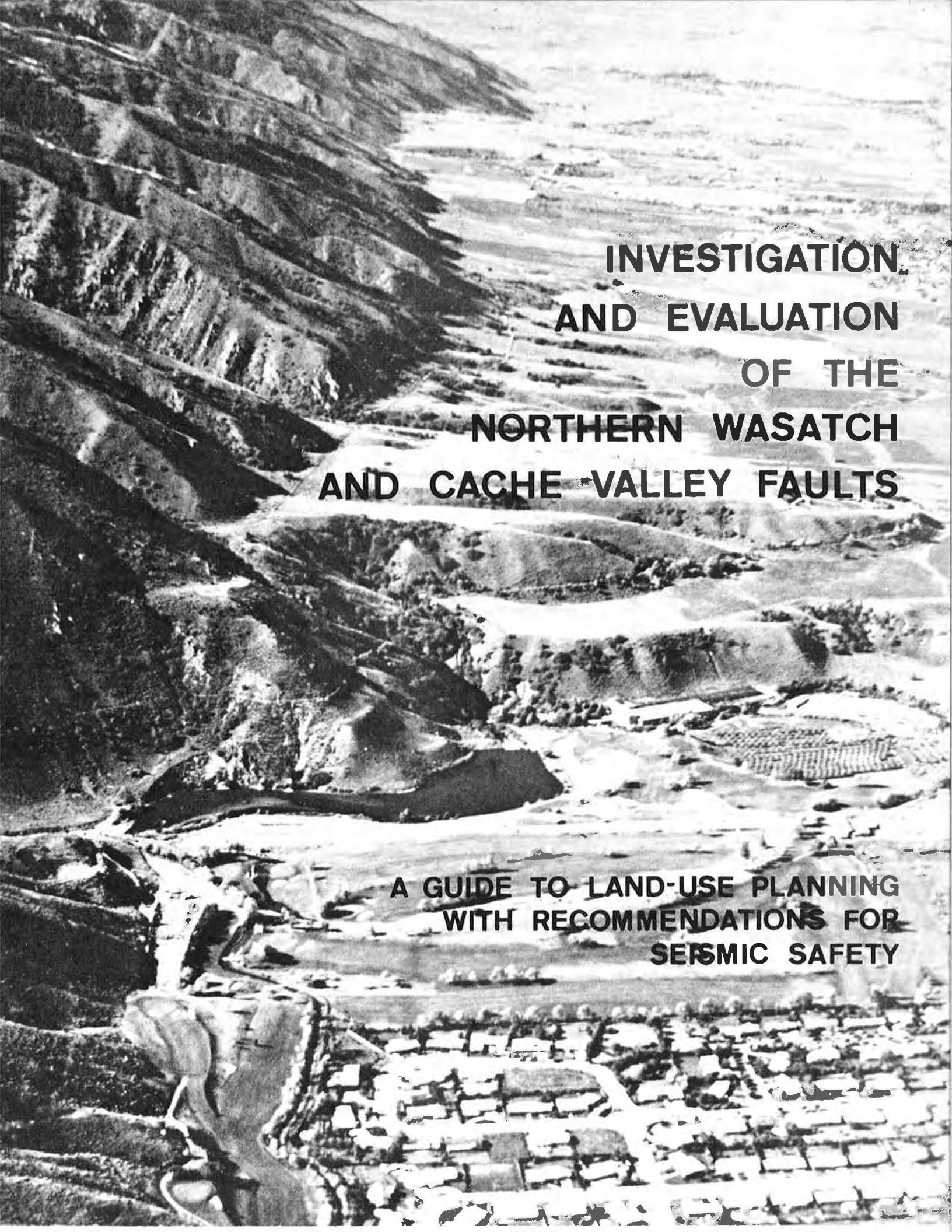
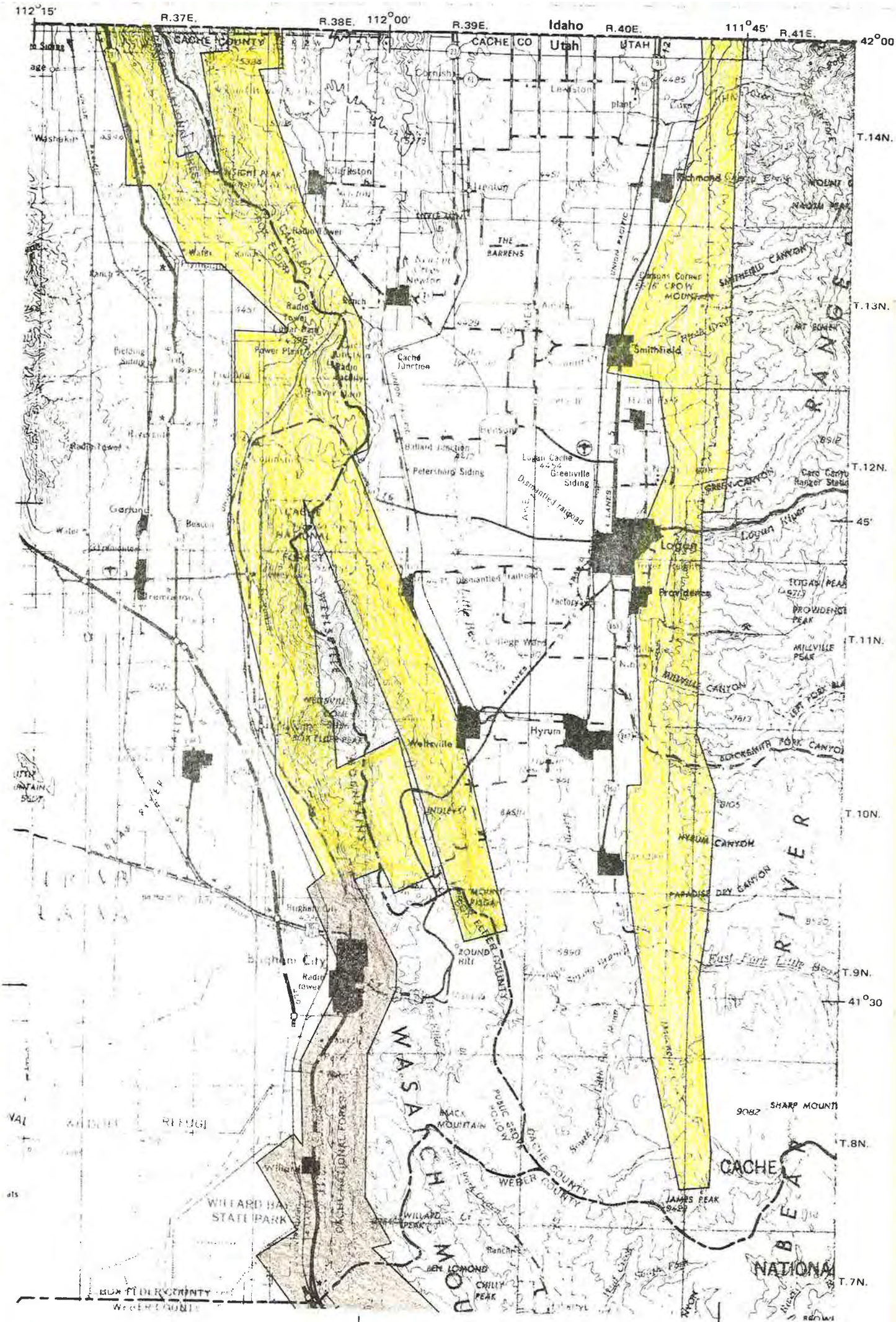


INVESTIGATION AND EVALUATION OF THE NORTHERN WASATCH AND CACHE VALLEY FAULTS

A GUIDE TO LAND-USE PLANNING WITH RECOMMENDATIONS FOR SEISMIC SAFETY

COVER PHOTO

Oblique aerial photograph of the East Cache Fault at Logan, Utah, looking south. The fault extends along the base of the Bear River Range in this area. One trace of the fault is located within the golf course, where it is marked by a faint, curving shadow; this trace extends into the developed area in the foreground and beneath the reservoir in the middleground. Active traces of the fault also extend through the terraces south of Logan, a potentially hazardous area that may be developed within the next decade.



EXPLANATION

Approximate limits of Special Aerial Photography

County Line

State Line

5 0 5 Miles

Scale 1:250,000

INDEX MAP FOR NORTHERN WASATCH & CACHE VALLEY FAULTS

UGMS Project No. G 12069

USGS Contract No. 14 08 001 13665

March 1975

Urban & Engineering Geology Section
Utah Geological & Mineral Survey
Salt Lake City, Utah 84112

#681

UTAH GEOLOGICAL AND MINERAL SURVEY

Donald T. McMillan, Director

103 UGS Bldg., University of Utah
Salt Lake City, Utah 84112
(801) 581-6831

Calvin L. Rampton
Governor
Gordon E. Harmston
Executive Director,
Department of Natural Resources

March 12, 1975

Gentlemen:

It is with pleasure that we transmit to you a copy of the report, "Investigation and Evaluation of the Northern Wasatch and Cache Valley Faults". The distribution of this report is being made at the request of the United States Geological Survey. The work was done by the U.S. Geological Survey as a continuation of the Utah Geological and Mineral Survey's earlier efforts along the central and southern portion of the Wasatch Front and Wasatch Fault Zone.

To assist in coping with geologic hazards in the state the Utah Geological & Mineral Survey identifies such hazards, educates Utah's officials and citizens of the hazards, and helps in resolving potential problems by cooperating with local, state and federal agencies upon their request. Particular emphasis is placed upon cooperation with the various planning entities at all government levels to assure that these hazards are adequately considered.

UGMS is the state's earth science investigative agency with statutory authority to (Utah Code, Annotated: 53-36-6):

Assist and advise state and local government agencies and state educational institutions on geologic subjects.

Determine and investigate areas of geologic and topographic hazards that could affect the safety of, or cause economic loss to, the citizens of Utah.

Cooperate with state agencies, political subdivisions of the state, quasi-governmental and federal agencies and others in the fields of mutual concern including field investigations, and preparation, publication and distribution of reports, maps, and publications embodying the results of the work.

The following page is an index map that we've prepared for you to immediately assess the area of fault study undertaken to date in Box Elder and Cache Counties.

Should you have questions or require more information relative to our Earthquake Hazards Reduction Program we would be glad to assist you further.

Donald T. McMillan, Director &
State Geologist

Bruce N. Kaliser, Chief, Urban &
Engineering Geology Section

INVESTIGATION AND EVALUATION OF THE WASATCH FAULT NORTH OF BRIGHAM CITY AND CACHE VALLEY FAULTS, UTAH AND IDAHO; A GUIDE TO LAND-USE PLANNING WITH RECOMMENDATIONS FOR SEISMIC SAFETY

By

Lloyd S. Cluff, Carl E. Glass, and George E. Brogan

Geologic investigation and evaluation in this report

Prepared For

U. S. Geological Survey

345 Middlefield Road

Menlo Park, California

Contract No. 14-08-001-13665

WOODWARD-LUNDGREN & ASSOCIATES
Consulting Engineers and Geologists
Oakland, California

WOODWARD - LUNDGREN & ASSOCIATES
CONSULTING ENGINEERS AND GEOLOGISTS
AN AFFILIATE OF WOODWARD-CLYDE CONSULTANTS

2730 Adeline Street
Oakland, Ca 94607
(415) 444-1256
P.O. Box 24075
Oakland, Ca 94623

Raymond Lundgren
George E. Hervert
B.A. Vallerga
Lloyd S. Cluff
Keshavan Nair

William T. Black
Edward Margason
Mahmut Otus
C.J. Van Til
Ulrich Luscher
Bernard B. Gordon
I.M. Idriss

June 30, 1974

Project: G-12865

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

Attention: Dr. Max D. Crittenden, Jr.

Gentlemen:

INVESTIGATION AND EVALUATION
OF THE
WASATCH FAULT NORTH OF BRIGHAM CITY
AND
CACHE VALLEY FAULTS
UTAH AND IDAHO
A GUIDE TO LAND-USE PLANNING WITH
RECOMMENDATIONS FOR SEISMIC SAFETY

The attached report and maps present the results of our investigation and evaluation of the Wasatch fault between Brigham City, Utah, and Malad City, Idaho; the West Cache fault between Mantua, Utah, and Oxford, Idaho; and the East Cache fault between Avon and Richmond, Utah.

This work marks the completion of detailed photogeologic mapping of the Wasatch fault between Gunnison, Utah and Malad City, Idaho, and the Cache Valley faults, for the purpose of land-use planning.

It is hoped that this report, and our two previous reports on the northern and southern Wasatch fault, which were prepared for the Utah Geological and Mineralogical Survey, will be utilized for land-use planning in order to minimize the potential hazards from future surface faulting. The maps in these three reports define the areas in which there is the greatest likelihood for surface faulting.

The geological record of recent surface faulting, as documented in Part I of this report and by our previous reports, attests to the fact that large prehistoric earthquakes have occurred along the Wasatch and Cache Valley faults. We believe that large earthquakes accompanied by surface faulting are likely to occur in the future. When this occurs, a significant number of people who live in the urban areas along the Wasatch and Cache Valley faults will be affected, as

approximately 85% of the population of Utah is located on or within five miles of the Wasatch fault. Thus, there is potential for not only an economic castastrophe, but also a tremendous loss of life, should a large earthquake occur. We hope that the use of this report will minimize the disasterous effects of such a future large earthquake.

Part I of this report presents the map data, conclusions, and a summary of recommendations that have been formulated as a result of this study.

We have included as Part II of this report some examples of legislation from California that attempt to regulate planning and construction in a way that should help to minimize the effects from earthquakes and surface faulting. We include these as recommendations, as it is our hope that legislation of the type in these examples will be passed in the state of Utah, so that planning and construction might be adequate in the event of a large earthquake accompanied by surface faulting.

We have included as Appendix A of this report a general discussion of active faults and earthquakes for those persons not familiar with these topics.

We understand that our previous two reports, in which we have mapped the Wasatch fault from Gunnison to Brigham City, Utah, are presently available at the Utah Geological and Mineralogical Survey, 103 Utah Geological Survey Building, University of Utah, Salt Lake City, Utah 84112.

We appreciate the opportunity of working with the personnel of the U.S. Geological Survey on this extremely important project, and for the interest and encouragement that this project has received.

Very truly yours,

Lloyd S. Cluff

LSC/sw

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PART I

THE NORTHERN WASATCH

AND

CACHE VALLEY FAULTS

INTRODUCTION

Damage resulting from surface faulting can occur whenever works of man are constructed astride a trace of an active fault. In Utah the potential for this type of earthquake damage is great, owing to the fact that the major population centers such as Salt Lake City, Provo, and Ogden, are aligned along the active Wasatch fault. Urban development along the Wasatch fault has proceeded in the past without regard to the consequences of fault displacements and, as a result, many important structures straddle the traces of active faults. This disregard, coupled with Utah's rapid growth and the paucity of detailed maps to aid planners and developers, has resulted in the continued development of areas that are potentially unsafe because of earthquake-related hazards such as active faulting.

The goal of this report is to identify areas along the Wasatch fault from Brigham City, Utah to Malad City, Idaho, as well as areas in Cache Valley, that exhibit high risk from future fault displacements and earthquake-induced ground failure. This report serves as an initial step in minimizing the consequences of future strong earthquakes accompanied by surface faulting in the Cache Valley and Malad-Bear River Valley areas by: (1) insuring a better understanding of the location of the active traces of the faults, and (2) making available this information to governmental agencies and urban planners.

There is no question that urban development will continue along the Wasatch fault and along faults in Cache Valley; however, this expansion should be carefully guided by adequate planning for geologic hazards with knowledge obtained by thorough engineering geologic investigations. When this guidance is implemented during the early planning stages of development, and incorported into long-range regional planning, urban development can proceed safely near active fault zones in Utah.

CONCLUSIONS

1. The Wasatch fault and the Cache Valley faults are part of a zone of active faults that extend from southern Utah into Idaho, Wyoming, and Montana. This zone, which is within the Intermountain seismic belt, has generated large earthquakes in the historic past, and will generate major earthquakes in the future. Although surface faulting may not accompany all earthquakes, surface faulting has occurred twice in this zone in historic time (Hebgen Lake Montana, 1959; Hansel Valley Utah, 1934), and is anticipated in the future along many of the active faults.

2. The Wasatch fault north of Brigham City and the Cache Valley faults are considered active on the basis of geomorphic evidence and historic seismicity. The landforms along these faults exhibit features typical of other recently active faults, but in general are more subdued than those along the Wasatch fault in the area of Salt Lake City. Thus, the Wasatch fault in the Salt Lake City area appears to have been active more recently than the faults in the area covered by this report. This may be interpreted in several ways to have implications for future fault and earthquake activity. It may mean that faulting in the area of Salt Lake City occurs more often than north of Brigham City or in Cache Valley, or it may mean that strain accumulated in the Salt Lake City area has been relieved recently, while strain accumulating along the northern Wasatch and Cache Valley faults has not. This accumulating strain could be relieved in the future by means of a large earthquake, a series of earthquakes, aseismic fault creep, or a combination of all of these mechanisms.

3. The Wasatch fault and Cache Valley faults are likely to generate large earthquakes in the future, and many of these large earthquakes will be accompanied by surface faulting. Structures located astride these active faults that have been mapped in this report, and in Cluff, et. al., (1970 and 1973), will no doubt be severely damaged or destroyed in such an event.

4. Structures located within the zones of lineaments that have been identified in this report, and in Cluff, et. al. (1970, 1973), have a great likelihood of being located astride an active fault. Thus, new structures being considered within the zone of lineaments should be constructed only after faulting at the site has been considered in detail (one such plan is presented in Part II of this report in the section entitled, "Methods of Evaluating Fault-Risk Problems").

5. It is likely that future fault displacements will occur along the most recently developed planes of weakness, which are shown on Map Sheets 1 through 25. The most likely locations for future major surface fault ruptures are along lines marked on the maps as Class I. Where no Class I lines are shown, the Class II lines represent the most likely lines along which surface faulting could occur. Minor displacements due to branch faulting or secondary faulting are most likely to be located along Class II and Class III lines; however, it must be recognized that, in areas where the faulting is older or obscured by recent cultural or other modification of the land surface, faults may rupture along lines not present on the accompanying maps.

6. Vertical deformation in the form of tilting of the land surface has occurred during prehistoric episodes of normal faulting along the Wasatch fault. This tilting has occurred over large areas adjacent to the fault, at distances as great as several hundred feet from the fault trace. It is likely that future episodes of surface faulting will be accompanied by tilting of the land adjacent to the fault. Tilting is important in certain structures, such as high-rise buildings, and is also significant to gravity-flow systems, such as aqueducts, canals, drainage lines and sewer systems.

7. The area of this and our previous studies (Cluff, et. al., 1970; 1973) is within the intermountain seismic zone and is likely to

be subjected to earthquake-induced hazards other than active faulting. Such hazards include strong shaking, landsliding, and ground failure due to compaction or liquefaction of foundation materials. The location of a site at which these hazards may exist is independent of the proximity of the site to the causative fault. Rather, these effects are directly related to the duration and intensity of shaking and the response of the foundation materials and soils to the earthquake. Therefore, it is possible to have a site located near an active fault that may be safer than a site with poor soil conditions (such as unconsolidated sands in a high water table) located several miles from the causative fault.

8. There are numerous landslides along the Wasatch Range front. These landslides may have been triggered by prehistoric earthquakes. Large earthquakes that are anticipated in the future could trigger other large landslides and rockfalls. These would be expected primarily in areas with steep slopes, and would affect areas adjacent to the range front.

9. Active faulting has been observed in some areas not covered by aerial photography for this study or Cluff, et. al. (1970, 1973). Although we believe that the main active traces of the Wasatch fault and Cache Valley faults have been identified by these studies, there is a possibility of active faulting in Utah and adjacent Idaho outside of the limits of this and the previous investigations.

SUMMARY OF RECOMMENDATIONS

This section of the report summarizes many of the recommendations located in Part II of this report.

Before private or public development is allowed to continue along the Wasatch fault and Cache Valley faults, comprehensive geological and engineering investigations and evaluations should be required. These investigations should define the exact locations of surface fault ruptures and other geologic hazards on or near any proposed development. Once these features have been defined accurately, an estimate should be made, with appropriate supporting data, of the extent and magnitude of displacement that should be anticipated for design purposes. Attention should be given to evaluate overall site stability to assure that a site can be expected to remain substantially intact during and subsequent to the design earthquake or fault displacement.

It is recommended that the maps within this and our previous reports (Cluff et. al., 1970; 1973) be utilized in land-use planning in the cities and counties in which the active faults and other earthquake-related hazards are located.

In evaluating the landslide potential, as well as locations of soil strata that might be subject to reduction of strength or liquefaction, it is recognized that complete certainty in the locations of such strata and in the evaluation of their behavior during an earthquake is not practically feasible. Therefore, the studies should be carried to a degree of thoroughness that would indicate a high order of dependability in the overall conclusions. The recommendations reached should include an appropriate evaluation of the limits of confidence that might be expected, based on the extent of the studies made.

Schools, hospitals, emergency services, and other buildings of high socio-economical importance should not be built astride traces of active faults. High-pressure transmission lines, including water, gas,

petroleum, chemical, and other volatile products, should avoid crossing an active fault if possible. Where these transmission lines must cross an active fault, they should do so at or near the ground surface in order to allow maintenance of the line at the fault. Design of these systems should incorporate such safety features as flexible joints and automatic shutoff valves to be activated immediately if the lines are damaged by fault displacement or during an earthquake.

Contingency plans to be followed in the event of a large earthquake should beformulated. It is important that recovery and reconstruction operations do not duplicate one another or create new disaster situations.

A highly competent Board of Review should be implemented and charged with the responsibility of evaluating the appropriateness of specific investigations and analyses that may be required for any particular land use or project. The appropriate scope and extent of such investigations and studies should be sufficient to enable the knowledgeable professional geologists, engineers, and other specialists on the Board of Review to ascertain that the severity of each particular type of problem has been reasonably evaluated, and the margins of safety provided are appropriate in relation to the particular problem under consideration. It is expected that, as work is carried on under this program, there will develop a sound body of information concerning investigative and design and construction procedures that will enable desirable projects to be carried out with an optimum balance between the factors of cost, risk, and function. This can be accomplished while encouraging continued improvement in the state of the art regarding application of technical knowledge to advantageous use of the properties concerned.

The responsibility of the Board should be as follows: 1) to establish and revise safety criteria with respect to risk zoning for active faults and structures within fault zones; 2) to review all proposed development projects for the adequacy of their specific safety criteria and

to make recommendations concerning these criteria; 3) to gather and make available data developed from specific projects under their jurisdiction; and 4) to complement the functions of local building departments and local city and county planning departments.

The organization of the Board of Review should consist of an equal number of geologists, soil engineers, and structural engineers. It should also include an architect and a planner. The membership should be balanced between 1) private employment, 2) academic institutions, and 3) government. The Board of Review should have adequate authority from either state code or local ordinances to give meaning to their actions.

Adequate legislation pertaining to fault zone hazards, particularly relating to schools, hospitals, emergency services, high-occupancy structures, and subdivisions should be introduced on both a statewide and local level. Examples of such earthquake legislation from California are presented in Part II of this report.

Building code standards should be related to fault zone problems established or recognized in this report and our previous reports (Cluff et al. 1970, 1973).

In view of the many different uses that may be planned for land areas along the Wasatch fault, and the variations in the geologic, soil, and foundation problems which require consideration, it is not feasible at this time to prescribe specific investigations, tests, or analyses that would be appropriate for all of these varied requirements. The object of the foregoing discussion, therefore, has been directed toward outlining the nature of the problems which might require consideration in any specific land use.

PURPOSE OF STUDY

The purpose of this study is two-fold: (1) to delineate the location of active traces of the Wasatch fault zone north of Brigham City, to delineate the locations of active faults marginal to Cache Valley and to indicate the potential hazards that exist along these faults; and (2) to recommend specific steps that can be taken to minimize the risk from fault and earthquake hazards.

To accomplish the first purpose, Part I of this report provides a series of maps of the Wasatch fault zone, from near Brigham City to Malad City, and the Cache Valley faults; it is accompanied by a descriptive text, and by background information in a general discussion of faulting and earthquakes in Appendix A. We suggest that persons not familiar with active faults, earthquake problems, and related land-use planning problems read Appendix A in order to obtain a better understanding of these phenomena.

To accomplish the second purpose, Part II of this report provides a discussion entitled, "Methods of evaluating fault-risk problems," which is a discussion of the types and sequence of investigations that should be used to minimize risk from active fault hazards. Also in Part II is a discussion of legislation needed on the state level in Utah and examples of recent legislation from California that deal with minimizing risk from active faults and earthquakes. The recommendations of this report bring into focus the actions that need to be taken by state, county, and civic bodies to reduce risk from fault and earthquake hazards along the Wasatch fault and Cache Valley faults.

SCOPE OF STUDY

This study consists of a regional geologic investigation to identify and delineate the active and potentially active traces of the Wasatch fault between Brigham City, Utah, and Malad City, Idaho, and faults in Cache Valley, Utah, as shown on Figure 1. The area investigated includes only those areas covered by low-sun-angle aerial photography taken especially for this study. The locations of the photography are shown on the map sheets in this report. The area covered by the low-sun-angle aerial photography is, in our opinion, the most critical zone for land-use planning with regard to active faulting. However, active faulting may extend beyond the limits of the area covered by the special aerial photography (for example, see Figures 4 and 5), and other studies may be needed to evaluate these areas. The enclosed maps delineate the most recently active fault traces and also show some of the more prominent landslides within the area of investigation. However, this study was designed specifically to delineate active fault traces and not especially designed to delineate other earthquake-related hazards, such as areas of potential liquefaction, differential ground settlement, or specific locations of strong ground shaking.

METHOD OF STUDY

The present investigation consists of the following items.

REVIEW OF EXISTING KNOWLEDGE

Knowledge of the Wasatch fault and related faults in northern Utah and southern Idaho was available mainly through the U. S. Geological Survey and the Utah Geological and Mineralogical Survey.

AERIAL FIELD ORIENTATION

Aerial reconnaissance of the area was undertaken to better establish the critical areas for study, to finalize the locations of flight lines, and to estimate the optimum time of day to take the low-sun-angle aerial photography.

SPECIAL LOW-SUN-ANGLE AERIAL PHOTOGRAPHY

Over the past few years we have developed a technique of aerial photography that enables one to see fault features and patterns of faulting often unrecognizable on conventional aerial photographs. This technique was developed in 1967-1968 by Cluff and Slemmons (see Slemmons, 1969; Cluff & Slemmons, 1971; and Slemmons, 1972) and uses low-angle sun illumination to accentuate surficial fault features. The object is to use shadowing and lighting effects produced by optimal sun illumination conditions. By photographing at the ideal time of day and year, characteristic features, which are difficult or impossible to see on conventional aerial photos, are enhanced.

Some of this new photography along the Wasatch fault is illustrated in Figures 6 though 17. Figure 2 is a reproduction of a conventional vertical aerial photograph taken of the Wasatch fault just south of Bells Canyon; for comparison, Figure 3 is a low-sun-angle vertical aerial photograph of the same area.

Photographs were flown for the present project at an approximate scale of 1:12,000. These were taken in summer, in the morning and evening.

The aerial photographs were interpreted stereoscopically and faults and related features were mapped on clear acetate overlays. The most significant of these fault-related features were then plotted on 7-1/2 minute topographic maps.

FIELD RECONNAISSANCE

A brief reconnaissance was conducted to field check some of the features interpreted on aerial photographs. Because of time limitations, the scope of this investigation did not permit comprehensive field verification of all features. We have plotted all those features that we feel are fault-related in symbols that are defined in the Explanation of Maps.

The investigation outlined above is a preliminary regional investigation, and as such corresponds to Step A of our "method of evaluating the fault risk problem;" this general method is outlined in Part II of this report.

ACTIVE FAULTS AND EARTHQUAKE-RELATED RISK IN UTAH AND IDAHO

Much of Utah and Idaho is situated in a seismically active region of the western United States; this seismically active area is laced by earthquake faults that often are located within or adjacent to major urban areas. The Wasatch fault, the East Cache fault, and the West Cache fault are but three of these active faults. Because of these and other active faults, virtually all of Utah and much of Idaho, Wyoming, and Montana are subject to earthquake shaking. Many experts in the disciplines of seismology, engineering geology, and structural engineering believe that future large earthquakes are inevitable in Utah and adjacent parts of Idaho and Wyoming, and that great damage and disaster are inevitable.

Active faults are but one such earthquake-related hazard, and if treated properly by adequate land-use planning, design, and construction, the risks from active faulting can be minimized to an acceptable level. Fortunately, the risk from active faults actually passing through structures is low in many western states because of the generally low correlation between active faults and population centers. However, Utah is in a unique position in this regard, in that: (1) the state is traversed by numerous active faults (some are shown in Figure 1), (2) past earthquake activity in Utah is great as evidenced by geologically young displacements along these faults, as well as by historic accounts of damaging earthquakes and, (3) three-quarters of a million people--about 85 percent of Utah's population--live within or along the active Wasatch fault zone. This unique correlation between population density and major active faults results in a high probability for serious damage as a result of future strong earthquakes. Recent experience with earthquakes in other areas of the world (for example, Agadir, 1960; Caracas, 1967; and Managua, 1972) indicates that extensive damage can occur even as a result of moderate earthquakes, when population density and the zone of earthquake energy release coincide closely as they could in Utah.

At present, the risk from surface faulting is highest in areas where development has taken place astride the active Wasatch fault. Risk can be minimized during future development by increased awareness of the fault, knowledge of the precise location of the fault, and knowledge of current methods used in mitigating fault- and earthquake-related hazards.

Actually, the greatest earthquake hazard to man is not directly from faulting or earthquake shaking, but instead it is from the effect of these natural phenomena on works of man. People are safely able to ride out a great earthquake in open country, provided there is no landslide, large-scale liquefaction, seich (a standing wave on a body of water) or tsunami (along an exposed coastline). It is primarily the structures that have been constructed in earthquakeprone regions that create the greatest hazard. Although the parameters of an earthquake cannot be controlled or predicted, land-use planning in potentially hazardous areas, and construction in earthquake-prone regions can be controlled. Thus, people have the ability to minimize earthquake hazards to an acceptable level now, mainly through adequate legislation at the state and local level.

California has recently been facing its earthquake hazard, mainly because of the San Fernando earthquake of 1971. Utah has a problem similar to California, but it has not yet been adequately recognized, because there have been relatively few moderate to large earthquakes in Utah in historic time.

Often in areas where the historic earthquake activity has been low, there is a tendency to ignore the earthquake risk and to concentrate on other geologic problems such as flash floods or landslides. All such geologic hazards are important and should be addressed so as to insure proper land use; however, when one considers that a single major earthquake could endanger the lives of a large percentage of the Salt Lake area population simultaneously, the problem can be placed in appropriate perspective. For example, the Salt Lake City area has not been affected by a damaging earthquake in its history, which is longer

than 100 years yet geologic data suggest that the most recent displacement along the Wasatch fault may have occurred only 200 to 300 years ago. It has been suggested, even by some competent professionals, that because Salt Lake City has not been damaged by an earthquake in the past 100 years, that the risk from other geologic hazards such as flashfloods, pose a more severe problem and should be addressed to the exclusion of the risk from earthquakes.

There are several new subdivisions in the Salt Lake City area which are located at the mouths of major stream canyons at the base of the Wasatch Front. In the event of a cloudburst, a flashflood originating in one of these canyons will surely destroy several homes in these subdivisions. Let us assume for purposes of discussion only that the return period for a severe cloudburst flashflood is 50 years, and that ten homes are destroyed during this event, killing half of the people in the homes. Assuming a family size of 4.5 people, the death risk (deaths/exposed persons/year) is 2.56×10^{-6}, where the exposed persons is taken to be the population of Salt Lake City (175,885 persons).

The active Wasatch fault passes through Salt Lake City and directly beneath numerous homes, businesses and apartment buildings, from approximately Little Cottonwood Canyon to just west of the University of Utah (for precise locations of the fault in Salt Lake City see Cluff, et. al., 1970). In the event of another displacement along the fault of the magnitude that produced the most recent scarps, the accompanying earthquake would be of major proportions (probably of magnitude 7-1/2 to 8-1/2); we can assume that all of the structures astride the fault would be destroyed by the fault displacement, and numerous other structures would be destroyed by other earthquake-related hazards such as ground shaking and ground failure. Let us assume that only three 10-story apartment buildings are destroyed. If we assume that there are 4 apartments per floor with family size of 4.5 persons in each, and if there is a 50% mortality rate in those buildings, the death risk is 5.12×10^{-6} for an earthquake with a recurrence period of 300 years. This is approximately double the

life-loss risk from flashfloods. If we assume a return period of 400 years, the death risk is 3.84×10^{-6} ; for a return period of 500 years the death risk is 3.07×10^{-6} ; these are still higher than the risk from flashfloods.

These figures are extremely rough and are not intended to represent risk quantitatively, as much more study would be required before that would become possible. However, the figures are valuable for comparison purposes. The example of risk used above is not at all conservative since many more than 3 buildings would be destroyed in the event of a large earthquake centered on a metropolitan area like Salt Lake City. To compound this situation, Salt Lake City's lifelines (water, gas, electricity, roads etc.) criss-cross the Wasatch fault and would be displaced and broken by faulting and could easily be lost for the first few days after the earthquake. If so, emergency services would be crippled at a critical time. It is quite possible that both the risk from flashfloods and from earthquakes may be unacceptable; it is up to the public to determine the risk it is willing to accept. In order to make such a decision, the public needs to be aware of all of the risks.

Recently, parallels have been drawn between earthquake risk in Salt Lake City and Managua, Nicaragua. Managua was destroyed by moderate-sized earthquakes centered at the city in 1931 and 1972. In terms of loss of life, Managua appears to have higher risk because of the shorter earthquake return period; however, in terms of metropolitan layout and spatial distribution of lifelines with respect to active faults and potential earthquake magnitude, the parallel between the two cities is striking indeed. Damage in Salt Lake City as a result of an earthquake beneath the city along the Wasatch fault could easily be as great as or greater than the damage that occurred in Managua in 1972.

The overall goal of this report and of our previous reports is to inform the public of active faults in and near urban areas of Utah and to suggest

some procedures to decrease the high risks associated with these faults. The risk from earthquakes and faulting in Utah is high, and should not be ignored. Neither should other hazards be ignored; proper land-use planning should incorporate a careful, comprehensive plan to evaluate geologic hazards (including earthquakes) and avoid areas that exhibit unacceptable risks. Part II of this report and Appendices B of our previous reports (Cluff, et. al., 1970 and 1973) provide examples of how other areas have approached the problem of developing a comprehensive land-use plan for assessment of geologic hazards.

WASATCH FAULT FROM BRIGHAM CITY, UTAH TO MALAD CITY, IDAHO

Faulting along the Wasatch front from Brigham City to Malad City is generally more subdued than faulting in areas to the south that exhibit very recent activity. The fault scarps have been modified by Lake Bonneville deposition and erosion, as well as other depositional and erosional processes.

The typical morphology of Bonneville shorelines is one of broad alluvial aprons which have been modified into a stairstep succesion of terraces. Geomorphology in the areas north of Brigham City, at the foot of the Wellsville Mountains, however, differs markedly from the typical. There the typical broad alluvial apron at the foot of the range front is replaced by a low, sometimes swampy area which is coincident with the foot of the Wellsville Mountains from Brigham City to Deweyville, Utah (Figures 6, 7, and 8). The abrupt departure from the typical geomorphology in other areas of the Wasatch fault is probably due to a combination of two things: (1) broad tilting of the downthrown fault block toward the upfaulted Wellsville Mountains; (2) large-scale landsliding into Lake Bonneville. The block tilting is responsible for the broad marshy areas at the foot of the mountains; urbanization in this area should take into account the saturated condition of the area as well as strong ground shaking and broad tilting that will undoubtedly accompany future earthquakes. The large-scale landsliding is exemplified immediately south of Flat Bottom Canyon where the last remnant

of the alluvial apron can be observed (Figure 9). The features between the rangefront and the gravel pit of Figure 9 are landslide features associated with the most recent episodes of landsliding and are not fault-related features.

A prominent fault scarp is located at the base of the Wellsville mountains between Flat Bottom Canyon and Kotter Canyon, coincident with the eastern edge of the subdivision shown on Figures 6 and 7. The prominence of the fault in this area strongly suggests a close correlation between the landsliding and the fault activity along the fault.

Faulting between Brigham City and Deweyville consists of relatively subdued, west-facing scarps that are more prominent where they displace the older alluvial fans but locally show some evidence of displacing younger fans as well.

The rangefront adjacent to Deweyville apparently marks the northern end of the mass landsliding into Lake Bonneville. The dominant features in this area consist of a complex association of faulting, block landsliding, and Bonneville shorelines (Figure 10). This complex association of features continues north of Deweyville around the northwest end of the Wellsville Mountains and appears to stop. The manner with which this faulting correlates with the faulting farther north is unclear at this time. Three possibilities exist: (1) faulting ceases at the end of the Wellsville Mountains forming a branch of a large en echelon feature, but is continued at the base of the Malad range to the north; (2) faulting continues but is concealed, around the northern end of the Wellsville Mountains where it again turns near Cutler Dam and along the western edge of the Junction Hills; or, (3) faulting continues, across the Bear River Valley where it intersects the western edge of the Junction Hills northeast of Fielding, Utah. The third possibility is difficult to establish due to the extensive agricultural development along the Bear River, which could have obliterated any existing fault features. The second possibility appears to be the most likely interpretation at this time.

In the area between Fielding and Plymouth, Utah, faulting exists at the western foot of the highlands that form the abutments for Cutler Dam (Figures 11 and 12). Probably the most spectacular features in this area are the large landslides that occur both south and north of Cutler Dam and along the southern slopes of Clarkston Mountain.

Immediately south of the southern abutment of Cutler Dam, a large landslide distorts the Bonneville shorelines, indicating post-Bonneville movement (Figure 12). Along the western slopes of the Junction Hills, very large block-landsliding has taken place, possibly as a result of earthquake activity during high stands of Lake Bonneville (Figure 13). The southern slopes of Clarkston Mountain exhibit considerable instability exemplified by numerous landslides and debris flows that are shown on Figure 14.

Faulting between Plymouth, Utah and Malad City, Idaho, exhibits a combination of relatively old, complex, bedrock and alluvial scarps. The most recent fault activity is located at the foot of the Malad Range (Figure 15) with several faults in bedrock in the general vicinity of Henderson Creek north of Woodruff, Idaho. Although the faulting in bedrock is prominent, it does not appear to displace the more recent alluvial material at the base of the range. The scarps that extend westward from the range displace older alluvial material, but younger alluvial fans appear to overlap the scarps without being displaced. Several landslides exist along this segment of the Wasatch fault, the largest of which is located east of Malad City between Maple Hollow and Little Valley (Figure 16).

CACHE VALLEY FAULT ZONES

Aerial photographs were taken along both the east and west Cache Valley fault zones. The east Cache fault zone is herein considered to include the faulting along the western edge of the Bear River Range from about James Peak, Utah, on the south, to Richmond, Utah, on the north. The west Cache fault zone is a discontinuous zone of scarps on the western edge of Cache Valley from approximately Mt. Pisgah, Utah on the south, to Oxford, Idaho, on the north.

East Cache Fault Zone

Faulting northeast of James Peak, Utah, exists as two branches. The western branch is followed by Davenport Creek and the eastern branch is located at the rangefront of the Bear River Mountains. The Davenport Creek branch looks quite prominent (Figure 17). However, there is little indication of its activity from the aerial photographs. North of Pole Creek, the Davenport Creek branch becomes difficult to trace, but is probably the controlling factor responsible for the landsliding and slope instability south of Avon (Figure 18). Also on Figure 18 are fault-related features that are apparently occupied by streams between Davenport Creek and the range-front.

