Preliminary Seismic Risk Analysis

for the Delta Water Management Study: North Delta

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U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
GEOTECHNICAL ENGINEERING AND GEOLOGY DIVISION
DENVER, COLORADO

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DEPARTMENT OF THE INTERIOR
U.S. BUREAU OF RECLAMATION
2800 COTTAGE WAY
SACRAMENTO, CA 95825-1898

PRELIMINARY SEISMIC RISK ANALYSIS

FOR THE

DELTA WATER MANAGEMENT STUDY: NORTH DELTA

by

Jon Ake*
John Wilson#
Dean Ostenaa*
Roland LaForge*

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*Seismotectonics and Geophysics Section
Geology Branch

#Geotechnical Engineering and Embankment
Dams Branch

Geotechnical Engineering and Geology Division
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Prepared by:

Jon Ake
Seismologist

Prepared by:

John A. Wilson
Geotechnical Engineer

Prepared by:

Dean Ostenaa
Lead Seismotectonic Geologist

Reviewed by:

J. Lawrence Von Thun
Technical Specialist

Submitted by:

Hunter C. Harrell
Head, Seismotectonics and
Geophysics Section

Submitted by:

William O. Engemoen
Design Manager

Approved by:

Richard H. Throner, Chief
Geology Branch

Approved by:

Francis G. McLean, Chief
Geotechnical Engineering and
Embankment Dams Branch

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EXECUTIVE SUMMARY

This report is a preliminary seismic risk assessment of typical water management facilities within the North Delta study area. This report will be used as input to the environmental impact statement/environmental impact report (EIS/EIR) prepared as part of the Delta Water Management Study: North Delta. The scope of this study was limited and did not include a comprehensive review of existing data or acquisition of new data for any aspect of the analysis. Thus, we have made many assumptions and generalizations in lieu of conducting thorough reviews and initiating additional research and data investigations.

The first part of the analysis consists of a probabilistic assessment which integrates all relevant earthquake sources in the region, and yields peak horizontal acceleration and velocity values for an exposure period of 100 years and a probability of non-exceedance of 0.9. The values computed near the center of the study area were 0.09g and 14.0 cm/sec, respectively. However, the range of accelerations and velocities was from less than 0.05g to 0.25g and from less than 10 cm/sec to 20 cm/sec, within the study area. Within the 40 percent of the study with computed accelerations of 0.1g or greater, it is estimated that 23-36 percent of the levee area will fail due to foundation liquefaction. For the roughly 50 percent of the study area where computed accelerations are 0.05 -0.1g, 8-23 percent of the levee area is expected to fail due to foundation liquefaction. The second part of the analysis consists of a geotechnical and failure probability analysis for two representative North Delta levee sections. Liquefaction potential was analyzed with limited shear strength and standard penetration tests (SPT) data from sites within the Delta. Deformation and settlement analyses were also performed.

The results suggest that ground motions are expected to equal or exceed levels required to cause liquefaction of the foundation soils resulting in failure of a variable percentage of the total levee area, for a 100-year exposure period. For approximately 40 percent of the North Delta area, computed accelerations are 0.1g or greater. For the same exposure period and loadings it is estimated that cyclic stress in the levee soils will equal or exceed those levels required to cause 5 to 10 percent of the levees to fail due to soil liquefaction. From the results of the displacement and settlement analyses, it is estimated that ground motions will equal or exceed levels required to cause deformation failure in 10 percent of the total levee area.

A more comprehensive analysis, including additional data from field and laboratory investigations directed at specific sites in the North Delta, and additional studies of seismic sources in the region, are needed to improve the confidence in the conclusions and to broaden the range of application of the analysis.

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1.0 INTRODUCTION

These studies are part of the North Delta Water Management Study, a joint U.S. Bureau of Reclamation - California Department of Water Resources (USBR-CDWR) study to develop solutions to water supply concerns of water users in the North Delta. This report presents the results of a preliminary seismic risk analysis of typical water management structures within the study area. This report will be used as input to the environmental impact statement/environmental impact report (EIS/EIR) prepared as part of the Delta Water Management Study: North Delta. This report is intended to present a preliminary identification of the seismic risk associated with the facilities' components and is to be used as input in the selection of the preferred alternatives.

This preliminary study provides a generalized framework for assessing the seismic risk for typical water management facilities in the North Delta area. The scope of this preliminary study was limited and did not include a comprehensive review of data for any facet of this project. Thus, we have made many assumptions and generalizations in lieu of conducting a comprehensive review of existing data or initiating new data-gathering investigations. References for data sources and assumptions are noted in relevant sections of the report.

Principal sources of earthquakes in the region include the many late Quaternary faults of the region such as the San Andreas, Hayward, and Calaveras, as well as more local sources in the North Delta area (fig. 1). Our data base on these faults was the readily available published and unpublished data that we had at our disposal. Our judgement on the inclusion of specific fault sources is weighted by the proximity of the fault to the North Delta study area and the available information on the tectonic characteristics of the fault. Undoubtedly, further study would include additional sources and delete or modify those used in this preliminary assessment.

The assessment of the seismic hazard to the North Delta area is presented as earthquake ground motion parameters at a given probability of non-exceedance (.9) in a 100-year exposure time. The probabilistic assessment used the program SEISRISK III (Bender and Perkins, 1987). Our general approach has been to assign a "characteristic event" or range of events to each fault or source based on geologic and seismologic considerations such as slip rate, fault length, tectonic setting, and historic seismicity.

The assessment of seismic risk in the North Delta is based on preliminary analyses to estimate the probabilities of failure of the North Delta levees due to liquefaction and seismically-induced deformation. Limited geological and geotechnical data were available from the referenced reports, so numerous assumptions were required. A carefully designed field exploration and laboratory testing program should be executed to confidently determine the appropriate parameters and properly analyze the seismic response of these structures.

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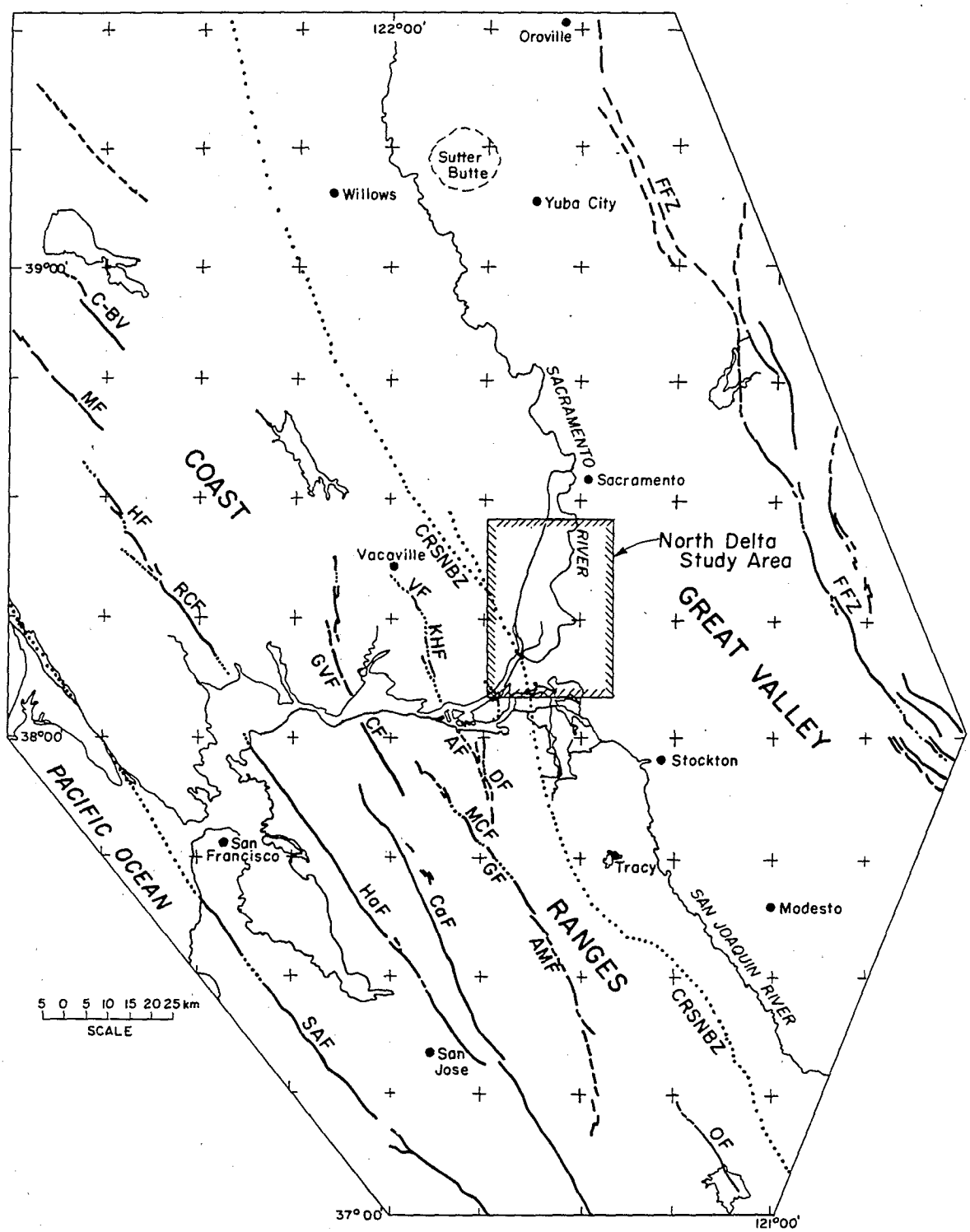

Figure 1. Major faults and location map, North Delta study area. SAF-San Andreas Fault; HaF-Hayward Fault; GVF-Green Valley Fault; CF-Concord Fault; CaF-Calaveras Fault; VF-Vaca Fault; KHF-Kirby Hill Fault; AF-Antioch Fault; DF-Davis Fault; MCF-Marsh Creek Fault; GF-Greenville Fault; AMF-Arroyo Mocho Fault; OF-Ortigalita Fault; CRSNBZ-Coast Range Sierra Nevada Boundary Zone; FFZ-Foothills Fault Zone, C-BV-Collaymi-Big Valley Fault.

Historical stability problems throughout the Delta indicate the relevance of the seismic risk to levees at numerous locations. Poor construction techniques, inadequate design and unfavorable foundation conditions have combined to create continual maintenance problems. The addition of seismic loads to structures of already marginal stability is cause for concern.

The seismic risk analysis performed and presented in this report is intended to serve as a model for subsequent, more detailed investigations and analyses which will further define and expand the conclusions discussed herein. We have previously completed a similar study for the South Delta area (Ostenaa and others, 1989). The present study is a direct extension of that study, with relatively minor additions to seismic source zones to the north, but we have not otherwise updated source data with new information. More recent analyses of fault behavior in the region, resulting in part from the 1989 Loma Prieta earthquake (USGS, 1990), suggest higher slip rates for several faults in the area compared to previous estimates. These new data suggest slip rates for the San Andreas, Hayward, and Rodger Creek faults that are about 18-28 percent higher than the rates used in previous estimates (USGS, 1988; Ostenaa and others, 1989). Similarly, preliminary analysis of seismic network data from the Sierran Foothills (Ake and others, 1991; LaForge and others, 1991) suggests that the return period for moderate and large magnitude events in that region may be less than previously suggested. None of this new data has been incorporated into our estimates of ground motions. In general, it appears that this new data would increase the levels of strong ground motion expected in the North Delta study area.

1.1 Previous Studies

There have been many prior assessments of the seismic hazard and risk for various portions and facilities within the Delta area. The scope of this preliminary study did not permit a comprehensive review of all previous work on this subject. CDWR (1980) reviewed potential seismicity hazards in the Delta region and recommended further studies and investigations. CDWR (1982) examined the problems and feasibility of upgrading and rehabilitating the levees in the Delta region. CWDD (1981) and EBMUD (1982, 1984) reviewed the seismic hazard to EBMUD Mokelumne Aqueduct, which crosses the Delta just north of the study area of this report. EBMUD (1982, 1984) made slight modifications to the original CWDD study and estimated that the return period for accelerations of 0.22 g was about 100 years. The McDonald Island Levee stability studies by Dames and Moore (1985) found at least a 50 percent chance of levee failure due to liquefaction in the next 50 years for the levees they studied. Newmark (1985) evaluated the potential for earthquake-induced levee failures in the Delta and outlined potential future studies. Finch (1988) examined the performance of the Twitchell Island levees under maximum credible earthquake conditions. Ostenaa and others (1989) examined two sites in the South Delta area. For a 0.9 (90 percent) probability of non-occurrence and a 100-year exposure period, a peak acceleration of

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0.18g was determined. These results suggest that for a 100-year exposure period, ground motions are expected to equal or exceed levels required to cause liquefaction of the foundation soils and dynamic displacement of the levees over broad areas of the total levee area within the South Delta area.

2.0 SEISMIC SOURCE ASSESSMENT

2.1 Regional Seismotectonic Setting

The North Delta study area is located at the central portion of the Great Valley, just north of the confluence of the San Joaquin and Sacramento Rivers (fig. 1). The San Joaquin and Sacramento Rivers drain the southern and northern half of the Great Valley respectively, a depositional basin that has existed since the Mesozoic. East of the Great Valley are the foothills of the Sierra Nevada. To the west are the Central California Coast Ranges and San Francisco Bay.

Most of the late Quaternary faults in the Central California Coast Range region can be considered part of the San Andreas fault system. This group of faults forms a transform boundary between the North American and Pacific plates, and collectively absorbs an average right-lateral slip of nearly 5 cm/yr. Much of this slip is accommodated along the San Andreas fault proper, but significant slip occurs along other faults of the system as well.

The physiographic boundary between the Coast Ranges and the Great Valley also appears to represent a fundamental tectonic boundary. The Coast Ranges are extensively dissected by a complex system of strike-slip faults related to the San Andreas. In contrast, the gently west-tilted Sierra Nevada Block appears to be a relatively rigid block which extends beneath the Great Valley. Late Cenozoic deformation has occurred mostly around its borders, with only limited intra-block deformation. The western boundary zone between the Sierran Block and the Coast Ranges is thought to be a compressional boundary characterized by a zone of thrust faulting, reverse faults, and folding. The North Delta study area lies astride or adjacent to this boundary zone.

Recorded seismicity in the study area appears to correlate with the major tectonic and physiographic boundaries. West of the Coast Ranges - Great Valley boundary, seismicity is quite pronounced, while east of this boundary activity is sparse. In the western part, larger events such as the 1970 Livermore event (M_L 5.5-5.9) and the 1984 Morgan Hill earthquake (M_L 6.2) have occurred on mapped faults and were associated with surface fault rupture. Ellsworth and others (1982) found that well located seismicity from 1969 to 1980 lined up along the larger faults, including the Hayward, Calaveras, Greenville, and Concord faults. However, a considerable amount of activity was clearly not associated with mapped faults. Wong and Biggar (1989) examined seismicity in a region southwest of the North Delta study area, and found no correlation between seismic activity and the Antioch, Davis, and Midland faults. Both studies found predominantly strike-slip faulting on northwest or northeast-trending planes, based on first motion analyses, and both noted the abrupt decrease in seismicity at the Coast Ranges - Great Valley boundary zone.

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2.2 Earthquake Sources

Earthquake sources for this risk assessment have been selected based on their proximity to the North Delta area, and based on available information which suggests that these sources are sites of moderate to large historic earthquakes or Holocene to latest Pleistocene surface faulting. The sources selected for this risk assessment do not represent a comprehensive inventory of earthquake sources that may be significant to features in the North Delta. Rather, they are intended to provide a representative picture of the general level of seismic risk present in the area. At progressively greater distances from the North Delta, faults and sources of greater activity have been omitted, since at these distances they do not contribute significantly to the ground motions. More detailed review of existing data and further studies of many sources would be required in order to fully characterize the seismic hazard in this region.

2.2.1 Characteristic Events

To describe the behavior of individual sources and faults in the region, we have adopted the "characteristic event" model of fault behavior (Schwartz and Coppersmith, 1984). This model depicts earthquake occurrence on a fault or source as clustered about a relatively narrow magnitude range, with individual large events separated by periods of virtual quiescence on the fault. This is in contrast to a log-normal distribution of earthquake occurrence, in which a full range of events is inferred to occur on an individual fault. The log-normal model has long been known to describe earthquake occurrence on a regional basis, but does not appear to adequately describe the behavior of individual faults. The characteristic model appears to better describe the behavior of many faults in the western United States. The characteristic magnitude estimate does not necessarily include the maximum event which could occur on a fault or source, but rather represents our judgment of the probable range of fault behavior based on the available data. As noted in the discussions below, we have relied heavily on the compilations of Wesnousky (1986) and Clark and others (1984) for the basic data on fault behavior in the region. A recent assessment of the probabilities of a large earthquake on the San Andreas and Hayward faults (USGS, 1988) is a primary source of information for our assessment of these two faults.

Table 1 tabulates the basic fault behavior parameters that have been used as input to our seismic risk studies. The closest approach column shows the range of distances to potential sites in the North Delta. Figure 1 depicts the locations of these sources with respect to the North Delta study area. Background information on the individual sources is discussed briefly in the following section.

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Table 1
Principal earthquake sources

Fault or source	Characteristic magnitude (M_s)	Closest approach (km)	Return period (yrs)	Slip rate (mm/yr)	References*
San Andreas	8	80-125	300	16	(1)
Hayward	7	50-95	200	7.5	(1)
Calaveras	7	35-85	200	7.5	(3),#
Healdsburg-Rodgers Cr.	7	55-90	220	7	(2),#
Maacama	7.5	90-130	700	7	(3),#
Green Valley-Cordelia	6.5	30-65	420	4	(2),#
Concord	6.5	30-70	320	4	(2),#
Clayton	6.5	25-70	1000	<1	(3),#
Marsh Cr.-Greenville	6.5	30-75	1000	<1	(3),#
Arroyo Mocho	6.5	50-90	1000	<1	(3),#
Vaca	6	15-50	260	>.3	(2),(4)
Kirby Hill	6	15-50	260	>.3	#
Antioch	6	10-60	260	>.3	#
Davis	6	15-60	260	>.3	#
Foothills	6	35-80	10000	<< 1	#
CRSB	6.5	0-25	1000	?	(5),#
Ortigalita	6.5	95-140	5000	<1	(6)
Background seismicity	4.7-5.8	0-40	5	n.a	(7)
Collayami-Big Valley	6.5	90-140	2000	0.3	(2),(4)

*References: (1) USGS, 1988; (2) Wesnousky, 1986; (3) ESA, 1982; (4) Clark and others, 1984; (5) Wong and others, 1988; (6) Anderson and others, 1982; # inferred, this report; (7) Collins and Urhammer, 1988.

San Andreas Fault. The San Andreas fault (SAF) is the major element of the plate boundary system in Central California and the best studied of all the faults in the region. The fault is the site of a historic *M* 8+ earthquake in 1906 which ruptured a fault length of about 450 km with slip of 4-7 m along most of that length. Most slip rate estimates for the SAF in northern and central California range from 8 to 15 mm/yr (Clark, 1984). USGS (1988) notes that these values may be lower bounds and uses a slip rate of 16 $\pm$ 2.5 mm/yr for their probability calculations. They estimate that the **conditional** probability of an *M* 8 event on the North Coast segment of the fault in the next 30 years is <0.1. (All probabilities are conditional on no segment-rupturing event occurring on the segment prior to January 1, 1990.) The conditional probability of a *M* 7 event on the

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San Francisco Peninsula segment in the same time period is estimated to be 0.2. For the Santa Cruz Mountains segment, the conditional probability of a *M* 6.5 is estimated to be 0.3. For this report we adopt the slip rate estimate of USGS (1988). These values suggest a recurrence time of about 300 years for an *M* 8 event on the northern San Andreas fault. We do not consider separate San Francisco Peninsula or Santa Cruz Mountains segments as the probable events on these segments and their distance from the North Delta study area would not contribute significant ground motions to our evaluation.

The October 17, 1989 Loma Prieta earthquake (M_S 7.1) occurred at the northern end of the Santa Cruz Mountains segment of the SAF (USGS, 1989; Astaneh and others, 1989). New data and interpretations generated as a result of this event have increased estimates of the probability of a large earthquake in the Bay Area (Working Group, 1990). No liquefaction was reported in the North Delta area due to the Loma Prieta earthquake. The occurrence of this event does not affect the probabilities of estimated events on other faults or segments of the SAF. No reports of damage or liquefaction in the North Delta are available at present (August 1991). Reclamation instruments at the toe of Martinez Dam (~30 km southwest of the North Delta area) and on the crest of Contra Loma Dam (~20 km southwest of the North Delta area) recorded uncorrected peak horizontal accelerations of 0.023 g and 0.07 g, respectively (Wood and others, 1991). From presently available information, it appears that peak accelerations at sites in the North Delta were $<<0.1$ g. This level of ground shaking is not considered significant to our evaluation of seismic risk in the North Delta study area.

Hayward Fault. The Hayward fault is the site of two major historic earthquakes; a *M* 6.8 event in 1868 and a *M* 6.8 event in 1836 (Toppozada and others, 1981). Fault rupture length and slip parameters for these events are poorly known and considerable uncertainty exists regarding the locations of these two historic events. There are no published Holocene slip rates or paleoseismic estimates of the occurrence of prehistoric large events on the Hayward fault. The high degree of urbanization along the fault dictates that this is unlikely to change. However, the fault has a geomorphic expression indicative of a high slip rate and abundant associated microseismicity. Presently, active creep characterizes much of the fault. Creep rates from surface features of up to 6 mm/yr have been recorded and geodetic data suggests that up to 10 mm/yr could be occurring along the fault (Lindh, 1983).

The historic occurrence of two events near *M* 7 and the evidence for high rates of contemporary creep along the fault represent a fundamental paradox in assessing the earthquake hazard from the fault. If creep rates are high then no elastic strain is accumulating along the fault and the near-term hazard from moderate to large events is low. On the other hand, potential strain accumulation rates are high enough that even if part of the strain is accumulating, recurrence intervals for events of about *M* 7 need only be a few hundred years. USGS (1988) adopted a slip rate of 7.5 ± 2.0 mm/yr and considered that two rupture segments with lengths of 50 km are present. With a

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characteristic slip of 140 $\pm$ 40 cm per event an average recurrence interval of 209 years is estimated for each segment. Conditional probability estimates of an *M* 7 event in the next 30 years using these fault parameters are about 0.2. For the purposes of this report we adopt the slip and segmentation parameters used by USGS (1988).

Calaveras Fault. The >100 km long Calaveras fault appears to be dominated by aseismic creep along much of its length (Prescott and others, 1981), but is also the site of significant historic seismicity. Most recently two *M* ~6 events have occurred along the southern portion of the fault (1979 and 1984) and a slightly smaller magnitude event may have caused surface rupture along the northern portion of the fault in 1861 (Toppozoda and others, 1981). These appear to be the largest events to have occurred on the fault in historic time. Geodetic data suggests a recent slip rate of 7 $\pm$ 1 mm/yr across a zone a few kilometers wide centered on the fault (Prescott and others, 1981). No geologic determinations of slip rate exist along the major portion of the fault.

Problems with assessing the earthquake hazard along the Calaveras fault are similar to those for the Hayward fault. High contemporary creep rates contrast with the occurrence of moderate magnitude historic seismicity, while strain accumulation rates are high enough to suggest very short recurrence times for larger events. For the purposes of this report, we assume fault behavior for the Calaveras fault to be similar to that of the Hayward fault. An alternative approach assumes that the characteristic event on the Calaveras fault is about *M* 6 (Wesnousky, 1986) or comparable to the historic events that have been observed along the fault.

Rodgers Creek - Healdsburg - Maacama faults. The Rodgers Creek, Healdsburg and Maacama faults are the en echelon continuations of the Hayward fault north of San Francisco Bay. Geodetic estimates of slip rates on these faults are comparable to estimates for the Hayward and Calaveras faults to the south (Wesnousky, 1986), although creep rates north of the bay appear to be much less. For the purposes of this report, fault behavior similar to the Hayward and Calaveras faults is assumed with the exception that the Maacama fault is assigned a *M* 7.5 event following Wesnousky (1986).

Greenville system. Individual faults within the Greenville system (Clayton, Marsh Creek, Greenville, Arroyo Mocho and extensions) constitute the easternmost, continuous system of right-lateral, strike-slip faults in the central San Francisco Bay region. Inclusive of possible extensions to the south the total length of the system is nearly 200 km. Evidence for Holocene strike-slip displacement and slip rates along the several segments of the Greenville fault system is discussed by ESA (1982). For this report we adopt a slip rate (<1 mm/yr) and recurrence estimate (1000 years for M 6.5 $\pm$ 0.25) based on the data presented by ESA. Such a choice implies that extensive segmented rupture characterizes the behavior of the fault system.

Concord - Green Valley - Cordelia Faults. The Concord and Green Valley - Cordelia faults have significant slip rates and may be accommodating strain transfer from both the

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Calaveras and the Greenville fault systems (ESA, 1982). Slip rate estimates of about 4 mm/yr for the Concord and Green Valley faults (Wesnousky, 1986) indicate potential return periods for moderate magnitude events of no more than a few hundred years. Detailed mapping by Frizzel and Brown (1976) documents possible evidence of historic offset along the Green Valley fault. For this report we have considered the Concord, Green Valley, and Cordelia faults as a system consisting of multiple rupture segments for characteristic magnitudes of 6.5.

Vaca - Antioch and related faults. The Vaca, Kirby Hill, Antioch, and Davis faults are considered together as a more or less continuous, segmented fault system. We have taken this approach because the faults are 1) roughly on trend with each other; 2) individual faults are all relatively short; 3) there is intermittent evidence within the zone for young surface offset and creep; 4) seismologic evidence suggests they are within the tectonic environment characterized by right-lateral slip; and 5) previous investigators (e.g., ESA, 1982; Wong and Biggar, 1989) have considered some of these faults potential seismic sources despite a lack of geologic evidence for recent displacement.

Focal mechanisms compiled by Wong and others (1988) suggest right-lateral strike-slip along both the Vaca and Antioch faults, although some events are significantly deeper than is commonly observed in Central California. These data suggest that this zone of faults forms the approximate eastern limit of strike-slip faulting in the central San Francisco Bay region. Detailed analyses (Wong and Biggar, 1989) in the area south of Antioch, suggests that the eastern limit of strike-slip faulting lies east of this zone of faults. The question of the continuity of these faults is unresolved.

For the purposes of this report we consider the Vaca, Kirby Hill, Antioch, and Davis faults as part of a segmented fault system with similar behavior on each segment. A characteristic magnitude of M 6 is assigned and the recurrence estimate of 260 years cited by Wesnousky (1986) for the Vaca fault is applied to the whole system. Smaller magnitude events possibly associated with these faults are accounted for in the Background Seismicity source.

Northern Coast Range Faults. Several additional Quaternary faults are present in the northern Coast Ranges from the Lake Berryessa area north and northwest to the Clear Lake area. Quaternary slip rates are based mostly on offsets of Pliocene and Quaternary volcanic and sedimentary units. Individual faults in this area generally have lengths less than 10-15 km, and slip rates are mostly about 0.1 mm/yr or less. For this North Delta evaluation, these faults do not produce significant ground motions in the study area and they therefore have not been included as sources. The Collayami and Big Valley faults have been included to represent sources from this region because published slip rates (Clark, 1984; Wesnousky, 1986) are higher than for most other faults in this region.

Foothills Fault System. Studies following the 1975 M_L 5.7 Oroville earthquake attempted to demonstrate the presence of late Quaternary faulting on reactivated faults

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in the Sierra Nevada foothills. Regional studies (Woodward-Clyde Consultants, 1977) suggested that the return period of surface faulting events on individual fault segments in the Foothills Fault system was on the order of 30,000 years. For the purposes of this report we assign a characteristic event of *M* 6 with a return period of 10,000 years to the Foothills fault zone.

Coast Ranges - Sierran Block Boundary Zone (CRSB). The CRSB boundary zone (Wong and others, 1988) lies approximately along the physiographic boundary between the Coast Ranges and the Great Valley. This zone represents the transition from predominantly strike-slip faulting of the San Andreas system in the Coast Ranges to the relatively stable, extensional regime of the Sierran Block. Focal mechanisms (Wong and others, 1988; Wong and Biggar, 1989) suggest that this zone marks the eastern extent of strike-slip faulting in Central California. Compilations of stress data indicate that the area is characterized by northeast-directed compression (Zoback and others, 1987). Tectonically the zone has been interpreted as a zone of crustal wedging involving reverse faults and low angle thrusting (Wentworth and others, 1984; Wentworth and Zoback, 1989) based on studies in the Coalinga area or as a result of the compressional interactions of the Sierran Block and the Coast Ranges (Wong and others, 1988). The 1892 Winters (M_L 6-7) and the 1983 Coalinga (M_L 6.7) earthquakes have been interpreted as representative of the types of events which may characterize this zone (Eaton, 1986; Wong and others, 1988;). Significant surface deformation is not expected to accompany the larger events in this zone (Namson and Davis, 1988). Rather, source faults for the larger events in the CRSB are inferred to be thrusts and reverse faults coring folds, or low angle detachments related to crustal wedges at seismogenic depths.

For this report, for the simplified purposes of estimating ground motions in the North Delta study area, we treat the CRSB as a single, continuous, segmented fault source located along the western Great Valley margin. Our representation of this zone is taken to be roughly coincident with the traces of the Midland, Sherman Island, Black Butte and San Joaquin fault zones and is inferred to be continuous through the region of the North Delta study area. The character and existence of this zone through the North Delta area is speculative and requires additional investigations. We note, however, that the existence of this zone is based on circumstantial evidence, its location is uncertain (Herd, 1979; Lettis, 1988), and the existence and significance of the Midland and San Joaquin faults have been questioned (California Department of Water Resources, 1982; Anderson and others, 1982). In spite of these uncertainties, we have included the CRSB as a source, since for longer exposure periods or shorter return periods than we have inferred, it may make a significant contribution to the hazard in the area.

Ortigalita Fault. Detailed studies by Reclamation for San Luis and O'Neill Forebay Dams (Anderson and others, 1981; 1982; LaForge and Lee, 1982) have demonstrated Holocene strike-slip activity along the Ortigalita fault. Slip rates and recurrence are poorly constrained, but suggest a low rate of activity compared to other strike-slip faults

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in Central California. For this report, we assign a *M* 6.5 event as a characteristic event for the Ortigalita fault with an average recurrence interval of 5000 years.

Collayami - Big Valley Faults. The Collayami and Big Valley faults displace late Quaternary volcanic units, but are not known to have Holocene displacement. As cited in Wesnousky (1986) and Clark and others (1984), slip rate estimates on these faults are uncertain, but in the range of 0.1 to 1 mm/yr. We have assigned a m 6.5 event to these faults based on their lengths, slip rates, and similarity to other segmented faults in the Coast Ranges (e.g., Ortigalita, Greenville - Marsh Creek).

Background Seismicity. Significant earthquake activity occurs in the San Francisco Bay region that is not directly associated with the faults we have identified as sources. In addition, events with magnitudes less than the characteristic magnitude we have assigned to individual fault sources may occur on these faults. To account for these events in the seismic risk analysis, we have defined a background seismicity source using the Central Coast Ranges recurrence relation of Collins and Uhrhammer (1988). Because earthquake recurrence in the Great Valley is much lower than in the adjacent Coast Ranges, we have limited this source to the Coast Range area (see figure 2). We have chosen the magnitude range for this source as *M* 4.7 - 5.8 since larger events generally occur on specific fault sources with surface rupture and because at probability levels such as those used in this study, the inclusion of smaller events may lead to an overestimate of ground motion levels (Bender and Campbell, 1989).

2.3 SEISRISK Analysis

Probabilistic ground motion parameters were estimated for this study using the program SEISRISK III (Bender and Perkins, 1987). The basic methodology of this widely used technique can be summarized as follows: a geographical grid model is constructed on which two types of earthquake sources are represented: faults, characterized by a series of line segments, and random or background seismicity, characterized by uniform earthquake occurrence within a specified area. While background seismicity is assumed to occur in a Poissonian manner according to a specified recurrence relationship, fault-related events are assumed to rupture a specific length of the fault, at specified time intervals. Earthquake "occurrences" for each source are then tabulated in accordance with the recurrence information and exposure period, translated into a ground motion parameter felt at a site, and then summed (integrated) over all the sources. The ground motion value that has a given probability of not being exceeded during the exposure time is then computed. The complete details of the method are described in Bender and Perkins (1987).

