppersmith (1985). The results are also presented in Appendix D. The probabilistic analysis was used to define the Design Basis and Maximum Considered Earthquakes at the site for use in structural design. Note that the graphs for rock with '1' do not incorporate Magnitude Weighting Factors and represent the probabilistic values presented in the text of this report. the graphs for deep soil with '1' also do not incorporate Magnitude Weighting Factors and represent the probabilistic values presented in the text of this report and the graphs for deep soil with '2' incorporated Magnitude Weighting Factors which may be used in liquefaction analysis.

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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 0730-020-00
DATE: 01-17-2008

JOB NAME: Cuyamaca - Descanso

CALCULATION NAME: Test Run Analysis

FAULT-DATA-FILE NAME: C:\Program Files\EQFAULT1\cgseq03n.dat

SITE COORDINATES:
   SITE LATITUDE: 32.8619
   SITE LONGITUDE: 116.6131

SEARCH RADIUS: 62.14 mi

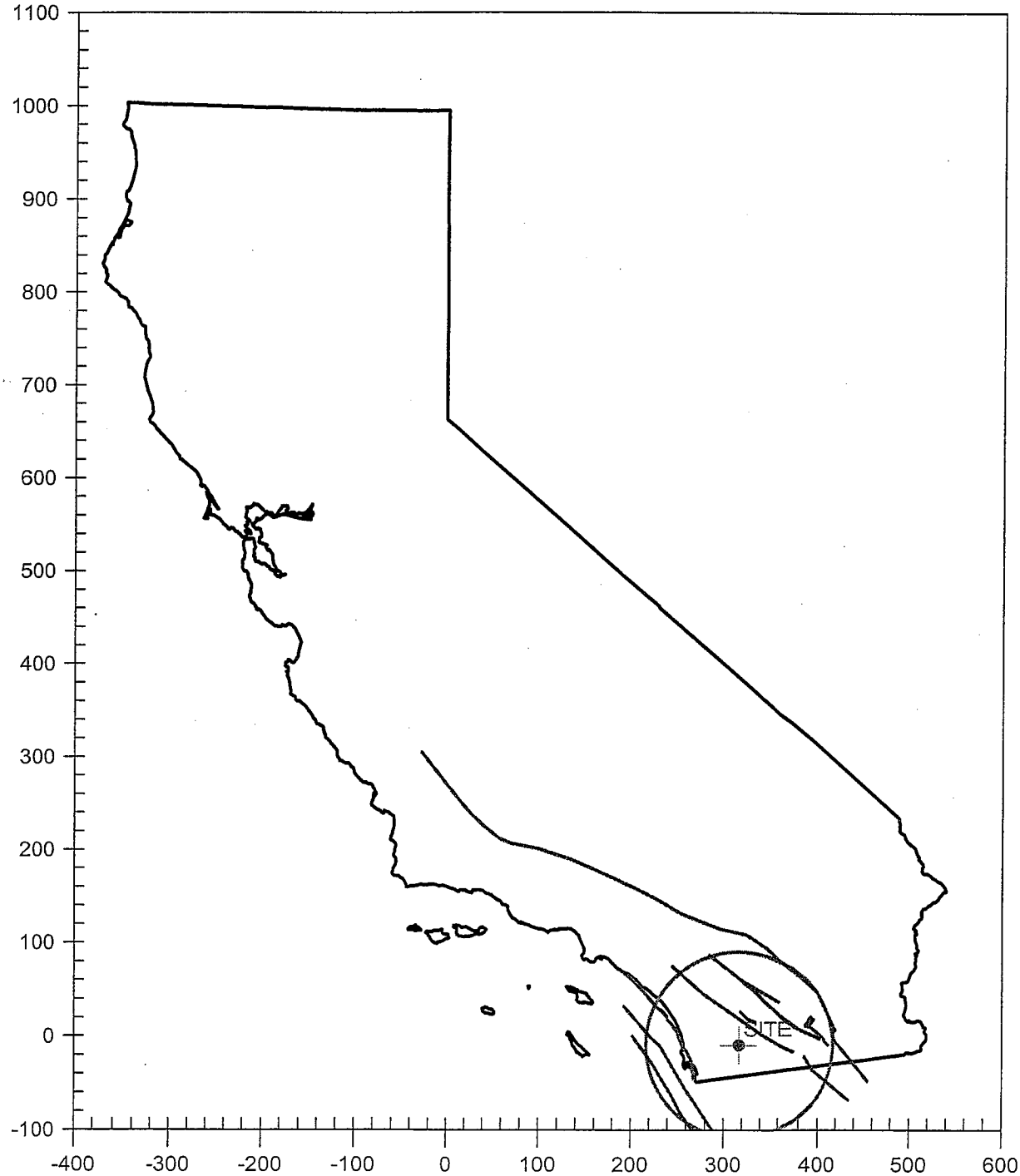
ATTENUATION RELATION: 20) Sadigh et al. (1997) Horiz. - Soil
   UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
   DISTANCE MEASURE: clodis
   SCOND: 0
   Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: C:\Program Files\EQFAULT1\cgseq03n.dat

MINIMUM DEPTH VALUE (km): 0.0

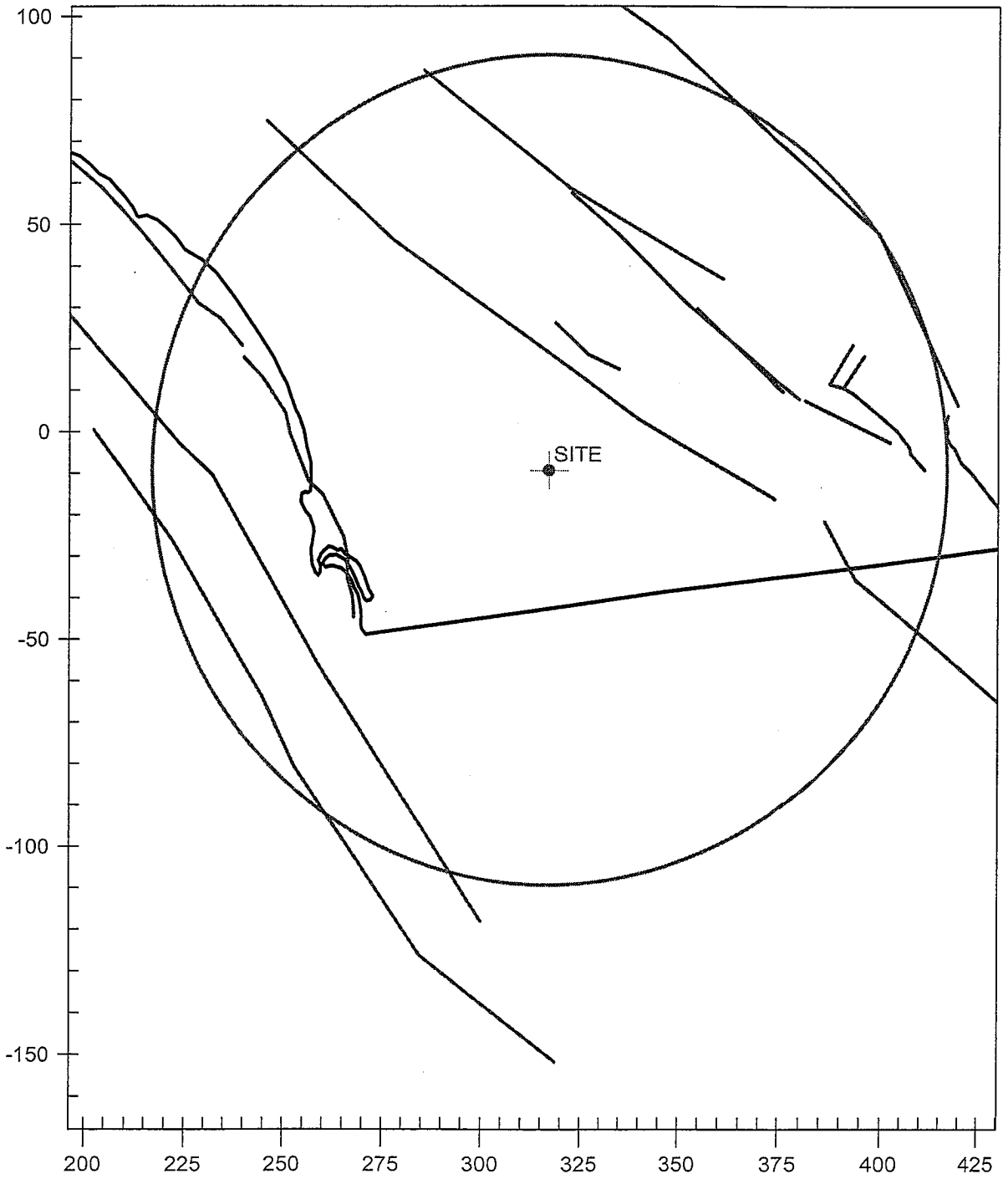
CALIFORNIA FAULT MAP

Cuyamaca - Descanso



CALIFORNIA FAULT MAP

Cuyamaca - Descanso



EQFAULT SUMMARY

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.
ELSINORE (JULIAN)	13.3(21.4)	7.1	0.204	VIII
ELSINORE (COYOTE MOUNTAIN)	16.2(26.1)	6.8	0.147	VIII
EARTHQUAKE VALLEY	18.5(29.7)	6.5	0.108	VII
SAN JACINTO-COYOTE CREEK	33.2(53.5)	6.8	0.068	VI
ROSE CANYON	33.6(54.0)	7.2	0.088	VII
SAN JACINTO - BORREGO	33.7(54.3)	6.6	0.057	VI
SAN JACINTO-ANZA	38.5(62.0)	7.2	0.075	VII
SAN JACINTO-SUPERSTITION MTN.	41.2(66.3)	6.6	0.044	VI
ELSINORE (TEMECULA)	42.5(68.4)	6.8	0.049	VI
LAGUNA SALADA	43.5(70.0)	7.0	0.056	VI
SAN JACINTO-SUPERSTITION HILLS	45.5(73.2)	6.6	0.039	V
ELMORE RANCH (WEST)	45.5(73.2)	6.6	0.039	V
CORONADO BANK	45.7(73.5)	7.6	0.081	VII
ELMORE RANCH (EAST)	47.3(76.2)	6.6	0.037	V
NEWPORT-INGLEWOOD (OFFSHORE)	51.5(82.9)	7.1	0.048	VI
SAN DIEGO TROUGH	55.7(89.7)	7.7	0.069	VI
SAN ANDREAS - SB-Coach. M-1b-2	60.6(97.6)	7.7	0.062	VI
SAN ANDREAS - Whole M-1a	60.6(97.6)	8.0	0.077	VII
SAN ANDREAS - SB-Coach. M-2b	60.6(97.6)	7.7	0.062	VI
SAN ANDREAS - Coachella M-1c-5	60.6(97.6)	7.2	0.042	VI
BRAWLEY SEISMIC ZONE	61.6(99.1)	6.4	0.021	IV
IMPERIAL (MODEL A)	62.0(99.8)	7.0	0.035	V

****

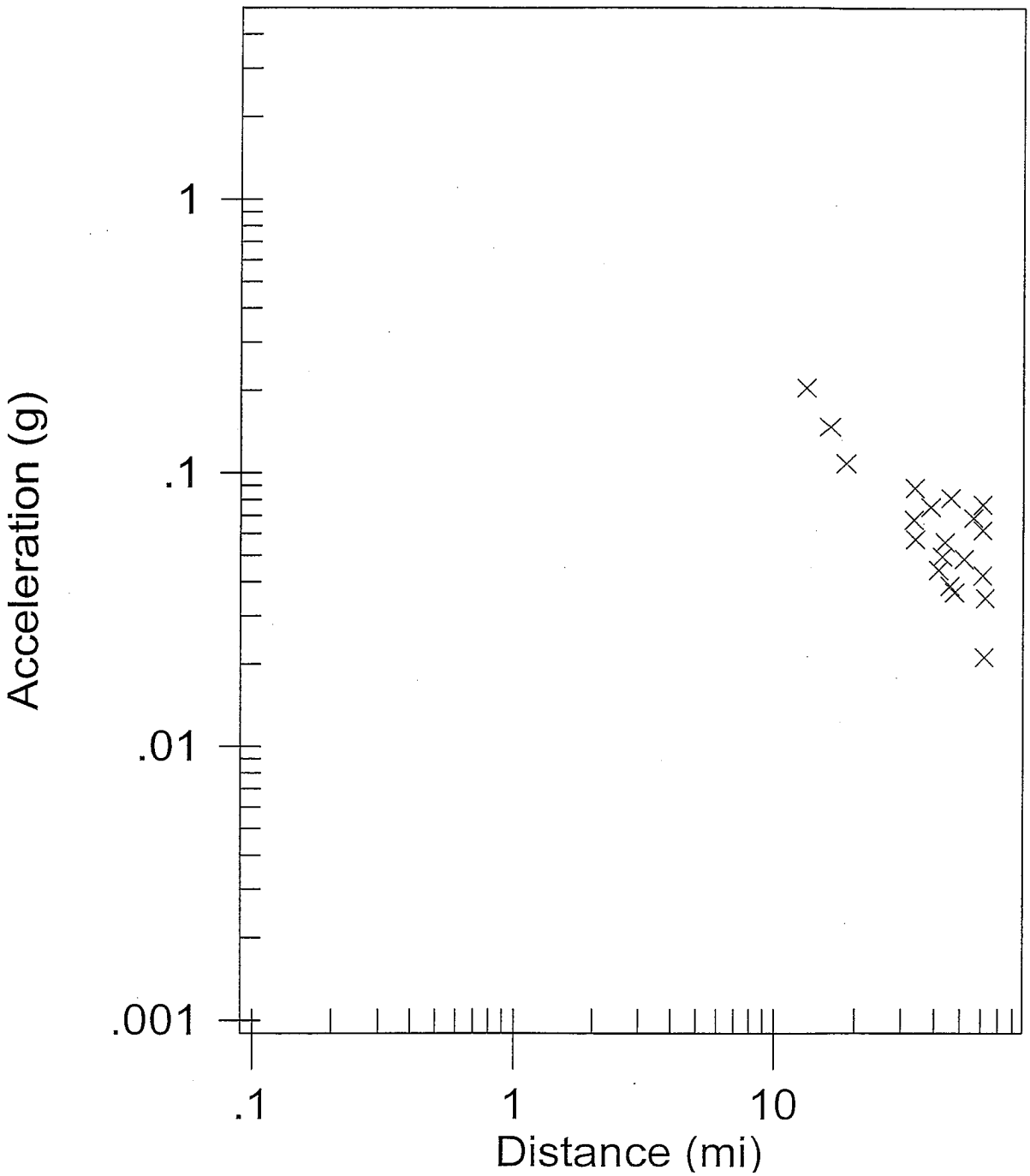
-END OF SEARCH- 22 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE ELSINORE (JULIAN) FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 13.3 MILES (21.4 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.2040 g

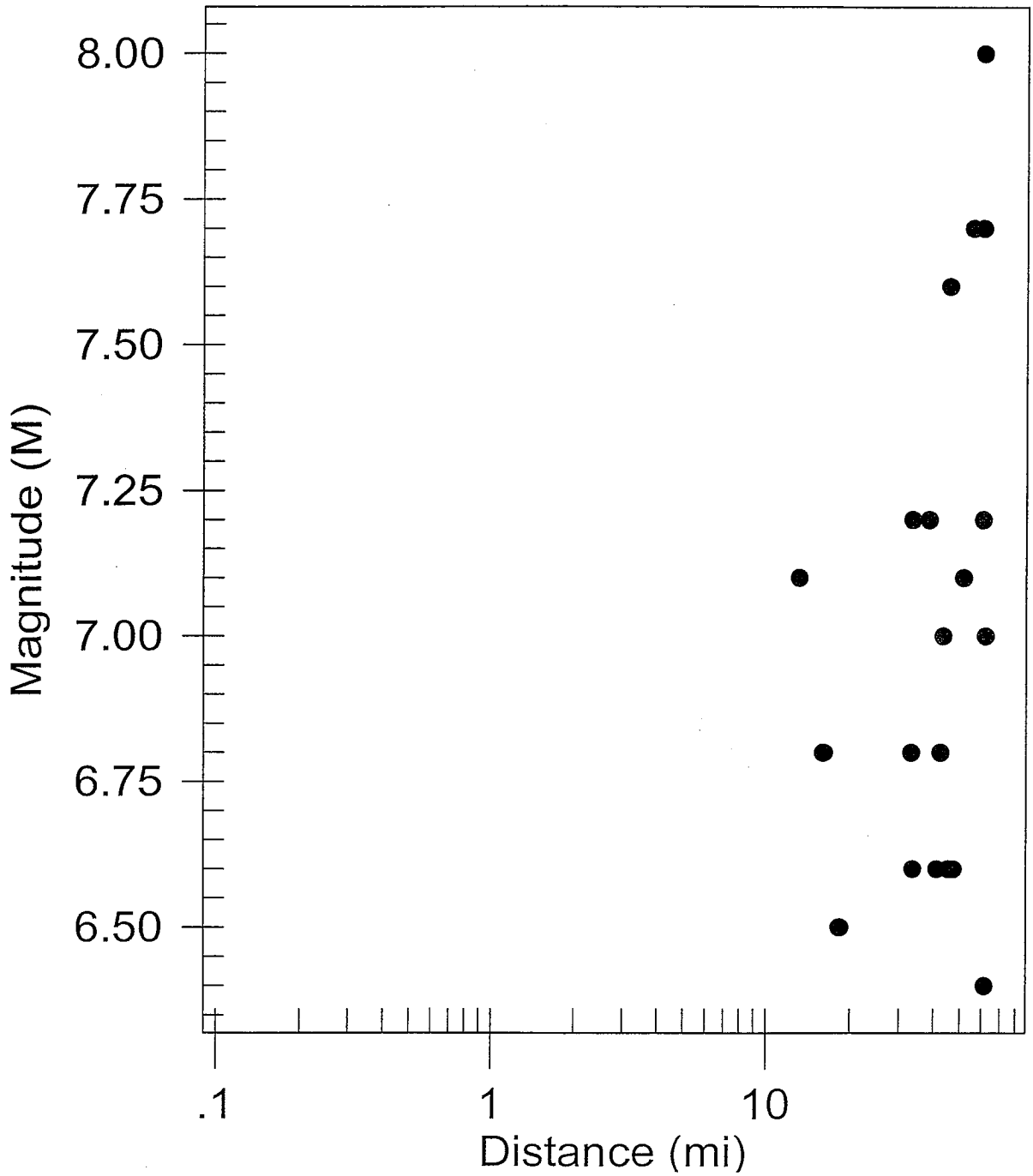
MAXIMUM EARTHQUAKES

Cuyamaca - Descanso



EARTHQUAKE MAGNITUDES & DISTANCES

Cuyamaca - Descanso



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ESTIMATION OF
PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 0730-020-00
DATE: 01-17-2008

JOB NAME: Cuyamaca - Descanso

EARTHQUAKE-CATALOG-FILE NAME: C:\Program Files\EQSEARCH\ALLQUAKE.DAT

MAGNITUDE RANGE:
   MINIMUM MAGNITUDE: 4.00
   MAXIMUM MAGNITUDE: 9.00

SITE COORDINATES:
   SITE LATITUDE: 32.8619
   SITE LONGITUDE: 116.6131

SEARCH DATES:

START DATE: 1800
END DATE: 2005

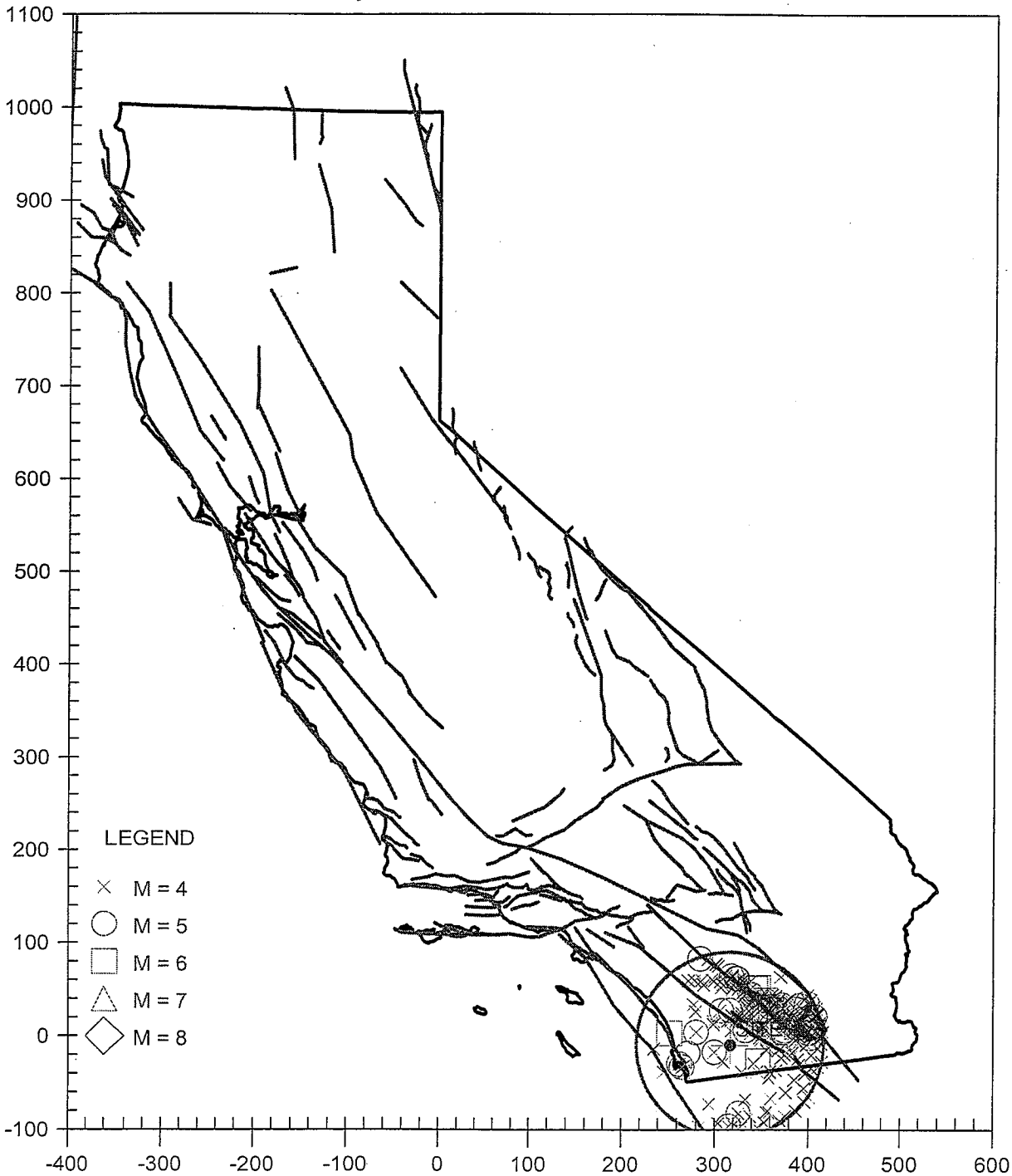
SEARCH RADIUS:
62.1 mi
100.0 km

ATTENUATION RELATION: 20) Sadigh et al. (1997) Horiz. - Soil
   UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
   ASSUMED SOURCE TYPE: SS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
   SCOND: 0 Depth Source: A
   Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km): 0.0