The eastern branch is a prominent series of west-facing scarps at the base of the Bear River Mountains. The faulting appears to be more recent than that on the Davenport Creek branch (Figure 19). However, the most recent alluvial materials do not appear to be displaced by the faulting. North of Blacksmith Fork, the fault is prominent at the base of the Bear River Mountains (Figure 20). The faulting is more recent through eastern Logan, and can be seen on Figures 21-23 as it crosses Logan Country Club and passes through the eastern edge of the adjoining subdivision to the north (also shown on cover photograph).

Approximately 500 feet north of Green Canyon, north of Logan, the fault bifurcates. The western branch extends along the low series of hills located east of Smithfield. This western branch fault extends east of Round Hill and Long Hill, where some titling has apparently taken place. The fault becomes more subdued north of Smithfield and is marked by landslides near Birch Canyon and Smithfield Canyon. This fault can be traced northward, east of Richmond, Utah where several other landslides can be seen. North of Richmond, the fault can be traced intermittently to the Idaho border, where it appears to die out.

The eastern branch formed at the bifurcation north of Green Canyon is located along the base of the main Bear River Mountains to approximately Hyde Park Canyon where it is located in bedrock and extends northward to an area east of Franklin, Idaho.

West Cache Fault Zone

The southern limit of photo coverage of the west Cache fault zone is north and east of Mantua, Utah, near Mt. Pisgah. In the region of McMurdie Hollow, the photographs show lineaments in bedrock that may represent faults, or bedding planes, or both. These lineaments continue northward to Wellsville, where the faulting is located at the base of the Wellsville Mountains. The fault in that area is subdued and vegetated heavily; it continues with this same surface expression to the northern end of the Wellsville Mountains.

On the western flank of Cache Butte, several very young fault scarps displace Bonneville shorelines (Figure 24). This faulting continues across Cutler Reservoir along the eastern edge of the Junction Hills, at the foot of Clarkston Mountain, north to Hammond Flat. Numerous landslides occur on both sides of Cutler Reservoir and probably correspond landsliding to the Salt Lake Group and Lake Bonneville deposits (Figure 25). Near Clarkston, the fault forms a significant east-facing break in slope that is covered by thick vegetation (Figure 26).

North of Hammond Flat the fault is subdued, with much less evidence of activity. This fault exists from the eastern foot of the Malad Range to Cherry Creek, where it becomes difficult to trace on aerial photographs.

Another relatively short zone of faulting is located west of Clifton at the foot of the range. This fault is subdued and extends to the area of Oxford, where it appears to end.

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PART II

RECOMMENDATIONS FOR REDUCING RISK FROM EARTHQUAKES AND ACTIVE FAULTS

INTRODUCTION

The state of Utah is situated in a seismically active region of the United States, and major active faults adjoin or traverse all of the major population centers of the state. Consequently, virtually all of Utah's population is vulnerable to the damaging effects of earthquakes, and future earthquakes capable of producing great damage and disaster are inevitable.

Accordingly, the people and institutions of the state of Utah should commit themselves to a comprehensive and long-term effort to (1) take all practicable measures that will reduce the present high hazard levels and (2) avoid creating further hazards by discontinuing imprudent practices of planning, building, and development.

METHODS OF EVALUATING FAULT-RISK PROBLEMS

In order to mitigate earthquake hazards in California that appear to be similar in many ways to those of Utah, the state formed a Joint Committee on Seismic Safety. After four years of work by more than seventy technical experts and eight California legislators, their final report, entitled "Meeting the Earthquake Challenge," was published. It proposed guidelines for seismic safety on p. 5-6, which are quoted below:

> "First, thoughtful land use decisions are fundamental to seismic safety. We should make sure not to erect a structure on ground that is subject to high levels of seismic or geologic hazard, unless such construction is unavoidable, or the risk to life and property can be made acceptably low. Sometimes, of course, we are forced to build in areas of high hazard, such as across earthquake faults. A good example is the case of water mains. In such cases, we must use sophisticated and often expensive designs so that the structure and principal mains can accommodate substantial movement without loss of function. We should, moreover, also provide adequate back-up capacity and alternative temporary emergency facilities in case the use of the original facilities is lost."

> "Second, when contemplating grading or construction in seismic areas, one should first consider the stability of the underlying geologic formations. With ground of doubtful stability under earthquake conditions, building or grading should proceed only after all the likely consequences have been evaluated and approved by competent professionals."

> "Third, in a seismic region like California, decision makers should observe one invariable rule of thumb,

namely, that every significant structure in California can be expected to undergo at least one major earthquake in its lifetime. All should therefore be located, designed, and built to withstand future shaking or ground failure in order to minimize possible death or injury and avoid unnecessary or unacceptable damage. In any event, no action should be taken that will raise the earthquake risk above levels that reasonable people would presumably consider acceptable."

"All of the above considerations are important, but the third is crucial. Every building should be made as secure against earthquake shaking as is practicable. To this end, no structure should be built unless the geologist, architect, engineer, and builder - as well as the community - are satisfied that it meets adequate standards designed to prevent life-threatening collapse or damage in future earthquakes."

Thus, the fault-risk problem is not a simple question of either designing for complete protection or ignoring the risk altogether. From the point of view of society, neither of these alternatives is acceptable. To establish an acceptable, efficient and practical solution requires a significant amount of knowledge about the Wasatch fault and Cache Valley faults and their potential effects on works of man.

The most recently active portions of the Wasatch fault north of Brigham City and the Cache Valley faults have never before been sufficiently mapped. However, for site evaluations, accurate determination of a fault and full evaluation of its significance can only be accomplished by detailed geologic studies, geodetic studies, seismic studies and other special studies such as drilling and trenching. The geologic investigations should be followed by interdisciplinary evaluations involving geology, engineering and planning.

A comprehensive investigation for siting a structure to fully determine the exact location and significance of all active fault features and related geologic hazards should entail the following steps:

Step A: Preliminary Regional Geologic Investigation and Evaluation - (this is the scope of this report).

(1) Review of Existing Knowledge, including review of existing literature, maps, aerial photographs, and consultation with experts.

(2) Aerial Field Orientation, including aerial reconnaissance at both high and low altitude to reveal both synoptic and detailed features.

(3) Special Low Sun-Angle Aerial Photography at various scales (1:6000-1:24000).

(4) Field Study following preceding steps.

(5) Synthesis of Results.

(6) Preliminary Report should include results of above steps and recommend any additional necessary studies.

Upon completion of the above, sufficient preliminary information exists to establish regional land-use planning guides. This method allows urban development to proceed on a regional basis, while indicating the locations of potential hazards so that more detailed investigations can be undertaken to more fully evaluate their magnitude, extent and significance.

Step B: Detailed Investigations and Evaluation

(1) Detailed aerial photointerpretation.

(2) Detailed field mapping.

(3) Preliminary subsurface investigations as needed, including geophysical methods (seismic refraction, magnetic, gravity and resistivity); and selected trenching and drilling.

(4) Evaluation of fault-related features in conjunction with structural engineering considerations.

(5) Preparation of fault-risk zoning and a corresponding guide to land-use planning, taking into consideration (a) type of occupancy or land-use, (b) type of construction, (c) structural systems and height that will house the occupancy.

Upon completion of Step B, sufficient information will exist to determine the feasibility of certain types of land-use and building occupancy. The next step may warrant even more detailed investigations and evaluations of sites for specific land-use of building occupancy, such as hospitals, emergency services, and high occupancy structures.

Step C: Detailed Site Investigation and Evaluation

(1) Detailed extensive subsurface investigations utilizing mainly trenching and drilling.

(2) Detailed structural engineering evaluation.

Upon completion of Step C a specific site or proposed land-use could be fully evaluated from all aspects of active faulting and fault-related seismic hazards.

Ideally, the above investigations and evaluations (Steps A through C) should be completed along the entire Wasatch fault if high-density urban

development is desired; however, this study is limited to Step A, "Preliminary Regional Investigation and Evaluation" of the areas shown on the accompanying map sheets.

Before further development proceeds, complete investigations as outlined above should be undertaken in those areas where active faults or other geologic hazards are known or suspected.

AN APPROACH TO SEISMIC SAFETY

The following systematic approach, recommended by the California Joint Committee on Seismic Safety, can help to formulate guidelines for seismic safety and specific hazard-reducing measures for Utah. The community can reasonably be asked to adopt measures similar to these and, otherwise, implement them if it is to deal responsibly with earthquake hazards. Accordingly, the following recommendations are made:

(1) "We must insure that all who are directly involved in designing for earthquake safety, geologists, seismologists, planners, architects, engineers, builders, developers, and owners are effectively forewarned about earthquake and geologic hazards that should enter into their decisions. They should have such hazard information on hand even before any contemplated structure reaches the design or site selection stages, in order to avoid possible misunderstanding. Good decisions with regard to earthquake safety require a full understanding of existing hazards and their implications for site selection and preparation, and for designing, building, equipping and maintaining structures.

(2) "Full recognition should be given to seismic hazards when preparing general plans and land use regulations. This will enable land use control measures to play a vital role in minimizing future earthquake hazard.

(3) "In planning and designing structures, the participating professionals and owners need to engage in interdisciplinary communication during the design process, to ensure that their efforts are compatible, and mutually contribute to seismic safety.

(4) "We ought to make certain, through governmental controls, that building plans are reviewed by competent professionals to ensure that the designs and standards of construction called for will achieve acceptable levels of seismic safety (see Table II-1). To this end, the design process should be monitored and checked to ensure that earthquake safety standards are met. The designers need someone looking over their shoulders to see that a good job is done.

(5) "Adequate inspection - independent of the designer - and enforcement should take place during construction to make sure that the earthquake safety measures called for by the plans and specifications are carried out effectively, and that no on-the-job shortcuts create unnecessary earthquake hazards.

(6) "Preparedness plans and measures should be in readiness to guide the initial efforts that ought to be made when the inevitable happens and future earthquakes strike populated areas. Such measures must include the rescue and care of the injured and the housing and feeding of survivors. They must include plans for recovery and reconstruction-plans outlined before -and to prevent hasty rebuilding that may recreate old mistakes. They must include plans for economic recovery, and for aid to those who have suffered significant economic losses.

(7) "Financial rehabilitation measures may need to include a comprehensive disaster insurance program, with earthquake insurance a component part."

The Committee points out that getting the above recommendations enacted may be an extremely difficult job, due to the wide range of

Table II-1

A Scale of Acceptable Risks

Level of Acceptable Risk	Kinds of Structures	Extra Project Cost Probably Required to Reduce Risk to an Acceptable Level
1. Extremely low[1]	Structures whose continued functioning is critical, or whose failure might be catastrophic: nuclear reactors, large dams, power intertie systems, plants manufacturing or storing explosives or toxic materials	No set percentage (whatever is required for maximum attainable safety)
2. Slightly higher than under level 1[1]	Structures whose use is critically needed after a disaster: important utility centers; hospitals; fire, police, and emergency communication facilities; fire stations; and critical transportation elements such as bridges and overpasses; also smaller dams	5 to 25 percnet of project cost[2]
3. Lowest possible risk to occupants of the structure[3]	Structures of high occupancy, or whose use after a disaster would be particularly convenient: schools, churches, theaters, large hotels, and other high-rise buildings housing large numbers of people, other places normally attracting large concentrations of people, civic buildings such as fire stations, secondary utility structures, extremely large commercial enterprises, most roads, alternative or noncritical bridges and overpasses.	5 to 15 percent of project cost[4]
4. An "ordinary" level of risk to occupants of the structure[3,5]	The vast majority of structures: most commercial and industrial buildings, small hotels and apartment buildings, and single family residences.	1 to 2 percent of project cost, in most cases (2 to 10 percent of project cost in a minority of cases)[4]

[1] Failure of a single structure may affect substantial populations.

[2] These additional percentages are based on the assumption that the base cost is the total cost of the building or other facility when ready for occupancy. In addition, it is assumed that the structure would have been designed and built in accordance with current California practice. Moreover, the estimated additional cost presumes that structures in this acceptable-risk category are to embody sufficient safety to remain functional following an earthquake.

[3] Failure of a single structure would affect primarily only the occupants.

[4] These additional percentages are based on the assumption that the base cost is the total cost of the building or facility when ready for occupancy. In addition, it is assumed that the structures would have been designed and built in accordance with current California practice. Moreover the estimated additional cost presumes that structures in this acceptable-risk category are to be sufficiently safe to give reasonable assurance of preventing injury or loss of life during an earthquake, but otherwise not necessarily to remain functional.

[5] "Ordinary risk": Resist minor earthquakes without damage; resist moderate earthquakes without structural damage, but with some non-structural damage; resist major earthquakes of the intensity or severity of the strongest experienced in California, without collapse, but with some structural as well as nonstructural damage. In most structures, it is expected that structural damage, even in a major earthquake, could be limited to repairable damage. (Structural Engineers Association of California).

interests, disciplines, professions, and organizations involved. This difficulty should be considered as a challenge rather than a deterrent; and in this light, the Committee has recommended a basic legislative package which would apply equally to Utah as it does to California.

A BASIC LEGISLATIVE PACKAGE

The State of Utah should establish a commission on seismic safety with responsibility and authority to (1) develop seismic safety goals and programs, (2) help evaluate and integrate the work of state and local agencies concerned with earthquake safety, and (3) to see that programs are carried out effectively and the objectives accomplished.

The functions and responsibilities of the Utah commission on seismic safety in connection with earthquake hazard reduction should be the following: (1) set goals and priorities, (2) develop programs, (3) devise criteria and standards, (4) provide technical assistance, (5) monitor performance, review accomplishments, and recommend program changes, (6) review reconstruction efforts after damaging earthquakes, (7) gather, analyze, and disseminate information, (8) encourage research, (9) sponsor training to help improve the competence of specialized enforcement and other technical personnel, (10) help coordinate the seismic safety activities of government at all levels, and (11) ensure compliance with standards.

In order to carry out the above functions, the commission would need adequate powers, funds, and staff. While the commission's role would be advisory, coordinative, and policy making in nature, it should have the power to order compliance with State standards, should any state or local agency fail to implement and enforce sound seismic safety practices within a reasonable period of time.

The commission should consist of approximately eight to ten members. The commission should, above all, be principally representative of the public and authorized to establish advisory groups representing appropriate professions, disciplines, and interests.

LAND USE PLANNING MEASURES

Most basic zoning controls are lodged at the city and county level, where most land use planning decisions are actually implemented.

However, the State is unquestionably obligated to assure that the overriding questions of public health and safety are given adequate consideration. This is not being done in Utah today. State responsibility should include: (1) prudent planning and zoning to reduce future hazards, and (2) earthquake recovery guidance to ensure that post-disaster reconstruction programs do not re-create disaster situations.

The State of Utah should have a group (a Board of Review, as discussed in the Summary of Recommendations, or a Commission on Seismic Safety) by which the progress of local governments could be checked with respect to incorporating adequate seismic safety elements in their general plans. In addition, the State should consider adopting policies designed to ensure that the zoning and public building construction practices of cities and counties are consistent with the seismic safety elements of their general plans.

Legislation should be enacted to ensure that any future subdivision or building activity of substantial scope be undertaken only with full cognizance of the geologic and soils conditions in the general area and at the site of construction. Whenever there is any question in regard to the stability of the ground during earthquakes, neither grading nor building should be permitted until the question has been satisfactorily resolved by competent professionals in soils engineering and engineering geology.

Additional effort should be devoted to designating critical seismic-risk areas such as fault zones. This could be facilitated immediately by using Part I of this report and our previous reports (Cluff, et. al. 1970; 1973) as guides. Such areas should be of critical statewide concern, and appropriate measures should be taken immediately to regulate development by requiring special permits, setting aside open space in hazardous areas, and identifying hazards in general plans. Public funding agencies should ensure that public investment decisions and capitol improvements do not encourage development in hazardous areas.

The State should redefine subdivision to include all divisions of land into two or more parcels, so that no future land-dividing activity may escape the geologic safety regulation proposed above and spread, uncontrolled, across active faults or other severe geologic hazards as is happening at present along the Wasatch fault and Cache Valley areas. Accordingly, the State should require that cities and counties deny subdivision approval whenever there is reasonable doubt about the seismic-geologic safety of individual lots or subdivisions.

BUILDING CONSTRUCTION

The State of Utah should persistently pursue efforts to improve construction engineering standards and other code measures.

For more recommendations on building construction, refer to "Meeting the Earthquake Challenge," available from the Joint Committee on Seismic Safety, 777 N. First Street, suite 600, San Jose, California 95112.

ABATEMENT OF HAZARDOUS BUILDINGS

The State of Utah should proceed as soon as possible with a program of hazardous-building abatement. Activities should concentrate first on older buildings and those in areas of known hazards. For more specific recommendations, see "Meeting the Earthquake Challenge."

CRITICAL AND HIGH-EXPOSURE FACILITIES

It is essential to immediately begin to improve safety levels of facilities whose continued performance is critical immediately after an earthquake or whose failure would cause significant numbers of injuries and perhaps substantial loss of life. Structures such as schools, hospitals, emergency services, and high-rise structures should be examined with regard to: (1) collapse hazard, (2) performance of elevators, stairways, and mechanical and electrical facilities during and after an earthquake, (3) fire hazard and fire safety measures, and (4) performance of nonstructural components undergoing earthquake stresses.

EMERGENCY PREPAREDNESS MEASURES

The State should make it unmistakably clear that cities and counties are obligated to prepare and maintain emergency plans. Similar plans should be required of special districts and of public utilities that provide essential services such as water, gas, electricity, and sewage disposal. Provisions should be made for implementing the plans on a county and regional basis.

The California Joint Committee on Seismic Safety has influenced the activities of many disaster-related organizations in California through public hearings and investigations into earthquake safety programs. Through the committee's efforts, a number of items of legislation - considered too important to be delayed - have been presented. Among the urgent items of legislation, 14 out of 26 have been adopted into law. Of special interest are major bills covering hospital construction, strong motion instrumentation, faultline zoning, seismic safety element, and emergency service structures. This urgent legislation is provided in detail below with a brief synopsis before each bill.

CALIFORNIA LEGISLATION PROPOSED IN 1971

Senate Bill 351

Seismic Safety Element

Status: Enacted (Chapter 150)

SB 351 requires that all general plans consider the following: (a) a land use element, (b) a circulation element, (c) a housing element, (d) a conservation element, (e) an open-space element, and (f) a seismic safety element consisting of the identification and appraisal of seismic hazards.

Section 1. *Section 65302 of the Government Code is amended to read:*

65302. The general plan shall consist of a statement of development policies and shall include a diagram or diagrams and text setting forth objectives, principles, standards, and plan proposals. The plan shall include the following elements:

(a) A land use element which designates the proposed general distribution and general location and extent of the uses of the land for housing, business, industry, open space, including agriculture, natural resources, recreation, and enjoyment of scenic beauty, education, public buildings and grounds, solid and liquid waste disposal facilities, and other categories of public and private uses of land. The land use element shall include a statement of the standards of population density and building intensity recommended for the various districts and other territory covered by the plan. The land use element shall also identify areas covered by the plan which are subject to flooding and shall be reviewed annually with respect to such areas.

(b) A circulation element consisting of the general location and extent of existing and proposed major thoroughfares, transportation routes, terminals, and other local public utilities and facilities, all correlated with the land use element of the plan.

(c) A housing element consisting of standards and plans for the improvement of housing and for provision of adequate sites for housing. This element of the plan shall endeavor to make adequate provision for the housing needs of all economic segments of the community.

(d) A conservation element for the conservation, development, and utilization of natural resources including water and its hydraulic force, forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, and other natural resources. That portion of the conservation element including waters shall be developed in coordination with any countywide water agency and with all district and city agencies which have developed, served, controlled, or conserved water for any purpose for the county or city for which the plan is prepared. The conservation element may also cover:

(1) The reclamation of land and waters.

(2) Flood control.

(3) Prevention and control of the pollution of streams and other waters.

(4) Regulation of the use of land in stream channels and other areas required for the accomplishment of the conservation plan.

(5) Prevention, control, and correction of the erosion of soils, beaches, and shores.

(6) Protection of watersheds.

(7) The location, quantity and quality of the rock, sand and gravel resources.

(e) An open-space element as provided in Article 10.5 (commencing with Section 65560) of this chapter.

(f) A seismic safety element consisting of an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failures, or to effects of seismically induced waves such as tsunamis and seiches.

Senate Bill 352

Hospital Safety

Status: Passed into law as SB 519 (Chapter 1130) in 1972

SB 352 requires that plans for hospital construction or alteration be made by a structural engineer and a licensed architect. It establishes earthquake resistance standards for hospitals, and provides for approval of the plans and inspection of hospital construction and operation by the State Department of Public Health through its contract with the Schoolhouse Section of the Office of Architecture and Construction in the Department of General Services.

The people of the State of California do enact as follows:

Section 1. Division 12.5 (commencing with Section 15000)

DIVISION 12.5. BUILDINGS USED BY THE PUBLIC

CHAPTER 1. HOSPITALS

15000. The Legislature finds and declares as follows:

(a) California is situated on the rim of the great Circum-Pacific seismic belt, and it is inevitable that strong seismic disturbances along this belt will cause extensive property damage and endanger the lives of all people who enter or are near buildings which may collapse or be seriously damaged by such seismic disturbances.

(b) It is reasonable to expect that any building located anywhere within California will be subjected to the forces generated by a strong earthquake at least once during its life.

(c) Following the 1933 Long Beach earthquake, the Legislature enacted the so-called "Field Act" (Secs. 15451 to 15466, incl., Ed.C.) as an urgency measure, which established reasonable minimum standards and procedures for the design and construction of new public school buildings. The durability during subsequent earthquakes of school buildings designed and constructed under the provisions of those statutes, when compared with the durability during the same earthquakes of other buildings not designed and constructed pursuant to the "Field

Act," has repeatedly illustrated the prudence of such legislation.

(d) The San Fernando Valley earthquake of February 9, 1971, although moderate in terms of total energy release, resulted in such total collapse or damage as made many hospital buildings inoperable. Some of these damaged or destroyed hospital buildings were relatively new structures, designed and constructed to meet the standards as prescribed by most local jurisdictions throughout the State of California.

15001. It is the intent of the Legislature that hospitals, which house patients having less than the capacity of normally healthy persons to protect themselves, and which must be completely functional to perform all necessary services to the public after a disaster, shall be designed and constructed to resist, insofar as practicable, the forces generated by earthquakes. In order to accomplish this purpose the Legislature intends to establish proper building standards for earthquake resistance based upon current knowledge, and intends that procedures for the design and construction of hospitals be subjected to independent review. It is further the intent of the Legislature that this division shall be administered by the state department, which shall contract for enforcement of such provisions with the Schoolhouse Section of the Office of Architecture and Construction in the Department of General Services which now successfully enforces the provisions of the "Field Act." It is the intent of the Legislature that the Schoolhouse Section shall analyze the structural systems and details, as set forth in the working drawings and specifications, and supervise the construction of hospital projects and report the findings of such analysis to the state department. It is further the intent of the Legislature that those persons who prepare plans and specifications for hospitals be required to meet more stringent standards with respect to knowledge of aseismic design that has been previously required. It is further the intent of the Legislature to preempt from local jurisdictions the enforcement of building regulations adopted pursuant to this chapter including the plan checking. It is further the intent of the Legislature that where local jurisdictions have more restrictive standards for the enforcement of building regulations and construction supervision, such standards shall be enforced by the state.

15002. "Hospital building," as used in this chapter, means and includes any building used, or designed to be used, for a hospital,

as defined by Section 1401.

15003. "Construction or alteration," as used in this chapter, includes any construction, reconstruction, or alteration of, or addition to, any hospital building.

15004. "Schoolhouse Section," as used in this chapter, means the Schoolhouse Section of the Office of Architecture and Construction in the Department of General Services.

15005. The state department through its contract with the Schoolhouse Section shall supervise the construction of any hospital building and the reconstruction or alteration of or addition to any hospital building, for the protection of life and property.

15006. The state department through its contract with the Schoolhouse Section shall pass upon and approve or reject all plans for the construction or the alteration of any hospital building, independently reviewing the design and geological data to assure compliance with requirements of this chapter. Geological data shall be reviewed by an engineering geologist validly certified under Chapter 12.5 (commencing with Section 7800) of Division 3 of the Business and Professions Code and structural design data shall be reviewed by a structural engineer validly certified to use the title structural engineer under Chapter 7 (commencing with Section 6700) of Division 3 of the Business and Professions Code. The governing board of each hospital or other hospital governing authority, before adopting any plans for such hospital building, shall submit the plans to the state department for approval and shall pay the fees prescribed in this chapter.

15007. In each case, the application for approval of the plans shall be accompanied by the plans and full, complete, and accurate specifications, and structural design computations, and the specified fee, which shall comply with requirements prescribed by the state department.

15008. Plans submitted pursuant to this chapter for work which affects structural elements shall contain an assessment of the nature of the site and potential for earthquake damage, based upon geologic and engineering investigations by competent personnel of the causes of earthquake damage, such as:

(a) Sudden or slow slippage along a fault where evidence of past rupture indicates that future surface rupture can be expected within

the life of the structure. Siting shall not be permitted on such an active fault.

(b) Ground shaking.

(c) Ground failure, such as land sliding, lateral spreading, lurching, differential compaction, ground cracking, and liquefaction.

(d) Seismically induced waves such as tsunamis and seiches.

15009. The structural engineer shall give appropriate consideration to the ground shaking characteristics evaluation made pursuant to Section 15008.

The structural design of hospitals shall be performed only by a structural engineer.

15010. The application shall be accompanied by a filing fee in amounts as determined by the state department based on the estimated construction cost. The final fee shall be equal to the cost of the plan checking and construction services as determined by the cost accounting records of the Schoolhouse Section, including the costs of administering this chapter, but such final fee shall not exceed six-tenths of 1 percent of the final construction contract costs.

The minimum fee in any case shall be one hundred dollars ($100). If the actual construction cost exceeds the estimated construction cost by more than 5 percent, a further fee shall be paid to the state department, based on the above schedule and computed on the amount by which the actual cost exceeds the amount of the estimated cost.

15011. All fees shall be paid into the State Treasury and credited to the Hospital Building Account, which is hereby created in the Architecture Public Building Fund, and are continuously appropriated without regard to fiscal years for the use of the state department, subject to approval of the Department of Finance, in carrying out the provisions of this chapter. Adjustments in the amounts of the fees, as determined by the state department and approved by the Department of Finance, shall be made within the limits set in Section 15010 in order to maintain a reasonable working balance in the account.

15012. All plans and specifications shall be prepared by a certified architect holding a valid license under Chapter 3 (commencing with Section 5500) of Division 3 of the Business and Professions Code. A structural engineer holding a valid certificate to use the title structural engineer under Chapter 7 (commencing with Section 6700) of

Division 3 of the Business and Professions Code shall prepare the structural design for such plans and specifications. Administration of the work of construction shall be under the responsible charge of such architect and structural engineer, except that where plans and specifications for alterations or repairs do not affect architectural or structural conditions, such plans and specifications may be prepared and work of construction may be supervised by a professional engineer duly qualified to perform such services and holding a valid certificate under Chapter 7 (commencing with Section 6700) of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which said plans, specifications, and estimates and work of construction are applicable.

15013. Before letting any contract for any construction or alteration of any hospital building, the written approval of the plans as to safety of design and construction, by the state department through its contract with the Schoolhouse Section, shall be first had and obtained.

15014. No contract for the construction or alteration of any hospital building, made or executed on or after the effective date of this chapter by the governing board or authority of any hospital or other similar public board, body, or officer otherwise vested with authority to make or execute such a contract, is valid, and no money shall be paid for any work done under such a contract or for any labor or materials furnished in constructing or altering any such building, (1) unless the plans and specifications comply with the provisions of this chapter and the requirements prescribed by the state department, and (2) the approval thereof in writing has first been had and obtained from the state department through its contract with the Schoolhouse Section, and (3) the hospital building is to be accessible to, and usable by, the physically handicapped, as determined by the state department.

15015. The state department through its contract with the Schoolhouse Section shall make such inspection of the hospital buildings and of the work of construction or alteration as in its judgment is necessary or proper for the enforcement of this chapter and the protection of the safety of the public. The hospital governing board or authority shall provide for and require competent, adequate, and continuous

inspection during construction or alteration by an inspector satisfactory to the architect, structural engineer, and the state department. The inspector shall act under the direction of the architect and structural engineer, and be responsible to the board or authority. Notwithstanding any other provision of this section, where alterations or repairs are to be conducted under the supervision of a professional engineer pursuant to Section 15012, the inspector need only be satisfactory to the state department and to the professional engineer, and the inspector shall act under the direction of the professional engineer. In approving any inspector, the state department shall consult with the Schoolhouse Section.

15016. From time to time, as the work of construction or alteration progresses and whenever the Schoolhouse Section requires, the certified architect and structural engineer in charge of construction or registered engineer in charge of other work, the inspector on the work, and the contractor shall each make to the Schoolhouse Section a report, duly verified by him, upon a form prescribed by the state department in consultation with the Schoolhouse Section showing, of his own personal knowledge, that the work during the period covered by the report has been performed and materials used and installed are in accordance with the approved plans and specifications, setting forth such detailed statements of fact as are required by the Schoolhouse Section.

The term "personal knowledge," as used in this section and as applied to the architect, the registered engineer, and the contractor, means personal knowledge which is the result of such general administration of construction as is required and accepted of, and for, such persons in the superintendence of the construction of buildings. The term "personal knowledge," as applied to such persons, is to be distinguished from the continuous personal superintendence of the inspector who is continuously at the site of construction. Such persons shall, however, use reasonable diligence to obtain the information required.

The term "personal knowledge," as applied to the inspector, means the actual personal knowledge of the inspector obtained by his personal, continuous observation of the work of construction at the construction site in all stages of progress.

15017. Upon written request to the state department by the governing board or authority of any hospital, the Schoolhouse Section shall make, or cause to be made, an examination and report on the structural condition of any hospital building subject to the payment by the governing board or authority of the actual expenses incurred by the Schoolhouse Section.

15018. The state department may call upon Schoolhouse Section to make a periodic review of hospital operation to assure that the hospital is adequately prepared to resist damage caused by earthquake tremor. The review shall include, but not be limited to, evaluations of the structural safety of elevators, standby equipment and emergency procedures, and procedures and facilities for storage of dangerous gases, liquids, and solids. The governing board or authority of the hospital shall reimburse the state department for actual expenses incurred by the Schoolhouse Section in making such review. The state department shall contract with the Schoolhouse Section to cover expenses of such services.

15019. The state department, with the advice of the Schoolhouse Section, shall from time to time make such rules and regulations as it deems necessary, proper, or suitable to effectually carry out the provisions of this chapter. Standards developed by the Building Safety Board pursuant to Section 15021 shall be enforced by the state department with the advice of the Schoolhouse Section.

15020. Any person who knowingly violates any of the provisions of this chapter or makes any false statement in any verified report or affidavit required pursuant to this chapter is guilty of a felony.

15021. There is in the Department of General Services a Building Safety Board which shall conduct all activities with regard to seismic structural safety of hospitals or other structures as may be delegated to it. The Director of General Services shall appoint the members of the Building Safety Board, which shall develop building standards, and shall advise and act as a board of appeals in all matters affecting seismic structural safety in the administration and enforcement of this chapter. The board shall consist of 10 members appointed by the Director of General Services and five ex officio members who are: the Director of Public Health, the State Architect, the State Fire Marshal, the State Geologist, and the Chief Structural Engineer of the

Schoolhouse Section. Of the appointive members, two shall be structural engineers, two shall be architects, one shall be engineering geologist, one shall be a soils engineer, one shall be a seismologist, one shall be a mechanical engineer, one shall be an electrical engineer, and one shall be a hospital administrator. The appointive members shall serve at the pleasure of the director. He may also appoint as many other ex officio members as he may desire. Ex officio members are not entitled to vote. Board members, qualified by close connection with hospital design and construction and highly knowledgeable in their respective fields with particular reference to seismic safety, shall be appointed from nominees recommended by the governing bodies of the Structural Engineers Association of California; the California Council, American Institute of Architects; the Earthquake Engineering Research Institute; the Association of Engineering Geologists; the Consulting Engineers Association of California; the California Hospital Association. Board members shall be residents of California.

15022. The Building Safety Board shall convene upon request of the chairman thereof. He may convene a meeting of the board whenever it may be necessary, in his judgment, for the board to meet. The board shall adopt such rules of procedure as are necessary to enable it to perform its duties. The chairman of the board shall, in his discretion, or upon instructions from the board, designate subcommittees to study and report back to the board upon any technical subject or matter for which an independent review or further study is desired. Members of the board shall be reimbursed from the Hospital Building Account in the Architecture Public Building Fund for their reasonable actual expenses in attending meetings conducted to carry out the provisions of this chapter, but shall receive no compensation for their services.

15023. When there is disagreement regarding the construction or enforcement of this chapter concerning matters having to do with routine approval of plans and specifications, with specific approval or lack of approval, or when a new ruling or regulation or an amendment to an existing ruling or regulation is desired regarding any construction material, type of construction, or building, appeal may be had to the Building Safety Board, which appeal shall be submitted to the board accompanied by relevant data. The board will examine and consider all proper matters referred to it, together with the arguments

or other documents submitted in connection therewith. The board shall make such rulings as may seem advisable. Such rulings shall be binding on all parties concerned, and shall be subject to judicial review only as provided in Section 1094.5 of the Code of Civil Procedure.

15024. No license architect or license structural engineer, employed by the governing board or authority of a hospital to prepare plans for any hospital-building construction or alteration or employed to examine any hospital building pursuant to this chapter, shall be held personally liable for injury to persons or damage to property resulting from structural inadequacy or failure of the hospital building, provided such architect or engineer has exercised normal professional diligence in carrying out his functions under this chapter.

Senate Bill 479

Public School Siting

Status: Enacted (Chapter 913)

SB 479 requires a geologic investigation of prospective sites for new schools and for additions to existing schools. Sites investigated within the past five years are exempted.

The people of the State of California do enact as follows:

Section 1. Section 15002.1 of the Education Code is amended to read:

15002.1. The governing board of a school district, prior to acquiring any site on which it proposes to construct any school building as defined in Section 15452 shall have the site, or sites, under consideration investigated by competent personnel to ensure that the final site selection is determined by an evaluation of all factors affecting the public interest and is not limited to selection on the basis of raw land cost only. The investigation shall include such geological and engineering studies by competent personnel as are needed to provide an assessment of the nature of the site and potential for earthquake damage from causes such as:

(a) Sudden or slow slippage along a fault where surface rupture can be expected within the life of the building.

(b) Ground shaking.

(c) Ground failure, such as land sliding, lateral spreading, lurching, differential compaction, ground cracking, and liquefaction.

(d) Seismically induced waves such as tsunamis and seiches.

The geological and engineering studies of the site shall also be of such a nature as will preclude siting of a school on or below a slide area, or in any other location where the geological characteristics are such that the construction effort required to make the site safe for occupancy is economically unfeasible. No school building shall be constructed or situated on a geological fault. The evaluation shall also include location of the site with respect to

population, transportation, water supply, waste disposal facilities, utilities, traffic hazards, surface drainage conditions, and other factors affecting the operating costs, as well as the initial costs, of the total project. Such geological and engineering investigations shall be made for all additions or alterations, costing more than ten thousand dollars ($10,000), to existing buildings for work that effects structural elements, or for replacement of any building. No such study need be made if the site or sites under consideration have been the subject of adequate prior study made within five years preceding the date of commencement of the proposed construction.

A copy of the report of each investigation conducted pursuant to this section shall be submitted to the Department of General Services pursuant to Article 4 (commencing with Section 15451) of Chapter 2 of this division.

The cost of geological and engineering studies and investigations conducted pursuant to this section may be treated as a capital expenditure.

Senate Bill 778

Local Building Department Records

Status: Enacted (Chapter 616)

SB 778 requires that the building department of a city or county maintain as public records plans of the buildings for which that department has issued permits.

The people of the State of California do enact as follows:

Section 1. Chapter 10 (commencing with Section 19850) is added to Part 3, Division 13 of the Health and Safety Code, to read:

CHAPTER 10. BUILDING RECORDS

19850. The building department of every city or county shall maintain an official copy, which may be on microfilm or other type of photographic copy, of the plans of every building, during the life of such building, for which such department issued a building permit.

"Building department" means the department, bureau, or officer charged with the enforcement of laws or ordinances regulating the erection, construction, or alteration of buildings.

Plans need not be filed for:

(a) Single or multiple dwellings not more than two stories and basement in height.

(b) Garages and other structures appurtenant to buildings described under subdivision (a).

(c) Farm or ranch buildings.

(d) Any one-story building where the span between bearing walls does not exceed 25 feet. The exemption in this subdivision does not, however, apply to a steel frame or concrete building.

19851. The official copy of the plans maintained by the building department of the city or county provided for under Section 19850 shall be open for inspection only on the premises of the building department as a public record. Such copy may not be duplicated in whole or in

part except with the written permission of the certified, license or registered professional or his successor, if any, who signed the original documents and the written permission of the owner of such building, or by order of a proper court.

19852. The governing body of a city or county may prescribe such fees as will pay the expenses incurred by the building department of such city or county in maintaining the official copy of the plans of buildings for which it has issued a building permit.

19853. This chapter shall not apply to any building containing a bank, other financial institution, or public utility.

Senate Bill 1206

Active Faults

Status: Passed into law as SB 520 (Chapter 1354) in 1972

SB 1206 directs the State Geologist to delineate a zone along active faults and requires that all structures to be constructed within that zone be approved by the State Geologist on the basis of geologic and engineering reports.

The people of the State of California do enact as follows:

Section 1. Section 682 is added to the Public Resources Code to read:

682. There is in the department a Policy and Appeals Board which consists of six members appointed by the Governor and serving at his pleasure, who shall be recognized authorities in the fields of geology, seismology, engineering, and planning.

The State Geologist shall delineate a zone one-quarter mile wide centered approximately on the most recently active traces of the San Andreas Fault, from Point Arena to the southern boundary of San Bernardino County, and along any other faults or segments thereof, that he deems sufficiently well defined and active to constitute a potential hazard to structures from surface faulting.

Within the delineated zone, every proposed new real estate development or structure for human occupancy shall be approved by the State Geologist on the basis of geological and engineering reports directed to the problem of surface faulting and in accordance with policies and criteria established by the Policy and Appeals Board. The State Geologist shall not approve such a development or structure if an undue hazard would be created by the proposed development, giving consideration to the earthquake forces and movements identified in and justified by the geological and engineering reports. Each applicant shall be charged a fee according to a fee schedule established by the Policy and Appeals Board. It is the intent of the Legislature that the cost of the program established pursuant to this section shall be reimbursed by such fees.

Senate Bill 1374

Strong Motion Instrumentation Program

Status: Enacted (Chapter 1152)

SB 1374 directs the California Division of Mines and Geology to organize, purchase, install, and monitor strong motion instruments in representative structures and geological environments in the State.

The people of the State of California do enact as follows:

CHAPTER 8. STRONG-MOTION INSTRUMENTATION PROGRAM

2700. There is hereby established in the State of California a strong-motion instrumentation program for the purpose of administering the program and of acquiring strong-motion instruments and installing and maintaining such instruments as needed in representative geologic environments and structures throughout the state.

2701. The division shall organize and monitor the program with the advice of an advisory board appointed by the State Geologist which shall include, but not be limited to, a representative of the Earthquake Engineering Research Institute, the National Oceanic and Atmospheric Administration, the United States Geological Survey, the Structural Engineers Association of California, the Earthquake Engineering Research Center at the University of California, Berkeley, and the Earthquake Engineering Research Laboratory at the California Institute of Technology.

2702. The division shall purchase and install instruments in representative structures and geologic environments throughout the state as deemed necessary and desirable by the advisory board.