A map of the fault sources considered in this study is shown as figure 1. A description of each fault source, with its estimated MCE and associated recurrence time, is discussed in section 2.2. These parameters are listed in table 1. The faults, as represented on the

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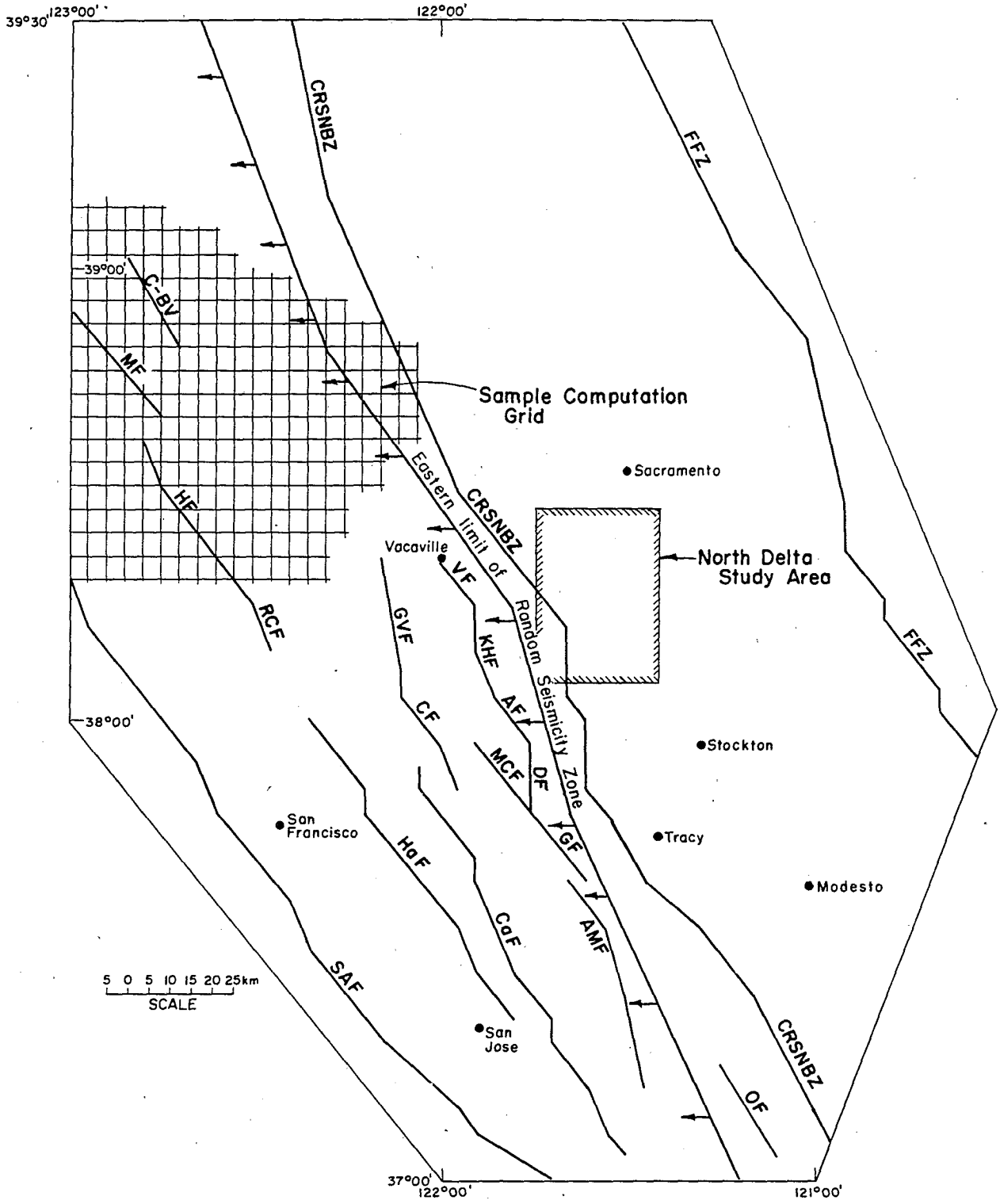

Figure 2. Tectonic grid model for SEISRISK III analysis, North Delta study area.

grid pattern, are shown on figure 2. For this study we have assumed that earthquake occurrence on mapped faults follows the "characteristic earthquake" model, as described in section 2.2.1, and that the magnitude range of this event is 0.6. For example, in table 1 an MCE of M_L 8.0 for the San Andreas fault encompasses events of magnitude 7.7 to 8.3. For fault sources, the ratio of small to large events, as represented by the *b* value in the equation $\text{Log}(N) = a - bm$ (where *N* is the cumulative number of events of magnitude *M* or greater, and *a* and *b* are constants), is assumed to be 1.0.

It must be noted, however, that aside from the largest historical events on the San Andreas and Hayward faults, none of the earthquakes that have occurred in the study area to our knowledge can be considered "characteristic" events. Some have occurred on mapped faults, some have not, and for many, poor location accuracy precludes a determination. To account for this activity, we have assumed that such events can be considered a "random" source, with a magnitude range of 4.7 to 5.8. A magnitude-frequency relationship for the central Coast Ranges province calculated by Collins and Uhrhammer (1987) was used to characterize the occurrence of these events. Earthquakes greater than magnitude 2.5 that occurred from 1949 through 1987 were used in the computation. We have assumed that, based on the physiographic boundary of the Coast Ranges and historical seismicity patterns, this activity will occur west of the boundary shown on figure 2. The relationship of Collins and Uhrhammer (1987), with *N* normalized to the number of events occurring in the area west of the boundary on figure 2 per year, is $\text{Log}(N) = 3.436 - .793(M)$.

An exposure period of 100 years, and a probability of non-exceedance of 0.9 for that time period were judged to be appropriate parameters for the purposes of this study. Attenuation relationships for peak horizontal acceleration and peak horizontal velocity developed by Joyner and Boore (1981) were utilized. While differentiation between rock and soil sites was not found to be statistically significant for the acceleration equation, Joyner and Boore (1981) found that the addition of a "soil site" term for the velocity equation was valid. More recent work however, has suggested considerable amplification may occur in soft near-surface materials such as underlie the North Delta (Joyner and Boore, 1988; Alei and Richards, 1980). The velocity values calculated for this study assume a soil site. An advantage to the Joyner-Boore relations is that standard deviations were obtained which can be used to quantify the reliability of the results. Computations were also made with the commonly used acceleration attenuation relation of Seed and Idriss (1982). Another ground motion parameter, duration of motion, is one that is important for modeling engineered structures, but has received little quantitative treatment (Hanks and McGuire, 1981). Estimates of this parameter can be made for specific magnitudes and distances, however, from recent compilations by Krinitzsky and others (1988).

Since the number of events that can occur on a fault source is related to the length of rupture for the specific magnitudes considered, the use of proper fault rupture length vs. magnitude relationships is important. For the strike-slip faults in our model, the "US7"

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relation of Bonilla and others (1984) was used. This relation was derived from California strike-slip earthquakes only, and has a very high correlation coefficient. For the Midland-San Joaquin fault source the "RV" (reverse faulting) relation was used, and for the Foothills fault source the "WNA" (western North America) relation was employed (Bonilla and others, 1984).

Two sites within the North Delta, shown on figure 3, were chosen as target sites. The sites were placed near the southwestern and northeastern edges of the target area in order to minimize and maximize the distance to the major seismic sources, respectively. SEISRISK III has the capability of smoothing sharp boundaries of source zones by incorporating an epicentral location standard error into the analysis. In order to minimize the abruptness of the zone of random seismicity, a location error of 5 kilometers was assumed.

Each source was analyzed separately to assess its individual effect on the target sites. The resulting acceleration is obtained through the equation

$$\mathrm{Ex}(a) = -\log_e P(0,t)/t \qquad (1)$$

where Ex(a) is the yearly exceedance rate of acceleration a, and $P(0,t)$ is the probability of there being zero yearly events, given $p = .9$ and $t = 100$ years. If Ex(a) is less than the right hand term of equation (1) for all values of a, it can be said that insufficient occurrences were recorded to satisfy the conditions of exposure period and probability level. Sources for which this was the case are marked in table 2. Note that these accelerations are not the result of the occurrence of the characteristic magnitude listed in table 2, but are derived probabilistically. Since the exceedances at the different levels of ground motion are summed over all the sources, the final value will exceed that from any one source.

2.3.1 SEISRISK Results

In order to assess the spatial variability of expected ground motions within the study area, a matrix of 56 points was defined for analysis. The results of the SEISRISK calculations are shown as contour maps of the study area on figures 3 and 4. The Joyner and Boore (1981) attenuation model was used to construct figure 3 and the Seed and Idriss (1982) attenuation function to construct figure 4. Clearly a significant decrease in expected ground motions is evident trending from southwest to northeast (i.e., away from the zone of random seismicity and the most active faults).

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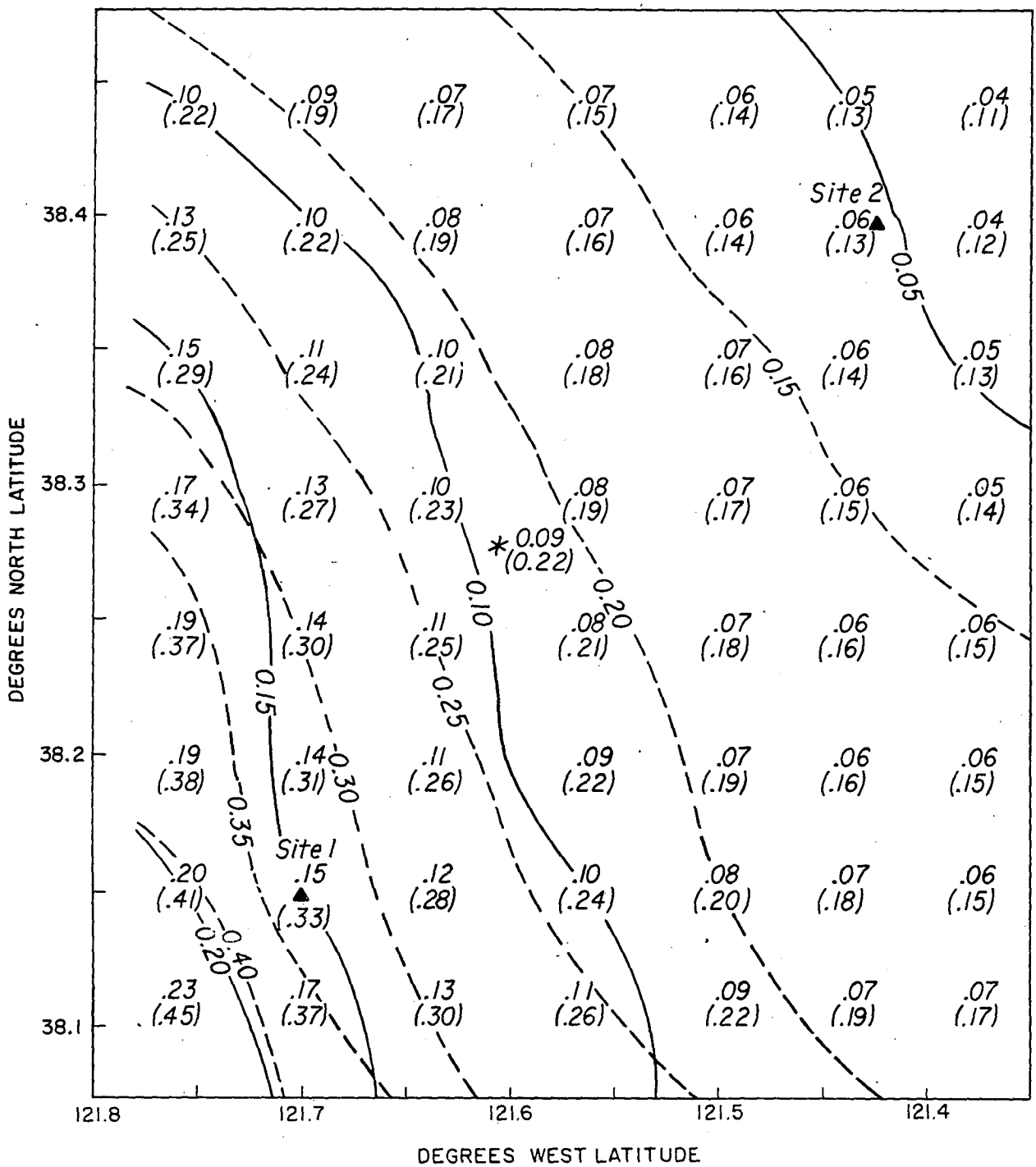

Figure 3. Peak acceleration (in g's) with 90 percent probability of non-exceedance in 100-year exposure period, North Delta study area. Attenuation relationships of Joyner and Boore (1981) used, mean values with +1 standard deviation values shown in parentheses. Contours for mean values shown as solid lines, contours for +1 standard deviation values as dashed lines.

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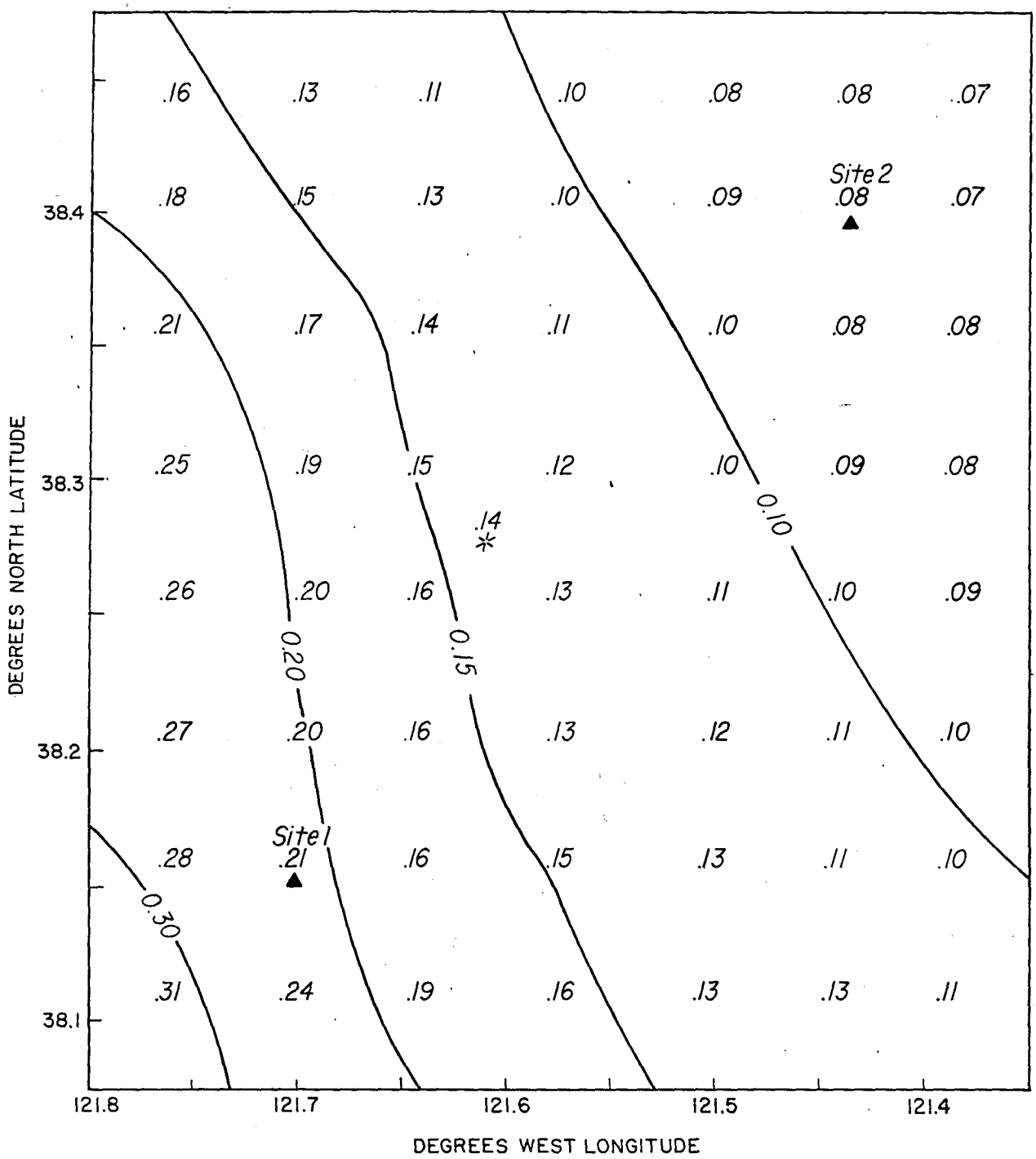

Figure 4. Peak acceleration (in g's) with 90 percent probability of non-exceedance in 100-year exposure period, North Delta study area. Attenuation relationship of Seed and Idriss (1982) used.

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Table 2
Principal earthquake sources and peak acceleration values
for representative sites 1 and 2

Fault or source	Characteristic magnitude (M_s)	Closest approach (km) site 1/site 2	Return period (yrs)	Peak Horizontal Acceleration (g) site 1/site2
San Andreas	8	86/119	300	.06/.03
Hayward	7	56/91	200	.07/.04
Calavaras	7	42/78	200	.08/.04
Healdsburg-Rogers Cr.	7	66/93	220	.06/.04
Maacama	7.5	131/138	700	.02/.02
Green Valley-Cordelia	6.5	36/62	420	.08/.03
Concord	6.5	35/70	320	.09/.04
Clayton	6.5	25/50	1000	***
Marsh Creek - Greenville	6.5	29/65	1000	*/*
Arroyo Mocho	6.5	57/86	1000	*/*
Vaca	6	21/44	260	.11/.05
Kirby Hill	6	17/44	260	.15/.05
Antioch	6	18/53	260	.14/.04
Davis	6	23/58	260	.10/.04
Foothills	6	73/43	10000	*/*
CRSB	6.5	4/29	1000	*/*
Ortigalita	6.5	108/130	5000	*/*
Background seismicity	4.7-5.8	-/-	5	.11/.03
Collayami-Big Valley	6.5	113/118	2000	*/*

*Occurrences insufficient to satisfy probability and exposure period requirements
***Included with Marsh Creek - Greenville faults
Note: Attenuation relationship of Joyner and Boore (1981) used to calculate acceleration.

For sites 1 and 2, the sources were combined and the analysis performed. The results are summarized in table 3. The Joyner-Boore (1981) results are presented with plus one standard deviation shown in parentheses. No statistical parameters were given by Seed and Idriss (1982), and it should be noted that their relation is for rock sites. A printout for site 1 using the Joyner-Boore acceleration values is included as appendix A. This output can be interpreted by consulting Bender and Perkins (1987).

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Table 3 Ground motion parameters for two North Delta sites			
	Acceleration (g) (Joyner-Boore, 1981)	Acceleration (g) (Seed-Idriss, 1982)	Velocity (cm/sec) (Joyner-Boore, 1981)
Site 1	0.15 (0.33)*	0.21	19.7 (41.2)*
Site 2	0.05 (0.13)*	0.08	10.7 (17.9)*
* + 1 standard deviation			

In summary, the Joyner-Boore (1981) values in table 3 give what we consider to be conservative preliminary values for ground motions in the North Delta at the given probability and exposure levels. The Seed-Idriss (1982) values are also presented to point out that the choice of attenuation relationship has a significant effect on the final values. This observation is discussed elsewhere (e.g., Youngs and Coppersmith, 1985), and makes direct comparisons to previous studies in the Delta difficult. For example, CDWR (1981) used the attenuation relationship of Schnabel and Seed (1973), the EBMUD study (CWDD, 1981) used Housner (1965) and Schnabel and Seed (1973), and the Dames and Moore (1985) study used Donovan and Bornstein (1975). An analysis of the sensitivity of the final values to the numerous attenuation relationships available is beyond the scope of this study. Other possible sources of error in this analysis are uncertainties in our knowledge of fault behavior and in the applicability of the statistical model to the process of earthquake occurrence.

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3.0 GEOTECHNICAL ANALYSIS

A preliminary geotechnical analysis has been performed to provide an estimate of the behavior of the levee soils to seismic loading. Although the analysis performed is quantitative, it was limited by data availability and resources. However, this study is considered adequate as a basis for determining the need for and guiding the form of a more thorough, detailed analysis to be performed at a later date. The procedures applied here should serve as a model for detailed analyses which, coupled with complete field and laboratory data, can allow a much more reliable estimate of the seismic response of the North Delta levees to be made.

3.1 Typical Levee Foundation and Section

Throughout the Sacramento - San Joaquin Delta, the levees are generally founded on soft, compressible peaty soil which is underlain by unconsolidated sandy-silty alluvium. Subsidence of the peat soil has been a continual maintenance problem, requiring frequent raises in the height of levees in many areas. Generally speaking, in the North Delta area, the peat soils vary in thickness from less than 3 m to more than 12 m (CDWR, 1982).

There is, however, considerable variability in both the levee composition and in the foundation conditions throughout the North Delta. It was, therefore, decided to use two levee cross sections in this preliminary analysis in order to determine a range of responses which might be expected. A true parametric study, where many geotechnical parameters are varied over a reasonable range, was not performed at this time, but is recommended as part of a final analysis.

The two sections analyzed for this study are described as the average levee section (fig. 5) and a less stable levee section (fig. 6). The average section has 1.2 m of freeboard above the base flood condition (50-year flood), a 3.0 m thick layer of peat beneath the levee, a relatively flat downstream slope, and 2.0 m of peat at the downstream toe (1.0 m of subsidence or erosion has made the peat layer thinner downstream of the levee). The less stable levee section is characterized by only 0.6 m of freeboard above the base flood condition, 5.5 m of peat beneath the levee, a somewhat steeper downstream slope, and assumes 1.2 m of subsidence or erosion in the peat at the downstream toe. The less stable model is not intended to represent the worst possible situation, but it is assumed that roughly 85-90 percent of the North Delta levees are more stable than this model.

Geotechnical data, such as standard penetration test (SPT) blowcounts, gradations, foundation stratigraphy, etc., were obtained from several available references (Finch, 1988; Dames and Moore, 1985; COE, 1987). This data provides relatively thorough coverage of the soils conditions throughout the North Delta area. Additional data would, however, make a more complete evaluation of the delta, with its high degree of variability, possible. The shear strength parameters used in this analysis are shown on table 4.

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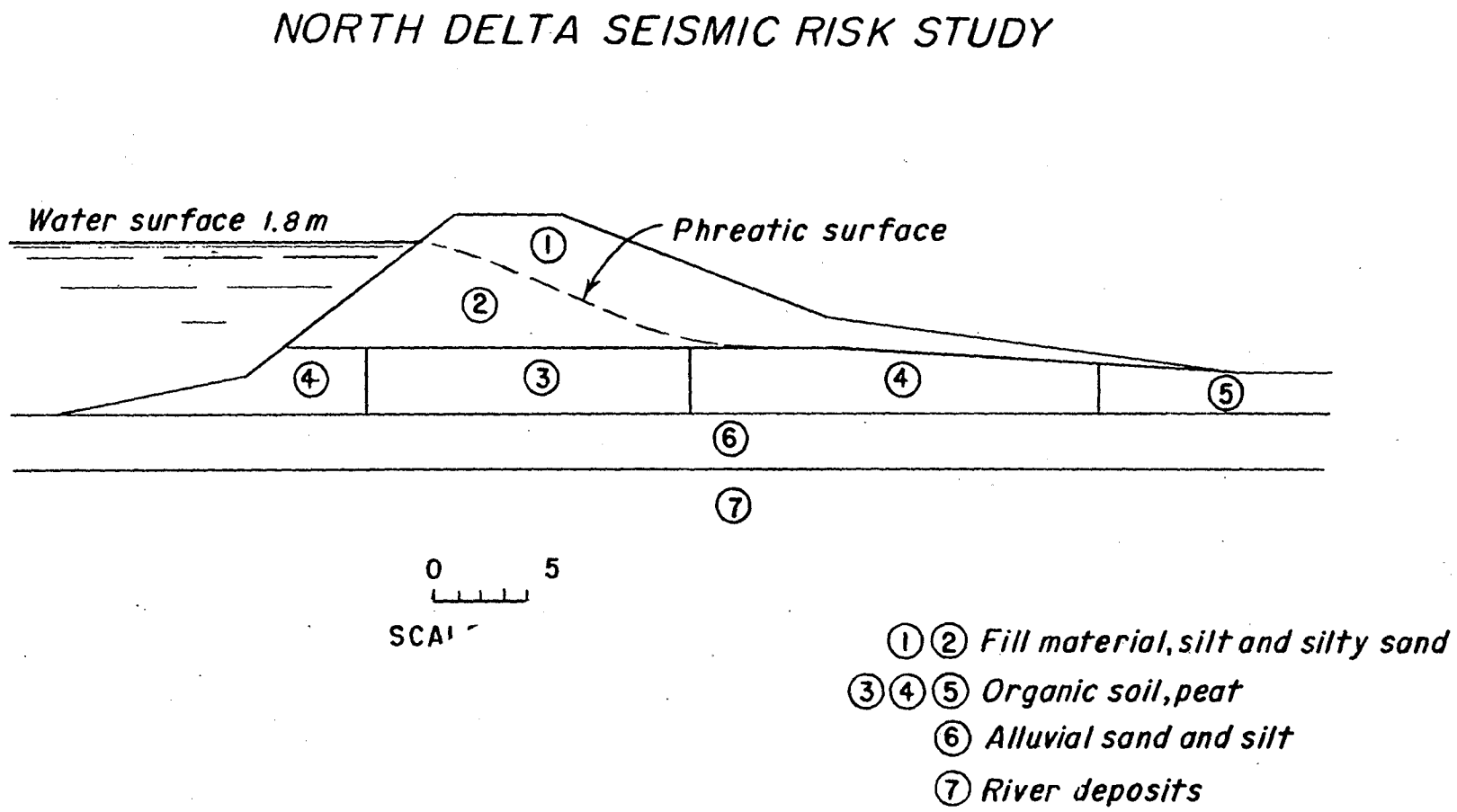

Figure 5. Average levee section, North Delta study area.

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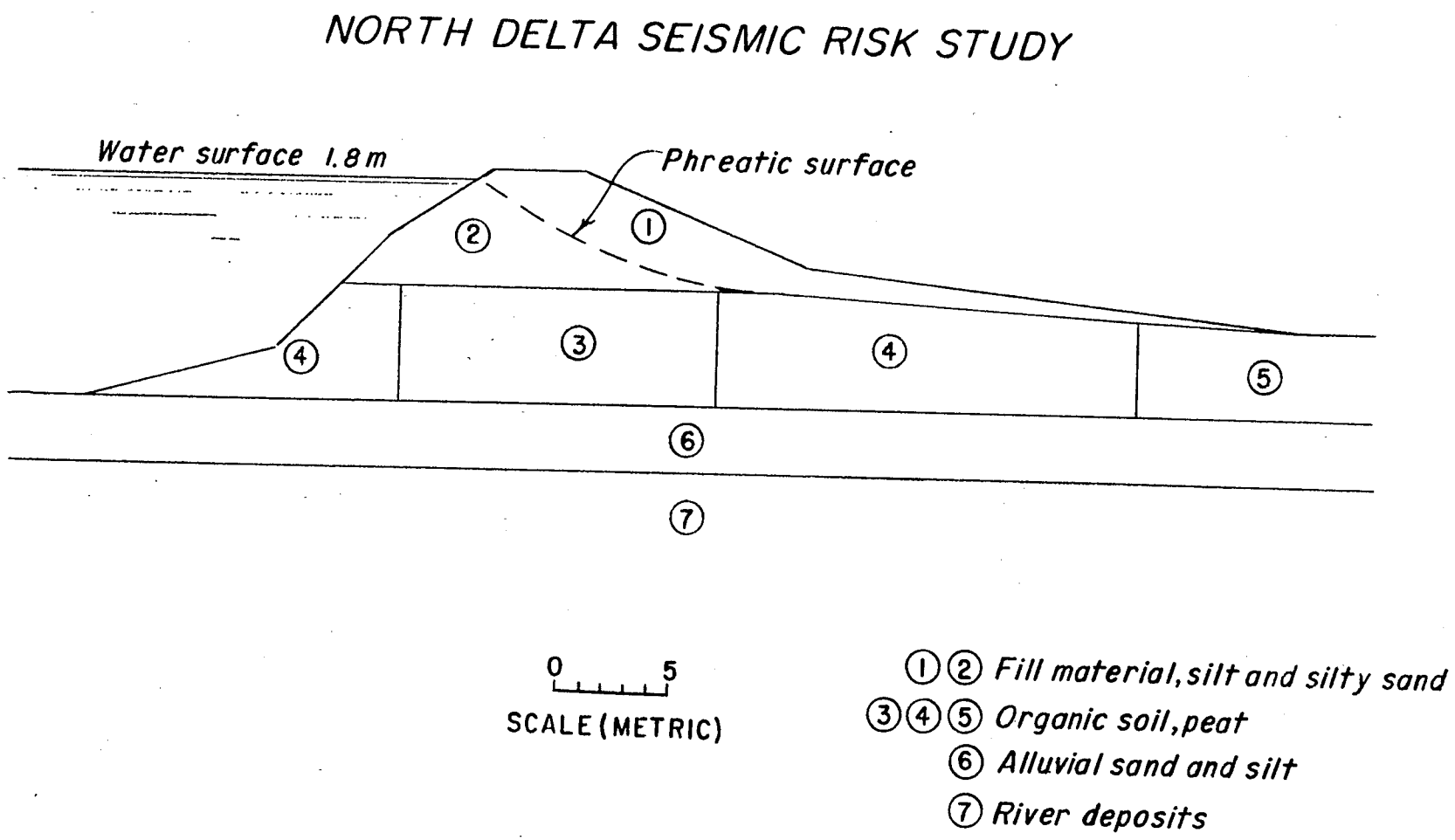

Figure 6. Less stable levee section, North Delta study area.

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Table 4 Shear strength parameters				
Soil type	Density (kg/m^3)	Friction angle (degrees)	Cohesion (kg/m^2)	Shear wave velocity (m/sec)
1. Fill soil, levee	1602	28	0	183
2a. Peat, under levee	1041	0	2440	122
2b. Peat, under slopes	1041	0	1710	122
2c. Peat, downstream	1041	0	975	122
3. Alluvium	1842	32	0	213
4. River deposits	2002	36	0	274

Note: Soils are numbered to correspond to figures 5 and 6.

3.2 Liquefaction Analysis

A simplified liquefaction analysis was performed using the procedure described by Seed and others (1983). This method uses data obtained from SPT for sites which are known to have liquefied or not liquefied during earthquakes to establish a criterion for evaluation of liquefaction potential of sandy soils. The limited data from the North Delta area made it necessary to make some assumptions regarding the distribution and characteristics of the soils in the area.

Penetration test blowcounts were available from numerous locations throughout the North Delta islands and are described in the report by the Corps of Engineers (1987). Many of the penetration resistance tests were performed using "non-standard" procedures and required corrections to correlate to "standard" SPT blowcount values. The blowcounts were corrected for overburden pressure and plotted on the curves from Seed and others (1983) to determine the available resistance to liquefaction of these soils (fig. 7). This resistance was evaluated relative to the cyclic stress ratio required to induce liquefaction for a representative magnitude 6.5 earthquake. Based on the range of magnitudes shown in table 2 (roughly 5.5 to 7.5), an earthquake with a magnitude of 6.5 was felt to best represent the average spectral content of the significant seismic sources considered in this study. A more detailed analysis would vary the earthquake magnitude analysis, using the appropriate probabilities for each. It was assumed for this study that the soil in question contained less than 5 percent fines.