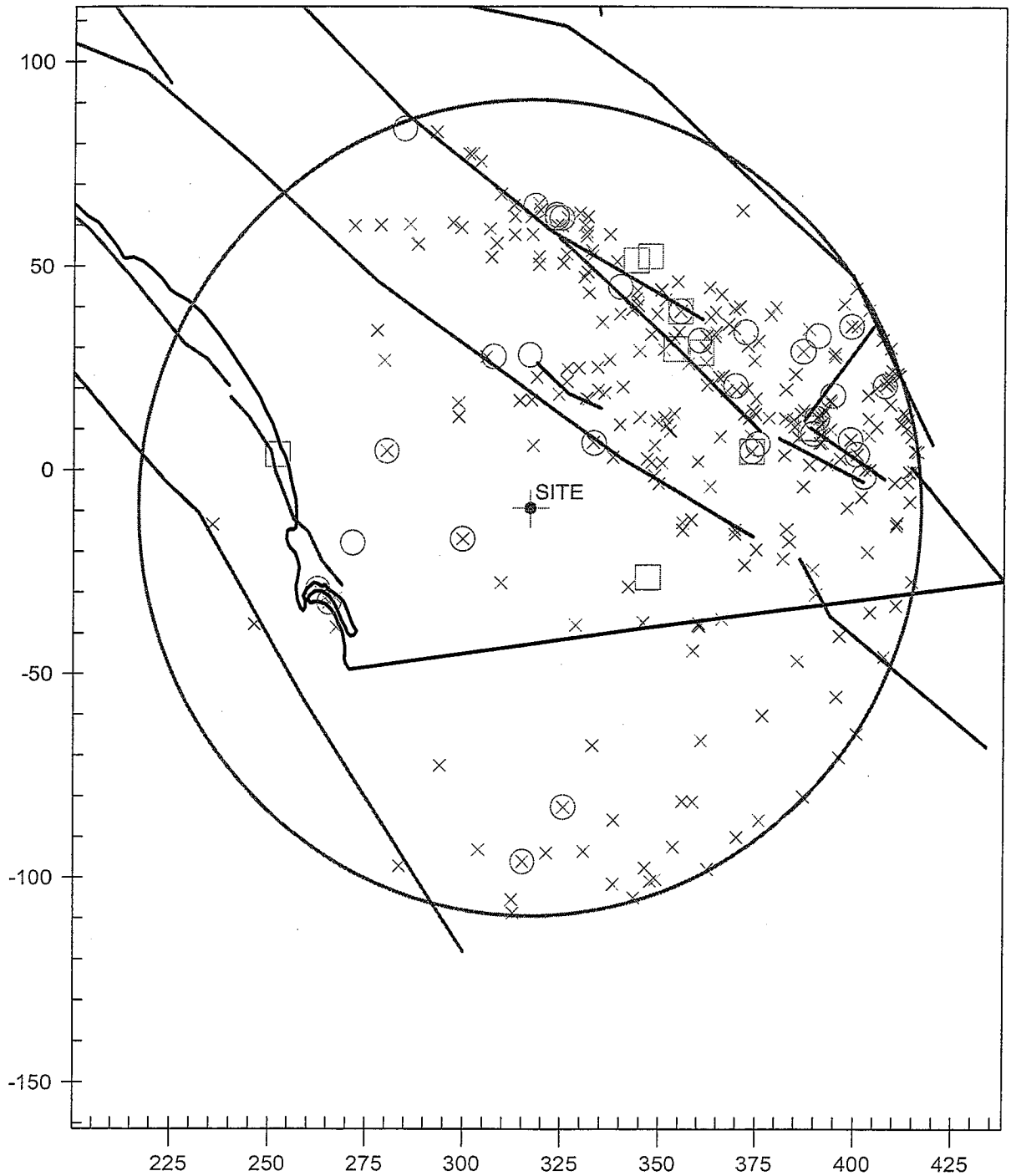
EARTHQUAKE EPICENTER MAP

Cuyamaca - Descanso



EARTHQUAKE EPICENTER MAP

Cuyamaca - Descanso



EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
MGI	33.0000	116.6000	06/11/1917	354 0.0	0.0	4.00	0.030	V	9.6(15.4)
DMG	32.8000	116.8000	10/23/1894	23 3 0.0	0.0	5.70	0.093	VII	11.7(18.7)
MGI	32.8000	116.8000	08/14/1927	1448 0.0	0.0	4.60	0.039	V	11.7(18.7)
MGI	32.7000	116.7000	03/21/1918	2325 0.0	0.0	4.00	0.022	IV	12.3(19.7)
DMG	33.0020	116.4360	07/02/1957	65638.5	12.8	4.10	0.020	IV	14.1(22.7)
DMG	33.0000	116.4330	06/04/1940	1035 8.3	0.0	5.10	0.047	VI	14.1(22.7)
DMG	32.9670	116.3830	10/31/1942	15 758.0	0.0	4.00	0.017	IV	15.2(24.4)
MGI	33.1000	116.6000	05/28/1917	1017 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	03/04/1915	1250 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	08/19/1917	710 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	08/10/1921	2151 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	02/09/1920	220 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	02/05/1922	1915 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	05/11/1915	1145 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	08/10/1921	19 6 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	02/16/1915	1330 0.0	0.0	4.00	0.015	IV	16.5(26.5)
DMG	33.1000	116.6330	02/08/1952	174028.0	0.0	4.00	0.015	IV	16.5(26.5)
DMG	33.1100	116.5230	01/24/1957	205449.9	3.9	4.60	0.023	IV	17.9(28.8)
GSP	33.0700	116.8000	12/04/1991	071057.5	15.0	4.20	0.016	IV	18.0(28.9)
DMG	33.0970	116.4440	08/18/1959	215221.3	17.3	4.30	0.016	IV	19.0(30.5)
DMG	33.1000	116.4500	11/23/1953	1339 7.0	0.0	4.30	0.016	IV	19.0(30.5)
DMG	33.0380	116.3610	02/26/1957	211652.2	0.0	4.10	0.014	IV	19.0(30.6)
MGI	32.6000	116.5000	05/03/1918	425 0.0	0.0	4.00	0.012	III	19.2(31.0)
DMG	32.6800	116.3540	01/21/1970	1124 0.4	8.0	4.10	0.013	III	19.6(31.5)
MGI	33.1000	116.8000	06/22/1918	557 0.0	0.0	4.00	0.012	III	19.7(31.7)
DMG	32.9610	116.2900	08/25/1971	23 033.0	8.0	4.00	0.012	III	19.9(32.1)
DMG	33.1500	116.5830	12/02/1935	319 0.0	0.0	4.00	0.012	III	20.0(32.1)
PAS	33.1380	116.5010	10/10/1984	212258.9	11.6	4.50	0.018	IV	20.1(32.4)
DMG	32.9230	116.2720	10/14/1969	131842.7	10.0	4.50	0.018	IV	20.2(32.5)
DMG	32.9520	116.2790	09/13/1973	173039.8	8.0	4.80	0.023	IV	20.3(32.7)
PAS	32.9050	116.2610	12/25/1975	71852.3	3.6	4.00	0.011	III	20.6(33.2)
DMG	33.1170	116.4170	10/21/1940	64933.0	0.0	4.50	0.017	IV	21.0(33.7)
DMG	33.1170	116.4170	06/04/1940	103656.0	0.0	4.00	0.011	III	21.0(33.7)
GSP	33.1100	116.4000	04/01/1984	071702.3	11.0	4.00	0.011	III	21.1(34.0)
DMG	32.7000	116.3000	02/24/1892	720 0.0	0.0	6.70	0.105	VII	21.3(34.3)
DMG	32.9900	116.2680	11/08/1958	132044.1	2.4	4.10	0.011	III	21.9(35.2)
DMG	32.9500	116.2500	11/14/1951	2355 3.0	0.0	4.10	0.011	III	21.9(35.3)
DMG	33.1670	116.5000	06/23/1932	22552.7	0.0	4.00	0.010	III	22.1(35.5)
DMG	33.1670	116.5000	06/23/1932	23037.1	0.0	4.00	0.010	III	22.1(35.5)
DMG	33.0530	116.3060	04/02/1967	201538.6	1.0	4.30	0.013	III	22.1(35.6)
DMG	33.1670	116.4670	08/01/1960	193930.0	0.0	4.20	0.012	III	22.7(36.5)
MGI	33.2000	116.6000	10/12/1920	1748 0.0	0.0	5.30	0.030	V	23.4(37.6)
DMG	33.1210	116.3490	05/25/1971	10 252.9	8.0	4.10	0.010	III	23.5(37.9)
DMG	33.2000	116.7000	01/01/1920	235 0.0	0.0	5.00	0.022	IV	23.9(38.4)
DMG	33.1670	116.4170	12/05/1939	173352.0	0.0	4.00	0.009	III	23.9(38.5)
DMG	33.1670	116.4170	10/14/1935	1550 0.0	0.0	4.00	0.009	III	23.9(38.5)
DMG	33.1670	116.4170	07/10/1938	18 6 0.0	0.0	4.00	0.009	III	23.9(38.5)
DMG	33.0430	116.2600	08/22/1961	231933.6	12.1	4.40	0.013	III	24.0(38.6)
DMG	33.2000	116.7200	05/12/1930	172548.5	0.0	4.20	0.011	III	24.1(38.9)
DMG	32.8170	116.2000	11/22/1953	81138.0	0.0	4.10	0.010	III	24.2(38.9)
MGI	32.8000	116.2000	07/23/1929	1155 0.0	0.0	4.30	0.012	III	24.3(39.2)
DMG	33.0000	117.0000	03/03/1906	2025 0.0	0.0	4.50	0.014	IV	24.4(39.2)
MGI	33.0000	117.0000	12/29/1914	10 0 0.0	0.0	4.00	0.009	III	24.4(39.2)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
MGI	33.0000	117.0000	09/21/1856	730 0.0	0.0	5.00	0.022	IV	24.4(39.2)
DMG	32.6000	116.3170	06/15/1946	194653.0	0.0	4.80	0.018	IV	25.0(40.2)
DMG	33.0190	116.2250	08/20/1969	152957.2	0.6	4.00	0.009	III	25.0(40.2)
DMG	33.0330	116.2330	09/20/1961	5 410.0	0.0	4.00	0.009	III	25.0(40.2)
DMG	33.0210	116.2230	01/13/1963	23938.9	13.0	4.20	0.010	III	25.1(40.4)
DMG	33.0500	116.2380	08/23/1961	1 047.8	11.9	4.70	0.016	IV	25.3(40.7)
GSP	32.8220	116.1750	05/24/1992	122225.8	12.0	4.10	0.009	III	25.6(41.1)
DMG	33.1830	116.3830	10/14/1949	02925.0	0.0	4.10	0.009	III	25.9(41.6)
PAS	33.0580	116.2110	03/22/1982	85328.6	4.6	4.50	0.012	III	26.9(43.4)
DMG	32.9500	116.1500	10/25/1942	185939.0	0.0	4.00	0.008	II	27.5(44.3)
MGI	32.8000	117.1000	05/25/1803	0 0 0.0	0.0	5.00	0.018	IV	28.6(46.0)
DMG	32.8940	116.1190	09/16/1961	194939.4	18.5	4.40	0.010	III	28.7(46.2)
DMG	33.2000	116.3000	05/12/1930	414 0.0	0.0	4.00	0.007	II	29.5(47.6)
DMG	33.2670	116.4000	06/06/1940	2321 4.0	0.0	4.00	0.006	II	30.6(49.2)
GSP	32.5920	116.1650	02/19/1999	030832.2	3.0	4.20	0.007	II	32.0(51.5)
GSP	32.5930	116.1630	04/07/1999	062640.1	8.0	4.00	0.006	II	32.1(51.6)
DMG	33.2000	116.2330	04/05/1942	92039.0	0.0	4.00	0.006	II	32.1(51.6)
GSP	32.5880	116.1670	03/13/1999	133120.4	6.0	4.30	0.008	III	32.1(51.6)
DMG	33.0020	116.0850	11/21/1964	172559.7	4.1	4.20	0.007	II	32.1(51.6)
GSP	32.5870	116.1630	04/18/1999	155301.1	7.0	4.20	0.007	II	32.3(52.0)
MGI	33.2000	117.0000	07/20/1923	7 0 0.0	0.0	4.00	0.006	II	32.3(52.1)
DMG	33.2350	116.2660	04/09/1968	93833.0	5.2	4.00	0.006	II	32.7(52.6)
DMG	32.7960	116.0550	11/30/1965	84325.1	16.4	4.00	0.006	II	32.7(52.6)
DMG	32.7860	116.0550	07/04/1938	215945.3	10.0	4.00	0.006	II	32.8(52.8)
DMG	33.2830	116.3500	04/13/1949	75336.0	0.0	4.10	0.006	II	32.8(52.8)
DMG	33.1670	116.1670	11/16/1937	1057 0.0	0.0	4.00	0.006	II	33.3(53.6)
DMG	33.2000	116.2000	05/28/1892	1115 0.0	0.0	6.30	0.045	VI	33.4(53.8)
PAS	32.6790	117.1510	06/18/1985	32228.7	5.7	4.00	0.006	II	33.7(54.2)
DMG	33.1170	116.1170	06/18/1943	161546.0	0.0	4.50	0.009	III	33.7(54.2)
DMG	32.5330	116.1830	11/12/1939	1849 0.0	0.0	4.00	0.006	II	33.8(54.3)
DMG	32.5330	116.1830	02/22/1939	1030 0.0	0.0	4.00	0.006	II	33.8(54.3)
DMG	33.3330	116.4330	02/12/1954	94428.0	0.0	4.50	0.009	III	34.2(55.0)
DMG	33.2910	116.3170	03/19/1966	142156.0	10.9	4.00	0.005	II	34.2(55.1)
PDP	33.2240	116.2030	05/21/2005	003932.7	15.0	4.10	0.006	II	34.5(55.5)
DMG	32.6000	116.1000	12/24/1941	73012.0	0.0	4.50	0.008	III	34.9(56.1)
T-A	32.6700	117.1700	05/24/1865	0 0 0.0	0.0	5.00	0.013	III	34.9(56.2)
T-A	32.6700	117.1700	04/15/1865	840 0.0	0.0	4.30	0.007	II	34.9(56.2)
T-A	32.6700	117.1700	12/00/1856	0 0 0.0	0.0	5.00	0.013	III	34.9(56.2)
T-A	32.6700	117.1700	01/25/1863	1020 0.0	0.0	4.30	0.007	II	34.9(56.2)
T-A	32.6700	117.1700	10/21/1862	0 0 0.0	0.0	5.00	0.013	III	34.9(56.2)
DMG	32.7170	116.0330	06/01/1959	163536.0	0.0	4.60	0.009	III	35.1(56.5)
DMG	33.3000	116.3000	01/04/1940	8 711.0	0.0	4.00	0.005	II	35.3(56.7)
DMG	33.1670	116.1170	04/09/1968	233 9.0	0.0	4.30	0.007	II	35.6(57.3)
DMG	33.1670	116.1170	04/09/1968	23930.0	0.0	4.40	0.007	II	35.6(57.3)
PAS	32.6150	117.1520	10/29/1986	23815.3	14.6	4.10	0.006	II	35.6(57.3)
DMG	33.2370	116.1900	04/14/1968	125558.7	10.8	4.30	0.007	II	35.6(57.3)
DMG	33.2790	116.2490	01/07/1966	191023.0	-1.7	4.00	0.005	II	35.7(57.4)
MGI	32.7000	117.2000	09/08/1915	742 0.0	0.0	4.00	0.005	II	35.9(57.7)
MGI	32.7000	117.2000	04/19/1906	028 0.0	0.0	4.30	0.007	II	35.9(57.7)
MGI	32.7000	117.2000	05/20/1920	1330 0.0	0.0	4.00	0.005	II	35.9(57.7)
DMG	32.7000	117.2000	05/27/1862	20 0 0.0	0.0	5.90	0.029	V	35.9(57.7)
DMG	33.1330	116.0830	05/07/1936	1147 0.0	0.0	4.50	0.008	III	35.9(57.9)
DMG	33.1330	116.0830	10/06/1940	181953.0	0.0	4.00	0.005	II	35.9(57.9)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	33.1330	116.0830	02/28/1940	1728 7.0	0.0	4.50	0.008	III	35.9(57.9)
DMG	33.1330	116.0830	10/16/1940	175213.0	0.0	4.00	0.005	II	35.9(57.9)
DMG	33.3150	116.3050	04/09/1968	1831 3.8	12.6	4.70	0.010	III	36.0(57.9)
DMG	33.1900	116.1290	04/09/1968	22859.1	11.1	6.40	0.045	VI	36.0(58.0)
DMG	33.1030	116.0610	04/09/1968	111754.5	4.8	4.00	0.005	II	36.0(58.0)
DMG	32.9670	116.0000	10/22/1942	181326.0	0.0	5.00	0.013	III	36.3(58.4)
DMG	32.9670	116.0000	11/03/1942	101834.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	04/07/1943	34614.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	11/12/1942	0 737.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	11/07/1942	439 6.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	162519.0	0.0	5.00	0.013	III	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	164759.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	10/29/1942	162157.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	1753 5.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	08/20/1944	113310.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/30/1942	53545.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	10/22/1942	125553.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	225031.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	03/07/1943	205631.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	04/27/1943	32833.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	11/03/1942	5 629.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	11/02/1942	125942.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	04/30/1943	155256.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	165716.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	175041.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	1638 6.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	10/29/1942	1556 0.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	11/16/1943	18 9 9.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/29/1942	173552.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/22/1942	113951.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	01/08/1943	024 3.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	02/24/1943	15831.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	03/26/1943	62957.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	162654.0	0.0	5.00	0.013	III	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	214928.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	18 134.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/26/1942	434 4.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	08/17/1943	155058.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	191028.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	32.9670	116.0000	11/22/1942	63951.0	0.0	4.00	0.005	II	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	162213.0	0.0	6.50	0.048	VI	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	163439.0	0.0	4.50	0.008	III	36.3(58.4)
DMG	33.3680	116.4440	03/25/1937	232026.7	10.0	4.00	0.005	II	36.3(58.4)
DMG	32.7500	116.0000	02/19/1919	458 0.0	0.0	4.50	0.008	III	36.4(58.6)
DMG	33.2670	117.0170	06/07/1935	1633 0.0	0.0	4.00	0.005	II	36.4(58.6)
DMG	33.3430	116.3460	04/28/1969	232042.9	20.0	5.80	0.026	V	36.6(58.9)
PAS	33.1360	116.0710	02/29/1984	2 731.7	6.6	4.30	0.007	II	36.7(59.0)
DMG	33.0000	116.0000	05/18/1920	625 0.0	0.0	4.50	0.008	II	36.8(59.2)
DMG	33.0500	116.0170	08/26/1955	52322.0	0.0	4.30	0.006	II	36.9(59.4)
DMG	33.2000	116.1170	12/28/1950	52211.0	0.0	4.20	0.006	II	37.0(59.5)
DMG	33.2170	116.1330	08/15/1945	175624.0	0.0	5.70	0.023	IV	37.1(59.6)
GSP	33.3790	116.4350	01/02/2002	121128.7	12.0	4.20	0.006	II	37.2(59.8)
DMG	33.3330	116.3000	08/06/1933	332 0.0	0.0	4.70	0.009	III	37.2(59.9)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	33.3330	116.3000	08/05/1933	2331 0.0	0.0	4.40	0.007	II	37.2(59.9)
DMG	33.4000	116.5670	02/04/1953	43616.0	0.0	4.30	0.006	II	37.2(59.9)
DMG	33.0400	116.0050	05/11/1968	810 4.0	8.8	4.20	0.006	II	37.3(60.0)
DMG	33.1040	116.0360	04/09/1968	34810.3	4.8	4.70	0.009	III	37.4(60.1)
DMG	32.9830	115.9830	05/23/1942	154729.0	0.0	5.00	0.012	III	37.5(60.3)
DMG	32.3330	116.4670	01/13/1935	224 0.0	0.0	4.00	0.005	II	37.5(60.3)
DMG	33.1130	116.0370	04/09/1968	3 353.5	5.0	5.20	0.014	IV	37.6(60.5)
DMG	33.4000	116.5000	10/11/1918	4 0 0.0	0.0	4.00	0.005	II	37.7(60.7)
DMG	33.3100	116.2240	05/22/1968	132655.4	7.5	4.40	0.007	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	957 7.0	0.0	4.60	0.008	III	38.3(61.6)
DMG	33.2830	116.1830	03/20/1954	6 353.0	0.0	4.30	0.006	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	14 057.0	0.0	4.10	0.005	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	143750.0	0.0	4.00	0.005	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	13 8 4.0	0.0	4.30	0.006	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	102610.0	0.0	4.00	0.005	II	38.3(61.6)
DMG	33.2830	116.1830	03/20/1954	41919.0	0.0	4.90	0.011	III	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	101957.0	0.0	4.50	0.007	II	38.3(61.6)
DMG	33.2830	116.1830	03/23/1954	41450.0	0.0	5.10	0.013	III	38.3(61.6)
DMG	33.2830	116.1830	10/26/1944	225410.0	0.0	4.20	0.006	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	10 139.0	0.0	4.20	0.006	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	102117.0	0.0	5.50	0.018	IV	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	95556.0	0.0	5.00	0.012	III	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	95748.0	0.0	4.00	0.005	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	101522.0	0.0	4.50	0.007	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	95429.0	0.0	6.20	0.035	V	38.3(61.6)
DMG	33.2830	116.1830	04/04/1954	42920.0	0.0	4.10	0.005	II	38.3(61.6)
GSP	33.2250	116.1130	09/21/2002	212616.6	14.0	4.30	0.006	II	38.3(61.6)
DMG	33.0560	115.9930	04/09/1968	35836.0	7.9	4.30	0.006	II	38.3(61.7)
DMG	33.4170	116.5670	12/22/1950	2 536.0	0.0	4.00	0.005	II	38.4(61.8)
DMG	33.0480	115.9860	04/16/1968	33029.9	8.3	4.80	0.010	III	38.5(62.0)
PAS	33.4200	116.6980	06/05/1978	16 3 3.9	11.9	4.40	0.007	II	38.8(62.5)
DMG	33.1070	116.0070	04/09/1968	8 038.5	4.0	4.00	0.004	I	39.0(62.7)
DMG	33.3330	116.2360	10/05/1962	1529 2.6	13.9	4.10	0.005	II	39.2(63.0)
DMG	33.4200	116.4900	03/29/1937	17 316.8	10.0	4.00	0.004	I	39.2(63.1)
DMG	33.3330	116.2330	06/09/1942	5 633.0	0.0	4.00	0.004	I	39.3(63.2)
GSP	33.2240	116.0880	07/10/1998	212913.8	12.0	4.10	0.005	II	39.3(63.3)
DMG	33.0830	115.9830	07/13/1940	163923.0	0.0	4.00	0.004	I	39.6(63.7)
DMG	33.0830	115.9830	03/02/1934	2130 0.0	0.0	4.50	0.007	II	39.6(63.7)
DMG	33.0830	115.9830	07/14/1940	0 144.0	0.0	4.00	0.004	I	39.6(63.7)
DMG	33.0830	115.9830	12/15/1937	958 0.0	0.0	4.00	0.004	I	39.6(63.7)
DMG	33.0830	115.9830	12/10/1938	312 0.0	0.0	4.00	0.004	I	39.6(63.7)
DMG	33.2330	116.0860	08/26/1965	133814.0	-2.0	4.50	0.007	II	39.8(64.1)
DMG	33.4170	116.4170	01/02/1943	141118.0	0.0	4.50	0.007	II	40.0(64.3)
GSP	33.3990	116.3540	07/26/1997	031456.0	11.0	4.80	0.009	III	40.0(64.4)
DMG	33.0390	115.9490	05/06/1968	173147.6	6.7	4.00	0.004	I	40.4(65.0)
DMG	33.4260	116.4210	03/25/1937	20 4 8.3	10.0	4.00	0.004	I	40.5(65.2)
DMG	33.2670	116.1000	01/04/1954	233152.0	0.0	4.20	0.005	II	40.8(65.6)
DMG	33.4500	116.6830	04/25/1955	25515.0	0.0	4.00	0.004	I	40.8(65.7)
DMG	32.7920	115.9140	10/12/1936	135631.8	10.0	4.00	0.004	I	40.8(65.7)
DMG	33.0000	117.3000	11/22/1800	2130 0.0	0.0	6.50	0.041	V	40.9(65.9)
GSP	32.7270	115.9260	01/13/1999	132056.0	2.0	4.40	0.006	II	40.9(65.9)
DMG	32.9550	115.9110	04/10/1967	04717.3	4.4	4.00	0.004	I	41.2(66.3)
DMG	33.4000	116.3000	02/09/1890	12 6 0.0	0.0	6.30	0.034	V	41.3(66.5)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	32.7640	115.9080	10/12/1936	17 750.1	10.0	4.00	0.004	I	41.5(66.7)
DMG	33.3490	116.1880	05/19/1969	144033.0	8.6	4.50	0.006	II	41.7(67.0)
PAS	32.3020	116.8810	08/19/1978	931 5.7	19.8	4.10	0.004	I	41.7(67.1)
DMG	33.4670	116.6330	02/20/1934	1035 0.0	0.0	4.00	0.004	I	41.8(67.3)
DMG	33.4670	116.5830	03/27/1937	528 0.0	0.0	4.00	0.004	I	41.8(67.3)
DMG	33.4670	116.5830	03/26/1937	2124 0.0	0.0	4.00	0.004	I	41.8(67.3)
DMG	33.4670	116.5830	01/04/1938	029 0.0	0.0	4.50	0.006	II	41.8(67.3)
DMG	33.4670	116.5830	03/27/1937	742 0.0	0.0	4.50	0.006	II	41.8(67.3)
DMG	33.2780	116.0850	08/26/1965	125351.0	1.0	4.20	0.005	II	41.9(67.5)
DMG	33.1670	115.9830	07/21/1940	836 3.0	0.0	4.40	0.006	II	42.1(67.8)
GSP	33.2500	116.0500	08/31/1990	033800.0	8.0	4.20	0.005	II	42.2(67.9)
DMG	33.2400	116.0360	04/28/1961	63021.2	-1.2	4.20	0.005	II	42.4(68.2)
PAS	33.4580	116.4340	02/12/1979	44842.3	3.9	4.20	0.005	II	42.4(68.3)
DMG	33.2000	116.0000	08/15/1951	1227 9.0	0.0	4.00	0.004	I	42.5(68.4)
DMG	33.4080	116.2610	03/25/1937	1649 1.8	10.0	6.00	0.025	V	42.8(69.0)
DMG	33.0360	115.9030	10/05/1964	121 9.5	-2.0	4.10	0.004	I	42.9(69.0)
DMG	33.4670	116.4330	05/12/1939	1925 2.2	0.0	4.50	0.006	II	43.1(69.3)
DMG	33.4830	116.7000	12/28/1948	125341.0	0.0	4.00	0.004	I	43.2(69.5)
PAS	33.4840	116.5130	08/11/1976	152455.5	15.4	4.30	0.005	II	43.3(69.7)
DMG	33.4830	116.5000	02/15/1951	104957.0	0.0	4.80	0.008	III	43.4(69.8)
DMG	33.4830	116.5000	02/15/1951	104759.0	0.0	4.80	0.008	III	43.4(69.8)
DMG	32.8850	115.8650	10/27/1963	145822.4	-2.0	4.40	0.006	II	43.4(69.9)
DMG	33.2310	116.0040	05/26/1957	155933.6	15.1	5.00	0.010	III	43.5(70.0)
PAS	33.0290	115.8880	11/26/1987	1739 2.0	1.8	4.30	0.005	II	43.6(70.1)
PAS	33.4600	116.3700	09/07/1984	175730.3	15.2	4.10	0.004	I	43.6(70.2)
PAS	33.0170	115.8810	11/24/1987	185040.3	0.0	4.30	0.005	II	43.7(70.4)
PAS	32.9930	115.8720	11/24/1987	133259.9	0.0	4.20	0.005	I	43.9(70.6)
DMG	33.0330	115.8830	08/27/1945	112520.0	0.0	4.00	0.004	I	43.9(70.7)
DMG	33.3330	116.1000	06/12/1943	192141.0	0.0	4.00	0.004	I	44.0(70.9)
PAS	33.4830	116.4380	07/02/1988	02658.2	12.6	4.00	0.004	I	44.1(70.9)
DMG	33.4540	116.8980	07/29/1936	142252.8	10.0	4.00	0.004	I	44.1(70.9)
DMG	33.4560	116.8960	06/16/1938	55916.9	10.0	4.00	0.004	I	44.2(71.1)
DMG	33.4880	116.7770	06/12/1959	11 313.0	5.7	4.00	0.004	I	44.3(71.2)
GSP	33.2100	115.9700	07/19/1991	024136.8	3.0	4.00	0.004	I	44.3(71.3)
DMG	33.2830	116.0330	03/16/1949	18 027.0	0.0	4.00	0.004	I	44.4(71.5)
DMG	33.2830	116.0330	03/29/1951	233929.0	0.0	4.40	0.005	II	44.4(71.5)
DMG	33.1000	115.9000	04/25/1957	2248 0.0	0.0	4.10	0.004	I	44.4(71.5)
DMG	33.1000	115.9000	04/25/1957	2249 0.0	0.0	4.20	0.004	I	44.4(71.5)
DMG	33.1000	115.9000	04/25/1957	22 5 0.0	0.0	4.20	0.004	I	44.4(71.5)
DMG	33.5060	116.5850	05/21/1967	144234.4	19.4	4.70	0.007	II	44.5(71.6)
PAS	33.5010	116.5130	02/25/1980	104738.5	13.6	5.50	0.015	IV	44.5(71.6)
DMG	33.5000	116.5000	09/30/1916	211 0.0	0.0	5.00	0.009	III	44.5(71.7)
DMG	33.3170	116.0670	09/04/1944	125528.0	0.0	4.10	0.004	I	44.6(71.7)
DMG	33.5080	116.6310	08/11/1967	05711.4	10.7	4.10	0.004	I	44.6(71.8)
DMG	32.3340	116.1700	08/24/1963	204749.5	4.8	4.10	0.004	I	44.6(71.8)
PAS	32.9320	115.8470	09/05/1982	52126.6	4.2	4.40	0.005	II	44.7(71.9)
DMG	33.5000	116.4830	02/23/1941	183614.0	0.0	4.50	0.006	II	44.7(71.9)
GSP	33.5080	116.5140	10/31/2001	075616.6	15.0	5.10	0.010	III	45.0(72.4)
DMG	33.0450	115.8630	12/17/1968	225351.2	8.0	4.70	0.007	II	45.3(72.8)
DMG	33.2880	116.0180	07/27/1965	14 441.4	0.6	4.30	0.005	II	45.3(72.9)
MGI	33.5000	116.8000	05/31/1917	435 0.0	0.0	4.00	0.004	I	45.4(73.0)
MGI	33.5000	116.8000	06/02/1917	435 0.0	0.0	4.00	0.004	I	45.4(73.0)
MGI	33.5000	116.8000	03/30/1918	16 5 0.0	0.0	4.60	0.006	II	45.4(73.0)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
MGI	33.5000	116.8000	11/26/1916	17 5 0.0	0.0	4.00	0.004	I	45.4(73.0)
DMG	33.5010	116.4290	02/23/1971	0 739.2	8.0	4.20	0.004	I	45.4(73.0)
PAS	33.5200	116.5580	08/02/1975	014 7.7	13.4	4.70	0.007	II	45.5(73.3)
DMG	32.7000	115.8500	11/01/1941	142434.0	0.0	4.00	0.004	I	45.7(73.5)
GSP	33.5100	116.4500	02/18/1990	155259.9	9.0	4.10	0.004	I	45.7(73.6)
DMG	32.2000	116.5500	11/04/1949	204238.0	0.0	5.70	0.017	IV	45.8(73.8)
DMG	32.2000	116.5500	11/05/1949	43524.0	0.0	5.10	0.010	III	45.8(73.8)
DMG	32.2000	116.5500	11/05/1949	20 2 7.0	0.0	4.00	0.004	I	45.8(73.8)
DMG	32.2000	116.5500	11/06/1949	23 510.0	0.0	4.00	0.004	I	45.8(73.8)
DMG	32.2000	116.5500	11/11/1949	1354 0.0	0.0	4.20	0.004	I	45.8(73.8)
DMG	33.0530	115.8550	10/05/1964	12455.5	0.0	4.40	0.005	II	45.9(73.8)
PAS	33.0130	115.8390	11/24/1987	131556.5	2.4	6.00	0.022	IV	46.0(74.1)
PDP	33.5290	116.5720	06/12/2005	154146.5	14.0	5.20	0.011	III	46.1(74.2)
DMG	33.0000	115.8330	01/08/1946	185418.0	0.0	5.40	0.013	III	46.2(74.3)
DMG	33.5330	116.6330	09/21/1942	7 754.0	0.0	4.00	0.003	I	46.3(74.6)
DMG	33.5340	116.5610	09/23/1956	112441.9	12.2	4.30	0.005	I	46.5(74.8)
PAS	33.1330	115.8730	11/24/1987	133355.8	0.0	4.00	0.003	I	46.8(75.3)
PAS	32.9790	115.8160	11/25/1987	135410.0	0.6	4.20	0.004	I	46.9(75.5)
USG	32.6450	115.8440	02/28/1988	5 259.5	7.1	4.21	0.004	I	47.1(75.8)
PAS	32.9960	115.8160	11/27/1987	11010.5	6.0	4.70	0.007	II	47.1(75.8)
PAS	32.6270	117.3770	06/29/1983	8 836.4	5.0	4.60	0.006	II	47.2(76.0)
PAS	32.9950	115.8130	12/02/1987	4 3 6.2	1.7	4.00	0.003	I	47.3(76.1)
PAS	32.9800	115.8090	11/28/1987	03910.9	0.8	4.20	0.004	I	47.3(76.1)
DMG	33.0330	115.8210	09/30/1971	224611.3	8.0	5.10	0.009	III	47.4(76.3)
PAS	33.0140	115.8150	11/24/1987	131848.9	6.0	4.10	0.004	I	47.4(76.3)
DMG	33.5000	116.9170	11/04/1935	355 0.0	0.0	4.50	0.005	II	47.4(76.3)
DMG	32.9310	115.7980	01/12/1972	1231 9.6	0.0	4.00	0.003	I	47.5(76.4)
PAS	33.0360	115.8200	11/24/1987	21435.5	4.7	4.50	0.005	II	47.5(76.4)
PAS	33.0330	115.8140	11/24/1987	22159.6	4.5	4.00	0.003	I	47.8(76.9)
PAS	33.0220	115.8080	11/24/1987	62323.1	3.4	4.00	0.003	I	47.9(77.1)
PAS	33.0400	115.8120	11/24/1987	253 0.7	3.5	4.70	0.006	II	48.0(77.3)
PAS	33.5580	116.6670	06/15/1982	234921.3	12.2	4.80	0.007	II	48.2(77.5)
DMG	33.2670	115.9330	12/30/1960	214025.0	0.0	4.00	0.003	I	48.3(77.7)
PAS	33.0470	115.8080	11/24/1987	143629.9	0.0	4.00	0.003	I	48.4(77.8)
DMG	32.5000	115.9000	06/25/1941	1715 0.0	0.0	4.00	0.003	I	48.4(77.9)
DMG	32.3830	116.0000	01/03/1956	1424 1.0	0.0	4.70	0.006	II	48.6(78.2)
PAS	33.0500	115.8000	11/24/1987	21647.2	6.0	4.00	0.003	I	48.9(78.6)
PAS	33.0480	115.7980	11/24/1987	21523.2	5.0	4.80	0.007	II	48.9(78.8)
PAS	33.0080	115.7860	11/24/1987	1321 0.2	6.0	4.10	0.003	I	49.0(78.8)
DMG	32.1670	116.4170	09/17/1950	194330.0	0.0	4.50	0.005	II	49.3(79.4)
DMG	33.5000	117.0000	08/08/1925	1013 0.0	0.0	4.50	0.005	II	49.4(79.5)
DMG	33.1830	115.8500	04/25/1957	222412.0	0.0	5.10	0.009	III	49.4(79.5)
DMG	33.1830	115.8500	04/25/1957	222148.0	0.0	4.20	0.004	I	49.4(79.5)
PAS	32.9420	115.7630	11/24/1987	133439.9	14.0	4.80	0.007	II	49.6(79.8)
DMG	33.2830	115.9170	03/28/1952	11622.0	0.0	4.20	0.004	I	49.7(79.9)
DMG	32.8330	115.7500	02/24/1933	1933 0.0	0.0	4.50	0.005	II	50.1(80.6)
PAS	33.0670	115.7810	11/24/1987	13248.1	4.0	4.20	0.004	I	50.2(80.8)
PAS	33.0720	115.7820	11/24/1987	153 3.2	4.2	4.00	0.003	I	50.3(80.9)
DMG	32.8500	117.4830	02/23/1943	92112.0	0.0	4.00	0.003	I	50.5(81.2)
PAS	32.2020	116.2290	12/12/1979	213741.0	5.5	4.00	0.003	I	50.7(81.7)
PAS	33.0820	115.7750	11/24/1987	15414.5	4.9	5.80	0.016	IV	50.9(81.9)
T-A	33.5000	117.0700	12/29/1880	7 0 0.0	0.0	4.30	0.004	I	51.4(82.7)
DMG	32.2000	116.2000	03/03/1957	11 6 3.0	0.0	4.40	0.004	I	51.6(83.1)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	32.9830	115.7330	01/24/1951	717 2.6	0.0	5.60	0.013	III	51.7(83.2)
DMG	32.9830	115.7330	01/24/1951	733 7.0	0.0	4.00	0.003	I	51.7(83.2)
DMG	33.2330	115.8330	06/24/1942	235240.0	0.0	4.00	0.003	I	51.9(83.5)
DMG	33.2330	115.8330	06/14/1942	213623.0	0.0	4.00	0.003	I	51.9(83.5)
DMG	33.2330	115.8330	06/14/1942	222549.0	0.0	4.00	0.003	I	51.9(83.5)
DMG	32.9500	115.7170	06/14/1953	42958.0	0.0	4.80	0.006	II	52.3(84.2)
DMG	32.9500	115.7170	06/14/1953	41729.9	0.0	5.50	0.012	III	52.3(84.2)
DMG	32.8560	115.7100	09/18/1936	144032.1	10.0	4.50	0.005	II	52.4(84.3)
DMG	32.1000	116.6000	01/07/1950	93735.0	0.0	4.00	0.003	I	52.6(84.7)
DMG	33.2160	115.8080	04/25/1957	215738.7	-0.3	5.20	0.009	III	52.6(84.7)
DMG	32.1130	116.7850	04/23/1968	131825.4	10.0	4.20	0.003	I	52.7(84.8)
DMG	32.5510	115.7850	01/23/1971	22 736.0	8.0	4.10	0.003	I	52.7(84.8)
DMG	32.9000	115.7000	10/02/1928	19 1 0.0	0.0	5.00	0.007	II	53.0(85.3)
DMG	32.1000	116.5000	01/08/1937	1246 0.0	0.0	4.00	0.003	I	53.0(85.3)
DMG	32.9150	115.6970	05/23/1963	63635.7	1.2	4.30	0.004	I	53.2(85.7)
DMG	33.1670	115.7670	05/10/1955	43840.0	0.0	4.30	0.004	I	53.3(85.8)
GSP	33.6320	116.7190	07/19/1999	220927.5	14.0	4.20	0.003	I	53.5(86.1)
DMG	33.1750	115.7640	10/28/1963	81417.1	0.9	4.00	0.003	I	53.7(86.4)
DMG	32.7330	115.7000	04/21/1960	233920.0	0.0	4.20	0.003	I	53.7(86.5)
DMG	32.0830	116.6670	09/27/1934	2140 0.0	0.0	4.00	0.003	I	53.9(86.7)
DMG	32.0830	116.6670	11/25/1934	818 0.0	0.0	5.00	0.007	II	53.9(86.7)
DMG	32.0830	116.6670	10/12/1938	1231 0.0	0.0	4.00	0.003	I	53.9(86.7)
PAS	32.9140	115.6840	01/28/1988	254 2.4	5.9	4.70	0.005	II	54.0(86.9)
DMG	32.9900	115.6820	11/29/1964	142526.4	13.8	4.20	0.003	I	54.7(88.0)
GSP	33.6500	116.7400	12/02/1989	231647.8	14.0	4.20	0.003	I	54.9(88.4)
DMG	33.6500	116.7500	09/05/1950	191956.0	0.0	4.80	0.006	II	55.0(88.5)
DMG	33.0270	115.6810	05/23/1963	1553 1.8	0.4	4.80	0.006	II	55.2(88.8)
DMG	32.6000	115.7000	04/26/1963	1 342.0	0.0	4.00	0.003	-	56.0(90.2)
DMG	32.6000	115.7000	12/19/1958	1437 0.0	0.0	4.10	0.003	I	56.0(90.2)
PAS	33.0790	115.6800	04/26/1981	124043.4	6.0	4.20	0.003	I	56.1(90.3)
DMG	33.0080	115.6600	06/17/1965	74013.5	8.8	4.10	0.003	I	56.1(90.3)
DMG	32.4170	115.8000	05/13/1960	123640.0	0.0	4.10	0.003	I	56.4(90.7)
DMG	32.1020	116.2580	05/07/1966	32657.4	12.7	4.50	0.004	I	56.4(90.8)
MGI	33.5000	116.0000	09/30/1916	425 0.0	0.0	4.00	0.003	-	56.5(91.0)
PAS	33.0940	115.6550	06/13/1979	194645.9	6.0	4.10	0.003	I	57.8(92.9)
DMG	32.8830	115.6170	01/16/1946	11 654.0	0.0	4.20	0.003	I	57.8(93.0)
PAS	32.0580	116.3370	01/29/1980	1949 3.3	5.0	4.40	0.004	I	57.8(93.0)
DMG	33.2330	115.7170	10/26/1942	615 4.0	0.0	4.50	0.004	I	57.8(93.1)
DMG	33.2330	115.7170	10/22/1942	15038.0	0.0	5.50	0.010	III	57.8(93.1)
DMG	33.2330	115.7170	10/26/1942	34316.0	0.0	4.00	0.002	-	57.8(93.1)
DMG	33.2330	115.7170	10/26/1942	3 215.0	0.0	4.50	0.004	I	57.8(93.1)
PAS	32.7880	115.6180	10/15/1979	2355 2.6	5.0	4.20	0.003	I	58.0(93.3)
DMG	32.7940	115.6150	04/23/1968	1624 9.5	5.0	4.10	0.003	I	58.1(93.5)
DMG	32.0830	117.0000	05/10/1948	34925.0	0.0	4.00	0.002	-	58.3(93.8)
DMG	33.2840	115.7350	10/27/1963	145023.4	-2.0	4.00	0.002	-	58.6(94.2)
DMG	33.2330	115.7000	08/30/1946	111645.0	0.0	4.60	0.004	I	58.7(94.5)
DMG	32.0250	116.4240	08/20/1961	42843.0	12.6	4.60	0.004	I	58.8(94.7)
DMG	33.0560	115.6200	06/16/1965	242 6.1	-0.5	4.40	0.003	I	59.1(95.1)
PAS	33.0980	115.6320	04/26/1981	12 928.4	3.8	5.70	0.012	III	59.1(95.1)
PAS	33.0990	115.6300	04/26/1981	12 557.4	4.2	4.00	0.002	-	59.2(95.3)
PAS	33.7010	116.8370	08/22/1979	2 136.3	5.0	4.10	0.003	-	59.4(95.5)
PAS	33.1100	115.6270	04/25/1981	21155.3	4.8	4.10	0.003	-	59.6(95.9)
DMG	32.0000	116.7000	12/02/1929	1124 0.0	0.0	4.50	0.004	I	59.7(96.1)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	32.8830	115.5830	04/13/1938	1929 0.0	0.0	4.50	0.004	I	59.7(96.2)
GSP	32.6120	115.6280	07/27/1992	204008.8	15.0	4.10	0.003	-	59.8(96.2)
PAS	33.1030	115.6220	11/04/1976	133127.7	3.7	4.20	0.003	I	59.8(96.2)
PAS	33.1030	115.6210	11/04/1976	1139 8.4	0.9	4.10	0.003	-	59.8(96.3)
DMG	32.1520	116.0200	02/16/1967	194127.4	5.3	4.00	0.002	-	60.0(96.5)
DMG	32.0320	116.3090	08/27/1963	121 1.8	14.6	4.00	0.002	-	60.0(96.5)
DMG	32.1170	116.0830	07/09/1951	9 622.0	0.0	4.20	0.003	I	60.0(96.5)
DMG	32.0280	116.3230	09/20/1961	1036 2.6	11.4	4.20	0.003	I	60.0(96.6)
PAS	33.1090	115.6190	11/04/1976	114940.4	2.2	4.10	0.003	-	60.0(96.6)
PAS	32.8390	115.5780	10/15/1979	232552.6	8.1	4.00	0.002	-	60.1(96.6)
DMG	33.0120	115.5920	04/11/1965	04646.1	-2.0	4.10	0.003	-	60.1(96.7)
PAS	32.9040	115.5760	10/17/1979	191438.4	15.9	4.10	0.003	-	60.2(96.9)
DMG	32.5000	115.6670	02/12/1932	23021.0	0.0	4.00	0.002	-	60.4(97.2)
PAS	33.1170	115.6150	04/26/1976	64637.5	14.8	4.00	0.002	-	60.4(97.2)
PAS	32.9070	115.5660	10/16/1979	114655.3	11.4	4.80	0.005	II	60.8(97.8)
DMG	33.0370	115.5840	06/17/1965	73020.9	-1.3	4.30	0.003	I	60.8(97.9)
PAS	33.0010	115.5760	10/16/1979	74947.2	8.5	4.00	0.002	-	60.9(97.9)
DMG	33.1310	115.6110	10/27/1963	181250.7	7.8	4.20	0.003	I	60.9(98.0)
GSP	33.0300	115.5800	03/24/1989	231648.0	6.0	4.00	0.002	-	61.0(98.1)
DMG	33.0190	115.5730	06/17/1965	743 5.0	-2.0	4.20	0.003	I	61.2(98.5)
DMG	32.9820	115.5660	05/23/1963	9 6 4.7	25.4	4.60	0.004	I	61.2(98.6)
DMG	33.7100	116.9250	09/23/1963	144152.6	16.5	5.00	0.006	II	61.3(98.6)
DMG	33.2000	115.6330	10/27/1963	145245.2	-2.0	4.10	0.002	-	61.3(98.7)
PAS	32.6630	115.5830	10/31/1980	125536.7	3.6	4.40	0.003	I	61.4(98.7)
GSP	33.3170	115.7000	11/13/2001	204315.0	5.0	4.10	0.002	-	61.5(98.9)
DMG	33.2670	115.6670	08/10/1951	1130 8.0	0.0	4.40	0.003	I	61.5(98.9)
PAS	32.9500	115.5570	10/16/1979	33934.3	12.1	4.50	0.004	I	61.5(99.0)
PAS	33.1170	115.5950	11/04/1976	141250.2	5.0	4.40	0.003	I	61.5(99.0)
PAS	33.1180	115.5950	11/04/1976	62110.7	5.0	4.10	0.002	-	61.6(99.1)
DMG	31.9940	116.3700	08/20/1961	125245.9	8.2	4.00	0.002	-	61.6(99.1)
PAS	33.1230	115.5960	11/04/1976	54820.9	5.0	4.20	0.003	I	61.6(99.1)
DMG	32.2000	115.9000	05/31/1960	191736.0	0.0	4.00	0.002	-	61.7(99.3)
DMG	31.9700	116.6980	04/23/1968	132234.8	10.0	4.00	0.002	-	61.8(99.4)
DMG	32.0500	116.1670	02/06/1958	111530.0	0.0	4.50	0.004	I	61.8(99.4)
PAS	33.1180	115.5900	11/04/1976	635 3.5	4.5	4.10	0.002	-	61.8(99.5)
GSP	32.9480	115.5500	05/24/2003	020429.0	16.0	4.20	0.003	I	61.9(99.6)
DMG	32.2830	115.8000	09/26/1959	34050.0	0.0	4.30	0.003	I	61.9(99.7)
PAS	33.1810	115.6110	03/07/1989	02458.2	2.8	4.10	0.002	-	62.1(99.9)
DMG	32.3330	115.7500	12/15/1938	0 2 0.0	0.0	4.00	0.002	-	62.1(99.9)