2703. The division shall negotiate with the National Oceanic and Atmospheric Administration or other competent agency an agreement by which the administration or such agency shall maintain and service the strong-motion instruments installed, and shall negotiate with appropriate state agencies to collect and interpret all records from the instruments and to make the records available and interpretations to

all interested parties.

2704. It is the intent of the Legislature in enacting this chapter to provide adequate instrumentation throughout California.

2705. All counties and cities shall collect a fee from all applicants for construction permits which shall be equal to .007 percent of the estimated construction cost of the structure.

2706. All fees collected pursuant to Section 2705 shall be deposited in the State Treasury in the Strong-Motion Instrumentation Special Fund, which fund is hereby created, to be used exclusively for the purposes of this chapter. All moneys in such fund are continuously appropriated to the division for the purposes of this chapter.

2707. The division, upon the advice of the advisory board, whenever it determines that an adequate instrumentation program has been achieved, may reduce the fee levied against building permits as provided in Section 2705 to a level sufficient to maintain the program established pursuant to this chapter.

2708. Any city or county that has adopted an ordinance requiring the installation of accelerographs in structures shall be exempted from the provisions of Section 2705 if both of the following has occurred:

(a) A minimum of one structure has been instrumented with three accelerographs installed in accordance with such ordinance prior to October 1, 1971.

(b) The State Geologist has received, on or before June 30, 1972, a written request of the governing body of such city or county that they be exempted.

CALIFORNIA LEGISLATION PROPOSED IN 1972

Senate Bill 519

Seismic Structural Safety of Hospitals

Status: Enacted (Chapter 1130)

SB 519 requires that the State Department of Public Health, through a contract with the Department of General Services, develop hospital construction standards and regulations, assume responsibility for overseeing construction, and perform structural plan-checking, and such periodic review of operating hospitals as required to assure adequate resistance to earthquake damage. It also calls for creation of an advisory building safety board.

Legislative Counsel's Digest

SB 519, as amended, Alquist. Hospital construction.

Requires the State Department of Public Health, through a contract with the Department of General Services, to (1) observe the construction of or addition to any hospital building or, if the work alters structural elements, the reconstruction or alteration of any hospital building, as it deems necessary for the protection of life and property; and (2) pass upon and approve or reject all plans for the construction or the alteration of any hospital building, independently reviewing the design and geological data to assure compliance with the requirements of the act. Requires that geological data be reviewed by an engineering geologist and structural design data be reviewed by a structural engineer.

Requires the governing board of each hospital or other hospital governing authority, before adopting any plans for such hospital

building, to submit the plans to the State Department of Public Health for approval and to pay prescribed fees, specifies what must accompany the application for approval, and prescribes requirements for plans and specifications.

Creates a Hospital Building Account in the Architecture Public Building Fund, requires that all fees collected pursuant to the act be credited to such account, and continuously appropriate money in such account, without regard to fiscal years, for the use of the State Department of Public Health, subject to approval of the Department of Finance, in carrying out the provisions of the act.

Declares that no contract for the construction or alteration of any hospital building made or executed on or after the effective date of the act is valid, and prohibits payment of any money for work done under such a contract, or for any labor or materials furnished in constructing or altering any such building, unless prescribed requirements are satisfied.

Prescribes requirments re administration of the work of construction, inspection of hospital buildings and of the work of construction or alteration, and reports concerning the work of construction or alteration.

Authorizes the State Department of Public Health to call upon the Department of General Services to make a periodic review of hospital operations to assure that the hospital is adequately prepared to resist damage caused by earthquake tremor and prescribes requirements re such review.

Authorizes the State Department of Public Health to make regulations to carry out the act.

The people of the State of California do enact as follows:

SECTION 1. The Legislature finds and declares as follows:

(a) California is situated on the rim of the great Circum-Pacific seismic belt and it is inevitable that strong seismic disturbances along this belt will cause extensive property damage and endanger the lives of all people who enter or are near buildings which may collapse or be seriously damaged by such seismic disturbances.

(b) It is reasonable to expect that any building located anywhere within California will be subjected to the forces generated by a strong earthquake at least once during its life.

(c) Following the 1933 Long Beach earthquake, the Legislature enacted the so-called "Field Act" (Sections 15451 to 15466, inclusive, Education Code) as an urgency measure, which established reasonable minimum standards and procedures for the design and construction of new public school buildings. The durability during subsequent earthquake of school buildings designed and constructed under the provisions of those statutes, when compared with the durability during the same earthquakes of other buildings not designed and constructed pursuant to the "Field Act," has repeatedly illustrated the prudence of such legislation.

(d) The San Fernando Valley earthquake of February 9, 1971, although moderate in terms of total energy release, resulted in such total collapse or damage as made many hospital buildings inoperable. Some of these damaged or destroyed hospital buildings were relatively new structures, designed and constructed to meet the standards as prescribed by most local jurisdictions throughout the State of California.

SEC. 2. It is the intent of the Legislature that hospitals, which house patients having less than the capacity of normally healthy persons to protect themselves, and which must be completely functional to perform all necessary services to the public after a disaster, shall be designed and constructed to resist, insofar as practicable, the forces generated by earthquakes, gravity, and winds. In order to accomplish this purpose the Legislature intends to establish proper building standards for earthquake resistance based upon current knowledge, and intends that procedures for the design and construction of hospitals be subjected to independent review. It is further the intent of the Legislature that Division 12.5 (commencing with Section 15000) of the Health and Safety Code shall be administered by the State Department of Public Health, which shall contract for enforcement of such provisions with the Department of General Services which now successfully enforces the provisions of the "Field Act."

SEC. 3. Division 12.5 (commencing with Section 15000) is added to the Health and Safety Code, to read:

DIVISION 12.5 BUILDINGS USED BY THE PUBLIC

CHAPTER 1. Hospitals

15000. It is the intent of the Legislature that the Department of General Services shall analyze the structural systems and details, as set forth in the working drawings and specifications, and inspect the construction of hospital projects and report the findings of such analysis to the state department. It is further the intent of the Legislature to preempt from local jurisdictions the enforcement of building regulations adopted pursuant to this chapter including the plan checking. It is further the intent of the Legislature that where local jurisdictions have more restrictive standards for the enforcement of building regulations and construction supervision, such standards shall be enforced by the state.

15001. "Hospital building," as used in this chapter, means and includes any building used, or designed to be used, for a hospital and shall include all of the following:

(a) All hospitals of a type required to be licensed pursuant to Chapter 2 (commencing with Section 1400) of Division 2 and facilities of a type required to be licensed pursuant to Chapter 1 (commencing with Section 7000) of Division 7 of the Welfare and Institutions Code.

(b) Institutions conducted, maintained, or operated by this state or any state department, authority, district, bureau, commission, or officer or by the Regents of the University of California, or by a board of supervisors of a county under the provisions of Chapter 2.5 (commencing with Section 1440) of Division 2, which, except for the exemption provided by Section 1415, would be encompassed by the terms of subdivision (a).

15002. "Construction or alteration," as used in this chapter, include any construction, reconstruction, or alteration of, or addition to, any hospital building.

15003. "Architect," as used in this chapter, means a person who is certified and holds a valid license under Chapter 3 (commencing with Section 5500) of Division 3 of the Business and Professions Code.

15004. "Structural engineer," as used in this chapter, means a person who is validly certified to use the title structural engineer under Chapter 7 (commencing with Section 6700) of Division 3 of the Business and Professions Code.

15005. "Engineering geologist," as used in this chapter, means a person who is validly certified under Chapter 12.5 (commencing with Section 7800) of Division 3 of the Business and Professions Code.

15006. The state department, through its contract with the Department of General Services, shall observe the construction of, or addition to, any hospital building or, if the work alters structural elements, the reconstruction or alteration of any hospital building, as it deems necessary to comply with the provisions of this chapter for the protection of life and property.

15007. The state department, through its contract with the Department of General Services, shall pass upon and approve or reject all plans for the construction or the alteration of any hospital building, independently reviewing the design and geological data to assure compliance with requirements of this chapter. Geological data shall be reviewed by an engineering geologist and structural design data shall be reviewed by a structural engineer. The governing board of each hospital or other hospital governing authority, before adopting any plans for such hospital building, shall submit the plans to the state department for approval and shall pay the fees prescribed in this chapter.

15008. In each case, the application for approval of the plans shall be accompanied by the plans and full, complete, and accurate specifications, and structural design computations, and the specified fee, which shall comply with requirements prescribed by the state department.

15009. Plans submitted pursuant to this chapter for work which affects structural elements shall contain an assessment of the nature of the site and potential for earthquake damage, based upon geologic and engineering investigations by competent personnel of the causes of earthquake damage. One-story Type V construction of 4,000 square feet or less shall be exempt from the provisions of this section.

15010. The engineering investigation shall be correlated with the geologic evaluation made pursuant to Section 15009.

15011. The application shall be accompained by a filing fee in an amount which the state department determines will cover the costs of administering this chapter. Such fee shall be based on a uniform percentage of the estimated construction cost, and shall not exceed 0.7 percent of the estimated construction cost.

The minimum fee in any case shall be one hundred dollars ($100). If the actual construction cost exceeds the estimated construction cost by more than 5 percent, a further fee shall be paid to the state department, based on the above schedule and computed on the amount by which the actual cost exceeds the amount of the estimated cost.

15012. All fees shall be paid into the State Treasury and credited to the Hospital Building Account, which is hereby created in the Architecture Public Building Fund, and are continuously appropriated without regard to fiscal years for the use of the state department, subject to approval of the department of Finance, in carrying out the provisions of this chapter. Adjustments in the amounts of the fees, as determined by the state department and approved by the Department of Finance, shall be made within the limits set in Section 15011 in order to maintain a reasonable working balance in the account.

15013. All plans and specifications shall be prepared by an architect. A structural engineer shall prepare the structural design for such plans and specifications. Administration of the work of construction shall be under the responsible charge of such architect and structural engineer, except that where plans and specifications for alterations or repairs do not affect architectural or structural conditions, such plans and specifications may be prepared and work of construction may be administered by a professional engineer duly qualified to perform such services and holding a valid certificate under Chapter 7 (commencing with Section 6700) of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which said plans, specifications, and estimates and work of construction are applicable.

15014. Before letting any contract for any construction or alteration of any hospital building, the written approval of the plans as to safety of design and construction, by the state department, through its contract with the Department of General Services, shall be first had and obtained.

15015. No contract for the construction or alteration of any hospital building, made or executed on or after the effective date of this chapter by the governing board or authority of any hospital or other similar public board, body, or officer otherwise vested with authority to make or execute such a contract, is valid, and no money shall be paid for any work done under such a contract or for any labor or materials furnished in constructing or altering any such building, (1) unless the plans and specifications comply with the provisions of this chapter and the requirements prescribed by the state department, and (2) the approval thereof in writing has first been had and obtained from the state department, through its contract with the Department of General Services, and (3) the hospital building is to be accessible to, and usable by, the physically handicapped, and (4) the plans and specifications comply with the first and panic safety requirements of the State Fire Marshal.

15016. The state department, through its contract with the Department of General Services, shall make such inspection of the hospital buildings and of the work of construction or alteration as in its judgment is necessary or proper for the enforcement of this chapter and the protection of the safety of the public. The hospital governing board or authority shall provide for and require competent, adequate, and continuous inspection during construction or alteration by an inspector satisfactory to the architect, structural engineer, and the state department. The inspector shall act under the direction of the architect and structural engineer, and be responsible to the board or authority. Notwithstanding any other provision of this section, where alterations or repairs are to be conducted under the supervision of a professional engineer pursuant to Section 15013, the inspector need only be satisfactory to the state department and to

the professional engineer, and the inspector shall act under the direction of the professional engineer. In approving any inspector, the state department shall consult with the Department of General Services.

15017. From time to time, as the work of construction or alteration progresses and whenever the Department of General Services requires, the architect and structural engineer in charge of construction or registered engineer in charge of other work, the inspector on the work, and the contractor shall each make to the Department of General Services a report, duly verified by him, upon a form prescribed by the state department, in consultation with the Department of General Services, showing, of his own personal knowledge, that the work during the period covered by the report has been performed and materials used and installed are in accordance with the approved plans and specifications, setting forth such detailed statements of fact as are required by the Department of General Services.

The term "personal knowledge," as used in this section and as applied to the architect and registered engineer, means personal knowledge which is the result of such general administration of construction as is required and accepted of, and for, such persons in the construction of buildings. Such persons shall, however, use reasonable diligence to obtain the information required.

The term "personal knowledge," as applied to the inspector, means the actual personal knowledge of the inspector obtained by his personal, continuous observation of the work of construction at the construction site in all stages of progress.

15018. Upon written request to the state department by the governing board or authority of any hospital, the state department through contract with the Department of General Services shall make, or cause to be made, an examination and report on the structural condition of any hospital building subject to the payment by the governing board or authority of the actual expenses incurred by the state department.

15019. The state department may call upon the Department of General Services to make a periodic review of hospital operation to

assure that the hospital is adequately prepared to resist damage caused by earthquake tremor. The review shall include, but not be limited to, evaluations of the structural safety of elevators, standby equipment and emergency procedures, and procedures and facilities for storage of dangerous gases, liquids, and solids. The governing board or authority of the hospital shall reimburse the state department for actual expenses incurred in making such review. The state department shall contract with the Department of General Services for such services.

15020. The state department, with the advice of the Department of General Services, shall from time to time make such rules and regulations as it deems necessary, proper, or suitable to effectually carry out the provisions of this chapter.

15021. There is in the state department a Building Safety Board which shall advise and act as a board of appeals with regard to seismic structural safety of hospitals. The Director of Public Health, with the advise of the Department of General Services, shall appoint the members of the Building Safety Board, which shall advise and act as a board of appeals in all matters affecting seismic structural safety in the administration and enforcement of this chapter. The board shall consist of 11 members appointed by the Director of Public Health and six ex officio members who are: the Director of Public Health, the State Architect, the State Fire Marshal, the State Geologist, the Chief of the Bureau of Health Facilities Planning and Construction in the state department and the Chief Structural Engineer of the School-house Section of the Office of Architecture and Construction in the Department of General Services. Of the appointive members, two shall be structural engineers, two shall be architects, one shall be an engineering geologist, one shall be a soils engineer, one shall be a seismologist, one shall be a mechanical engineer, one shall be an electrical engineer, and one shall be a hospital administrator. The appointive members shall serve at the pleasure of the director. He may also appoint as many other ex officio members as he may desire. Ex officio members are not entitled to vote. Board members, qualified

Senate Bill 520

Geologic Hazard Zones

Status: Enacted (Chapter 13454)

SB 520 expands the membership of the State Mining and Geology Board, and instructs that body to prepare policies and criteria for the development of designated special studies zones encompassing major active fault traces. Additional fees are charged to those applying for building permits for sites within such zones, and the revenues are split by the State and local jurisdictions. The State Geologist shall prepare maps of those zones for use by local and State government.

The people of the State of California do enact as follows:

SECTION 1. Section 660 of the Public Resources Code is amended to read:

660. There is in the department a State Mining and Geology Board, consisting of 11 members appointed by the Governor, subject to confirmation by the Senate, for terms of four years and until their successors are appointed and qualified. The State Mining and Geology Board shall also serve as a policy and appeals board for the purposes of Chapter 7.5 (commencing with Section 2621) of Division 2.

SEC. 2. Section 661 of the Public Resources Code is ammended to read:

661. Members of the board shall be selected from citizens of this state associated with or having broad knowledge of the mineral industries of this state, of its geologic resources, or of related technical and scientific fields, to the end that the functions of the board as specified in Section 667 are conducted in the best interests of the state. Among the 11 members, two should be mining geologists, mining engineers, or mineral economists, one should be a structural engineer, one should be a geophysicist, one should be an urban or regional planner, one should be a soils engineer, two should be geologists,

one should be a representative of county government, and at least two shall be members of the public having an interest in and knowledge of the environment.

SEC. 3. Section 662 of the Public Resources Code is amended to read:

662. The terms of the members of the board in office when this article takes effect in 1965 shall expire as follows: one member January 15, 1966; two members January 15, 1967; and two members January 15, 1968. The terms shall expire in the same relative order as to each member as the term for which he holds office before this article takes effect. The terms of the two additional members first appointed pursuant to the amendment of this section at the 1968 Regular Session of the Legislature shall commence on January 15, 1969. The terms of the two additional members first appointed pursuant to the amendment of Section 660 at the 1970 Regular Session of the Legislature shall commence on January 15, 1971, but the term of one of such additional members, who shall be designated by the Governor, shall expire on January 15, 1974. The terms of the two additional members first appointed pursuant to the amendment of Section 660 at the 1972 Regular Session of the Legislature shall commence on January 15, 1973, but the term of one of such additional members, who shall be designated by the Governor, shall expire on January 15, 1976.

SEC. 4. Chapter 7.5 (commencing with Section 2621) is added to Division 2 of the Public Resources Code, to read:

CHAPTER 7.5. HAZARD ZONES

2621. This chapter shall be known and may be cited as the Alquist-Priolo Geologic Hazard Zones Act.

2621.5. It is the purpose of this chapter to provide for the adoption and administration of zoning laws, ordinances, rules, and regulations by cities and counties, as well as to implement such general plan as may be in effect in any city or county. The Legislature declares that the provisions of this chapter are intended to provide policies and criteria to assist cities, counties, and state agencies in the exercise of their responsibility to provide for the public safety in hazardous fault zones.

2622. In order to assist cities and counties in their planning, zoning, and building-regulation functions, the State Geologist shall delineate, by December 31, 1973, appropriately wide special studies zones to encompass all potentially and recently active traces of the San Andreas, Calaveras, Hayward, and San Jacinto Faults, and such other faults, or segments thereof, as he deems sufficiently active and well-defined as to constitute a potential hazard to structures from surface faulting or fault creep. Such special studies zones shall ordinarily be one-quarter mile or less in width, except in circumstances which may require the State Geologist to designate a wider zone.

Pursuant to this section, the State Geologist shall compile maps delineating the special studies zones and shall submit such maps to all affected cities, counties, and state agencies, not later than December 31, 1973, for review and comment. Concerned jurisdictions and agencies shall submit all such comments to the State Mining and Geology Board for review and consideration within 90 days. Within 90 days of such review, the State Geologist shall provide copies of the official maps to concerned state agencies and to each city or county having jurisdiction over lands lying within any such zone.

The State Geologist shall continually review new geologic and seismic data and shall revise the special studies zones or delineate additional special studies zones when warranted by new information. The State Geologist shall submit all such revisions to all affected cities, counties, and state agencies for their review and comment. Concerned jurisdictions and agencies shall submit all such comments to the State Mining and Geology Board for review and consideration within 30 days. Within 30 days of such review, the State Geologist shall provide copies of the revised official maps to concerned state agencies and to each city or county having jurisdiction over lands lying within any such zone.

2623. Within the special studies zones delineated pursuant to Section 2622, the site of every proposed new real estate development or structure for human occupancy shall be approved by the city or county having jurisdiction over such lands in accordance with

policies and criteria established by the State Mining and Geology Board and the findings of the State Geologist. Such policies and criteria shall be established by the State Mining and Geology Board not later than December 31, 1973. In the development of such policies and criteria, the State Mining and Geology Board shall seek the comment and advice of affected cities, counties, and state agencies. Cities and counties shall not approve the location of such a development or structure within a delineated special studies zone if an undue hazard would be created, and approval may be withheld pending geologic and engineering studies to more adequately define the zone of hazard. If the city or county finds that no undue hazard exists, geologic and engineering studies may be waived, with approval of the State Geologist, and the location of the proposed development or structure may be approved.

2624. Nothing in this chapter is intended to prevent cities and counties from establishing policies and criteria which are stricter than those established by the State Mining and Geology Board, nor from imposing and collecting fees in addition to those required under this chapter.

2625. Each applicant for a building permit within a delineated special studies zone shall be charged a reasonable fee according to a fee schedule established by the State Mining and Geology Board. Such fees shall be set in an amount sufficient to meet, but not to exceed, the costs to state and local government of administering and complying with the provisions of this chapter. Such fee shall not exceed one-tenth of 1 percent of the total valuation of the proposed building construction for which the building permit is issued, as determined by the local building official. One-half of the proceeds of such fees shall be retained by the city or county having jurisdiction over the proposed development or structure for the purpose of implementing this chapter, and the remaining one-half of the proceeds shall be deposited in the General Fund.

SEC. 5. There is hereby appropriated from the General Fund in the State Treasury to the Department of Conservation the sum of one hundred thousand dollars ($100,000) for the purposes of Section 2622 of the Public Resources Code.

Senate Bill 689

Clarification of School Building Sites Bill of 1971

Status: Enacted (Chapter 332)

SB 689 makes clarifying changes in the requirements established by SB 479 (1971) concerning geologic and soils investigations for school building sites.

The people of the State of California do enact as follows:

SECTION 1. Section 15002.1 of the Education Code is amended to read:

15002.1 The governing board of a school district, prior to acquiring any site on which it proposes to construct any school building as defined in Section 15452 shall have the site, or sites, under consideration investigated by competent personnel to ensure that the final site selection is determined by an evaluation of all factors affecting the public interest and is not limited to selection on the basis of raw land cost only. The investigation shall include such geological and soil engineering studies by competent personnel as are needed to provide an assessment of the nature of the site and potential for earthquake damage.

The geological and soil engineering studies of the site shall be of such a nature as will preclude siting of a school in any location where the geological characteristics are such that the construction effort required to make the site safe for occupancy is economically unfeasible. The evaluation shall also include location of the site with respect to population, transportation, water supply, waste disposal facilities, utilities, traffic hazards, surface drainage conditions, and other factors affecting the operating costs, as well as the initial costs, of the total project.

No school building shall be constructed or situated on the trace of an active geological fault. For purposes of this section, an active geological fault is defined as one along which surface rupture

can be reasonably expected to occur within the life of the building.

Similar geological and soil engineering investigations shall be made as deemed necessary by the Department of General Services for the construction of any school building as defined in Section 15452 or, if the estimated cost exceeds ten thousand dollars ($10,000), the reconstruction or alteration of or addition to any such school building for work which alters structural elements. No such study need be made if the site or sites under consideration have been the subject of adequate prior study made within five years preceding the date of commencement of the proposed construction.

A copy of the report of each investigation conducted pursuant to this section shall be submitted to the Department of General Services and the Department of Education pursuant to Article 4 (commencing with Section 15451) of Chapter 2 of this division. The cost of geological and soil engineering studies and investigations conducted pursuant to this section may be treated as a capital expenditure.

Senate Bill 895

Clarification of Strong-Motion Program of 1971

Status: Enacted (Chapter 664)

SB 895 makes clarifying changes in the requirements established by SB 1374 (1971) concerning the basis for fee collection and administration by local jurisdictions of the strong-motion instrumentation program.

The people of the State of California do enact as follows:

SECTION 1. Section 2705 of the Public Resources Code is ammended to read:

2705. All counties and cities shall collect a fee from all applicants for building permits. Each such fee shall be equal to 0.007 percent of the valuation of the building as determined by the local building official or fifty cents ($0.50) whichever amount is the higher. "Building", for the purpose of this chapter, is any structure built for the support, shelter, or enclosure of persons, animals, chattels, or property of any kind.

SEC. 2. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting such necessity are:

This act is urgently needed for the protection of persons and property from earthquakes in that it effects changes in the funding of the Strong-Motion Instrumentation Program which is essential to the implementation of that program.

Senate Bill 896

Dam Safety

Status: Enacted (Chapter 780)

SB 896 requires that owners of dams designated by the State Office of Emergency Services (OES) prepare inundation maps and submit them to appropriate local public safety agencies and OES. Local jurisdictions affected are required to prepare emergency evacuation procedures based upon such information.

The people of the State of California do enact as follows:

SECTION 1. The Legislature intends, by that act, to encourage procedures for the emergency evacuation and control of populated areas below dams. The value of such a program has been demonstrated by that of the Los Angeles Department of Water and Power, administered by the Los Angeles Police Department, which has been very successful.

SEC. 2. Section 8589.5 is added to the Government Code, to read:

8589.5. (a) The Office of Emergency Services shall encourage local governmental organizations, utilities, and owners of dams to adopt emergency procedures for the evacuation and control of populated areas below dams. The office shall determine whether adequate public safety measures exist for the evacuation and control of populated areas below dams the partial or complete failure of which would be likely to result in death, injury and property damage.

(b) Inundation maps showing the potential flood zones based on the maximum legal capacity of the particular dam shall be prepared by the owner of each dam specified by the Office of Emergency Services. The delivery of such maps in complete form to the governing bodies of the jurisdictions likely to be affected shall be accomplished within six months from the effective date of this section. Copies of such maps shall be reviewed, approved, and filed with the Department of Water Resources and the Office of Emergency Services.

(c) The appropriate governmental agency designated by the Office of Emergency Services shall develop evacuation plans. Such plans shall include, at least: (1) delineation of area to be evacuated; (2) routes to be used; (3) traffic control measures; (4) shelters to be activated for the care of the evacuees; (5) methods for the movement of people without their own transportation; (6) identification of particular areas or facilities in the flood zones which will not require evacuation because of their location on high ground or similar circumstances; (7) identification and development of special procedures for the evacuation and care of people from unique institutions; (8) procedures for the perimeter and interior security of the area, including such things as passes, identification requirements, and antilooting patrols; (9) procedures for the lifting of the evacuation and reentry of the area; and (10) details of which organizations are responsible for these functions and the material and personnel resources required. The agency that prepares such a plan shall review it at least every two years.

SEC. 3. The Office of Emergency Services shall report to the Legislature on the plans required by this act within 21 months of its enactment.

Senate Bill 897

Assessment of Geologically Hazardous Lands

Status: Held in Senate Review and Taxation Committee for interim study

SB 897 would establish procedures whereby property owners could obtain reduced property assessments based upon geologic reports submitted to the assessor, providing the owner agreed not to develop such property for the areas determined to be unsafe.

The people of the State of California do enact as follows:

SECTION 1. Section 155.2 is added to the Revenue and Taxation Code, to read:

155.2. In consequence of any reassessment pursuant to Section 402.3, such reassessment shall be forthwith equalized and entered upon the assessment roll for the taxable year in question, the tax roll adjusted accordingly, and the amount of any reduction in taxes for such year upon the affected parcel shall be refunded or canceled.

SEC. 2. Section 402.2 is added to the Revenue and Taxation Code, to read:

402.2. In the assessment of property, the assessor shall consider the effect upon value of any geologic or soils defect or hazard in the land of which he may be aware. The report of a competent geologist, civil engineer, or soils engineer that the land may not be safely used for certain purposes otherwise allowed by law shall create a rebuttable presumption, to be applicable in any administrative or judicial proceeding, to determine the accuracy of the assessment, that the use of the land is so restricted. If in consequence of an application therefor by the owner pursuant to this section, the

assessed value of land is reduced, the owner shall not thereafter develop the land for those uses which are determined to be unsafe in accordance with this section, unless the owner shall have first caused the unsafe conditions to be removed or overcome.

SEC. 3. Section 402.3 is added to the Revenue and Taxation Code, to read:

402.3. If it appears that the reduction in full cash value of property which has been damaged by earth or soil failures, including earthquakes, exceeds one thousand dollars ($1,000) as a result of such failures, the assessor shall, upon application of the owner, promptly reassess the property according to its full cash value immediately after the damage. In determining such full cash value, the assessor shall deduct from the value immediately preceding the failure the probable cost of repairing the land and structures damaged by the failure. In no instance shall the reduction in value due to such damages be greater than the value of the land and structures prior to the failure.

CALIFORNIA LEGISLATION PROPOSED IN 1973

Senate Bill 1266

Revision of Dam Safety Bill of 1972

Status: Enacted (Chapter 762)

SB 1266 amends SB 896 (1972), requiring only one inundation map at full capacity and stipulating that OES, rather than dam owners, will distribute the maps to public safety officials.

The people of the State of California do enact as follows:

SECTION 1. Section 8589.5 of the Government Code is amended to read:

8589.5. (a) Inundation maps showing the areas of potential flooding in the event of sudden or total failure of any dam, the partial or total failure of which the Office of Emergency Services determines, after consultation with the Department of Water Resources, would result in death or personal injury, shall be prepared and submitted as provided in this subdivision within six months after the effective date of this section, unless the time for submission of such maps is extended for reasonable cause by the Office of Emergency Services. The local governmental organization, utility, or other owner of any dam so designated shall submit to the Office of Emergency Services one such map which shall delineate potential flood zones that could result in the event of dam failure when the reservoir is at full capacity or if the local governmental organization, utility, or other owner of any dam shall determine it to be desirable he shall submit three such maps, which shall delineate potential flood zones that could result in the event of dam failure when the reservoir is at full capacity, at median-storage level, and at normally low-storage level. After submission of copies of such map or maps, the Office Emergency Services shall review the map or maps, and shall return that map or maps which do not meet

the requirements of this subidivison, together with recommendations relative to conforming to such provisions. Maps rejected by the Office of Emergency Services shall be revised to conform to such recommendations and resubmitted. The Office of Emergency Services shall keep on file those maps which conform to the provisions of this subdivision. Maps approved pursuant to this subdivision shall also be kept on file with the Department of Water Resources. The owner of a dam shall submit final copies of such maps to the Office of Emergency Services which shall immediately submit identical copies to the appropriate public safety agency of any city, county, or city and county likely to be affected.

(b) Based upon a review of inundation maps submitted pursuant to subdivision (a), the Office of Emergency Services shall designate areas within which death or personal injury would, in its determination, result from the partial or total failure of a dam. The appropriate public safety agencies of any city, county, or city and county, the territory of which includes such an area, shall adopt emergency procedures for the evacuation and control of populated areas below such dams. The Office of Emergency Services shall review such procedures to determine whether adequate public safety measures exist for the evacuation and control of populated areas below the dams, and shall make recommendations with regard to the adequacy of such procedures to the concerned public safety agency. In conducting such review the Office of Emergency Services shall consult with appropriate state and local agencies.

Emergency procedures specified in this subdivision shall conform to local needs, and may be required to include any of the following elements or any other appropriate element, in the discretion of the Office of Emergency Services: (1) delineation of area to be evacuated; (2) routes to be used; (3) traffic control measures; (4) shelters to be activated for the care of the evacuees; (5) methods for the movement of people without their own transportation; (6) identification of particular areas or facilities in the flood zones which will not require evacuation because of their location on high ground or similar circumstances; (7) identification and development of special procedures

for the evacuation and care of people from unique institutions; (8) procedures for the perimeter and interior security of the area, including such things as passes, identification requirements, and antilooting patrols; (9) procedures for the lifting of the evacuation and reentry of the area; and (10) details of which organizations are responsible for these functions and the material and personnel resources required. It is the intent of the Legislature to encourage each agency that prepares such emergency procedures to establish a procedure for their review every two years.

(c) "Dam," as used in this section, has the same meaning as specified in Sections 6002, 6003, and 6004 of the Water Code.

SEC. 2. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting such necessity are:

This act makes optional with specified dam owners the requirement that inundation maps be filed with the Office of Emergency Services with respect to dam failure when the reservoir is at a medium-or normally low-level, while continuing the requirement that a map relating to dam failure at full-reservoir capacity be so filed.

Present law requires all three types of maps be filed within six months after the effective date of Section 8589.5 of the Government Code which was March 7, 1973.

Thus, in order to give effect to the policy determined by the Legislature in this act before that six-month period has elapsed, it is necessary that this act take effect immediately.

Senate Bill 1372

Future Emergency Services Structures

Status: Heard in Senate Committee on Governmental Organization in January 1974.

SB 1372 provides for the development of construction regulations for future emergency service structures by the State Office of Architecture and Construction. Enforcement is to be at the local level. Appeals procedures are also provided for.

The people of the State of California do enact as follows:

SECTION 1. Chapter 2 (commencing with Section 15100) is added to Division 12.5 of the Health and Safety Code, to read:

CHAPTER 2. PUBLIC BUILDINGS

15100. It is the intent of the Legislature that emergency service buildings or structures, the collapse or damage of which would preclude or seriously impair services to the public necessary in immediate postdisaster earthquake operations, meet requirements which shall be established by the Office of Architecture and Construction to assure, insofar as practicable, their ability to continue to function after a maximun probable earthquake.

The Legislature finds that all emergency service buildings and structures should be available for postdisaster use.

15101. As used in this chapter:

(a) "Construction or alteration" includes any new construction or reconstruction, alteration, or addition to any existing emergency service building or structure which affects structural elements or nonstructural elements affecting the continued function of the emergency services housed in the structure. Construction, reconstruction, alteration, or additions costing one thousand dollars ($1,000) or less shall be excluded.

(b) "Enforcement agency" means the building department of the city, city and county, or county of jurisdiction. Where there is no local enforcement agency, or if requested by the local agency, the Department of General Services shall enforce all the applicable provisions of this chapter. If the state funds more than 50 percent of the construction or alteration cost of an emergency service structure, the Department of General Services shall be the enforcement agency.

(c) "Emergency service buildings or structures" means fire stations, police stations, jails, those buildings and structures designated by the local jurisdiction as the central headquarters for governmental operations during an emergency, and those buildings and structures designated by the local jurisdiction to be their central emergency communications center. It does not, however, include any hospital building as defined in Section 15001.

(d) "Structural engineer" means a person who is validly certified to use the title "structural engineer" under Chapter 7 (commencing with Section 6700) of Division 3 of the Business and Professions Code.

(e) "Architect" means a person who is certified and holds a valid license under Chapter 3 (commencing with Section 5500) of Division 3 of the Business and Professions Code.

(f) "Engineering geologist" means a person who is validly certified under Chapter 12.5 (commencing with Section 7800) of Division 3 of the Business and Professions Code.

(g) "Civil engineer" means a person who is validly certified to use the title "civil engineer" under Chapter 7 (commencing with Section 6700) of Division 3 of the Business and Professions Code.

(h) "Building designer" means a person who is validly certified to use the title "building designer" under Chapter 3 (commencing with Section 5500) of Division 3 of the Business and Professions Code.

15102. No contract for the construction or alteration of any building or structure constructed or altered in whole or in part pursuant to a contract made or executed on or after January 1, 1976, which contains emergency service buildings or structures is valid, and no money shall be paid for any work done under such a contract or for any labor or materials furnished in constructing or altering any such building or structure, unless the plans and specifications

for the work to be performed under the contract comply with the provisions of this chapter, the plans and specifications comply with the fire and panic safety requirements of the State Fire Marshal, and approval in writing of such plans and specifications has been obtained from the enforcement agency.

15103. Minimum earthquake design requirements for buildings or structures subject to this chapter shall be prepared and adopted by the Office of Architecture and Construction of the Department of General Services after consultation with recognized code-writing organizations, including but not limited to, the Structural Engineers Association of California and the International Conference of Building Officials, by June 30, 1975. The office shall consider structural, mechanical, electrical, utility, and architectural systems, in preparing and adopting the requirements. The requirements shall be reviewed annually by the office for updating. If emergency service buildings or structures occupy only a portion of a building or structure, those portions of the building or structure that do not provide emergency service do not need to comply with the requirements of this chapter, except to the extent that they affect the operating capacity of the emergency service buildings or structures.

Local jurisdictions shall adopt minimum earthquake design requirements which are no less stringent than those adopted by the office pursuant to this section.

15104. All plans and specifications shall be prepared under the responsible charge of a registered building designer, working under the supervision of an architect, structural engineer, or civil engineer, or a registered architect, structural engineer, or civil engineer, or any combination thereof. All structural design plans, provisions, and specifications related thereto, shall be prepared and signed by a structural engineer. A geologic siting investigation and report, including soils engineering and, where appropriate, seismological aspects, shall be conducted, and prepared.

The geologic siting investigation and report shall be conducted, prepared, and signed by an engineering geologist. The foundation or soils engineering report of the site shall be prepared and signed by a civil engineer. One-story wood-framed or all metal-framed construction of 4,000 square feet or less shall be excluded from the requirements

of the geologic and seismological siting investigation and report.

Administration of the work of construction shall be under the responsible charge of an architect, structural engineer, or civil engineer. Where structural elements are involved, the structural work shall be administered by an architect or structural engineer. Where plans and specifications for alterations or repairs do not affect architectural or structural conditions, such plans and specifications may be prepared and the work of construction may be administered by a professional engineer who is qualified to perform such services and holds a valid certificate under Chapter 7 (commencing with Section 6700) of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which the plans, specifications, and estimates and work of construction are applicable. Other design plans may be prepared and signed by other appropriate licensed or certified engineers, architects, or designers.

15105. (a) The enforcement agency shall establish a formal procedure for the approval of plans and specifications in accordance with the intent of this chapter. Each application for approval shall be accompanied by the plans; full, complete, and accurate specifications; and structural design computations and required site reports; which shall comply in every respect with all requirements prescribed by the enforcement agency. The application shall also be accompanied by a filing and processing fee, in an amount determined by the enforcement agency to be reasonably necessary for carrying out the provisions of this chapter, which fees, except those received by the Department of General Services, shall be deposited in a special fund available without reference to fiscal year for the use of the enforcement agency in carrying out the provisions of this chapter. Filing and processing fees received by the Department of General Services shall be deposited in a special account of the Architecture Public Building Fund which is continuously appropriated from the fund to the department for use in carrying out the provisions of this chapter.

(b) The enforcement agency shall pass upon and approve or reject all plans for the construction or alteration of any emergency service building or structure, independently reviewing the design and geological

data to assure compliance with requirements of this chapter and any rules and regulations adopted pursuant to this chapter. Each design plan and specification shall be checked for compliance with earthquake requirements of this chapter or regulations adopted pursuant to this chapter by a structural engineer, who is independent of the design engineers who prepared the plans and specifications. The structural engineer who reviews the plans shall sign the approval stamp of the enforcement agency. Geologic, soils engineering, and seismological data shall be checked for compliance with the requirements of this chapter and any rules or regulations adopted pursuant to this chapter by an engineering geologist.

15106. From time to time, as the work of construction or alteration progresses, at the completion of the project, and whenever the enforcement agency requires, the person in charge of construction, the inspector on the work, and the contractor shall each make to the enforcement agency a verified report, from personal knowledge, upon a form prescribed by the enforcement agency that the work during the period covered by the report has been performed and that the materials used and installed are in accordance with the approved plans and specifications, setting forth detailed statements of fact as required by the enforcement agency. The verification form shall be prescribed by the enforcement agency, based upon guidelines developed by the Office of Architecture and Construction after consultation with local enforcement agencies. Final payment shall not be made to the contractor until all final reports are filed with the enforcement agency.

The term "personal knowledge," as used in this section and as applied to the person in charge of construction, means personal knowledge which is acquired from the general administration of construction by such persons by accepted practices in the construction trades. It shall, however, include the use of reasonable diligence to obtain required information.

The term "personal knowledge," as used in this section and as applied to the inspector, means the actual personal detailed knowledge acquired by the inspector obtained during his personal continuing observation of construction work at the construction site in all stages of progress.

The enforcement agency shall make such inspection of the work of construction or alteration as in its judgment is necessary and proper for the enforcement of the provisions of this chapter.

15107. Any building or structure subject to this chapter shall be competently, adequately, and continually inspected during the period of construction by a construction inspector provided by the owner.

Senate Bill 1373

Mandate of Local Disaster Plans

Status: Same as SB 1372

SB 2373 mandates local disaster plans which are now optional. OES is charged with establishing criteria and checking local plans for compliance with the State disaster plan. OES would report yearly to the legislature on the status of the plans.

The people of the State of California do enact as follows:

SECTION 1. The heading of Article 10 (commencing with Section 8610) of Chapter 7 of Division 1 of Title 2 of the Government Code is amended to read:

Article 10. Local Jurisdictions

SEC. 2. Section 8610 of the Government Code is repealed.