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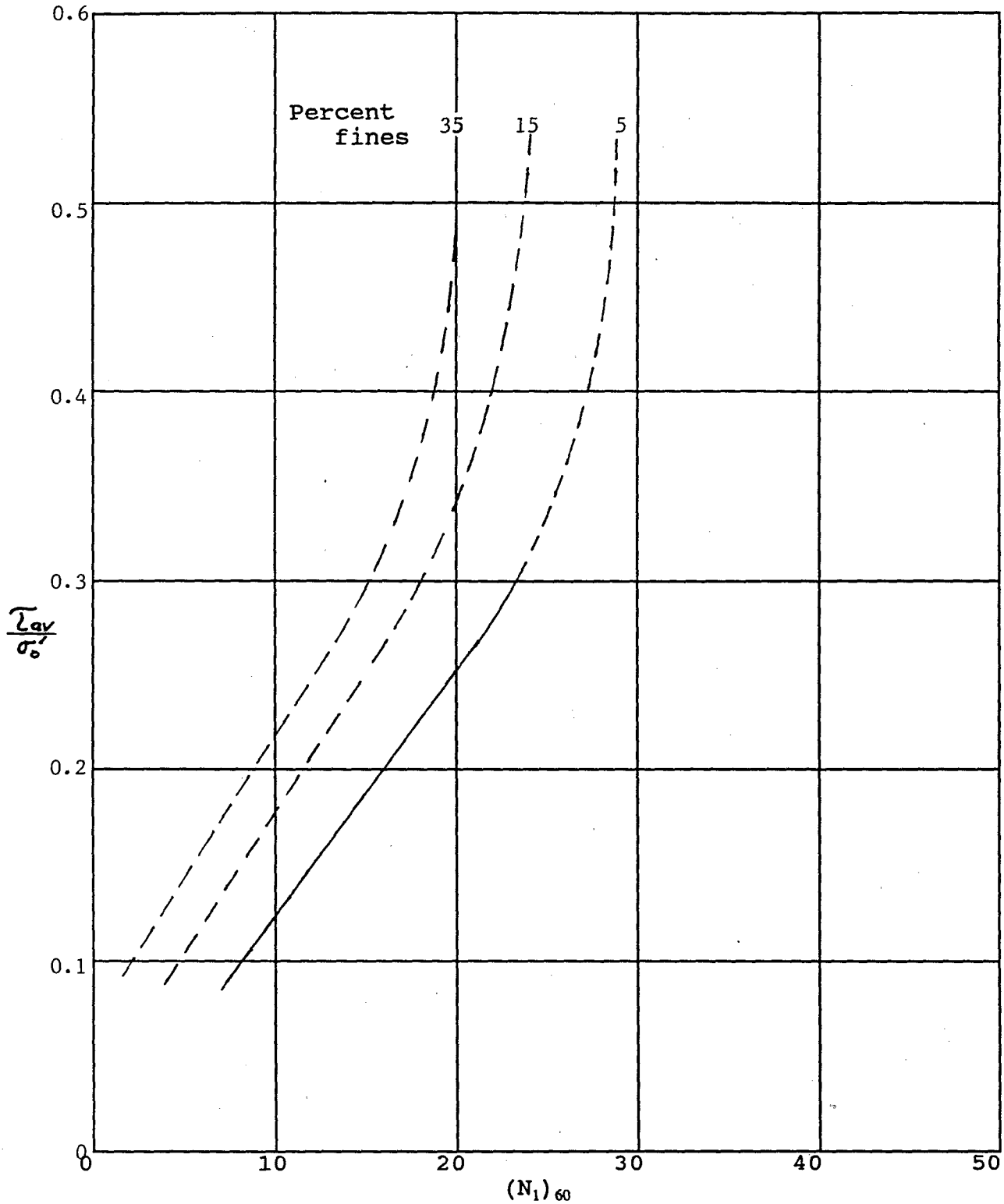

Figure 7. Relationship between stress ratio causing liquefaction and N_1-value for silty sands for M 6.5 earthquake (from Seed and Idriss, 1982).

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The cyclic stress ratio induced by the subject earthquake was determined using the computer program SHAKE. SHAKE (Schnabel and others, 1972) is used to compute the dynamic response of a horizontally layered soil system of infinite lateral extent to vertically traveling horizontal seismic waves. The program is based on the continuous solution of the one-dimensional wave equation and a Fast Fourier Transform algorithm. Nonlinear soil properties are accounted for by the use of equivalent linear soil properties with an iterative procedure to obtain values for shear modulus and damping compatible with the effective strains in each layer. Geotechnical properties required to run SHAKE include: density, shear modulus or shear wave velocity, damping, and thickness of individual layers making up the modeled system. Stresses and strains due to the earthquake motion can then be calculated for the middle of any soil layer within the system. Also, maximum accelerations and accelerograms can be computed for the top of any given layer for use in the deformation analysis. A more thorough description of the program and its uses is given in the SHAKE users' manual (Schnabel and others, 1972).

Design earthquake ground motions were synthetically generated to match the response spectrum representing a deep cohesionless soil site. The spectrum was developed as a representative model by Seed and Idriss (1982). Seismic parameters for the design earthquake (Section 2.3 and table 3) are peak acceleration of 0.15 g, and a peak velocity of 19.7 cm/sec. Additionally, although these parameters are not associated with a specific single magnitude-distance relationship, the velocity spectrum intensity is estimated to be 70 cm (Von Thun and others, 1988). The synthetic earthquake generated resulted in a peak acceleration of 0.15 g, a peak velocity of 16.3 cm/sec and velocity spectrum intensity of 72.0 cm (figs. 8 and 9).

As a comparison, an accelerogram from the 1971 San Fernando earthquake (C.I.T. No DO57) recorded on a deep soil site was also used in the SHAKE analysis. This comparison is useful for determining whether a more severe response would be computed using a natural record from site conditions comparable to those anticipated in the North Delta. The recorded peak acceleration was 0.15 g. This earthquake record has a peak velocity of 10.2 cm/s and a velocity spectrum intensity of 73.6 cm/s. The computed accelerations and stresses were slightly greater from the synthetic record, so those results were carried through in the analysis.

The cyclic stress ratio induced by the design earthquake was then compared with the cyclic stress ratio required to cause liquefaction (fig. 7) to determine whether the tested soil at each interval is liquefiable. The results are discussed in section 4.2 of this report.

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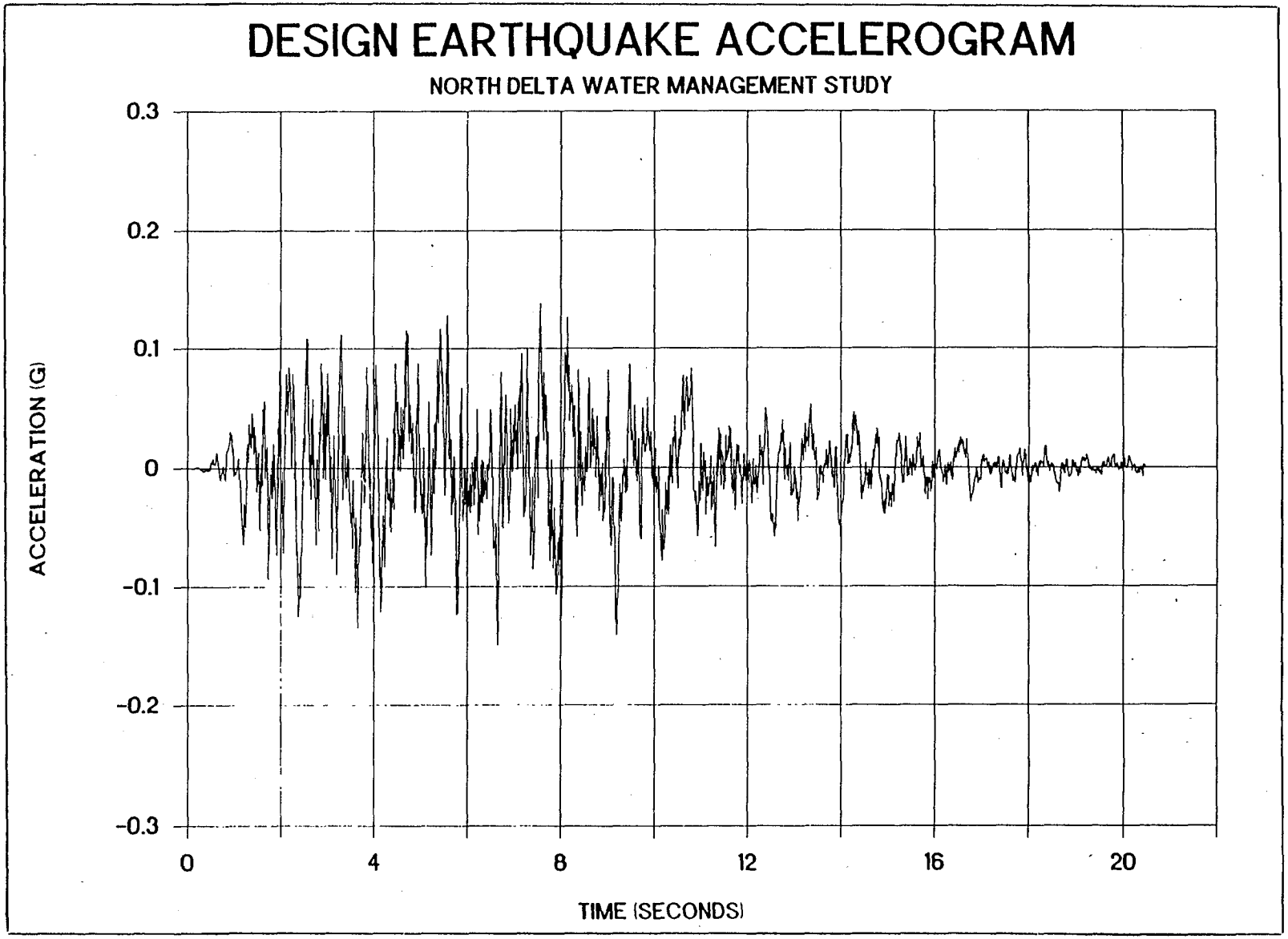

Figure 8. Design earthquake accelerogram used in analysis.

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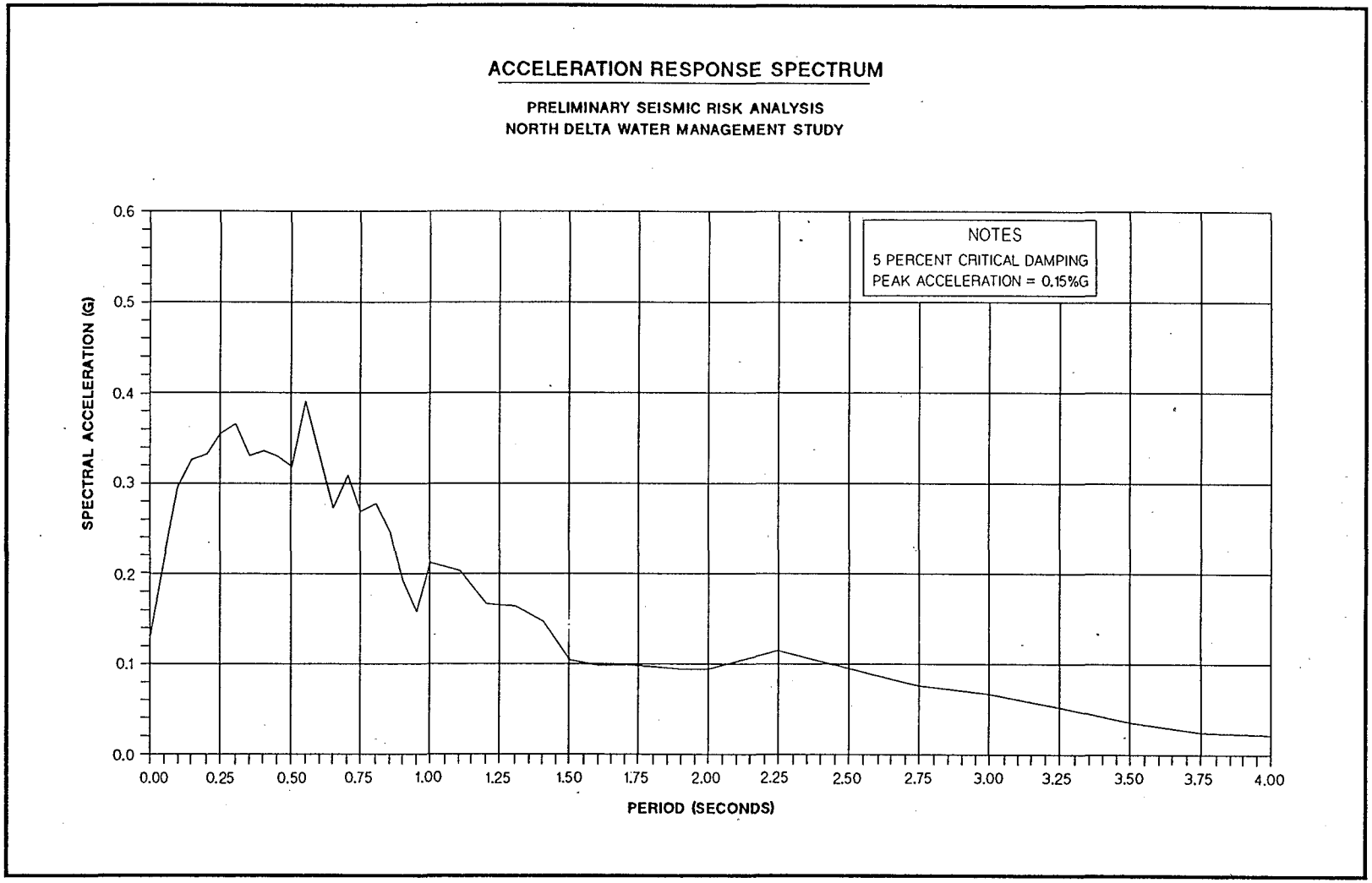

Figure 9. Acceleration response spectrum, North Delta study area.

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3.3 Deformation Analysis

Seismically-induced deformations were estimated using the computer program DYNDSP (Von Thun and Harris, 1981). This program uses the sliding block procedure developed by Newmark (1965) for estimating permanent displacements where it is assumed that slide planes develop within the mass and that the material above the slide plane behaves as a rigid body. DYNDSP combines the limit equilibrium slope stability method of Spencer and the rigid block dynamic analysis method of Newmark to compute the incremental permanent displacement in the direction of an effective angle of motion each time the earthquake loading causes the driving forces along the sliding plane to exceed the resisting forces. DYNDSP provides several enhancements over commonly used dynamic deformation calculation procedures. For example, the program updates the yield acceleration at each time step as a function of the magnitude of the horizontal and vertical earthquake components and of the pore pressures generated in the embankment. DYNDSP also has the capability of reducing shear strength parameters of the individual soil materials after a specified amount of displacement. For this analysis, the shear strengths of the levee fill soils, the sandy alluvium and the river deposits were reduced by twenty percent, to allow for an increase in pore water pressures, after the slide mass moved 0.03 m. The shear strength of the peat material was assumed to be unchanged by the seismic loading and associated deformation.

Seismically-induced displacement was computed for both the average and the less stable sections. Failure surfaces were those with the lowest static factors of safety, and in all cases were deep enough to pass through considerable portions of the peat layers and include the entire crest of the levees in the slide mass. Results of the deformation analysis are presented and discussed in section 4.2.

3.4 Settlement Analysis

Earthquake-induced settlement was estimated using a simplified procedure which uses the results of the SHAKE analysis and theoretical relationships between cyclic shear stress and volumetric strain (Dewey, 1987). Settlement due to the dynamic loads of the earthquake and settlement after the earthquake due to pore pressure dissipation and reconsolidation were both estimated. The weighted average of the maximum cyclic shear strain computed in SHAKE for both the average and the less stable sections was compared with theoretical curves (Dewey, 1987) to obtain a range of seismically-induced settlements.

The total dynamic deformation which would be expected to occur (in the absence of liquefaction) would be some combination of settlement and sliding, rather than a clear case of one or the other. Historically, earthquake effects on dams and embankments include slumping (settlement), cracking, and minor sliding along irregular failure surfaces. The total dynamic deformation of the North Delta levees (in the absence of liquefaction), as discussed in section 4.2, would be expected to be small.

4.0 FAILURE PROBABILITY ANALYSIS

The failure probability analysis was performed following a generalized approach which is applicable to a detailed analysis as well as the preliminary analysis presented here. For this preliminary analysis, however, conservative assumptions were used in defining the failure criteria. The first step in this approach was to establish criteria for failure by liquefaction and failure by non-liquefaction seismic deformation. For liquefaction, the failure probability was determined by obtaining the probability of non-exceedance of the base ground motions, then estimating the probability of exceedance (or non-exceedance) of the cyclic stresses computed by the SHAKE analysis. Next the results of the analysis were used to estimate the probability of liquefaction. For this study the probability of failure due to liquefaction was assumed to be equal to one-half of the probability of liquefaction. That is, 50 percent of the locations that were determined to have liquefiable soils were assumed to produce failure of the levee in that location.

The probability of failure due to deformation not associated with liquefaction was computed in a similar manner. First the probability of non-exceedance of the base ground motion was obtained, followed by the estimation of the probability of exceedance (or non-exceedance) of the accelerations computed in the SHAKE analysis. The deformation analysis was then completed and the probability of the resulting displacements exceeding a predefined amount was computed. Displacements exceeding this amount were said to constitute failure at that location.

4.1 Failure Criterion

Two types of earthquake-induced failure are considered to be possible; liquefaction related deformation and non-liquefaction related deformation failure. Liquefaction is considered to be most likely in the sandy, silty-sand alluvium beneath the peat layer. However, there are indications that in some areas the fill soil used to construct the levees may have a high enough sand content to be liquefiable. This is difficult to establish at this time, as standard penetration tests and soil gradations were rarely available for the levee soils. Deformation failure, not associated with liquefaction, is assumed to be most probable in locations where static factors of safety are the lowest, whether due to steeper slopes, weaker soils, or thicker peat layers.

Failure criteria have been established for both types of potential failures using conservative definitions. A more detailed analysis using high quality site-specific data is recommended for the next phase of this study. Such an analysis would provide a more refined and more confident estimate of the seismic response of the levees and foundations. Conservative assumptions considered necessary for this preliminary assessment would not be required.

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Several drill holes have been identified containing soils which are potentially liquefiable under earthquake loading. Liquefaction of any one location may or may not cause failure of the associated levee. For this study, liquefaction-related failure has been assumed to occur in one-half (50 percent) of the locations where potentially liquefiable soils are present. This assumes that 50 percent of the locations contain soils which are continuous enough to cause a broad area of liquefied soil capable of creating significant deformation of the levee. It is believed that most of the alluvial deposits contain sand lenses which are not continuous and could sustain significant strength loss without affecting the stability of a structure founded upon the soil. An important goal of an exploration program for a more refined analysis should be to determine continuity in potentially liquefiable soils.

Due to subsidence, poor design and construction, and inadequate maintenance, many of the levees in the North Delta have very little available freeboard. A relatively small amount of earthquake-induced deformation, then, could result in overtopping and failure of some portions of the levee. Deformation failure is assumed to occur if 0.3 meters of total displacement occurs, whether it be for the average section or the less stable levee section. This arbitrary definition of failure is not meant to imply that all instances of failure (0.3 m of deformation) will necessarily result in flooding. Recall that for this study there is an assumed 10-15 percent of the total levee area judged to be less stable than the model described as the "less stable" levee section. It is possible, therefore, that some sections will experience more deformation than the maximum estimated in this analysis; other sections may have less freeboard, resulting in failure after smaller amounts of deformation.

4.2. Results

4.2.1 Liquefaction Failure

The ground motion parameters postulated for the design earthquake and used in the analysis were selected to correspond to a 90 percent probability of non-exceedance in a 100-year exposure period (section 2.3). These ground motion parameters are then used in a dynamic response analysis to determine stresses and accelerations in the levee and foundation. Uncertainties in the geotechnical parameters and limitations of the analytical method used in the response analysis call for a conservative application of the computed stresses and accelerations. Densities, shear wave velocities and damping are all soil behavior parameters required as input in SHAKE. Also, shear modulus and damping versus strain curves, which are used on many different soils but are not established specifically for the North Delta soils, are used in the equivalent linear procedure within SHAKE. Only two models of the levee-foundation system are analyzed in this study, but field conditions vary widely throughout the North Delta. Since SHAKE has been used for many years and has provided generally good results for the cases where earthquakes have occurred and comparisons with models have been performed, we assume that there is a high probability that the SHAKE results are representative of what would occur due to the input ground motions. The results, however, may be either

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conservative or nonconservative. An analysis of the error introduced through this analysis should be performed as part of a more detailed analysis.

Liquefaction of Foundation Soils. One hundred nineteen drill holes with penetration resistance tests have been identified in the North Delta area (COE, 1987 and Finch, 1987). Many of the North Delta islands and levees had no drill hole data available. This is a limited amount of data for evaluating such a large area, and emphasizes the need for a comprehensive exploration program. The data has been analyzed using the Seed (1983) simplified procedure, and the results are presented as liquefaction potential for variable peak acceleration values. Liquefaction potential was evaluated for a representative magnitude 6.5 earthquake and for peak accelerations of 0.05 g, 0.10 g, 0.20 g, and greater than 0.20 g.

Thirty-four of the one hundred nineteen (29 percent) drill holes contained no identifiable soils which were determined to be potentially liquefiable. Fifteen percent of the drill holes contained soils which are determined to be liquefiable for peak accelerations of 0.05 g. An additional thirty percent of the drill holes identified soils which are expected to be liquefiable under peak accelerations equal to or greater than 0.1 g. Liquefiable soils for a peak acceleration of 0.20 g (or greater) were located in an additional 16 percent of the drill holes. A peak acceleration of greater than 0.20 g is required to cause liquefaction in the remaining 10 percent of the drill holes analyzed.

The assumed failure criteria is that failure will occur at 50 percent of the sites with potentially liquefiable soils. Based on the variation in seismic loading computed across the study area, the percentage of sites that would be expected to fail increase from northeast to southwest across the study area (figure 10). For approximately 40 percent of the North Delta area, accelerations greater than 0.1g have a 90 percent probability of non-exceedance in 100 years. Within this area, the results of this study suggest that 23-36 percent of the levee area would experience liquefaction-induced foundation failure (figure 10).

Liquefaction of Levee Fills. Investigations to date have focused on the alluvial soil in the levee foundations. The fill soils used to construct the levees are assumed to contain higher percentages of clay and be less susceptible to liquefaction. The levees are described as constructed of silty sand and clayey sand and may, in some cases, contain enough loose sandy soil to result in liquefaction failure in an earthquake. A probability of liquefaction of 5-10 percent has been assumed based on empirical information, for the levee soils. This means that for the 100-year exposure period seismic loads will equal or exceed levels required to cause liquefaction failure in 5-10 percent of the total levee area. This estimate is assumed to be independent of the foundation liquefaction probability.

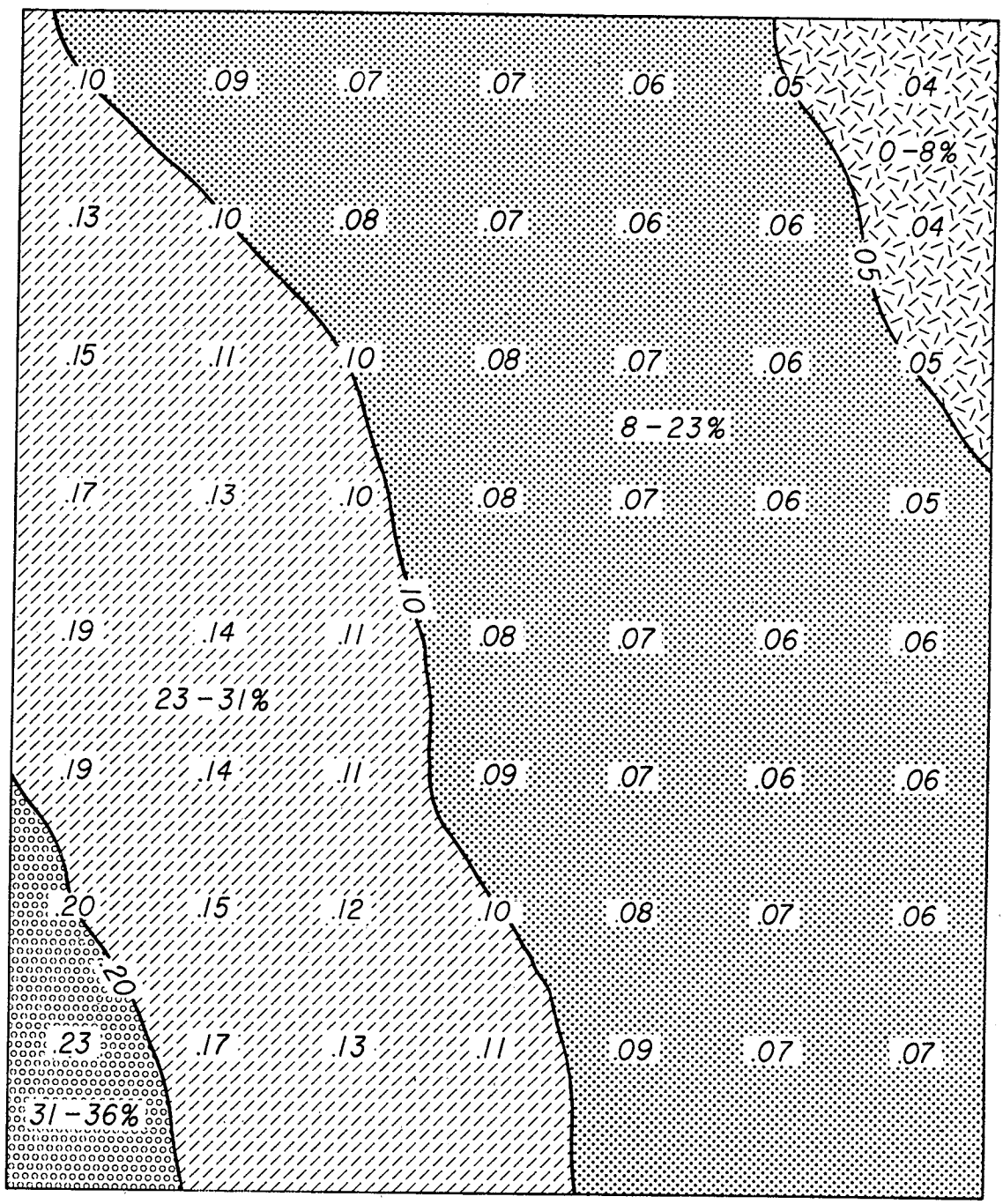

Figure 10. Liquefaction potential in the North Delta. Percentage of delta levees expected to undergo liquefaction-induced failure, based on peak acceleration values.

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4.2.2 Deformation Failure

Accelerations used in the dynamic deformation analysis were generated from the SHAKE computer runs, so they are assumed to have an 90 percent probability of non-exceedance for the 100-year exposure period. This is also assumed to be the case for the shear strains obtained from SHAKE and used in the settlement analysis.

Seismically-induced displacements, obtained from the DYNDSP analysis, are 0.0 m for the average section and 0.01 m for the less stable section. Very small displacements were computed due to the relatively low loading (peak accelerations of 0.14 g were generated in the SHAKE analysis) and due to the requirement that only failure surfaces which involve a significant portion of the crest be considered. Much more significant displacements would be expected for shallow, ravelling-type (infinite slope) surfaces, but these would not result in failure of the levees.

The simplified procedure for estimating dynamically induced settlement discussed previously (Dewey, 1987) gives a broad range within which the actual settlement experienced is expected to fall. For the average section, settlement is estimated to be from a minimum of 0.02 m to a maximum of 0.10 m. Settlement for the less stable section is estimated to range from 0.02 m to 0.12 m. The actual amount of seismically-induced settlement experienced would, of course, vary throughout the North Delta, but would most likely be less than the maximum amounts estimated. A conservative assumption would be that the maximum settlement actually experienced would be at the 75 percent point between the minimum and maximum amounts estimated. This assumes 0.08 m for the average section and 0.09 m for the less stable section.

As stated previously, the total amount of seismically-induced deformation the levees would be expected to experience would most likely be some combination of sliding displacement and settlement. Therefore, the total deformation estimated by this analysis is 0.08 m for the average section and 0.1 m for the less stable section. Deformation failure has been defined earlier as a total deformation of 0.3 m. The analysis, therefore, does not indicate that seismically-induced deformation failures are probable for the given seismic loading.

An estimated 10-15 percent of the levee area, however, is estimated to be less stable or have less freeboard than the cross section defined for this analysis as a less stable section. Displacement failures, then, are assumed to occur in about 10 percent of the total North Delta levee area. That is, for the 100-year exposure period, seismic loads are assumed to equal or exceed levels required to cause deformation failure in 10 percent of the total levee area.

5.0 CONCLUSIONS

The preliminary seismic source assessment and geotechnical analysis presented in this report clearly indicate that there is significant risk of failure due to earthquake loads in the North Delta. Numerous seismic sources with potential to affect the Delta have been identified, and a preliminary analysis shows that potentially damaging seismic loads are likely within the next 100 years. Levee failures due to overtopping and/or stability problems have been documented throughout the Delta (CDWR, 1982), indicating a significant concern regarding the long-term performance of all the Delta levees. This report presents several conclusions regarding the risk to the performance of the levees due to seismic loading. It should be emphasized that these conclusions are preliminary in nature, based on limited review of readily available data, and should serve as a model for more comprehensive investigations and analyses to follow at a later date.

The analyses discussed in this report show that:

- Significant spatial variability in peak ground motion is observed within the North Delta study area. For an exposure period of 100 years and a probability of non-exceedance of 0.9, peak accelerations vary from less than 0.05 g to 0.25 g and peak velocity varies between 10 and 20 cm/sec. These values were calculated using the SEISRISK III program and the attenuation relationships of Joyner and Boore (1981). The estimated peak acceleration is 0.1g or greater for about 40 percent of the North Delta study area.

- For the 100-year exposure period described above, the analyses indicate that the given loading conditions will induce seismic stresses in the foundation soils which will equal or exceed levels required to cause liquefaction failure over a variable portion of the levees as shown in figure 10. For the areas where peak acceleration are 0.1g or greater, approximately 23-36 percent of the levees areas meet the failure criteria.

- For the 100-year exposure period and loading, it is assumed that cyclic stresses in the levee fills will equal or exceed levels to cause 5-10 percent of the levees to fail due to liquefaction.

- Although this preliminary analysis showed no deformation failures according to the defined failure criteria, it is assumed that during the 100-year exposure period that seismic loads will equal or exceed levels required to cause deformation failure in approximately 10 percent of the total levee area.

5.1 Recommendations

A more comprehensive analysis, using additional data from field and laboratory investigations related specifically to the North Delta area would improve the confidence in the conclusions and broaden the range of application considerably. More thorough review of existing data and additional detailed studies of the most significant seismic sources in the region would permit better characterization of the probability of earthquake loadings in the North Delta area. Detailed assessment of attenuation from these sources to the North Delta area would allow more reliable description of ground

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motion characteristics for use in geotechnical analyses. These studies would allow for the detailed characterization of potential seismic loadings in the North Delta area over a wide range of probabilities and exposure periods. Additionally, the relationship between duration of strong shaking, spectral content of accelerogram, soil amplification factor, linear attenuation relationship and high-stress level damping characteristics of the near-surface materials should be investigated more fully.

For the liquefaction analysis, an exploration program consisting of standard penetration tests on levee fill and foundation soils, gradations on each interval tested, followed by crosshole shear wave velocity tests in selected locations would provide the data necessary to perform a reliable analysis of liquefaction potential. Remaining uncertainty in input seismic loads and geotechnical parameters could be evaluated by a parametric study. Completion of these analyses could provide reliable estimates of probabilities of liquefaction for areas throughout the North Delta for various seismic loading probabilities.

The deformation analysis can be refined by obtaining better data on the geotechnical parameters including density shear strength, shear strength under dynamic loading, and consolidation under dynamic loading. Seismically-induced displacements could then be computed with a higher degree of confidence for earthquakes with varying probabilities of occurrence. Laboratory tests to determine dynamic consolidation could remove much of the uncertainty in the settlement estimates. Remaining uncertainty in geotechnical parameters, particularly loss in shearing resistance due to dynamic loading, could then be evaluated by varying the shear strength parameters over a reasonable range.

It is believed that implementation of these recommendations would provide the necessary data to confidently assess the seismic risk to the North Delta levees. The risk could then be expressed as probabilities of failure for different seismic loading probabilities, with a higher degree of confidence than is presented in this preliminary analysis.