****

-END OF SEARCH- 410 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2005

LENGTH OF SEARCH TIME: 206 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 9.6 MILES (15.4 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 6.7

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.105 g

COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:

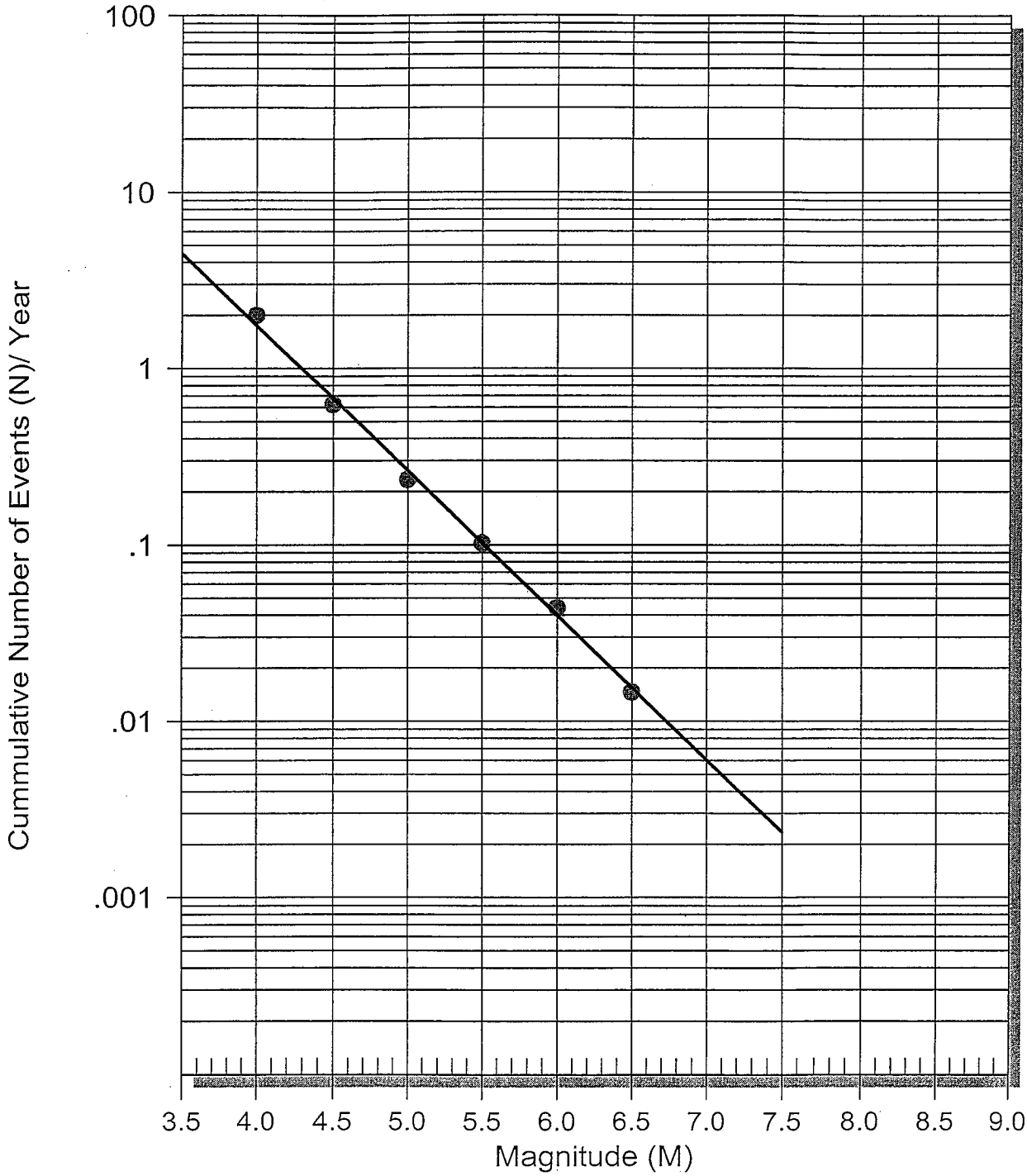
a-value= 3.524
b-value= 0.820
beta-value= 1.889

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	410	1.99029
4.5	128	0.62136
5.0	48	0.23301
5.5	21	0.10194
6.0	9	0.04369
6.5	3	0.01456

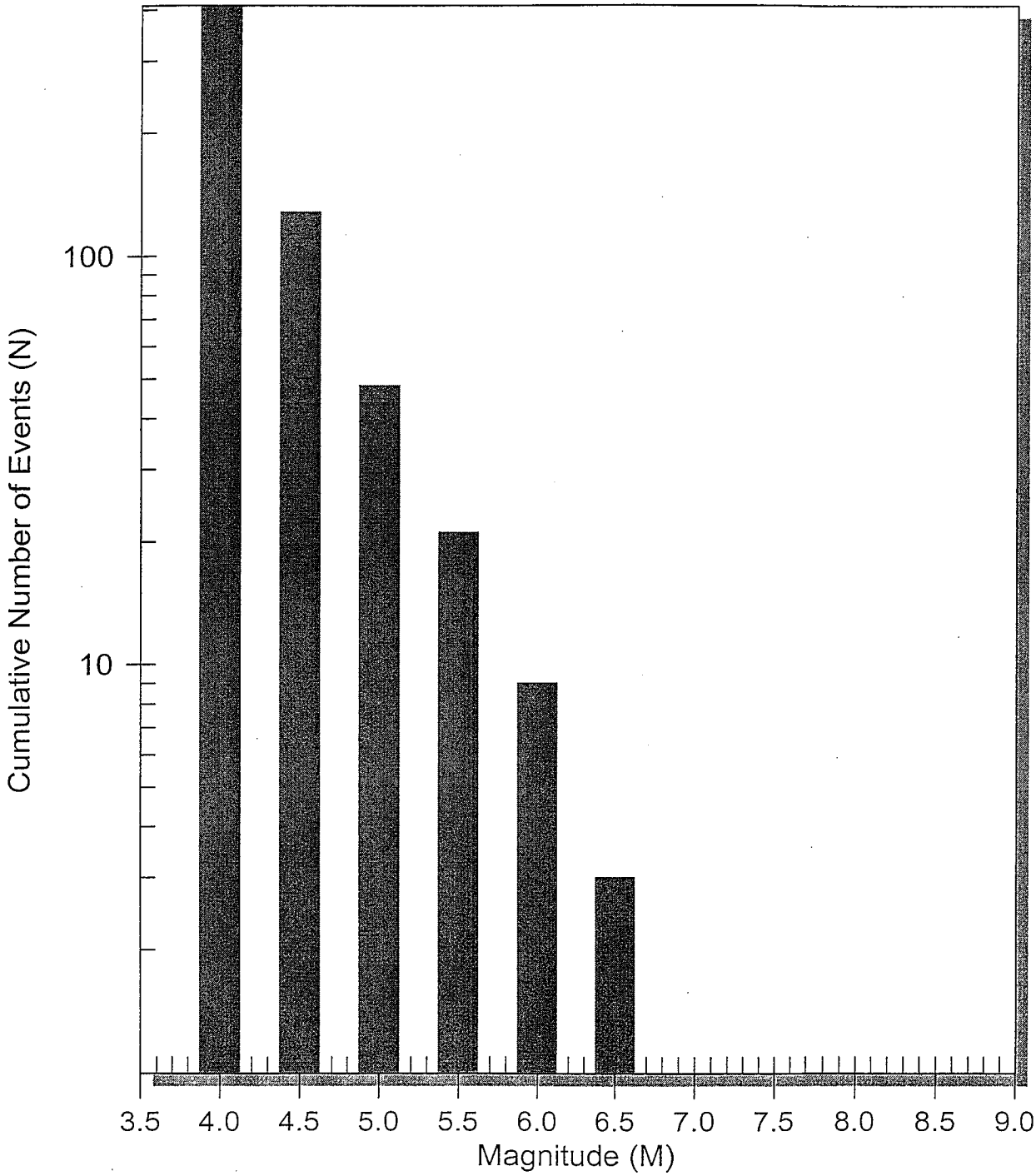
EARTHQUAKE RECURRENCE CURVE

Cuyamaca - Descanso



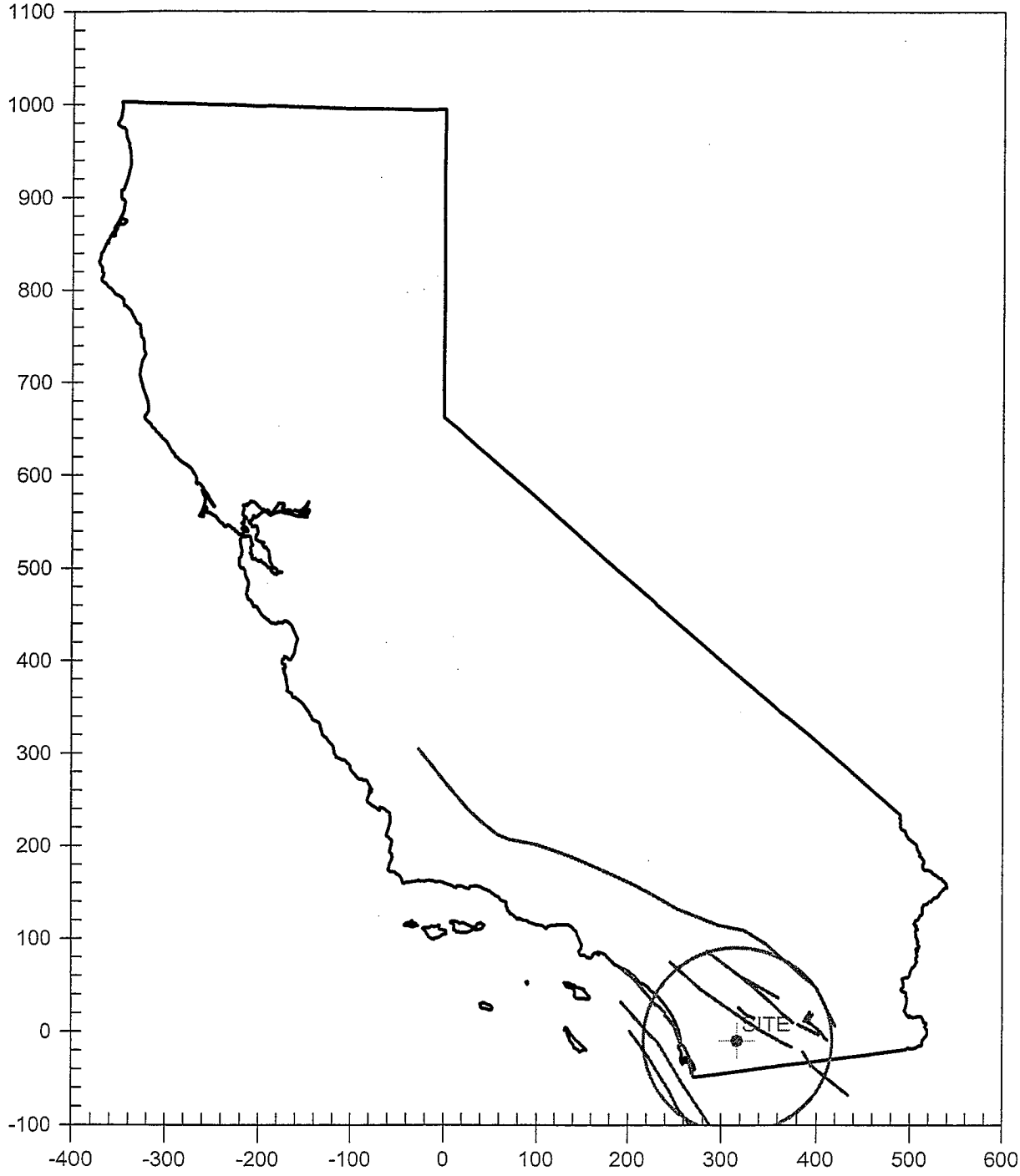
Number of Earthquakes (N) Above Magnitude (M)