SEC. 3. Section 8610 is added to the Government Code, to read:

8610. Each county, city and county, and city shall adopt an ordinance which provides for the establishment of a disaster council, an emergency organization and an emergency plan. The formation of a disaster council shall be optional to any city which is represented on a countywide disaster council. The preparation of an emergency plan shall be optional to any city which is represented in a county plan.

The disaster council shall be structured to provide representation from all segments of the local jurisdiction which represent major potential sources of emergency resources. The council shall meet at least annually to review the status of local emergency preparedness and shall report its findings to the governing body of such jurisdiction.

SEC. 4. Section 8610.5 is added to the Government Code, to read:

8610.5. The governing body of each county, city and county, and city shall ensure the development of an emergency plan for meeting

any conditions constituting a local emergency, state of emergency, or state of war emergency; such plan shall provide for the effective utilization of all of the resources within the jurisdiction, both public and private.

The plan, to be duly adopted and promulgated by the governing body, shall provide for the emergency organization, powers and duties, emergency divisions, emergency services, and emergency staff of the emergency organization. The local emergency planning shall be based on criteria established by the Office of Emergency Services to ensure consistency with the state emergency plan. The Office of Emergency Services shall establish the Criteria Development Committee for Local Disaster Plans and Organizations. The committee shall consist of one member chosen by each of the following: The League of California Cities, the County Supervisors Association of California, the California Civil Defense and Disaster Association, the Office of Emergency Services, California Chiefs' Association, California Peace Officers' Association, and the Northern California Emergency Services Council. The committee shall develop the criteria to be applied to the local development of and the approval by the Office of Emergency Services of the plan.

The committee shall elect a chairman and a vice chairman from among its members. The committee shall hold at least one regular meeting each month until the requirements of this article have been fulfilled. Additional meetings may be held upon call of the chairman or at the written request of any two members of the committee. Four members of the committee shall at all times constitute a quorum. Each member of the committee shall receive a per diem of twenty-five dollars ($25) for each day actually spent in the discharge of official duties, and shall be reimbursed for his traveling and other expenses necessarily incurred in the performance of his duties. Such payments in each instance shall be made only from the fund from which the expenses of the agency are paid and shall be subject to the availability of money in that fund.

Both the plan and the ordinance upon which it is based shall be reviewed and updated as necessary. A copy of each such plan and of each revision thereof shall be filed with the Office of Emergency Services.

The governing body of a county, city and county, or city may, by ordinance or resolution, authorize public officers, employees, and registered volunteers to command the aid of citizens when necessary in the execution of their duties during a state of war emergency, a state of emergency, or a local emergency.

Counties, cities and counties, and cities may enact ordinances or resolutions to establish rules and regulations for dealing with local emergencies that can be adequately dealt with locally, or authorize disaster councils to recommend to the director of the local emergency organization the establishment of such rules and regulations; and further may act to carry out mutual aid on a voluntary basis and, to this end, may enter into agreements.

SEC. 5. Section 8614.5 is added to the Government Code, to read:

8614.5. The Office of Emergency Services shall report to the Legislature and the Governor's Emergency Council on or before September 30th of each year on local jurisdictions which have not complied with the provisions of this chapter.

SEC. 6. It is the intent of the Legislature that the actual real expenses incurred by a local jurisdiction for the planning of a disaster plan and organization, where none exists, be funded by the state. The state will not mandate emergency program or capital improvement costs to any local jurisdiction nor will the state be responsible for any capital improvements made by any local jurisdiction for the purposes of disaster preparedness.

SEC. 7. The sum of thirty-seven thousand eight hundred dollars ($37,800) is hereby appropriated, without regard to fiscal year, from the General Fund, and in addition thereto, any amounts received from federal grants or other sources, for the following purposes:

(a) To the Office of Emergency Services, twenty-seven thousand dollars ($27,000), to be used by the office for administering the provisions of this act.

(b) To the State Controller, ten thousand eight hundred dollars ($10,800) for payments to local agencies pursuant to Section 2231 of the Revenue and Taxation Code to reimburse them for costs incurred pursuant to this act. This money shall be available until June 30, 1975.

Payment shall be made to local agencies in accordance with the following provisions:

Each local agency to which the mandate is applicable shall submit to the State Controller, within 45 days of the operative date of the mandate, a claim for reimbursement based upon its estimate of the units of work to be performed during the 1974-75 fiscal year and a reasonable amount for nonrecurring expenses for said fiscal year.

Computation of amounts claimed for units of work shall be on the basis of a unit cost in the amount of six hundred dollars ($600) per city which has yet to pass an ordinance dealing with disaster control which shall be the unit of work. The State Controller shall pay each claimant as reimbursement for units of work an amount determined by multiplying: (1) the unit cost of work as specified herein, by (2) the number of units of work estimated to be performed by the claimant.

Any payment, adjustment, or audit of claims by the State Controller shall be on the basis of units of work, rounded to the nearest whole unit, and at the unit costs specified herein rather than actual costs. The State Controller (1) may reduce any claim which he determines is excessive or unreasonable, (2) may audit the records of any local agency to verify the actual units of work performed, and (3) shall make any adjustments necessary to correct for underpayments or overpayments which occurred in the 1974-75 fiscal year.

Claims for reimbursement shall be prepared in the form, and payments made at the time, specified by the State Controller. No claim or amendment to a claim shall be accepted by the State Controller after the time prescribed herein for filing of claims.

In the event that the amount appropriated for reimbursement purposes pursuant to this act is not sufficient to pay all claims filed timely, the State Controller shall pay such claims on a pro rata basis and notify the Director of Finance of the deficiency.

Senate Bill 1374

Existing Emergency Services Structures

Status: Dropped

SB 1374 provides for bringing existing emergency service structures up to Code (SB 1372) when funds are available from State and local bonds.

The people of the State of California do enact as follows:

SECTION 1. Chapter 2 (commencing with Section 15100) is added to Division 12.5 of the Health and Safety Code, to read:

CHAPTER 2. BUILDINGS

15100. Any building or structure constructed in whole or in part with public funds prior to January 1, 1974, which contains emergency administrative operating centers, emergency or standby power installations, public safety facilities, or essential elements of key communications systems shall, if it does not satisfy the same requirements as are prescribed for hospital buildings by Chapter 1 (commencing with Section 15000) and the rules and regulations adopted pursuant to that chapter, be brought into compliance with such requirements or replaced by a building or structure which is in compliance with such requirements, as funds become available from state or local general obligation bonds approved at an election.

Senate Bill 1375

New Equipment in Emergency Services Structures

Status: Dropped

SB 1375, the final Bill in the "Emergency Service Structures" series forbids the installation of new Federal or State funded communications and/or disaster equipment in any structures not meeting the standards established in SB 1372.

The people of the State of California do enact as follows:

SECTION 1. Section 15025 is added to the Health and Safety Code, to read:

15025. No new installation of, or addition to, emergency communications or other disaster-oriented equipment, which is funded in whole or in part by federal or state funds, shall be placed in any building or structure which fails to meet the minimum standards of this chapter.

CALIFORNIA LEGISLATION PROPOSED IN 1974

Senate Bill 1632

Dam Safety

Status: Enacted as Chapter 314 in 1974

SB 1632 permits the Office of Emergency Services (OES), under certain circumstances, to waive the requirement for an inundation map required of specified dam owners. Requires that the local jurisdiction notify the OES if development occurs in any exempted dam area and that the OES reevaluate waivers every two years.

The people of the State of California do enact as follows:

SECTION 1. Section 8589.5 of the Government Code is amended to read:

8589.5. (a) Inundation maps showing the areas of potential flooding in the event of sudden or total failure of any dam, the partial or total failure of which the Office of Emergency Services determines, after consultation with the Department of Water Resources, would result in death or personal injury, shall be prepared and submitted as provided in this subdivision within six months after the effective date of this section, unless the time for submission of such maps is extended for reasonable cause by the Office of Emergency Services. The local governmental organization, utility, or other owner of any dam so designated shall submit to the Office of Emergency Services one such map which shall delineate potential flood zones that could result in the event of dam failure when the reservoir is at full capacity or if the local governmental organization, utility, or other owner of any dam shall determine it to be desirable he shall submit three such maps, which shall delineate potential flood zones that could result in the event of dam failure when the reservoir is at full capacity, at median-storage level, and at normally low-storage level. After submission of copies of such map or maps, the Office of Emergency Services shall review

the map or maps, and shall return that map or maps which do not meet the requirements of this subdivision, together with recommendations relative to conforming to such provisions. Maps rejected by the Office of Emergency Services shall be revised to conform to such recommendations and resubmitted. The Office of Emergency Services shall keep on file those maps which conform to the provisions of this subdivision. Maps approved pursuant to this subdivision shall also be kept on file with the Department of Water Resources. The owner of a dam shall submit final copies of such maps to the Office of Emergency Services which shall immediately submit identical copies to the appropriate public safety agency of any city, county, or city and county likely to be affected.

(b) Based upon a review of inundation maps submitted pursuant to subdivision (a), the Office of Emergency Services shall designate areas within which death or personal injury would, in its determination, result from the partial or total failure of a dam. The appropriate public safety agencies of any city, county, or city and county, the territory of which includes such an area, shall adopt emergency procedures for the evacuation and control of populated areas below such dams. The Office of Emergency Services shall review such procedures to determine whether adequate public safety measures exist for the evacuation and control of populated areas below the dams, and shall make recommendations with regard to the adequacy of such procedures to the concerned public safety agency. In conducting such review the Office of Emergency Services shall consult with appropriate state and local agencies.

Emergency procedures specified in this subdivision shall conform to local needs, and may be required to include any of the following elements or any other appropriate element, in the discretion of the Office of Emergency Services: (1) delineation of area to be evacuated; (2) routes to be used; (3) traffic control measures; (4) shelters to be activated for the care of the evacuees; (5) methods for the movement of people without their own transportation; (6) identification of particular areas or facilities in the flood zones which will not require evacuation because of their location on high ground or similar circumstances; (7) identification and development of special procedures for the evacuation and care of people from unique institutions; (8) procedures for the perimeter and interior security of the area,

including such things as passes, identification requirements, and antilooting patrols; (9) procedures for the lifting of the evacuation and reentry of the area; and (10) details of which organizations are responsible for these functions and the material and personnel resources required. It is the intent of the Legislature to encourage each agency that prepares such emergency procedures to establish a procedure for their review every two years.

(c) "Dam," as used in this section, has the same meaning as specified in Sections 6002, 6003, and 6004 of the Water Code.

(d) Under certain exceptional conditions as follows, the Office of Emergency Services may waive the requirement for an inundation map:

(1) Where the effects of potential inundation in terms of death or personal injury are determined through onsite inspection by the Office of Emergency Services in consultation with the Department of Water Resources and the affected local jurisdictions to be limited and logically definable; and

(2) Where adequate evacuation procedures can be developed without benefit of an inundation map.

(e) If development should occur in any exempted area after a waiver has been granted, the local jurisdiction shall notify the Office of Emergency Services of such development. All waivers shall be reevaluated every two years by the Office of Emergency Services.

SEC. 2. No appropriation is made by this act, nor is any obligation created thereby under Section 2231 of the Revenue and Taxation Code, for the reimbursement of any local agency for any costs that may be incurred by it in carrying on any program or performing any service required to be carried on or performed by it by this act.

SEC. 3. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or seafty within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting such necessity are:

Present law (Section 8589.5 of the Government Code) requires that specified dam owners file inundation maps with the Office of Emergency Services.

This act permits, under certain circumstances, the Office of Emergency Services to waive the requirements of an inundation map.

Thus, because of the enormous burden placed on specified dam owners to file inundation maps in certain cases where such filing is not necessary to protect the public from loss of life or injury, it is necessary that this act take effect immediately.

Senate Bill 1729

Seismic Safety Commission

Status: Heard before Senate Governmental Organization Committee; being revised

SB 1729 creates a Seismic Safety Commission and requires the Commission to report annually to the Governor and Legislature on its findings, progress, and recommendations relating to earthquake hazard reduction. Reassigns the responsibilities assigned to the Strong Motion Instrumentation Board and the Building Safety Board to the Commission.

The people of the State of California do enact as follows:

SECTION 1. Chapter 12 (commencing with Section 8860) is added to Division 1 of Title 2 of the Government Code, to read:

CHAPTER 12. SEISMIC SAFETY COMMISSION ACT

8860. The Legislature finds and declares as follows:

The work of the Legislature's Joint Committee on Seismic Safety as well as that of the Governor's Earthquake Council provides impressive and wide-ranging evidence for the following:

First, many different agencies at various levels of government have substantial responsibilities in the fields of earthquake preparedness and seismic safety.

Second, there is a pressing need to provide for these fields a consistent policy framework and to coordinate the pertinent activities of agencies at all governmental levels and within the private sector. This need is not now being addressed by any state governmental entity that has continuity and duration.

Third, only through concerted efforts of broad scope, coordinated by a Seismic Safety Commission, can the required long-term progress be made toward higher levels of seismic safety.

8861. There is created in the state government a Seismic Safety Commission which shall report annually to the Governor and to the Legislature on its findings, progress, and recommendations relating to earthquake hazard reduction.

8862. The commission shall consist of 13 members appointed by the Governor and confirmed by the Senate. One of the members shall be appointed Chairman of the Seismic Safety Commission by the Governor and shall serve as chairman at the pleasure of the Governor.

8863. The initial Seismic Safety Commission membership shall consist of five members appointed by the Governor from a list of not more than 12 nominees submitted to the Governor by the Chairman of the Joint Committee on Seismic Safety, five members appointed by the Governor from a list of nominees submitted to the Governor by the Governor's Earthquake Council, an initial chairman appointed by the Governor from a nominee mutually agreed upon by the Chairman of the Joint Committee on Seismic Safety and the Chairman of the Governor's Earthquake Council, and one Member of the Senate appointed by the Senate Rules Committee and one Member of the Assembly appointed by the Speaker of the Assembly.

8864. After the initial appointments, the membership of the Commission on Seismic Safety shall be appointed by the Governor and confirmed by the Senate from lists of nominees submitted by organizations as listed below:

(a) Three members appointed from nominees submitted by established organizations designated by the commission representing the structural engineering, earthquake engineering, soils engineering, and geology professions;

(b) Three members appointed from nominees submitted by established organizations, designated by the commission, representing the architecture and planning professions, fire protection agencies, and public utilities;

(c) Three members representing local government and the public at large;

(d) Two members appointed from nominees submitted by organizations, designated by the commission, in insurance and social service;

(e) One member shall be appointed from the Senate by the Senate Rules Committee, and one member shall be appointed from the Assembly by the Speaker of the Assembly.

8865. The term of office for each member of the Seismic Safety Commission shall be four years and each shall hold office until the appointment and qualification of his or her successor, except that of the initial commissioners, the Governor shall appoint six whose terms will expire two years after appointment and six members plus the chairman whose terms shall expire four years after appointment. All initial appointments shall be made by July 1, 1975.

8866. The Commission on Seismic Safety shall annually select its own vice chairman, and may replace him with another commissioner by majority vote.

8867. The members of the Commission on Seismic Safety shall serve without compensation but shall be paid per diem expenses plus actual necessary travel expenses as determined by the State Board of Control.

8868. The commission, in the discharge of its responsibilities, may:

(a) Accept grants, contributions, and appropriations from public agencies, private foundations, or individuals.

(b) Appoint committees from its membership, appoint advisory committees from interested public and private groups, and appoint ex officio members who shall not be entitled to vote, to advise the commission.

(c) Contract for or employ with the approval of the Director of Finance any professional services and research required by the commission or required for the performance of necessary work and services which in the commission's opinion cannot satisfactorily be performed by its officers and employees or by other federal, state, or local governmental agencies.

(d) Do any and all other things necessary to carry out the purposes of this chapter.

8869. The commission shall appoint an executive director who shall have charge of administering the affairs of the commission, subject to the direction and policies of the commission.

The executive director shall, subject to the approval of the commission, appoint such employees as may be necessary to carry out the functions of the commission.

The executive director shall receive a yearly compensation of twenty-five thousand dollars ($25,000).

8870. The commission shall be responsible for the following in connection with earthquake hazard reduction:

(a) Setting goals and priorities in the public and private sectors;

(b) Developing programs in the public and private sectors;

(c) Devising criteria and standards or requesting appropriate agencies to accomplish this;

(d) Providing technical assistance or requesting appropriate agencies to accomplish this;

(e) Monitoring performance, reviewing accomplishments, and recommending program changes of state agencies, local agencies, and the private sector;

(f) Reviewing reconstruction efforts after damaging earthquakes;

(g) Gathering, analyzing and disseminating information;

(h) Encouraging research;

(i) Sponsoring training to help improve the competence of specialized enforcement and other technical personnel;

(j) Helping to coordinate the seismic safety activities of government at all levels; and

(k) Ensuring compliance with standards.

8871. To implement the foregoing responsibilities, the commission may:

(a) Review state budgets and review grant proposals in earthquake related activities and to advise the Governor and Legislature thereon;

(b) Review earthquake related legislation proposals, to advise the Governor and Legislature concerning such proposals, and to propose needed legislation;

(c) Order compliance with state standards if, within a period of time determined by the commission, noncompliance by any state agency or local government is shown, and conduct public hearings as deemed necessary;

(d) Recommend the addition, deletion, or changing of state agency standards when, in the commission's view, the existing situation creates an undue seismic hazard, and to so report to the Governor and Legislature when such determination is made.

8872. This act shall be known and cited as the Seismic Safety Commission Act.

SEC. 2. Where existing provisions of law conflict with the provisions of this act which establish the power and authority of the Seismic Safety Commission, the provisions of this act shall take precedence.

SEC. 3. Section 15021 of the Health and Safety Code is repealed.

SEC. 4. Section 15022 of the Health and Safety Code is repealed.

SEC. 5. Chapter 8 (commencing with Section 2700) of Division 2 of the Public Resources Code is repealed.

SEC. 6. The unencumbered balance of all money available for expenditure by the Strong-Motion Instrumentation Board in carrying out the provisions of Chapter 8 (commencing with Section 2700) of Division 2 of the Public Resources Code and the Building Safety Board in carrying out its functions pursuant to the provisions of Sections 15021 and 15022 of the Health and Safety Code shall be made available for the support and maintenance of the Seismic Safety Commission for the purpose of carrying out the provisions of Chapter 12 (commencing with Section 8860) of Division 1 of Title 2 of the Government Code; and all books, documents, records, and property of the Strong-Motion Instrumentation Board and the Building Safety Board shall be transferred to the Seismic Safety Commission.

SEC. 7. There is hereby appropriated from the General Fund the amount of _____ dollars ($_____) to the Seismic Safety Commission for the purposes of this act.

Senate Bill 1903

Hospital Safety

Status: Enacted as Chapter 244 in 1974

Revises definitions of term "hospital building" for purposes of statutory provisions regarding seismic structural safety of hospitals.

The people of the State of California do enact as follows:

SECTION 1. Section 15001 of the Health and Safety Code is amended to read:

15001. "Hospital building," as used in this chapter, means and includes any building used, or designed to be used, for a hospital and shall include all health facilities of a type required to be licensed pursuant to Chapter 2 (commencing with Section 1250) of Division 2 but shall not include any building which is not physically attached to a health facility and in which only outpatient services are provided.

SEC. 2. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting such emergency are:

Chapter 1130 of the Statutes of 1972, providing for the regulation of the construction and alteration of hospital buildings for the purpose of assuring structural resistance to earthquakes, was intended to apply to health facilities providing medical care to persons admitted for a 24-hour stay or longer. Application of such standards to nonmedical community care facilities, such as family homes and day centers, would be unduly restrictive and would result in the reduction of facilities needed to maintain such program. Such facilities are greatly needed throughout the state to insure the availability of nonmedical care services for those requiring such services. In order to avert these problems before they result in serious harm to community care programs, it is necessary that this act go into immediate effect.

Senate Bill 1982

Blighted Areas

Status: Passed the Senate; will be sent to Assembly

Enlarges the concept of blighted area for the purposes of the Community Redevelopment Law to include areas characterized by seismic hazards subject to surface ruptures from specified causes, by geological hazards subject to specified dangers, and by the existence of substantial damage caused by seismic disturbances or other natural disasters.

The people of the State of California do enact as follows:

SECTION 1. Section 33032 of the Health and Safety Code is amended to read:

33032. A blighted area is characterized by:

(a) An economic dislocation, deterioration, or disuse, resulting from faulty planning.

(b) The subdividing and sale of lots of irregular form and shape and inadequate size for proper usefulness and development.

(c) The laying out of lots in disregard of the contours and other physical characteristics of the ground and surrounding conditions.

(d) The existence of inadequate streets, open spaces, and utilities.

(e) The existence of lots or other areas which are subject to being submerged by water.

(f) The existence of a seismic hazardous area susceptible to surface ruptures from faulting, to ground shaking, to ground failures, or to the effects of seismically induced waves such as tsunami and seiche.

(g) The existence of a geological hazardous area susceptible to mudslides, landslides, or slope instability.

(h) The existence of substantial damage resulting from seismic disturbances or other natural disasters.

Senate Bill 1983

Subdivision Conditions

Status: in Senate Committee

SB 1983 revises provisions relating to subdivisions to require geological reports in addition to soil reports. Requires the Commission of Housing and Community Development to adopt specified rules and regulations relating to soil and geological reports. Requires each City and County to adopt ordinances requiring geological reports.

The people of the State of California do enact as follows:

SECTION 1. It is the intent and purpose of the Legislature to extend in the interest of public safety the present requirement for soil investigations of proposed subdivision sites for the possible presence of expansive soils, to include where warranted investigation of all geologic conditions designated in Sections 65302 and 65302.1 of the Government Code or where slope dimensions are five horizontal to one vertical, or steeper. Ordinances with similar intent are currently in effect in several political subdivisions of the state, and where adequately conceived and enforced, have been notably successful in the prevention of loss of life and property from hazardous geologic conditions and processes. This act is intended to afford similar protection to all areas of the state. This act is not intended to preempt stricter city or county ordinances currently in effect.

SEC. 2. Section 11568 of the Business and Professions Code is amended to read:

11568. When a soil report or a soil and geologic report has been prepared, this fact shall be noted on the final map, together with the date of the report and the name of the engineer and geologist making the report.

SEC. 3. Section 17953 of the Health and Safety Code is amended to read:

17953. The rules and regulations adopted by the commission pursuant to this part shall require, and each city, county, and city and county shall by ordinance require:

(a) A preliminary soil report, prepared by a civil engineer who is registered by the state, based upon adequate test borings or excavations, of every subdivision, as defined in Sections 11535 and 11535.1 of the Business and Professions Code. The preliminary soil report may be waived if the building department of the city, county or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of this part, shall determine that, due to the knowledge such department has as to the qualities of the soil of the subdivision or lot, no preliminary analysis is necessary.

(b) A preliminary geologic report, prepared or approved by a geologist who is registered by the state and certified in engineering geology, of every such subdivision likely to be affected by hazardous or potentially hazardous geologic conditions as designated in Sections 65302 and 65302.1 of the Government Code, or containing slopes whose dimensions are five horizontal to one vertical, or steeper. The preliminary geologic report may be waived if the building department or other enforcement agency of the city, county, or city and county, charged with the administration and enforcement of the provisions of this part, shall determine that there are no hazardous or potentially hazardous geologic conditions within, adjacent to, or affecting the subdivision, based upon the technical knowledge such department possesses.

SEC. 4. Section 17954 of the Health and Safety Code is amended to read:

17954. If the preliminary soil or geologic report indicates the presence of critically expansive soils or other soil or geologic problems which, if not corrected, or adequately planned for in design, would lead to structural defects, the rules and regulations and the ordinance described in Section 17953 shall require a soil investigation of each lot in the subdivision and a geologic investigation of that portion of the subdivision affected. The soil investigation shall be prepared by a civil engineer who is registered in this state. Each geologic report shall be prepared or approved by a geologist registered in this state

and certified in engineering geology. The civil engineer shall design corrective procedures based upon the recommendation of the soil engineer, and where applicable, the geologist, to prevent structural damage to each dwelling proposed to be constructed on the expansive soil or otherwise unstable or geologically hazardous site.

SEC. 5. Section 17955 of the Health and Safety Code is amended to read:

17955. The building department of each city, county, or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of this part, shall approve the soil and geologic reports if it determines that the recommended action is likely to prevent structural damage to each dwelling to be constructed. As a condition to the building permit, the rules and regulations and the ordinance described in Section 17953 shall require that the approved recommended action be incorporated in the construction of each dwelling. Appeal from such determination shall be to the local appeals board. The rules and regulations and the ordinance shall impose the same requirements and regulations as adopted by the commission and prescribed in Chapter 70 of the Uniform Building Code, 1973 edition, as adopted by the International Conference of Building Officials, unless existing regulations or requirements are more restrictive or unless the governing body of a city or county adopts more restrictive requirements or regulations after making an express finding that they are necessary because of local conditions.

Such a finding shall be available as a public record and a copy, together with the modification or change, filed with the department.

SEC. 6. Section 17958.7 of the Health and Safety Code is amended to read:

17958.7. The governing body of a city or county before making any modifications or changes pursuant to Sections 17955 or 17958.5 shall make an express finding that such modifications or changes are needed. Such a finding shall be available as a public record and a copy, together with the modification or change, filed with the department. Nothing contained in this part shall be construed to require or to suggest that

the governing body of any city or county alter in any way building regulations that are more restrictive than those contained in this part.

SEC. 7. Any duties, obligations or responsibilities imposed on local government by this act are minor in nature and do not result in a significant new program for local government, or a significant increase in level of service of an existing mandated program, and no additional economic burden or cost is intended to be imposed hereby. Therefore, no appropriation is made by this act, nor is any obligation created thereby under Section 2231 of the Revenue and Taxation Code for reimbursement of any local agency for any costs that may be incurred by it.

Senate Bill 2148

Emergency Services

Status: An amended form was passed out of the Senate Judiciary Committee

SB 2148 exempts licensed engineers, geologists, architects, and building officials who voluntarily respond to render services during an emergency situation caused by an earthquake from liability for such services performed during the first 72 hours of the emergency or until public authority is restored, whichever comes first.

The people of the State of California do enact as follows:

SECTION 1. Section 8659.2 is added to the Government Code, to read:

8659.2. Engineers, geologists, architects and building officials operating within the confines of their licensed professions who voluntarily respond to render aid, assistance or expertise during an emergency situation involving or arising out of an earthquake shall be absolutely immune from liability for services performed during the first 72 hours of the emergency or until public authority is restored, whichever first occurs.

Senate Bill 2149

Seismic Design and Construction Standards

Status: in Senate Committee

Requires the Department of General Services to develop recommended seismic design and construction standards, as prescribed, by July 1, 1976, for future adoption and application by the state and by local jurisdictions. Requires the department to develop special standards for buildings housing facilities providing specified essential services and requires such special standards to be submitted in draft form to the Office of Architecture and Construction in the department on or before July 1, 1975. Requires the department to transmit copies of the completed seismic design and construction standards to state agencies and departments having responsibilities involving seismic safety and to statewide organizations concerned with earthquake safety standards, and requires the department to notify counties and cities of the standards and to make copies available to them at cost.

Appropriates $180,000 to the department for the purposes of the act.

The people of the State of California do enact as follows:

SECTION 1. Chapter 2.5 (commencing with Section 19200) is added to Part 3 of Division 13 of the Health and Safety Code, to read:

CHAPTER 2.5. SEISMIC DESIGN AND CONSTRUCTION STANDARDS

19200. The Legislature makes the following findings and declarations:

(a) California is situated on the rim of the great Circum-Pacific seismic belt and it is inevitable that strong seismic disturbances along this belt will cause extensive property damage and endanger the lives of all people who enter or are near buildings which may collapse or be seriously damaged by such seismic disturbances.

(b) It is reasonable to expect that any building located anywhere within California will be subjected to the forces generated by a strong earthquake at least once during its life.

(c) Californians are entitled to live, work, and play in structures which are adequately designed for the earthquake motions to which they will be subjected. However, dynamic response analyses have shown that forces much larger than those prescribed by existing codes, including the Uniform Building Code, can reasonably be expected during earthquakes anticipated to occur in California.

(d) Existing building-code standards have been, for the most part, developed by practicing engineers, building officials, and other professionals on a volunteer basis. During the past 15 years extensive research, dynamic analyses, and actual earthquakes have generated extensive new data which should be assimilated into seismic design standards but the massive volume of this information precludes its prompt translation into practical application for construction of safer buildings under the present system of volunteer efforts.

(e) The need for updated design and construction standards relating to seismic safety is widely recognized throughout the related professions, as well as by public earthquake task teams. State support through funding has been recommended by several such organizations, by the Legislative Analyst in his report of May of 1972 and by the Joint Committee on Seismic Safety in its report of January of 1974.

(f) The inadequacies of the present building code provisions have led many local jurisdictions to develop their own codes. Updated, improved, and comprehensive statewide seismic design and construction standards would greatly reduce the need for development of these special codes and would reduce the variances now existing among regulations of local jurisdictions.

19201. Therefore, it is the intent of the Legislature in enacting this chapter to provide for the development of recommended minimum design and construction standards relating to seismic safety, which, when adopted and applied by the state or by local jurisdictions, will incorporate the most recent developments in the sciences of earthquake engineering and will provide reasonable safety from future earthquakes for buildings which are designed and constructed in conformity with such standards.

19202. The Department of General Services shall contract with a qualified private nonprofit consulting organization, established by qualified engineering associations operating in California, for the development of recommended minimum seismic design and construction standards for the State of California pursuant to this chapter. Such standards may be based upon the Uniform Building Code promulgated by the International Conference of Building Officials or on other uniform codes or local codes currently in use, but such standards shall contain provisions dealing with all pertinent aspects of design and construction related to seismic safety which are considered in the 1973 edition of the Uniform Building Code, together with additional emphasis upon soil-structure interaction, geologic hazards, and nonstructural building components. In developing the standards, the Department of General Services shall consult with existing code-writing associations and shall attempt in all cases to obtain the most recent scientific data upon which the standards shall be based.

19203. The standards shall include special provisions relating to the design and construction of buildings that house facilities providing services which are necessary to assist in emergency or recovery situations following earthquakes.

The buildings to which this section applies include fire stations, police stations, jails, buildings and structures designated by a local jurisdiction or by the state as the central headquaters for governmental operations during an emergency, and buildings and structures designated by a local jurisdiction or by the state as a central communications center; however, hospital buildings, as defined in Section 15001, are not included.

Standards for such buildings shall be designed to assure that such facilities will remain operable following a maximum probable earthquake.

19204. The Department of General Services shall provide for completion of the seismic design and construction standards developed pursuant to this part not later than July 1, 1976. The standards specified in Section 19203 shall, however, be developed in draft form prior to July 1, 1975, and shall be provided to the Office of Architecture and Construction in the department not later than such date. The Department of General

Services shall submit a report to the Legislature detailing initial progress in implementing this chapter on or before July 1, 1975.

19205. Copies of the completed seismic design and construction standards shall be transmitted to all state agencies or departments having responsibilities involving seismic safety and to statewide organizations concerned with earthquake safety standards. The Department of General Services shall notify all counties and cities of the availability of the seismic design and construction standards, and copies shall be provided to any county or city at cost, upon request.

SEC. 2. The sum of one hundred eighty thousand dollars ($180,000) is hereby appropriated from the General Fund to the Department of General Services for expenditure without regard to fiscal year for the purposes of Chapter 2.5 (commencing with Section 19200) of Part 3 of Division 13 of the Health and Safety Code.

Senate Bill 2224

Abatement of Unsafe Buildings

Status: In interim study in the Senate

Requires local jurisdictions, as defined, to develop abatement programs for seismically hazardous buildings on or before January 1, 1976.

Requires local jurisdictions in implementing such abatement programs for seismically hazardous buildings, to commence the abatement of unusually hazardous buildings, as defined, prior to initiating the abatement of other hazardous buildings, according to prescribed priorities of hazards to life and property.

Specifies the elements which each plan must contain in order to be approved by the State Hazardous Building Commission according to specified criteria. Creates such commission as an independent agency, with specified powers and duties, for the purposes of performing the functions of this act and consisting of nine members whose terms and appointments are specified.

Requires such commission to prepare abatement programs for local jurisdictions which fail to have an abatement program approved; to administer the abatement program of any local jurisdiction which does not enforce the provisions of this act or the approved local abatement program; and to develop and adopt a hazardous building abatement program for state-owned buildings, to be administered by the Department of General Services.

Permits local jurisdictions, which have not already done so, to add a surcharge to building permit fees to cover the costs for local implementation of hazardous building abatement programs.

Appropriates $60,000 to the State Hazardous Buildings Commission for purposes of the act.

Provides that no appropriation is made nor obligation created for the reimbursement of any local agency for costs incurred by it pursuant to the act.

The people of the State of California do enact as follows:

SECTION 1. Part 1 (commencing with Section 15500) is added to Division 13 of the Health and Safety Code, to read:

PART 1. ABATEMENT OF UNSAFE BUILDINGS

CHAPTER 1. GENERAL PROVISIONS

Article 1. Intent

15500. Past earthquakes have shown there are certain types of buildings which produce an unusually high hazard during earthquakes. Collapses of these buildings have resulted in large losses of life, such as the Agnew State Hospital in San Francisco in 1906: 112 dead; a furniture store in Tehachapi in 1952: 6 dead; and the Veterans' Hospital in San Fernando in 1971: 47 dead.

In the interest of providing safety for Californians, these unusually hazardous buildings should be retired from use as soon as economically and socially feasible. As a first step, each local jurisdiction should institute a plan for the orderly removal of unusually hazardous buildings still in use. As a second step, local jurisdictions should establish ongoing programs for the orderly inspection and abatement of all other seismically hazardous structures. While certain provisions of the Uniform Building Code do provide the means for establishment of abatement programs, few local jurisdictions have enforced these provisions. Therefore, it is necessary for the state to provide guidance and directives for the establishment of abatement programs.

Article 2. Definitions

15510. Unless the content otherwise requires, the definitions in this article govern the construction of this part.

15511. "Abate" means to eliminate, to reconstruct, or to reinforce a building to meet standards comparable to those required for new construction under the current edition of the Uniform Building Code and current supplements, as adopted by the International Conference of Building Officials.

15512. "Abatement program" means a local hazardous building abatement program, except as used with regard to state-owned buildings, including the elements required by Chapter 2 (commencing with Section 15530), whether developed by a local jurisdiction or the State Hazardous Building Commission.

15513. "Building" means any assembly of materials constructed for use for any occupancy, including, but not limited to, buildings, stadiums, grandstands, observation towers, shelters, or any portions thereof, except structures consisting of four or fewer family dwelling units.

15514. "Commission" means the State Hazardous Building Commission.

15515. "Hazardous buildings" means those types of buildings which, having experienced an earthquake, have proven to have a high probability of failure and which are defined as dangerous buildings in the current Uniform Code for the Abatement of Dangerous Buildings and current supplements, as adopted by the International Conference of Building Officials.

15516. "Local jurisdiction" means a city, city and county, or county.

15517. "Unusually hazardous buildings" means those buildings which have unreinforced masonry load bearing walls with wood floors and roofs.

CHAPTER 2. LOCAL PROGRAMS

15530. Local jurisdictions shall develop abatement programs for seismically hazardous buildings in compliance with the provisions of this part, on or before January 1, 1976.

15531. Each abatement program shall have two phases: (1) abatement of unusually hazardous buildings and (2) abatement of other hazardous buildings. Abatement of unusually hazardous buildings shall receive priority and shall be at least one-third accomplished before abatement

of other hazardous buildings is initiated. All unusually hazardous buildings shall be abated by January 1, 1986.

15532. Each phase of the abatement program shall consist of at least the following elements:

(a) A program for identification and categorization of the hazardous buildings according to the classifications provided in subdivision (b) of this section.

(b) A schedule for the abatement of the hazardous buildings. The schedule for abatement of the hazardous buildings shall consider the following factors, all as related to the degree of hazard and considering the social and economic impact on the community which should be minimized:

(1) Certain occupancy classifications as defined in the current Uniform Building Code and current supplements, as adopted by the International Conference of Building Officials, shall have a higher priority for abatement. These classifications, ranging in order from the highest, ranging in order through Group B, Group J tanks and towers, Group C, Group D, Group F2 with occupancy loads of 100 or more persons, Group H, Group F2 with occupancy loads of less than 100, Group G, Groups F1 and F3, and Group E. Group I and buildings, other than tanks and towers, in Group J are not required to be reviewed.

(2) Buildings that have a high pedestrian traffic density adjacent to the building shall have a higher priority for abatement than buildings with a lower traffic density.

(3) Buildings located on soils which have a high probability of intensity of ground motion, and buildings which are adjacent to or on active faults or which are located where there is a high susceptibility to ground failure shall have a higher priority for abatement than buildings which have a lower probability of such hazards or have a probability of less intense motion.

(4) Buildings whose failure or damage could create undue life hazard to adjacent property, public or private, shall have a higher priority for abatement than buildings not so situated.

(5) Buildings situated in groups of hazardous buildings such that the hazard for the group is greater than the sums of the hazards of the

individual buildings shall have a higher priority for abatement than buildings not so situated.

(6) Buildings whose function and use to the community have alternate facilities available shall have a higher priority for abatement than other buildings which have fewer available alternatives.

(7) Buildings with less historical significance shall have a higher priority for abatement than other buildings of greater historical significance.

(8) Buildings with dangerous or unstable parapets or appendages shall have a higher priority for abatement than other buildings without these dangerous appurtenances.

(c) A program of implementation and enforcement of the schedule for abatement.

(d) Proposed regulations restricting the increase of hazard through change of occupancy classification from a lower use to higher use pursuant to paragraph (1) of subdivision (b) without adequate provision to reduce hazard.

(e) Procedures by which buildings of local or state historical significance, as determined by local agencies or the state, may be preserved with such reinforcement as necessary to provide a risk level consistent with their occupancy, use and location.

(f) Procedures for the preliminary inspection, notifications, thorough engineering review, approvals, and eventual demolition or reinforcement shall be detailed in the abatement program.

(g) Provisions for a local appeals board with procedures for hearing matters regarding the application of the rules and regulations of the local abatement program.

15533. The hazardous buildings abatement programs described in Sections 15530, 15531, and 15532 shall be submitted to the commission except as otherwise provided in this section, on or before January 1, 1976. The commission shall establish standards and regulations for the evaluation of local programs. The commission shall approve a program if the program submitted accomplishes the goal of adequately reducing hazards in a manner that is basically and economically least disturbing to the community in view of the degree of exposure to earthquake hazard. If the

submitted program does not adequately achieve these ends, the program shall not be approved, but shall be disapproved and returned to the local community for change or amendment to be resubmitted within 180 days of disapproval. If no program submitted by a local jurisdiction is approved, the commission shall prepare a program pursuant to subdivisions (d) and (e) of Section 15558. Approved programs shall be put into effect within 60 days of approval.

15534. The local jurisdiction may submit and the commission shall approve acceptable abatement programs in two phases in order to expedite the implementation of this part. The first phase shall contain all the elements for the abatement of the unusually hazardous buildings while the second phase shall contain the elements relating to all other earthquake hazardous buildings.

15535. Upon approval of the program, the local jurisdiction shall implement the program and enforce it.

15536. In any local jurisdiction which does not enforce the provisions of this part, a surcharge on construction permit fees shall be collected by the local jurisdiction and transmitted to the commission for its administration of the local abatement program. The amount of the surcharge shall be determined by the commission after the notice and hearing in accordance with Chapter 4.5 (commencing with Section 11371), Part 1, Division 3, Title 2 of the Government Code. In no event shall the surcharge exceed the construction permit fee subject to the surcharge.

15537. It is not the intent of this part to preclude local jurisdictions from adopting more stringent standards or programs than required in this part.

15538. Local jurisdictions may add a surcharge to building permit fees to cover the cost of local implementation of this part if such jurisdictions have not already established such a surcharge for the implementation of hazardous building abatement programs in existence on January 1, 1975.