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APPENDIX A

SEISRISK III output for Site 1

Acceleration Input File

```
North Delta
0 0.
.9 1 100
.50  0 .65 0
123.0 38.5 120.5 38.5
123.00    40.00     120.50    37.00      .050
38 38 21 21
0
8 15
'jb81-ac'  8.5   8.0   7.5   7.0   6.5   6.0   5.5   5.0
  3.0   1.5107 1.1341 0.8515 0.6392 0.4799 0.3603 0.2705 0.2031
  5.0   1.3399 1.0060 0.7552 0.5670 0.4257 0.3196 0.2399 0.1801
  7.0   1.1636 0.8736 0.6558 0.4924 0.3697 0.2775 0.2083 0.1564
 10.0   0.9379 0.7042 0.5287 0.3969 0.2980 0.2237 0.1679 0.1261
 15.0   0.6788 0.5096 0.3826 0.2872 0.2156 0.1619 0.1215 0.0912
 20.0   0.5176 0.3886 0.2918 0.2190 0.1644 0.1235 0.0927 0.0696
 30.0   0.3374 0.2533 0.1902 0.1428 0.1072 0.0805 0.0604 0.0454
 40.0   0.2419 0.1816 0.1363 0.1024 0.0768 0.0577 0.0433 0.0325
 50.0   0.1837 0.1379 0.1035 0.0777 0.0584 0.0438 0.0329 0.0247
 65.0   0.1300 0.0976 0.0733 0.0550 0.0413 0.0310 0.0233 0.0175
 80.0   0.0970 0.0728 0.0547 0.0410 0.0308 0.0231 0.0174 0.0130
100.0   0.0691 0.0519 0.0390 0.0293 0.0220 0.0165 0.0124 0.0093
120.0   0.0513 0.0385 0.0289 0.0217 0.0163 0.0122 0.0092 0.0069
140.0   0.0391 0.0294 0.0220 0.0165 0.0124 0.0093 0.0070 0.0053
160.0   0.0304 0.0229 0.0172 0.0129 0.0097 0.0073 0.0055 0.0041
00 100.      2          zn01 5.0
 4  1  1
123.00 39.50 122.65 39.50
123.00 38.00 121.80 38.25
122.50 37.50 121.65 37.80
122.00 37.00 121.20 37.00
9.12 22.72
5.50  5.00
99 1.0       2          ft01-3.72  .767 .074
  9  1  1
123.00    38.30     122.9     38.2      122.65    37.9      122.6     37.8
122.4     37.6      122.35    37.5      121.95    37.15     121.9     37.1
121.7     37.0
.0033
8.000
00 1.0       2          ft02-3.72  .767 .074
  4  1  1
122.8     38.6      122.75    38.5      122.5     38.25
122.45    38.15
.0045
7.000
00 1.0       2          ft03-3.72  .767 .074
  6  1  1
122.35    38.0      122.2     37.85     122.2     37.8      121.95    37.55
121.9     37.45     121.8     37.35
.0050
7.000
00 1.0       2          ft04-3.72  .767 .074
 10  1  1
122.05    37.9      122.05    37.85     121.9     37.7      121.9     37.65
121.8     37.45     121.7     37.35     121.7     37.3      121.6     37.2
```

SOURCES

Background Seismicity

San Andreas

Healdsburg/Rodgers Creek

Hayward

Calaveras

```
121.55    37.1      121.5     37.05
.0050
7.000
00 1.0       2          ft05-3.72  .767 .074     Green Valley-Cordelia
  2  1  1
122.15    38.35     122.10    38.1
.0024
6.500
00 1.0       2          ft07-3.72  .767 .074          Concord
  3  1  1
122.1     38.05     122.0     37.95      121.95     37.85
.0031
6.500
00 1.0       2          ft08-3.72  .767 .074            Vaca
  2  1  1
122.0     38.35     121.9     38.25
.0038
6.000
00 1.0       2          ft09-3.72  .767 .074          Kirby Hill
  3  1  1
121.9     38.25     121.9     38.15     121.85    38.05
.0038
6.000
00 1.0       2          ft10-3.72  .767 .074           Antioch
  2  1  1
121.85    38.05     121.75    37.95
.0028
6.000
00 1.0       2          ft11-3.72  .767 .074           Davis
  2  1  1
121.75    37.95     121.75    37.85
.0038
6.000
00 1.0       2          ft12-3.72  .767 .074     Marsh Creek.
  2  1  1
121.9     37.95     121.75    37.8
.0010
6.500
00 1.0       2          ft13-3.72  .767 .074      /Grenville
  2  1  1
121.75    37.8      121.6     37.65
.0010
6.500
00 1.0       2          ft14-3.72  .767 .074      Arryo Mocho
  4  1  1
121.65    37.65     121.55    37.55   121.50  37.4
121.45    37.25
.0010
6.500
00 1.0       2          ft15-2.44  .566 .219     Foothills Fault Zone
 10  1  1
121.0     38.8      121.2     39.0      121.5     39.5      120.9     38.4
120.9     38.35     120.8     38.25     120.8     38.2      120.65    38.05
120.65    38.0      120.55    37.9
.0001
6.000
```

```
00 1.0        1          ft16-1.96  .497 .20
 10  1  1
122.30    39.125    122.40    39.50     121.95    38.50     121.65    38.20
121.65    38.05     121.60    38.00     121.60    37.85     121.55    37.80
121.45    37.65     121.30    37.55
.0010
6.500
00 1.0        2          ft17-3.72  .767 .074
  2  1  1
121.25    37.25     121.10    37.05
.0002
6.500
00 1.0        2          ft18-3.72  .767 .074
  2  1  1
122.95    38.8      123.00    38.875
.0014
7.500
00 1.0        2          ft19-3.72  .767 .074
  2  1  1
122.70    38.8      122.85    39.00
.0005
6.50
99
```

Coast Ranges-Sierran Boundry

Ortigalita

Maacama

Coyami

Acceleration Results

```
1North Delta
 isw=0: new run--no previous results included
 extreme probability  0.900
   for exposure times (years)   100
 scale factor for ground motion "box" levels=   0.50
 coordinates input in decimal degrees
    coordinates are printed in decimal degrees
 variability in attenuation, sigma=  0.65
 grid oriented parallel to great circle thru ( 123.00, 38.50),( 120.50, 38.50)
 corners of gridded area-upper left= 123.00,  40.00
                         lower right= 120.50,  37.00
 longitude increment= 0.0500 (decimal degrees)
 latitude increment = 0.0500 (decimal degrees)
 gridded region contains  61 rows,   40 cols including border    0 rows and cols
 for this run begin at row  38 end row  38, begin col  21 end col  21
 new coordinates (km) gridded area
       upper left=   215.56    -4.92; lower right=   166.96  -166.96
 sites are also located on   0 line(s)
 attenuation function jb81-ac
                              magnitude
   dist(km)    8.50      8.00      7.50      7.00      6.50      6.00      5.50      5.00
       3.00   1.51070   1.13410   0.85150   0.63920   0.47990   0.36030   0.27050   0.20310
       5.00   1.33990   1.00600   0.75520   0.56700   0.42570   0.31960   0.23990   0.18010
       7.00   1.16360   0.87360   0.65580   0.49240   0.36970   0.27750   0.20830   0.15640
      10.00   0.93790   0.70420   0.52870   0.39690   0.29800   0.22370   0.16790   0.12610
      15.00   0.67880   0.50960   0.38260   0.28720   0.21560   0.16190   0.12150   0.09120
      20.00   0.51760   0.38860   0.29180   0.21900   0.16440   0.12350   0.09270   0.06960
      30.00   0.33740   0.25330   0.19020   0.14280   0.10720   0.08050   0.06040   0.04540
      40.00   0.24190   0.18160   0.13630   0.10240   0.07680   0.05770   0.04330   0.03250
      50.00   0.18370   0.13790   0.10350   0.07770   0.05840   0.04380   0.03290   0.02470
      65.00   0.13000   0.09760   0.07330   0.05500   0.04130   0.03100   0.02330   0.01750
      80.00   0.09700   0.07280   0.05470   0.04100   0.03080   0.02310   0.01740   0.01300
     100.00   0.06910   0.05190   0.03900   0.02930   0.02200   0.01650   0.01240   0.00930
     120.00   0.05130   0.03850   0.02890   0.02170   0.01630   0.01220   0.00920   0.00690
     140.00   0.03910   0.02940   0.02200   0.01650   0.01240   0.00930   0.00700   0.00530
     160.00   0.03040   0.02290   0.01720   0.01290   0.00970   0.00730   0.00550   0.00410
0yrnoc=   100. iprint= 2 for area zn01
    123.000    39.500   122.650    39.500
    123.000    38.000   121.800    38.250
    122.500    37.500   121.650    37.800
    122.000    37.000   121.200    37.000
 nr of levels of seismicity =  2
 zn01 beta=  2.4201
 before normalizing to rate/year
 occurrences=  2.720000  9.122000
 earthquake rate / year
 occurrences=  0.027200  0.091220
  magnitudes=       5.00       5.50
 zn01 area=   22462. sq km, rate/sq km=  .12110E-05 for mags  4.75- 5.25
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault= 9999.998 km
          zero attenuation variability                    variability in atten, sigma= 0.65
    g.m.   occ/yr    exc/yr  r(events) r(yrs)      g.m.   occ/yr    exc/yr  r(events) r(yrs)
     0.01  0.03239  0.08644     1.4    11.6         0.01  0.03975  0.07908     1.5    12.6
     0.02  0.05204  0.03440     3.5    29.1         0.02  0.03540  0.04368     2.7    22.9
```

C-071778

C—071778

0.03	0.01653	0.01787	6.6	56.0	0.03	0.01722	0.02646	4.5	37.8
0.04	0.00716	0.01071	11.1	93.4	0.04	0.00898	0.01748	6.8	57.2
0.05	0.00366	0.00705	16.9	141.9	0.05	0.00518	0.01230	9.7	81.3
0.06	0.00226	0.00478	24.8	209.0	0.06	0.00324	0.00906	13.1	110.4
0.07	0.00132	0.00347	34.3	288.6	0.07	0.00216	0.00690	17.2	144.9
0.08	0.00094	0.00252	47.1	396.2	0.08	0.00151	0.00539	22.0	185.4
0.09	0.00071	0.00181	65.7	552.6	0.09	0.00109	0.00430	27.6	232.5
0.10	0.00047	0.00134	88.8	747.2	0.10	0.00081	0.00349	34.1	286.8
0.11	0.00035	0.00099	120.1	1010.6	0.11	0.00062	0.00287	41.5	349.0
0.12	0.00028	0.00071	166.7	1402.5	0.12	0.00048	0.00238	49.9	420.0
0.13	0.00019	0.00052	228.5	1922.9	0.13	0.00038	0.00200	59.5	500.6
0.14	0.00015	0.00037	319.9	2692.2	0.14	0.00031	0.00169	70.3	591.8
0.15	0.00011	0.00026	462.6	3893.2	0.15	0.00025	0.00144	82.5	694.4
0.16	0.00009	0.00017	697.1	5866.8	0.16	0.00020	0.00124	96.2	809.6
0.17	0.00006	0.00011	1095.4	9218.5	0.17	0.00017	0.00107	111.5	938.5
0.18	0.00004	0.00007	1789.8	15062.3	0.18	0.00014	0.00092	128.6	1082.4
0.19	0.00003	0.00004	3297.0	27745.4	0.19	0.00012	0.00080	147.6	1242.5
0.20	0.00002	0.00002	7543.5	63481.5	0.20	0.00010	0.00070	168.8	1420.2
0.21	0.00001	0.00000	28892.8	99999.9	0.21	0.00009	0.00062	192.1	1617.0
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00007	0.00055	218.0	1834.4
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00006	0.00048	246.5	2074.3
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00005	0.00043	277.9	2338.3
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00005	0.00038	312.3	2628.3
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00004	0.00034	350.0	2945.8
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00004	0.00030	391.4	3293.5
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00003	0.00027	436.5	3673.5
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00003	0.00024	485.8	4088.2
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00002	0.00022	539.5	4540.2
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00002	0.00020	598.0	5032.2
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00002	0.00018	661.5	5566.8
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00002	0.00016	730.5	6147.3
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00002	0.00015	805.2	6776.6
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00001	0.00013	886.2	7458.1
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00001	0.00012	973.8	8195.3
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00001	0.00011	1068.5	8991.9
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00001	0.00010	1170.7	9851.8
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00001	0.00009	1280.9	10779.1
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00001	0.00008	1399.6	11778.1
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00001	0.00008	1527.3	12853.4
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00001	0.00007	1664.8	14009.7
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00001	0.00007	1812.4	15252.2
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00001	0.00006	1970.5	16582.5
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00000	0.00006	2140.0	18009.1
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00000	0.00005	2321.6	19537.8
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00000	0.00005	2516.2	21174.7
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00000	0.00004	2724.3	22926.2
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00000	0.00004	2946.8	24798.7
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00000	0.00004	3184.5	26799.5
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00001	0.00003	4749.2	39967.2
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00001	0.00002	6929.5	58314.8
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00001	0.00001	9907.2	83374.1
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00000	0.00001	13931.5	99999.9
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00000	0.00001	19305.8	99999.9
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00000	0.00000	26409.4	99999.9
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00000	0.00000	35659.7	99999.9
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00000	0.00000	47652.9	99999.9

C-071779

C-071779

0.98	0.00000	0.00000	99999.9	99999.9		0.98	0.00000	0.00000	63093.0	99999.9
1.03	0.00000	0.00000	99999.9	99999.9		1.03	0.00000	0.00000	82663.2	99999.9
1.09	0.00000	0.00000	99999.9	99999.9		1.09	0.00000	0.00000	99999.9	99999.9
total yearly events		0.11883				total yearly events		0.11883		

zero attenuation variability — variability in atten, sigma=0.65

0.900 ext prob = 0.108 for 100 years — 0.171 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 . 1.00

0yrnoc= 1. iprint= 2 for area ft01

Distance between dummy faults= 0.0

fault 1 of 1

123.00 38.30, 122.90 38.20, 122.65 37.90, 122.60 37.80,
122.40 37.60, 122.35 37.50, 121.95 37.15, 121.90 37.10,
121.70 37.00,

nr of levels of seismicity = 1

ft01 beta= -2.0000

earthquake rate / year

occurrences= 0.003300

magnitudes= 8.00

fault rupture length parameters al= -3.720 bl= 0.767 sigl= 0.07

1North Delta

site at long 121.697, lat 38.156

shortest dist to fault= 86.876 km

zero attenuation variability — variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.08974	1.4	11.1	0.01	0.03976	0.08237	1.5	12.1
0.02	0.05204	0.03770	3.2	26.5	0.02	0.03554	0.04683	2.6	21.4
0.03	0.01653	0.02117	5.8	47.2	0.03	0.01754	0.02929	4.2	34.1
0.04	0.00716	0.01401	8.7	71.4	0.04	0.00938	0.01991	6.1	50.2
0.05	0.00366	0.01035	11.8	96.6	0.05	0.00558	0.01434	8.5	69.8
0.06	0.00386	0.00649	18.8	154.0	0.06	0.00360	0.01074	11.4	93.2
0.07	0.00264	0.00385	31.7	259.5	0.07	0.00246	0.00827	14.8	120.9
0.08	0.00133	0.00252	48.4	396.2	0.08	0.00176	0.00651	18.8	153.6
0.09	0.00071	0.00181	67.5	552.6	0.09	0.00130	0.00521	23.4	191.9
0.10	0.00047	0.00134	91.3	747.2	0.10	0.00098	0.00423	28.9	236.4
0.11	0.00035	0.00099	123.4	1010.6	0.11	0.00076	0.00347	35.2	288.0
0.12	0.00028	0.00071	171.3	1402.5	0.12	0.00059	0.00288	42.4	347.3
0.13	0.00019	0.00052	234.8	1922.9	0.13	0.00047	0.00241	50.7	415.3
0.14	0.00015	0.00037	328.8	2692.2	0.14	0.00038	0.00203	60.2	492.8
0.15	0.00011	0.00026	475.5	3893.2	0.15	0.00031	0.00172	70.9	580.9
0.16	0.00009	0.00017	716.5	5866.8	0.16	0.00025	0.00147	83.1	680.5
0.17	0.00006	0.00011	1125.8	9218.5	0.17	0.00021	0.00126	96.8	792.8
0.18	0.00004	0.00007	1839.5	15062.3	0.18	0.00017	0.00109	112.2	918.9
0.19	0.00003	0.00004	3388.5	27745.4	0.19	0.00015	0.00094	129.5	1060.2
0.20	0.00002	0.00002	7753.0	63481.5	0.20	0.00012	0.00082	148.7	1217.9
0.21	0.00001	0.00000	29695.2	99999.9	0.21	0.00010	0.00072	170.2	1393.7
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00009	0.00063	194.0	1588.8
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00008	0.00055	220.5	1805.1
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00006	0.00049	249.7	2044.3
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00006	0.00043	281.9	2308.2
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00005	0.00038	317.3	2598.3
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00004	0.00034	356.3	2917.1
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00004	0.00031	399.0	3266.9
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00003	0.00027	445.7	3649.8
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00003	0.00025	496.9	4068.5
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00002	0.00022	552.7	4525.5

C-071780

C-071780

0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00002	0.00020	613.5	5023.6
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00002	0.00018	679.7	5565.7
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00002	0.00016	751.7	6155.0
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00002	0.00015	829.8	6794.6
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00001	0.00013	914.5	7488.0
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00001	0.00012	1006.2	8238.8
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00001	0.00011	1105.4	9051.0
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00001	0.00010	1212.5	9928.4
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00001	0.00009	1328.2	10875.5
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00001	0.00008	1452.9	11896.6
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00001	0.00008	1587.2	12996.5
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00001	0.00007	1731.8	14180.1
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00001	0.00006	1886.8	15449.6
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00001	0.00006	2053.3	16813.0
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00000	0.00005	2232.0	18276.0
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00000	0.00005	2423.6	19844.5
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00000	0.00005	2628.8	21525.0
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00000	0.00004	2848.5	23323.9
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00000	0.00004	3083.5	25248.1
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00001	0.00003	4635.7	37957.5
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00001	0.00002	6809.3	55755.5
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00001	0.00001	9791.7	80175.9
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00000	0.00001	13838.3	99999.9
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00000	0.00001	19262.7	99999.9
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00000	0.00000	26459.4	99999.9
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00000	0.00000	35869.5	99999.9
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00000	0.00000	48122.6	99999.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00000	63975.0	99999.9
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00000	84053.8	99999.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00000	99999.9	99999.9

total yearly events 0.12213 total yearly events 0.12213

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.108 for 100 years 0.182 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft02
 Distance between dummy faults=  0.0
 fault  1 of  1
    122.80   38.60,    122.75   38.50,    122.50   38.25,    122.45   38.15,
 nr of levels of seismicity =  1
 ft02 beta= -2.0000
 earthquake rate / year
 occurrences=  0.004500
  magnitudes=      7.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   65.999 km
```

zero attenuation variability variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.09424	1.3	10.6	0.01	0.03979	0.08684	1.5	11.5
0.02	0.05204	0.04220	3.0	23.7	0.02	0.03585	0.05099	2.5	19.6
0.03	0.01653	0.02567	4.9	39.0	0.03	0.01812	0.03287	3.9	30.4
0.04	0.00716	0.01851	6.8	54.0	0.04	0.01003	0.02284	5.5	43.8
0.05	0.00503	0.01348	9.4	74.2	0.05	0.00617	0.01667	7.6	60.0
0.06	0.00699	0.00649	19.5	154.0	0.06	0.00410	0.01257	10.1	79.5

C-071781

C—071781

0.07	0.00264	0.00385	32.9	259.5	0.07	0.00286	0.00971	13.0	103.0
0.08	0.00133	0.00252	50.2	396.2	0.08	0.00207	0.00764	16.6	130.9
0.09	0.00071	0.00181	70.0	552.6	0.09	0.00154	0.00610	20.8	163.9
0.10	0.00047	0.00134	94.6	747.2	0.10	0.00117	0.00493	25.7	202.8
0.11	0.00035	0.00099	128.0	1010.6	0.11	0.00090	0.00403	31.4	248.2
0.12	0.00028	0.00071	177.6	1402.5	0.12	0.00071	0.00332	38.1	300.9
0.13	0.00019	0.00052	243.5	1922.9	0.13	0.00056	0.00276	45.8	361.8
0.14	0.00015	0.00037	340.9	2692.2	0.14	0.00045	0.00232	54.7	431.7
0.15	0.00011	0.00026	493.0	3893.2	0.15	0.00036	0.00195	64.8	511.8
0.16	0.00009	0.00017	742.9	5866.8	0.16	0.00030	0.00166	76.3	602.8
0.17	0.00006	0.00011	1167.3	9218.5	0.17	0.00024	0.00142	89.4	706.1
0.18	0.00004	0.00007	1907.3	15062.3	0.18	0.00020	0.00122	104.2	822.7
0.19	0.00003	0.00004	3513.4	27745.4	0.19	0.00017	0.00105	120.8	954.0
0.20	0.00002	0.00002	8038.6	63481.5	0.20	0.00014	0.00091	139.4	1101.2
0.21	0.00001	0.00000	30789.3	99999.9	0.21	0.00012	0.00079	160.3	1265.9
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00010	0.00069	183.5	1449.5
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00009	0.00060	209.4	1653.7
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00007	0.00053	238.1	1880.2
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00006	0.00047	269.8	2130.8
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00005	0.00042	304.8	2407.2
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00005	0.00037	343.4	2711.7
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00004	0.00033	385.8	3046.5
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00004	0.00029	432.3	3414.0
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00003	0.00026	483.3	3816.5
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00003	0.00023	539.0	4256.7
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00002	0.00021	599.9	4737.4
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00002	0.00019	666.2	5261.5
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00002	0.00017	738.5	5831.9
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00002	0.00015	817.0	6452.1
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00001	0.00014	902.3	7125.4
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00001	0.00013	994.7	7855.4
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00001	0.00012	1094.8	8646.0
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00001	0.00011	1203.1	9501.2
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00001	0.00010	1320.1	10425.2
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00001	0.00009	1446.4	11422.4
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00001	0.00008	1582.6	12497.7
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00001	0.00007	1729.2	13656.0
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00001	0.00007	1886.7	14899.5
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00001	0.00006	2056.0	16236.1
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00001	0.00006	2237.7	17671.6
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00000	0.00005	2432.8	19211.8
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00000	0.00005	2641.9	20863.1
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00000	0.00004	2865.9	22632.0
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00000	0.00004	3105.6	24525.5
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00001	0.00003	4692.5	37057.5
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00001	0.00002	6921.4	54659.1
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00001	0.00001	9988.1	78877.1
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00000	0.00001	14159.7	99999.9
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00000	0.00001	19767.0	99999.9
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00000	0.00000	27228.4	99999.9
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00000	0.00000	36998.1	99999.9
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00000	0.00000	49759.5	99999.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00000	66332.1	99999.9
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00000	87150.9	99999.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00000	99999.9	99999.9

total yearly events 0.12663 total yearly events 0.12663

C-071782

C—071782

```
        zero attenuation variability                    variability in atten, sigma=0.65
    0.900 ext prob =  0.108 for   100 years                     0.190 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft03
 Distance between dummy faults=  0.0
 fault  1 of  1
    122.35   38.00,    122.20   37.85,    122.20   37.80,    121.95   37.55,
    121.90   37.45,    121.80   37.35,
 nr of levels of seismicity =  1
 ft03 beta= -2.0000
 earthquake rate / year
 occurrences=  0.005000
  magnitudes=      7.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   55.846 km
        zero attenuation variability                    variability in atten, sigma= 0.65
```

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.09924	1.3	10.1	0.01	0.03980	0.09183	1.4	10.9
0.02	0.05204	0.04720	2.8	21.2	0.02	0.03604	0.05579	2.4	17.9
0.03	0.01653	0.03067	4.3	32.6	0.03	0.01857	0.03722	3.5	26.9
0.04	0.00716	0.02351	5.6	42.5	0.04	0.01061	0.02662	4.9	37.6
0.05	0.00503	0.01848	7.1	54.1	0.05	0.00676	0.01986	6.6	50.4
0.06	0.00828	0.01020	12.9	98.0	0.06	0.00463	0.01522	8.6	65.7
0.07	0.00583	0.00437	30.1	228.7	0.07	0.00333	0.01189	11.1	84.1
0.08	0.00182	0.00255	51.6	392.4	0.08	0.00246	0.00943	14.0	106.0
0.09	0.00074	0.00181	72.7	552.6	0.09	0.00186	0.00757	17.4	132.1
0.10	0.00047	0.00134	98.4	747.2	0.10	0.00143	0.00614	21.4	162.9
0.11	0.00035	0.00099	133.0	1010.6	0.11	0.00112	0.00502	26.2	199.2
0.12	0.00028	0.00071	184.6	1402.5	0.12	0.00088	0.00414	31.8	241.5
0.13	0.00019	0.00052	253.1	1922.9	0.13	0.00070	0.00344	38.3	290.7
0.14	0.00015	0.00037	354.4	2692.2	0.14	0.00056	0.00288	45.8	347.6
0.15	0.00011	0.00026	512.5	3893.2	0.15	0.00046	0.00242	54.4	413.0
0.16	0.00009	0.00017	772.2	5866.8	0.16	0.00037	0.00205	64.2	488.0
0.17	0.00006	0.00011	1213.4	9218.5	0.17	0.00031	0.00174	75.5	573.6
0.18	0.00004	0.00007	1982.6	15062.3	0.18	0.00025	0.00149	88.3	670.8
0.19	0.00003	0.00004	3652.1	27745.4	0.19	0.00021	0.00128	102.8	780.9
0.20	0.00002	0.00002	8356.0	63481.5	0.20	0.00018	0.00110	119.1	905.1
0.21	0.00001	0.00000	32005.1	99999.9	0.21	0.00015	0.00096	137.5	1044.8
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00012	0.00083	158.1	1201.4
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00011	0.00073	181.2	1376.4
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00009	0.00064	206.9	1571.6
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00008	0.00056	235.4	1788.7
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00007	0.00049	267.1	2029.3
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00006	0.00044	302.2	2295.5
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00005	0.00039	340.9	2589.6
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00004	0.00034	383.5	2913.7
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00004	0.00031	430.4	3270.1
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00003	0.00027	481.9	3661.4
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00003	0.00024	538.4	4090.3
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00003	0.00022	600.2	4559.6
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00002	0.00020	667.6	5072.2
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00002	0.00018	741.2	5631.3
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00002	0.00016	821.4	6240.2

C-071783

C-071783

0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00002	0.00014	908.6	6902.4
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00001	0.00013	1003.2	7621.7
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00001	0.00012	1105.9	8401.8
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00001	0.00011	1217.2	9247.1
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00001	0.00010	1337.6	10161.7
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00001	0.00009	1467.7	11150.3
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00001	0.00008	1608.2	12217.7
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00001	0.00007	1759.4	13366.7
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00001	0.00007	1922.4	14604.5
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00001	0.00006	2097.7	15936.6
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00001	0.00006	2286.2	17368.9
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00000	0.00005	2488.8	18907.5
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00000	0.00005	2706.1	20558.9
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00000	0.00004	2939.2	22329.9
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00002	0.00003	4490.9	34117.8
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00001	0.00002	6687.8	50808.2
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00001	0.00001	9732.9	73942.4
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00000	0.00001	13901.8	99999.9
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00000	0.00001	19539.1	99999.9
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00000	0.00000	27085.3	99999.9
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00000	0.00000	37031.1	99999.9
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00000	0.00000	50110.5	99999.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00000	67226.5	99999.9
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00000	88833.6	99999.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00000	99999.9	99999.9

total yearly events 0.13163 total yearly events 0.13163

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.108 for 100 years 0.203 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft04
 Distance between dummy faults=  0.0
 fault  1 of  1
     122.05   37.90,    122.05   37.85,    121.90   37.70,    121.90   37.65,
    121.80   37.45,    121.70   37.35,    121.70   37.30,    121.60   37.20,
    121.55   37.10,    121.50   37.05,
 nr of levels of seismicity =  1
 ft04 beta= -2.0000
 earthquake rate / year
 occurrences=  0.005000
  magnitudes=      7.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   42.175 km
```

zero attenuation variability variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.10424	1.3	9.6	0.01	0.03983	0.09680	1.4	10.3
0.02	0.05204	0.05220	2.6	19.2	0.02	0.03630	0.06049	2.3	16.5
0.03	0.01653	0.03567	3.8	28.0	0.03	0.01907	0.04143	3.3	24.1
0.04	0.00758	0.02809	4.9	35.6	0.04	0.01118	0.03025	4.5	33.1
0.05	0.00602	0.02207	6.2	45.3	0.05	0.00732	0.02293	6.0	43.6
0.06	0.00911	0.01296	10.5	77.2	0.06	0.00513	0.01780	7.7	56.2
0.07	0.00642	0.00654	20.9	152.9	0.07	0.00375	0.01404	9.7	71.2
0.08	0.00273	0.00381	35.9	262.5	0.08	0.00282	0.01122	12.2	89.1
0.09	0.00172	0.00209	65.4	478.3	0.09	0.00216	0.00906	15.1	110.4

C-071784

C—071784

0.10	0.00075	0.00134	102.1	747.2
0.11	0.00035	0.00099	138.1	1010.6
0.12	0.00028	0.00071	191.6	1402.5
0.13	0.00019	0.00052	262.7	1922.9
0.14	0.00015	0.00037	367.8	2692.2
0.15	0.00011	0.00026	531.9	3893.2
0.16	0.00009	0.00017	801.6	5866.8
0.17	0.00006	0.00011	1259.5	9218.5
0.18	0.00004	0.00007	2057.9	15062.3
0.19	0.00003	0.00004	3790.8	27745.4
0.20	0.00002	0.00002	8673.4	63481.5
0.21	0.00001	0.00000	33220.8	99999.9
0.22	0.00000	0.00000	99999.9	99999.9
0.23	0.00000	0.00000	99999.9	99999.9
0.24	0.00000	0.00000	99999.9	99999.9
0.25	0.00000	0.00000	99999.9	99999.9
0.26	0.00000	0.00000	99999.9	99999.9
0.27	0.00000	0.00000	99999.9	99999.9
0.28	0.00000	0.00000	99999.9	99999.9
0.29	0.00000	0.00000	99999.9	99999.9
0.30	0.00000	0.00000	99999.9	99999.9
0.31	0.00000	0.00000	99999.9	99999.9
0.32	0.00000	0.00000	99999.9	99999.9
0.33	0.00000	0.00000	99999.9	99999.9
0.34	0.00000	0.00000	99999.9	99999.9
0.35	0.00000	0.00000	99999.9	99999.9
0.36	0.00000	0.00000	99999.9	99999.9
0.37	0.00000	0.00000	99999.9	99999.9
0.38	0.00000	0.00000	99999.9	99999.9
0.39	0.00000	0.00000	99999.9	99999.9
0.40	0.00000	0.00000	99999.9	99999.9
0.41	0.00000	0.00000	99999.9	99999.9
0.42	0.00000	0.00000	99999.9	99999.9
0.43	0.00000	0.00000	99999.9	99999.9
0.44	0.00000	0.00000	99999.9	99999.9
0.45	0.00000	0.00000	99999.9	99999.9
0.46	0.00000	0.00000	99999.9	99999.9
0.47	0.00000	0.00000	99999.9	99999.9
0.48	0.00000	0.00000	99999.9	99999.9
0.49	0.00000	0.00000	99999.9	99999.9
0.50	0.00000	0.00000	99999.9	99999.9
0.55	0.00000	0.00000	99999.9	99999.9
0.61	0.00000	0.00000	99999.9	99999.9
0.66	0.00000	0.00000	99999.9	99999.9
0.71	0.00000	0.00000	99999.9	99999.9
0.77	0.00000	0.00000	99999.9	99999.9
0.82	0.00000	0.00000	99999.9	99999.9
0.87	0.00000	0.00000	99999.9	99999.9
0.93	0.00000	0.00000	99999.9	99999.9
0.98	0.00000	0.00000	99999.9	99999.9
1.03	0.00000	0.00000	99999.9	99999.9
1.09	0.00000	0.00000	99999.9	99999.9

total yearly events 0.13663

zero attenuation variability
0.900 ext prob = 0.108 for 100 years

0.10	0.00168	0.00738	18.5	135.4
0.11	0.00132	0.00606	22.5	164.9
0.12	0.00105	0.00502	27.2	199.4
0.13	0.00084	0.00418	32.7	239.4
0.14	0.00068	0.00350	39.0	285.7
0.15	0.00055	0.00295	46.3	339.1
0.16	0.00045	0.00250	54.7	400.4
0.17	0.00037	0.00213	64.3	470.4
0.18	0.00031	0.00182	75.2	550.0
0.19	0.00026	0.00156	87.5	640.4
0.20	0.00021	0.00135	101.5	742.6
0.21	0.00018	0.00117	117.2	857.8
0.22	0.00015	0.00101	134.9	987.2
0.23	0.00013	0.00088	154.7	1132.2
0.24	0.00011	0.00077	176.8	1294.3
0.25	0.00009	0.00068	201.5	1475.0
0.26	0.00008	0.00060	229.0	1675.9
0.27	0.00007	0.00053	259.4	1898.7
0.28	0.00006	0.00047	293.1	2145.4
0.29	0.00005	0.00041	330.4	2418.0
0.30	0.00005	0.00037	371.4	2718.6
0.31	0.00004	0.00033	416.7	3049.6
0.32	0.00003	0.00029	466.3	3413.1
0.33	0.00003	0.00026	520.8	3812.0
0.34	0.00003	0.00024	580.5	4248.7
0.35	0.00002	0.00021	645.7	4726.2
0.36	0.00002	0.00019	717.0	5247.6
0.37	0.00002	0.00017	794.6	5816.0
0.38	0.00002	0.00016	879.2	6434.8
0.39	0.00001	0.00014	971.1	7107.6
0.40	0.00001	0.00013	1070.9	7838.2
0.41	0.00001	0.00012	1179.2	8630.6
0.42	0.00001	0.00011	1296.5	9489.0
0.43	0.00001	0.00010	1423.4	10417.8
0.44	0.00001	0.00009	1560.3	11420.2
0.45	0.00001	0.00008	1708.2	12502.3
0.46	0.00001	0.00007	1867.6	13669.3
0.47	0.00001	0.00007	2039.4	14926.7
0.48	0.00001	0.00006	2224.3	16280.1
0.49	0.00001	0.00006	2423.2	17735.7
0.50	0.00000	0.00005	2636.9	19299.7
0.55	0.00002	0.00003	4068.0	29774.3
0.61	0.00001	0.00002	6113.0	44742.0
0.66	0.00001	0.00002	8972.1	65668.3
0.71	0.00000	0.00001	12916.7	94538.9
0.77	0.00000	0.00001	18289.1	99999.9
0.82	0.00000	0.00001	25529.8	99999.9
0.87	0.00000	0.00000	35131.5	99999.9
0.93	0.00000	0.00000	47838.4	99999.9
0.98	0.00000	0.00000	64574.7	99999.9
1.03	0.00000	0.00000	85844.4	99999.9
1.09	0.00000	0.00000	99999.9	99999.9

total yearly events 0.13663

variability in atten, sigma=0.65
0.217 for 100 years

C-071785

C—071785

```
  ratio  100 yr 0.900 extreme value to  100 yr val        =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft05
 Distance between dummy faults=  0.0
 fault  1 of  1
     122.15   38.35,    122.10   38.10,
 nr of levels of seismicity =  1
 ft05 beta= -2.0000
 earthquake rate / year
 occurrences=  0.002400
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   35.935 km
```

zero attenuation variability					variability in atten, sigma= 0.65				
g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.10664	1.3	9.4	0.01	0.03983	0.09920	1.4	10.1
0.02	0.05204	0.05460	2.5	18.3	0.02	0.03633	0.06286	2.2	15.9
0.03	0.01653	0.03807	3.7	26.3	0.03	0.01917	0.04370	3.2	22.9
0.04	0.00758	0.03049	4.6	32.8	0.04	0.01135	0.03235	4.3	30.9
0.05	0.00602	0.02447	5.7	40.9	0.05	0.00752	0.02483	5.6	40.3
0.06	0.00911	0.01536	9.1	65.1	0.06	0.00535	0.01948	7.1	51.3
0.07	0.00642	0.00894	15.6	111.9	0.07	0.00396	0.01552	9.0	64.4
0.08	0.00283	0.00611	22.7	163.6	0.08	0.00301	0.01250	11.1	80.0
0.09	0.00397	0.00214	64.9	466.6	0.09	0.00233	0.01017	13.7	98.3
0.10	0.00079	0.00135	103.0	741.1	0.10	0.00183	0.00834	16.7	119.9
0.11	0.00036	0.00099	140.5	1010.6	0.11	0.00145	0.00689	20.2	145.2
0.12	0.00028	0.00071	195.0	1402.5	0.12	0.00116	0.00573	24.3	174.6
0.13	0.00019	0.00052	267.3	1922.9	0.13	0.00094	0.00479	29.0	208.8
0.14	0.00015	0.00037	374.3	2692.2	0.14	0.00076	0.00403	34.5	248.3
0.15	0.00011	0.00026	541.3	3893.2	0.15	0.00062	0.00340	40.8	293.8
0.16	0.00009	0.00017	815.7	5866.8	0.16	0.00051	0.00289	48.1	345.9
0.17	0.00006	0.00011	1281.6	9218.5	0.17	0.00042	0.00247	56.4	405.4
0.18	0.00004	0.00007	2094.1	15062.3	0.18	0.00035	0.00211	65.8	473.1
0.19	0.00003	0.00004	3857.4	27745.4	0.19	0.00030	0.00182	76.4	549.9
0.20	0.00002	0.00002	8825.8	63481.5	0.20	0.00025	0.00157	88.5	636.7
0.21	0.00001	0.00000	33804.3	99999.9	0.21	0.00021	0.00136	102.1	734.7
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00018	0.00118	117.4	844.8
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00015	0.00103	134.6	968.3
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00013	0.00090	153.8	1106.4
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00011	0.00079	175.2	1260.5
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00009	0.00070	199.1	1431.9
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00008	0.00062	225.6	1622.4
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00007	0.00055	254.9	1833.5
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00006	0.00048	287.4	2067.1
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00005	0.00043	323.2	2325.0
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00005	0.00038	362.8	2609.2
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00004	0.00034	406.2	2922.0
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00004	0.00031	454.0	3265.5
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00003	0.00027	506.4	3642.3
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00003	0.00025	563.7	4054.8
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00002	0.00022	626.4	4505.9
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00002	0.00020	694.9	4998.4
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00002	0.00018	769.6	5535.4
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00002	0.00016	850.9	6120.1
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00002	0.00015	939.3	6756.0