Cuyamaca - Descanso



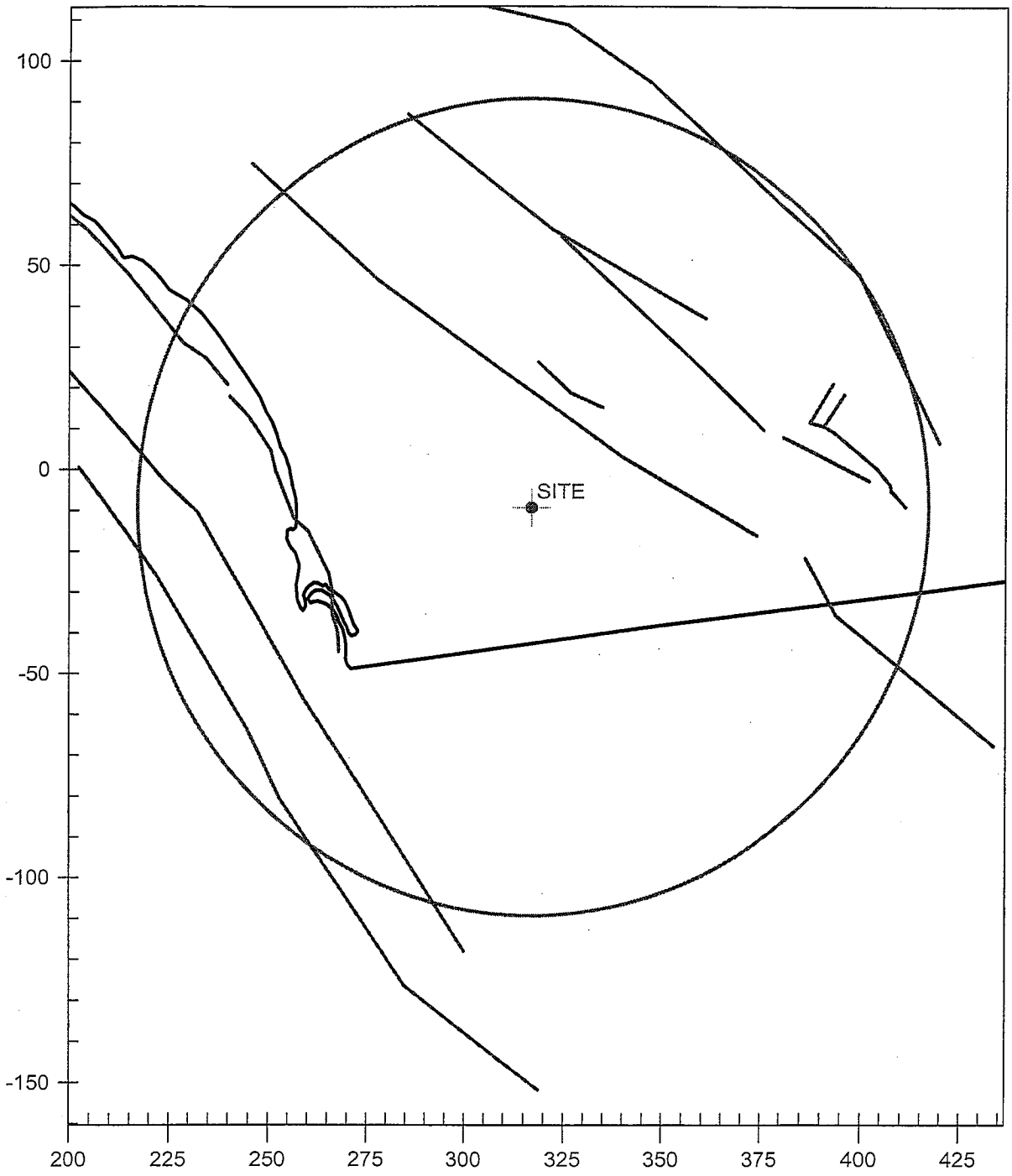
CALIFORNIA FAULT MAP

Cuyamaca - Descanso



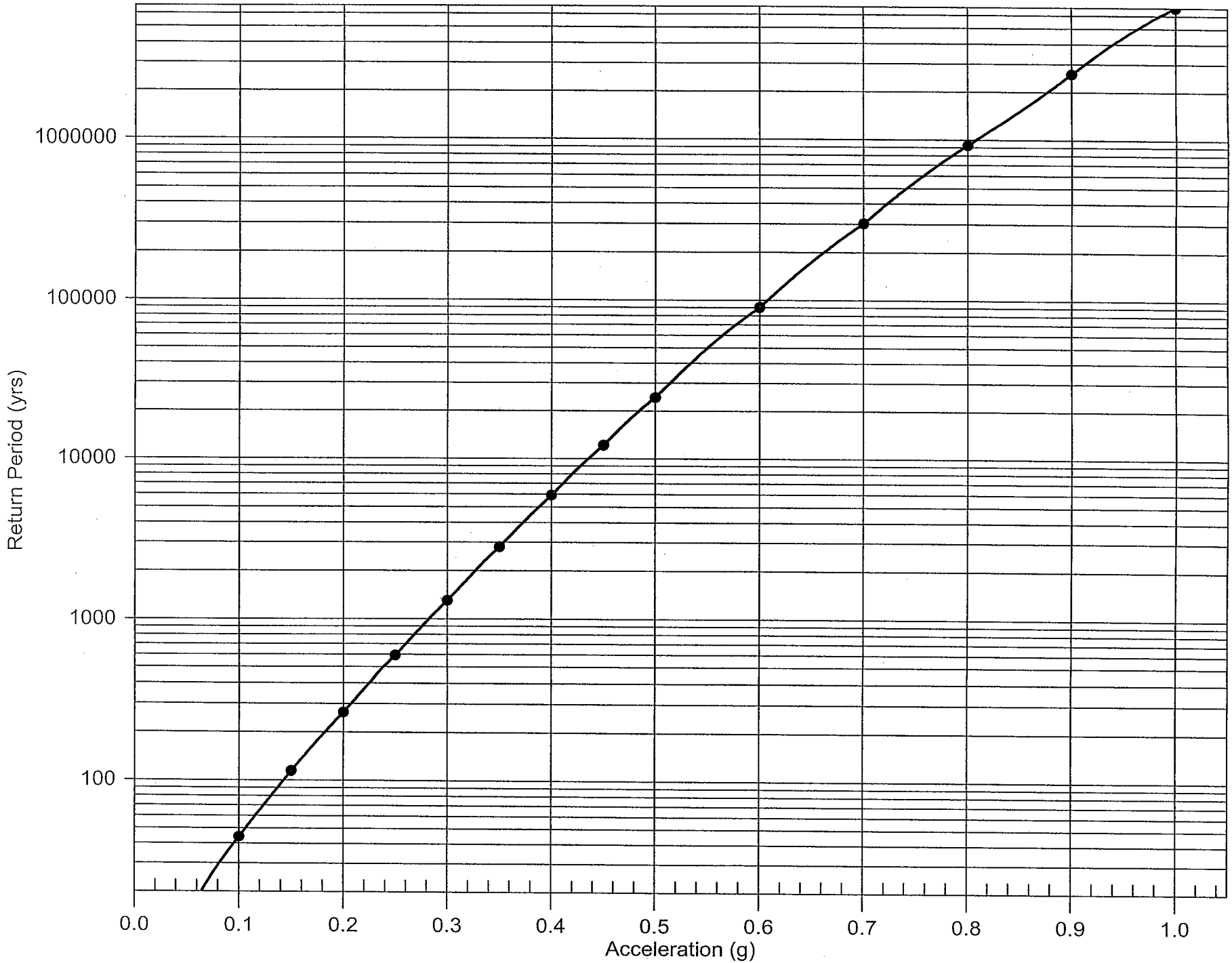
CALIFORNIA FAULT MAP

Cuyamaca - Descanso



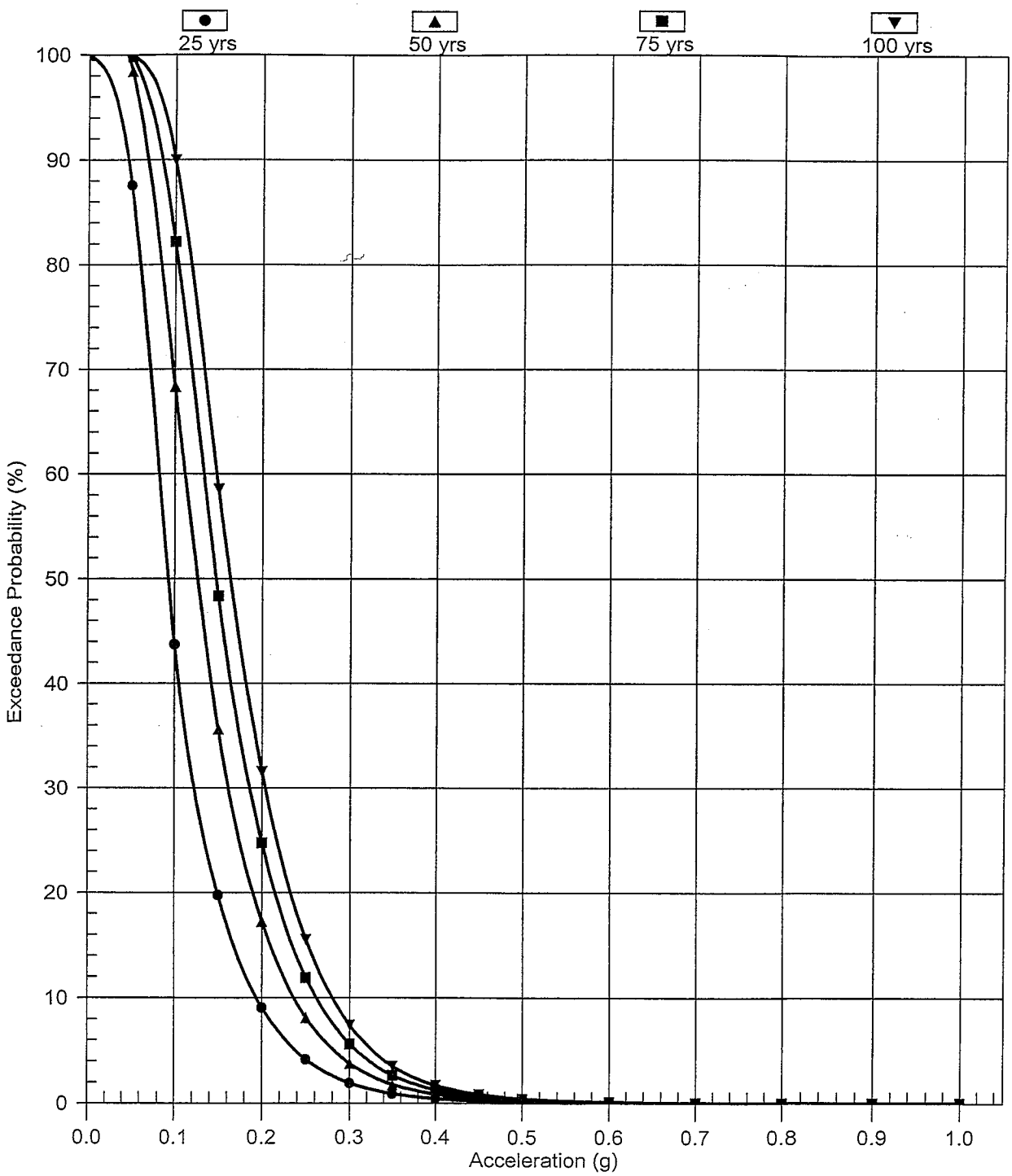
RETURN PERIOD vs. ACCELERATION

SADIGH ET AL. (1997) DEEP SOIL 1



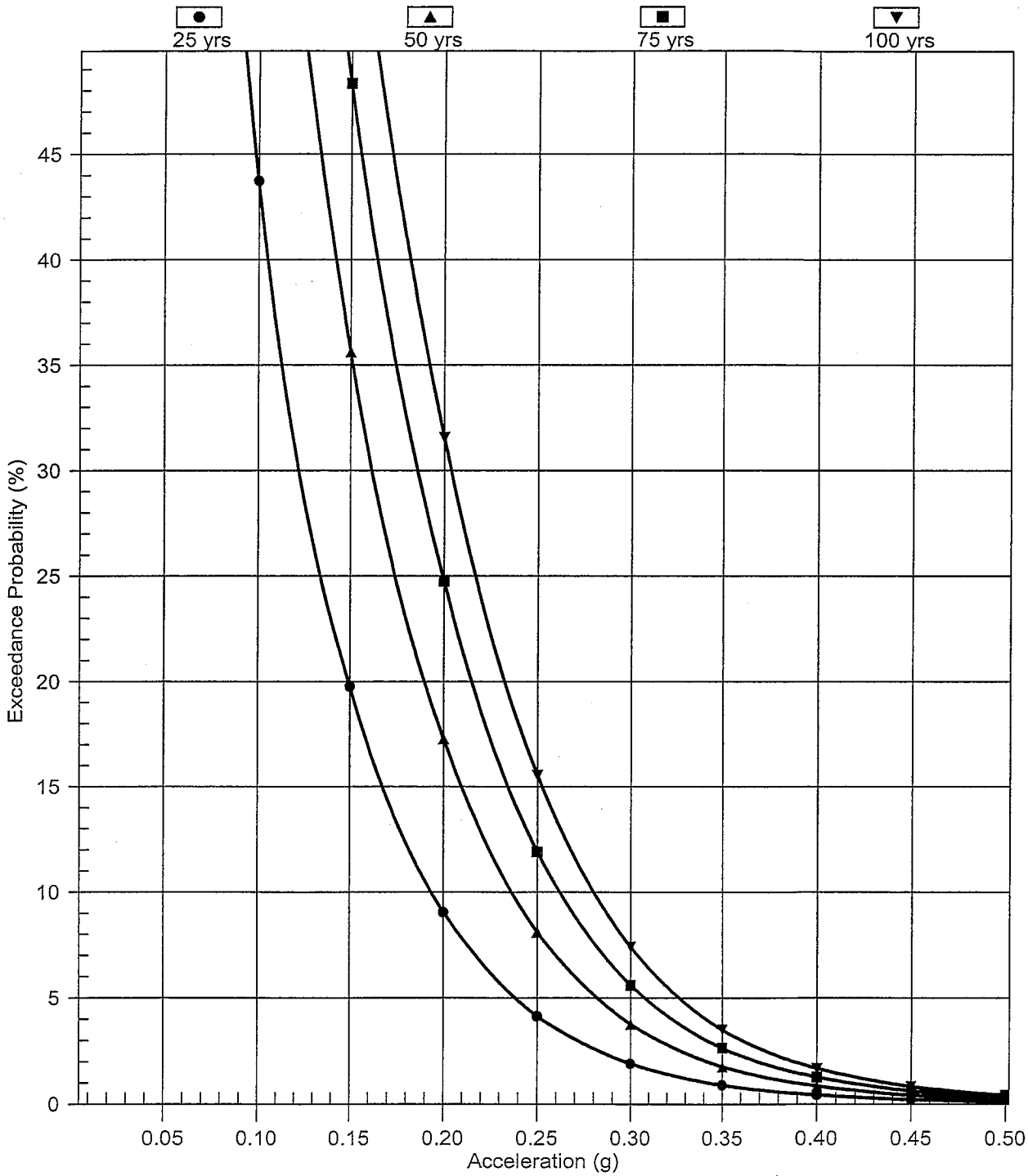
PROBABILITY OF EXCEEDANCE

SADIGH ET AL. (1997) DEEP SOIL 1



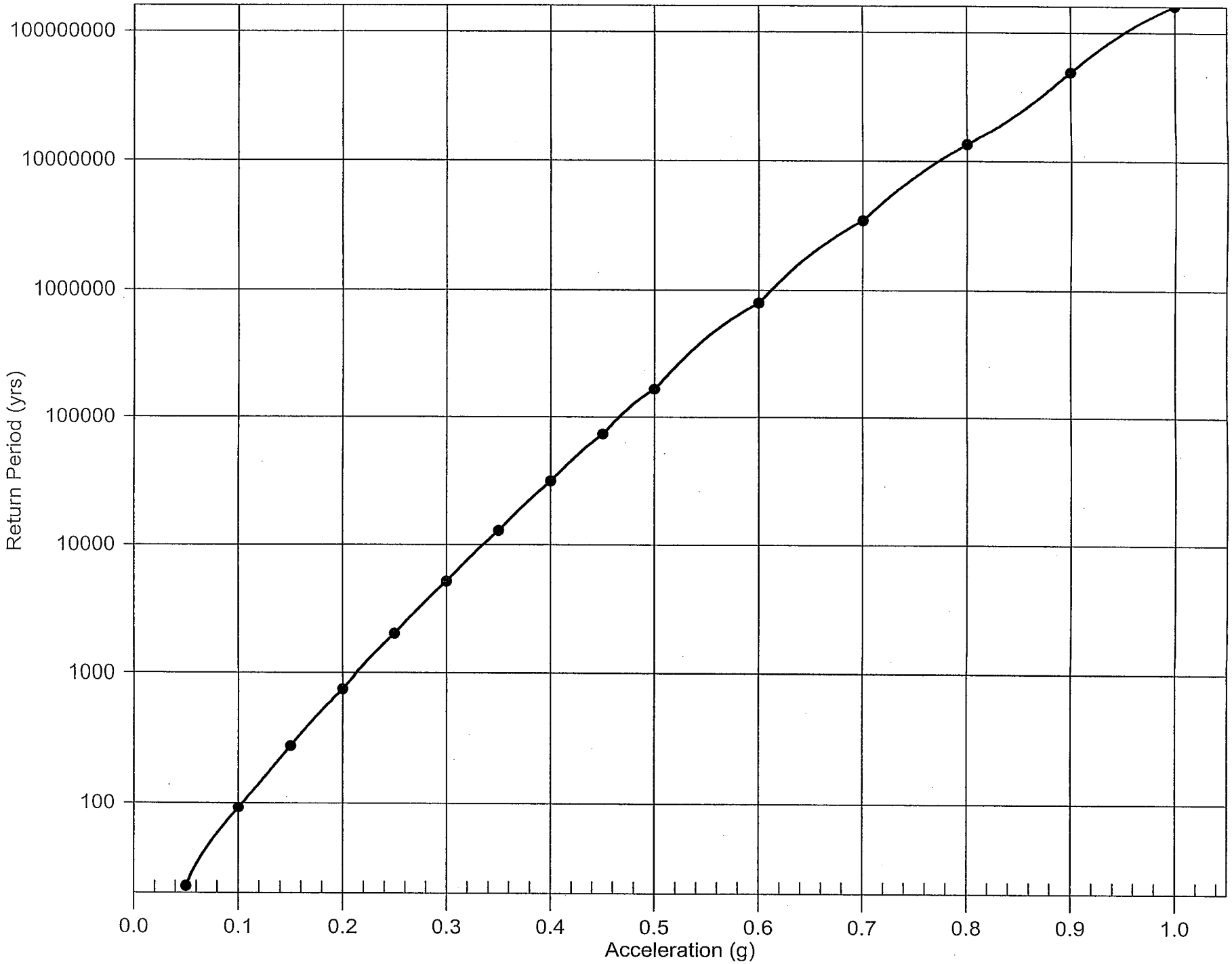
PROBABILITY OF EXCEEDANCE

SADIGH ET AL. (1997) DEEP SOIL 1



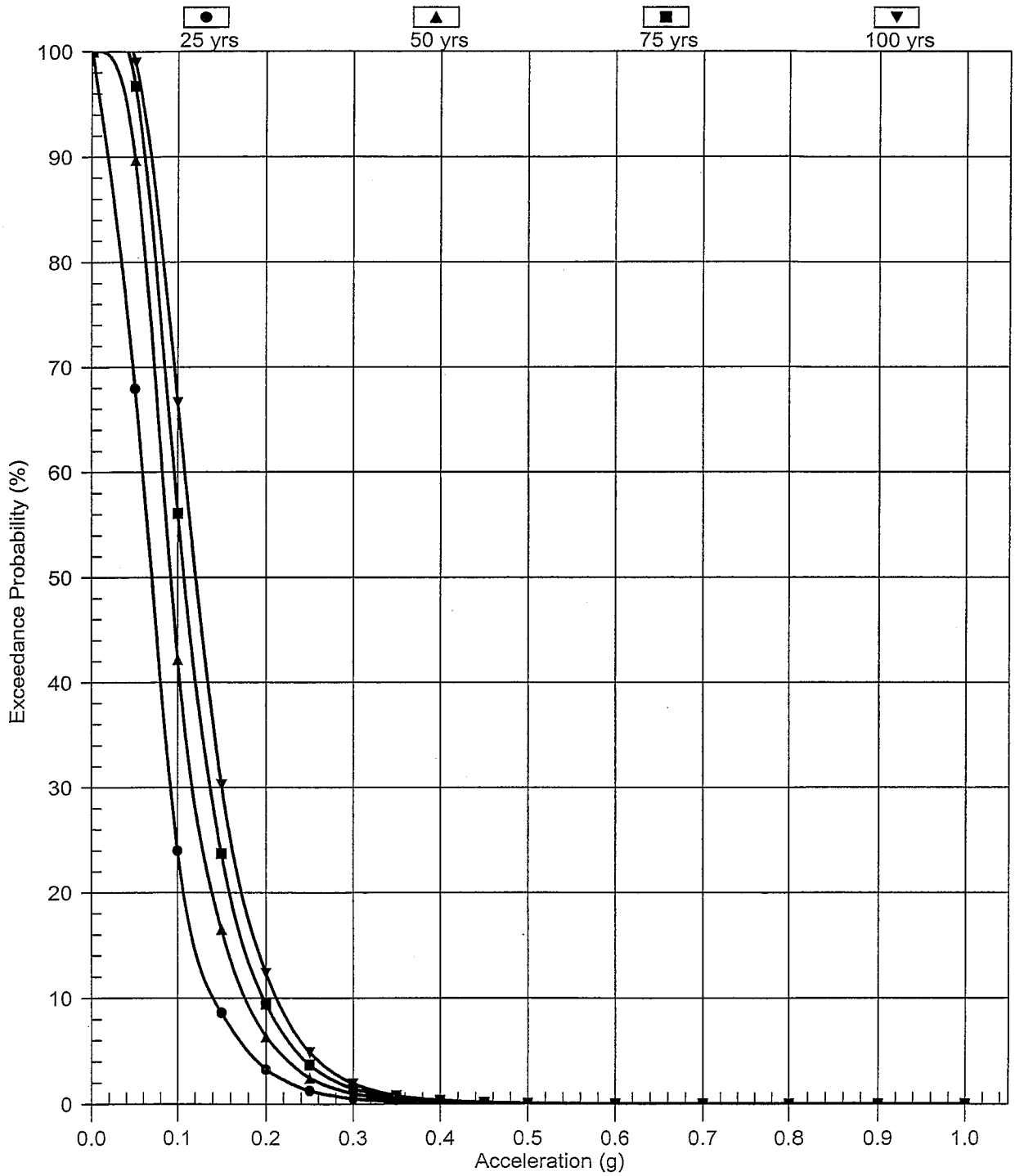
RETURN PERIOD vs. ACCELERATION

SADIGH ET AL. (1997) DEEP SOIL 2



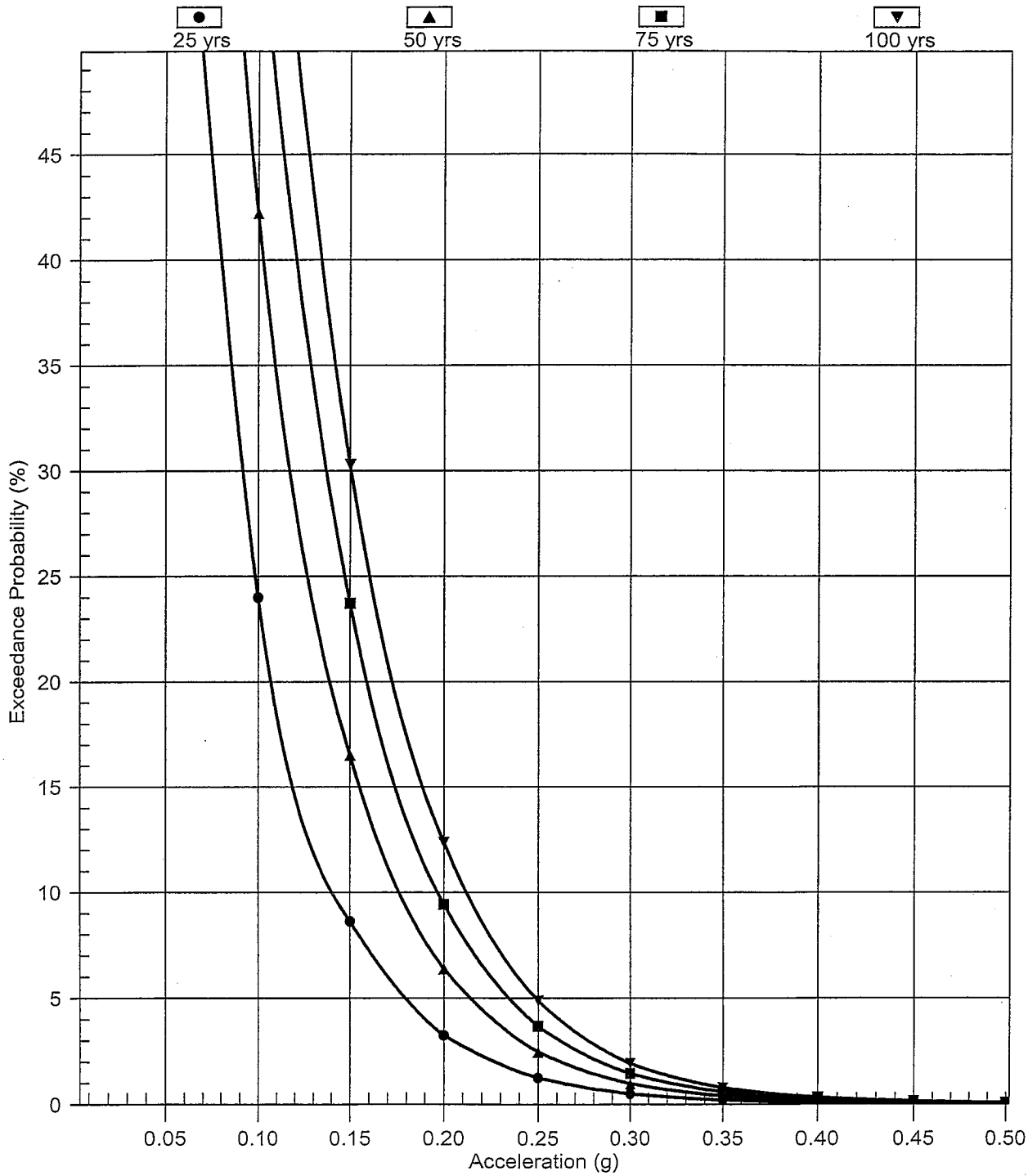
PROBABILITY OF EXCEEDANCE

SADIGH ET AL. (1997) DEEP SOIL 2



PROBABILITY OF EXCEEDANCE

SADIGH ET AL. (1997) DEEP SOIL 2



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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 0730-020-00
DATE: 01-17-2008