CHAPTER 3. STATE HAZARDOUS BUILDING COMMISSION

15550. There is hereby created the State Hazardous Building Commission which shall perform the functions set forth in this part.

15551. The commission, representative of the general public, shall consist of nine members, five of whom shall be appointed by the Governor, two by the Senate Rules Committee and two by the Speaker of the Assembly.

15552. The term of office of each commissioner shall be four years and until his or her successor has been appointed and has qualified; except the terms of three of the initial members appointed by the Governor shall expire two years after the appointment and the term of one initial member appointed by the Senate Rules Committee and one initial member appointed by the Speaker of the Assembly shall expire two years after their appointment.

15553. All appointments of the initial nine members of the commission shall be made by February 1, 1975.

15554. The commission shall elect, and may replace, from its membership, a chairman and vice chairman and may employ sufficient personnel to conduct the clerical and other duties assigned the commission.

15555. The commission shall be independent of any other state agency or department and is authorized to obtain such information or expert opinion from any other state agency or department as is necessary for the performance of its duties relating to seismic safety.

15556. The commission shall meet at least quarterly in the second week of February, May, August, and November of each year or as soon thereafter as possible. It shall also meet at the call of the chairman or upon written request of three or more members.

15557. The members of the commission shall serve without compensation, but shall receive per diem expenses and actual necessary travel expenses, as determined by the State Board of Control.

15558. The commission shall have the following duties:

(a) To gather and disseminate upon request from a local jurisdiction, or upon its own initiative in emergency situations, current and relevant information regarding the relationship of hazardous buildings to seismic safety. It is the intention of the Legislature that the commission not act as a clearinghouse for all hazardous buildings and earthquake data nor to voluntarily furnish material of general nature or which has long been public information. Instead, it is the intention of the Legislature to impose upon the commission the obligation of furnishing recent developments in the field of hazardous buildings that will aid and assist local

jurisdictions in developing and enforcing local abatement programs.

(b) To review local hazardous building abatement programs submitted to the commission under this part. In the conduct of such review, the commission shall endeavor to evaluate each local agency's response to its hazardous building problem as it relates to known seismic safety problems and the seismic history of the area, provided each local jurisdiction has submitted a program containing the minimum elements as required by Chapter 2 (commencing with Section 15530). The commission shall act upon each local jurisdiction's hazardous building abatement program within 90 days of receipt of the program or resubmittal of a disapproved program unless the commission and the local jurisdiction agree upon an extension of the review time. However, in no event shall the cumulative amount of such extensions exceed 90 days.

(c) To approve or disapprove those local building abatement programs. Evidence of such approval or disapproval shall be transmitted to the local jurisdiction in writing upon appropriate response forms prepared and approved by the commission. In disapproving any local program, the commission shall indicate the deficiencies in the program and what changes are necessary to make the program acceptable.

(d) To hear petitions for reconsideration regarding the adequacy of a local abatement program. Before the commission may prepare and approve a mandatory hazardous building abatement program for any local jurisdiction pursuant to subdivision (e), such local jurisdiction shall have the right to petition for reconsideration a rejection of its plan or any portion thereof to the commission. The commission shall establish appropriate procedures for such petitions for reconsideration providing for sufficient notice and opportunity for hearing for any affected local jurisdiction.

(e) To prepare local hazardous building abatement programs for local jurisdictions that fail to have a hazardous building abatement program approved by the commission. If no program has been submitted by a local jurisdiction, the commission shall prepare a program for the local jurisdiction within 180 days after January 1, 1976. If a program of a local jurisdiction has been disapproved upon resubmittal, the commission shall prepare a program for the local jurisdiction within 90 days of such disapproval.

In preparing such local hazardous building programs the commission shall be guided by the standards set forth in Chapter 2 (commencing with Section 15530). Upon preparation of the local hazardous building abatement program the same shall be submitted to the local jurisdiction by the commission and shall become effective as the approved local hazardous building abatement program of the affected local jurisdiction 60 days after receipt of such submittal unless a hearing is requested thereon by the local jurisdiction within 15 days of receipt of the local hazardous building program. If a hearing is requested, the matter shall be set for hearing within 30 days of such request. It shall be heard and a decision rendered within 60 days of the hearing date unless both parties agree to continue the same.

(f) To develop and adopt, on or before January 1, 1976, a hazardous building abatement program for all state-owned buildings, based upon the same criteria as set forth in Sections 15531 and 15532. The Department of General Services shall administer such program.

(g) To administer the local abatement program in any local jurisdiction which does not enforce the provisions of this part or the abatement program approved for such local jurisdiction pursuant to the provisions of this part.

15559. In discharging its duties as set forth in this chapter, the commission shall have the further power to do all of the following:

(a) Accept grants, contributions and appropriations from public agencies, private foundations, and individuals.

(b) Appoint committees from its membership, appoint advisory groups from interested public and private groups and appoint ex officio members to advise the commission but without the power to vote or ultimately determine matters.

(c) Contract for or employ, with the approval of the Director of Finance, any professional services and research required by the commission or required for the necessary work and services which in the opinion of the commission cannot be performed satisfactorily by its officers and employees or by, through or under other federal, state or local governmental agencies.

(d) Do any and all things necessary to carry out the purposes of this part.

SEC. 2. The sum of sixty thousand dollars ($60,000) is hereby appropriated from the General Fund to the Hazardous Building Commission for expenditure, without regard to fiscal year, in carrying out the provisions of Part 1 (commencing with Section 15500) of Division 12 of the Health and Safety Code.

SEC. 3. No appropriation is made by this act, nor is obligation created under Section 2231 of the Revenue and Taxation Code, for the reimbursement of any local agency for any costs that may be incurred by it in carrying on any program or performing any service required to be carried on or performed by it by this act.

Senate Bill 2367

Disaster Exercises

Status: To be reintroduced in 1975

Provides for the conduct of disaster exercises and statewide service counterpart programs by state and local agencies in alternating years commencing in 1977. Imposes various duties and functions upon the Office of Emergency Services, relative to such activities.

Appropriates an unspecified sum from the General Fund to the Office of Emergency Services for use during the 1975 and 1976 calendar years for the purposes of this act.

The people of the State of California do enact as follows:

SECTION 1. Article 21 (commencing with Section 8670) is added to Chapter 7 of Division 1 of Title 2 of the Government Code, to read:

Article 21. Disaster Exercises

8670. The Legislature finds and declares that the protection of the health and safety and preservation of the lives and property of the people of California from the effects of natural and man-made emergencies is of paramount importance. It is further declared that response to emergencies normally necessitates the combined efforts of several local jurisdictions as well as the state, and that therefore, cooperative planning and response among local jurisdictions and the state are essential to the expeditious relief of emergency situations. It is further decleared that to build an effective, coordinated response program throughout the state, it is mandatory that disaster exercises be held regularly to test existing plans and to generate cooperation between jurisdictions. The Legislature further finds that state involvement and support of a disaster exercise program is

critical in generating local concern and support. Therefore, the Legislature declares that the Office of Emergency Services and other state agencies and departments shall be principal participants along with local jurisdictions in disaster exercises. Private industry, public utilities, and public service agencies normally involved in disaster assistance and relief shall be invited to participate in the disaster exercises but are not required to do so by this article.

8671. The following definitions shall govern the construction of this article:

(a) "Disaster" means those situations defined as a state of emergency and local emergency in subdivisions (b) and (c) of Section 8558.

(b) "Service counterpart programs" means the planning between representatives of state departments designated by the Governor for involvement in disaster planning and response pursuant to Administrative Orders 72-1 to 72-30, inclusive, plus any additional administrative orders approved by the Governor as recorded in the State of California Emergency Plan, Part Three, and the counterparts of these state department representatives in the general units of local government who are responsible for conducting emergency operations as designated in local disaster plans or ordinances pursuant to Article 10 (commencing with Section 8610) of this chapter. Counterpart planning between all state departments designated under the above administrative orders and all local jurisdictions shall occur every other year based on the schedule set forth below.

(c) "State department representatives" means those persons who have responsibility for departmental disaster operations and who would normally assume a departmental command position in the event of a disaster.

(d) "Regions" means those "mutual aid regions" defined in subdivision (a) of Section 8559.

(e) "General units of local government" means cities, cities and counties, and counties, and special districts and agencies having responsibilities in the event of a disaster as determined by the Office of Emergency Services.

8672. Disaster exercises shall be held annually. Such exercises shall alternate between statewide service counterpart programs one year and regional exercises the next, commencing with the service counterpart program in 1977.

Regional disaster exercises shall be held in each of the mutual aid regions with the general units of local government in each region.

Disaster exercises need not necessarily include practice with equipment, but shall include the participation of at least those persons designated by local ordinance to direct emergency operations as required by Article 10 (commencing with Section 8610) of this chapter. State department representatives shall be those as defined above.

8673. The duties and functions of the Office of Emergency Services with respect to disaster exercises shall be to manage the entire disaster exercise program. Management shall include:

(a) Developing guidelines as to what constitutes an acceptable exercise by June 30, 1975.

(b) Directing the statewide service counterpart disaster exercises and the regional exercises in those years when such exercises are held.

(c) Undertaking during the 1975 and 1976 calendar years, the necessary planning and preparation to implement the exercise program which is to begin in 1977. In planning and preparing for the implementation of the exercise program, the Office of Emergency Services shall:

(1) Request participation and input from all general units of local government on planning for future disaster exercises. In order to encourage local participation in planning and local assistance in holding the actual disaster exercises, the Office of Emergency Services shall establish regional and as the Office of Emergency Services is requested by local jurisdictions, such regional planning councils in each of the mutual aid regions. These councils shall consist of at least the Office of Emergency Services regional manager and affected county disaster coordinators. These councils shall determine the scope, nature, and extent of disaster planning and exercises required in this act for the regions. If local jurisdictions do not participate in the disaster exercise planning through their regional or subregional councils, the Office of Emergency Services shall accomplish the necessary planning. Regional disaster councils shall participate in the actual disaster exercises beginning in 1977.

(2) Develop guidelines for regional disaster exercises by June 30, 1975, for use in planning by the regional and subregional councils. These guidelines shall also be distributed to all local jurisdictions by June 30, 1975.

(3) Develop a schedule for exercises to be held during 1977 and 1978. The exercises will include (i) "service counterpart program" planning to be conducted between all counterparts of state and general units of local government in disaster oriented services to be held in 1977 and (ii) at least one exercise related to the unique hazards of each of the mutual aid regions to be held in 1978. Schedules shall be distributed to local jurisdictions by June 30, 1975. Scheduling for subsequent exercises may be accomplished in subsequent years.

(4) Complete scheduling and any necessary planning in sufficient detail by June 30, 1975, to allow for a cost analysis to be conducted on the exercises by December 31, 1975. Regional and subregional council planning, based on the Office of Emergency Services guidelines and scheduling, shall be completed by June 30, 1976. By June 30, 1976, final schedules shall be distributed to local jurisdictions and regional and subregional councils, and all exercise plans shall be filed with the Office of Emergency Services. The time from July 1, 1976, to December 31, 1976, shall be used to prepare for implementing the plans as finalized.

(5) Complete by December 31, 1975, a cost analysis survey for state departments and local governments to implement the exercise program. The survey shall be conducted jointly by the Office of Emergency Services and the Department of Finance, and shall include consultations with state departments to be involved and with local jurisdictions. The cost analysis shall be reported to the Office of Emergency Services, the Legislature and Governor by December 31, 1975. The Office of Emergency Services and the Department of Finance shall also determine what types of local expenses shall constitute legitimate claims against the state for reimbursement under the disaster exercises program. This information shall be distributed to each local jurisdiction and regional or subregional council.

8674. Each state agency which is participating in this program as designated above shall report annually to the Director of the Office of Emergency Services, who shall in turn file a consolidated report on the results of the disaster exercises including a report including a review of regional exercises with the State Emergency Council, Legislature, and the Governor on progress made that year. Reports to the Legislature shall be filed with the proper committee, including finance committees, which shall hold public

hearings on the reports. Reports shall also be forwarded to all city and county administrators.

SEC. 2. It is not the intent of the Legislature to preclude local jurisdictions from conducting additional disaster exercises.

SEC. 3. It is the intent of the Legislature to include funding for reimbursement of costs to local governments and the Office of Emergency Services for the 1977-78 exercises in the Budget Act of 1976. Appropriations thereafter shall be allocated annually in the budget.

SEC. 4. The sum of _____ dollars ($) is appropriated from the General Fund to the Office of Emergency Services for use during the 1975 and 1976 calendar years to develop a cost analysis and for planning and scheduling the exercises to be held in 1977 and 1978.

Senate Bill 2422

Funding for Geologic Hazards Zones Act

Status: In Senate Finance Committee

SB2422 requires cities and counties to charge a reasonable fee to an applicant for a site approval for a proposed new real estate development (defined to include a subdivision) or structure for human occupancy located within a special studies zone delineated pursuant to the Alquist-Priolo Geologic Hazard Zones Act rather than requiring such fee for a building permit according to a fee schedule established by the State Mining and Geology Board, and makes related changes. Requires the State Geologist to define "new real estate development" and "structure for human occupancy" for purposes of the act. Deletes provisions requiring 1/2 of the proceeds of fees imposed under the act to be retained by the city or county and the remaining 1/2 to be deposited in the General Fund.

Provides that neither appropriation is made nor obligation created for the reimbursement of any local agency for any costs incurred by it pursuant to the act for a specified reason.

Appropriates $100,000 to the Division of Mines and Geology of the Department of Conservation for the purposes of carrying out the provisions of the act.

The people of the State of California do enact as follows:

SECTION 1. Section 2623 of the Public Resources Code is amended to read:

2623. Within the special studies zones delineated pursuant to Section 2622, the site of every proposed new real estate development or structure for human occupancy shall be approved by the city or county having jurisdiction over such lands in accordance with policies and criteria established

by the State Mining and Geology Board and the findings of the State Geologist. The State Geologist shall, by regulation, define "new real estate development" and "structure for human occupancy" for the purposes of this chapter; provided, however, that a new real estate development shall include a subdivision as defined in the Subdivision Map Act (commencing with Section 11500, Business and Professions Code). Such policies and criteria shall be established by the State Mining and Geology Board not later than December 31, 1973. In the development of such policies and criteria, the State Mining and Geology Board shall seek the comment and advice of affected cities, counties, and state agencies. Cities and counties shall not approve the location of such a development or structure within a delineated special studies zone if an undue hazard would be created, and approval may be withheld pending geologic and engineering studies to more adequately define the the zone of hazard. If the city or county finds that no undue hazard exists, geologic and engineering studies may be waived, with approval of the State Geologist, and the location of the proposed development or structure may be approved.

SEC. 2. Section 2625 of the Public Resources Code is amended to read:

2625. (a) Each applicant for a site approval for a new real estate development or structure for human occupancy within a delineated special studies zone shall be charged a reasonable fee by the city or county having jurisdiction over the proposed development or structure.

(b) Such fees shall be set in an amount sufficient to meet, but not to exceed, the costs to local government of administering and complying with the provisions of this chapter. The fee charged to an applicant for a site approval for a development or structure shall not exceed one-tenth of 1 percent of the total valuation of the proposed development or structure, as determined by the local jurisdiction.

(c) The geologic and engineering studies specified in Section 2623 shall be in sufficient detail to meet the criteria and policies established by the State Mining and Geology Board for individual parcels of land.

SEC. 3. No appropriation is made by this act, nor is any obligation created thereby under Section 2231 of the Revenue and Taxation Code, for the reimbursement of any local agency for any costs that may be incurred by it in carrying on any program or performing any service required to be

carried on or performed by it by this act because any such costs shall be recovered from fees collected pursuant to this act.

SEC. 4. There is hereby appropriated from the General Fund to the Division of Mines and Geology of the Department of Conservation the sum of one hundred thousand dollars ($100,000) for the purposes of carrying out the provisions of Chapter 7.5 (commencing with Section 2621 of Division 2 of the Public Resources Code.

Senate Joint Resolution 63

Abatement of Hazardous Federal Buildings

Status: In interim study in the Senate

Urges the President and Congress of the United States to assure the people of California that action will be initiated to establish a program to abate seismically hazardous federally owned structures in the State of California and that such program will consider the elements of abatement programs in existence in California.

WHEREAS, The earthquake hazard to California, the nation's most populated state, is severe, and the urban areas of California are increasingly more vulnerable to seismic disaster because of the ever-increasing strain along major fault traces and the increasing concentration of population; and

WHEREAS, The world's earthquake experts agree that California will experience and is chronologically overdue for another "great" earthquake of the magnitude of that experienced by San Francisco in 1906; and

WHEREAS, Many seismically hazardous buildings still exist in California, some of which are federally owned structures; and

WHEREAS, Several federally owned structures have collapsed in recent earthquakes resulting in numerous deaths and an inability to provide services necessary to relief and recovery operations, one of such structures being the Veterans Hospital in the San Fernando Earthquake of 1971 which resulted in 47 deaths; and

WHEREAS, The Veterans Administration is currently studying the need for more stringent earthquake building code provisions for use in veterans hospitals in California; and

WHEREAS, Local jurisdictions and the State of California are initiating programs for the abatement of public and private hazardous buildings; now, therefore, be it

Resolved by the Senate and Assembly of the State of California, jointly,

That the Legislature of the State of California respectfully memorializes the President and the Congress of the United States to assure the people of California that action will be initiated to establish a program for the abatement of seismically hazardous federally owned structures in the State of California, and that such program will consider the elements of abatement programs in existence in California; and be it further

Resolved, That the Secretary of the Senate transmit copies of this resolution to the President and Vice President of the United States, to the Speaker of the House of Representatives, and to each Senator and Representative from California in the Congress of the United States.

Local Planning Ordinance

The city of Portola Valley, within the San Andreas fault zone in Northern California, has recently enacted a progressive local planning ordinance in an attempt to deal with their geologic hazards problems. An ordinance similar to this would be extremely effective at the local planning level in Utah. By using this example as a model and the active fault maps presented in this report and in Cluff et al, (1970 and 1973) as a base, a large step toward seismic safety at local jurisdictions can be made.

Portola Valley California

Resolution No. 500, 1974

A RESOLUTION OF THE TOWN OF PORTOLA VALLEY APPROVING AND ADOPTING "GEOLOGIC MAP" AND "MOVEMENT POTENTIAL OF UNDISTURBED GROUND" AND ESTABLISHING LAND USE POLICIES FOR LANDS SHOWN ON SAID MAPS

RESOLVED, by the Council of the Town of Portola Valley as follows:

BACKGROUND: The Town Council of Portola Valley realizes the extreme importance of geologic data in many decisions which face the Town. It also realizes that geologically hazardous conditions exist in extensive portions of the Town. While results of highly detailed geologic studies might justify detailed restrictions on the use of some lands, such studies are not now available for most of the Town. The geologic maps which have been prepared by the Town, however, are based on the study of aerial photographs, field investigations and other available geologic studies, and portray geologic conditions with considerable accuracy. Given this level of data, the Town Council finds it appropriate to adopt these maps as policy, to have them serve as guidelines for administering the affairs of the Town, and to modify them from time to time as better information becomes available. It is the Town Council's intention that these maps

and related land use policies shall be employed as guides in all decisions to which they are relevant and shall be adhered to unless modifications or deviations are permitted as provided for herein.

PURPOSE: 1. To help prevent Town decisions which might result in the loss of life and/or public or private land or improvements as a result of geologic hazards.

2. To establish a set of geologic maps which will serve as a consistent basis for reviewing applications before the Town and various other Town actions.

3. To establish policies for land uses to be permitted in different geologic settings.

APPLICABILITY: This resolution shall be used in all decisions of the Town Staff, Committees, Commissions and the Town Council where geologic considerations are relevant. It shall, in particular, be employed in applications under the following regulations:

1. *Zoning Ordinance*
2. *Subdivision Ordinance*
3. *Site Development Ordinance*
4. *Building Code*

GEOLOGIC MAPS: The adoption, modification and maintenance of geologic maps shall be as set forth below.

ADOPTION: The following maps are adopted as the official geologic maps of the Town of Portola Valley:

1. *"Geologic Map," 1"=500', 9/18/73*
2. *"Movement Potential of Undisturbed Ground," 1"=500', 9/18/73*

MODIFICATION: It is recognized that these maps are based on a certain level of geologic information and that further study may permit their improvement; therefore, the following procedures are available for modification of the maps:

1. In the course of reviewing any application wherein this resolution is used as a guide in reviewing the geology, the Planning Commission may, after recommendation from the Town Geologist, modify the map(s) if it determines, based upon evidence before it, that such modification is warranted. Where a modification is approved, a written report shall be prepared indicating the nature of the change, the reasons therefore; and such report shall be filed with the Town Geologist.

2. In instances where no application is involved, a land owner or his authorized representative may file a request for modification with the Planning Commission Secretary along with such supporting information as is required by the Town Geologist. The Town Geologist shall thereafter make a recommendation to the Planning Commission and the Commission shall act as set forth in Item 1 above.

3. The Town Geologist may at any time submit a written recommendation to the Planning Commission for modification of the maps and the Planning Commission may modify the maps if it determines, based on evidence before it, that such modification is warranted.

MAINTENANCE OF MAPS AND RECORDS: 1. The Town Geologist shall be responsible for seeing that all requests for changes and actions thereon are filed and maintained.

2. The Town Geologist shall be responsible for seeing that all changes approved by the Planning Commission are posted to the maps within 30 days after approval of such changes.

LAND USE POLICIES -- MOVEMENT POTENTIAL MAP: The land-use policies shown on Table 1 shall be adhered to. These policies have been established on the premise that, in future action, the Town wants to avoid any major failures of ground due to landslides which would endanger public or private property. Where land uses that are under consideration by a decision-making body are not listed on Table 1, the decision-making body shall use the policies in Table 1 as a guide insofar as is possible.

TABLE 1

	Map Symbol[1]	Roads		Houses[2]			Utilities	Water Tanks
		Public	Private	1/4 Ac	1 Ac	3 Ac		
Most Stable	Sbr	Y	Y	Y	Y	Y	Y	Y
	Sun	Y	Y	Y	Y	Y	Y	Y
	Sex	Y*	Y	Y*	Y	Y	Y	Y*
	Sls	Y*	Y*	N*	Y*	Y*	Y*	N*
	Ps	Y*	Y*	N*	Y*	Y*	Y*	N*
	Pmw	N*	N*	N*	N*	N*	N*	N*
	Ms	N*	N*	N	N	N	N	N
	Pd	N	N*	N	N	N	N	N
	Psc	N	N	N	N	N	N	N
Least Stable	Md	N	N	N	N	N	N	N
	Pf	Y*	Y*	(See Sec. 6209.2 of Zoning Ord.)			N*	N*

1 / *Symbols are shown on the map, "Movement Potential of Undisturbed Ground."*

2 / *The acreage figures are for the individual parcel area for each house.*

LEGEND:

Y	*Yes (permitted)*
*Y**	*The land use would normally be expected to be permitted, provided the geologic data and/or engineering solutions are favorable; however, there will be instances where the use will not be appropriate.*
N	*No (not permitted)*
*N**	*The land use would normally be expected to not be permitted; however, there will be circumstances where geologic data and/or engineering solutions will permit the use.*

DEVIATIONS: Since this is a policy and not an ordinance, deviations from the land use policies shall be considered in deliberations on the associated applications or other actions and may be approved or denied by the approving authority. It is anticipated that only minor deviations will be approved, and, even then, only when it is clearly demonstrated to the decision-making body that such deviations will not unduly jeopardize life, public property or private property. When deviations are made, a written report describing such deviation and reasons therefor shall be made and filed with the Town Geologist.

ORDINANCE NO. 1973-119

AN ORDINANCE AMENDING THE ZONING ORDINANCE
OF THE TOWN OF PORTOLA VALLEY

EARTHQUAKE FAULT ZONE

The Council of the Town of Portola Valley does ordain as follows:

SECTION 1. Sections No. 6105.1, 6209, 6209.1, 6209.2, 6935.1 and 6935.10 of Ordinance No. 1967-80, An Ordinance Adopting Zoning Regulations for the Town of Portola Valley, adopted July 18, 1967, are added and amended as herein provided.

SECTION 2. Section 6105.1, the Zoning Map, shall be, and it is hereby, amended by adding Sheet 2 to the Zoning Map, showing special building setback lines in the EF (Earthquake Fault) Zone, in the form of said Sheet 2 hereto attached and by reference incorporated herein.

SECTION 3. Sections 6209.2, 6209.3 and 6209.4 shall be, and they are hereby, repealed. Sections 6209 and 6209.1 shall be amended, and a new Section 6209.2 shall be added, relating to special building setback lines, general, scenic and earthquake fault, to read as follows:

"Section 6209. SPECIAL BUILDING SETBACK LINES - GENERAL.

Special building setback lines are intended to regulate the location of buildings where special features such as scenic roads, geologically hazardous areas, and flood plains require in the public interest setback regulations in addition to those otherwise specified in this ordinance.

6209.1. Special Building Setback Lines - S (Scenic).

A. Purpose. Special Building Setback Lines - S are established along streets to assure the provision of space for light, air, safety, circulation, and visual amenity, and to permit or require adjustment in the location of buildings to observe unusual physical conditions. Special Building Setback Lines shall be adopted and amended in conformance with the requirements of Section 6937 of this ordinance and when adopted shall be set forth on the Zoning Map.

B. Requirements. No structure shall be located closer to a street parcel line than the special building setback line. In any district where the least depth or least width of yard required for

such district is greater or less than the distance set forth for any special building setback line, the distance established by the special building setback line shall govern.

C. *Measurement. The location of a special building setback line shall be established by measurements in feet measured at right angles from the parcel line of the subject parcel.*

D. *Adopted Special Building Setback Lines - S -*

1) *Skyline Boulevard - No buildings shall be closer than two hundred (200) feet to the right-of-way of Skyline Boulevard, provided, however, that the Architectural and Site Control Commission may allow a reduction of the setback to no less than one hundred (100) feet when it finds that in such a location the proposed building will not be visible from the right-of-way of Skyline Boulevard.*

2) *Alpine Road - No buildings shall be located closer than seventy-five (75) feet to the right-of-way of Alpine Road in that section of Alpine Road lying between the northerly Town limits and Portola Road.*

6209.2 Special Building Setback Lines - EF (Earthquake Fault)

A. *Purpose. Special Building Setback Lines - EF are established along earthquake fault traces to minimize the potential loss of property and life resulting from differential movement along such fault traces caused by tectonic forces. Special building setback lines shall be adopted and amended in conformance with the requirements of Section 6937 of this ordinance and when adopted shall be set forth on the Zoning Map.*

B. *Delineation of Earthquake Fault Traces. Earthquake fault traces are mapped as "known" locations and "inferred" locations. "Known" locations are based on surface expressions or subsurface explorations which fix the location of the trace. "Inferred" locations are based on the presence of a limited number of surface or subsurface indications of a fault trace. The actual position of the "inferred" location is subject to wider error than the "known" location and therefore the width of potential risk band is increased.*

C. Requirements.

1) No buildings for human occupancy shall be located closer than fifty (50) feet from a fault trace mapped as a "known" location.

2) Only single-family, one story, wood-frame residences or single-family residences of different construction deemed by the Town to be of at least equivalent earthquake resistant characteristics, and buildings for other than human occupancy may be located within bands lying between fifty (50) feet and one-hundred-twenty-five (125) feet from a fault trace mapped as a "known" location.

3) When a fault trace is mapped as an "inferred" location, the set-back requirements set forth in 1) and 2) above shall be increased by fifty (50) feet respectively.

D. Measurement. The location of a special building setback line shall be established by measurements in feet measured at right angles from the mapped fault trace as shown on the Zoning Map.

E. Modification of Requirements. When geologic studies acceptable to the Planning Commission identify an "inferred" segment of a trace at a level of accuracy equivalent to previously mapped "known" traces, such fault trace segment shall be automatically reclassified as a "known" location."

Section 4. Sections 6935.1 and 6935.10, relating to conditional use permit regulations, are hereby amended to read as follows:

"6935.1. Purposes and Special Considerations. The uses listed as Conditional Uses are hereby declared to be uses possessing characteristics of such unique and special qualities as to require special review to determine whether or not any such use should be permitted in a specific location which may be proposed.

A. The purposes of the review are to:

1) Determine whether the location proposed for the Conditional Use applied for is properly related to the development of the neighborhood or community as a whole;

2) Determine whether or not the use proposed in the particular location would be reasonably compatible with the types of uses normally permitted in the surrounding area;

3) *Evaluate whether or not adequate facilities and services required for such use exist or can be provided.*

4) *Determine whether the site is or can be made safe from hazards or storm water runoff, soil erosion, earth movement, earthquake, and other geologic hazards.*

5) *Stipulate such conditions and requirements as would reasonably assure that the basic purposes of this ordinance and the objectives of the General Plan would be served.*

B. *Factors to be considered are:*

1) *The relationship of the location proposed to:*

a) *The service or market area of the use or facility proposed;*

b) *Transportation, utilities and other facilities required to serve it;*

c) *Uses of other lands in the vicinity;*

d) *The suitability of the soils, geology and hydrology for the proposed use.*

2) *Probable effects on persons, land uses, and properties adjoining and the general vicinity, including:*

a) *Probable inconvenience, economic loss, or hazard occasioned by unusual volume or character of traffic or the congregating of a large number of people;*

b) *Probable hazard from explosion, contamination or fire;*

c) *Probable inconvenience, damage or nuisance from noise, smoke, odor, dust, vibration, radiation or similar causes."*

"6935.10. Planning Commission Findings and Action. All actions of the Planning Commission related to the findings shall be taken in accordance with the requirements of Section 6939.7 of this ordinance. The Planning Commission may grant a Conditional Use Permit if it finds that:

A. *The proposed use or facility is properly located in relation to the community as a whole and to land uses and transportation and services facilities in the vicinity.*

B. *The site for the proposed use is adequate in size and shape to accommodate the proposed use and all yards, open spaces, walls and fences, parking, loading, landscaping and such other features as may be required by this ordinance or in the opinion of the Commission be needed to assure that the proposed use will be reasonably compatible with land uses normally permitted in the surrounding area.*

C. *The site for the proposed use will be served by streets and highways of adequate width and pavement type to carry the quantity and kind of traffic generated by the proposed use.*

D. *The proposed use will not adversely affect the abutting property or the permitted use thereof.*

E. *The site for the proposed use is demonstrated to be reasonably safe from or can be made reasonably safe from hazards of storm water run-off, soil erosion, earth movement, earthquake and other geologic hazards.*

F. *In the case of any Planned Unit Development, the proposed uses and development will conform with the requirements set forth in Section 6111.4 of this ordinance.*

If the Planning Commission is unable to make the findings required above, the Planning Commission shall disapprove the granting of the Conditional Use Permit. Action of the Planning Commission in approving or disapproving the granting of the Conditional Use Permit shall be final, except that the matter may be appealed to the Town Council in accordance with Section 6951 of this ordinance or the Town Council may elect to review the action of the Planning Commission in accordance with the provisions of Section 6952."

Section 5. All ordinances and parts of ordinances inconsistent herewith any hereby repealed.

Section 6. This ordinance shall be posted in three public places and shall become effective thirty days after the date of its adoption.

_____

Mayor

ATTEST:

_____

Clerk of the Town of Portola Valley

(SEAL)

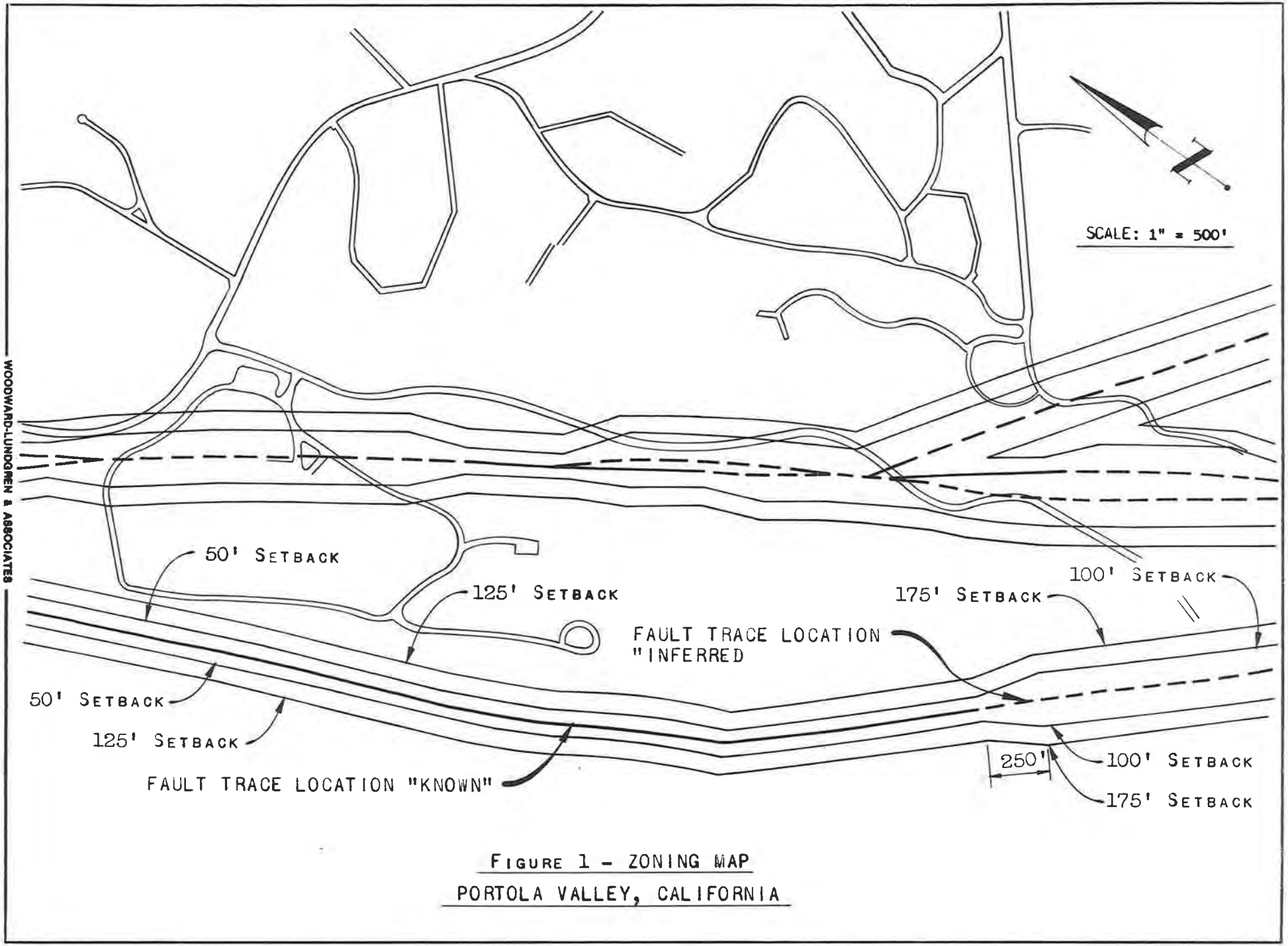


FIGURE 1 - ZONING MAP
PORTOLA VALLEY, CALIFORNIA

WOODWARD-LUNDGREN & ASSOCIATES

CONCLUSION

As a result of continuing advances in technology, as well as knowledge gained as a result of the tragic experiences of the 1971 San Fernando and 1972 Managua earthquakes, we now have the knowledge necessary to reduce earthquake risks: all that remains is to begin applying this knowledge. The foregoing legislation and exerpts from the California Joint Committee on Seismic Safety final report show how California is attacking their earthquake problems. Many seismic safety measures have already been implemented; however, a great deal remains to be done. Utah is in a position to make pioneering advances in this area before a major disaster strikes, however, while Utah delays, the potential for earthquake catastrophe continues to increase rapidly as population concentrates in urban centers along active faults and as long as hazardous buildings remain in use.

ILLUSTRATIONS

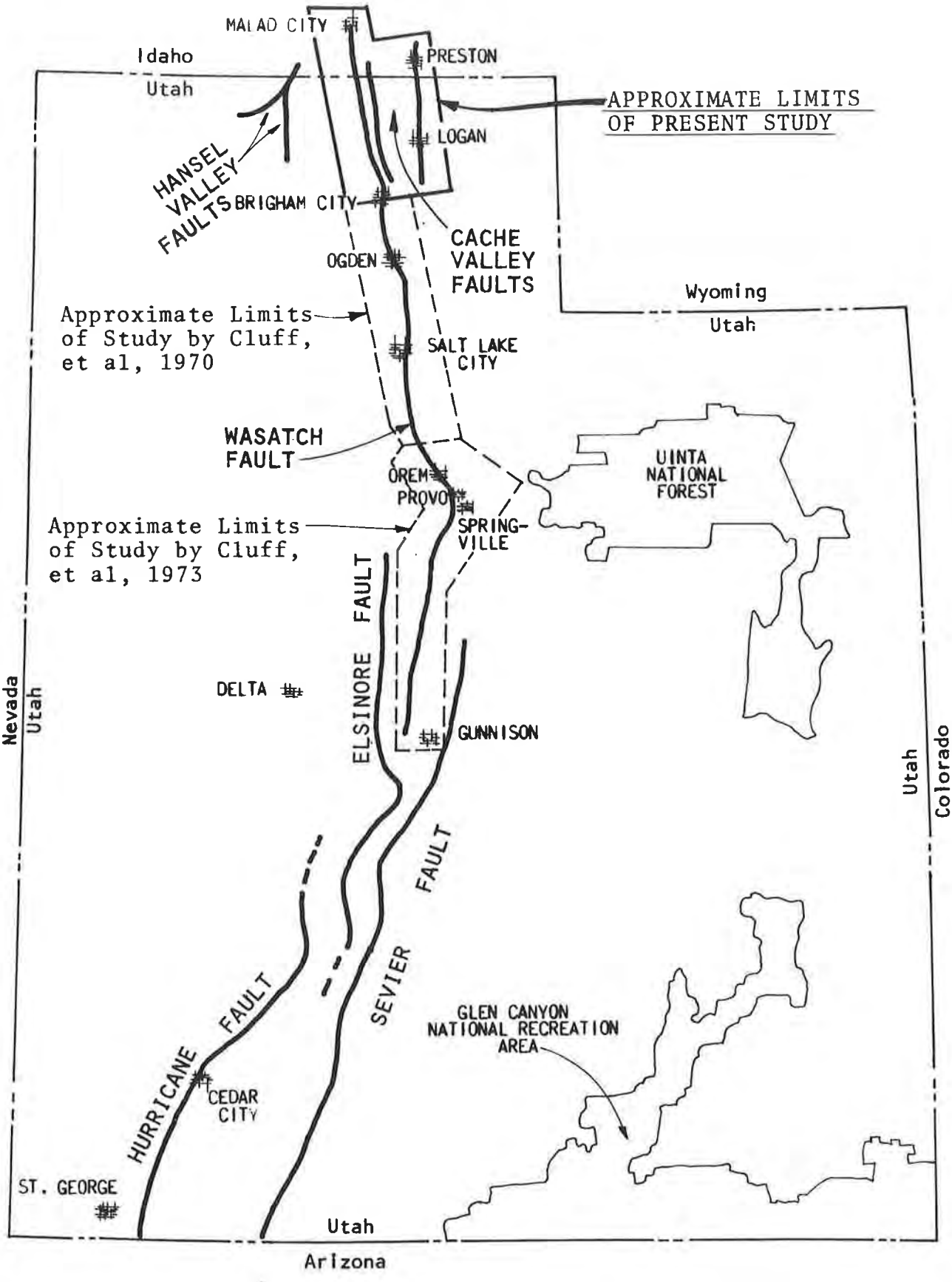


FIGURE 1. Locations of the area of this study and study areas of Cluff, et al. (1970 and 1973) and selected active faults of the region.