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0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00001	0.00013	1035.3	7446.8
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00001	0.00012	1139.5	8196.2
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00001	0.00011	1252.4	9008.3
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00001	0.00010	1374.5	9886.2
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00001	0.00009	1506.4	10835.4
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00001	0.00008	1649.0	11860.7
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00001	0.00008	1802.8	12966.9
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00001	0.00007	1968.6	14159.4
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00001	0.00006	2147.1	15443.8
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00001	0.00006	2339.3	16825.8
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00002	0.00004	3632.1	26124.9
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00001	0.00003	5492.6	39507.2
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00001	0.00002	8112.0	58348.2
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00001	0.00001	11748.3	84503.1
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00000	0.00001	16729.1	99999.9
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00000	0.00001	23477.6	99999.9
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00000	0.00000	32478.0	99999.9
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00000	0.00000	44447.7	99999.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00000	60288.2	99999.9
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00000	80576.5	99999.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00000	99999.9	99999.9

total yearly events 0.13903 total yearly events 0.13903

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.108 for 100 years 0.229 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

0yrnoc= 1. iprint= 2 for area ft07

Distance between dummy faults= 0.0

fault 1 of 1

122.10 38.05, 122.00 37.95, 121.95 37.85,

nr of levels of seismicity = 1

ft07 beta= -2.0000

earthquake rate / year

occurrences= 0.003100

magnitudes= 6.50

fault rupture length parameters al= -3.720 bl= 0.767 sigl= 0.07

1North Delta

site at long 121.697, lat 38.156

shortest dist to fault= 35.167 km

zero attenuation variability variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.10974	1.3	9.1	0.01	0.03983	0.10229	1.4	9.8
0.02	0.05204	0.05770	2.5	17.3	0.02	0.03637	0.06592	2.2	15.2
0.03	0.01653	0.04117	3.5	24.3	0.03	0.01930	0.04662	3.0	21.4
0.04	0.00758	0.03359	4.2	29.8	0.04	0.01156	0.03506	4.1	28.5
0.05	0.00602	0.02757	5.2	36.3	0.05	0.00778	0.02728	5.2	36.7
0.06	0.00911	0.01846	7.7	54.2	0.06	0.00562	0.02166	6.6	46.2
0.07	0.00642	0.01204	11.8	83.1	0.07	0.00423	0.01743	8.2	57.4
0.08	0.00370	0.00834	17.1	120.0	0.08	0.00326	0.01417	10.0	70.6
0.09	0.00533	0.00300	47.3	332.9	0.09	0.00255	0.01162	12.2	86.1
0.10	0.00140	0.00160	88.7	624.0	0.10	0.00203	0.00959	14.8	104.3
0.11	0.00061	0.00099	143.6	1010.6	0.11	0.00162	0.00797	17.8	125.5
0.12	0.00028	0.00071	199.3	1402.5	0.12	0.00131	0.00666	21.3	150.2
0.13	0.00019	0.00052	273.3	1922.9	0.13	0.00106	0.00560	25.4	178.7
0.14	0.00015	0.00037	382.6	2692.2	0.14	0.00087	0.00472	30.1	211.7
0.15	0.00011	0.00026	553.3	3893.2	0.15	0.00072	0.00401	35.5	249.5

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C—071787

0.16	0.00009	0.00017	833.8	5866.8	0.16	0.00059	0.00342	41.6	292.8
0.17	0.00006	0.00011	1310.2	9218.5	0.17	0.00049	0.00292	48.6	342.2
0.18	0.00004	0.00007	2140.8	15062.3	0.18	0.00041	0.00251	56.6	398.4
0.19	0.00003	0.00004	3943.4	27745.4	0.19	0.00035	0.00216	65.7	462.1
0.20	0.00002	0.00002	9022.6	63481.5	0.20	0.00029	0.00187	75.9	534.2
0.21	0.00001	0.00000	34558.1	99999.9	0.21	0.00025	0.00163	87.5	615.4
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00021	0.00142	100.4	706.6
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00018	0.00124	115.0	809.0
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00015	0.00108	131.3	923.5
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00013	0.00095	149.4	1051.3
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00011	0.00084	169.6	1193.6
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00010	0.00074	192.1	1351.8
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00008	0.00065	217.1	1527.2
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00007	0.00058	244.7	1721.4
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00006	0.00052	275.2	1936.0
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00006	0.00046	308.8	2172.7
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00005	0.00041	345.9	2433.4
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00004	0.00037	386.6	2720.1
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00004	0.00033	431.3	3034.8
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00003	0.00030	480.3	3379.7
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00003	0.00027	534.0	3757.2
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00003	0.00024	592.6	4169.8
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00002	0.00022	656.7	4620.2
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00002	0.00020	726.5	5111.3
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00002	0.00018	802.4	5645.9
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00002	0.00016	885.1	6227.3
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00001	0.00015	974.8	6858.8
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00001	0.00013	1072.2	7544.0
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00001	0.00012	1177.6	8285.8
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00001	0.00011	1291.8	9088.8
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00001	0.00010	1415.2	9957.2
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00001	0.00009	1548.5	10895.3
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00001	0.00008	1692.5	11907.9
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00001	0.00008	1847.6	12999.9
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00001	0.00007	2014.8	14176.3
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00003	0.00005	3144.5	22124.6
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00002	0.00003	4780.7	33636.5
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00001	0.00002	7099.6	49952.3
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00001	0.00001	10338.1	72738.2
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00000	0.00001	14799.4	99999.9
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00000	0.00001	20876.0	99999.9
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00000	0.00000	29028.8	99999.9
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00000	0.00000	39926.2	99999.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00000	54418.2	99999.9
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00000	73138.8	99999.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00000	97638.0	99999.9
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00000	99999.9	99999.9

total yearly events 0.14213 total yearly events 0.14213

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.109 for 100 years 0.242 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

0yrnoc= 1. iprint= 2 for area ft08

Distance between dummy faults= 0.0

fault 1 of 1

122.00 38.35, 121.90 38.25,

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C—071788

nr of levels of seismicity = 1
ft08 beta= -2.0000
earthquake rate / year
occurrences= 0.003800
magnitudes= 6.00
fault rupture length parameters al= -3.720 bl= 0.767 sigl= 0.07
1North Delta
site at long 121.697, lat 38.156
shortest dist to fault= 20.654 km

zero attenuation variability					variability in atten, sigma= 0.65				
g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.11354	1.3	8.8	0.01	0.03983	0.10609	1.4	9.4
0.02	0.05204	0.06150	2.4	16.3	0.02	0.03640	0.06970	2.1	14.3
0.03	0.01653	0.04497	3.2	22.2	0.03	0.01938	0.05031	2.9	19.9
0.04	0.00758	0.03739	3.9	26.7	0.04	0.01172	0.03859	3.8	25.9
0.05	0.00602	0.03137	4.7	31.9	0.05	0.00800	0.03059	4.8	32.7
0.06	0.00911	0.02226	6.6	44.9	0.06	0.00588	0.02471	5.9	40.5
0.07	0.00642	0.01584	9.2	63.1	0.07	0.00450	0.02021	7.2	49.5
0.08	0.00370	0.01214	12.0	82.4	0.08	0.00353	0.01668	8.7	59.9
0.09	0.00543	0.00670	21.8	149.2	0.09	0.00281	0.01387	10.5	72.1
0.10	0.00235	0.00435	33.5	229.9	0.10	0.00227	0.01161	12.6	86.2
0.11	0.00202	0.00233	62.6	428.7	0.11	0.00184	0.00976	14.9	102.4
0.12	0.00161	0.00072	201.4	1380.0	0.12	0.00151	0.00825	17.7	121.1
0.13	0.00020	0.00052	280.6	1922.9	0.13	0.00124	0.00701	20.8	142.6
0.14	0.00015	0.00037	392.9	2692.2	0.14	0.00103	0.00598	24.4	167.2
0.15	0.00011	0.00026	568.1	3893.2	0.15	0.00086	0.00512	28.5	195.2
0.16	0.00009	0.00017	856.1	5866.8	0.16	0.00072	0.00440	33.1	227.0
0.17	0.00006	0.00011	1345.2	9218.5	0.17	0.00060	0.00380	38.4	263.1
0.18	0.00004	0.00007	2198.0	15062.3	0.18	0.00051	0.00329	44.3	303.9
0.19	0.00003	0.00004	4048.9	27745.4	0.19	0.00043	0.00286	51.0	349.8
0.20	0.00002	0.00002	9263.8	63481.5	0.20	0.00037	0.00249	58.6	401.4
0.21	0.00001	0.00000	35482.0	99999.9	0.21	0.00031	0.00218	67.0	459.4
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00027	0.00191	76.5	524.2
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00023	0.00168	87.1	596.6
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00020	0.00148	98.8	677.2
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00017	0.00130	111.9	766.9
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00015	0.00115	126.4	866.4
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00013	0.00102	142.5	976.6
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00011	0.00091	160.3	1098.4
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00010	0.00081	179.9	1233.0
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00009	0.00072	201.6	1381.2
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00008	0.00065	225.4	1544.4
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00007	0.00058	251.5	1723.7
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00006	0.00052	280.3	1920.5
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00005	0.00047	311.7	2136.0
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00005	0.00042	346.1	2371.9
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00004	0.00038	383.7	2629.7
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00004	0.00034	424.8	2911.0
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00003	0.00031	469.5	3217.7
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00003	0.00028	518.3	3551.6
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00003	0.00026	571.3	3914.8
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00002	0.00023	628.8	4309.3
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00002	0.00021	691.3	4737.5
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00002	0.00019	759.1	5201.7
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00002	0.00018	832.4	5704.1
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00002	0.00016	911.7	6247.6

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0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00001	0.00015	997.4	6835.0
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00001	0.00013	1090.0	7469.4
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00001	0.00012	1189.9	8153.9
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00001	0.00011	1297.6	8891.9
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00001	0.00010	1413.6	9686.7
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00004	0.00007	2197.0	15055.1
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00002	0.00004	3332.1	22833.6
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00001	0.00003	4944.2	33881.2
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00001	0.00002	7200.4	49342.5
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00001	0.00001	10315.6	70689.7
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00000	0.00001	14567.6	99827.7
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00000	0.00001	20292.8	99999.9
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00000	0.00001	27958.8	99999.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00000	38161.8	99999.9
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00000	51446.5	99999.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00000	68864.7	99999.9
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00000	91662.3	99999.9
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00000	99999.9	99999.9

total yearly events 0.14593 total yearly events 0.14593

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.117 for 100 years 0.268 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft09
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.90   38.25,    121.90   38.15,    121.85   38.05,
 nr of levels of seismicity =  1
 ft09 beta= -2.0000
 earthquake rate / year
 occurrences=  0.003800
  magnitudes=      6.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
```

zero attenuation variability variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.11734	1.3	8.5	0.01	0.03983	0.10989	1.4	9.1
0.02	0.05204	0.06530	2.3	15.3	0.02	0.03640	0.07349	2.0	13.6
0.03	0.01653	0.04877	3.1	20.5	0.03	0.01941	0.05408	2.8	18.5
0.04	0.00758	0.04119	3.6	24.3	0.04	0.01179	0.04229	3.5	23.6
0.05	0.00602	0.03517	4.3	28.4	0.05	0.00811	0.03419	4.4	29.3
0.06	0.00911	0.02606	5.7	38.4	0.06	0.00602	0.02816	5.3	35.5
0.07	0.00642	0.01964	7.6	50.9	0.07	0.00467	0.02349	6.4	42.6
0.08	0.00370	0.01594	9.4	62.8	0.08	0.00372	0.01977	7.6	50.6
0.09	0.00543	0.01050	14.3	95.2	0.09	0.00301	0.01676	8.9	59.7
0.10	0.00235	0.00815	18.4	122.7	0.10	0.00247	0.01429	10.5	70.0
0.11	0.00202	0.00613	24.4	163.1	0.11	0.00204	0.01225	12.2	81.6
0.12	0.00161	0.00452	33.1	221.0	0.12	0.00170	0.01055	14.2	94.8
0.13	0.00020	0.00432	34.7	231.5	0.13	0.00143	0.00913	16.4	109.6
0.14	0.00100	0.00332	45.0	300.8	0.14	0.00120	0.00792	18.9	126.2
0.15	0.00307	0.00026	582.9	3893.2	0.15	0.00102	0.00691	21.7	144.8
0.16	0.00009	0.00017	878.4	5866.8	0.16	0.00087	0.00604	24.8	165.6
0.17	0.00006	0.00011	1380.3	9218.5	0.17	0.00074	0.00530	28.3	188.8
0.18	0.00004	0.00007	2255.3	15062.3	0.18	0.00064	0.00466	32.1	214.6

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0.19	0.00003	0.00004	4154.3	27745.4	0.19	0.00055	0.00411	36.4	243.2
0.20	0.00002	0.00002	9505.0	63481.5	0.20	0.00047	0.00364	41.2	274.9
0.21	0.00001	0.00000	36406.0	99999.9	0.21	0.00041	0.00323	46.4	310.0
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00036	0.00287	52.2	348.7
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00031	0.00256	58.6	391.3
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00027	0.00228	65.6	438.2
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00024	0.00204	73.3	489.7
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00021	0.00183	81.8	546.2
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00019	0.00164	91.0	608.0
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00016	0.00148	101.2	675.6
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00015	0.00133	112.2	749.4
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00013	0.00120	124.3	829.9
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00012	0.00109	137.4	917.6
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00010	0.00099	151.7	1013.0
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00009	0.00090	167.2	1116.6
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00008	0.00081	184.0	1229.1
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00007	0.00074	202.3	1351.1
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00007	0.00067	222.1	1483.1
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00006	0.00061	243.5	1626.0
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00005	0.00056	266.6	1780.5
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00005	0.00051	291.6	1947.3
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00004	0.00047	318.5	2127.3
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00004	0.00043	347.6	2321.3
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00004	0.00040	378.8	2530.2
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00003	0.00036	412.5	2755.0
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00003	0.00033	448.7	2996.6
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00003	0.00031	487.5	3256.2
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00002	0.00028	529.3	3534.8
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00002	0.00026	574.0	3833.7
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00002	0.00024	622.0	4154.1
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00002	0.00022	673.4	4497.3
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00002	0.00021	728.4	4864.6
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00007	0.00014	1092.6	7297.1
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00004	0.00009	1605.1	10719.9
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00003	0.00006	2314.4	15457.7
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00002	0.00005	3283.5	21930.0
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00001	0.00003	4591.5	30665.5
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00001	0.00002	6338.0	42330.0
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00002	8644.0	57731.7
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00000	0.00001	11667.1	77922.0
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00001	15601.6	99999.9
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00001	20653.6	99999.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00001	27134.6	99999.9
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00000	35410.6	99999.9
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00000	45811.9	99999.9
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00000	58943.4	99999.9
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00000	75482.3	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00000	96285.5	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00000	99999.9	99999.9

total yearly events 0.14973 total yearly events 0.14973

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.144 for 100 years 0.313 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

0yrnoc= 1. iprint= 2 for area ft10

Distance between dummy faults= 0.0

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C—071791

fault 1 of 1
121.85 38.05, 121.75 37.95,
nr of levels of seismicity = 1
ft10 beta= -2.0000
earthquake rate / year
occurrences= 0.002800
magnitudes= 6.00
fault rupture length parameters al= -3.720 bl= 0.767 sigl= 0.07
1North Delta
site at long 121.697, lat 38.156
shortest dist to fault= 16.910 km

zero attenuation variability					variability in atten, sigma= 0.65				
g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.12014	1.3	8.3	0.01	0.03983	0.11269	1.4	8.9
0.02	0.05204	0.06810	2.2	14.7	0.02	0.03640	0.07629	2.0	13.1
0.03	0.01653	0.05157	3.0	19.4	0.03	0.01944	0.05685	2.7	17.6
0.04	0.00758	0.04399	3.5	22.7	0.04	0.01185	0.04500	3.4	22.2
0.05	0.00602	0.03797	4.0	26.3	0.05	0.00820	0.03680	4.1	27.2
0.06	0.00911	0.02886	5.3	34.7	0.06	0.00614	0.03066	5.0	32.6
0.07	0.00642	0.02244	6.8	44.6	0.07	0.00481	0.02584	5.9	38.7
0.08	0.00370	0.01874	8.1	53.4	0.08	0.00387	0.02197	6.9	45.5
0.09	0.00543	0.01330	11.5	75.2	0.09	0.00317	0.01880	8.1	53.2
0.10	0.00235	0.01095	13.9	91.3	0.10	0.00263	0.01617	9.4	61.8
0.11	0.00202	0.00893	17.1	112.0	0.11	0.00219	0.01398	10.9	71.5
0.12	0.00161	0.00732	20.8	136.5	0.12	0.00185	0.01213	12.6	82.4
0.13	0.00066	0.00667	22.9	150.0	0.13	0.00156	0.01057	14.4	94.6
0.14	0.00334	0.00332	45.9	300.8	0.14	0.00133	0.00924	16.5	108.2
0.15	0.00307	0.00026	593.8	3893.2	0.15	0.00114	0.00810	18.8	123.4
0.16	0.00009	0.00017	894.9	5866.8	0.16	0.00098	0.00713	21.4	140.3
0.17	0.00006	0.00011	1406.1	9218.5	0.17	0.00084	0.00629	24.3	159.0
0.18	0.00004	0.00007	2297.4	15062.3	0.18	0.00073	0.00556	27.4	179.8
0.19	0.00003	0.00004	4232.0	27745.4	0.19	0.00063	0.00493	30.9	202.8
0.20	0.00002	0.00002	9682.8	63481.5	0.20	0.00055	0.00438	34.8	228.2
0.21	0.00001	0.00000	37086.8	99999.9	0.21	0.00048	0.00390	39.1	256.1
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00042	0.00348	43.8	286.9
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00037	0.00312	48.9	320.8
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00032	0.00279	54.6	357.9
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00029	0.00251	60.8	398.6
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00025	0.00226	67.6	443.1
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00022	0.00203	75.0	491.8
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00020	0.00184	83.1	544.9
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00018	0.00166	91.9	602.8
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00016	0.00150	101.6	665.8
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00014	0.00136	112.0	734.3
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00013	0.00124	123.4	808.8
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00011	0.00112	135.7	889.5
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00010	0.00102	149.0	977.1
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00009	0.00093	163.5	1071.9
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00008	0.00085	179.1	1174.5
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00007	0.00078	196.1	1285.3
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00007	0.00071	214.3	1405.0
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00006	0.00065	234.0	1534.2
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00005	0.00060	255.2	1673.4
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00005	0.00055	278.1	1823.3
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00004	0.00050	302.7	1984.6
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00004	0.00046	329.2	2158.1

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0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00004	0.00043	357.6	2344.4
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00003	0.00039	388.1	2544.4
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00003	0.00036	420.8	2758.9
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00003	0.00033	455.9	2988.9
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00003	0.00031	493.5	3235.3
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00002	0.00029	533.7	3499.0
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00002	0.00026	576.7	3781.2
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00009	0.00018	861.3	5646.6
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00006	0.00012	1260.7	8265.6
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00004	0.00008	1812.8	11885.1
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00002	0.00006	2566.0	16822.9
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00004	3581.2	23479.2
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00001	0.00003	4935.4	32357.5
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00002	6722.2	44072.0
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00002	9062.1	59412.6
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00001	12103.7	79354.3
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00001	16010.3	99999.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00001	21016.6	99999.9
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00001	27400.4	99999.9
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00000	35432.6	99999.9
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00000	45562.1	99999.9
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00000	58301.1	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00000	74292.4	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00000	94131.0	99999.9
1.46	0.00000	0.00000	99999.9	99999.9	1.46	0.00000	0.00000	99999.9	99999.9

total yearly events 0.15253 total yearly events 0.15253

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.144 for 100 years 0.337 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft11
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.75   37.95,    121.75   37.85,
 nr of levels of seismicity =  1
 ft11 beta= -2.0000
 earthquake rate / year
 occurrences=  0.003800
  magnitudes=      6.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
```

zero attenuation variability variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.12394	1.3	8.1	0.01	0.03984	0.11649	1.3	8.6
0.02	0.05204	0.07190	2.2	13.9	0.02	0.03643	0.08006	2.0	12.5
0.03	0.01653	0.05537	2.8	18.1	0.03	0.01954	0.06052	2.6	16.5
0.04	0.00758	0.04779	3.3	20.9	0.04	0.01203	0.04849	3.2	20.6
0.05	0.00602	0.04177	3.7	23.9	0.05	0.00845	0.04004	3.9	25.0
0.06	0.00911	0.03266	4.8	30.6	0.06	0.00642	0.03362	4.7	29.7
0.07	0.00642	0.02624	6.0	38.1	0.07	0.00510	0.02851	5.5	35.1
0.08	0.00370	0.02254	6.9	44.4	0.08	0.00416	0.02436	6.4	41.1
0.09	0.00563	0.01691	9.2	59.1	0.09	0.00344	0.02092	7.5	47.8
0.10	0.00409	0.01282	12.2	78.0	0.10	0.00287	0.01805	8.7	55.4
0.11	0.00389	0.00893	17.5	112.0	0.11	0.00241	0.01564	10.0	64.0

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0.12	0.00161	0.00732	21.3	136.5
0.13	0.00066	0.00667	23.4	150.0
0.14	0.00334	0.00332	47.0	300.8
0.15	0.00307	0.00026	608.6	3893.2
0.16	0.00009	0.00017	917.2	5866.8
0.17	0.00006	0.00011	1441.1	9218.5
0.18	0.00004	0.00007	2354.7	15062.3
0.19	0.00003	0.00004	4337.4	27745.4
0.20	0.00002	0.00002	9924.0	63481.5
0.21	0.00001	0.00000	38010.8	99999.9
0.22	0.00000	0.00000	99999.9	99999.9
0.23	0.00000	0.00000	99999.9	99999.9
0.24	0.00000	0.00000	99999.9	99999.9
0.25	0.00000	0.00000	99999.9	99999.9
0.26	0.00000	0.00000	99999.9	99999.9
0.27	0.00000	0.00000	99999.9	99999.9
0.28	0.00000	0.00000	99999.9	99999.9
0.29	0.00000	0.00000	99999.9	99999.9
0.30	0.00000	0.00000	99999.9	99999.9
0.31	0.00000	0.00000	99999.9	99999.9
0.32	0.00000	0.00000	99999.9	99999.9
0.33	0.00000	0.00000	99999.9	99999.9
0.34	0.00000	0.00000	99999.9	99999.9
0.35	0.00000	0.00000	99999.9	99999.9
0.36	0.00000	0.00000	99999.9	99999.9
0.37	0.00000	0.00000	99999.9	99999.9
0.38	0.00000	0.00000	99999.9	99999.9
0.39	0.00000	0.00000	99999.9	99999.9
0.40	0.00000	0.00000	99999.9	99999.9
0.41	0.00000	0.00000	99999.9	99999.9
0.42	0.00000	0.00000	99999.9	99999.9
0.43	0.00000	0.00000	99999.9	99999.9
0.44	0.00000	0.00000	99999.9	99999.9
0.45	0.00000	0.00000	99999.9	99999.9
0.46	0.00000	0.00000	99999.9	99999.9
0.47	0.00000	0.00000	99999.9	99999.9
0.48	0.00000	0.00000	99999.9	99999.9
0.49	0.00000	0.00000	99999.9	99999.9
0.50	0.00000	0.00000	99999.9	99999.9
0.55	0.00000	0.00000	99999.9	99999.9
0.61	0.00000	0.00000	99999.9	99999.9
0.66	0.00000	0.00000	99999.9	99999.9
0.71	0.00000	0.00000	99999.9	99999.9
0.77	0.00000	0.00000	99999.9	99999.9
0.82	0.00000	0.00000	99999.9	99999.9
0.87	0.00000	0.00000	99999.9	99999.9
0.93	0.00000	0.00000	99999.9	99999.9
0.98	0.00000	0.00000	99999.9	99999.9
1.03	0.00000	0.00000	99999.9	99999.9
1.09	0.00000	0.00000	99999.9	99999.9
1.14	0.00000	0.00000	99999.9	99999.9
1.19	0.00000	0.00000	99999.9	99999.9
1.25	0.00000	0.00000	99999.9	99999.9
1.30	0.00000	0.00000	99999.9	99999.9
1.35	0.00000	0.00000	99999.9	99999.9
1.41	0.00000	0.00000	99999.9	99999.9

0.12	0.00204	0.01359	11.5	73.6
0.13	0.00174	0.01186	13.2	84.3
0.14	0.00148	0.01037	15.1	96.4
0.15	0.00127	0.00910	17.2	109.9
0.16	0.00109	0.00801	19.5	124.9
0.17	0.00094	0.00706	22.1	141.6
0.18	0.00082	0.00625	25.0	160.1
0.19	0.00071	0.00554	28.2	180.6
0.20	0.00062	0.00492	31.8	203.3
0.21	0.00054	0.00438	35.7	228.4
0.22	0.00047	0.00391	40.0	256.0
0.23	0.00041	0.00349	44.8	286.4
0.24	0.00036	0.00313	50.0	319.8
0.25	0.00032	0.00281	55.7	356.4
0.26	0.00028	0.00252	62.0	396.5
0.27	0.00025	0.00227	68.9	440.5
0.28	0.00022	0.00205	76.4	488.4
0.29	0.00020	0.00185	84.5	540.8
0.30	0.00018	0.00167	93.5	597.9
0.31	0.00016	0.00152	103.2	660.0
0.32	0.00014	0.00137	113.7	727.6
0.33	0.00013	0.00125	125.2	801.0
0.34	0.00011	0.00114	137.7	880.7
0.35	0.00010	0.00103	151.2	967.0
0.36	0.00009	0.00094	165.8	1060.5
0.37	0.00008	0.00086	181.6	1161.7
0.38	0.00007	0.00079	198.7	1271.0
0.39	0.00007	0.00072	217.1	1389.1
0.40	0.00006	0.00066	237.1	1516.4
0.41	0.00005	0.00060	258.5	1653.7
0.42	0.00005	0.00056	281.6	1801.6
0.43	0.00005	0.00051	306.5	1960.7
0.44	0.00004	0.00047	333.3	2131.7
0.45	0.00004	0.00043	362.0	2315.5
0.46	0.00003	0.00040	392.8	2512.8
0.47	0.00003	0.00037	425.9	2724.5
0.48	0.00003	0.00034	461.4	2951.4
0.49	0.00003	0.00031	499.4	3194.5
0.50	0.00002	0.00029	540.1	3454.8
0.55	0.00010	0.00019	809.7	5179.4
0.61	0.00006	0.00013	1189.5	7609.1
0.66	0.00004	0.00009	1716.1	10977.9
0.71	0.00003	0.00006	2436.7	15586.9
0.77	0.00002	0.00005	3410.5	21816.6
0.82	0.00001	0.00003	4712.7	30146.6
0.87	0.00001	0.00002	6435.2	41164.5
0.93	0.00001	0.00002	8695.8	55625.8
0.98	0.00000	0.00001	11641.0	74465.6
1.03	0.00000	0.00001	15433.4	98724.7
1.09	0.00000	0.00001	20304.5	99999.9
1.14	0.00000	0.00001	26531.1	99999.9
1.19	0.00000	0.00000	34390.1	99999.9
1.25	0.00000	0.00000	44331.2	99999.9
1.30	0.00000	0.00000	56875.6	99999.9
1.35	0.00000	0.00000	72683.8	99999.9
1.41	0.00000	0.00000	92395.8	99999.9