JOB NAME: Cuyamaca-Descanso

CALCULATION NAME: Test Run Analysis

FAULT-DATA-FILE NAME: C:\Program Files\EQFAULT1\cgseq03n.dat

SITE COORDINATES:
   SITE LATITUDE: 32.8619
   SITE LONGITUDE: 116.6131

SEARCH RADIUS: 62.14 mi

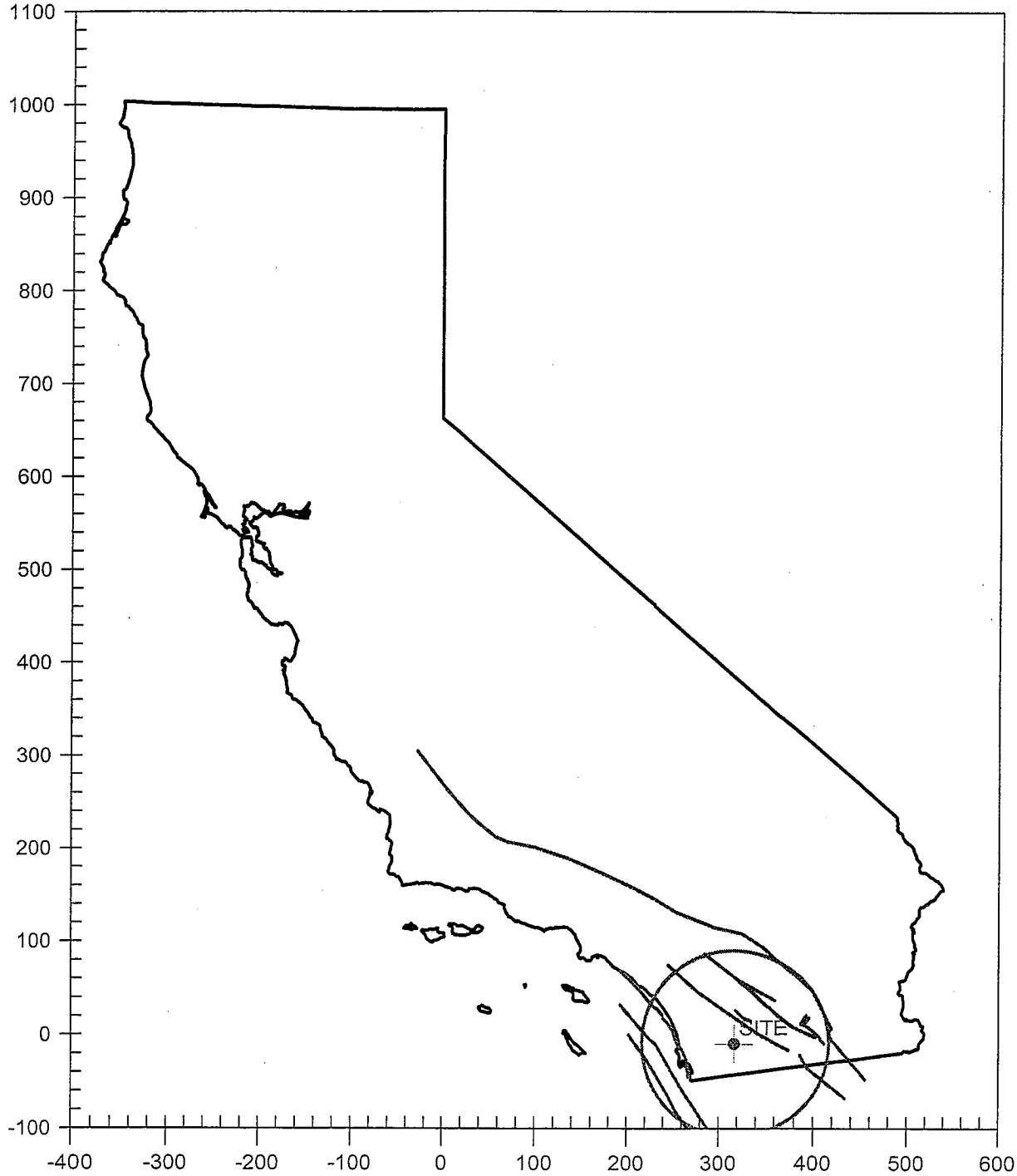
ATTENUATION RELATION: 21) Sadigh et al. (1997) Horiz. - Rock
   UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
   DISTANCE MEASURE: clodis
   SCOND: 1
   Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: C:\Program Files\EQFAULT1\cgseq03n.dat

MINIMUM DEPTH VALUE (km): 0.0

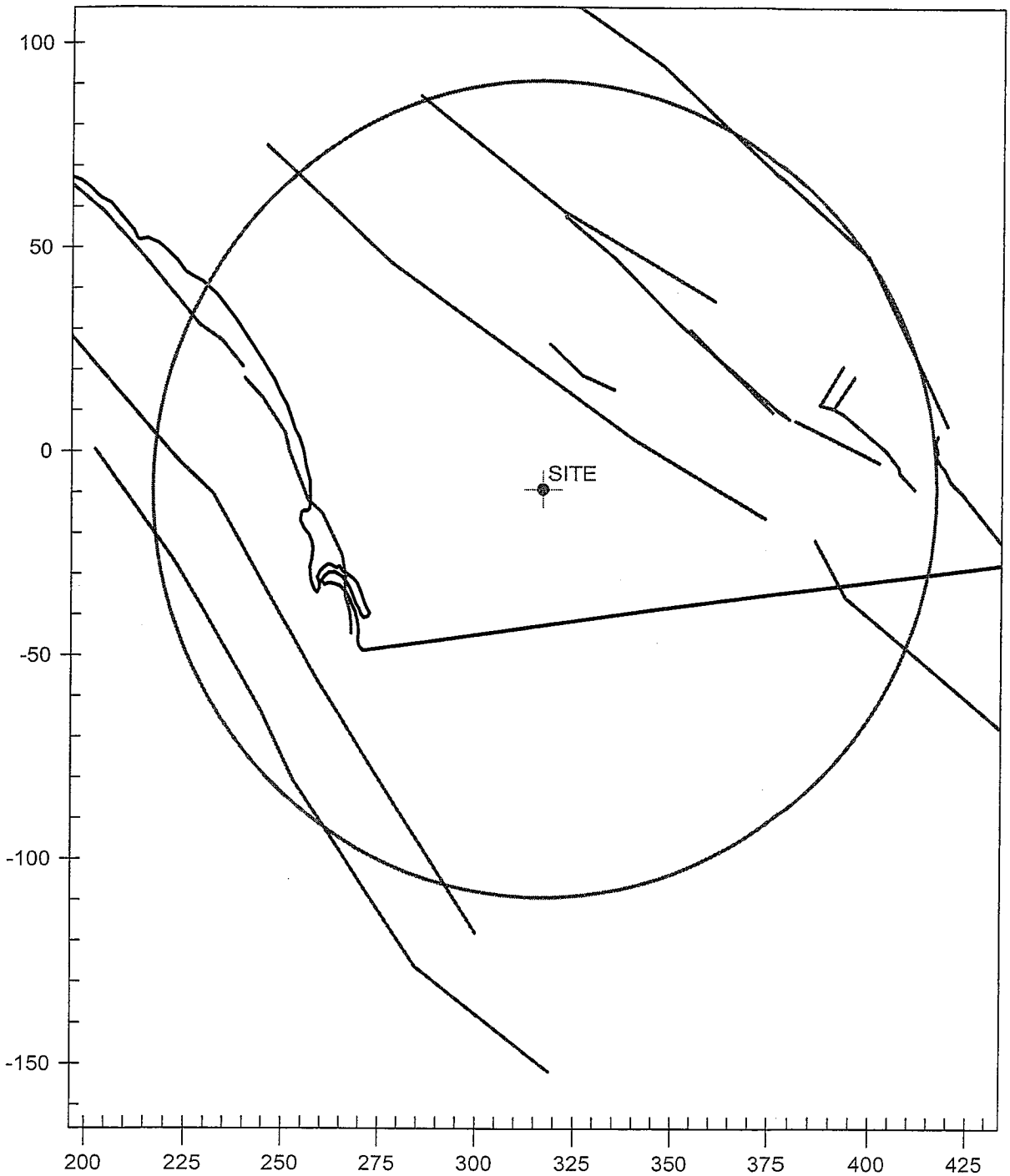
CALIFORNIA FAULT MAP

Cuyamaca-Descanso



CALIFORNIA FAULT MAP

Cuyamaca-Descanso



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.
ELSINORE (JULIAN)	13.3(21.4)	7.1	0.214	VIII
ELSINORE (COYOTE MOUNTAIN)	16.2(26.1)	6.8	0.147	VIII
EARTHQUAKE VALLEY	18.5(29.7)	6.5	0.104	VII
SAN JACINTO-COYOTE CREEK	33.2(53.5)	6.8	0.057	VI
ROSE CANYON	33.6(54.0)	7.2	0.076	VII
SAN JACINTO - BORREGO	33.7(54.3)	6.6	0.047	VI
SAN JACINTO-ANZA	38.5(62.0)	7.2	0.062	VI
SAN JACINTO-SUPERSTITION MTN.	41.2(66.3)	6.6	0.035	V
ELSINORE (TEMECULA)	42.5(68.4)	6.8	0.039	V
LAGUNA SALADA	43.5(70.0)	7.0	0.044	VI
SAN JACINTO-SUPERSTITION HILLS	45.5(73.2)	6.6	0.029	V
ELMORE RANCH (WEST)	45.5(73.2)	6.6	0.029	V
CORONADO BANK	45.7(73.5)	7.6	0.066	VI
ELMORE RANCH (EAST)	47.3(76.2)	6.6	0.027	V
NEWPORT-INGLEWOOD (OFFSHORE)	51.5(82.9)	7.1	0.037	V
SAN DIEGO TROUGH	55.7(89.7)	7.7	0.053	VI
SAN ANDREAS - SB-Coach. M-1b-2	60.6(97.6)	7.7	0.047	VI
SAN ANDREAS - Whole M-1a	60.6(97.6)	8.0	0.059	VI
SAN ANDREAS - SB-Coach. M-2b	60.6(97.6)	7.7	0.047	VI
SAN ANDREAS - Coachella M-1c-5	60.6(97.6)	7.2	0.031	V
BRAWLEY SEISMIC ZONE	61.6(99.1)	6.4	0.015	IV
IMPERIAL (MODEL A)	62.0(99.8)	7.0	0.025	V

****

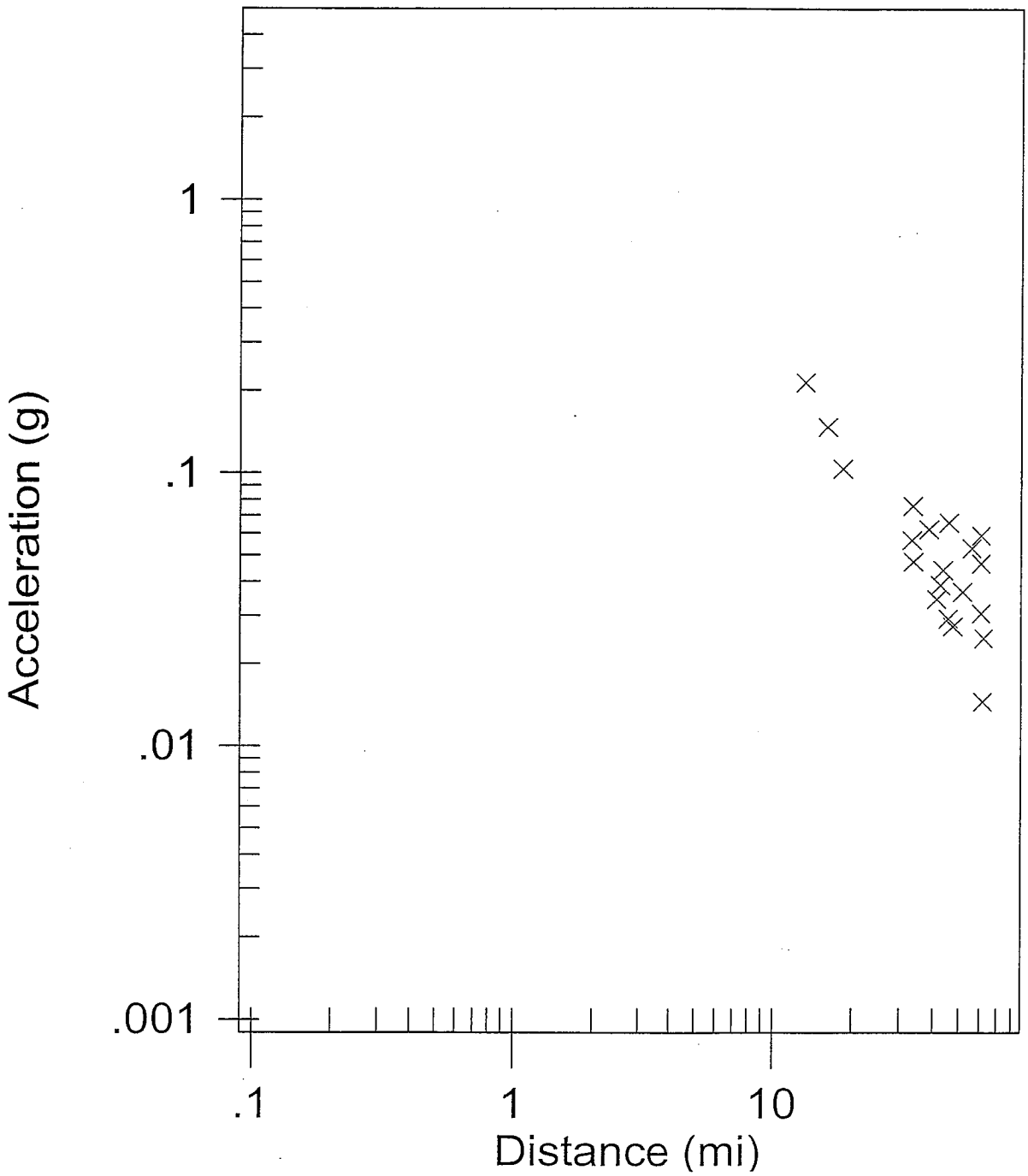
-END OF SEARCH- 22 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE ELSINORE (JULIAN) FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 13.3 MILES (21.4 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.2141 g

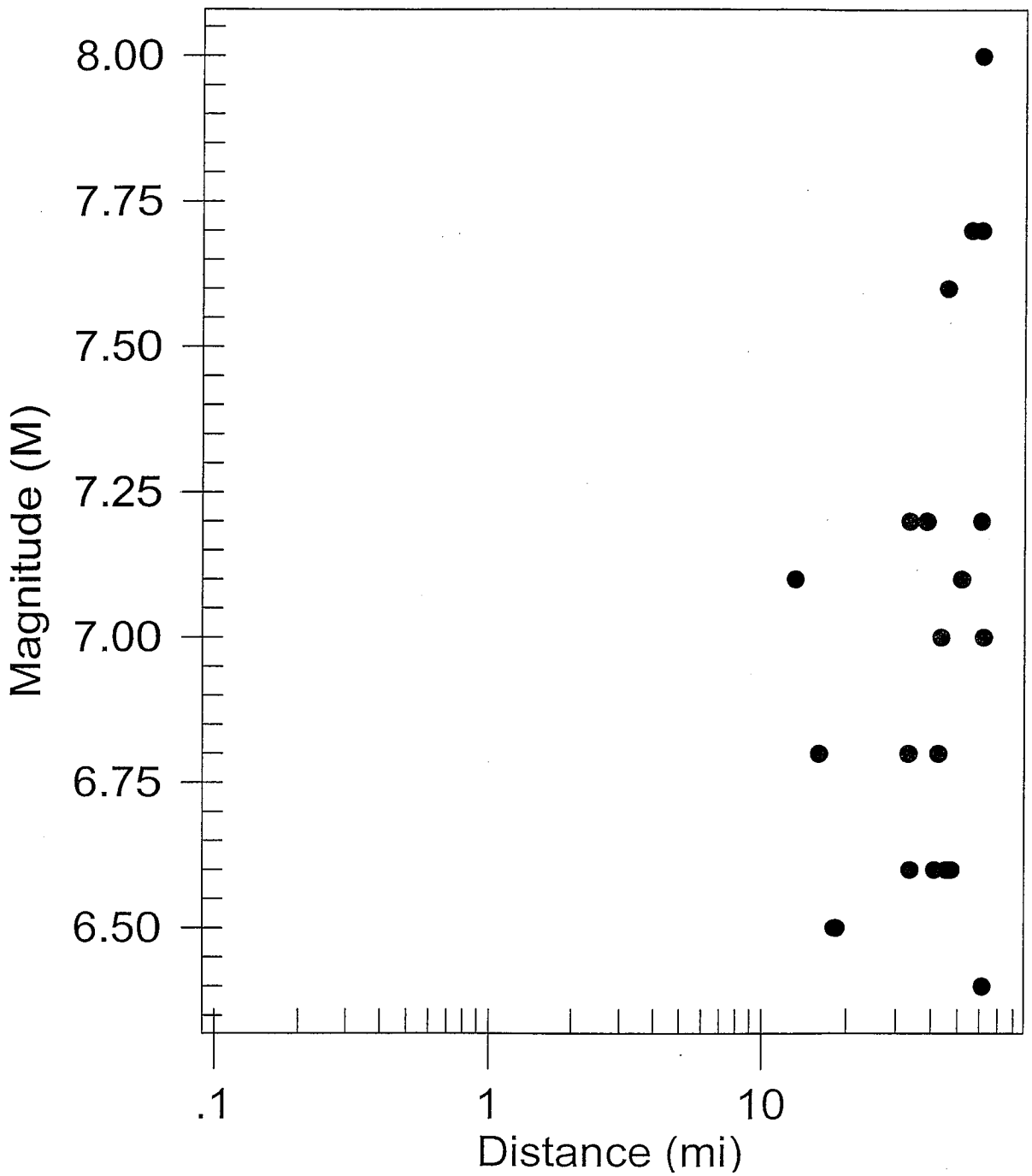
MAXIMUM EARTHQUAKES

Cuyamaca-Descanso



EARTHQUAKE MAGNITUDES & DISTANCES

Cuyamaca-Descanso



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ESTIMATION OF
PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 0730-020-00
DATE: 01-17-2008

JOB NAME: Cuyamaca-Descanso

EARTHQUAKE-CATALOG-FILE NAME: C:\Program Files\EQSEARCH\ALLQUAKE.DAT

MAGNITUDE RANGE:
   MINIMUM MAGNITUDE: 4.00
   MAXIMUM MAGNITUDE: 9.00

SITE COORDINATES:
   SITE LATITUDE: 32.8619
   SITE LONGITUDE: 116.6131

SEARCH DATES:

START DATE: 1800
END DATE: 2005

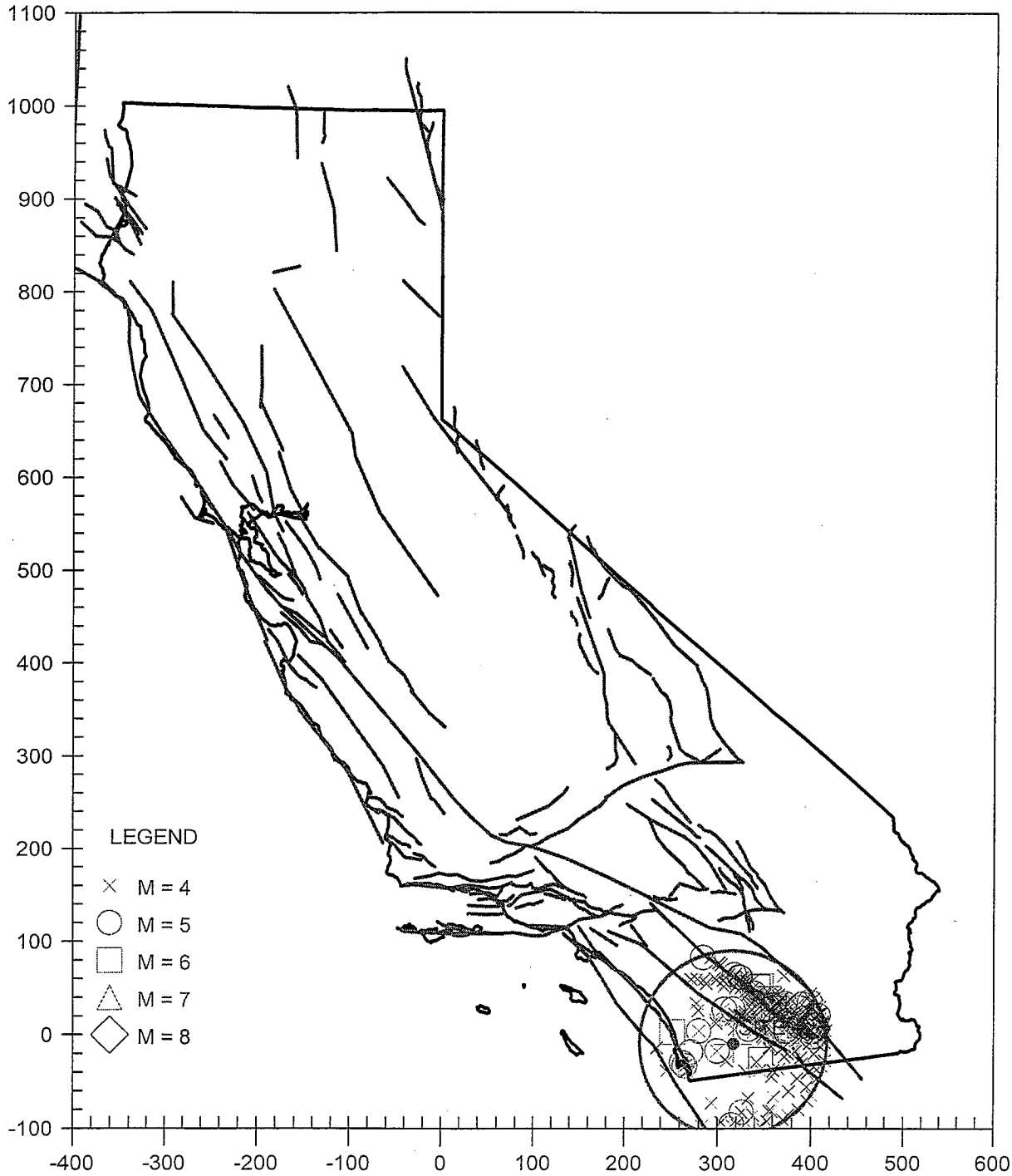
SEARCH RADIUS:
62.1 mi
100.0 km

ATTENUATION RELATION: 21) Sadigh et al. (1997) Horiz. - Rock
   UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
   ASSUMED SOURCE TYPE: SS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
   SCOND: 1 Depth Source: A
   Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km): 0.0