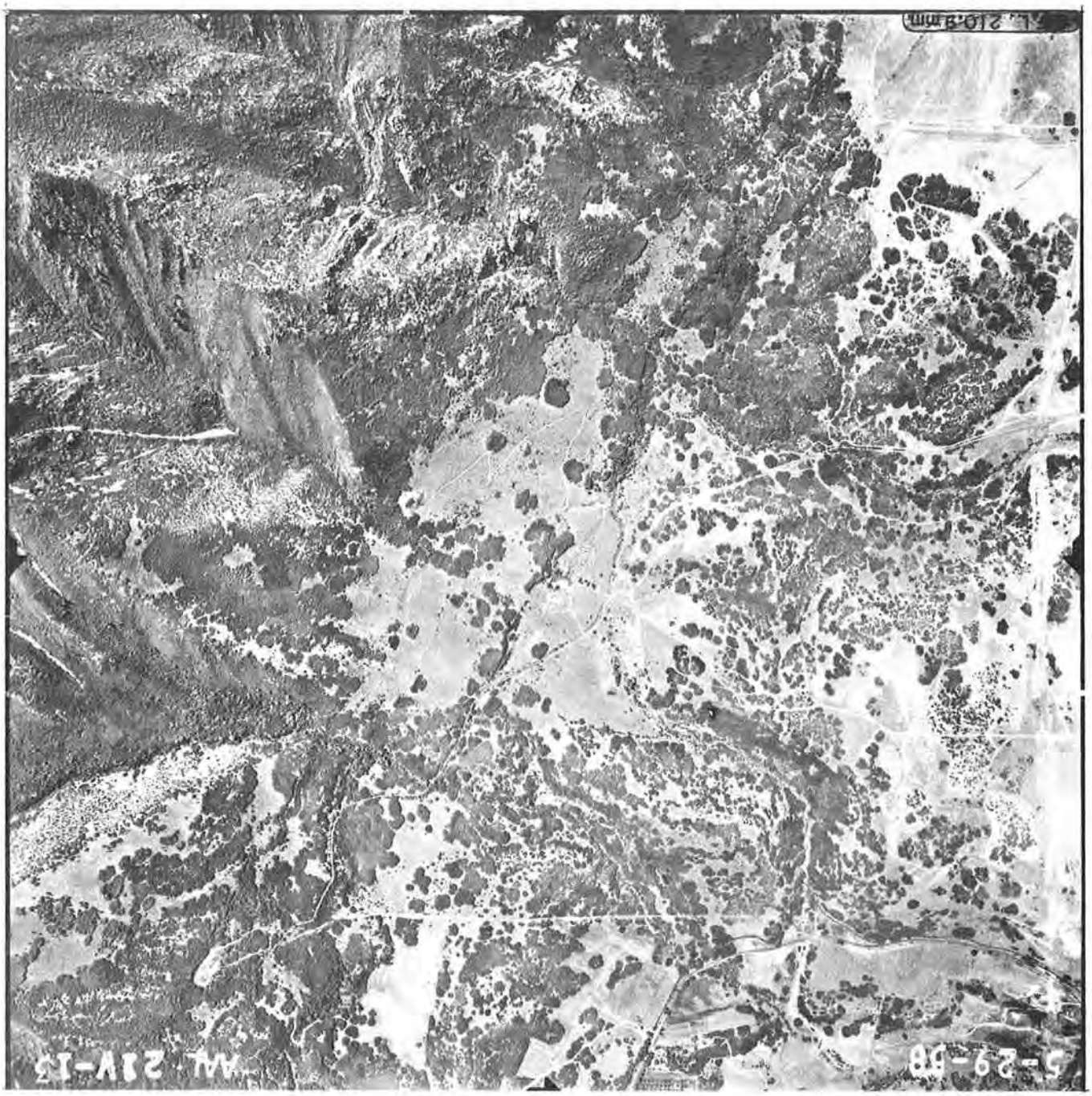


FIGURE 2. Conventional aerial photograph of the area south of Bells Canyon, near Draper, Utah. Original Photo measured 9" x 9" and was at a scale of 1:10,000.

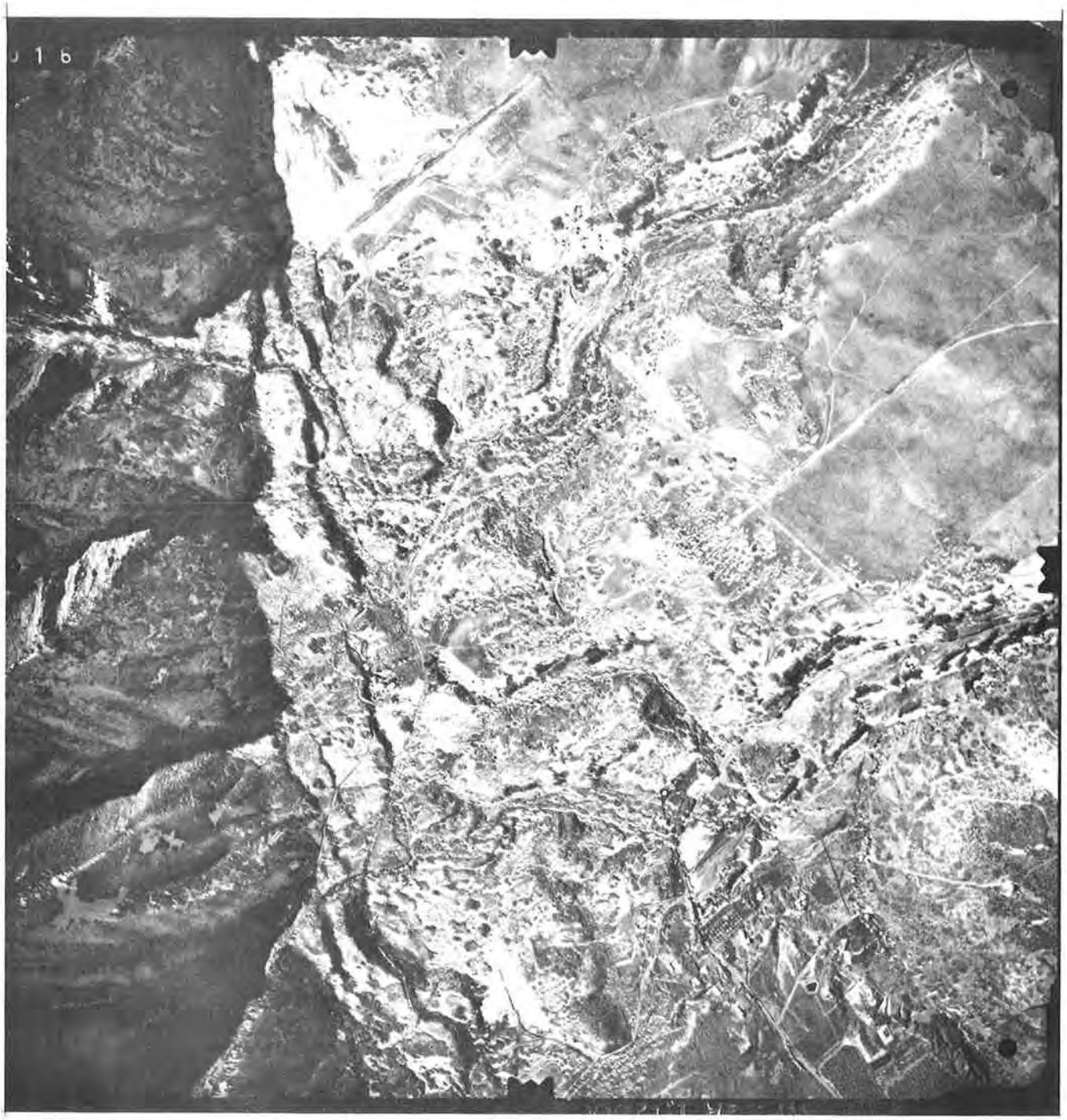


FIGURE 3. Low-Sun-Angle aerial photograph of the same general area as Figure 2. Original photo measured 9" x 9" and was at scale of 1:12,000.

FIGURE 4. Active fault near Trenton, Utah. The view of this low oblique aerial photograph is southwest from directly over Trenton. This fault, two traces of which are indicated by arrows, is outside of the area of photographic coverage for this study. The fault was discovered during the field reconnaissance after the maps of active faults (Maps 1-25) were completed.

FIGURE 5. Active fault southeast of Logan, Utah. A view of this low oblique aerial photograph is southwest of Bear Lake, in the area of Saddle Creek. This fault, indicated by arrows, is one of several active faults in that area, which is outside of the limits of this investigation.

FIGURE 6. The Wasatch fault at Brigham City, Utah. View looks north, with Brigham City in the foreground at the base of the Wellsville Mountains. The fault in this area is marked by springs (indicated by arrow on right) and west-facing esarpments (indicated by arrow on left). The relatively level terraces uphill from the springs are shorelines from Lake Bonneville; these are faulted in the center of the photograph.

FIGURE 7. The Wasatch fault at Brigham City, Utah. The view of this vertical Low-Sun-Angle aerial photograph is the same as the right foreground of Figure 6. The most recent fault scarps, marked by a sinuous line of shadows and springs, are located between the arrows.

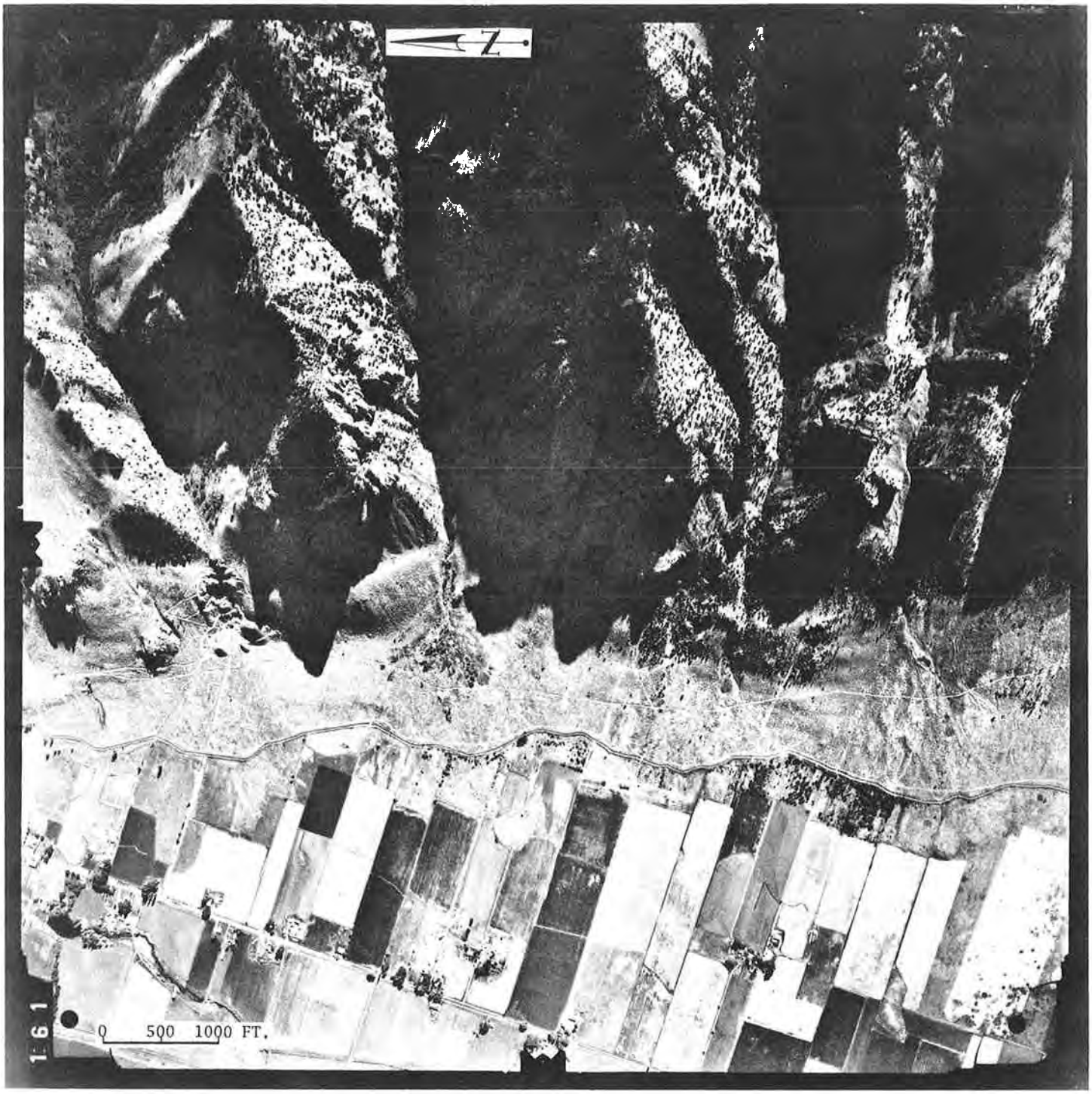


FIGURE 8. The Wasatch fault near Deweyville, Utah. This Low-Sun-Angle Aerial photograph shows the narrow alluvial apron between the cultivated fields and the range front. The cultivated area appears to have been tilted toward the range by faulting, yet the most recent fault scarps are either buried by the alluvial apron or are old and subdued within it.

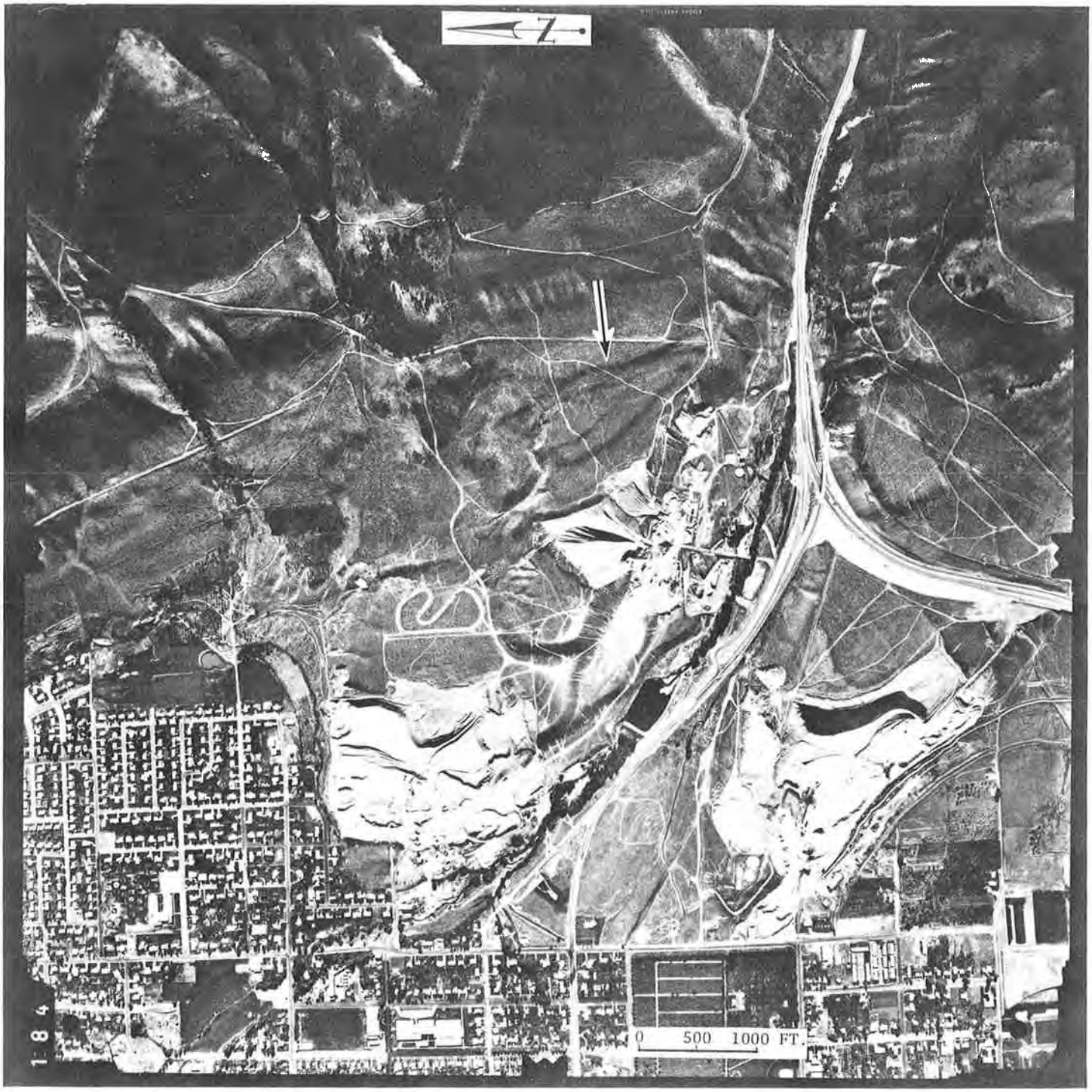


FIGURE 9. The Wasatch fault at Brigham City, Utah. This Low-Sun-Angle aerial photograph shows large-scale landsliding with faulting east of Brigham City. The area of landsliding is indicated by the arrow; landslide scarps cast linear shadows that show as dark lines on the photograph.

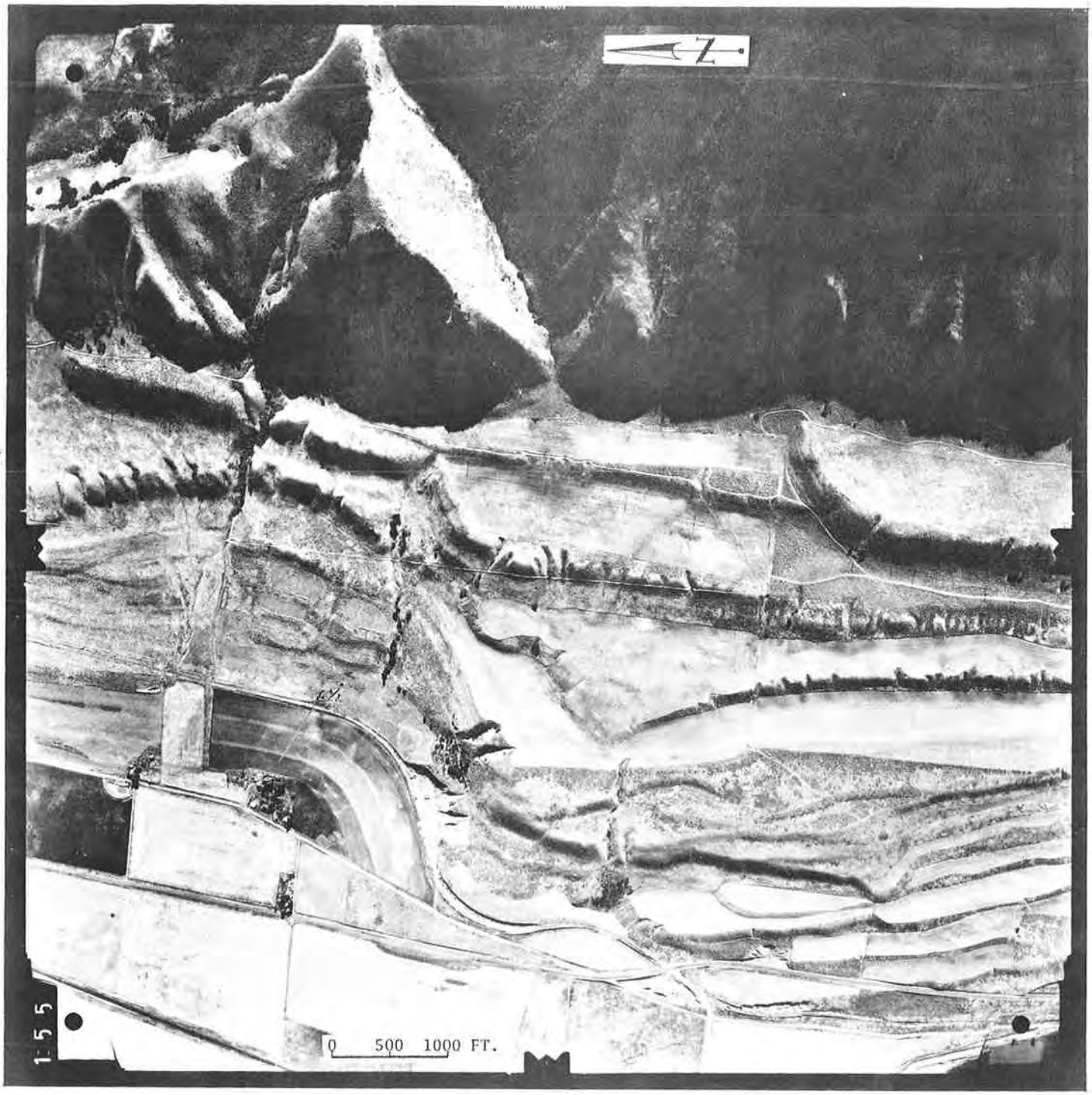


FIGURE 10. Vertical aerial photograph of landslide scarps and Lake Bonneville shorelines near Deweyville, Utah. The linear breaks in slope in this photograph generally mask the most recent surface faulting.

FIGURE 11. Oblique aerial photograph of Culter Dam. The view looks east. The area in the foreground was involved with large-scale landsliding that was apparently covered by Lake Bonneville. Faults are apparently masked by younger landslides in this area.

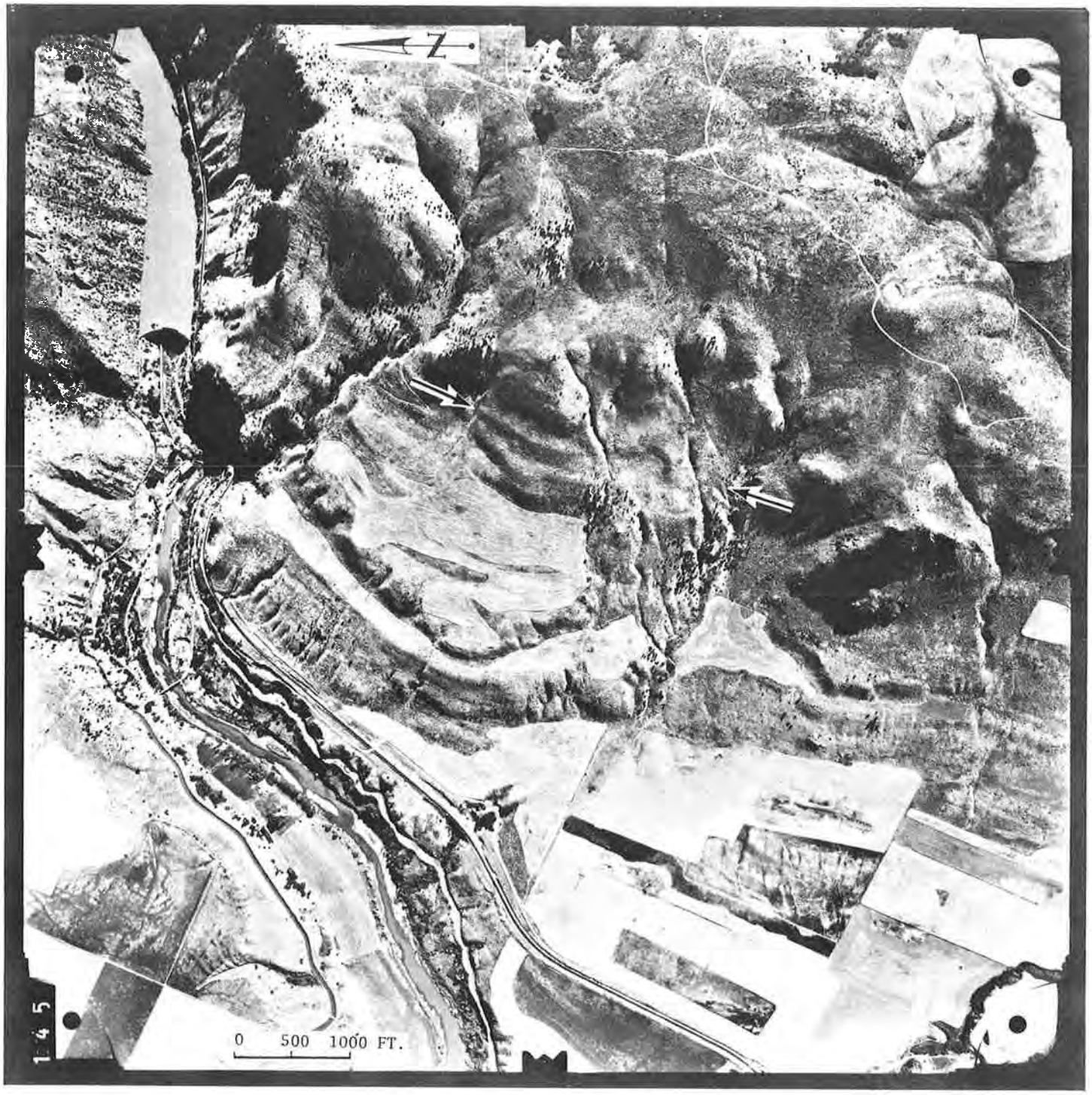


FIGURE 12. Vertical aerial photograph of Culter Dam Area. This is the same general area as Figure 11. The smooth linear breaks in slope are shorelines from Lake Bonneville. Some of the shorelines, between the arrows, are distorted by landsliding. The faults in this area are apparently masked by younger landslides.

FIGURE 13. Vertical aerial photograph of the west slopes of the Junction Hills. Landsliding is evident in this area, and large boulders derived from the landslides cover the gentle slopes in this area. The elongate breaks in slope are shorelines.

FIGURE 14. Vertical aerial photograph of Clarkston Mountain. This view of the southwest range front shows numerous large landslides that may have been triggered by earthquakes. The most recent active trace of the Wasatch fault in this area is along the base of the mountains and does not appear to displace any of the landslides.

FIGURE 15. Oblique aerial photograph of the Wasatch fault at Malad, Idaho. The view looks south-southeast, Malad is in the foreground. The most recent faulting this area is along the base of the Malad Range, but because it is subdued, it is inferred to be relatively older than the most recent surface faulting in the area of Salt Lake City.

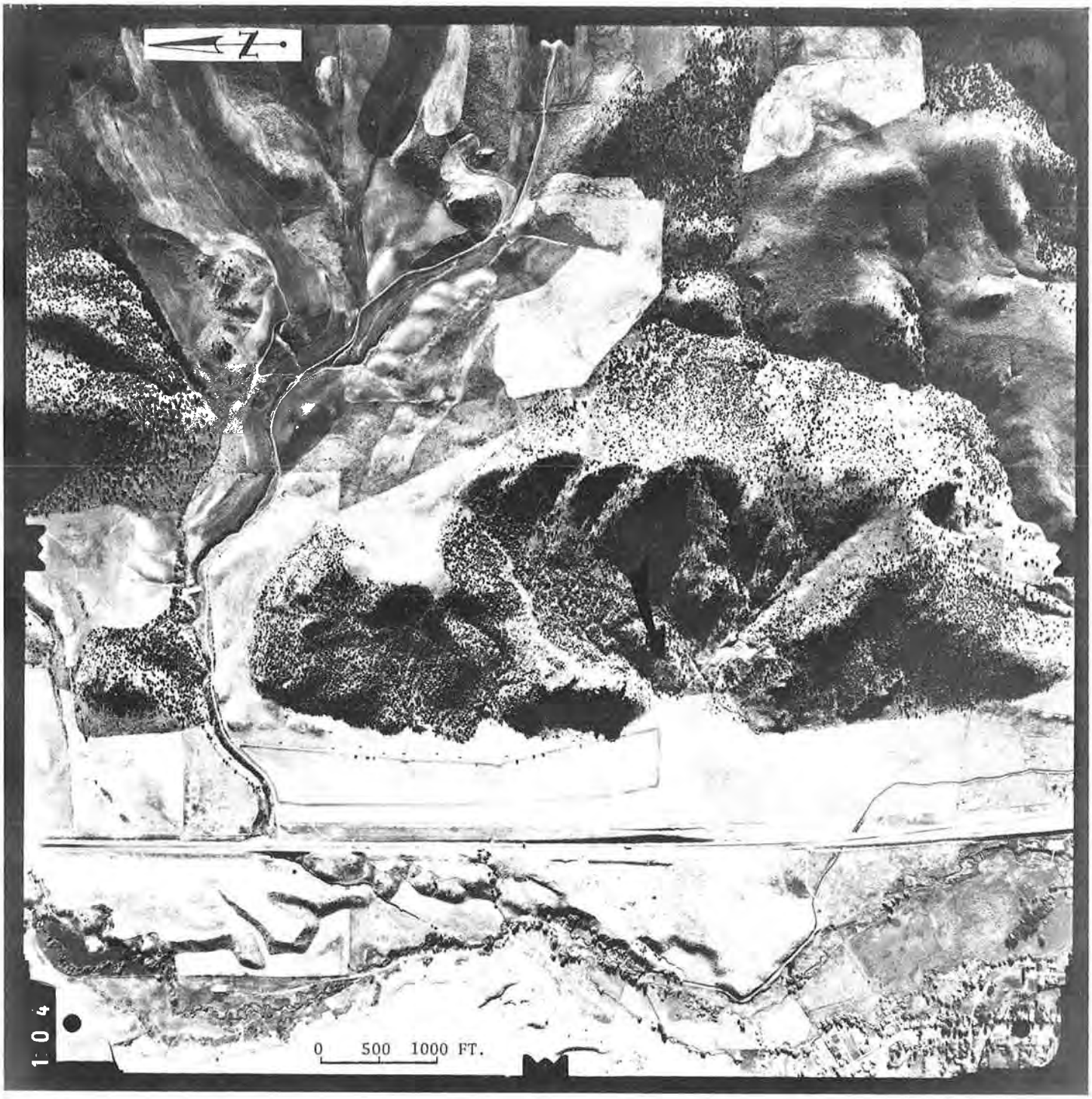


FIGURE 16. Vertical aerial photograph of a landslide near Malad City, Idaho. The landslide debris at the base of the range appears to be modified by erosion in Lake Bonneville. The most recent surface faulting in this area may be older than the landslide.

FIGURE 17. Vertical aerial photograph of the East Cache fault along Davenport Creek. The fault, indicated by arrows, is followed by the Creek, which has eroded the most recent fault scarplets.

FIGURE 18. Vertical aerial photograph of the East Cache fault near Avon, Utah. Landsliding in this area, indicated by curving arrows within the landslide, are located along recently active fault traces. The prominent linear shadows are probably fault-controlled streams and breaks in slope.

FIGURE 19. Vertical aerial photograph of the East Cache fault South of Logan, Utah. The most recently active fault trace forms the prominent west-facing slopes, indicated by arrows, but the fault does not appear to displace the young alluvium in this area.

FIGURE 20. Oblique aerial photograph of the East Cache fault South of Logan, Utah. View is southeast, Providence is in the foreground. The most recently active traces of the fault are subdued, but generally at the base of the Bear River Range.

FIGURE 21. Vertical aerial photograph of the East Cache fault at Logan, Utah. The view is southeast. Active traces of the fault are between, but not limited to, the area between the arrows. The fault scarps show as lines of shadows, especially through the Golf Course. See also Figures 22 and 23 and the cover photograph.

FIGURE 22. Oblique aerial photograph of the East Cache fault at Logan, Utah. Stream erosion in Logan Canyon has removed recent evidence of faulting in the Canyon. Some of the recently active fault traces are indicated by arrows. See also Figures 21 and 23, and the cover photograph.

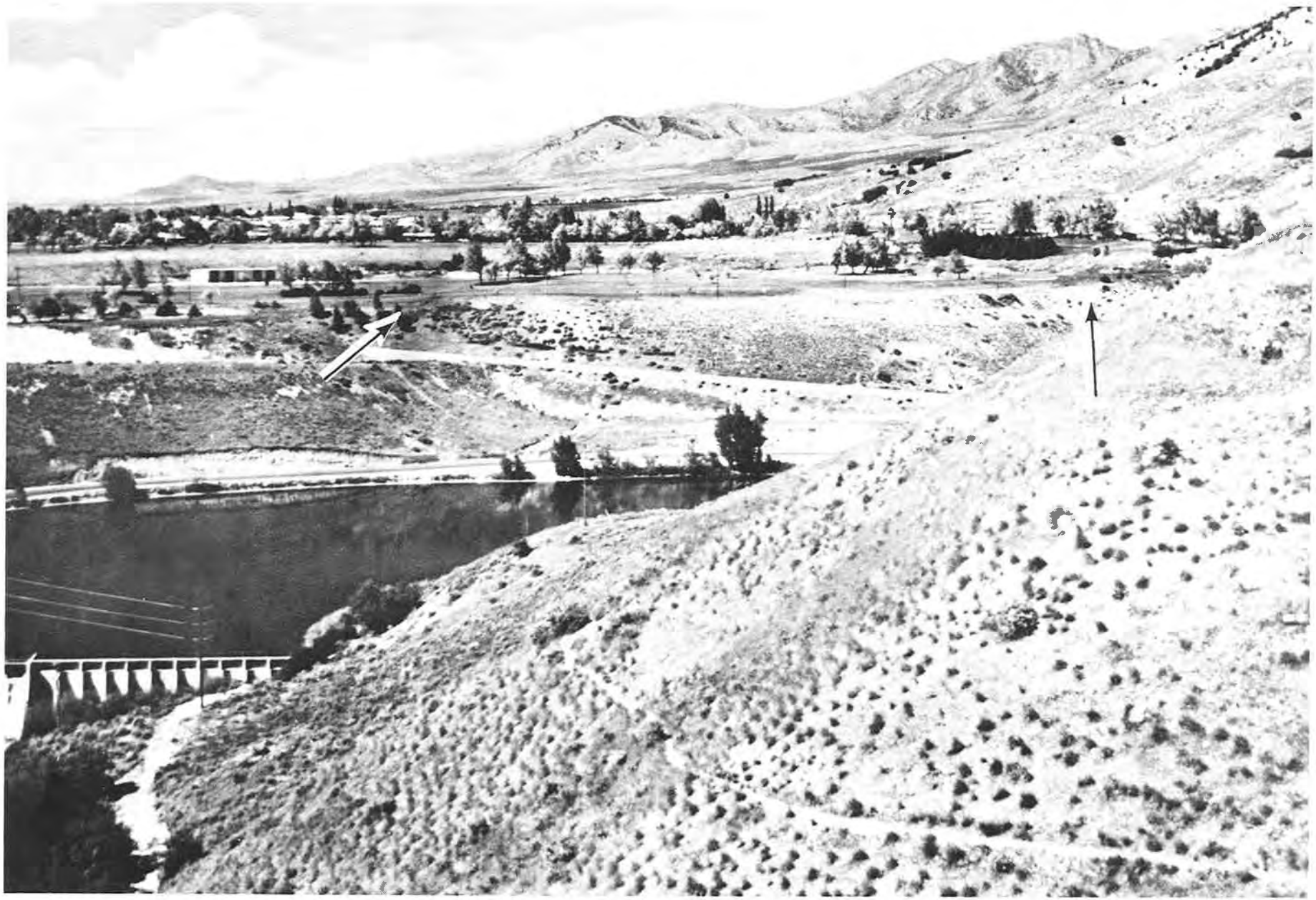


FIGURE 23. Photograph of the East Cache fault at Logan, Utah. The view is North. Two of the fault traces indicated in Figures 21 and 22 are indicated by arrows on this photograph; they are west-facing scarplets in young materials. The slopes on the scarplets are gentle relative to slopes on recently active fault scarps in the area of Salt Lake City. This indicates that the most recent faulting in this area is older than that at Salt Lake City.

FIGURE 24. Vertical aerial photograph of the West Cache fault South of Cutler Reservoir. Several prominent traces of the fault, indicated by arrows, displace sediments and recessional shorelines from Lake Bonneville.

FIGURE 25. Vertical aerial photograph of the West Cache fault at Cutler Reservoir. Active traces of the fault are subdued in this area (one is indicated by the straight arrow), which is dominated by landslides, some of which are indicated by the curving arrows within the landslides.

FIGURE 26. Oblique aerial photograph or the West Cache fault near Clarkston. The most recently active fault traces, indicated by arrows, are at the base of the Malad Range.

APPENDIX A

APPENDIX A
GENERAL DISCUSSION OF EARTHQUAKES AND FAULTING

INTRODUCTION

The following discussion is given primarily for persons not familiar with active faults and earthquake-related problems. We suggest that those persons read this supplement to obtain background for a clearer understanding of this report.

CAUSES OF EARTHQUAKES

Earthquakes may be generated by a number of mechanisms; however, the most destructive earthquakes appear to be associated with a sudden rupturing of the earth's crust. Minor earthquakes are generated by volcanic activity, which is related to subsurface movements of molten rock material straining the nearby crust. Some deep earthquakes may be related to sudden changes in rock properties, such as density changes or phase changes beneath the crust.

The mechanism of sudden rupturing or faulting of the earth's crust involves a sudden release of accumulated strain energy. The energy release is centered on a rupture, called a *fault*, and is accompanied by relative displacement (vertically, horizontally, or both) of the two adjacent blocks on opposite sides of the fault.

This explanation of the mechanics of strong ground shaking, or an earthquake, became widely accepted after the 1906 California earthquake. It is based on the *elastic rebound theory* of Professor H. F. Reid. Before Reid's time, a common explanation was in terms of explosion-like phenomena at depth, often associated with the movement of hot molten rock. In the 1906 earthquake, large-scale and continuous fault rupture was evident in the field. Of great importance, geodetic surveys of the region existed before and after the earthquake. The U. S. Coast and Geodetic Survey had made triangulation measurements across the San Francisco Bay region in 1851-65, 1874-92,

and 1906-07. Reid interpreted these surveys as showing, between the first and third surveys, (a) little change in elevation, (b) significant horizontal, right-lateral displacements of the crust parallel to the San Andreas fault, and (c) relative displacement of about 11 feet of distant points on opposite sides of the fault.

Reid stated:

> *It is impossible for rock to rupture without first being subjected to elastic strains greater than it can endure. We conclude that the crust in many parts of the earth is being slowly displaced and the difference between displacements in neighboring regions sets up elastic strains, which may become larger than the rock can endure. A rupture then takes place and then strained rock rebounds under its own elastic stresses, until the strain is largely or wholly relieved. In the majority of cases, the elastic rebounds on opposite sides of the fault are in opposite directions.*

The seismic waves that are generated when the fault ruptures arise from the sudden movement of the rocks in the vicinity of the fault.

WORLD-WIDE SEISMICITY

Locations of Earthquakes

While small earthquakes occur widely over the surface of the earth, there are certain regions where large-to-moderate earthquakes occur frequently. The greatest number of earthquakes is found in the Circum-Pacific belt around the margins of the Pacific Ocean, and in the Alpide belt, which traverses a comparatively broad area including the East Indies, the Himalayas, Iran, Turkey, and the Balkans, and Italy. Highly localized concentrations of shallow earthquakes also occur along the world-encircling system of mid-oceanic rises, such as the Mid-Atlantic ridge and the East Pacific rise. Wherever there are ocean trenches, such as off the Aleutians, Japan, Chile, Tonga-Kermadecs, and the eastern Carribean, there are earthquakes. The locations of these zones of intense seismicity are shown in Figure A-1. This seismicity map indicates the locations in which tectonic forces are now actively deforming the crust of the earth.