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```
    1.46  0.00000  0.00000 99999.9 99999.9        1.46  0.00000  0.00000 99999.9 99999.9
  total yearly events    0.15633               total yearly events    0.15633

        zero attenuation variability                 variability in atten, sigma=0.65
    0.900 ext prob =  0.144 for   100 years                  0.348 for  100 years
  ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft12
 Distance between dummy faults=  0.0
 fault  1 of  1
    121.90   37.95,    121.75   37.80,
 nr of levels of seismicity =  1
 ft12 beta= -2.0000
 earthquake rate / year
 occurrences=  0.001000
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
        zero attenuation variability                 variability in atten, sigma= 0.65
```

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.12494	1.3	8.0	0.01	0.03984	0.11749	1.3	8.5
0.02	0.05204	0.07290	2.2	13.7	0.02	0.03644	0.08106	1.9	12.3
0.03	0.01653	0.05637	2.8	17.7	0.03	0.01956	0.06150	2.6	16.3
0.04	0.00758	0.04879	3.2	20.5	0.04	0.01207	0.04943	3.2	20.2
0.05	0.00602	0.04277	3.7	23.4	0.05	0.00851	0.04092	3.8	24.4
0.06	0.00911	0.03366	4.7	29.7	0.06	0.00649	0.03444	4.6	29.0
0.07	0.00642	0.02724	5.8	36.7	0.07	0.00517	0.02926	5.4	34.2
0.08	0.00370	0.02354	6.7	42.5	0.08	0.00423	0.02504	6.3	39.9
0.09	0.00563	0.01791	8.8	55.8	0.09	0.00350	0.02153	7.3	46.4
0.10	0.00413	0.01378	11.4	72.6	0.10	0.00293	0.01860	8.5	53.8
0.11	0.00441	0.00937	16.8	106.7	0.11	0.00247	0.01613	9.8	62.0
0.12	0.00203	0.00734	21.4	136.3	0.12	0.00210	0.01403	11.2	71.3
0.13	0.00067	0.00667	23.6	149.9	0.13	0.00178	0.01225	12.8	81.6
0.14	0.00335	0.00332	47.3	300.8	0.14	0.00153	0.01072	14.7	93.3
0.15	0.00307	0.00026	612.5	3893.2	0.15	0.00131	0.00941	16.7	106.2
0.16	0.00009	0.00017	923.0	5866.8	0.16	0.00113	0.00829	19.0	120.7
0.17	0.00006	0.00011	1450.3	9218.5	0.17	0.00097	0.00731	21.5	136.8
0.18	0.00004	0.00007	2369.7	15062.3	0.18	0.00084	0.00647	24.3	154.6
0.19	0.00003	0.00004	4365.2	27745.4	0.19	0.00073	0.00573	27.4	174.4
0.20	0.00002	0.00002	9987.5	63481.5	0.20	0.00064	0.00509	30.9	196.3
0.21	0.00001	0.00000	38253.9	99999.9	0.21	0.00056	0.00454	34.7	220.5
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00049	0.00405	38.9	247.1
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00043	0.00362	43.5	276.4
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00038	0.00324	48.6	308.6
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00033	0.00291	54.1	344.0
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00029	0.00261	60.2	382.7
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00026	0.00235	66.9	425.1
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00023	0.00212	74.2	471.5
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00021	0.00192	82.1	522.0
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00018	0.00173	90.8	577.2
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00016	0.00157	100.2	637.2
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00015	0.00142	110.5	702.5
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00013	0.00129	121.7	773.4
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00012	0.00118	133.8	850.4
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00011	0.00107	146.9	933.9

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0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00009	0.00098	161.1	1024.3
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00009	0.00089	176.5	1122.1
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00008	0.00081	193.2	1227.8
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00007	0.00075	211.1	1342.0
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00006	0.00068	230.5	1465.3
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00006	0.00063	251.4	1598.1
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00005	0.00057	273.9	1741.2
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00005	0.00053	298.2	1895.3
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00004	0.00049	324.2	2060.9
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00004	0.00045	352.2	2238.8
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00004	0.00041	382.3	2429.9
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00003	0.00038	414.5	2634.9
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00003	0.00035	449.1	2854.8
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00003	0.00032	486.2	3090.4
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00002	0.00030	525.9	3342.6
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00010	0.00020	789.0	5014.8
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00006	0.00014	1159.9	7372.5
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00004	0.00009	1674.6	10643.8
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00003	0.00007	2379.2	15122.6
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00005	3332.2	21180.1
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00001	0.00003	4607.3	29284.8
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00002	6294.9	40011.2
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00002	8511.0	54097.4
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00001	11399.7	72458.1
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00001	15121.6	96115.1
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00001	19904.7	99999.9
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00001	26021.9	99999.9
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00000	33748.7	99999.9
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00000	43528.6	99999.9
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00000	55877.6	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00000	71450.7	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00000	90890.0	99999.9
1.46	0.00000	0.00000	99999.9	99999.9	1.46	0.00000	0.00000	99999.9	99999.9
total yearly events		0.15733			total yearly events		0.15733		

```
        zero attenuation variability                    variability in atten, sigma=0.65
    0.900 ext prob =  0.144 for   100 years                     0.352 for  100 years
  ratio  100 yr 0.900 extreme value to  100 yr val          =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft13
 Distance between dummy faults=  0.0
 fault  1 of  1
    121.75   37.80,    121.60   37.65,
 nr of levels of seismicity =  1
 ft13 beta= -2.0000
 earthquake rate / year
 occurrences=  0.001000
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
        zero attenuation variability                    variability in atten, sigma= 0.65
```

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.12594	1.3	7.9	0.01	0.03984	0.11849	1.3	8.4
0.02	0.05204	0.07390	2.1	13.5	0.02	0.03646	0.08203	1.9	12.2
0.03	0.01653	0.05737	2.8	17.4	0.03	0.01962	0.06242	2.5	16.0

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C-071796

0.04	0.00758	0.04979	3.2	20.1	0.04	0.01216	0.05026	3.2	19.9
0.05	0.00602	0.04377	3.6	22.8	0.05	0.00861	0.04165	3.8	24.0
0.06	0.00911	0.03466	4.6	28.9	0.06	0.00659	0.03506	4.5	28.5
0.07	0.00652	0.02814	5.6	35.5	0.07	0.00526	0.02980	5.3	33.6
0.08	0.00458	0.02356	6.7	42.4	0.08	0.00431	0.02549	6.2	39.2
0.09	0.00565	0.01791	8.8	55.8	0.09	0.00357	0.02192	7.2	45.6
0.10	0.00413	0.01378	11.5	72.6	0.10	0.00299	0.01892	8.4	52.8
0.11	0.00441	0.00937	16.9	106.7	0.11	0.00252	0.01640	9.7	61.0
0.12	0.00203	0.00734	21.6	136.3	0.12	0.00214	0.01426	11.1	70.1
0.13	0.00067	0.00667	23.7	149.9	0.13	0.00182	0.01244	12.7	80.4
0.14	0.00335	0.00332	47.6	300.8	0.14	0.00156	0.01089	14.5	91.9
0.15	0.00307	0.00026	616.4	3893.2	0.15	0.00133	0.00955	16.6	104.7
0.16	0.00009	0.00017	928.9	5866.8	0.16	0.00115	0.00840	18.8	119.0
0.17	0.00006	0.00011	1459.6	9218.5	0.17	0.00099	0.00741	21.4	134.9
0.18	0.00004	0.00007	2384.8	15062.3	0.18	0.00086	0.00655	24.2	152.6
0.19	0.00003	0.00004	4392.9	27745.4	0.19	0.00075	0.00581	27.3	172.2
0.20	0.00002	0.00002	10051.0	63481.5	0.20	0.00065	0.00516	30.7	193.9
0.21	0.00001	0.00000	38497.0	99999.9	0.21	0.00057	0.00459	34.5	217.8
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00050	0.00409	38.7	244.2
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00044	0.00366	43.3	273.3
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00038	0.00328	48.3	305.3
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00034	0.00294	53.9	340.4
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00030	0.00264	60.0	378.8
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00026	0.00238	66.6	420.9
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00023	0.00214	73.9	466.9
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00021	0.00193	81.9	517.2
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00019	0.00175	90.6	571.9
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00017	0.00158	100.0	631.6
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00015	0.00144	110.3	696.5
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00013	0.00130	121.4	767.0
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00012	0.00119	133.6	843.5
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00011	0.00108	146.7	926.5
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00010	0.00098	160.9	1016.4
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00009	0.00090	176.3	1113.7
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00008	0.00082	193.0	1218.9
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00007	0.00075	211.0	1332.5
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00006	0.00069	230.4	1455.1
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00006	0.00063	251.3	1587.2
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00005	0.00058	273.9	1729.7
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00005	0.00053	298.1	1883.0
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00004	0.00049	324.2	2047.8
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00004	0.00045	352.3	2224.9
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00004	0.00041	382.4	2415.2
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00003	0.00038	414.7	2619.3
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00003	0.00035	449.4	2838.2
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00003	0.00033	486.5	3072.8
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00002	0.00030	526.3	3324.0
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00010	0.00020	790.0	4989.7
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00006	0.00014	1162.0	7339.2
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00004	0.00009	1678.3	10600.2
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00003	0.00007	2385.4	15066.1
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00005	3342.0	21107.9
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00001	0.00003	4622.1	29193.5
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00003	6316.9	39897.4
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00002	8543.0	53957.6
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00001	11445.4	72289.1

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1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00001	15186.1	95915.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00001	19995.0	99999.9
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00001	26147.6	99999.9
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00000	33921.7	99999.9
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00000	43766.2	99999.9
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00000	56204.1	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00000	71900.3	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00000	91463.3	99999.9
1.46	0.00000	0.00000	99999.9	99999.9	1.46	0.00000	0.00000	99999.9	99999.9

total yearly events 0.15833 total yearly events 0.15833

zero attenuation variability variability in atten, sigma=0.65
0.900 ext prob = 0.144 for 100 years 0.353 for 100 years
ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft14
 Distance between dummy faults=  0.0
 fault  1 of  1
    121.65   37.65,    121.55   37.55,    121.50   37.40,    121.45   37.25,
 nr of levels of seismicity =  1
 ft14 beta= -2.0000
 earthquake rate / year
 occurrences=  0.001000
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
```

zero attenuation variability variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03239	0.12694	1.3	7.9	0.01	0.03986	0.11946	1.3	8.4
0.02	0.05204	0.07490	2.1	13.4	0.02	0.03661	0.08285	1.9	12.1
0.03	0.01663	0.05827	2.7	17.2	0.03	0.01981	0.06304	2.5	15.9
0.04	0.00808	0.05019	3.2	19.9	0.04	0.01233	0.05071	3.1	19.7
0.05	0.00641	0.04378	3.6	22.8	0.05	0.00873	0.04198	3.8	23.8
0.06	0.00912	0.03466	4.6	28.9	0.06	0.00668	0.03530	4.5	28.3
0.07	0.00652	0.02814	5.7	35.5	0.07	0.00533	0.02997	5.3	33.4
0.08	0.00458	0.02356	6.8	42.4	0.08	0.00435	0.02562	6.2	39.0
0.09	0.00565	0.01791	8.9	55.8	0.09	0.00361	0.02201	7.2	45.4
0.10	0.00413	0.01378	11.6	72.6	0.10	0.00302	0.01899	8.4	52.6
0.11	0.00441	0.00937	17.0	106.7	0.11	0.00254	0.01645	9.7	60.8
0.12	0.00203	0.00734	21.7	136.3	0.12	0.00215	0.01430	11.1	69.9
0.13	0.00067	0.00667	23.9	149.9	0.13	0.00183	0.01247	12.8	80.2
0.14	0.00335	0.00332	47.9	300.8	0.14	0.00156	0.01091	14.6	91.6
0.15	0.00307	0.00026	620.3	3893.2	0.15	0.00134	0.00957	16.6	104.5
0.16	0.00009	0.00017	934.8	5866.8	0.16	0.00115	0.00842	18.9	118.8
0.17	0.00006	0.00011	1468.8	9218.5	0.17	0.00099	0.00742	21.5	134.7
0.18	0.00004	0.00007	2399.9	15062.3	0.18	0.00086	0.00656	24.3	152.4
0.19	0.00003	0.00004	4420.7	27745.4	0.19	0.00075	0.00582	27.4	172.0
0.20	0.00002	0.00002	10114.5	63481.5	0.20	0.00065	0.00516	30.9	193.6
0.21	0.00001	0.00000	38740.2	99999.9	0.21	0.00057	0.00460	34.7	217.6
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00050	0.00410	38.9	244.0
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00044	0.00366	43.5	273.1
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00038	0.00328	48.6	305.0
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00034	0.00294	54.2	340.1
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00030	0.00264	60.3	378.6
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00026	0.00238	67.0	420.6

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C—071798

0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00023	0.00214	74.3	466.6
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00021	0.00193	82.4	516.9
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00019	0.00175	91.1	571.6
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00017	0.00158	100.6	631.3
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00015	0.00144	110.9	696.1
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00013	0.00130	122.1	766.6
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00012	0.00119	134.3	843.2
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00011	0.00108	147.6	926.1
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00010	0.00098	161.9	1016.0
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00009	0.00090	177.4	1113.3
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00008	0.00082	194.1	1218.5
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00007	0.00075	212.2	1332.1
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00006	0.00069	231.8	1454.6
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00006	0.00063	252.8	1586.8
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00005	0.00058	275.5	1729.2
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00005	0.00053	299.9	1882.5
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00004	0.00049	326.2	2047.3
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00004	0.00045	354.4	2224.5
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00004	0.00041	384.7	2414.7
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00003	0.00038	417.2	2618.8
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00003	0.00035	452.1	2837.7
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00003	0.00033	489.5	3072.3
0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00002	0.00030	529.5	3323.4
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00010	0.00020	794.9	4989.1
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00006	0.00014	1169.2	7338.6
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00004	0.00009	1688.8	10599.5
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00003	0.00007	2400.3	15065.5
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00005	3363.0	21107.4
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00001	0.00003	4651.3	29193.4
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00003	6356.7	39897.3
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00002	8596.9	53957.5
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00001	11517.6	72289.1
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00001	15282.0	95915.8
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00001	20121.3	99999.9
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00001	26312.8	99999.9
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00000	34136.0	99999.9
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00000	44042.7	99999.9
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00000	56559.1	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00000	72354.4	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00000	92041.0	99999.9
1.46	0.00000	0.00000	99999.9	99999.9	1.46	0.00000	0.00000	99999.9	99999.9
total yearly events		0.15933			total yearly events		0.15933		

```
        zero attenuation variability                    variability in atten, sigma=0.65
    0.900 ext prob =  0.144 for   100 years                     0.353 for  100 years
  ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft15
 Distance between dummy faults=  0.0
 fault  1 of  1
    121.00   38.80,    121.20   39.00,    121.50   39.50,    120.90   38.40,
   120.90   38.35,    120.80   38.25,    120.80   38.20,    120.65   38.05,
   120.65   38.00,    120.55   37.90,
 nr of levels of seismicity =  1
 ft15 beta= -2.0000
 earthquake rate / year
 occurrences=  0.000100
```

C-071799

C—071799

C-071800

magnitudes= 6.00
fault rupture length parameters al= -2.440 bl= 0.566 sigl= 0.22
1North Delta
site at long 121.697, lat 38.156
shortest dist to fault= 16.910 km

zero attenuation variability					variability in atten, sigma= 0.65				
g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03240	0.12703	1.3	7.9	0.01	0.03989	0.11954	1.3	8.4
0.02	0.05209	0.07494	2.1	13.3	0.02	0.03665	0.08289	1.9	12.1
0.03	0.01667	0.05827	2.7	17.2	0.03	0.01983	0.06306	2.5	15.9
0.04	0.00808	0.05019	3.2	19.9	0.04	0.01234	0.05072	3.1	19.7
0.05	0.00641	0.04378	3.6	22.8	0.05	0.00874	0.04199	3.8	23.8
0.06	0.00912	0.03466	4.6	28.9	0.06	0.00668	0.03530	4.5	28.3
0.07	0.00652	0.02814	5.7	35.5	0.07	0.00533	0.02997	5.3	33.4
0.08	0.00458	0.02356	6.8	42.4	0.08	0.00435	0.02562	6.2	39.0
0.09	0.00565	0.01791	8.9	55.8	0.09	0.00361	0.02201	7.2	45.4
0.10	0.00413	0.01378	11.6	72.6	0.10	0.00302	0.01900	8.4	52.6
0.11	0.00441	0.00937	17.0	106.7	0.11	0.00254	0.01645	9.7	60.8
0.12	0.00203	0.00734	21.7	136.3	0.12	0.00215	0.01430	11.1	69.9
0.13	0.00067	0.00667	23.9	149.9	0.13	0.00183	0.01247	12.8	80.2
0.14	0.00335	0.00332	48.0	300.8	0.14	0.00156	0.01091	14.6	91.6
0.15	0.00307	0.00026	620.7	3893.2	0.15	0.00134	0.00957	16.7	104.5
0.16	0.00009	0.00017	935.3	5866.8	0.16	0.00115	0.00842	18.9	118.8
0.17	0.00006	0.00011	1469.7	9218.5	0.17	0.00099	0.00742	21.5	134.7
0.18	0.00004	0.00007	2401.4	15062.3	0.18	0.00086	0.00656	24.3	152.4
0.19	0.00003	0.00004	4423.4	27745.4	0.19	0.00075	0.00582	27.4	172.0
0.20	0.00002	0.00002	10120.8	63481.5	0.20	0.00065	0.00516	30.9	193.6
0.21	0.00001	0.00000	38764.5	99999.9	0.21	0.00057	0.00460	34.7	217.6
0.22	0.00000	0.00000	99999.9	99999.9	0.22	0.00050	0.00410	38.9	244.0
0.23	0.00000	0.00000	99999.9	99999.9	0.23	0.00044	0.00366	43.5	273.1
0.24	0.00000	0.00000	99999.9	99999.9	0.24	0.00038	0.00328	48.6	305.0
0.25	0.00000	0.00000	99999.9	99999.9	0.25	0.00034	0.00294	54.2	340.1
0.26	0.00000	0.00000	99999.9	99999.9	0.26	0.00030	0.00264	60.4	378.6
0.27	0.00000	0.00000	99999.9	99999.9	0.27	0.00026	0.00238	67.1	420.6
0.28	0.00000	0.00000	99999.9	99999.9	0.28	0.00023	0.00214	74.4	466.6
0.29	0.00000	0.00000	99999.9	99999.9	0.29	0.00021	0.00193	82.4	516.9
0.30	0.00000	0.00000	99999.9	99999.9	0.30	0.00019	0.00175	91.1	571.6
0.31	0.00000	0.00000	99999.9	99999.9	0.31	0.00017	0.00158	100.6	631.3
0.32	0.00000	0.00000	99999.9	99999.9	0.32	0.00015	0.00144	111.0	696.1
0.33	0.00000	0.00000	99999.9	99999.9	0.33	0.00013	0.00130	122.2	766.6
0.34	0.00000	0.00000	99999.9	99999.9	0.34	0.00012	0.00119	134.4	843.2
0.35	0.00000	0.00000	99999.9	99999.9	0.35	0.00011	0.00108	147.7	926.1
0.36	0.00000	0.00000	99999.9	99999.9	0.36	0.00010	0.00098	162.0	1016.0
0.37	0.00000	0.00000	99999.9	99999.9	0.37	0.00009	0.00090	177.5	1113.3
0.38	0.00000	0.00000	99999.9	99999.9	0.38	0.00008	0.00082	194.3	1218.5
0.39	0.00000	0.00000	99999.9	99999.9	0.39	0.00007	0.00075	212.4	1332.1
0.40	0.00000	0.00000	99999.9	99999.9	0.40	0.00006	0.00069	231.9	1454.6
0.41	0.00000	0.00000	99999.9	99999.9	0.41	0.00006	0.00063	253.0	1586.8
0.42	0.00000	0.00000	99999.9	99999.9	0.42	0.00005	0.00058	275.7	1729.2
0.43	0.00000	0.00000	99999.9	99999.9	0.43	0.00005	0.00053	300.1	1882.5
0.44	0.00000	0.00000	99999.9	99999.9	0.44	0.00004	0.00049	326.4	2047.3
0.45	0.00000	0.00000	99999.9	99999.9	0.45	0.00004	0.00045	354.6	2224.5
0.46	0.00000	0.00000	99999.9	99999.9	0.46	0.00004	0.00041	385.0	2414.7
0.47	0.00000	0.00000	99999.9	99999.9	0.47	0.00003	0.00038	417.5	2618.8
0.48	0.00000	0.00000	99999.9	99999.9	0.48	0.00003	0.00035	452.4	2837.7
0.49	0.00000	0.00000	99999.9	99999.9	0.49	0.00003	0.00033	489.8	3072.3

C—071800

0.50	0.00000	0.00000	99999.9	99999.9	0.50	0.00002	0.00030	529.8	3323.4
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00010	0.00020	795.4	4989.1
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00006	0.00014	1170.0	7338.6
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00004	0.00009	1689.9	10599.5
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00003	0.00007	2401.8	15065.5
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00005	3365.1	21107.4
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00001	0.00003	4654.2	29193.4
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00003	6360.7	39897.3
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00002	8602.3	53957.5
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00000	0.00001	11524.9	72289.1
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00000	0.00001	15291.6	95915.9
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00001	20133.9	99999.9
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00001	26329.3	99999.9
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00000	34157.4	99999.9
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00000	44070.3	99999.9
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00000	56594.5	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00000	72399.8	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00000	92098.6	99999.9
1.46	0.00000	0.00000	99999.9	99999.9	1.46	0.00000	0.00000	99999.9	99999.9

total yearly events 0.15943 total yearly events 0.15943

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.144 for 100 years 0.353 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

0yrnoc= 1. iprint= 1 for area ft16

Distance between dummy faults= 0.0

fault 1 of 1

122.30 39.13, 122.40 39.50, 121.95 38.50, 121.65 38.20,
121.65 38.05, 121.60 38.00, 121.60 37.85, 121.55 37.80,
121.45 37.65, 121.30 37.55,

nr of levels of seismicity = 1

ft16 beta= -2.0000

earthquake rate / year

occurrences= 0.001000

magnitudes= 6.50

fault rupture length parameters al= -1.960 bl= 0.497 sigl= 0.20

1North Delta

site at long 121.697, lat 38.156

shortest dist to fault= 3.995 km

zero attenuation variability variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03240	0.12803	1.3	7.8	0.01	0.03999	0.12044	1.3	8.3
0.02	0.05238	0.07565	2.1	13.2	0.02	0.03681	0.08363	1.9	12.0
0.03	0.01676	0.05888	2.7	17.0	0.03	0.01994	0.06369	2.5	15.7
0.04	0.00814	0.05075	3.2	19.7	0.04	0.01241	0.05128	3.1	19.5
0.05	0.00646	0.04428	3.6	22.6	0.05	0.00879	0.04249	3.8	23.5
0.06	0.00917	0.03512	4.6	28.5	0.06	0.00673	0.03576	4.5	28.0
0.07	0.00656	0.02855	5.6	35.0	0.07	0.00537	0.03040	5.3	32.9
0.08	0.00461	0.02394	6.7	41.8	0.08	0.00438	0.02601	6.2	38.4
0.09	0.00567	0.01827	8.8	54.7	0.09	0.00363	0.02238	7.2	44.7
0.10	0.00415	0.01411	11.4	70.8	0.10	0.00304	0.01934	8.3	51.7
0.11	0.00443	0.00968	16.6	103.3	0.11	0.00256	0.01678	9.6	59.6
0.12	0.00205	0.00763	21.0	131.0	0.12	0.00217	0.01461	11.0	68.4
0.13	0.00068	0.00695	23.1	143.9	0.13	0.00185	0.01277	12.6	78.3
0.14	0.00336	0.00359	44.7	278.5	0.14	0.00158	0.01119	14.3	89.4
0.15	0.00308	0.00051	314.5	1960.4	0.15	0.00135	0.00984	16.3	101.6

C-071801

C-071801

0.16	0.00010	0.00041	389.7	2429.1	0.16	0.00116	0.00867	18.5	115.3
0.17	0.00007	0.00034	472.1	2943.0	0.17	0.00101	0.00767	20.9	130.4
0.18	0.00005	0.00029	554.5	3456.1	0.18	0.00087	0.00680	23.6	147.2
0.19	0.00004	0.00025	639.1	3983.7	0.19	0.00076	0.00604	26.6	165.6
0.20	0.00003	0.00022	719.0	4481.6	0.20	0.00066	0.00538	29.8	186.0
0.21	0.00002	0.00020	785.4	4895.3	0.21	0.00058	0.00480	33.4	208.3
0.22	0.00001	0.00019	827.9	5160.3	0.22	0.00051	0.00429	37.4	232.9
0.23	0.00001	0.00019	852.3	5312.4	0.23	0.00044	0.00385	41.7	259.7
0.24	0.00001	0.00018	877.3	5468.2	0.24	0.00039	0.00346	46.4	289.1
0.25	0.00001	0.00018	903.6	5632.4	0.25	0.00035	0.00311	51.5	321.1
0.26	0.00001	0.00017	930.5	5799.9	0.26	0.00031	0.00281	57.1	356.0
0.27	0.00000	0.00017	957.9	5971.0	0.27	0.00027	0.00254	63.2	394.0
0.28	0.00000	0.00016	986.4	6148.4	0.28	0.00024	0.00230	69.8	435.2
0.29	0.00000	0.00016	1015.7	6331.2	0.29	0.00021	0.00208	77.0	479.9
0.30	0.00000	0.00015	1045.2	6514.8	0.30	0.00019	0.00189	84.8	528.3
0.31	0.00000	0.00015	1074.0	6694.3	0.31	0.00017	0.00172	93.1	580.6
0.32	0.00000	0.00014	1106.9	6899.8	0.32	0.00015	0.00157	102.2	637.1
0.33	0.00000	0.00014	1142.7	7122.9	0.33	0.00014	0.00143	112.0	698.0
0.34	0.00000	0.00014	1180.4	7358.0	0.34	0.00012	0.00131	122.5	763.6
0.35	0.00000	0.00013	1219.5	7601.7	0.35	0.00011	0.00120	133.8	834.1
0.36	0.00000	0.00013	1260.1	7854.5	0.36	0.00010	0.00110	146.0	909.9
0.37	0.00000	0.00012	1303.1	8122.6	0.37	0.00009	0.00101	159.0	991.1
0.38	0.00000	0.00012	1353.9	8439.2	0.38	0.00008	0.00093	173.0	1078.2
0.39	0.00001	0.00011	1507.2	9394.7	0.39	0.00007	0.00085	187.9	1171.4
0.40	0.00001	0.00010	1683.0	10490.3	0.40	0.00007	0.00079	203.9	1271.0
0.41	0.00001	0.00009	1884.3	11745.4	0.41	0.00006	0.00073	221.0	1377.3
0.42	0.00001	0.00008	2117.2	13197.3	0.42	0.00006	0.00067	239.2	1490.8
0.43	0.00001	0.00007	2402.3	14974.0	0.43	0.00005	0.00062	258.5	1611.6
0.44	0.00001	0.00006	2836.5	17680.7	0.44	0.00005	0.00057	279.2	1740.3
0.45	0.00001	0.00004	3718.5	23178.8	0.45	0.00004	0.00053	301.1	1877.0
0.46	0.00003	0.00001	14893.8	92837.7	0.46	0.00004	0.00049	324.4	2022.3
0.47	0.00000	0.00001	18400.0	99999.9	0.47	0.00004	0.00046	349.2	2176.5
0.48	0.00000	0.00001	23255.5	99999.9	0.48	0.00003	0.00043	375.4	2340.1
0.49	0.00000	0.00001	30361.6	99999.9	0.49	0.00003	0.00040	403.2	2513.3
0.50	0.00000	0.00000	41648.9	99999.9	0.50	0.00003	0.00037	432.6	2696.6
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00011	0.00026	620.0	3864.6
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00007	0.00019	866.8	5403.0
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00005	0.00014	1185.2	7387.8
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00003	0.00010	1589.0	9905.0
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00008	2093.3	13048.5
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00002	0.00006	2714.7	16921.6
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00005	3470.6	21633.7
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00004	4381.6	27311.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00001	0.00003	5469.6	34093.8
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00001	0.00002	6755.3	42108.0
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00002	8267.7	51535.7
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00002	10036.5	62561.0
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00001	12085.8	75335.1
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00001	14457.1	90116.4
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00001	17190.1	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00001	20329.1	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00001	23906.6	99999.9
1.46	0.00000	0.00000	99999.9	99999.9	1.46	0.00000	0.00001	27988.1	99999.9
1.51	0.00000	0.00000	99999.9	99999.9	1.51	0.00000	0.00000	32633.8	99999.9
1.57	0.00000	0.00000	99999.9	99999.9	1.57	0.00000	0.00000	37858.5	99999.9
1.62	0.00000	0.00000	99999.9	99999.9	1.62	0.00000	0.00000	43770.7	99999.9

C-071802

C—071802

1.67	0.00000	0.00000	99999.9	99999.9		1.67	0.00000	0.00000	50449.6	99999.9
1.73	0.00000	0.00000	99999.9	99999.9		1.73	0.00000	0.00000	57895.6	99999.9
1.78	0.00000	0.00000	99999.9	99999.9		1.78	0.00000	0.00000	66265.5	99999.9
1.83	0.00000	0.00000	99999.9	99999.9		1.83	0.00000	0.00000	75662.2	99999.9
2.11	0.00000	0.00000	99999.9	99999.9		2.11	0.00000	0.00000	99999.9	99999.9
total yearly events		0.16043				total yearly events		0.16043		

```
        zero attenuation variability                    variability in atten, sigma=0.65
    0.900 ext prob =  0.146 for   100 years                     0.365 for  100 years
  ratio  100 yr 0.900 extreme value to  100 yr val        =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft17
 Distance between dummy faults=  0.0
 fault  1 of  1
    121.25   37.25,    121.10   37.05,
 nr of levels of seismicity =  1
 ft17 beta= -2.0000
 earthquake rate / year
 occurrences=  0.000200
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=    3.995 km
```

zero attenuation variability					variability in atten, sigma= 0.65				
g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03240	0.12823	1.3	7.8	0.01	0.04004	0.12058	1.3	8.3
0.02	0.05258	0.07565	2.1	13.2	0.02	0.03689	0.08369	1.9	11.9
0.03	0.01676	0.05888	2.7	17.0	0.03	0.01997	0.06372	2.5	15.7
0.04	0.00814	0.05075	3.2	19.7	0.04	0.01242	0.05129	3.1	19.5
0.05	0.00646	0.04428	3.6	22.6	0.05	0.00880	0.04249	3.8	23.5
0.06	0.00917	0.03512	4.6	28.5	0.06	0.00673	0.03577	4.5	28.0
0.07	0.00656	0.02855	5.6	35.0	0.07	0.00537	0.03040	5.3	32.9
0.08	0.00461	0.02394	6.7	41.8	0.08	0.00438	0.02601	6.2	38.4
0.09	0.00567	0.01827	8.8	54.7	0.09	0.00363	0.02238	7.2	44.7
0.10	0.00415	0.01411	11.4	70.8	0.10	0.00304	0.01934	8.3	51.7
0.11	0.00443	0.00968	16.6	103.3	0.11	0.00256	0.01678	9.6	59.6
0.12	0.00205	0.00763	21.0	131.0	0.12	0.00217	0.01461	11.0	68.4
0.13	0.00068	0.00695	23.1	143.9	0.13	0.00185	0.01277	12.6	78.3
0.14	0.00336	0.00359	44.7	278.5	0.14	0.00158	0.01119	14.4	89.4
0.15	0.00308	0.00051	314.9	1960.4	0.15	0.00135	0.00984	16.3	101.6
0.16	0.00010	0.00041	390.2	2429.1	0.16	0.00116	0.00867	18.5	115.3
0.17	0.00007	0.00034	472.7	2943.0	0.17	0.00101	0.00767	20.9	130.4
0.18	0.00005	0.00029	555.1	3456.1	0.18	0.00087	0.00680	23.6	147.2
0.19	0.00004	0.00025	639.9	3983.7	0.19	0.00076	0.00604	26.6	165.6
0.20	0.00003	0.00022	719.9	4481.6	0.20	0.00066	0.00538	29.9	186.0
0.21	0.00002	0.00020	786.3	4895.3	0.21	0.00058	0.00480	33.5	208.3
0.22	0.00001	0.00019	828.9	5160.3	0.22	0.00051	0.00429	37.4	232.9
0.23	0.00001	0.00019	853.3	5312.4	0.23	0.00044	0.00385	41.7	259.7
0.24	0.00001	0.00018	878.3	5468.2	0.24	0.00039	0.00346	46.4	289.1
0.25	0.00001	0.00018	904.7	5632.4	0.25	0.00035	0.00311	51.6	321.1
0.26	0.00001	0.00017	931.6	5799.9	0.26	0.00031	0.00281	57.2	356.0
0.27	0.00000	0.00017	959.1	5971.0	0.27	0.00027	0.00254	63.3	394.0
0.28	0.00000	0.00016	987.6	6148.4	0.28	0.00024	0.00230	69.9	435.2
0.29	0.00000	0.00016	1017.0	6331.2	0.29	0.00021	0.00208	77.1	479.9
0.30	0.00000	0.00015	1046.5	6514.8	0.30	0.00019	0.00189	84.9	528.3
0.31	0.00000	0.00015	1075.3	6694.3	0.31	0.00017	0.00172	93.3	580.6