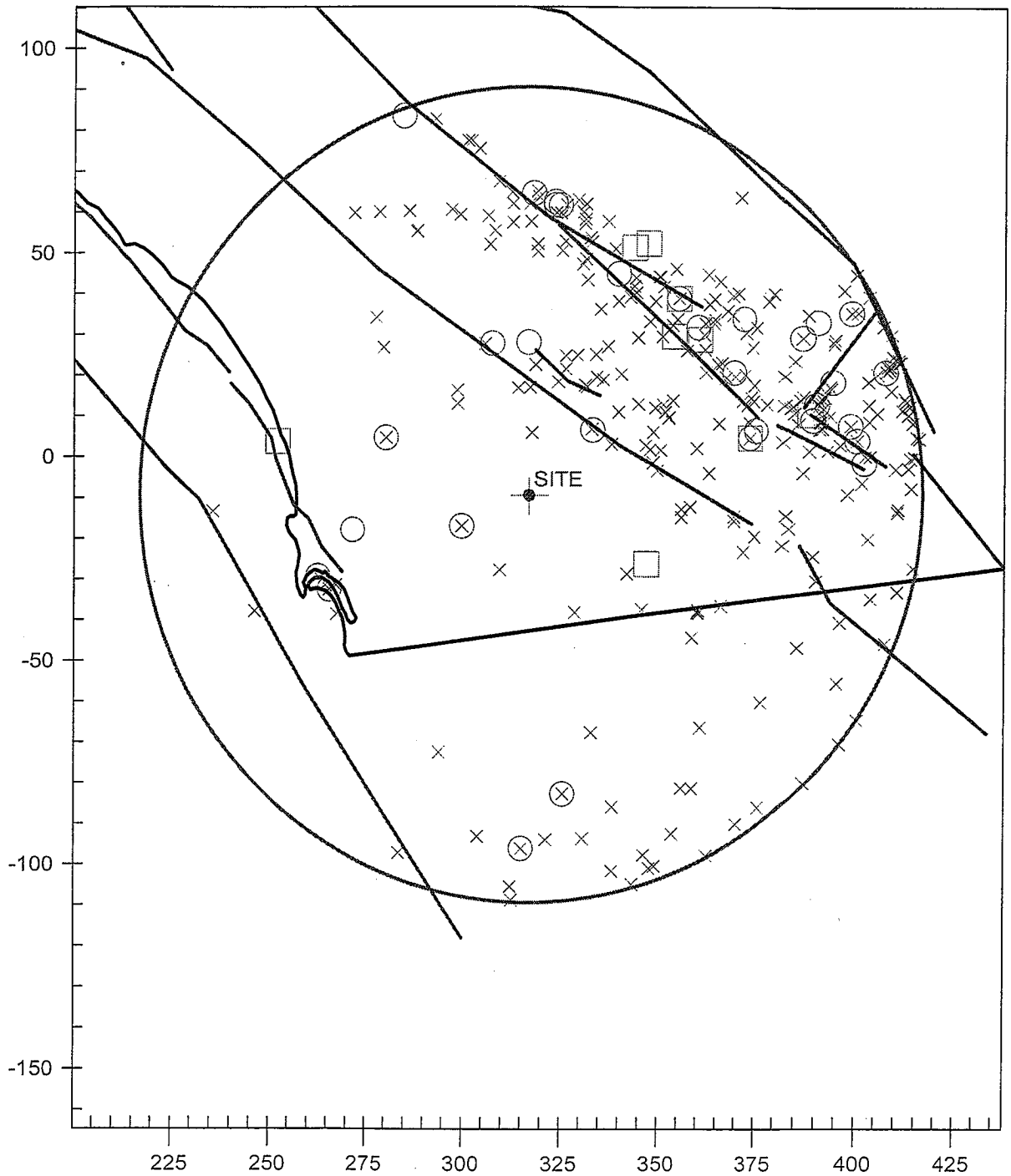
EARTHQUAKE EPICENTER MAP

Cuyamaca-Descanso



EARTHQUAKE EPICENTER MAP

Cuyamaca-Descanso



EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
MGI	33.0000	116.6000	06/11/1917	354 0.0	0.0	4.00	0.033	V	9.6(15.4)
DMG	32.8000	116.8000	10/23/1894	23 3 0.0	0.0	5.70	0.098	VII	11.7(18.7)
MGI	32.8000	116.8000	08/14/1927	1448 0.0	0.0	4.60	0.041	V	11.7(18.7)
MGI	32.7000	116.7000	03/21/1918	2325 0.0	0.0	4.00	0.024	IV	12.3(19.7)
DMG	33.0020	116.4360	07/02/1957	65638.5	12.8	4.10	0.021	IV	14.1(22.7)
DMG	33.0000	116.4330	06/04/1940	1035 8.3	0.0	5.10	0.048	VI	14.1(22.7)
DMG	32.9670	116.3830	10/31/1942	15 758.0	0.0	4.00	0.017	IV	15.2(24.4)
MGI	33.1000	116.6000	05/28/1917	1017 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	03/04/1915	1250 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	08/19/1917	710 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	08/10/1921	2151 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	02/09/1920	220 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	02/05/1922	1915 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	05/11/1915	1145 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	08/10/1921	19 6 0.0	0.0	4.00	0.015	IV	16.5(26.5)
MGI	33.1000	116.6000	02/16/1915	1330 0.0	0.0	4.00	0.015	IV	16.5(26.5)
DMG	33.1000	116.6330	02/08/1952	174028.0	0.0	4.00	0.015	IV	16.5(26.5)
DMG	33.1100	116.5230	01/24/1957	205449.9	3.9	4.60	0.023	IV	17.9(28.8)
GSP	33.0700	116.8000	12/04/1991	071057.5	15.0	4.20	0.016	IV	18.0(28.9)
DMG	33.0970	116.4440	08/18/1959	215221.3	17.3	4.30	0.016	IV	19.0(30.5)
DMG	33.1000	116.4500	11/23/1953	1339 7.0	0.0	4.30	0.016	IV	19.0(30.5)
DMG	33.0380	116.3610	02/26/1957	211652.2	0.0	4.10	0.013	III	19.0(30.6)
MGI	32.6000	116.5000	05/03/1918	425 0.0	0.0	4.00	0.012	III	19.2(31.0)
DMG	32.6800	116.3540	01/21/1970	1124 0.4	8.0	4.10	0.013	III	19.6(31.5)
MGI	33.1000	116.8000	06/22/1918	557 0.0	0.0	4.00	0.012	III	19.7(31.7)
DMG	32.9610	116.2900	08/25/1971	23 033.0	8.0	4.00	0.011	III	19.9(32.1)
DMG	33.1500	116.5830	12/02/1935	319 0.0	0.0	4.00	0.011	III	20.0(32.1)
PAS	33.1380	116.5010	10/10/1984	212258.9	11.6	4.50	0.017	IV	20.1(32.4)
DMG	32.9230	116.2720	10/14/1969	131842.7	10.0	4.50	0.017	IV	20.2(32.5)
DMG	32.9520	116.2790	09/13/1973	173039.8	8.0	4.80	0.022	IV	20.3(32.7)
PAS	32.9050	116.2610	12/25/1975	71852.3	3.6	4.00	0.011	III	20.6(33.2)
DMG	33.1170	116.4170	10/21/1940	64933.0	0.0	4.50	0.016	IV	21.0(33.7)
DMG	33.1170	116.4170	06/04/1940	103656.0	0.0	4.00	0.011	III	21.0(33.7)
GSP	33.1100	116.4000	04/01/1984	071702.3	11.0	4.00	0.010	III	21.1(34.0)
DMG	32.7000	116.3000	02/24/1892	720 0.0	0.0	6.70	0.099	VII	21.3(34.3)
DMG	32.9900	116.2680	11/08/1958	132044.1	2.4	4.10	0.011	III	21.9(35.2)
DMG	32.9500	116.2500	11/14/1951	2355 3.0	0.0	4.10	0.011	III	21.9(35.3)
DMG	33.1670	116.5000	06/23/1932	22552.7	0.0	4.00	0.010	III	22.1(35.5)
DMG	33.1670	116.5000	06/23/1932	23037.1	0.0	4.00	0.010	III	22.1(35.5)
DMG	33.0530	116.3060	04/02/1967	201538.6	1.0	4.30	0.013	III	22.1(35.6)
DMG	33.1670	116.4670	08/01/1960	193930.0	0.0	4.20	0.011	III	22.7(36.5)
MGI	33.2000	116.6000	10/12/1920	1748 0.0	0.0	5.30	0.027	V	23.4(37.6)
DMG	33.1210	116.3490	05/25/1971	10 252.9	8.0	4.10	0.010	III	23.5(37.9)
DMG	33.2000	116.7000	01/01/1920	235 0.0	0.0	5.00	0.020	IV	23.9(38.4)
DMG	33.1670	116.4170	12/05/1939	173352.0	0.0	4.00	0.008	III	23.9(38.5)
DMG	33.1670	116.4170	10/14/1935	1550 0.0	0.0	4.00	0.008	III	23.9(38.5)
DMG	33.1670	116.4170	07/10/1938	18 6 0.0	0.0	4.00	0.008	III	23.9(38.5)
DMG	33.0430	116.2600	08/22/1961	231933.6	12.1	4.40	0.012	III	24.0(38.6)
DMG	33.2000	116.7200	05/12/1930	172548.5	0.0	4.20	0.010	III	24.1(38.9)
DMG	32.8170	116.2000	11/22/1953	81138.0	0.0	4.10	0.009	III	24.2(38.9)
MGI	32.8000	116.2000	07/23/1929	1155 0.0	0.0	4.30	0.011	III	24.3(39.2)
DMG	33.0000	117.0000	03/03/1906	2025 0.0	0.0	4.50	0.013	III	24.4(39.2)
MGI	33.0000	117.0000	12/29/1914	10 0 0.0	0.0	4.00	0.008	III	24.4(39.2)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
MGI	33.0000	117.0000	09/21/1856	730 0.0	0.0	5.00	0.020	IV	24.4(39.2)
DMG	32.6000	116.3170	06/15/1946	194653.0	0.0	4.80	0.016	IV	25.0(40.2)
DMG	33.0190	116.2250	08/20/1969	152957.2	0.6	4.00	0.008	II	25.0(40.2)
DMG	33.0330	116.2330	09/20/1961	5 410.0	0.0	4.00	0.008	II	25.0(40.2)
DMG	33.0210	116.2230	01/13/1963	23938.9	13.0	4.20	0.009	III	25.1(40.4)
DMG	33.0500	116.2380	08/23/1961	1 047.8	11.9	4.70	0.014	IV	25.3(40.7)
GSP	32.8220	116.1750	05/24/1992	122225.8	12.0	4.10	0.008	III	25.6(41.1)
DMG	33.1830	116.3830	10/14/1949	02925.0	0.0	4.10	0.008	III	25.9(41.6)
PAS	33.0580	116.2110	03/22/1982	85328.6	4.6	4.50	0.011	III	26.9(43.4)
DMG	32.9500	116.1500	10/25/1942	185939.0	0.0	4.00	0.007	II	27.5(44.3)
MGI	32.8000	117.1000	05/25/1803	0 0 0.0	0.0	5.00	0.015	IV	28.6(46.0)
DMG	32.8940	116.1190	09/16/1961	194939.4	18.5	4.40	0.009	III	28.7(46.2)
DMG	33.2000	116.3000	05/12/1930	414 0.0	0.0	4.00	0.006	II	29.5(47.6)
DMG	33.2670	116.4000	06/06/1940	2321 4.0	0.0	4.00	0.006	II	30.6(49.2)
GSP	32.5920	116.1650	02/19/1999	030832.2	3.0	4.20	0.006	II	32.0(51.5)
GSP	32.5930	116.1630	04/07/1999	062640.1	8.0	4.00	0.005	II	32.1(51.6)
DMG	33.2000	116.2330	04/05/1942	92039.0	0.0	4.00	0.005	II	32.1(51.6)
GSP	32.5880	116.1670	03/13/1999	133120.4	6.0	4.30	0.007	II	32.1(51.6)
DMG	33.0020	116.0850	11/21/1964	172559.7	4.1	4.20	0.006	II	32.1(51.6)
GSP	32.5870	116.1630	04/18/1999	155301.1	7.0	4.20	0.006	II	32.3(52.0)
MGI	33.2000	117.0000	07/20/1923	7 0 0.0	0.0	4.00	0.005	II	32.3(52.1)
DMG	33.2350	116.2660	04/09/1968	93833.0	5.2	4.00	0.005	II	32.7(52.6)
DMG	32.7960	116.0550	11/30/1965	84325.1	16.4	4.00	0.005	II	32.7(52.6)
DMG	32.7860	116.0550	07/04/1938	215945.3	10.0	4.00	0.005	II	32.8(52.8)
DMG	33.2830	116.3500	04/13/1949	75336.0	0.0	4.10	0.005	II	32.8(52.8)
DMG	33.1670	116.1670	11/16/1937	1057 0.0	0.0	4.00	0.005	II	33.3(53.6)
DMG	33.2000	116.2000	05/28/1892	1115 0.0	0.0	6.30	0.037	V	33.4(53.8)
PAS	32.6790	117.1510	06/18/1985	32228.7	5.7	4.00	0.005	II	33.7(54.2)
DMG	33.1170	116.1170	06/18/1943	161546.0	0.0	4.50	0.007	II	33.7(54.2)
DMG	32.5330	116.1830	11/12/1939	1849 0.0	0.0	4.00	0.005	II	33.8(54.3)
DMG	32.5330	116.1830	02/22/1939	1030 0.0	0.0	4.00	0.005	II	33.8(54.3)
DMG	33.3330	116.4330	02/12/1954	94428.0	0.0	4.50	0.007	II	34.2(55.0)
DMG	33.2910	116.3170	03/19/1966	142156.0	10.9	4.00	0.005	II	34.2(55.1)
PDP	33.2240	116.2030	05/21/2005	003932.7	15.0	4.10	0.005	II	34.5(55.5)
DMG	32.6000	116.1000	12/24/1941	73012.0	0.0	4.50	0.007	II	34.9(56.1)
T-A	32.6700	117.1700	05/24/1865	0 0 0.0	0.0	5.00	0.011	III	34.9(56.2)
T-A	32.6700	117.1700	04/15/1865	840 0.0	0.0	4.30	0.006	II	34.9(56.2)
T-A	32.6700	117.1700	12/00/1856	0 0 0.0	0.0	5.00	0.011	III	34.9(56.2)
T-A	32.6700	117.1700	01/25/1863	1020 0.0	0.0	4.30	0.006	II	34.9(56.2)
T-A	32.6700	117.1700	10/21/1862	0 0 0.0	0.0	5.00	0.011	III	34.9(56.2)
DMG	32.7170	116.0330	06/01/1959	163536.0	0.0	4.60	0.008	II	35.1(56.5)
DMG	33.3000	116.3000	01/04/1940	8 711.0	0.0	4.00	0.004	I	35.3(56.7)
DMG	33.1670	116.1170	04/09/1968	233 9.0	0.0	4.30	0.006	II	35.6(57.3)
DMG	33.1670	116.1170	04/09/1968	23930.0	0.0	4.40	0.006	II	35.6(57.3)
PAS	32.6150	117.1520	10/29/1986	23815.3	14.6	4.10	0.005	II	35.6(57.3)
DMG	33.2370	116.1900	04/14/1968	125558.7	10.8	4.30	0.006	II	35.6(57.3)
DMG	33.2790	116.2490	01/07/1966	191023.0	-1.7	4.00	0.004	I	35.7(57.4)
MGI	32.7000	117.2000	09/08/1915	742 0.0	0.0	4.00	0.004	I	35.9(57.7)
MGI	32.7000	117.2000	04/19/1906	028 0.0	0.0	4.30	0.006	II	35.9(57.7)
MGI	32.7000	117.2000	05/20/1920	1330 0.0	0.0	4.00	0.004	I	35.9(57.7)
DMG	32.7000	117.2000	05/27/1862	20 0 0.0	0.0	5.90	0.023	IV	35.9(57.7)
DMG	33.1330	116.0830	05/07/1936	1147 0.0	0.0	4.50	0.007	II	35.9(57.9)
DMG	33.1330	116.0830	10/06/1940	181953.0	0.0	4.00	0.004	I	35.9(57.9)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	33.1330	116.0830	02/28/1940	1728 7.0	0.0	4.50	0.007	II	35.9(57.9)
DMG	33.1330	116.0830	10/16/1940	175213.0	0.0	4.00	0.004	I	35.9(57.9)
DMG	33.3150	116.3050	04/09/1968	1831 3.8	12.6	4.70	0.008	II	36.0(57.9)
DMG	33.1900	116.1290	04/09/1968	22859.1	11.1	6.40	0.036	V	36.0(58.0)
DMG	33.1030	116.0610	04/09/1968	111754.5	4.8	4.00	0.004	I	36.0(58.0)
DMG	32.9670	116.0000	10/22/1942	181326.0	0.0	5.00	0.010	III	36.3(58.4)
DMG	32.9670	116.0000	11/03/1942	101834.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	04/07/1943	34614.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	11/12/1942	0 737.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	11/07/1942	439 6.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	162519.0	0.0	5.00	0.010	III	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	164759.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	10/29/1942	162157.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	1753 5.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	08/20/1944	113310.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/30/1942	53545.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	10/22/1942	125553.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	225031.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	03/07/1943	205631.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	04/27/1943	32833.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	11/03/1942	5 629.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	11/02/1942	125942.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	04/30/1943	155256.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	165716.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	175041.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	1638 6.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	10/29/1942	1556 0.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	11/16/1943	18 9 9.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/29/1942	173552.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/22/1942	113951.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	01/08/1943	024 3.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	02/24/1943	15831.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	03/26/1943	62957.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	162654.0	0.0	5.00	0.010	III	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	214928.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	11/02/1943	18 134.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/26/1942	434 4.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	08/17/1943	155058.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	191028.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	32.9670	116.0000	11/22/1942	63951.0	0.0	4.00	0.004	I	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	162213.0	0.0	6.50	0.039	V	36.3(58.4)
DMG	32.9670	116.0000	10/21/1942	163439.0	0.0	4.50	0.007	II	36.3(58.4)
DMG	33.3680	116.4440	03/25/1937	232026.7	10.0	4.00	0.004	I	36.3(58.4)
DMG	32.7500	116.0000	02/19/1919	458 0.0	0.0	4.50	0.006	II	36.4(58.6)
DMG	33.2670	117.0170	06/07/1935	1633 0.0	0.0	4.00	0.004	I	36.4(58.6)
DMG	33.3430	116.3460	04/28/1969	232042.9	20.0	5.80	0.021	IV	36.6(58.9)
PAS	33.1360	116.0710	02/29/1984	2 731.7	6.6	4.30	0.005	II	36.7(59.0)
DMG	33.0000	116.0000	05/18/1920	625 0.0	0.0	4.50	0.006	II	36.8(59.2)
DMG	33.0500	116.0170	08/26/1955	52322.0	0.0	4.30	0.005	II	36.9(59.4)
DMG	33.2000	116.1170	12/28/1950	52211.0	0.0	4.20	0.005	II	37.0(59.5)
DMG	33.2170	116.1330	08/15/1945	175624.0	0.0	5.70	0.019	IV	37.1(59.6)
GSP	33.3790	116.4350	01/02/2002	121128.7	12.0	4.20	0.005	II	37.2(59.8)
DMG	33.3330	116.3000	08/06/1933	332 0.0	0.0	4.70	0.007	II	37.2(59.9)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	33.3330	116.3000	08/05/1933	2331 0.0	0.0	4.40	0.006	II	37.2(59.9)
DMG	33.4000	116.5670	02/04/1953	43616.0	0.0	4.30	0.005	II	37.2(59.9)
DMG	33.0400	116.0050	05/11/1968	810 4.0	8.8	4.20	0.005	II	37.3(60.0)
DMG	33.1040	116.0360	04/09/1968	34810.3	4.8	4.70	0.007	II	37.4(60.1)
DMG	32.9830	115.9830	05/23/1942	154729.0	0.0	5.00	0.010	III	37.5(60.3)
DMG	32.3330	116.4670	01/13/1935	224 0.0	0.0	4.00	0.004	I	37.5(60.3)
DMG	33.1130	116.0370	04/09/1968	3 353.5	5.0	5.20	0.012	III	37.6(60.5)
DMG	33.4000	116.5000	10/11/1918	4 0 0.0	0.0	4.00	0.004	I	37.7(60.7)
DMG	33.3100	116.2240	05/22/1968	132655.4	7.5	4.40	0.005	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	957 7.0	0.0	4.60	0.006	II	38.3(61.6)
DMG	33.2830	116.1830	03/20/1954	6 353.0	0.0	4.30	0.005	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	14 057.0	0.0	4.10	0.004	I	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	143750.0	0.0	4.00	0.004	I	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	13 8 4.0	0.0	4.30	0.005	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	102610.0	0.0	4.00	0.004	I	38.3(61.6)
DMG	33.2830	116.1830	03/20/1954	41919.0	0.0	4.90	0.009	III	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	101957.0	0.0	4.50	0.006	II	38.3(61.6)
DMG	33.2830	116.1830	03/23/1954	41450.0	0.0	5.10	0.010	III	38.3(61.6)
DMG	33.2830	116.1830	10/26/1944	225410.0	0.0	4.20	0.004	I	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	10 139.0	0.0	4.20	0.004	I	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	102117.0	0.0	5.50	0.015	IV	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	95556.0	0.0	5.00	0.009	III	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	95748.0	0.0	4.00	0.004	I	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	101522.0	0.0	4.50	0.006	II	38.3(61.6)
DMG	33.2830	116.1830	03/19/1954	95429.0	0.0	6.20	0.027	V	38.3(61.6)
DMG	33.2830	116.1830	04/04/1954	42920.0	0.0	4.10	0.004	I	38.3(61.6)
GSP	33.2250	116.1130	09/21/2002	212616.6	14.0	4.30	0.005	II	38.3(61.6)
DMG	33.0560	115.9930	04/09/1968	35836.0	7.9	4.30	0.005	II	38.3(61.7)
DMG	33.4170	116.5670	12/22/1950	2 536.0	0.0	4.00	0.004	I	38.4(61.8)
DMG	33.0480	115.9860	04/16/1968	33029.9	8.3	4.80	0.008	II	38.5(62.0)
PAS	33.4200	116.6980	06/05/1978	16 3 3.9	11.9	4.40	0.005	II	38.8(62.5)
DMG	33.1070	116.0070	04/09/1968	8 038.5	4.0	4.00	0.004	I	39.0(62.7)
DMG	33.3330	116.2360	10/05/1962	1529 2.6	13.9	4.10	0.004	I	39.2(63.0)
DMG	33.4200	116.4900	03/29/1937	17 316.8	10.0	4.00	0.004	I	39.2(63.1)
DMG	33.3330	116.2330	06/09/1942	5 633.0	0.0	4.00	0.004	I	39.3(63.2)
GSP	33.2240	116.0880	07/10/1998	212913.8	12.0	4.10	0.004	I	39.3(63.3)
DMG	33.0830	115.9830	07/13/1940	163923.0	0.0	4.00	0.004	I	39.6(63.7)
DMG	33.0830	115.9830	03/02/1934	2130 0.0	0.0	4.50	0.006	II	39.6(63.7)
DMG	33.0830	115.9830	07/14/1940	0 144.0	0.0	4.00	0.004	I	39.6(63.7)
DMG	33.0830	115.9830	12/15/1937	958 0.0	0.0	4.00	0.004	I	39.6(63.7)
DMG	33.0830	115.9830	12/10/1938	312 0.0	0.0	4.00	0.004	I	39.6(63.7)
DMG	33.2330	116.0860	08/26/1965	133814.0	-2.0	4.50	0.006	II	39.8(64.1)
DMG	33.4170	116.4170	01/02/1943	141118.0	0.0	4.50	0.005	II	40.0(64.3)
GSP	33.3990	116.3540	07/26/1997	031456.0	11.0	4.80	0.007	II	40.0(64.4)
DMG	33.0390	115.9490	05/06/1968	173147.6	6.7	4.00	0.003	I	40.4(65.0)
DMG	33.4260	116.4210	03/25/1937	20 4 8.3	10.0	4.00	0.003	I	40.5(65.2)
DMG	33.2670	116.1000	01/04/1954	233152.0	0.0	4.20	0.004	I	40.8(65.6)
DMG	33.4500	116.6830	04/25/1955	25515.0	0.0	4.00	0.003	I	40.8(65.7)
DMG	32.7920	115.9140	10/12/1936	135631.8	10.0	4.00	0.003	I	40.8(65.7)
DMG	33.0000	117.3000	11/22/1800	2130 0.0	0.0	6.50	0.032	V	40.9(65.9)
GSP	32.7270	115.9260	01/13/1999	132056.0	2.0	4.40	0.005	II	40.9(65.9)
DMG	32.9550	115.9110	04/10/1967	04717.3	4.4	4.00	0.003	I	41.2(66.3)
DMG	33.4000	116.3000	02/09/1890	12 6 0.0	0.0	6.30	0.026	V	41.3(66.5)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	32.7640	115.9080	10/12/1936	17 750.1	10.0	4.00	0.003	I	41.5(66.7)
DMG	33.3490	116.1880	05/19/1969	144033.0	8.6	4.50	0.005	II	41.7(67.0)
PAS	32.3020	116.8810	08/19/1978	931 5.7	19.8	4.10	0.004	I	41.7(67.1)
DMG	33.4670	116.6330	02/20/1934	1035 0.0	0.0	4.00	0.003	I	41.8(67.3)
DMG	33.4670	116.5830	03/27/1937	528 0.0	0.0	4.00	0.003	I	41.8(67.3)
DMG	33.4670	116.5830	03/26/1937	2124 0.0	0.0	4.00	0.003	I	41.8(67.3)
DMG	33.4670	116.5830	01/04/1938	029 0.0	0.0	4.50	0.005	II	41.8(67.3)
DMG	33.4670	116.5830	03/27/1937	742 0.0	0.0	4.50	0.005	II	41.8(67.3)
DMG	33.2780	116.0850	08/26/1965	125351.0	1.0	4.20	0.004	I	41.9(67.5)
DMG	33.1670	115.9830	07/21/1940	836 3.0	0.0	4.40	0.005	I	42.1(67.8)
GSP	33.2500	116.0500	08/31/1990	033800.0	8.0	4.20	0.004	I	42.2(67.9)
DMG	33.2400	116.0360	04/28/1961	63021.2	-1.2	4.20	0.004	I	42.4(68.2)
PAS	33.4580	116.4340	02/12/1979	44842.3	3.9	4.20	0.004	I	42.4(68.3)
DMG	33.2000	116.0000	08/15/1951	1227 9.0	0.0	4.00	0.003	I	42.5(68.4)
DMG	33.4080	116.2610	03/25/1937	1649 1.8	10.0	6.00	0.019	IV	42.8(69.0)
DMG	33.0360	115.9030	10/05/1964	121 9.5	-2.0	4.10	0.003	I	42.9(69.0)
DMG	33.4670	116.4330	05/12/1939	1925 2.2	0.0	4.50	0.005	II	43.1(69.3)
DMG	33.4830	116.7000	12/28/1948	125341.0	0.0	4.00	0.003	I	43.2(69.5)
PAS	33.4840	116.5130	08/11/1976	152455.5	15.4	4.30	0.004	I	43.3(69.7)
DMG	33.4830	116.5000	02/15/1951	104957.0	0.0	4.80	0.006	II	43.4(69.8)
DMG	33.4830	116.5000	02/15/1951	104759.0	0.0	4.80	0.006	II	43.4(69.8)
DMG	32.8850	115.8650	10/27/1963	145822.4	-2.0	4.40	0.004	I	43.4(69.9)
DMG	33.2310	116.0040	05/26/1957	155933.6	15.1	5.00	0.007	II	43.5(70.0)
PAS	33.0290	115.8880	11/26/1987	1739 2.0	1.8	4.30	0.004	I	43.6(70.1)
PAS	33.4600	116.3700	09/07/1984	175730.3	15.2	4.10	0.003	I	43.6(70.2)
PAS	33.0170	115.8810	11/24/1987	185040.3	0.0	4.30	0.004	I	43.7(70.4)
PAS	32.9930	115.8720	11/24/1987	133259.9	0.0	4.20	0.004	I	43.9(70.6)
DMG	33.0330	115.8830	08/27/1945	112520.0	0.0	4.00	0.003	I	43.9(70.7)
DMG	33.3330	116.1000	06/12/1943	192141.0	0.0	4.00	0.003	I	44.0(70.9)
PAS	33.4830	116.4380	07/02/1988	02658.2	12.6	4.00	0.003	I	44.1(70.9)
DMG	33.4540	116.8980	07/29/1936	142252.8	10.0	4.00	0.003	I	44.1(70.9)
DMG	33.4560	116.8960	06/16/1938	55916.9	10.0	4.00	0.003	I	44.2(71.1)
DMG	33.4880	116.7770	06/12/1959	11 313.0	5.7	4.00	0.003	I	44.3(71.2)
GSP	33.2100	115.9700	07/19/1991	024136.8	3.0	4.00	0.003	I	44.3(71.3)
DMG	33.2830	116.0330	03/16/1949	18 027.0	0.0	4.00	0.003	I	44.4(71.5)
DMG	33.2830	116.0330	03/29/1951	233929.0	0.0	4.40	0.004	I	44.4(71.5)
DMG	33.1000	115.9000	04/25/1957	2248 0.0	0.0	4.10	0.003	I	44.4(71.5)
DMG	33.1000	115.9000	04/25/1957	2249 0.0	0.0	4.20	0.003	I	44.4(71.5)
DMG	33.1000	115.9000	04/25/1957	22 5 0.0	0.0	4.20	0.003	I	44.4(71.5)
DMG	33.5060	116.5850	05/21/1967	144234.4	19.4	4.70	0.005	II	44.5(71.6)
PAS	33.5010	116.5130	02/25/1980	104738.5	13.6	5.50	0.011	III	44.5(71.6)
DMG	33.5000	116.5000	09/30/1916	211 0.0	0.0	5.00	0.007	II	44.5(71.7)
DMG	33.3170	116.0670	09/04/1944	125528.0	0.0	4.10	0.003	I	44.6(71.7)
DMG	33.5080	116.6310	08/11/1967	05711.4	10.7	4.10	0.003	I	44.6(71.8)
DMG	32.3340	116.1700	08/24/1963	204749.5	4.8	4.10	0.003	I	44.6(71.8)
PAS	32.9320	115.8470	09/05/1982	52126.6	4.2	4.40	0.004	I	44.7(71.9)
DMG	33.5000	116.4830	02/23/1941	183614.0	0.0	4.50	0.004	I	44.7(71.9)
GSP	33.5080	116.5140	10/31/2001	075616.6	15.0	5.10	0.008	II	45.0(72.4)
DMG	33.0450	115.8630	12/17/1968	225351.2	8.0	4.70	0.005	II	45.3(72.8)
DMG	33.2880	116.0180	07/27/1965	14 441.4	0.6	4.30	0.004	I	45.3(72.9)
MGI	33.5000	116.8000	05/31/1917	435 0.0	0.0	4.00	0.003	I	45.4(73.0)
MGI	33.5000	116.8000	06/02/1917	435 0.0	0.0	4.00	0.003	I	45.4(73.0)
MGI	33.5000	116.8000	03/30/1918	16 5 0.0	0.0	4.60	0.005	II	45.4(73.0)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
MGI	33.5000	116.8000	11/26/1916	17 5 0.0	0.0	4.00	0.003	I	45.4(73.0)
DMG	33.5010	116.4290	02/23/1971	0 739.2	8.0	4.20	0.003	I	45.4(73.0)
PAS	33.5200	116.5580	08/02/1975	014 7.7	13.4	4.70	0.005	II	45.5(73.3)
DMG	32.7000	115.8500	11/01/1941	142434.0	0.0	4.00	0.003	I	45.7(73.5)
GSP	33.5100	116.4500	02/18/1990	155259.9	9.0	4.10	0.003	I	45.7(73.6)
DMG	32.2000	116.5500	11/04/1949	204238.0	0.0	5.70	0.013	III	45.8(73.8)
DMG	32.2000	116.5500	11/05/1949	43524.0	0.0	5.10	0.007	II	45.8(73.8)
DMG	32.2000	116.5500	11/05/1949	20 2 7.0	0.0	4.00	0.003	I	45.8(73.8)
DMG	32.2000	116.5500	11/06/1949	23 510.0	0.0	4.00	0.003	I	45.8(73.8)
DMG	32.2000	116.5500	11/11/1949	1354 0.0	0.0	4.20	0.003	I	45.8(73.8)
DMG	33.0530	115.8550	10/05/1964	12455.5	0.0	4.40	0.004	I	45.9(73.8)
PAS	33.0130	115.8390	11/24/1987	131556.5	2.4	6.00	0.017	IV	46.0(74.1)
PDP	33.5290	116.5720	06/12/2005	154146.5	14.0	5.20	0.008	III	46.1(74.2)
DMG	33.0000	115.8330	01/08/1946	185418.0	0.0	5.40	0.010	III	46.2(74.3)
DMG	33.5330	116.6330	09/21/1942	7 754.0	0.0	4.00	0.003	I	46.3(74.6)
DMG	33.5340	116.5610	09/23/1956	112441.9	12.2	4.30	0.003	I	46.5(74.8)
PAS	33.1330	115.8730	11/24/1987	133355.8	0.0	4.00	0.003	-	46.8(75.3)
PAS	32.9790	115.8160	11/25/1987	135410.0	0.6	4.20	0.003	I	46.9(75.5)
USG	32.6450	115.8440	02/28/1988	5 259.5	7.1	4.21	0.003	I	47.1(75.8)
PAS	32.9960	115.8160	11/27/1987	11010.5	6.0	4.70	0.005	II	47.1(75.8)
PAS	32.6270	117.3770	06/29/1983	8 836.4	5.0	4.60	0.004	I	47.2(76.0)
PAS	32.9950	115.8130	12/02/1987	4 3 6.2	1.7	4.00	0.003	-	47.3(76.1)
PAS	32.9800	115.8090	11/28/1987	03910.9	0.8	4.20	0.003	I	47.3(76.1)
DMG	33.0330	115.8210	09/30/1971	224611.3	8.0	5.10	0.007	II	47.4(76.3)
PAS	33.0140	115.8150	11/24/1987	131848.9	6.0	4.10	0.003	I	47.4(76.3)
DMG	33.5000	116.9170	11/04/1935	355 0.0	0.0	4.50	0.004	I	47.4(76.3)
DMG	32.9310	115.7980	01/12/1972	1231 9.6	0.0	4.00	0.003	-	47.5(76.4)
PAS	33.0360	115.8200	11/24/1987	21435.5	4.7	4.50	0.004	I	47.5(76.4)
PAS	33.0330	115.8140	11/24/1987	22159.6	4.5	4.00	0.002	-	47.8(76.9)
PAS	33.0220	115.8080	11/24/1987	62323.1	3.4	4.00	0.002	-	47.9(77.1)
PAS	33.0400	115.8120	11/24/1987	253 0.7	3.5	4.70	0.005	II	48.0(77.3)
PAS	33.5580	116.6670	06/15/1982	234921.3	12.2	4.80	0.005	II	48.2(77.5)
DMG	33.2670	115.9330	12/30/1960	214025.0	0.0	4.00	0.002	-	48.3(77.7)
PAS	33.0470	115.8080	11/24/1987	143629.9	0.0	4.00	0.002	-	48.4(77.8)
DMG	32.5000	115.9000	06/25/1941	1715 0.0	0.0	4.00	0.002	-	48.4(77.9)
DMG	32.3830	116.0000	01/03/1956	1424 1.0	0.0	4.70	0.005	II	48.6(78.2)
PAS	33.0500	115.8000	11/24/1987	21647.2	6.0	4.00	0.002	-	48.9(78.6)
PAS	33.0480	115.7980	11/24/1987	21523.2	5.0	4.80	0.005	II	48.9(78.8)
PAS	33.0080	115.7860	11/24/1987	1321 0.2	6.0	4.10	0.003	-	49.0(78.8)
DMG	32.1670	116.4170	09/17/1950	194330.0	0.0	4.50	0.004	I	49.3(79.4)
DMG	33.5000	117.0000	08/08/1925	1013 0.0	0.0	4.50	0.004	I	49.4(79.5)
DMG	33.1830	115.8500	04/25/1957	222412.0	0.0	5.10	0.007	II	49.4(79.5)
DMG	33.1830	115.8500	04/25/1957	222148.0	0.0	4.20	0.003	I	49.4(79.5)
PAS	32.9420	115.7630	11/24/1987	133439.9	14.0	4.80	0.005	II	49.6(79.8)
DMG	33.2830	115.9170	03/28/1952	11622.0	0.0	4.20	0.003	I	49.7(79.9)
DMG	32.8330	115.7500	02/24/1933	1933 0.0	0.0	4.50	0.004	I	50.1(80.6)
PAS	33.0670	115.7810	11/24/1987	13248.1	4.0	4.20	0.003	I	50.2(80.8)
PAS	33.0720	115.7820	11/24/1987	153 3.2	4.2	4.00	0.002	-	50.3(80.9)
DMG	32.8500	117.4830	02/23/1943	92112.0	0.0	4.00	0.002	-	50.5(81.2)
PAS	32.2020	116.2290	12/12/1979	213741.0	5.5	4.00	0.002	-	50.7(81.7)
PAS	33.0820	115.7750	11/24/1987	15414.5	4.9	5.80	0.012	III	50.9(81.9)
T-A	33.5000	117.0700	12/29/1880	7 0 0.0	0.0	4.30	0.003	I	51.4(82.7)
DMG	32.2000	116.2000	03/03/1957	11 6 3.0	0.0	4.40	0.003	I	51.6(83.1)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	32.9830	115.7330	01/24/1951	717 2.6	0.0	5.60	0.010	III	51.7(83.2)
DMG	32.9830	115.7330	01/24/1951	733 7.0	0.0	4.00	0.002	-	51.7(83.2)
DMG	33.2330	115.8330	06/24/1942	235240.0	0.0	4.00	0.002	-	51.9(83.5)
DMG	33.2330	115.8330	06/14/1942	213623.0	0.0	4.00	0.002	-	51.9(83.5)
DMG	33.2330	115.8330	06/14/1942	222549.0	0.0	4.00	0.002	-	51.9(83.5)
DMG	32.9500	115.7170	06/14/1953	42958.0	0.0	4.80	0.004	I	52.3(84.2)
DMG	32.9500	115.7170	06/14/1953	41729.9	0.0	5.50	0.009	III	52.3(84.2)
DMG	32.8560	115.7100	09/18/1936	144032.1	10.0	4.50	0.003	I	52.4(84.3)
DMG	32.1000	116.6000	01/07/1950	93735.0	0.0	4.00	0.002	-	52.6(84.7)
DMG	33.2160	115.8080	04/25/1957	215738.7	-0.3	5.20	0.006	II	52.6(84.7)
DMG	32.1130	116.7850	04/23/1968	131825.4	10.0	4.20	0.002	-	52.7(84.8)
DMG	32.5510	115.7850	01/23/1971	22 736.0	8.0	4.10	0.002	-	52.7(84.8)
DMG	32.9000	115.7000	10/02/1928	19 1 0.0	0.0	5.00	0.005	II	53.0(85.3)
DMG	32.1000	116.5000	01/08/1937	1246 0.0	0.0	4.00	0.002	-	53.0(85.3)
DMG	32.9150	115.6970	05/23/1963	63635.7	1.2	4.30	0.003	I	53.2(85.7)
DMG	33.1670	115.7670	05/10/1955	43840.0	0.0	4.30	0.003	I	53.3(85.8)
GSP	33.6320	116.7190	07/19/1999	220927.5	14.0	4.20	0.002	-	53.5(86.1)
DMG	33.1750	115.7640	10/28/1963	81417.1	0.9	4.00	0.002	-	53.7(86.4)
DMG	32.7330	115.7000	04/21/1960	233920.0	0.0	4.20	0.002	-	53.7(86.5)
DMG	32.0830	116.6670	09/27/1934	2140 0.0	0.0	4.00	0.002	-	53.9(86.7)
DMG	32.0830	116.6670	11/25/1934	818 0.0	0.0	5.00	0.005	II	53.9(86.7)
DMG	32.0830	116.6670	10/12/1938	1231 0.0	0.0	4.00	0.002	-	53.9(86.7)
PAS	32.9140	115.6840	01/28/1988	254 2.4	5.9	4.70	0.004	I	54.0(86.9)
DMG	32.9900	115.6820	11/29/1964	142526.4	13.8	4.20	0.002	-	54.7(88.0)
GSP	33.6500	116.7400	12/02/1989	231647.8	14.0	4.20	0.002	-	54.9(88.4)
DMG	33.6500	116.7500	09/05/1950	191956.0	0.0	4.80	0.004	I	55.0(88.5)
DMG	33.0270	115.6810	05/23/1963	1553 1.8	0.4	4.80	0.004	I	55.2(88.8)
DMG	32.6000	115.7000	04/26/1963	1 342.0	0.0	4.00	0.002	-	56.0(90.2)
DMG	32.6000	115.7000	12/19/1958	1437 0.0	0.0	4.10	0.002	-	56.0(90.2)
PAS	33.0790	115.6800	04/26/1981	124043.4	6.0	4.20	0.002	-	56.1(90.3)
DMG	33.0080	115.6600	06/17/1965	74013.5	8.8	4.10	0.002	-	56.1(90.3)
DMG	32.4170	115.8000	05/13/1960	123640.0	0.0	4.10	0.002	-	56.4(90.7)
DMG	32.1020	116.2580	05/07/1966	32657.4	12.7	4.50	0.003	I	56.4(90.8)
MGI	33.5000	116.0000	09/30/1916	425 0.0	0.0	4.00	0.002	-	56.5(91.0)
PAS	33.0940	115.6550	06/13/1979	194645.9	6.0	4.10	0.002	-	57.8(92.9)
DMG	32.8830	115.6170	01/16/1946	11 654.0	0.0	4.20	0.002	-	57.8(93.0)
PAS	32.0580	116.3370	01/29/1980	1949 3.3	5.0	4.40	0.003	-	57.8(93.0)
DMG	33.2330	115.7170	10/26/1942	615 4.0	0.0	4.50	0.003	I	57.8(93.1)
DMG	33.2330	115.7170	10/22/1942	15038.0	0.0	5.50	0.007	II	57.8(93.1)
DMG	33.2330	115.7170	10/26/1942	34316.0	0.0	4.00	0.002	-	57.8(93.1)
DMG	33.2330	115.7170	10/26/1942	3 215.0	0.0	4.50	0.003	I	57.8(93.1)
PAS	32.7880	115.6180	10/15/1979	2355 2.6	5.0	4.20	0.002	-	58.0(93.3)
DMG	32.7940	115.6150	04/23/1968	1624 9.5	5.0	4.10	0.002	-	58.1(93.5)
DMG	32.0830	117.0000	05/10/1948	34925.0	0.0	4.00	0.002	-	58.3(93.8)
DMG	33.2840	115.7350	10/27/1963	145023.4	-2.0	4.00	0.002	-	58.6(94.2)
DMG	33.2330	115.7000	08/30/1946	111645.0	0.0	4.60	0.003	I	58.7(94.5)
DMG	32.0250	116.4240	08/20/1961	42843.0	12.6	4.60	0.003	I	58.8(94.7)
DMG	33.0560	115.6200	06/16/1965	242 6.1	-0.5	4.40	0.002	-	59.1(95.1)
PAS	33.0980	115.6320	04/26/1981	12 928.4	3.8	5.70	0.008	III	59.1(95.1)
PAS	33.0990	115.6300	04/26/1981	12 557.4	4.2	4.00	0.002	-	59.2(95.3)
PAS	33.7010	116.8370	08/22/1979	2 136.3	5.0	4.10	0.002	-	59.4(95.5)
PAS	33.1100	115.6270	04/25/1981	21155.3	4.8	4.10	0.002	-	59.6(95.9)
DMG	32.0000	116.7000	12/02/1929	1124 0.0	0.0	4.50	0.003	-	59.7(96.1)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	32.8830	115.5830	04/13/1938	1929 0.0	0.0	4.50	0.003	-	59.7(96.2)
GSP	32.6120	115.6280	07/27/1992	204008.8	15.0	4.10	0.002	-	59.8(96.2)
PAS	33.1030	115.6220	11/04/1976	133127.7	3.7	4.20	0.002	-	59.8(96.2)
PAS	33.1030	115.6210	11/04/1976	1139 8.4	0.9	4.10	0.002	-	59.8(96.3)
DMG	32.1520	116.0200	02/16/1967	194127.4	5.3	4.00	0.002	-	60.0(96.5)
DMG	32.0320	116.3090	08/27/1963	121 1.8	14.6	4.00	0.002	-	60.0(96.5)
DMG	32.1170	116.0830	07/09/1951	9 622.0	0.0	4.20	0.002	-	60.0(96.5)
DMG	32.0280	116.3230	09/20/1961	1036 2.6	11.4	4.20	0.002	-	60.0(96.6)
PAS	33.1090	115.6190	11/04/1976	114940.4	2.2	4.10	0.002	-	60.0(96.6)
PAS	32.8390	115.5780	10/15/1979	232552.6	8.1	4.00	0.002	-	60.1(96.6)
DMG	33.0120	115.5920	04/11/1965	04646.1	-2.0	4.10	0.002	-	60.1(96.7)
PAS	32.9040	115.5760	10/17/1979	191438.4	15.9	4.10	0.002	-	60.2(96.9)
DMG	32.5000	115.6670	02/12/1932	23021.0	0.0	4.00	0.002	-	60.4(97.2)
PAS	33.1170	115.6150	04/26/1976	64637.5	14.8	4.00	0.002	-	60.4(97.2)
PAS	32.9070	115.5660	10/16/1979	114655.3	11.4	4.80	0.003	I	60.8(97.8)
DMG	33.0370	115.5840	06/17/1965	73020.9	-1.3	4.30	0.002	-	60.8(97.9)
PAS	33.0010	115.5760	10/16/1979	74947.2	8.5	4.00	0.002	-	60.9(97.9)
DMG	33.1310	115.6110	10/27/1963	181250.7	7.8	4.20	0.002	-	60.9(98.0)
GSP	33.0300	115.5800	03/24/1989	231648.0	6.0	4.00	0.002	-	61.0(98.1)
DMG	33.0190	115.5730	06/17/1965	743 5.0	-2.0	4.20	0.002	-	61.2(98.5)
DMG	32.9820	115.5660	05/23/1963	9 6 4.7	25.4	4.60	0.003	I	61.2(98.6)
DMG	33.7100	116.9250	09/23/1963	144152.6	16.5	5.00	0.004	I	61.3(98.6)
DMG	33.2000	115.6330	10/27/1963	145245.2	-2.0	4.10	0.002	-	61.3(98.7)
PAS	32.6630	115.5830	10/31/1980	125536.7	3.6	4.40	0.002	-	61.4(98.7)
GSP	33.3170	115.7000	11/13/2001	204315.0	5.0	4.10	0.002	-	61.5(98.9)
DMG	33.2670	115.6670	08/10/1951	1130 8.0	0.0	4.40	0.002	-	61.5(98.9)
PAS	32.9500	115.5570	10/16/1979	33934.3	12.1	4.50	0.002	-	61.5(99.0)
PAS	33.1170	115.5950	11/04/1976	141250.2	5.0	4.40	0.002	-	61.5(99.0)
PAS	33.1180	115.5950	11/04/1976	62110.7	5.0	4.10	0.002	-	61.6(99.1)
DMG	31.9940	116.3700	08/20/1961	125245.9	8.2	4.00	0.002	-	61.6(99.1)
PAS	33.1230	115.5960	11/04/1976	54820.9	5.0	4.20	0.002	-	61.6(99.1)
DMG	32.2000	115.9000	05/31/1960	191736.0	0.0	4.00	0.002	-	61.7(99.3)
DMG	31.9700	116.6980	04/23/1968	132234.8	10.0	4.00	0.002	-	61.8(99.4)
DMG	32.0500	116.1670	02/06/1958	111530.0	0.0	4.50	0.002	-	61.8(99.4)
PAS	33.1180	115.5900	11/04/1976	635 3.5	4.5	4.10	0.002	-	61.8(99.5)
GSP	32.9480	115.5500	05/24/2003	020429.0	16.0	4.20	0.002	-	61.9(99.6)
DMG	32.2830	115.8000	09/26/1959	34050.0	0.0	4.30	0.002	-	61.9(99.7)
PAS	33.1810	115.6110	03/07/1989	02458.2	2.8	4.10	0.002	-	62.1(99.9)
DMG	32.3330	115.7500	12/15/1938	0 2 0.0	0.0	4.00	0.002	-	62.1(99.9)