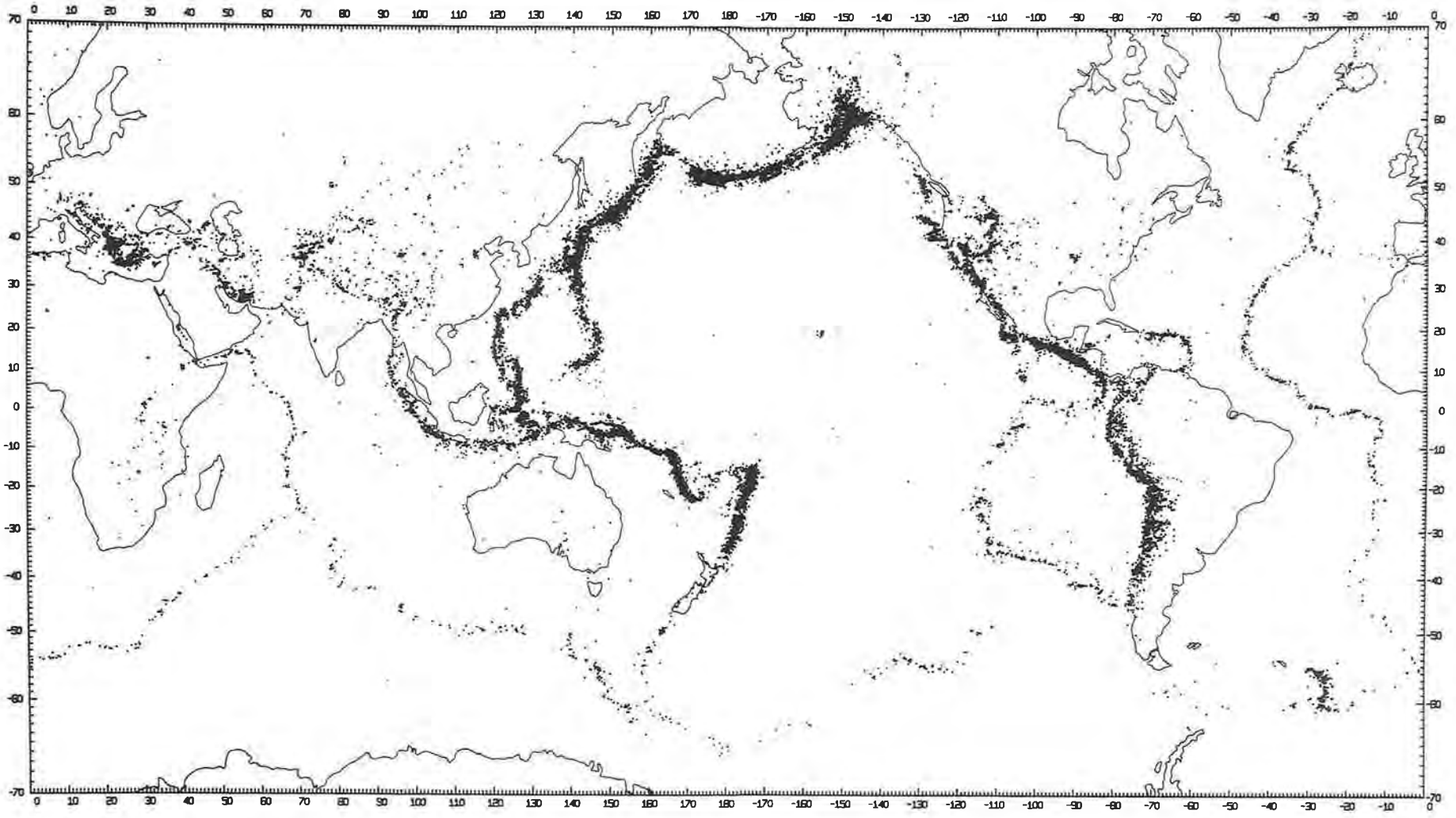


FIGURE A-1. Earthquake zones of the world. World-wide distribution of all earthquake epicenters (1961 through 1967).

The greater part of the ocean basins is devoid of earthquakes, as are the relatively stable pre-Cambrian shields of Africa, India, Siberia, Australia, Canada, and Brazil. Earthquakes within these relatively stable areas do occur; examples are the 1633 St. Lawrence Valley earthquake and the 1968 western Australia earthquake (magnitude 6.9), which damaged the town of Mekering.

Depth of Earthquakes

Not only do the locations of earthquakes differ, but the depth beneath the surface of the source of earthquake waves ranges from near the earth's surface, shallower than 10 miles (16 kilometers), to depths of 450 miles (700 kilometers), or so.

Earthquakes are often classified as *shallow*, *intermediate*, and *deep*. From the standpoint of earthquake hazards, shallow earthquakes can be taken as those originating at a depth of less than about 40 miles (70 kilometers). Deep shocks are those with foci at depths greater than about 200 miles (300 kilometers). Deep-focus shocks are almost entirely restricted to a few regions usually associated with oceanic trenches, such as Indonesia, Tonga, the Japan Sea, and South America. Frequency of occurrence, as a world average, decreases rapidly with depth; over three-quarters of the world's seismic energy released is from shallow-focus earthquakes. Even when geographically near developed areas, deep shocks are rarely destructive. One reason is that the source of the seismic waves is greater than 40 miles from the ground surface, so that the amplitude of the seismic waves are greatly attenuated. Another reason is that deep sources are not efficient generators of the seismic waves that travel only through the uppermost rocks of the earth (surface waves) and cause most of the sustained ground motion; nor do deep earthquakes generate *tsunamis* (seismic sea waves).

It should be noted that even in the class of shallow-focus earthquakes, variations in focal depth are often sufficient to produce rather different

If two adjacent plates slide past one another horizontally, as do the Pacific Plate and the adjacent North American Plate along the San Andreas fault system in California, shallow earthquakes will be generated. However, when two adjacent plates collide with one another, one plate slides beneath the other. If one of the plates is composed of an oceanic crust of basaltic rock, this material may pass downward into the mantle of the earth.

This process of incorporating crustal rocks into the mantle is called *subduction*. As the plate moves downward, it generates earthquakes that are progressively deeper in the direction of movement.

An example of subduction can be seen along the west coast of South America, where subduction of the Nazca Plate is occurring beneath the Andes. Shallow earthquakes are located where the two plates are colliding at the surface, and progressively deeper earthquakes are located to the east.

From the viewpoint of earthquake risk, shallow earthquakes present the greatest danger; however, the earthquakes generated along mid-oceanic rises that are far removed from centers of population present little risk to engineering works. The shallow earthquakes in landward areas, associated with two colliding plates, two plates sliding past one another, or two plates pulling apart from one another, present the greatest hazards to engineering works.

MEASUREMENT OF EARTHQUAKE SIZE

Two measures of earthquake size have been found to be useful--*intensity* and *magnitude*. Unfortunately, these terms are often confused and sometimes even used synonymously. Magnitude attaches a single number to the size of an earthquake that relates to the energy released at the earthquake focus. This is independent of the distance from the earthquake center and independent of the geological and soil conditions. For a measure of the *variation of ground motion* from point-to-point,

an intensity scale is used. The intensity value is assigned by an experienced observer using a descriptive scale. Both measures are too simple to describe the full complexity of an earthquake, and each should be used judiciously. Numerical relations between the two measures have been considered; but as the seismological literature shows, these must be taken only to establish an approximation.

Intensity Scales

Intensity is a rating of the severity of the ground motion at a specific location. The scale of measurement is based upon the sensations of persons, the behavior of natural objects, and upon physical damage to natural and man-made objects. Intensity scales came into being long before magnitude scales because intensity does not require instrumental observation. Over the years, different intensity scales have been devised.

The scale used must reflect the type of structure that is common to a particular region. The most widely accepted intensity scale in the United States is the Modified Mercalli (MM) Intensity Scale. This scale is given on the following page. It goes from I to XII on a twelve-point scale, usually denoted by Roman numerals.

In parts of Europe, the most popular intensity scale is the Medvedev, Sponhuer, Karnik (MSK) Intensity Scale. This intensity scale corresponds as precisely as is possible to the Modified Mercalli Intensity Scale, but the scale is better suited to European construction.

Intensity ratings may be subjective, since reported intensities may take on several meanings depending on who reports them and the type and quality of construction in an area. The reported intensity may be the maximum intensity at the population center nearest the epicenter, or it may be the intensity that should have been expected at the epicenter that is based upon observations at a center of population some distance

MODIFIED – MERCALLI INTENSITY SCALE OF 1931

I **Not felt by people, except under especially favorable circumstances. However, dizziness or nausea may be experienced.**
Sometimes birds and animals are uneasy or disturbed. Trees, structures, liquids, bodies of water may sway gently, and doors may swing very slowly.

II **Felt indoors by a few people, especially on upper floors of multi-story buildings, and by sensitive or nervous persons.**
As in Grade I, birds and animals are disturbed, and trees, structures, liquids and bodies of water may sway. Hanging objects swing, especially if they are delicately suspended.

III **Felt indoors by several people, usually as a rapid vibration that may not be recognized as an earthquake at first. Vibration is similar to that of a light, or lightly loaded trucks, or heavy trucks some distance away. Duration may be estimated in some cases.**
Movements may be appreciable on upper levels of tall structures. Standing motor cars may rock slightly.

IV **Felt indoors by many, outdoors by few. Awakens a few individuals, particularly light sleepers, but frightens no one except those apprehensive from previous experience. Vibration like that due to passing of heavy, or heavily loaded trucks. Sensation like a heavy body striking building, or the falling of heavy objects inside.**
Dishes, windows and doors rattle; glassware and crockery clink and clash. Walls and house frames creak, especially if intensity is in the upper range of this grade. Hanging objects often swing. Liquids in open vessels are disturbed slightly. Stationary automobiles rock noticeable.

V **Felt indoors by practically everyone, outdoors by most people. Direction can often be estimated by those outdoors. Awakens many, or most sleepers. Frightens a few people, with slight excitement; some persons run outdoors.**
Buildings tremble throughout, Dishes and glassware break to some extent. Windows crack in some cases, but not generally. Vases and small or unstable objects overturn in many instances, and a few fall. Hanging objects and doors swing generally or considerable. Pictures knock against walls, or swing out of place. Doors and shutters open or close abruptly. Pendulum clocks stop, or run fast or slow. Small objects move, and furnishings may shift to a slight extent. Small amounts of liquids spill from well-filled open containers. Trees and bushes shake slightly.

VI **Felt by everyone, indoors and outdoors. Awakens all sleepers. Frightens many people; general excitement, and some persons run outdoors.**
Persons move unsteadily. Trees and bushes shake slightly to moderately. Liquids are set in strong motion. Small bells in churches and schools ring. Poorly built buildings may be damaged. Plaster falls in small amounts. Other plaster cracks somewhat. Many dishes and glasses, and a few windows, break. Knick-knacks, books and pictures fall. Furniture overturns in many instances. Heavy furnishings move.

VII **Frightens everyone. General alarm, and everyone runs outdoors.**
People find it difficult to stand. Persons driving cars notice shaking. Trees and bushes shake moderately to strongly. Waves form on ponds, lakes and streams. Water is muddied. Gravel or sand stream banks cave in. Large church bells ring. Suspended objects quiver. Damage is negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in poorly built or badly designed buildings adobe houses, old walls (especially where laid up without mortar), spires, etc. Plaster and some stucco fall. Many windows and some furniture break. Loosened brickwork and tiles shake down. Weak chimneys break at the roofline. Cornices fall from towers and high buildings. Bricks and stones are dislodged. Heavy furniture overturns. Concrete irrigation ditches are considerably damaged.

VIII **General fright, and alarm approaches panic.**
Persons driving cars are disturbed. Trees shake strongly, and branches and trunks break off (especially palm trees). Sand and mud erupts in small amounts. Flow of springs and wells is temporarily and sometimes permanently changed. Dry wells renew flow. Temperatures of spring and well waters varies. Damage slight in brick structures built especially to withstand earthquakes; considerable in ordinary substantial buildings, with some partial collapse; heavy in some wooden houses, with some tumbling down. Panel walls break away in frame structures. Decayed pilings break off. Walls fall. Solid stone walls crack and break seriously. Wet grounds and steep slopes crack to some extent. Chimneys, columns, monuments and factory stacks and towers twist and fall. Very heavy furniture moves conspicuously or overturns.

IX **Panic is general.**
Ground cracks conspicuously. Damage is considerable in masonry structures built especially to withstand earthquakes; great in other masonry buildings - - some collapse in large part. Some wood frame houses built especially to withstand earthquakes are thrown out of plumb, others are shifted wholly off foundations. Reservoirs are seriously damaged and underground pipes sometimes break.

X **Panic is general.**
Ground, especially when loose and wet, cracks up to widths of several inches; fissures up to a yard in width run parallel to canal and stream banks. Landsliding is considerable from river banks and steep coasts. Sand and mud shifts horizontally on beaches and flat land. Water level changes in wells. Water is thrown on banks of canals, lakes, rivers, etc. Dams, dikes, embankments are seriously damaged. Well-built wooden structures and bridges are severely damaged, and some collapse. Dangerous cracks develop in excellent brick walls. Most masonry and frame structures, and their foundations, are destroyed. Railroad rails bend slightly. Pipe lines buried in earth tear apart or are crushed endwise. Open cracks and broad wavy folds open in cement pavements and asphalt road surfaces.

XI **Panic is general.**
Disturbances in ground are many and widespread, varying with the ground material. Broad fissures, earth slumps, and land slips develop in soft, wet ground. Water charged with sand and mud is ejected in large amounts. Sea waves of significant magnitude may develop. Damage is severe to wood frame structures, especially near shock centers, great to dams, dikes and embankments, even at long distances. Few if any masonry structures remain standing. Supporting piers or pillars of large, well-built bridges are wrecked. Wooden bridges that "give" are less affected. Railroad rails bend greatly and some thrust endwise. Pipe lines buried in earth are put completely out of service.

XII **Panic is general.**
Damage is total, and practically all works of construction are damaged greatly or destroyed. Disturbances in the ground are great and varied, and numerous shearing cracks develop. Landslides, rock falls, and slumps in river banks are numerous and extensive. Large rock masses are wrenched loose and torn off. Fault slips develop in firm rock, and horizontal and vertical offset displacements are notable. Water channels, both surface and underground, are disturbed and modified greatly. Lakes are dammed, new waterfalls are produced, rivers are deflected, etc. Surface waves are seen on ground surfaces. Lines of sight and level are distorted. Objects are thrown upward into the air.

away. Many circumstances arise that make it difficult to assign intensities, and the lack of precision in the intensity index should be recognized. Basically, intensity refers to the measure of earthquake effects of all types at a specified place. It is not based on the true measurement but is a rating assigned by an experienced observer using a descriptive scale with grades indicated by Roman numerals.

Because intensity is defined by the observed effects on the earth's surface, such as landslides or broken underground pipes, the intensity of an earthquake on a mid-oceanic ridge might be taken as zero. On the other hand, a smaller shock centered near weak, man-made structures on poor ground might yield a high intensity. For a given earthquake, intensity differs between localities depending upon the distance from the source, the duration of shaking, the geologic foundation, and the quality of design and construction.

The subjective nature of intensity ratings makes it important that the observer report in detail the evidence upon which the rating was estimated. Engineers and others can then draw their own conclusions at a later time. In the United States, ratings have been routinely gathered by the U. S. Coast and Geodetic Survey and the data reported in "United States Earthquakes", an annual publication started in 1928.

In order to remove some of the subjectivity in assigning intensity, a dense network of strong-motion seismoscopes and seismographs would give quantitatively the distribution of ground motion. Only in the Los Angeles, California, area is this now partly feasible. There are more than 270 strong-motion seismographs and 75 seismoscopes located in the Los Angeles, California, area. In the entire San Francisco Bay area of California, there are only about 50 strong-motion seismographs and 48 seismoscopes.

Magnitude Scales

Magnitude is based upon ground motion as recorded by distant seismographs. The most commonly used method of calculating magnitude

in the United States for large earthquakes is that of Charles F. Richter. Other magnitude scales are widely used by seismologists, both in the United States and in other countries. This sometimes leads to what appears to be conflicting magnitudes. In order to see how the Richter magnitude scale is assigned, suppose that there is a Wood-Anderson seismograph at a distance of 60 miles (100 kilometers) from the epicenter. The instrument will produce a seismogram. A centimeter scale is used to measure the half-width amplitude of the largest waves; this is converted to microns (10^4 microns = 1 centimeter). The logarithm to base 10 of the number is the *Richter magnitude of the earthquakes*. For example, if the maximum amplitude measured is one centimeter, the Richter magntiude is 4.0. Numerical tables provide the necessary adjustment when the seismograph is not at 100 kilometers epicentral distance or when other types of seismographs are used.

From the definition, the magnitude scale, unlike the intensity scale, has no greatest and smallest limit. Currently, more sensitive seismographs are available than when Richter defined magnitude in 1935; such instruments can record tiny earthquakes with negative magnitudes, often smaller than magnitude -2.0 with proper conditions. Large magnitudes have been recorded from the greatest earthquakes of the century. The 1964 Alaskan earthquake had a magnitude of about 8.6. Some of the early seismographs in Europe recorded the 1906 California earthquake and were used to estimate its magnitude at approximately 8-1/4.

There is reason to believe that the largest earthquake that is mechanically possible under present geological conditions would have a magnitude less than about 9.0. The largest earthquakes recorded since the scale was derived are the Sauriku earthquake in Japan on March 2, 1933, with an estimated magnitude of about 8.9, and the earthquake centered off the west coast of South America near Colombia in 1906, with perhaps a magnitude of 8.9.

Because the earthquake energy comes from elastic strain energy stored in the rocks, the total seismic energy released will be proportional in some way to the area of fault that ruptures. For great shallow-focus earthquakes, the depth of dislocation, usually less than 30 miles, is small when compared with the observed rupture length, which is of the order of hundreds of miles. Since the finite strength of crustan rocks limits the strain energy that can be stored, the total energy release would appear to be bounded by the length of fault available to rupture. The geography of seismically active regions shows that there is a limit on this maximum length of fault rupture. Among the longest fault ruptures ever observed or estimated were 270 miles in California (1906) and perhaps over 500 miles for the 1960 Chilean and 1964 Alaskan earthquakes.

While magnitude is a simple measure for classifying earthquakes roughly according to size or total energy released, there is evidence that magnitude alone is often given too much weight in urban planning and engineering design. This misuse comes from a failure to take into account the way that the partition of wave energy into various frequencies changes with the earthquake size and the great variation in rock and soil properties from place to place.

As an example, in Anchorage after the 1964 Alaskan earthquake, it has been pointed out that vibrational damage alone mainly affected only the tall, high-rise buildings that respond to the longer frequency waves. An even more striking example is the Caracas, Venezuela, earthquake of 1967, where more than 200 lives were lost because of the collapse of five high-rise apartment buildings that were designed to be earthquake resistant. The Caracas earthquake was only a moderate-magnitude shock of Richter magnitude 6.5 and was located approximately 30 miles (50 kilometers) from Caracas.

Consider, for example, structures that respond mainly to vibrations with periods of about one-half to three-quarters of a second; they will

be most affected by that part of the earthquake that has similar periods. Due to relative attenuation in the rocks, the proportion of energy in waves with such periods falls with increased length of path, so that waves coming from distant parts of the rupture will be mainly rich in longer periods.

In simple terms, damage to small structures in a city from a large-magnitude earthquake nearby (long fault rupture) might be expected in general to be mainly a result of waves generated by the nearest segment of the rupturing fault. Much the same wave energy might in the high frequency waves arise locally if only this local section of the fault ruptured (i.e., a smaller-magnitude earthquake occurred).

A number of empirical formulae linking magnitude and energy release have been worked out. For practical purposes, and particularly for the shallow earthquakes in California, the formula $\log_{10} E = 11.4 + 1.5\ M$ is recommended, where E is the energy in ergs and M is the Richter magnitude.

Because of the factor 1.5, the increase of a unit in magnitude indicates an increase in energy of 32 times, so that there is an enormous range of energy between the smallest and largest size earthquake. An attempt to indicate the great spread is shown in Figure A-2, where the energy in an earthquake is plotted as a multiple of that in the 1933 Long Beach, California, earthquake.

EARTHQUAKE-ASSOCIATED DAMAGE

It is a commonly held misconception that distance from the surface trace of an active fault is the best assurance against earthquake damage. Experience has shown that the intensity of an earthquake is not necessarily greatest at the surface trace of the earthquake-generating fault. If the structure is not astride an active fault, it matters little whether it is alongside the fault trace or several miles away because energy reaching the surface will be almost the same at the two points, everything else being equal.

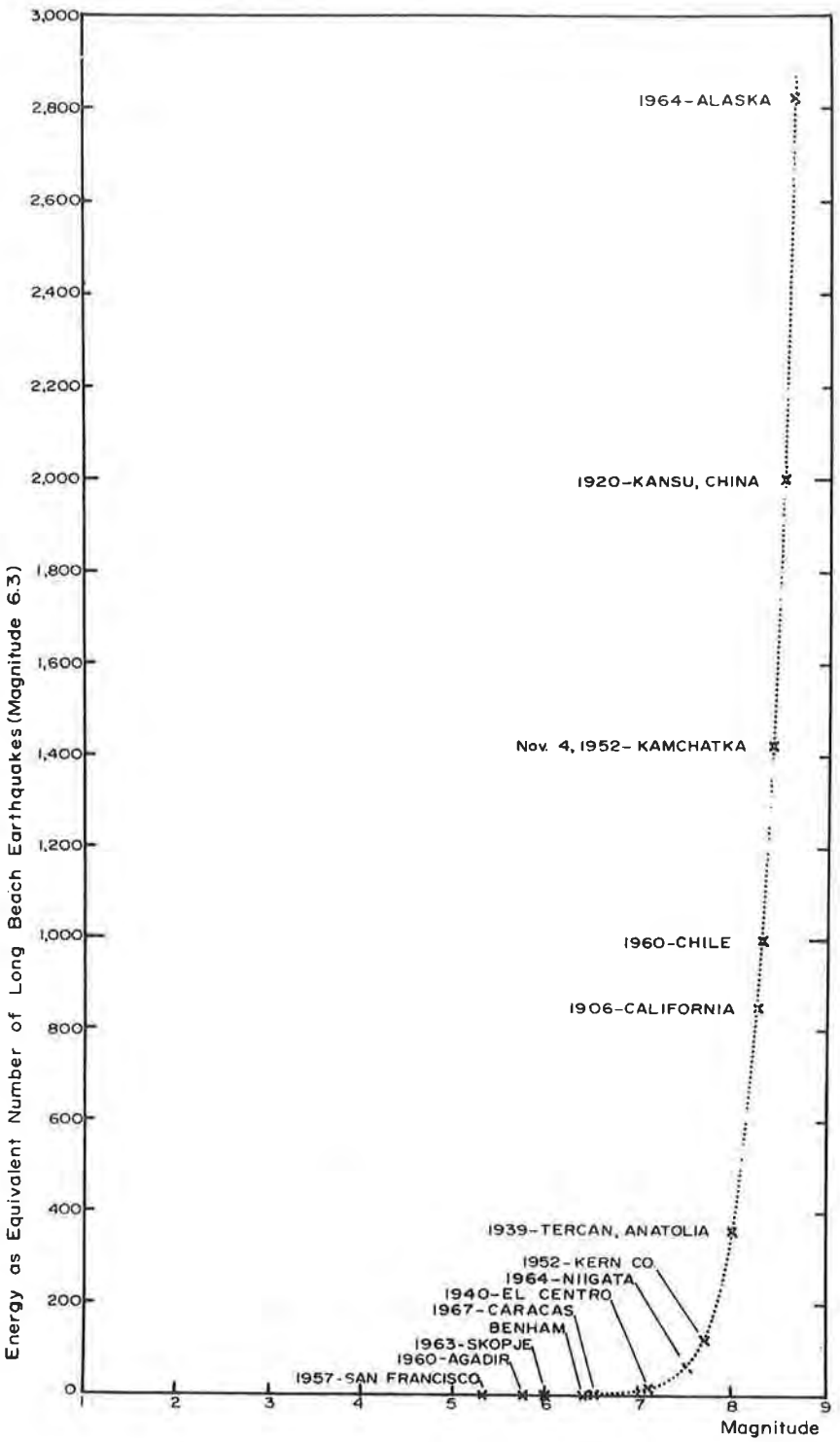


FIGURE A-2. Magnitude of an earthquake plotted against earthquake energy. In order to compress the energy scale, the energy values are equivalent numbers of 1933 Long Beach earthquakes.

Earthquake damage depends on many variables: earthquake magnitude, epicentral location, depth of focus, duration of shaking, intensity of shaking, near-surface soils and geologic conditions, structural type, quality of construction, and design. Damage related to foundation conditions depends upon material density, shear strength, thickness, and water level. Thus, proximity to an active fault should not be given undue weight when deciding where to build; more consideration should be given to ground conditions and structural design.

Earthquake-associated damage is usually manifest in four separate forms: (1) strong ground motion (shaking); (2) ground failure; (3) tsunamis (seismic sea waves); and (4) fault displacement.

Strong Ground Motion (Shaking)

Damage from strong ground motion (shaking) is caused by the transmission of earthquake vibrations from the ground into the structure. Figure A-3 shows damage to the Mijagual apartment building in Caracas, Venezuela, from the 1967 earthquake. The main variable factors that determine the extent of vibrational damage are: type of ground, earthquake-resistant design, quality of materials and construction, and intensity and duration of shaking.

Different kinds of ground respond differently to seismic loading. The relationships between soil and basement rock conditions and earthquake shaking are not clearly known. Estimates can be calculated if soil and basement rock properties are known but should be used with caution for risk estimation until more testing under actual earthquake conditions is done. The ground motion associated with a great earthquake (similar to the 1906 California shock) has never been recorded instrumentally.

Many urban areas are presently located along and near active faults. For example, in California urban areas are found along the San Andreas fault throughout its length from northern to southern California, along

Figure A-3. Mijagual high-rise apartment building in Caracas, Venezuela, showing total pancake collapse.

California's Calaveras fault near Pleasanton, along the Hayward fault in the San Francisco East Bay cities, along the San Jacinto and Inglewood faults in southern California, and in Utah along the Wasatch fault in and near Salt Lake City. Continuing urban growth is bringing about a constant increase in the use of land near active faults that will most likely be associated with substantial earthquakes. Outside the city areas, industrial development and utilities are frequently considered for sites close to active faults.

In these circumstances, the following question is becoming increasingly frequent: *In what ways, if any, does strong ground motion near the fault differ from the ground motion some distance away?* No strong motion

records were obtained from the large 1960 Chilean earthquake, nor in Alaska from the 1964 shock. A widely used strong-motion record in engineering design is the record from the El Centro, California, earthquake of 1940. It, however, was obtained about 6 miles from the Imperial Valley fault, along which displacements were observed in the magnitude 6.9 earthquake. In 1966, an array of strong-motion instruments was operational across the San Andreas fault near Cholame, California. These instruments recorded the earth movements at the time of the June 27, 1966, Parkfield, California, earthquakes. A record of ground acceleration was obtained within the fault zone about 200 feet from a fault trace that slipped.

The records show that the vertical and horizontal motions of the ground differed considerably in their frequency content and structure. There was a large ground motion, which amounted to a displacement of 10 inches perpendicular to the fault trace. The maximum horizontal ground acceleration was one-half the acceleration of gravity (0.5g); i.e., about 16 feet/second^2. The duration of the strong ground motion was extremely short, lasting only about one second.

Although the present status of strong-motion records provides valuable information, it is unclear whether the effects mentioned above could be extrapolated upward for a large earthquake. The Parkfield main shock was assigned a magnitude of 5.6, and the length of fault rupture observed was nearly 20 miles. Very little damage was reported along the fault zone, even though the short duration peak acceleration was surprisingly high. It is not clear whether a larger earthquake might produce significantly greater accelerations near the fault; however, a longer duration of ground shaking is quite likely.

The San Fernando, California, earthquake of February 9, 1971 (magnitude 6.4), was recorded by 272 strong-motion instruments in southern California. One of these instruments was located near one abutment of Pacoima Dam, approximately midway between the epicenter and the

surface fault rupture. The strong ground motion there lasted about 10 seconds and contained one pulse of horizontal acceleration that exceeded that of gravity. This is the strongest earthquake ground motion ever recorded; however, part of this strong ground motion was generated by the unique geometry of the ridge crest beneath the instrument. Because we lack direct observations, forecasts of ground motion must be largely based on extrapolation from experiments in the laboratory, from visual observations of past earthquakes, and upon suggestions from theoretical models. Certain likely properties of the ground motion near a fault can be stated for risk estimation subject to the necessary caution implied by the above statement of our lack of current observational information.

Damage from Ground Failure

Damage from ground failure may occur in several different forms; landsliding, liquefaction, and settlement. Figure A-4 and A-5 illustrate damage from landsliding and liquefaction.

If the proper geological conditions exist on the ocean floor, subaqueous landslides or turbidity currents may be generated of sufficient force to affect off-shore and on-shore structures. In 1929, an earthquake in the North Atlantic triggered a high-velocity, high-density turbidity current that is believed to have led to the shearing of eleven Trans-Atlantic communication cables. The sea floor over which this flow occurred had no more than a two to five percent slope. Numerous subaqueous landslides occurred during the 1964 Alaska earthquake causing extensive damage to nearby areas, especially from large water waves that were generated by the landsliding.

Saturated granular layers located at shallow depth below the surface may be susceptible to liquefaction during an earthquake. This phenomenon has frequently been observed in the past, notably in Niigata, Japan, in 1964, as shown in Figure A-5, Chile in 1960, and San Fernando, California in 1971. In general, the greater the depth and the

FIGURE A-4 Earthquake damage resulting from ground failure. Turnagain Heights landslide, Anchorage, Alaska, March 27, 1964.

relative density of a submerged sand layer, the less is the danger of liquefaction. Shallow, loose saturated sands appear to be most liquefiable; deep, dense sands are less liquefiable.

FIGURE A-5 Earthquake damage resulting from ground failure: Liquefaction. Niigata, Japan, 1964.

Tsunamis (Seismic Sea Waves)

Water waves may be generated in the ocean by large submarine earthquakes. The generating mechanism is probably rapid vertical displacement of part of the ocean floor through faulting or, sometimes, submarine landslides. Such waves are called *tsunamis* or *seismic sea waves*.

In the open ocean, tsunamis are characterized by long wave length (on the order of hundreds of miles), long periods of oscillation (about an hour), high velocities (more than 600 miles per hour), and low wave

heights (no more than a few feet or meters). Shoaling begins as the ocean becomes shallower than one-half the wave length of the acting wave. Tsunamis, therefore, begin to react as they approach the shore by decreasing velocity and increasing wave height. Their approach is typically indicated by water withdrawal followed by a series of wave surges. Some surges have attained heights of 100 feet (30 meters). Recorded surge heights of 50 feet (15 meters) are not uncommon along the Hawaiian shores. An earthquake in the Aleutian trench on April 1, 1946, generated a tsunami which impinged on the California coast and forced water to 11 feet (3 meters) at Half Moon Bay and 12 feet (3-plus meters) at Santa Cruz. The 1964 Alaskan earthquake generated a tsunami which resulted in damage in a number of places in the Pacific. The tsunami was disatrous at Crescent City, California, where it reached a height of 20.7 feet (about 6 meters) above mean sea level, killing eleven, injuring 35 and causing about $8,500,000 in property damage.

Mendocino County, California, reported damage to fishing boats in Noyo Harbor, with ten sunk. In Marin County, California, $1,000,000 damage occurred to small boats and berthing facilities. There was damage to docking facilities in Los Angeles County and Long Beach Harbor, California had a longer time to prepare for the onslaught of the sea wave than other pacific states; however, there was lack of sensible response among the public. Newpapers estimate 10,000 curious people waited on the San Francisco beaches to watch the tsunami arrive.

Faulting

Faulting, as the movement or fracturing along faults is called, may have horizontal and vertical components of displacement and may vary from a fraction of an inch (a few millimeters) to many feet (several meters). In the California earthquake of April 18, 1906, horizontal offsets along the San Andreas fault averaged from 8 to 15 feet (about

2-1/2 to 5 meters) and occurred from just north of San Juna Batista to north of Point Arena, California, a distance of more than 200 miles.

Fracturing and shearing associated with faulting is often observed in the field to be of a multiple and en echelon character, with several planes of displacement being formed through geologic time (millions of years); thus, the term *fault zone* is a more realistic designation. The exact location and characteristics of a fault zone are of vital concern in estimating the hazard from faulting. Once a fault is formed, it constitutes a plane of weakness that localizes further adjustments. Active faults usually are associated with one or more of the following: an historic record of faulting, the occurrence of earthquakes along their courses, evidence of geologically recent offset (within the most recent few thousand years) and slow fault slippage. A fault should be considered active if it has displaced recent alluvium or other recently deposited materials whose surface has not been modified to an appreciable extent by erosion.

Some fault zones, such as the San Andreas, are more than a mile wide (nearly 2 kilometers) in places, and contain many *fault traces* within the broad zone. One might ask, "What is the relative risk of developing or locating structures within such wide active fault zones?" Assigned risk need not always be extreme. It depends upon factors such as type of development, intended land use, type of structure, and site location with respect to the *active* fault traces. The broad fault zones have been formed over long periods of geologic time, and in some future geologic time (millions of years) not only may the present fault traces be reactivated, but new traces may be formed. However, if we consider this problem from the standpoint of engineering design time, which is generally of the order of 100 years, the probability of fault offset is much greater along the most recent fault traces that lie within broad fault zones. In such risk assessments, weak soil conditions,

which may arise from crushed rock or gouge in a fault zone, may turn out to be more crucial factors than concern over the exact positions of future fault offsets.

It is often believed that assurance against earthquake damage is directly proportional to the distance from the surface trace of a known active fault or fault zone. There is much evidence that the intensity of an earthquake is not necessarily greatest at the surface trace of the earthquake-generating fault. Provided the structure is not astride an active fault trace, so that displacement may not shear it in two, the location of the fault may not be decisive as a damage factor. Whether the site is alongside the fault trace or several miles away, wave energy

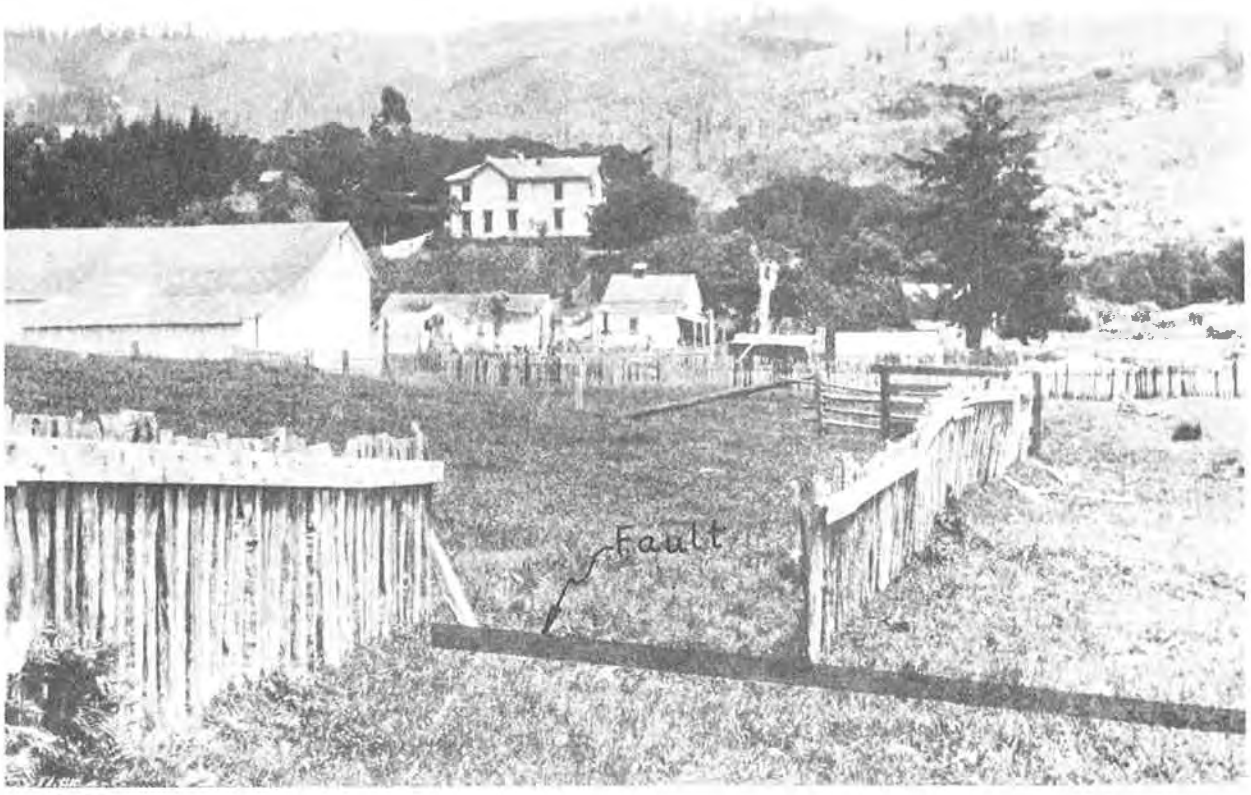


FIGURE A-6 Fence separated by displacement along the San Andreas Fault, April 18, 1906.

reaching the two localities may be comparable. Damage resulting from faulting occurs only where works of man are located astride the fault trace that moves. Figure A-6 shows damage to a fence that was across the 1906 San Andreas fault trace. Note the undamaged buildings of wood-frame, low-story construction located near the fault; the building also are located on stable ground. By contrast, buildings located 10 to 20 miles from the fault, such as in Santa Rosa and San Jose, on relatively less stable ground, were almost completely destroyed in the 1906 California shock.

Avoidance of damage from fault dislocation can be achieved by recognizing the most active fault traces and either locating structures elsewhere, or allowing for fault slippage in the design. This is a significant hazard only in a few localities.

FAULT MAPS

MAP LEGEND

SYMBOL	MAP SYMBOLS	
	Lineament Category	Interpretation
▬▬▬ ▬ ▬ ▬ ••••	CLASS I	- Prominent or obvious active fault, or very fresh fault-related feature; Ball is on downslope side of escarpment
▬▬▬▬ ▬ ▬ ▬ ·····	CLASS II	- Probaly active fault or rupture, or fault apparently with a lack of recent activity; Ball is on downslope side of escarpment
▬▬▬▬ ▬ ▬ ▬ · · · ·	CLASS III	- Possible active fault or rupture; Ball is on downslope side of escarpment
	Landslide - Arrow shows Direction of Movement	
	Limit of this study	

NOTE: DASHED LINES are approximate.
DOTTED LINES are concealed or inferred.

Upon completion of all aerial photo-interpretation and field checking, this series of maps and report was prepared.

All lineaments have been mapped from special low sun-angle aerial photography taken especially for this project. The basic scale of the photographs is 1:12,000, or 1 inch represents 1,000 feet. Fault-related features have been transferred from photographs to topographic base maps by using a vertical sketchmaster; locations were checked by inspection and scale dividers.

CLASS I LINEAMENTS

We are confident that the lineaments plotted as Class I are the locations of the most recently active surface fault ruptures or fault-related ruptures. The Class I lineaments commonly are associated with significant relief. It is our belief that all of the Class I lineaments are well defined topographic features that mark the most recently active fault ruptures. They are believed to have been produced mostly by, or related to, rapid fault displacements at the ground surface that have been accompanied by moderate to large earthquakes. Most Class I lineaments are undoubtedly the result of repeated fault displacements that are concentrated along previously established planes of weakness. Therefore, the Class I lineaments are the most likely locations for significant future fault displacement. Some surface displacement along portions of the Wasatch fault may be due to slow tectonic creep, as has been documented along other faults.

CLASS II LINEAMENTS

Class II lineaments are probable active faults that are generally associated with Class I faults as branch faults or faults with displacements that are secondary to the Class I faults; also, Class II lineaments are faults in bedrock or at a mountain front that do not display geomorphic evidence of recent surface faulting. Thus, Class II lineaments may or may not be associated with significant relief. It is believed that many Class II lineaments, especially those along range fronts without Class I lineaments, may represent the most recently active fault traces in areas of faulting as old as or older than a few thousand years. Even so, many of these could be classified as active faults from detailed site investigations.