C-071803

C—071803

0.32	0.00000	0.00014	1108.3	6899.8	0.32	0.00015	0.00157	102.3	637.1
0.33	0.00000	0.00014	1144.1	7122.9	0.33	0.00014	0.00143	112.1	698.0
0.34	0.00000	0.00014	1181.9	7358.0	0.34	0.00012	0.00131	122.7	763.6
0.35	0.00000	0.00013	1221.0	7601.7	0.35	0.00011	0.00120	134.0	834.1
0.36	0.00000	0.00013	1261.7	7854.5	0.36	0.00010	0.00110	146.2	909.9
0.37	0.00000	0.00012	1304.7	8122.6	0.37	0.00009	0.00101	159.2	991.1
0.38	0.00000	0.00012	1355.6	8439.2	0.38	0.00008	0.00093	173.2	1078.2
0.39	0.00001	0.00011	1509.1	9394.7	0.39	0.00007	0.00085	188.2	1171.4
0.40	0.00001	0.00010	1685.0	10490.3	0.40	0.00007	0.00079	204.2	1271.0
0.41	0.00001	0.00009	1886.6	11745.4	0.41	0.00006	0.00073	221.2	1377.3
0.42	0.00001	0.00008	2119.9	13197.3	0.42	0.00006	0.00067	239.5	1490.8
0.43	0.00001	0.00007	2405.3	14974.0	0.43	0.00005	0.00062	258.9	1611.6
0.44	0.00001	0.00006	2840.0	17680.7	0.44	0.00005	0.00057	279.5	1740.3
0.45	0.00001	0.00004	3723.2	23178.8	0.45	0.00004	0.00053	301.5	1877.0
0.46	0.00003	0.00001	14912.4	92837.7	0.46	0.00004	0.00049	324.8	2022.3
0.47	0.00000	0.00001	18422.9	99999.9	0.47	0.00004	0.00046	349.6	2176.5
0.48	0.00000	0.00001	23284.5	99999.9	0.48	0.00003	0.00043	375.9	2340.1
0.49	0.00000	0.00001	30399.4	99999.9	0.49	0.00003	0.00040	403.7	2513.3
0.50	0.00000	0.00000	41700.8	99999.9	0.50	0.00003	0.00037	433.2	2696.6
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00011	0.00026	620.8	3864.6
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00007	0.00019	867.9	5403.0
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00005	0.00014	1186.7	7387.8
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00003	0.00010	1591.0	9905.0
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00008	2095.9	13048.5
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00002	0.00006	2718.1	16921.6
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00005	3474.9	21633.7
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00004	4387.0	27311.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00001	0.00003	5476.4	34093.8
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00001	0.00002	6763.7	42108.0
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00002	8278.0	51535.7
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00002	10049.0	62561.0
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00001	12100.8	75335.1
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00001	14475.1	90116.4
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00001	17211.6	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00001	20354.5	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00001	23936.4	99999.9
1.46	0.00000	0.00000	99999.9	99999.9	1.46	0.00000	0.00001	28023.0	99999.9
1.51	0.00000	0.00000	99999.9	99999.9	1.51	0.00000	0.00000	32674.5	99999.9
1.57	0.00000	0.00000	99999.9	99999.9	1.57	0.00000	0.00000	37905.7	99999.9
1.62	0.00000	0.00000	99999.9	99999.9	1.62	0.00000	0.00000	43825.3	99999.9
1.67	0.00000	0.00000	99999.9	99999.9	1.67	0.00000	0.00000	50512.5	99999.9
1.73	0.00000	0.00000	99999.9	99999.9	1.73	0.00000	0.00000	57967.7	99999.9
1.78	0.00000	0.00000	99999.9	99999.9	1.78	0.00000	0.00000	66348.1	99999.9
1.83	0.00000	0.00000	99999.9	99999.9	1.83	0.00000	0.00000	75756.6	99999.9
2.11	0.00000	0.00000	99999.9	99999.9	2.11	0.00000	0.00000	99999.9	99999.9
total yearly events		0.16063			total yearly events		0.16063		

zero attenuation variability

0.900 ext prob = 0.146 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val

variability in atten, sigma=0.65

0.365 for 100 years

= 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft18
 Distance between dummy faults=  0.0
 fault  1 of  1
    122.95   38.80,    123.00   38.88,
 nr of levels of seismicity =  1
 ft18 beta= -2.0000
```

C-071804

C—071804

earthquake rate / year
occurrences= 0.001400
magnitudes= 7.50
fault rupture length parameters al= -3.720 bl= 0.767 sigl= 0.07
1North Delta
site at long 121.697, lat 38.156
shortest dist to fault= 3.995 km

zero attenuation variability					variability in atten, sigma= 0.65				
g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03240	0.12963	1.2	7.7	0.01	0.04016	0.12186	1.3	8.2
0.02	0.05258	0.07705	2.1	13.0	0.02	0.03730	0.08456	1.9	11.8
0.03	0.01816	0.05888	2.8	17.0	0.03	0.02032	0.06424	2.5	15.6
0.04	0.00814	0.05075	3.2	19.7	0.04	0.01264	0.05161	3.1	19.4
0.05	0.00646	0.04428	3.7	22.6	0.05	0.00892	0.04268	3.8	23.4
0.06	0.00917	0.03512	4.6	28.5	0.06	0.00680	0.03588	4.5	27.9
0.07	0.00656	0.02855	5.7	35.0	0.07	0.00541	0.03047	5.3	32.8
0.08	0.00461	0.02394	6.8	41.8	0.08	0.00441	0.02606	6.2	38.4
0.09	0.00567	0.01827	8.9	54.7	0.09	0.00365	0.02241	7.2	44.6
0.10	0.00415	0.01411	11.5	70.8	0.10	0.00305	0.01936	8.4	51.6
0.11	0.00443	0.00968	16.7	103.3	0.11	0.00257	0.01680	9.6	59.5
0.12	0.00205	0.00763	21.2	131.0	0.12	0.00217	0.01462	11.1	68.4
0.13	0.00068	0.00695	23.3	143.9	0.13	0.00185	0.01278	12.7	78.3
0.14	0.00336	0.00359	45.1	278.5	0.14	0.00158	0.01120	14.5	89.3
0.15	0.00308	0.00051	317.6	1960.4	0.15	0.00135	0.00984	16.5	101.6
0.16	0.00010	0.00041	393.6	2429.1	0.16	0.00117	0.00868	18.7	115.3
0.17	0.00007	0.00034	476.8	2943.0	0.17	0.00101	0.00767	21.1	130.4
0.18	0.00005	0.00029	560.0	3456.1	0.18	0.00087	0.00680	23.8	147.1
0.19	0.00004	0.00025	645.5	3983.7	0.19	0.00076	0.00604	26.8	165.6
0.20	0.00003	0.00022	726.1	4481.6	0.20	0.00066	0.00538	30.1	185.9
0.21	0.00002	0.00020	793.2	4895.3	0.21	0.00058	0.00480	33.7	208.3
0.22	0.00001	0.00019	836.1	5160.3	0.22	0.00051	0.00430	37.7	232.8
0.23	0.00001	0.00019	860.8	5312.4	0.23	0.00044	0.00385	42.1	259.7
0.24	0.00001	0.00018	886.0	5468.2	0.24	0.00039	0.00346	46.8	289.0
0.25	0.00001	0.00018	912.6	5632.4	0.25	0.00035	0.00311	52.0	321.1
0.26	0.00001	0.00017	939.7	5799.9	0.26	0.00031	0.00281	57.7	356.0
0.27	0.00000	0.00017	967.5	5971.0	0.27	0.00027	0.00254	63.8	394.0
0.28	0.00000	0.00016	996.2	6148.4	0.28	0.00024	0.00230	70.5	435.2
0.29	0.00000	0.00016	1025.8	6331.2	0.29	0.00021	0.00208	77.8	479.9
0.30	0.00000	0.00015	1055.6	6514.8	0.30	0.00019	0.00189	85.6	528.3
0.31	0.00000	0.00015	1084.7	6694.3	0.31	0.00017	0.00172	94.1	580.6
0.32	0.00000	0.00014	1118.0	6899.8	0.32	0.00015	0.00157	103.2	637.1
0.33	0.00000	0.00014	1154.1	7122.9	0.33	0.00014	0.00143	113.1	698.0
0.34	0.00000	0.00014	1192.2	7358.0	0.34	0.00012	0.00131	123.7	763.6
0.35	0.00000	0.00013	1231.7	7601.7	0.35	0.00011	0.00120	135.1	834.1
0.36	0.00000	0.00013	1272.7	7854.5	0.36	0.00010	0.00110	147.4	909.9
0.37	0.00000	0.00012	1316.1	8122.6	0.37	0.00009	0.00101	160.6	991.1
0.38	0.00000	0.00012	1367.4	8439.2	0.38	0.00008	0.00093	174.7	1078.2
0.39	0.00001	0.00011	1522.2	9394.7	0.39	0.00007	0.00085	189.8	1171.4
0.40	0.00001	0.00010	1699.7	10490.3	0.40	0.00007	0.00079	205.9	1271.0
0.41	0.00001	0.00009	1903.1	11745.4	0.41	0.00006	0.00073	223.2	1377.3
0.42	0.00001	0.00008	2138.3	13197.3	0.42	0.00006	0.00067	241.5	1490.8
0.43	0.00001	0.00007	2426.2	14974.0	0.43	0.00005	0.00062	261.1	1611.6
0.44	0.00001	0.00006	2864.8	17680.7	0.44	0.00005	0.00057	282.0	1740.3
0.45	0.00001	0.00004	3755.6	23178.8	0.45	0.00004	0.00053	304.1	1877.0
0.46	0.00003	0.00001	15042.4	92837.7	0.46	0.00004	0.00049	327.7	2022.3
0.47	0.00000	0.00001	18583.5	99999.9	0.47	0.00004	0.00046	352.7	2176.5

C-071805
C-071805

0.48	0.00000	0.00001	23487.5	99999.9	0.48	0.00003	0.00043	379.2	2340.1
0.49	0.00000	0.00001	30664.4	99999.9	0.49	0.00003	0.00040	407.2	2513.3
0.50	0.00000	0.00000	42064.3	99999.9	0.50	0.00003	0.00037	436.9	2696.6
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00011	0.00026	626.2	3864.6
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00007	0.00019	875.4	5403.0
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00005	0.00014	1197.0	7387.8
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00003	0.00010	1604.9	9905.0
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00008	2114.2	13048.5
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00002	0.00006	2741.8	16921.6
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00005	3505.2	21633.7
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00004	4425.3	27311.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00001	0.00003	5524.1	34093.8
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00001	0.00002	6822.6	42108.0
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00002	8350.2	51535.7
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00002	10136.6	62561.0
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00001	12206.3	75335.1
1.25	0.00000	0.00000	99999.9	99999.9	1.25	0.00000	0.00001	14601.3	90116.4
1.30	0.00000	0.00000	99999.9	99999.9	1.30	0.00000	0.00001	17361.6	99999.9
1.35	0.00000	0.00000	99999.9	99999.9	1.35	0.00000	0.00001	20531.9	99999.9
1.41	0.00000	0.00000	99999.9	99999.9	1.41	0.00000	0.00001	24145.0	99999.9
1.46	0.00000	0.00000	99999.9	99999.9	1.46	0.00000	0.00001	28267.3	99999.9
1.51	0.00000	0.00000	99999.9	99999.9	1.51	0.00000	0.00000	32959.2	99999.9
1.57	0.00000	0.00000	99999.9	99999.9	1.57	0.00000	0.00000	38236.0	99999.9
1.62	0.00000	0.00000	99999.9	99999.9	1.62	0.00000	0.00000	44207.2	99999.9
1.67	0.00000	0.00000	99999.9	99999.9	1.67	0.00000	0.00000	50952.8	99999.9
1.73	0.00000	0.00000	99999.9	99999.9	1.73	0.00000	0.00000	58473.0	99999.9
1.78	0.00000	0.00000	99999.9	99999.9	1.78	0.00000	0.00000	66926.3	99999.9
1.83	0.00000	0.00000	99999.9	99999.9	1.83	0.00000	0.00000	76416.8	99999.9
2.11	0.00000	0.00000	99999.9	99999.9	2.11	0.00000	0.00000	99999.9	99999.9

total yearly events 0.16203 total yearly events 0.16203

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.146 for 100 years 0.365 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft19
 Distance between dummy faults=  0.0
 fault  1 of  1
    122.70   38.80,    122.85   39.00,
 nr of levels of seismicity =  1
 ft19 beta= -2.0000
 earthquake rate / year
 occurrences=  0.000500
  magnitudes=       6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=    3.995 km
```

zero attenuation variability variability in atten, sigma= 0.65

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
0.01	0.03240	0.13013	1.2	7.7	0.01	0.04031	0.12222	1.3	8.2
0.02	0.05308	0.07705	2.1	13.0	0.02	0.03751	0.08471	1.9	11.8
0.03	0.01816	0.05888	2.8	17.0	0.03	0.02040	0.06431	2.5	15.6
0.04	0.00814	0.05075	3.2	19.7	0.04	0.01267	0.05163	3.1	19.4
0.05	0.00646	0.04428	3.7	22.6	0.05	0.00894	0.04270	3.8	23.4
0.06	0.00917	0.03512	4.6	28.5	0.06	0.00681	0.03589	4.5	27.9
0.07	0.00656	0.02855	5.7	35.0	0.07	0.00541	0.03048	5.3	32.8

C-071806

C-071806

0.08	0.00461	0.02394	6.8	41.8	0.08	0.00441	0.02606	6.2	38.4
0.09	0.00567	0.01827	8.9	54.7	0.09	0.00365	0.02241	7.3	44.6
0.10	0.00415	0.01411	11.5	70.8	0.10	0.00305	0.01936	8.4	51.6
0.11	0.00443	0.00968	16.8	103.3	0.11	0.00257	0.01680	9.7	59.5
0.12	0.00205	0.00763	21.3	131.0	0.12	0.00217	0.01462	11.1	68.4
0.13	0.00068	0.00695	23.4	143.9	0.13	0.00185	0.01278	12.7	78.3
0.14	0.00336	0.00359	45.3	278.5	0.14	0.00158	0.01120	14.5	89.3
0.15	0.00308	0.00051	318.6	1960.4	0.15	0.00135	0.00984	16.5	101.6
0.16	0.00010	0.00041	394.8	2429.1	0.16	0.00117	0.00868	18.7	115.3
0.17	0.00007	0.00034	478.3	2943.0	0.17	0.00101	0.00767	21.2	130.4
0.18	0.00005	0.00029	561.7	3456.1	0.18	0.00087	0.00680	23.9	147.1
0.19	0.00004	0.00025	647.5	3983.7	0.19	0.00076	0.00604	26.9	165.6
0.20	0.00003	0.00022	728.4	4481.6	0.20	0.00066	0.00538	30.2	185.9
0.21	0.00002	0.00020	795.6	4895.3	0.21	0.00058	0.00480	33.9	208.3
0.22	0.00001	0.00019	838.7	5160.3	0.22	0.00051	0.00430	37.8	232.8
0.23	0.00001	0.00019	863.4	5312.4	0.23	0.00044	0.00385	42.2	259.7
0.24	0.00001	0.00018	888.7	5468.2	0.24	0.00039	0.00346	47.0	289.0
0.25	0.00001	0.00018	915.4	5632.4	0.25	0.00035	0.00311	52.2	321.1
0.26	0.00001	0.00017	942.6	5799.9	0.26	0.00031	0.00281	57.9	356.0
0.27	0.00000	0.00017	970.5	5971.0	0.27	0.00027	0.00254	64.0	394.0
0.28	0.00000	0.00016	999.3	6148.4	0.28	0.00024	0.00230	70.7	435.2
0.29	0.00000	0.00016	1029.0	6331.2	0.29	0.00021	0.00208	78.0	479.9
0.30	0.00000	0.00015	1058.8	6514.8	0.30	0.00019	0.00189	85.9	528.3
0.31	0.00000	0.00015	1088.0	6694.3	0.31	0.00017	0.00172	94.4	580.6
0.32	0.00000	0.00014	1121.4	6899.8	0.32	0.00015	0.00157	103.5	637.1
0.33	0.00000	0.00014	1157.7	7122.9	0.33	0.00014	0.00143	113.4	698.0
0.34	0.00000	0.00014	1195.9	7358.0	0.34	0.00012	0.00131	124.1	763.6
0.35	0.00000	0.00013	1235.5	7601.7	0.35	0.00011	0.00120	135.6	834.1
0.36	0.00000	0.00013	1276.6	7854.5	0.36	0.00010	0.00110	147.9	909.9
0.37	0.00000	0.00012	1320.2	8122.6	0.37	0.00009	0.00101	161.1	991.1
0.38	0.00000	0.00012	1371.6	8439.2	0.38	0.00008	0.00093	175.2	1078.2
0.39	0.00001	0.00011	1526.9	9394.7	0.39	0.00007	0.00085	190.4	1171.4
0.40	0.00001	0.00010	1705.0	10490.3	0.40	0.00007	0.00079	206.6	1271.0
0.41	0.00001	0.00009	1909.0	11745.4	0.41	0.00006	0.00073	223.8	1377.3
0.42	0.00001	0.00008	2144.9	13197.3	0.42	0.00006	0.00067	242.3	1490.8
0.43	0.00001	0.00007	2433.7	14974.0	0.43	0.00005	0.00062	261.9	1611.6
0.44	0.00001	0.00006	2873.6	17680.7	0.44	0.00005	0.00057	282.8	1740.3
0.45	0.00001	0.00004	3767.2	23178.8	0.45	0.00004	0.00053	305.1	1877.0
0.46	0.00003	0.00001	15088.8	92837.7	0.46	0.00004	0.00049	328.7	2022.3
0.47	0.00000	0.00001	18640.9	99999.9	0.47	0.00004	0.00046	353.7	2176.5
0.48	0.00000	0.00001	23560.0	99999.9	0.48	0.00003	0.00043	380.3	2340.1
0.49	0.00000	0.00001	30759.0	99999.9	0.49	0.00003	0.00040	408.5	2513.3
0.50	0.00000	0.00000	42194.1	99999.9	0.50	0.00003	0.00037	438.3	2696.6
0.55	0.00000	0.00000	99999.9	99999.9	0.55	0.00011	0.00026	628.1	3864.6
0.61	0.00000	0.00000	99999.9	99999.9	0.61	0.00007	0.00019	878.1	5403.0
0.66	0.00000	0.00000	99999.9	99999.9	0.66	0.00005	0.00014	1200.7	7387.8
0.71	0.00000	0.00000	99999.9	99999.9	0.71	0.00003	0.00010	1609.8	9905.0
0.77	0.00000	0.00000	99999.9	99999.9	0.77	0.00002	0.00008	2120.7	13048.5
0.82	0.00000	0.00000	99999.9	99999.9	0.82	0.00002	0.00006	2750.2	16921.6
0.87	0.00000	0.00000	99999.9	99999.9	0.87	0.00001	0.00005	3516.1	21633.7
0.93	0.00000	0.00000	99999.9	99999.9	0.93	0.00001	0.00004	4438.9	27311.9
0.98	0.00000	0.00000	99999.9	99999.9	0.98	0.00001	0.00003	5541.2	34093.8
1.03	0.00000	0.00000	99999.9	99999.9	1.03	0.00001	0.00002	6843.7	42108.0
1.09	0.00000	0.00000	99999.9	99999.9	1.09	0.00000	0.00002	8375.9	51535.7
1.14	0.00000	0.00000	99999.9	99999.9	1.14	0.00000	0.00002	10167.8	62561.0
1.19	0.00000	0.00000	99999.9	99999.9	1.19	0.00000	0.00001	12244.0	75335.1

C-071807

C-071807

1.25	0.00000	0.00000	99999.9	99999.9		1.25	0.00000	0.00001	14646.3	90116.4
1.30	0.00000	0.00000	99999.9	99999.9		1.30	0.00000	0.00001	17415.2	99999.9
1.35	0.00000	0.00000	99999.9	99999.9		1.35	0.00000	0.00001	20595.3	99999.9
1.41	0.00000	0.00000	99999.9	99999.9		1.41	0.00000	0.00001	24219.5	99999.9
1.46	0.00000	0.00000	99999.9	99999.9		1.46	0.00000	0.00001	28354.5	99999.9
1.51	0.00000	0.00000	99999.9	99999.9		1.51	0.00000	0.00000	33060.9	99999.9
1.57	0.00000	0.00000	99999.9	99999.9		1.57	0.00000	0.00000	38354.0	99999.9
1.62	0.00000	0.00000	99999.9	99999.9		1.62	0.00000	0.00000	44343.6	99999.9
1.67	0.00000	0.00000	99999.9	99999.9		1.67	0.00000	0.00000	51110.0	99999.9
1.73	0.00000	0.00000	99999.9	99999.9		1.73	0.00000	0.00000	58653.4	99999.9
1.78	0.00000	0.00000	99999.9	99999.9		1.78	0.00000	0.00000	67132.9	99999.9
1.83	0.00000	0.00000	99999.9	99999.9		1.83	0.00000	0.00000	76652.7	99999.9
2.11	0.00000	0.00000	99999.9	99999.9		2.11	0.00000	0.00000	99999.9	99999.9

total yearly events 0.16253 total yearly events 0.16253

zero attenuation variability variability in atten, sigma=0.65

0.900 ext prob = 0.146 for 100 years 0.365 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

C-071808

C—071808

Velocity Input File

```
North Delta
0 0.
.9 1 100
800.  0 .60 0
123.0 38.5 120.5 38.5
123.00    40.00     120.50    37.00      .050
38 38 21 21
0
8 15
'jb81-vl'  8.5   8.0   7.5   7.0   6.5   6.0   5.5   5.0
  3.0   880.50 501.45 285.58 162.64  92.63  52.75  30.04  17.11
  5.0   681.89 388.34 221.16 125.96  71.73  40.85  23.27  13.25
  7.0   536.29 305.42 173.94  99.06  56.42  32.13  18.30  10.42
 10.0   395.09 225.01 128.14  72.98  41.56  23.67  13.48   7.68
 15.0   266.53 151.79  86.45  49.23  28.04  15.97   9.09   5.18
 20.0   197.12 112.26  63.94  36.41  20.74  11.81   6.73   3.83
 30.0   125.33  71.38  40.65  23.15  13.18   7.51   4.28   2.44
 40.0    89.00  50.68  28.86  16.44   9.36   5.33   3.04   1.73
 50.0    67.26  38.30  21.81  12.42   7.08   4.03   2.29   1.31
 65.0    47.43  27.01  15.38   8.76   4.99   2.84   1.62   0.92
 80.0    35.30  20.11  11.45   6.52   3.71   2.12   1.20   0.69
100.0    25.12  14.30   8.15   4.64   2.64   1.50   0.86   0.49
120.0    18.61  10.60   6.04   3.44   1.96   1.11   0.63   0.36
140.0    14.18   8.08   4.60   2.62   1.49   0.85   0.48   0.28
160.0    11.03   6.28   3.58   2.04   1.16   0.66   0.38   0.21
00 100.      2          zn01 5.0
 4  1  1
123.00 39.50 122.65 39.50
123.00 38.00 121.80 38.25
122.50 37.50 121.65 37.80
122.00 37.00 121.20 37.00
9.12 22.72
5.50  5.00
99 1.0       2          ft01-3.72  .767 .074
  9  1  1
123.00    38.30     122.9     38.2      122.65    37.9      122.6     37.8
122.4     37.6      122.35    37.5      121.95    37.15     121.9     37.1
121.7     37.0
.0033
8.000
00 1.0       2          ft02-3.72  .767 .074
  4  1  1
122.8     38.6      122.75    38.5      122.5     38.25
122.45    38.15
.0045
7.000
00 1.0       2          ft03-3.72  .767 .074
  6  1  1
122.35    38.0      122.2     37.85     122.2     37.8      121.95    37.55
121.9     37.45     121.8     37.35
.0050
7.000
00 1.0       2          ft04-3.72  .767 .074
 10  1  1
122.05    37.9      122.05    37.85     121.9     37.7      121.9     37.65
121.8     37.45     121.7     37.35     121.7     37.3      121.6     37.2
```

Fault Sources are in the same order as in the acceleration input file

```
121.55    37.1      121.5     37.05
.0050
7.000
00 1.0       2          ft05-3.72  .767 .074
  2  1  1
122.15    38.35     122.10    38.1
.0024
6.500
00 1.0       2          ft07-3.72  .767 .074
  3  1  1
122.1     38.05     122.0     37.95      121.95     37.85
.0031
6.500
00 1.0       2          ft08-3.72  .767 .074
  2  1  1
122.0     38.35     121.9     38.25
.0038
6.000
00 1.0       2          ft09-3.72  .767 .074
  3  1  1
121.9     38.25     121.9     38.15     121.85    38.05
.0038
6.000
00 1.0       2          ft10-3.72  .767 .074
  2  1  1
121.85    38.05     121.75    37.95
.0028
6.000
00 1.0       2          ft11-3.72  .767 .074
  2  1  1
121.75    37.95     121.75    37.85
.0038
6.000
00 1.0       2          ft12-3.72  .767 .074
  2  1  1
121.9     37.95     121.75    37.8
.0010
6.500
00 1.0       2          ft13-3.72  .767 .074
  2  1  1
121.75    37.8      121.6     37.65
.0010
6.500
00 1.0       2          ft14-3.72  .767 .074
  4  1  1
121.65    37.65     121.55    37.55   121.50  37.4
121.45    37.25
.0010
6.500
00 1.0       2          ft15-2.44  .566 .219
 10  1  1
121.0     38.8      121.2     39.0      121.5     39.5      120.9     38.4
120.9     38.35     120.8     38.25     120.8     38.2      120.65    38.05
120.65    38.0      120.55    37.9
.0001
6.000
```

```
00 1.0        1          ft16-1.96  .497 .20
 10  1  1
122.30    39.125    122.40    39.50     121.95    38.50     121.65    38.20
121.65    38.05     121.60    38.00     121.60    37.85     121.55    37.80
121.45    37.65     121.30    37.55
.0010
6.500
00 1.0        2          ft17-3.72  .767 .074
  2  1  1
121.25    37.25     121.10    37.05
.0002
6.500
00 1.0        2          ft18-3.72  .767 .074
  2  1  1
122.95    38.8      123.00    38.875
.0014
7.500
00 1.0        2          ft19-3.72  .767 .074
  2  1  1
122.70    38.8      122.85    39.00
.0005
6.50
99
```

Velocity Results

C-071814

```
1North Delta
 isw=0: new run--no previous results included
 extreme probability  0.900
   for exposure times (years)   100
 scale factor for ground motion "box" levels= 800.00
 coordinates input in decimal degrees
    coordinates are printed in decimal degrees
 variability in attenuation, sigma=  0.60
 grid oriented parallel to great circle thru ( 123.00, 38.50),( 120.50, 38.50)
 corners of gridded area-upper left= 123.00,  40.00
                         lower right= 120.50,  37.00
 longitude increment= 0.0500 (decimal degrees)
 latitude increment = 0.0500 (decimal degrees)
 gridded region contains  61 rows,   40 cols including border    0 rows and cols
 for this run begin at row  38 end row  38, begin col  21 end col  21
 new coordinates (km) gridded area
       upper left=   215.56    -4.92; lower right=   166.96  -166.96
 sites are also located on   0 line(s)
 attenuation function jb81-vl
                                magnitude
   dist(km)    8.50      8.00      7.50      7.00      6.50      6.00      5.50      5.00
       3.00    880.50    501.45    285.58    162.64     92.63     52.75     30.04     17.11
       5.00 681.88995 388.34000 221.15999 125.96000  71.73000  40.85000  23.27000  13.25000
       7.00 536.28998 305.41998 173.93999  99.06000  56.42000  32.13000  18.30000  10.42000
      10.00 395.09000 225.00999 128.14000  72.98000  41.56000  23.67000  13.48000   7.68000
      15.00 266.53000 151.78999  86.45000  49.23000  28.04000  15.97000   9.09000   5.18000
      20.00 197.12000 112.25999  63.94000  36.41000  20.74000  11.81000   6.73000   3.83000
      30.00 125.32999  71.38000  40.65000  23.15000  13.18000   7.51000   4.28000   2.44000
      40.00  89.00000  50.68000  28.86000  16.44000   9.36000   5.33000   3.04000   1.73000
      50.00  67.25999  38.30000  21.81000  12.42000   7.08000   4.03000   2.29000   1.31000
      65.00  47.43000  27.01000  15.38000   8.76000   4.99000   2.84000   1.62000   0.92000
      80.00  35.30000  20.11000  11.45000   6.52000   3.71000   2.12000   1.20000   0.69000
     100.00  25.12000  14.30000   8.15000   4.64000   2.64000   1.50000   0.86000   0.49000
     120.00  18.61000  10.60000   6.04000   3.44000   1.96000   1.11000   0.63000   0.36000
     140.00  14.18000   8.08000   4.60000   2.62000   1.49000   0.85000   0.48000   0.28000
     160.00  11.03000   6.28000   3.58000   2.04000   1.16000   0.66000   0.38000   0.21000
0yrnoc=   100. iprint= 2 for area zn01
    123.000    39.500   122.650    39.500
    123.000    38.000   121.800    38.250
    122.500    37.500   121.650    37.800
    122.000    37.000   121.200    37.000
 nr of levels of seismicity =  2
 zn01 beta=  2.4201
 before normalizing to rate/year
 occurrences=  2.720000  9.122000
 earthquake rate / year
 occurrences=  0.027200  0.091220
  magnitudes=       5.00       5.50
 zn01 area=   22462. sq km, rate/sq km=  .12110E-05 for mags  4.75- 5.25
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault= 9999.998 km
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)      g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.11838  0.00004  3168.3 26754.6       16.00  0.11803  0.00039   300.2  2534.7
    32.00  0.00004  0.00000 99999.9 99999.9       32.00  0.00034  0.00005  2282.9 19277.6
```

C—071814

```
    48.00  0.00000  0.00000 99999.9 99999.9        48.00  0.00004  0.00001 10342.3 87335.4
    64.00  0.00000  0.00000 99999.9 99999.9        64.00  0.00001  0.00000 35143.5 99999.9
    80.00  0.00000  0.00000 99999.9 99999.9        80.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.11842                total yearly events    0.11842

         zero attenuation variability                  variability in atten, sigma=0.60
     0.900 ext prob =  7.793 for   100 years                    9.946 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft01
 Distance between dummy faults=  0.0
 fault  1 of  1
     123.00   38.30,    122.90   38.20,    122.65   37.90,    122.60   37.80,
    122.40   37.60,    122.35   37.50,    121.95   37.15,    121.90   37.10,
    121.70   37.00,
 nr of levels of seismicity =  1
 ft01 beta= -2.0000
 earthquake rate / year
 occurrences=  0.003300
  magnitudes=      8.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   86.876 km
         zero attenuation variability                  variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.12023  0.00149    81.5   669.6       16.00  0.11954  0.00218    55.8   458.7
    32.00  0.00149  0.00000 99999.9 99999.9       32.00  0.00157  0.00061   199.7  1640.5
    48.00  0.00000  0.00000 99999.9 99999.9       48.00  0.00041  0.00020   612.0  5028.2
    64.00  0.00000  0.00000 99999.9 99999.9       64.00  0.00013  0.00007  1655.9 13604.2
    80.00  0.00000  0.00000 99999.9 99999.9       80.00  0.00004  0.00003  4060.1 33356.3
    96.00  0.00000  0.00000 99999.9 99999.9       96.00  0.00002  0.00001  9197.8 75565.4
   112.00  0.00000  0.00000 99999.9 99999.9      112.00  0.00001  0.00001 19545.1 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9      128.00  0.00000  0.00000 39375.4 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9      144.00  0.00000  0.00000 75935.3 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9      160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.12172                total yearly events    0.12172

         zero attenuation variability                  variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                   25.130 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft02
 Distance between dummy faults=  0.0
 fault  1 of  1
     122.80   38.60,    122.75   38.50,    122.50   38.25,    122.45   38.15,
 nr of levels of seismicity =  1
 ft02 beta= -2.0000
 earthquake rate / year
 occurrences=  0.004500
  magnitudes=      7.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   65.999 km
         zero attenuation variability                  variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
```