-END OF SEARCH- 410 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2005

LENGTH OF SEARCH TIME: 206 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 9.6 MILES (15.4 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 6.7

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.099 g

COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:

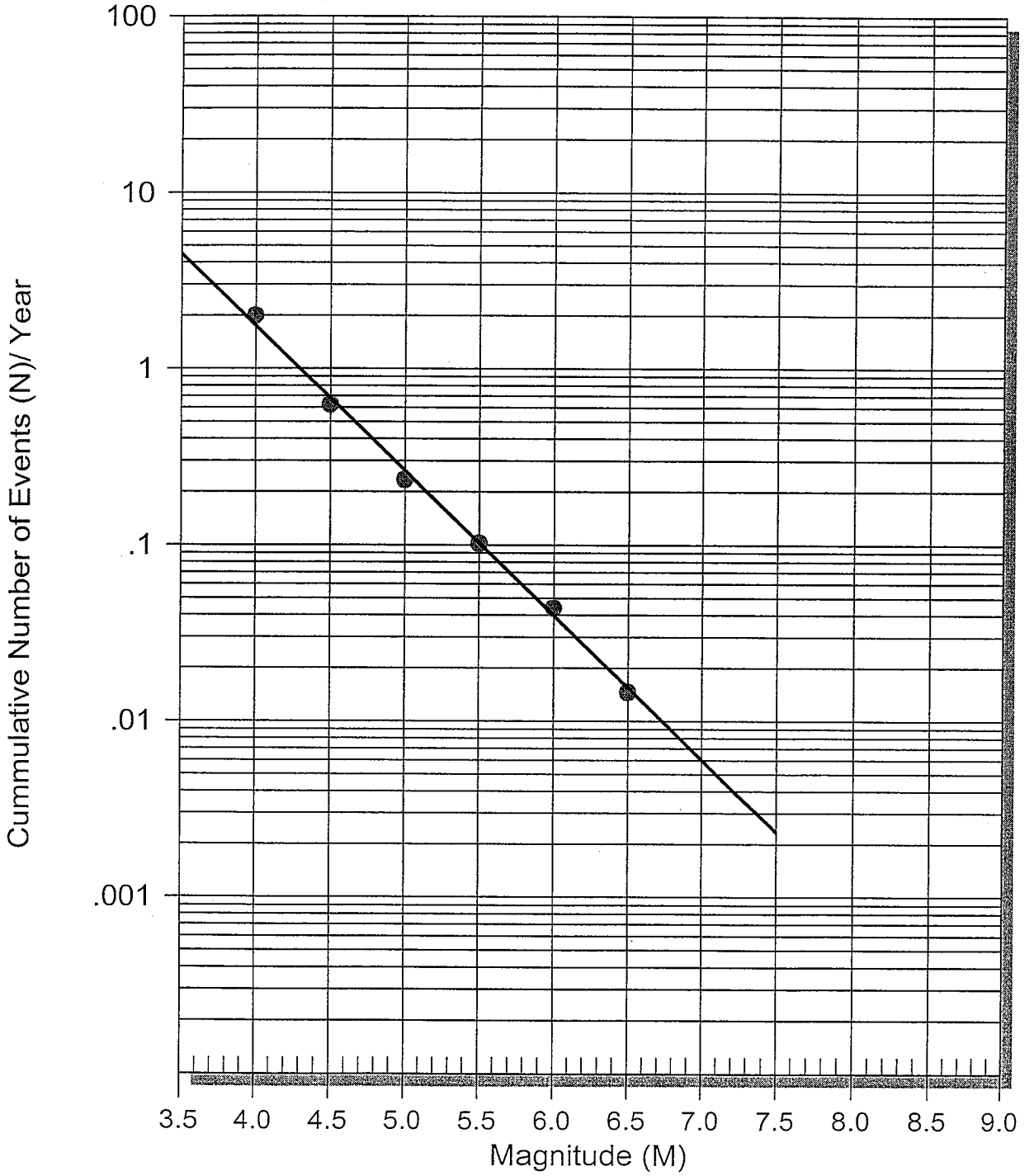
a-value= 3.524
b-value= 0.820
beta-value= 1.889

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	410	1.99029
4.5	128	0.62136
5.0	48	0.23301
5.5	21	0.10194
6.0	9	0.04369
6.5	3	0.01456