C-071815

C—071815

```
   16.00  0.12473  0.00149    84.5   669.6        16.00  0.12357  0.00265    47.6   376.8
   32.00  0.00149  0.00000 99999.9 99999.9        32.00  0.00201  0.00065   195.5  1548.5
   48.00  0.00000  0.00000 99999.9 99999.9        48.00  0.00044  0.00020   620.3  4914.4
   64.00  0.00000  0.00000 99999.9 99999.9        64.00  0.00013  0.00007  1698.3 13455.4
   80.00  0.00000  0.00000 99999.9 99999.9        80.00  0.00004  0.00003  4186.1 33165.2
   96.00  0.00000  0.00000 99999.9 99999.9        96.00  0.00002  0.00001  9512.5 75364.4
  112.00  0.00000  0.00000 99999.9 99999.9       112.00  0.00001  0.00001 20267.7 99999.9
  128.00  0.00000  0.00000 99999.9 99999.9       128.00  0.00000  0.00000 40831.1 99999.9
  144.00  0.00000  0.00000 99999.9 99999.9       144.00  0.00000  0.00000 78742.6 99999.9
  160.00  0.00000  0.00000 99999.9 99999.9       160.00  0.00000  0.00000 99999.9 99999.9
  total yearly events    0.12622                total yearly events    0.12622

         zero attenuation variability                  variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                    26.458 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft03
 Distance between dummy faults=  0.0
 fault  1 of  1
    122.35   38.00,    122.20   37.85,    122.20   37.80,    121.95   37.55,
   121.90   37.45,    121.80   37.35,
 nr of levels of seismicity =  1
 ft03 beta= -2.0000
 earthquake rate / year
 occurrences=  0.005000
  magnitudes=      7.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   55.846 km
         zero attenuation variability                  variability in atten, sigma= 0.60
   g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
   16.00  0.12973  0.00149    87.9   669.6        16.00  0.12747  0.00375    35.0   266.7
   32.00  0.00149  0.00000 99999.9 99999.9        32.00  0.00296  0.00079   165.9  1264.3
   48.00  0.00000  0.00000 99999.9 99999.9        48.00  0.00056  0.00023   569.5  4340.0
   64.00  0.00000  0.00000 99999.9 99999.9        64.00  0.00015  0.00008  1625.1 12384.9
   80.00  0.00000  0.00000 99999.9 99999.9        80.00  0.00005  0.00003  4102.9 31267.1
   96.00  0.00000  0.00000 99999.9 99999.9        96.00  0.00002  0.00001  9469.1 72161.7
  112.00  0.00000  0.00000 99999.9 99999.9       112.00  0.00001  0.00001 20408.7 99999.9
  128.00  0.00000  0.00000 99999.9 99999.9       128.00  0.00000  0.00000 41518.2 99999.9
  144.00  0.00000  0.00000 99999.9 99999.9       144.00  0.00000  0.00000 80926.9 99999.9
  160.00  0.00000  0.00000 99999.9 99999.9       160.00  0.00000  0.00000 99999.9 99999.9
  total yearly events    0.13122                total yearly events    0.13122

         zero attenuation variability                  variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                    29.052 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft04
 Distance between dummy faults=  0.0
 fault  1 of  1
    122.05   37.90,    122.05   37.85,    121.90   37.70,    121.90   37.65,
   121.80   37.45,    121.70   37.35,    121.70   37.30,    121.60   37.20,
   121.55   37.10,    121.50   37.05,
 nr of levels of seismicity =  1
 ft04 beta= -2.0000
```

C-071816

C—071816

```
 earthquake rate / year
 occurrences=  0.005000
  magnitudes=      7.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   42.175 km
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)      g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.13473  0.00149    91.2   669.6       16.00  0.13128  0.00494    27.6   202.5
    32.00  0.00149  0.00000 99999.9 99999.9       32.00  0.00395  0.00099   138.2  1014.8
    48.00  0.00000  0.00000 99999.9 99999.9       48.00  0.00071  0.00027   500.1  3671.2
    64.00  0.00000  0.00000 99999.9 99999.9       64.00  0.00018  0.00009  1481.4 10875.4
    80.00  0.00000  0.00000 99999.9 99999.9       80.00  0.00006  0.00004  3839.6 28186.9
    96.00  0.00000  0.00000 99999.9 99999.9       96.00  0.00002  0.00002  9032.0 66305.0
   112.00  0.00000  0.00000 99999.9 99999.9      112.00  0.00001  0.00001 19755.8 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9      128.00  0.00000  0.00000 40668.6 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9      144.00  0.00000  0.00000 80149.2 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9      160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.13622               total yearly events    0.13622

          zero attenuation variability                    variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                    31.336 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val        =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft05
 Distance between dummy faults=  0.0
 fault  1 of  1
     122.15   38.35,    122.10   38.10,
 nr of levels of seismicity =  1
 ft05 beta= -2.0000
 earthquake rate / year
 occurrences=  0.002400
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   35.935 km
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)      g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.13713  0.00149    92.8   669.6       16.00  0.13314  0.00548    25.3   182.5
    32.00  0.00149  0.00000 99999.9 99999.9       32.00  0.00443  0.00105   131.5   949.0
    48.00  0.00000  0.00000 99999.9 99999.9       48.00  0.00077  0.00028   487.4  3516.1
    64.00  0.00000  0.00000 99999.9 99999.9       64.00  0.00019  0.00009  1464.2 10562.8
    80.00  0.00000  0.00000 99999.9 99999.9       80.00  0.00006  0.00004  3827.7 27612.7
    96.00  0.00000  0.00000 99999.9 99999.9       96.00  0.00002  0.00002  9056.0 65329.7
   112.00  0.00000  0.00000 99999.9 99999.9      112.00  0.00001  0.00001 19896.5 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9      128.00  0.00000  0.00000 41132.4 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9      144.00  0.00000  0.00000 81480.9 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9      160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.13862               total yearly events    0.13862

          zero attenuation variability                    variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                    32.002 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val        =   1.00          1.00
```

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C—071817

```
0yrnoc=     1. iprint= 2 for area ft07
 Distance between dummy faults=  0.0
 fault  1 of  1
     122.10   38.05,    122.00   37.95,    121.95   37.85,
 nr of levels of seismicity =  1
 ft07 beta= -2.0000
 earthquake rate / year
 occurrences=  0.003100
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   35.167 km
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.14023  0.00149    94.9   669.6       16.00  0.13555  0.00617    23.0   162.2
    32.00  0.00149  0.00000 99999.9 99999.9       32.00  0.00501  0.00115   123.0   867.7
    48.00  0.00000  0.00000 99999.9 99999.9       48.00  0.00085  0.00030   466.1  3289.1
    64.00  0.00000  0.00000 99999.9 99999.9       64.00  0.00020  0.00010  1422.4 10037.0
    80.00  0.00000  0.00000 99999.9 99999.9       80.00  0.00006  0.00004  3759.2 26525.7
    96.00  0.00000  0.00000 99999.9 99999.9       96.00  0.00002  0.00002  8965.3 63260.9
   112.00  0.00000  0.00000 99999.9 99999.9      112.00  0.00001  0.00001 19823.4 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9      128.00  0.00000  0.00000 41200.2 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9      144.00  0.00000  0.00000 82074.9 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9      160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.14172               total yearly events    0.14172

          zero attenuation variability                    variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                    33.077 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft08
 Distance between dummy faults=  0.0
 fault  1 of  1
     122.00   38.35,    121.90   38.25,
 nr of levels of seismicity =  1
 ft08 beta= -2.0000
 earthquake rate / year
 occurrences=  0.003800
  magnitudes=      6.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   20.654 km
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.14403  0.00149    97.4   669.6       16.00  0.13853  0.00699    20.8   143.0
    32.00  0.00149  0.00000 99999.9 99999.9       32.00  0.00574  0.00125   116.0   797.4
    48.00  0.00000  0.00000 99999.9 99999.9       48.00  0.00093  0.00032   452.6  3110.0
    64.00  0.00000  0.00000 99999.9 99999.9       64.00  0.00022  0.00010  1405.6  9659.2
    80.00  0.00000  0.00000 99999.9 99999.9       80.00  0.00006  0.00004  3756.5 25814.3
    96.00  0.00000  0.00000 99999.9 99999.9       96.00  0.00002  0.00002  9028.1 62040.4
   112.00  0.00000  0.00000 99999.9 99999.9      112.00  0.00001  0.00001 20084.8 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9      128.00  0.00000  0.00000 41991.2 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9      144.00  0.00000  0.00000 84275.6 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9      160.00  0.00000  0.00000 99999.9 99999.9
```

C-071818

C-071818

```
  total yearly events    0.14552                total yearly events    0.14552

         zero attenuation variability                  variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                   34.048 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val        =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft09
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.90   38.25,    121.90   38.15,    121.85   38.05,
 nr of levels of seismicity =  1
 ft09 beta= -2.0000
 earthquake rate / year
 occurrences=  0.003800
  magnitudes=      6.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
         zero attenuation variability                  variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.14783  0.00149   100.0   669.6       16.00  0.14080  0.00852    17.5   117.4
    32.00  0.00149  0.00000 99999.9 99999.9       32.00  0.00696  0.00156    95.8   641.9
    48.00  0.00000  0.00000 99999.9 99999.9       48.00  0.00117  0.00039   380.3  2546.8
    64.00  0.00000  0.00000 99999.9 99999.9       64.00  0.00027  0.00012  1210.3  8105.3
    80.00  0.00000  0.00000 99999.9 99999.9       80.00  0.00008  0.00005  3309.6 22164.6
    96.00  0.00000  0.00000 99999.9 99999.9       96.00  0.00003  0.00002  8111.7 54324.6
   112.00  0.00000  0.00000 99999.9 99999.9      112.00  0.00001  0.00001 18342.1 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9      128.00  0.00000  0.00000 38892.9 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9      144.00  0.00000  0.00000 79030.0 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9      160.00  0.00000  0.00000 99999.9 99999.9
  total yearly events    0.14932                total yearly events    0.14932

         zero attenuation variability                  variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                   36.541 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val        =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft10
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.85   38.05,    121.75   37.95,
 nr of levels of seismicity =  1
 ft10 beta= -2.0000
 earthquake rate / year
 occurrences=  0.002800
  magnitudes=      6.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
         zero attenuation variability                  variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.15063  0.00149   101.9   669.6       16.00  0.14248  0.00963    15.8   103.8
    32.00  0.00149  0.00000 99999.9 99999.9       32.00  0.00785  0.00178    85.4   561.6
    48.00  0.00000  0.00000 99999.9 99999.9       48.00  0.00134  0.00044   342.1  2248.7
    64.00  0.00000  0.00000 99999.9 99999.9       64.00  0.00031  0.00014  1103.1  7251.6
```

C-071819

C—071819

```
    80.00  0.00000  0.00000 99999.9 99999.9       80.00  0.00009  0.00005  3055.6 20087.0
    96.00  0.00000  0.00000 99999.9 99999.9       96.00  0.00003  0.00002  7574.8 49795.1
   112.00  0.00000  0.00000 99999.9 99999.9      112.00  0.00001  0.00001 17294.8 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9      128.00  0.00000  0.00000 36989.9 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9      144.00  0.00000  0.00000 75747.4 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9      160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.15212               total yearly events    0.15212

         zero attenuation variability                  variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                   38.052 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft11
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.75   37.95,    121.75   37.85,
 nr of levels of seismicity =  1
 ft11 beta= -2.0000
 earthquake rate / year
 occurrences=  0.003800
  magnitudes=      6.00
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
         zero attenuation variability                  variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.15443  0.00149   104.4   669.6       16.00  0.14549  0.01043    15.0    95.9
    32.00  0.00149  0.00000 99999.9 99999.9       32.00  0.00855  0.00188    83.1   532.8
    48.00  0.00000  0.00000 99999.9 99999.9       48.00  0.00142  0.00046   338.1  2168.2
    64.00  0.00000  0.00000 99999.9 99999.9       64.00  0.00032  0.00014  1101.4  7064.0
    80.00  0.00000  0.00000 99999.9 99999.9       80.00  0.00009  0.00005  3071.9 19701.6
    96.00  0.00000  0.00000 99999.9 99999.9       96.00  0.00003  0.00002  7653.3 49085.2
   112.00  0.00000  0.00000 99999.9 99999.9      112.00  0.00001  0.00001 17549.0 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9      128.00  0.00000  0.00000 37695.6 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9      144.00  0.00000  0.00000 77639.6 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9      160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.15592               total yearly events    0.15592

         zero attenuation variability                  variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.712 for   100 years                   38.583 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft12
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.90   37.95,    121.75   37.80,
 nr of levels of seismicity =  1
 ft12 beta= -2.0000
 earthquake rate / year
 occurrences=  0.001000
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
```

C-071820

C—071820

```
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.15541  0.00151   104.1   663.6      16.00  0.14610  0.01082    14.5    92.4
    32.00  0.00151  0.00000 99999.9 99999.9      32.00  0.00887  0.00196    80.2   511.0
    48.00  0.00000  0.00000 99999.9 99999.9      48.00  0.00148  0.00048   326.7  2082.0
    64.00  0.00000  0.00000 99999.9 99999.9      64.00  0.00033  0.00015  1067.2  6800.8
    80.00  0.00000  0.00000 99999.9 99999.9      80.00  0.00009  0.00005  2984.8 19021.2
    96.00  0.00000  0.00000 99999.9 99999.9      96.00  0.00003  0.00002  7456.1 47515.2
   112.00  0.00000  0.00000 99999.9 99999.9     112.00  0.00001  0.00001 17136.0 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9     128.00  0.00000  0.00000 36885.3 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9     144.00  0.00000  0.00000 76109.6 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9     160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.15692              total yearly events    0.15692

          zero attenuation variability                    variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.813 for   100 years                    39.052 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft13
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.75   37.80,    121.60   37.65,
 nr of levels of seismicity =  1
 ft13 beta= -2.0000
 earthquake rate / year
 occurrences=  0.001000
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.15641  0.00151   104.8   663.6      16.00  0.14689  0.01102    14.3    90.7
    32.00  0.00151  0.00000 99999.9 99999.9      32.00  0.00904  0.00198    79.7   504.8
    48.00  0.00000  0.00000 99999.9 99999.9      48.00  0.00150  0.00048   326.0  2064.1
    64.00  0.00000  0.00000 99999.9 99999.9      64.00  0.00034  0.00015  1067.3  6758.2
    80.00  0.00000  0.00000 99999.9 99999.9      80.00  0.00010  0.00005  2989.8 18932.2
    96.00  0.00000  0.00000 99999.9 99999.9      96.00  0.00003  0.00002  7477.2 47348.4
   112.00  0.00000  0.00000 99999.9 99999.9     112.00  0.00001  0.00001 17202.2 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9     128.00  0.00000  0.00000 37065.0 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9     144.00  0.00000  0.00000 76583.8 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9     160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.15792              total yearly events    0.15792

          zero attenuation variability                    variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.813 for   100 years                    39.173 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft14
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.65   37.65,    121.55   37.55,    121.50   37.40,    121.45   37.25,
 nr of levels of seismicity =  1
 ft14 beta= -2.0000
 earthquake rate / year
```

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```
 occurrences=  0.001000
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.15741  0.00151   105.5   663.6      16.00  0.14788  0.01104    14.4    90.6
    32.00  0.00151  0.00000 99999.9 99999.9      32.00  0.00906  0.00198    80.2   504.6
    48.00  0.00000  0.00000 99999.9 99999.9      48.00  0.00150  0.00048   328.0  2063.8
    64.00  0.00000  0.00000 99999.9 99999.9      64.00  0.00034  0.00015  1074.0  6757.8
    80.00  0.00000  0.00000 99999.9 99999.9      80.00  0.00010  0.00005  3008.7 18932.2
    96.00  0.00000  0.00000 99999.9 99999.9      96.00  0.00003  0.00002  7524.6 47348.4
   112.00  0.00000  0.00000 99999.9 99999.9     112.00  0.00001  0.00001 17311.1 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9     128.00  0.00000  0.00000 37299.7 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9     144.00  0.00000  0.00000 77068.7 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9     160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.15892              total yearly events    0.15892

          zero attenuation variability                    variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.813 for   100 years                   39.176 for  100 years
   ratio  100 yr 0.900 extreme value to  100 yr val         =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft15
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.00   38.80,    121.20   39.00,    121.50   39.50,    120.90   38.40,
    120.90   38.35,    120.80   38.25,    120.80   38.20,    120.65   38.05,
    120.65   38.00,    120.55   37.90,
 nr of levels of seismicity =  1
 ft15 beta= -2.0000
 earthquake rate / year
 occurrences=  0.000100
  magnitudes=      6.00
 fault rupture length parameters al= -2.440 bl=  0.566  sigl=  0.22
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=   16.910 km
          zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.15751  0.00151   105.5   663.6      16.00  0.14798  0.01104    14.4    90.6
    32.00  0.00151  0.00000 99999.9 99999.9      32.00  0.00906  0.00198    80.2   504.6
    48.00  0.00000  0.00000 99999.9 99999.9      48.00  0.00150  0.00048   328.2  2063.8
    64.00  0.00000  0.00000 99999.9 99999.9      64.00  0.00034  0.00015  1074.6  6757.8
    80.00  0.00000  0.00000 99999.9 99999.9      80.00  0.00010  0.00005  3010.6 18932.2
    96.00  0.00000  0.00000 99999.9 99999.9      96.00  0.00003  0.00002  7529.3 47348.4
   112.00  0.00000  0.00000 99999.9 99999.9     112.00  0.00001  0.00001 17321.9 99999.9
   128.00  0.00000  0.00000 99999.9 99999.9     128.00  0.00000  0.00000 37323.1 99999.9
   144.00  0.00000  0.00000 99999.9 99999.9     144.00  0.00000  0.00000 77117.0 99999.9
   160.00  0.00000  0.00000 99999.9 99999.9     160.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.15902              total yearly events    0.15902

          zero attenuation variability                    variability in atten, sigma=0.60
 log interpolation fails--use linear
     0.900 ext prob = 20.813 for   100 years                   39.176 for  100 years
```

C-071822

C—071822

```
  ratio  100 yr 0.900 extreme value to  100 yr val        =   1.00          1.00
0yrnoc=     1. iprint= 1 for area ft16
 Distance between dummy faults=  0.0
 fault  1 of  1
     122.30   39.13,    122.40   39.50,    121.95   38.50,    121.65   38.20,
    121.65   38.05,    121.60   38.00,    121.60   37.85,    121.55   37.80,
    121.45   37.65,    121.30   37.55,
 nr of levels of seismicity =  1
 ft16 beta= -2.0000
 earthquake rate / year
 occurrences=  0.001000
  magnitudes=      6.50
 fault rupture length parameters al= -1.960 bl=  0.497  sigl=  0.20
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=    3.995 km
         zero attenuation variability                    variability in atten, sigma= 0.60
    g.m.   occ/yr    exc/yr  r(events) r(yrs)     g.m.   occ/yr    exc/yr  r(events) r(yrs)
    16.00  0.15823  0.00179    89.5   559.1      16.00  0.14868  0.01134    14.1    88.2
    32.00  0.00161  0.00018   875.9  5473.8      32.00  0.00917  0.00217    73.8   460.9
    48.00  0.00004  0.00014  1139.3  7119.9      48.00  0.00155  0.00062   260.2  1626.0
    64.00  0.00004  0.00010  1662.7 10390.4      64.00  0.00037  0.00024   664.3  4151.6
    80.00  0.00005  0.00005  3344.9 20903.2      80.00  0.00012  0.00012  1337.8  8360.2
    96.00  0.00004  0.00001 31792.9 99999.9      96.00  0.00005  0.00007  2301.6 14383.5
   112.00  0.00000  0.00000 99999.9 99999.9     112.00  0.00002  0.00004  3592.7 22451.9
   128.00  0.00000  0.00000 99999.9 99999.9     128.00  0.00001  0.00003  5279.5 32993.1
   144.00  0.00000  0.00000 99999.9 99999.9     144.00  0.00001  0.00002  7471.4 46690.9
   160.00  0.00000  0.00000 99999.9 99999.9     160.00  0.00001  0.00002 10276.1 64218.3
   176.00  0.00000  0.00000 99999.9 99999.9     176.00  0.00000  0.00001 13882.5 86755.5
   192.00  0.00000  0.00000 99999.9 99999.9     192.00  0.00000  0.00001 18494.7 99999.9
   208.00  0.00000  0.00000 99999.9 99999.9     208.00  0.00000  0.00001 24360.5 99999.9
   224.00  0.00000  0.00000 99999.9 99999.9     224.00  0.00000  0.00001 31673.7 99999.9
   240.00  0.00000  0.00000 99999.9 99999.9     240.00  0.00000  0.00000 40845.1 99999.9
   256.00  0.00000  0.00000 99999.9 99999.9     256.00  0.00000  0.00000 52280.4 99999.9
   272.00  0.00000  0.00000 99999.9 99999.9     272.00  0.00000  0.00000 66461.1 99999.9
   288.00  0.00000  0.00000 99999.9 99999.9     288.00  0.00000  0.00000 83957.3 99999.9
   304.00  0.00000  0.00000 99999.9 99999.9     304.00  0.00000  0.00000 99999.9 99999.9
   total yearly events    0.16002              total yearly events    0.16002

         zero attenuation variability                    variability in atten, sigma=0.60
     0.900 ext prob = 19.711 for   100 years                   41.168 for  100 years
  ratio  100 yr 0.900 extreme value to  100 yr val        =   1.00          1.00
0yrnoc=     1. iprint= 2 for area ft17
 Distance between dummy faults=  0.0
 fault  1 of  1
     121.25   37.25,    121.10   37.05,
 nr of levels of seismicity =  1
 ft17 beta= -2.0000
 earthquake rate / year
 occurrences=  0.000200
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=    3.995 km
         zero attenuation variability                    variability in atten, sigma= 0.60
```

C-071823

C—071823

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
16.00	0.15843	0.00179	89.6	559.1	16.00	0.14888	0.01134	14.1	88.2
32.00	0.00161	0.00018	877.0	5473.8	32.00	0.00917	0.00217	73.8	460.9
48.00	0.00004	0.00014	1140.7	7119.9	48.00	0.00155	0.00062	260.5	1626.0
64.00	0.00004	0.00010	1664.7	10390.4	64.00	0.00037	0.00024	665.2	4151.6
80.00	0.00005	0.00005	3349.1	20903.2	80.00	0.00012	0.00012	1339.5	8360.2
96.00	0.00004	0.00001	31832.6	99999.9	96.00	0.00005	0.00007	2304.5	14383.5
112.00	0.00000	0.00000	99999.9	99999.9	112.00	0.00002	0.00004	3597.2	22451.9
128.00	0.00000	0.00000	99999.9	99999.9	128.00	0.00001	0.00003	5286.1	32993.1
144.00	0.00000	0.00000	99999.9	99999.9	144.00	0.00001	0.00002	7480.8	46690.9
160.00	0.00000	0.00000	99999.9	99999.9	160.00	0.00001	0.00002	10289.0	64218.3
176.00	0.00000	0.00000	99999.9	99999.9	176.00	0.00000	0.00001	13899.9	86755.5
192.00	0.00000	0.00000	99999.9	99999.9	192.00	0.00000	0.00001	18517.8	99999.9
208.00	0.00000	0.00000	99999.9	99999.9	208.00	0.00000	0.00001	24391.0	99999.9
224.00	0.00000	0.00000	99999.9	99999.9	224.00	0.00000	0.00001	31713.3	99999.9
240.00	0.00000	0.00000	99999.9	99999.9	240.00	0.00000	0.00000	40896.1	99999.9
256.00	0.00000	0.00000	99999.9	99999.9	256.00	0.00000	0.00000	52345.8	99999.9
272.00	0.00000	0.00000	99999.9	99999.9	272.00	0.00000	0.00000	66544.2	99999.9
288.00	0.00000	0.00000	99999.9	99999.9	288.00	0.00000	0.00000	84062.3	99999.9
304.00	0.00000	0.00000	99999.9	99999.9	304.00	0.00000	0.00000	99999.9	99999.9
total yearly events		0.16022			total yearly events		0.16022		

zero attenuation variability — variability in atten, sigma=0.60

0.900 ext prob = 19.711 for 100 years — 41.168 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft18
 Distance between dummy faults=  0.0
 fault  1 of  1
    122.95   38.80,    123.00   38.88,
 nr of levels of seismicity =  1
 ft18 beta= -2.0000
 earthquake rate / year
 occurrences=  0.001400
  magnitudes=      7.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=    3.995 km
```

zero attenuation variability — variability in atten, sigma= 0.60

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
16.00	0.15983	0.00179	90.4	559.1	16.00	0.15025	0.01137	14.2	88.0
32.00	0.00161	0.00018	884.7	5473.8	32.00	0.00920	0.00217	74.4	460.6
48.00	0.00004	0.00014	1150.7	7119.9	48.00	0.00156	0.00062	262.7	1625.5
64.00	0.00004	0.00010	1679.3	10390.4	64.00	0.00037	0.00024	670.9	4151.2
80.00	0.00005	0.00005	3378.3	20903.2	80.00	0.00012	0.00012	1351.1	8359.9
96.00	0.00004	0.00001	32110.8	99999.9	96.00	0.00005	0.00007	2324.6	14383.3
112.00	0.00000	0.00000	99999.9	99999.9	112.00	0.00002	0.00004	3628.6	22451.9
128.00	0.00000	0.00000	99999.9	99999.9	128.00	0.00001	0.00003	5332.3	32993.1
144.00	0.00000	0.00000	99999.9	99999.9	144.00	0.00001	0.00002	7546.1	46690.9
160.00	0.00000	0.00000	99999.9	99999.9	160.00	0.00001	0.00002	10378.9	64218.3
176.00	0.00000	0.00000	99999.9	99999.9	176.00	0.00000	0.00001	14021.3	86755.5
192.00	0.00000	0.00000	99999.9	99999.9	192.00	0.00000	0.00001	18679.6	99999.9
208.00	0.00000	0.00000	99999.9	99999.9	208.00	0.00000	0.00001	24604.1	99999.9
224.00	0.00000	0.00000	99999.9	99999.9	224.00	0.00000	0.00001	31990.4	99999.9
240.00	0.00000	0.00000	99999.9	99999.9	240.00	0.00000	0.00000	41253.5	99999.9
256.00	0.00000	0.00000	99999.9	99999.9	256.00	0.00000	0.00000	52803.2	99999.9

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C-071824

272.00	0.00000	0.00000	99999.9	99999.9		272.00	0.00000	0.00000	67125.7	99999.9
288.00	0.00000	0.00000	99999.9	99999.9		288.00	0.00000	0.00000	84796.8	99999.9
304.00	0.00000	0.00000	99999.9	99999.9		304.00	0.00000	0.00000	99999.9	99999.9
total yearly events		0.16162				total yearly events		0.16162		

zero attenuation variability — variability in atten, sigma=0.60

0.900 ext prob = 19.711 for 100 years — 41.174 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

```
0yrnoc=     1. iprint= 2 for area ft19
 Distance between dummy faults=  0.0
 fault  1 of  1
     122.70   38.80,    122.85   39.00,
 nr of levels of seismicity =  1
 ft19 beta= -2.0000
 earthquake rate / year
 occurrences=  0.000500
  magnitudes=      6.50
 fault rupture length parameters al= -3.720 bl=  0.767  sigl=  0.07
1North Delta
 site at long  121.697, lat   38.156
 shortest dist to fault=    3.995 km
```

zero attenuation variability — variability in atten, sigma= 0.60

g.m.	occ/yr	exc/yr	r(events)	r(yrs)	g.m.	occ/yr	exc/yr	r(events)	r(yrs)
16.00	0.16033	0.00179	90.6	559.1	16.00	0.15075	0.01137	14.3	88.0
32.00	0.00161	0.00018	887.4	5473.8	32.00	0.00920	0.00217	74.7	460.6
48.00	0.00004	0.00014	1154.3	7119.9	48.00	0.00156	0.00062	263.5	1625.5
64.00	0.00004	0.00010	1684.5	10390.4	64.00	0.00037	0.00024	673.0	4151.2
80.00	0.00005	0.00005	3388.8	20903.2	80.00	0.00012	0.00012	1355.3	8359.9
96.00	0.00004	0.00001	32210.1	99999.9	96.00	0.00005	0.00007	2331.8	14383.3
112.00	0.00000	0.00000	99999.9	99999.9	112.00	0.00002	0.00004	3639.9	22451.9
128.00	0.00000	0.00000	99999.9	99999.9	128.00	0.00001	0.00003	5348.8	32993.1
144.00	0.00000	0.00000	99999.9	99999.9	144.00	0.00001	0.00002	7569.5	46690.9
160.00	0.00000	0.00000	99999.9	99999.9	160.00	0.00001	0.00002	10411.0	64218.3
176.00	0.00000	0.00000	99999.9	99999.9	176.00	0.00000	0.00001	14064.7	86755.5
192.00	0.00000	0.00000	99999.9	99999.9	192.00	0.00000	0.00001	18737.4	99999.9
208.00	0.00000	0.00000	99999.9	99999.9	208.00	0.00000	0.00001	24680.2	99999.9
224.00	0.00000	0.00000	99999.9	99999.9	224.00	0.00000	0.00001	32089.3	99999.9
240.00	0.00000	0.00000	99999.9	99999.9	240.00	0.00000	0.00000	41381.1	99999.9
256.00	0.00000	0.00000	99999.9	99999.9	256.00	0.00000	0.00000	52966.5	99999.9
272.00	0.00000	0.00000	99999.9	99999.9	272.00	0.00000	0.00000	67333.3	99999.9
288.00	0.00000	0.00000	99999.9	99999.9	288.00	0.00000	0.00000	85059.1	99999.9
304.00	0.00000	0.00000	99999.9	99999.9	304.00	0.00000	0.00000	99999.9	99999.9
total yearly events		0.16212			total yearly events		0.16212		

zero attenuation variability — variability in atten, sigma=0.60

0.900 ext prob = 19.711 for 100 years — 41.174 for 100 years

ratio 100 yr 0.900 extreme value to 100 yr val = 1.00 1.00

C-071825

C—071825

APPENDIX B

Liquefaction Calculations

Results of Liquefaction Analysis

North Delta Seismic Risk Evaluation

Locations within the North Delta area where Standard Penetration Tests have been performed, analyses completed, and the required peak accelerations from a magnitude 6.5 earthquake to induce liquefaction in the levee foundations.

ANDRUS-BRANNAN ISLAND

Drill Hole No.	Acceleration Required for Liquefaction
B-1	.10g
B-3	.10g
B-4	.10g
B-7	.10g
B-9	.20g
B-11	.20g
B-12	.10g
B-13	.05g
B-15	.10g
1A1	.20g
1A2	.10g
5B-72-1	.05g
135ABBS	.20g
141ABBS	.20g
RSS-1	.10g
RSS-2	.05g
RSS-3	.10g
RST-1	.10g
RST-2	.05g
RST-3	.05g
RST-4	.05g
RST-5	.05g
RST-6	.05g
WB-81	.10g
WB-82	> .20g
2F-66-1	.05g
2F-66-2	.05g
7F-75-3	.05g

BRACK TRACT

Drill Hole No.	Acceleration Required for Liquefaction
B1	.20g
B4	.05g
B5	nonliquefiable
B8	nonliquefiable
B9	.20g

CANAL RANCH TRACT

Drill Hole No.	Acceleration Required for Liquefaction
CR1	nonliquefiable
CR2	nonliquefiable
CR3	nonliquefiable
CR4	nonliquefiable
CR5	nonliquefiable
CR6	nonliquefiable
CR7	nonliquefiable
CR8	nonliquefiable
CR9	nonliquefiable

McCORMACK-WILLIAMSON TRACT

Drill Hole No.	Acceleration Required for Liquefaction
MW1	> .20g
MW2	nonliquefiable
MW3	nonliquefiable
MW4	> .20g
MW5	nonliquefiable
MW6	> .20g
MW7	nonliquefiable
MW8	nonliquefiable
MW9	> .20g

NEW HOPE TRACT

Drill Hole No.	Acceleration Required for Liquefaction
NH-1	nonliquefiable
NH-2	.10g
NH-3	.20g
NH-4	nonliquefiable
NH-5	.10g
NH-6	nonliquefiable
NH-7	nonliquefiable
NH-8	nonliquefiable
NH-9	> .20g
NH-10	nonliquefiable
NH-11	> .20g
NH-12	.10g
B-1	> .20g

SHERMAN ISLAND

Drill Hole No.	Acceleration Required for Liquefaction
SX-1	.10g
SX-2	nonliquefiable
SX-5	.10g
SHIX-1	nonliquefiable
SHIX-2	nonliquefiable
SHIX-3	.10g
SHIX-5	.10g
SHIX-6	.05g
SHIX-7	.10g
SIX-4	.05g
B1	nonliquefiable
35A	.20g
39A	.10g
43A	.20g
48A	.20g
53A	> .20g
60A	.20g
74A	.20g
80A	nonliquefiable
89A	.20g
93A	.20g
95A	.20g

STATEN ISLAND

Drill Hole No.	Acceleration Required for Liquefaction
9A	nonliquefiable
14A	nonliquefiable
20A	.05g
25A	nonliquefiable
45A	.20g
53A	.10g
59A	nonliquefiable
65A	.10g

TWITCHELL ISLAND

Drill Hole No.	Acceleration Required for Liquefaction
TIB-1	.05g
TIB-2	.10g
TIB-3	.10g
TIB-4	.05g
TIB-5	.10g
TIB-6	.10g
TIB-7	.10g
TIB-8	.20g
TIB-9	.10g
TIB-10	.10g
TIB-11	.10g
TIB-12	nonliquefiable
TIB-13	.10g
TIB-14	nonliquefiable
TIB-15	> .20g
TIB-16	> .20g
TIX-1	.10g
TIX1	> .20g
TIX-2	.10g
TIX2	.10g
4A	.20g
7A	.05g
13A	.05g
17A	.10g
21A	.10g
26A	nonliquefiable

TOTALS

Accel. Required	No.	Percent
.05g	19	15.8%
.10g	36	30.0%
.20g	19	15.8%
> .20g	12	10.0%
nonliquefiable	34	28.3%
	120	