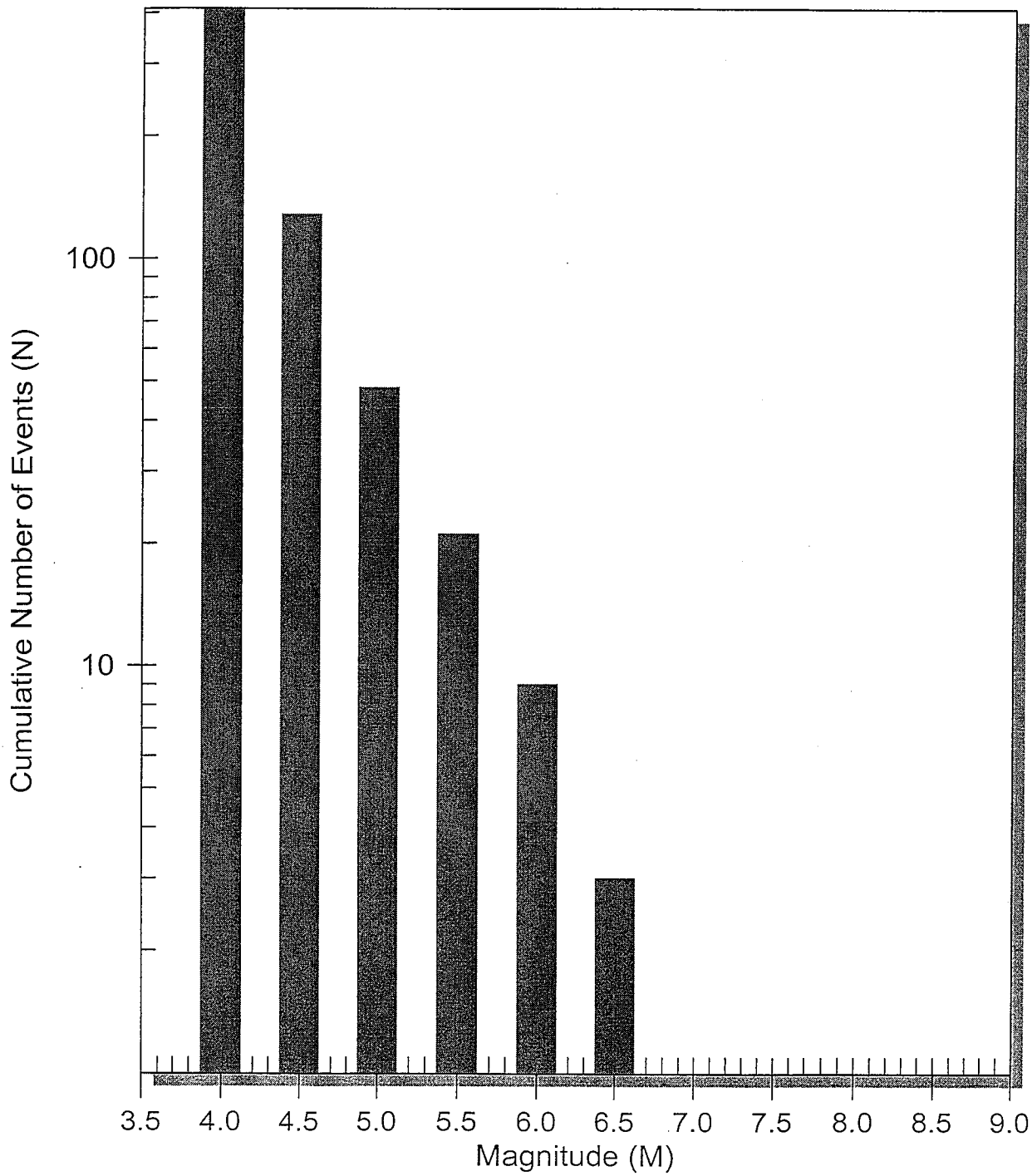
EARTHQUAKE RECURRENCE CURVE

Cuyamaca-Descanso



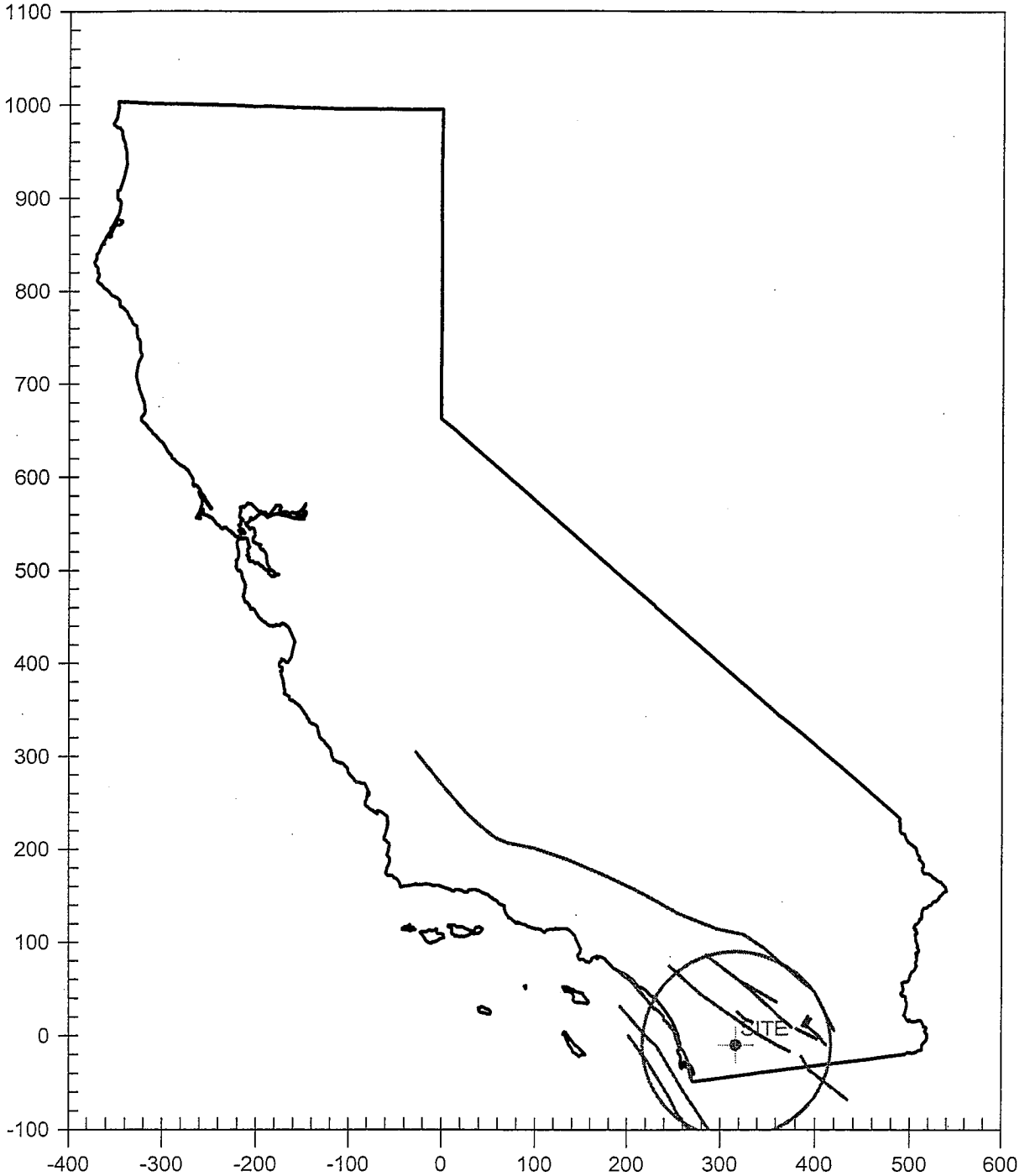
Number of Earthquakes (N) Above Magnitude (M)

Cuyamaca-Descanso



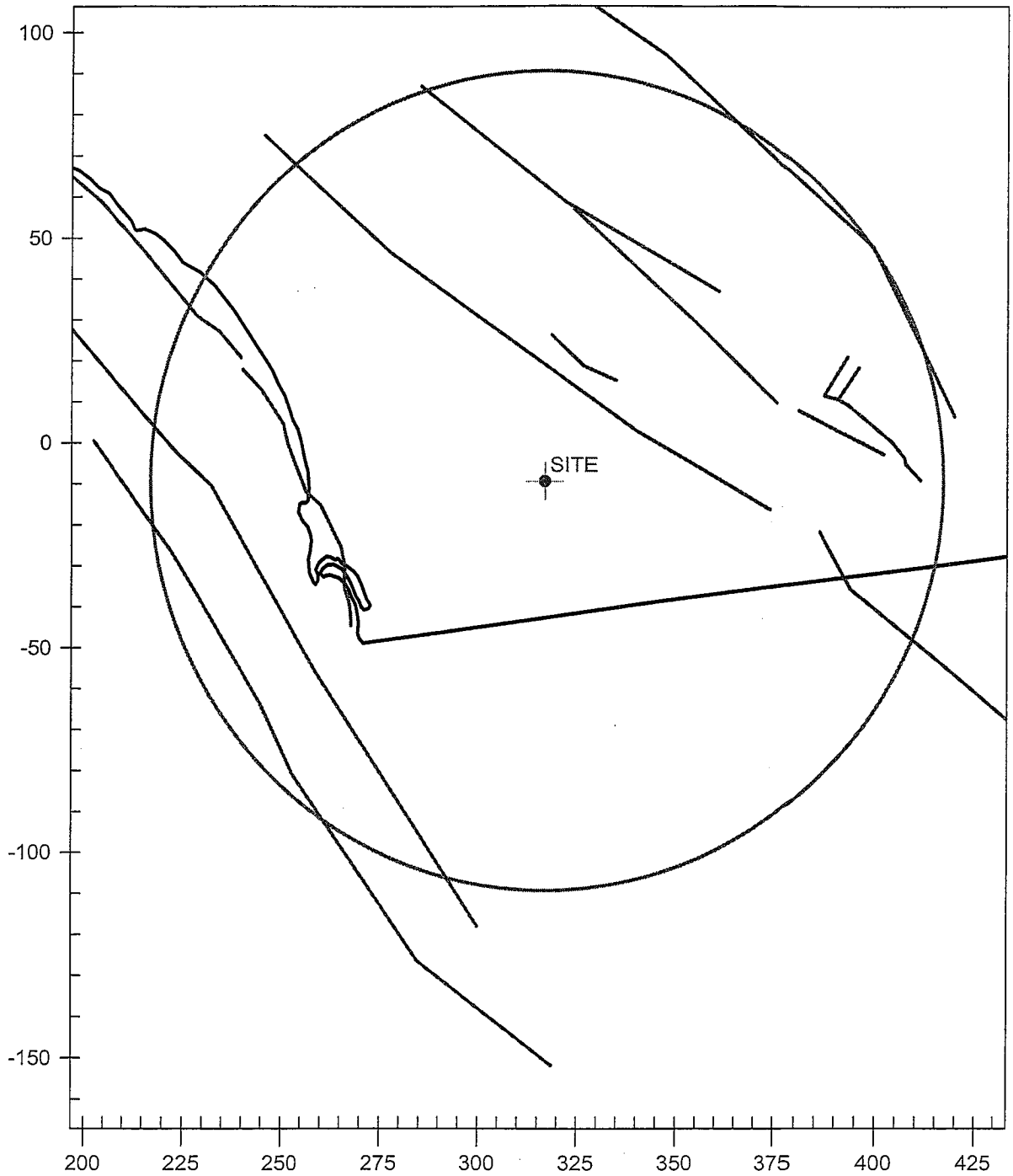
CALIFORNIA FAULT MAP

Cuyamaca-Descanso



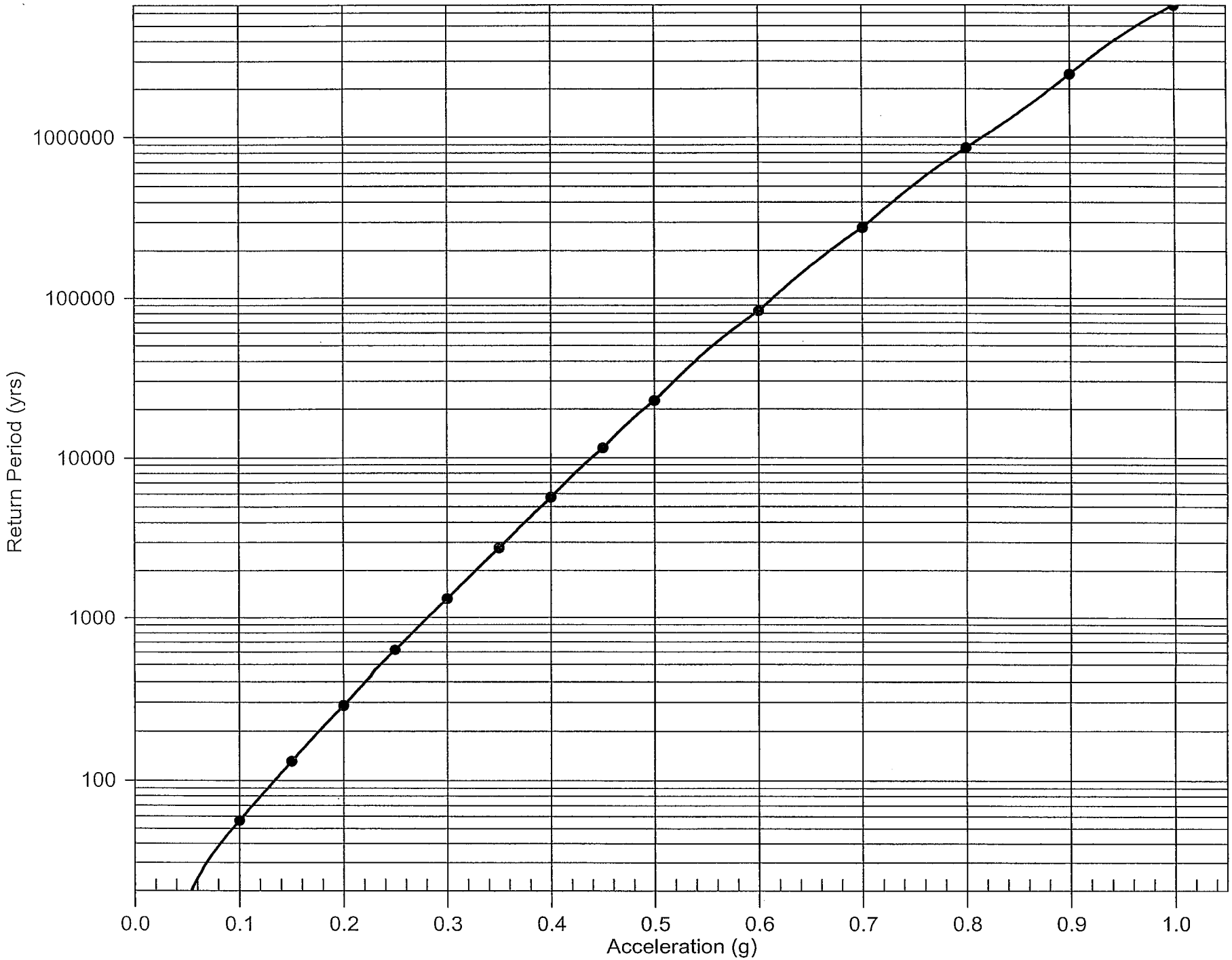
CALIFORNIA FAULT MAP

Cuyamaca-Descanso



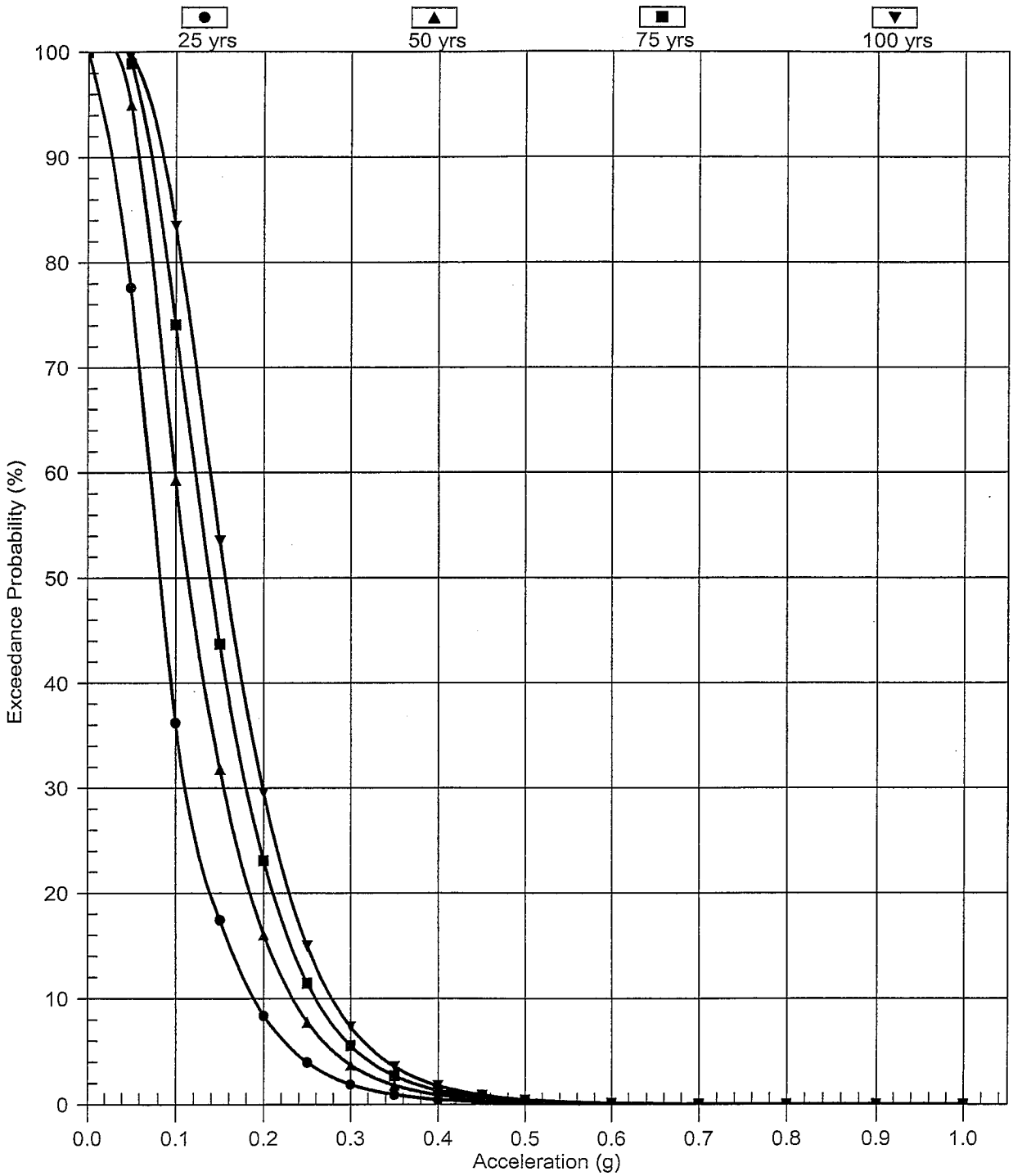
RETURN PERIOD vs. ACCELERATION

SADIGH ET AL. (1997) ROCK 1



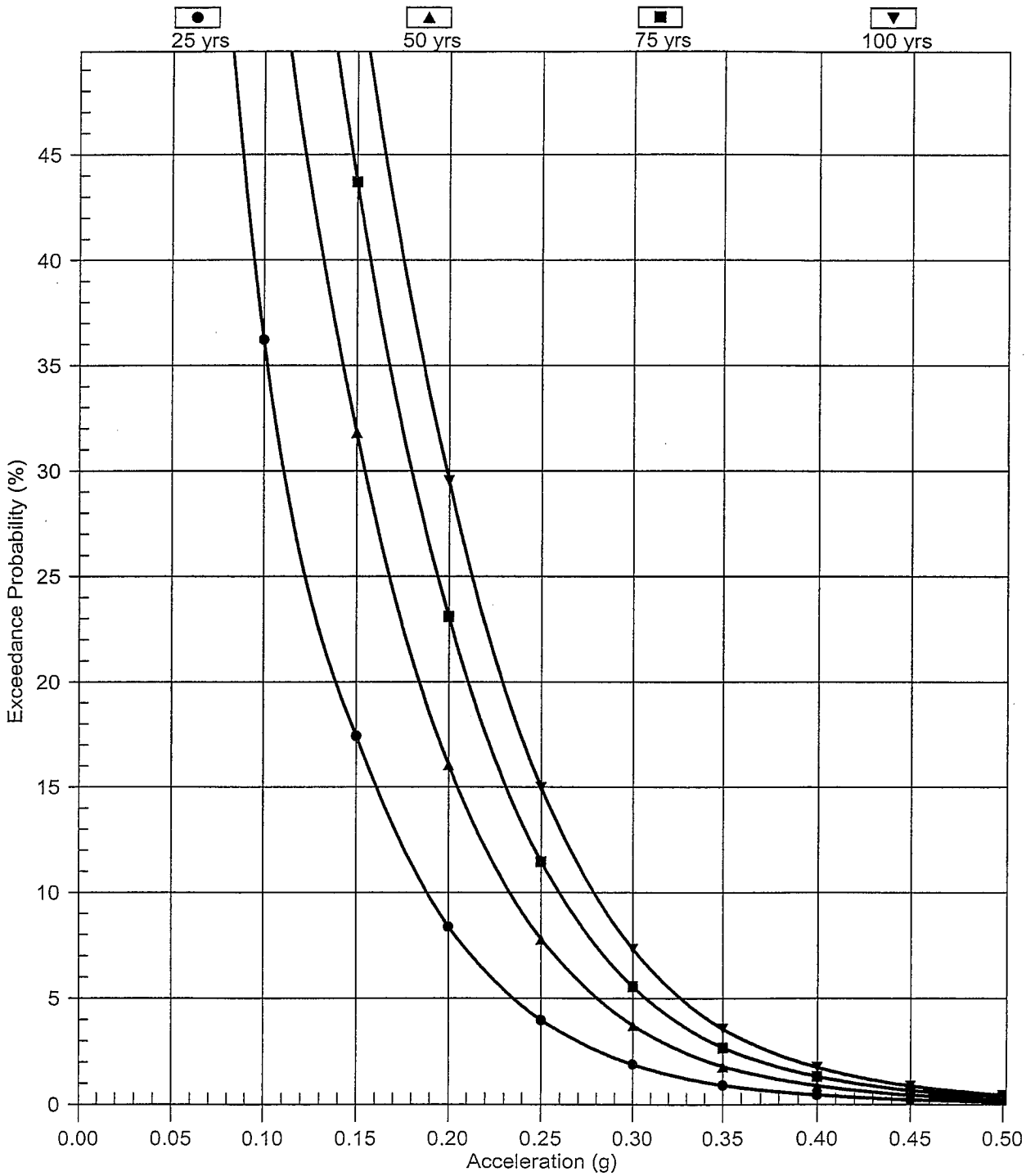
PROBABILITY OF EXCEEDANCE

SADIGH ET AL. (1997) ROCK 1



PROBABILITY OF EXCEEDANCE

SADIGH ET AL. (1997) ROCK 1

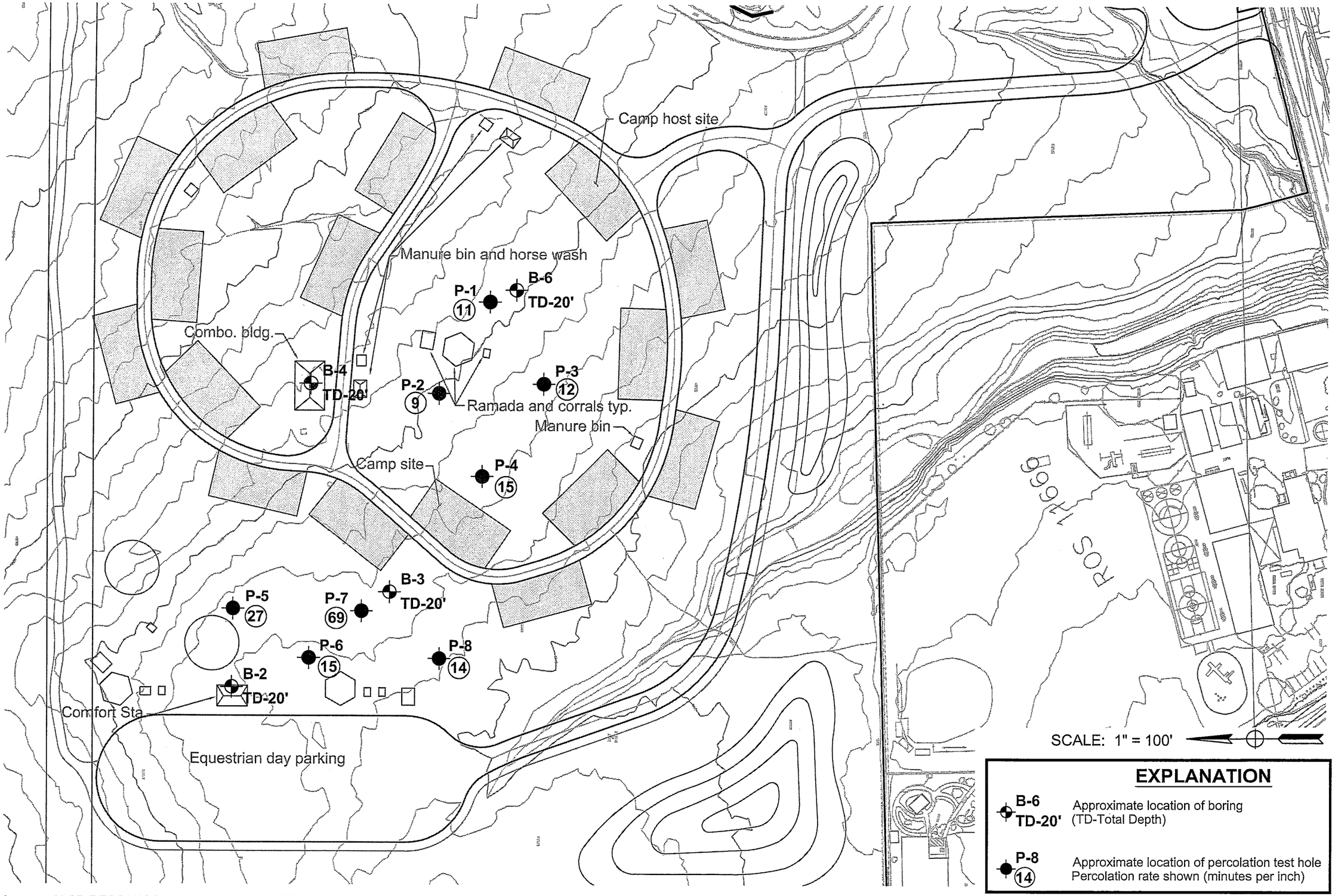


APPENDIX E

FIELD PERCOLATION TESTING

In-situ percolation testing was conducted at two potential leach field locations at the site. The percolation tests were conducted between January 10 and 11 of this year in general accordance with the County of San Diego Department of Environmental Health Land and Water Quality Division On-Site Sewage Disposal Systems manual. The approximate locations of the percolation tests are shown on the Percolation Test Location Plan, Figure E-1. The field percolation test results are summarized in Figure E-2, Field Percolation Test Results.

The test holes were drilled to a depth of 3 feet below the existing ground surfaces using a 6-inch diameter solid stem hand auger. The test holes were prepared by first removing all loose soils and debris, and then placing 2 inches of pea gravel in the bottom of the hole. The holes were then presoaked by filling them with clear water to 12-14 inches above the pea gravel. The columns of water were re-established periodically during the presoaking period (which lasted a total of 4 hours). Within 15 to 30 hours of the first presoak, the hole was again filled with water to 12-14 inches above the pea gravel for a period of one hour prior to starting the percolation testing. After the second presoak period, the water level was adjusted to 6 inches above the pea gravel and readings were taken relative to a fixed reference point at 30-minute intervals for a minimum of three hours. The stabilized rate of water drop was reached when two successive determinations did not vary by more than one-sixteenth of an inch. Based on the test results, the percolation rate of the in-situ soils ranges from approximately 8.6 to 68.6 minutes per inch. The test hole associated with the slowest percolation rate contained significantly more fine grained soils (mostly silt) than the remaining test holes. The next slowest percolation rate was 26.6 minutes per inch. Based on this investigation, it is our opinion that the on-site soils generally consist of silty sand with minor amounts of silt. The slowest percolation rate was obtained in a test hole with an unusual amount of fine grained soil, and should not be used in the septic system design. We recommend using a rate of 15 to 25 minutes per inch for septic system design purposes.



Reference: X-CB-DESCANSO.dwg and X-TOPO-MERIGAN.dwg, provided by WINZLER & KELLY.

Project No. 0730-020-00
Document No. 08-0028

FIGURE E-1

PERCOLATION TEST LOCATION PLAN

Geotechnics Incorporated

TEST HOLE	DEPTH (in)	STABILIZED CHANGE IN WATER LEVEL (in)	PERCOLATION RATE (minutes/inch)
P-1	36	2.75	10.9
P-2	36	3.5	8.6
P-3	36	2.56	11.7
P-4	36	2	15
P-5	36	1.125	26.6
P-6	36	1.125	26.6
P-7	36	0.4375	68.6
P-8	36	2.125	14