It is important to note that faults without surface expression on the aerial photographs have not been identified in this study. In urbanized areas, many fault-related features have been modified and obscured by urban development, and only the most obvious fault scarps are plotted; more detailed studies are needed to locate the less prominent faults. Thus, these maps show the locations of the most recently active faults that can be identified on the aerial photography only. This emphasizes the need for further detailed site investigations, especially those using subsurface techniques to define the faults. Our confidence that the lineaments mapped represent active faults increases from Clas III to Class I.

CLASS III LINEAMENTS

The Class III lineaments are possible active faults. They generally are associated with little or no relief. Most appear to be related to the Class I and II lineaments; however, some Class III lineaments may represent erosional fault-line features or shoreline-related features. The Class III lineaments are shown because we feel they are possibly fault-related and are important enough to be considered for further investigation and evaluation.

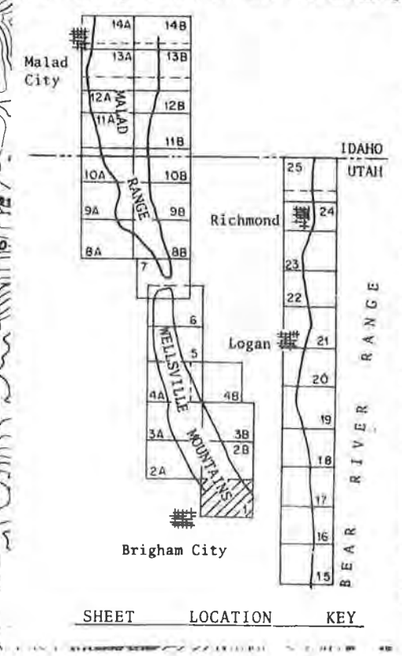
MAP ACCURACY

Fault-related features plotted on the map are generally believed to have a lateral accuracy of ± 100 feet. In areas of great relief or where cultural development such as roads, fence lines, and other similar features are lacking, the accuracy may be no better than ± 200 feet.

APPROXIMATE LIMITS OF INVESTIGATION

APPROXIMATE LIMITS OF INVESTIGATION

1000 0 1000 2000 3000 4000 FEET



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WASATCH-CACHE FAULT INVESTIGATION

BY: L.S. CLUFF, C. GLASS, G. BROGAN
DWN. BY: R.W., D.F. JUNE, 1974

SHEET 1

Malad City

Richmond

Logan

Brigham City

Flume

IDAHO

UTAH

BEAR RIVER RANGE

MALAD RANGE

WELLSVILLE MOUNTAINS

SALT FLAT

SALT FLAT

NORTH LAKE

Cement Ponds

Ruins

Airway Beacon (BM 4223)

Historical Monument

RAILROAD GRADE

APPROXIMATE LIMITS OF INVESTIGATION

Scarps on older fans modified by lake erosion

Subdued scarps on older fans are more pronounced on older fans but cut recent fans with small displacement

Entire area may be gently tilted toward range

Subdued west facing fault scarp

Gaging Station

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

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SHEET 2A

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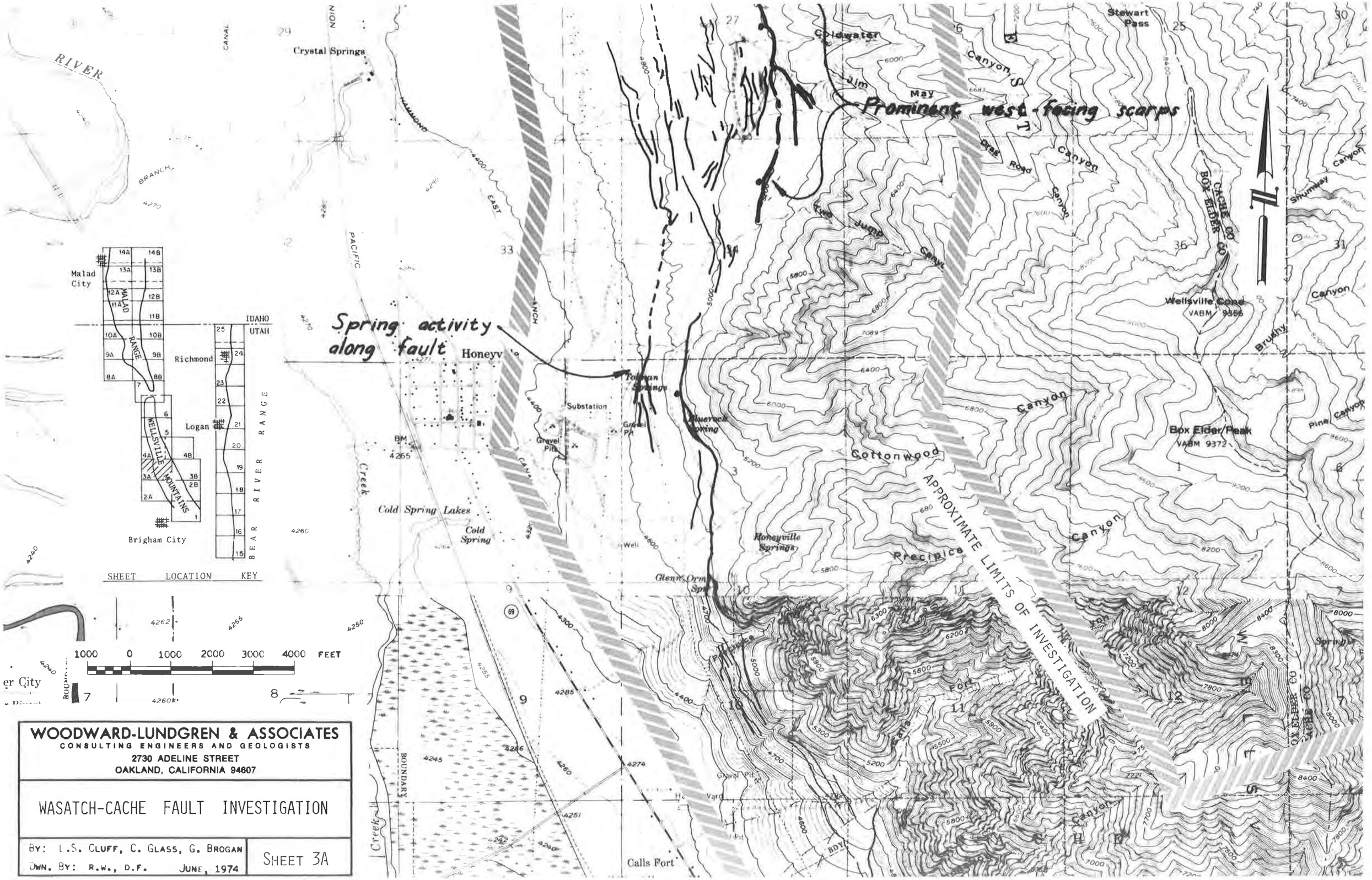
SHEET 2B

1000 0 1000 2000 3000 4000 FEET

SHEET LOCATION KEY

Malad City
Brigham City
Richmond
Logan
IDAHO
UTAH
WELLSVILLE MOUNTAINS
BEAR RIVER RANGE



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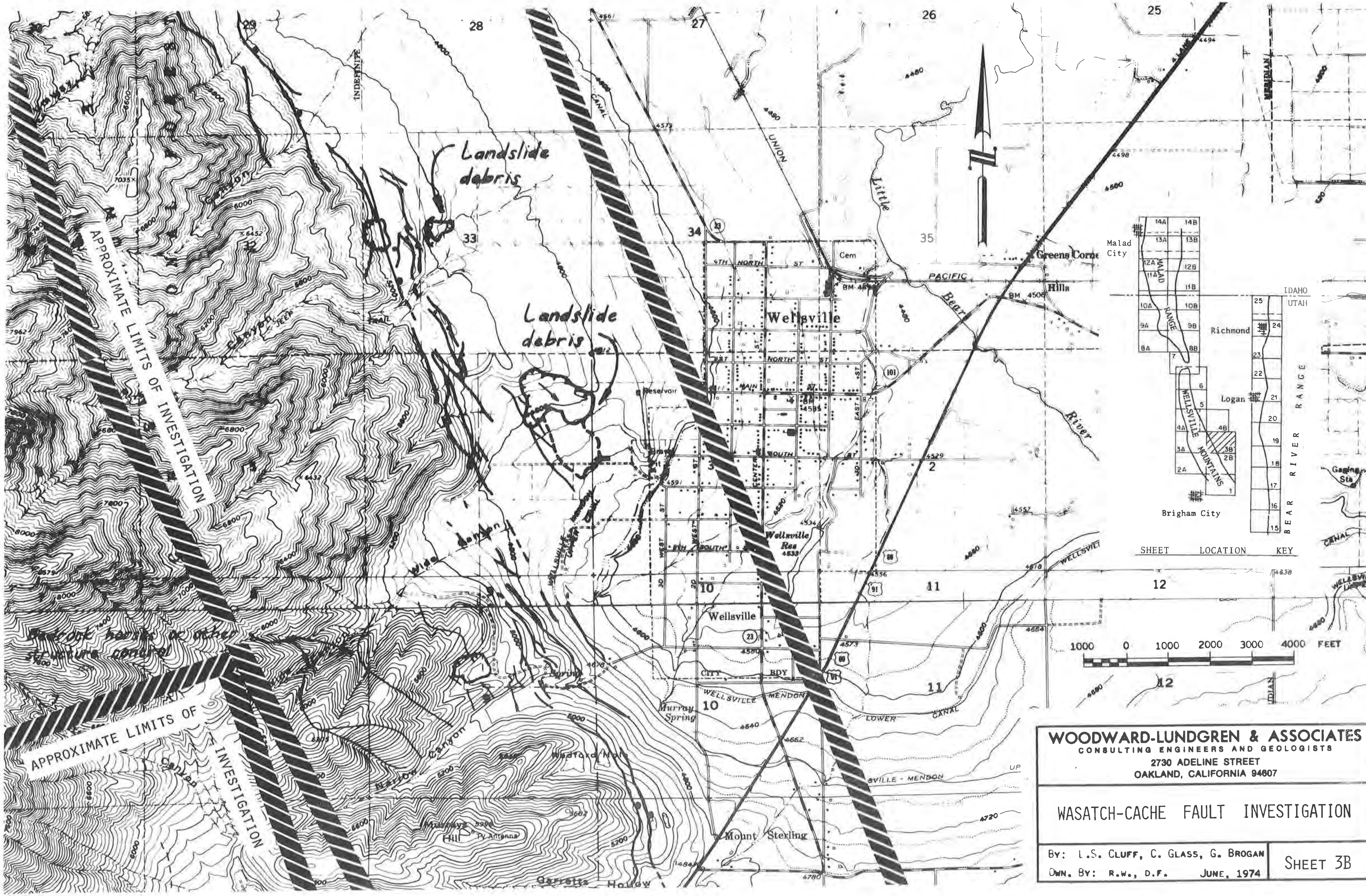
SHEET 3A



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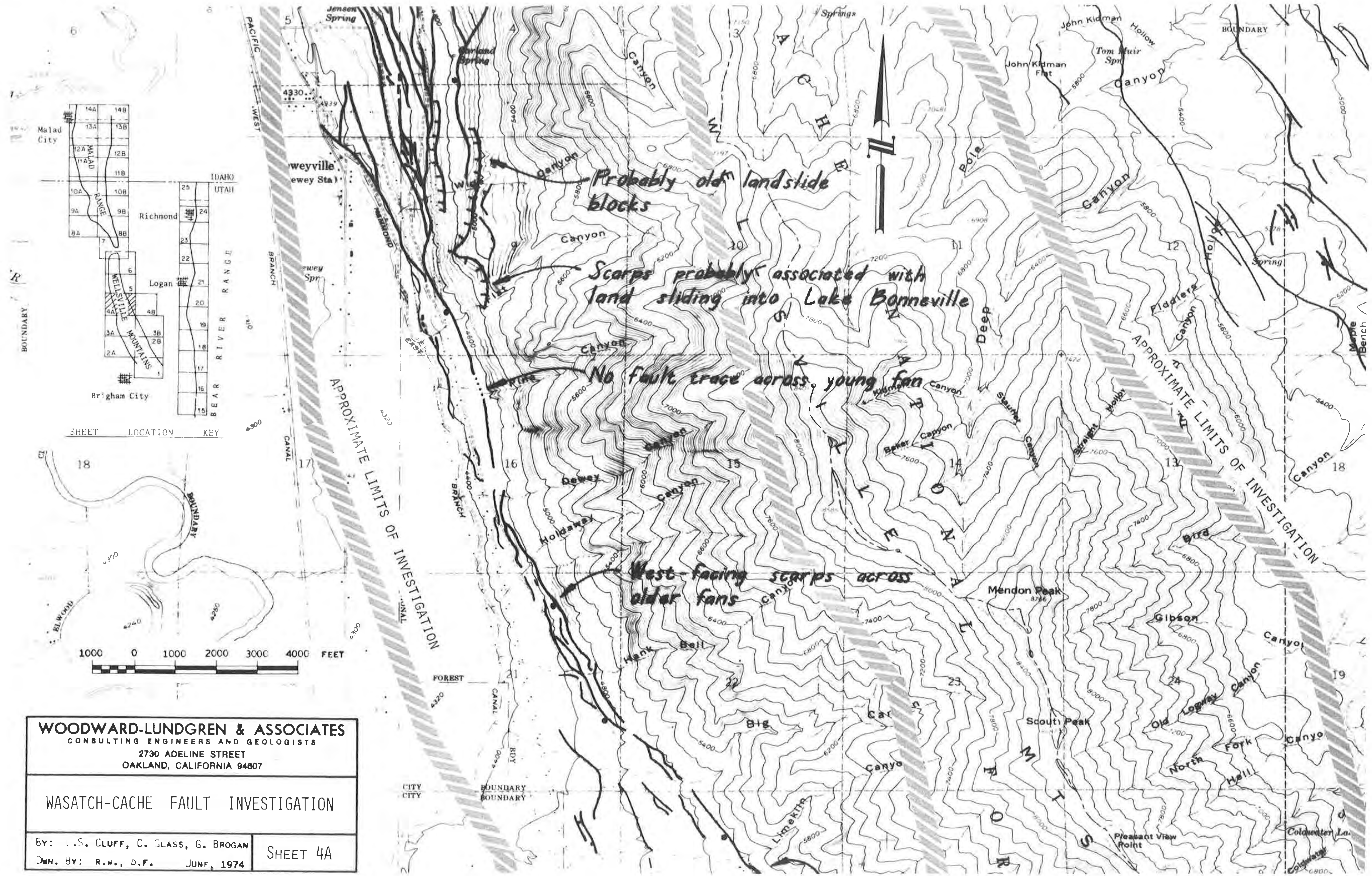
Sheet 3B



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Lake-modified fault block

Faulting and landsliding

APPROXIMATE LIMITS OF INVESTIGATION

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

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SHEET 4B

1000 0 1000 2000 3000 4000 FEET

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SHEET 5

Complex area of long-shore bars, probably combined with large scale sliding and faulting

Probably old landslide

Probably an area of complex landsliding and long-shore bars. Springs are along many of these scarps

APPROXIMATE LIMITS OF INVESTIGATION

APPROXIMATE LIMITS OF INVESTIGATION

Collinston

Gravel Pit

Mountain Dell Creek

Box Elder Co. Cache Co.

Willow Creek

Spring

Walter Ahern Spring Ruins

Hansen Lake

Chocolate Peak

Hawbush Spring

Wheat Spring

Threemile Canyon

Willow Hollow

Big Hollow

Pole Canyon

Chokecherry Flat

Malad City

Richmond

Logan

Brigham City

IDAHO UTAH

BEAR RIVER RANGE

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

...strictly indicates crest ... slide after its most recent movement.

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SHEET 6

Evidence of landsliding in Bonneville deposits

Large landslide block may have been active during the retreat of Lake Bonneville; however, the discordance of the shore lines across the slide block suggests post-Lake Bonneville landsliding.

Landslide

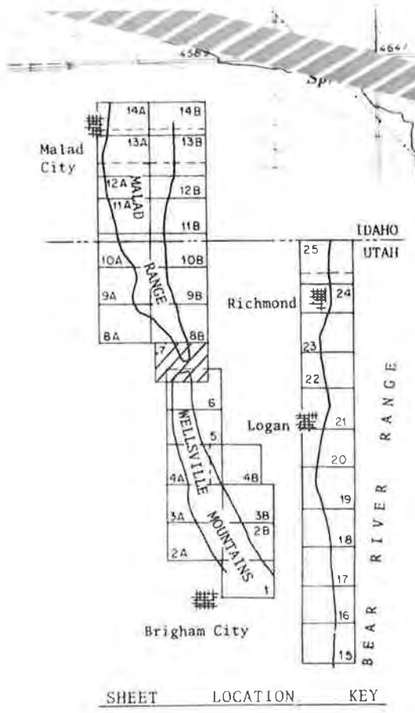
Fault displaces sediments deposited in Lake Bonneville

APPROXIMATE LIMITS OF INVESTIGATION

SHEET LOCATION KEY

Malad City
Richmond
Logan
Brigham City
Wellsville Mountains
Malad Range
Bear River Range
IDAHO
UTAH

Pacific
Willow
Creek
Jeep Trail
Cache Butte
Sleepy Hollow Spring
Fume
Union
Railroad
Cottonwood Grade
West Side Canal
Box Elder Co.
Cache Co.



SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

Lake Bonneville deposits are deformed by landsliding in this area but lack of deformation of the terrace surface apparently indicates the Lake covered the landslide after its most recent movement.

Landslide deposits including boulders

Junction Hills

Long Divide

Spring

RESERVOIR

CUTLER

NORMAL WATER ELEV 4407

Cache Junction

Landslide

Landslide block may

WEST SIDE CANAL

BEAR RIVER

HAMMOND

CACHE CO

BOX ELDER CO

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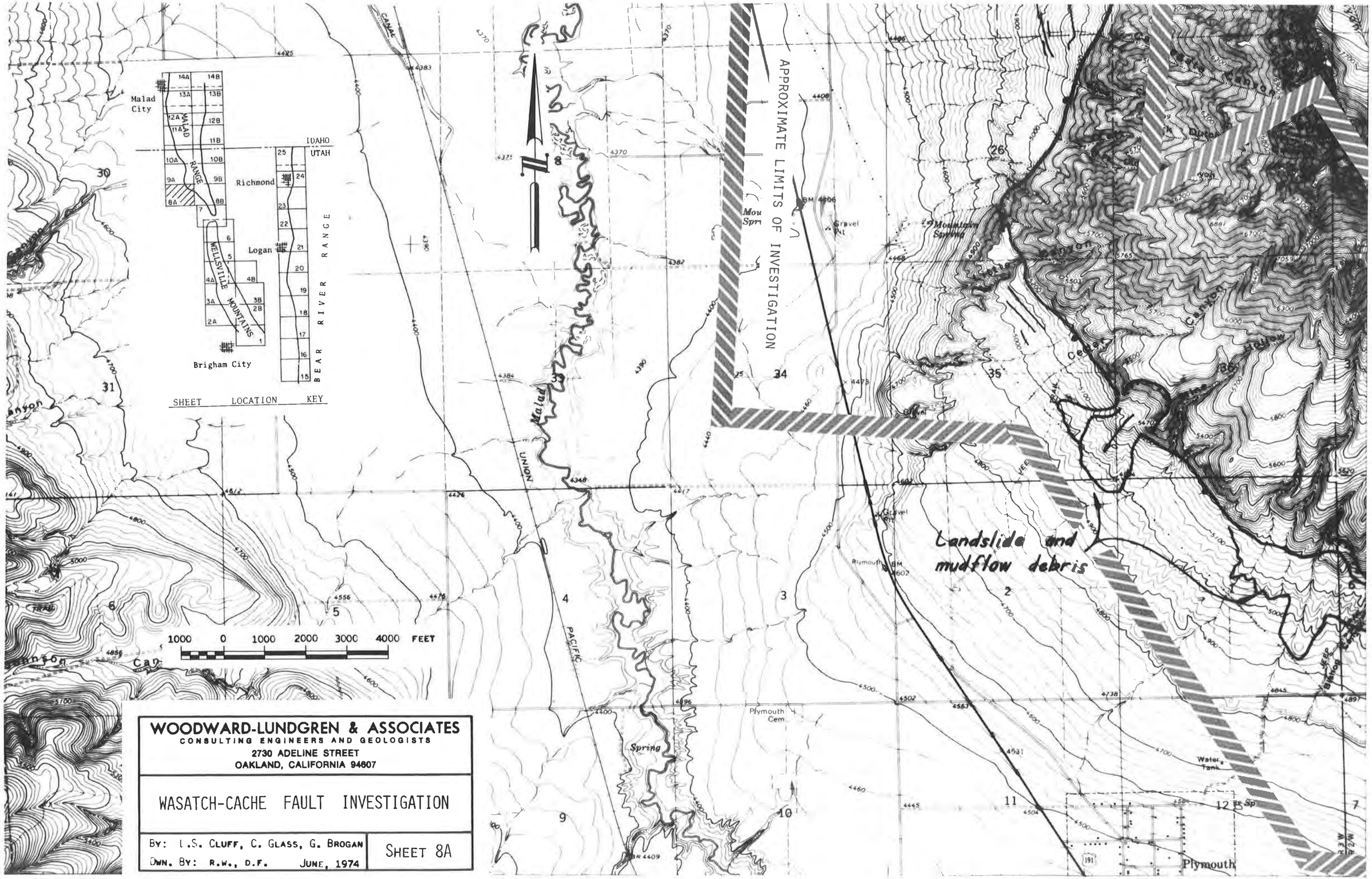
SHEET 7



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SHEET 8A

Faulting marked by break in slope and vegetation contrast

APPROXIMATE LIMITS OF INVESTIGATION

Landslide and mudflow debris

Shoreline may be fault controlled

Enclosed depressions in landslides

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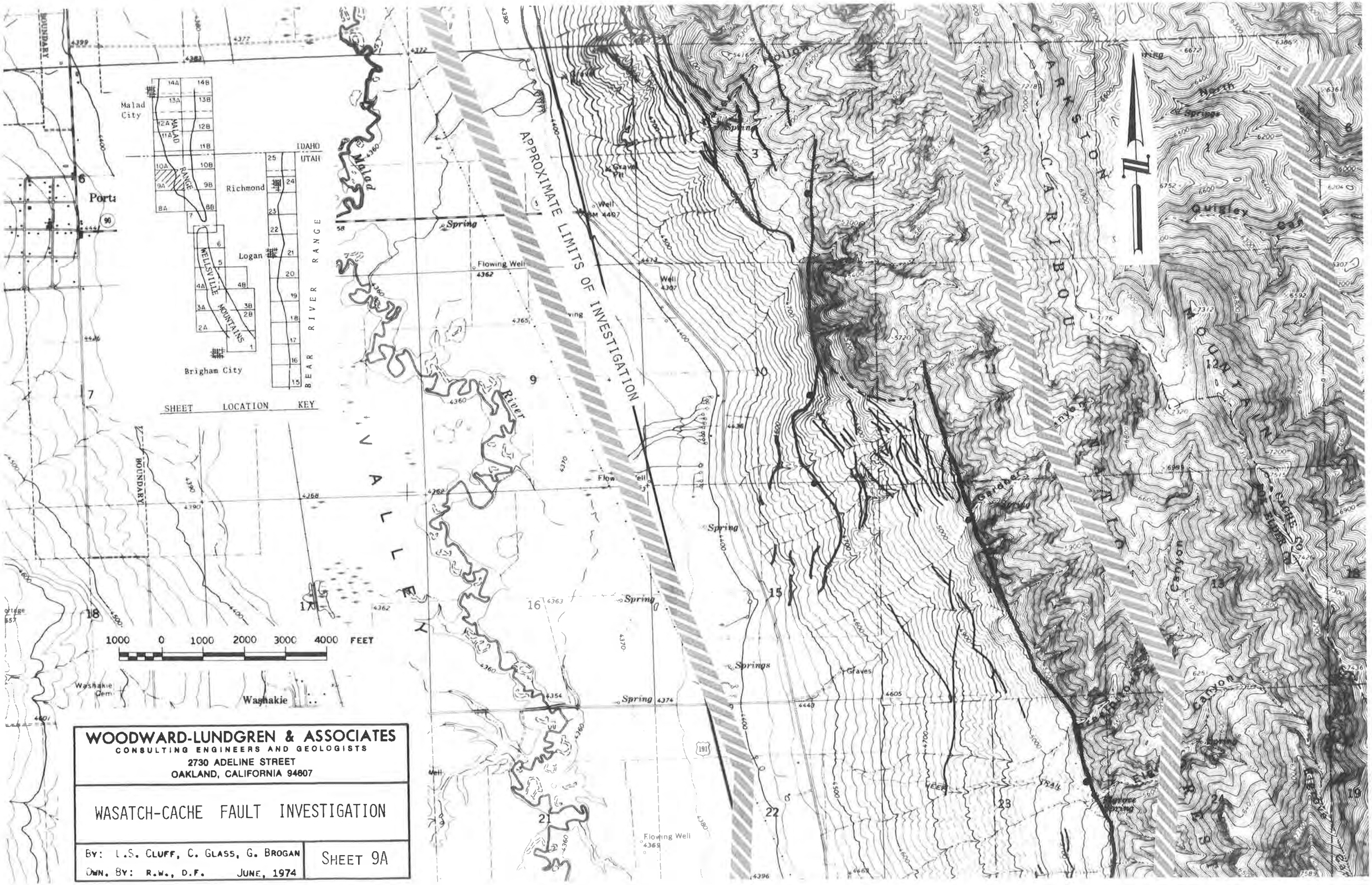
SHEET 8B

1000 0 1000 2000 3000 4000 FEET

SHEET LOCATION KEY

Malad City
Richmond
Logan
Brigham City
Flowing Well
IDAHO
UTAH
MALAD RANGE
WELLSVILLE MOUNTAINS
BEAR RIVER RANGE



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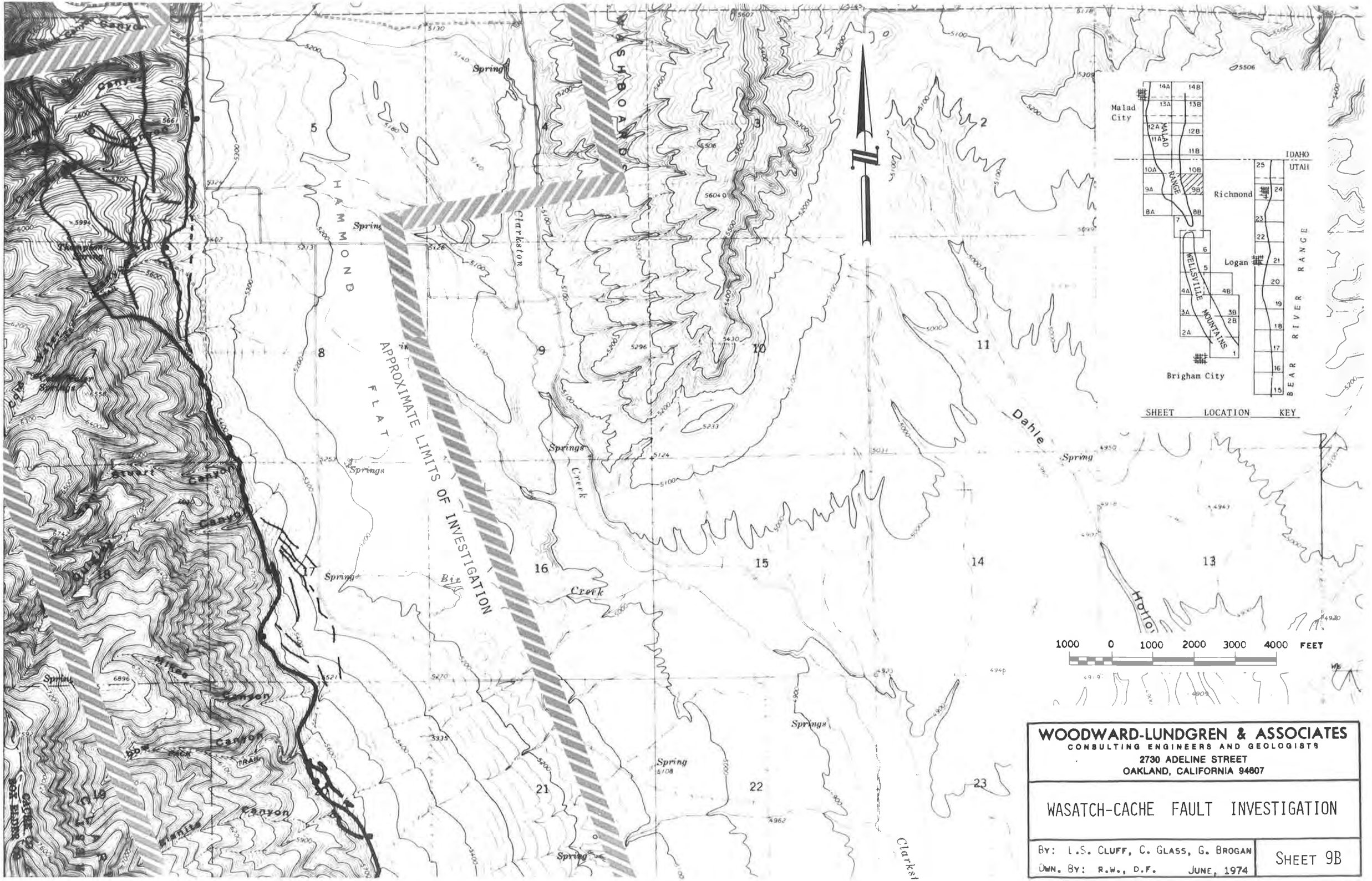
SHEET 9A



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SHEET 9B

Extensive agricultural modification obscures surface of fans

APPROXIMATE LIMITS OF INVESTIGATION

SHEET LOCATION KEY

Malad City | Richmond | Logan | Brigham City | IDAHO | UTAH | MALAD | RANGE | MELLSVILLE MOUNTAINS | BEAR RIVER RANGE

1000 0 1000 2000 3000 4000 FEET

ONEIDA CO | BOX ELDER CO | IDAHO | UTAH

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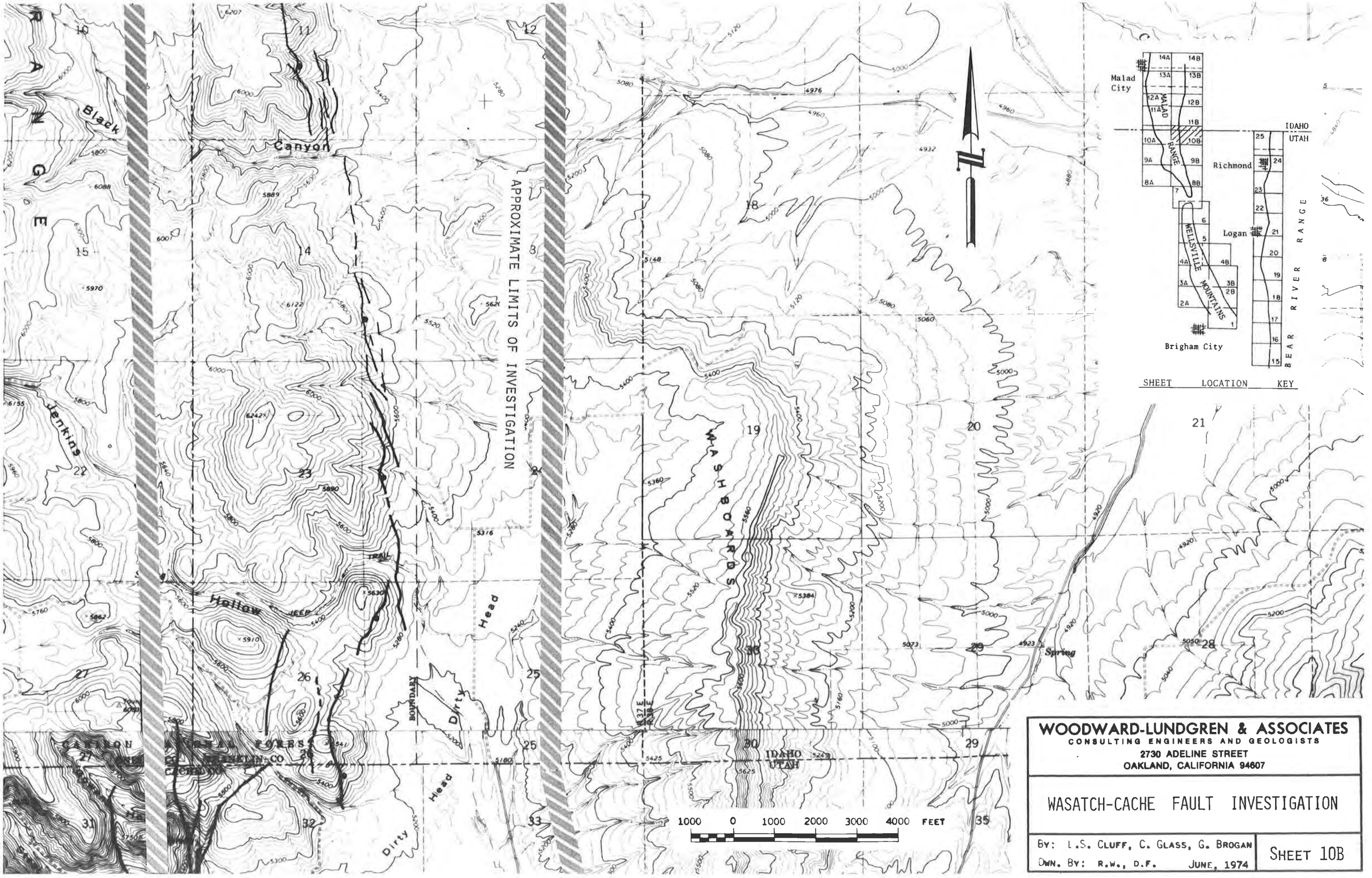
SHEET 10A



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SHEET 10B

Cherry Creek

Scarps in older fan

Landslide debris

APPROXIMATE LIMITS OF INVESTIGATION

Malad City

Richmond

Logan

Brigham City

IDAHO

UTAH

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

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APPROXIMATE LIMITS OF INVESTIGATION

Tonal contrast

Possible scarps marked by vegetation alignments and subtle breaks in slope

Malad City

Brigham City

Richmond

Logan

IDAHO

UTAH

MALAD RANGE

WELLSVILLE MOUNTAINS

BEAR RIVER RANGE

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

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SHEET 11B

Subtle west-facing breaks in slope

Large range-front fault with very little, if any, disturbance of fans

Range front faulting with little disturbance of younger alluvial fans

APPROXIMATE LIMITS OF INVESTIGATION

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

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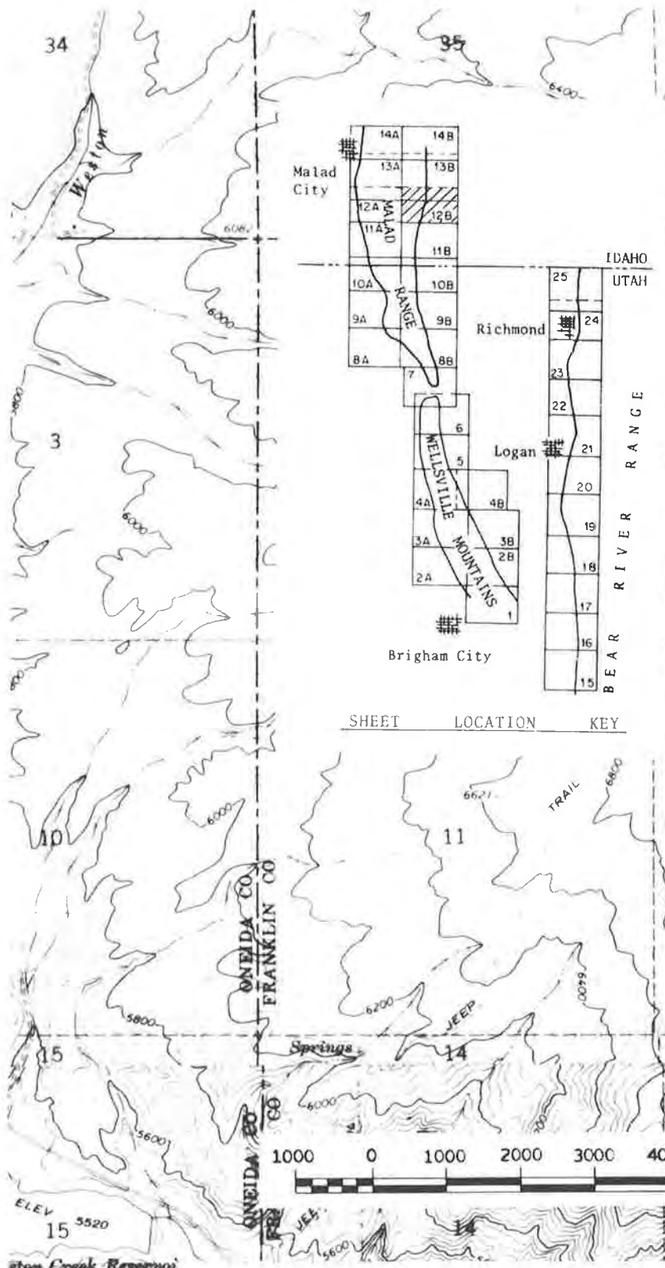
SHEET 12A



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SHEET 12B

APPROXIMATE LIMITS OF INVESTIGATION

Malad City

Deep

Quarry

Roadside Rest

Springhouse

Malad

Malad City Cem.

CORP BDY

COUNTY FAIRGROUNDS

Storage Bins

BM 4490

UNION PACIFIC

Sewage

Borrow Pits

Subtle west-facing breaks in slope

BM 4485

Twomile Creek

BOUNDARY

Flowing Well

Valley

Hollow

Spring

Sugar

Canyon

JEEP TRAIL

Spring

CARIBOU

NATIONAL

RANGE

Trail

Spring

Hollow

Spring

Spring

Spring

Dalem Spring

SKYLINE

1000 0 1000 2000 3000 4000 FEET

SHEET LOCATION KEY

Malad City

MALAD RANGE

MELLSVILLE MOUNTAINS

Brigham City

Logan

Richmond

BEAR RIVER RANGE

IDAHO

UTAH

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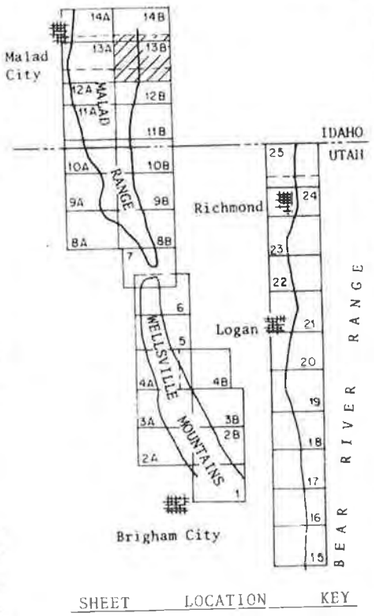
SHEET 13A

SHEET LOCATION KEY



1000 0 1000 2000 3000 4000 FEET

APPROXIMATE LIMITS OF INVESTIGATION

CARIBOU

Buck Peak

Clifton

Weston Peak

Old Baldy Peak

Canyon

Creek

Springs

Corral

Poison Spring

Steep

Davis

Basin

TRAIL

JEEP

PACK

AQUEDUCT

CANAL

LAKES

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SHEET 13B

APPROXIMATE LIMITS OF INVESTIGATION

Malad City

IDAHO

UTAH

Richmond

Logan

Brigham City

MALAD RANGE

WELLSVILLE MOUNTAINS

BEAR RIVER RANGE

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

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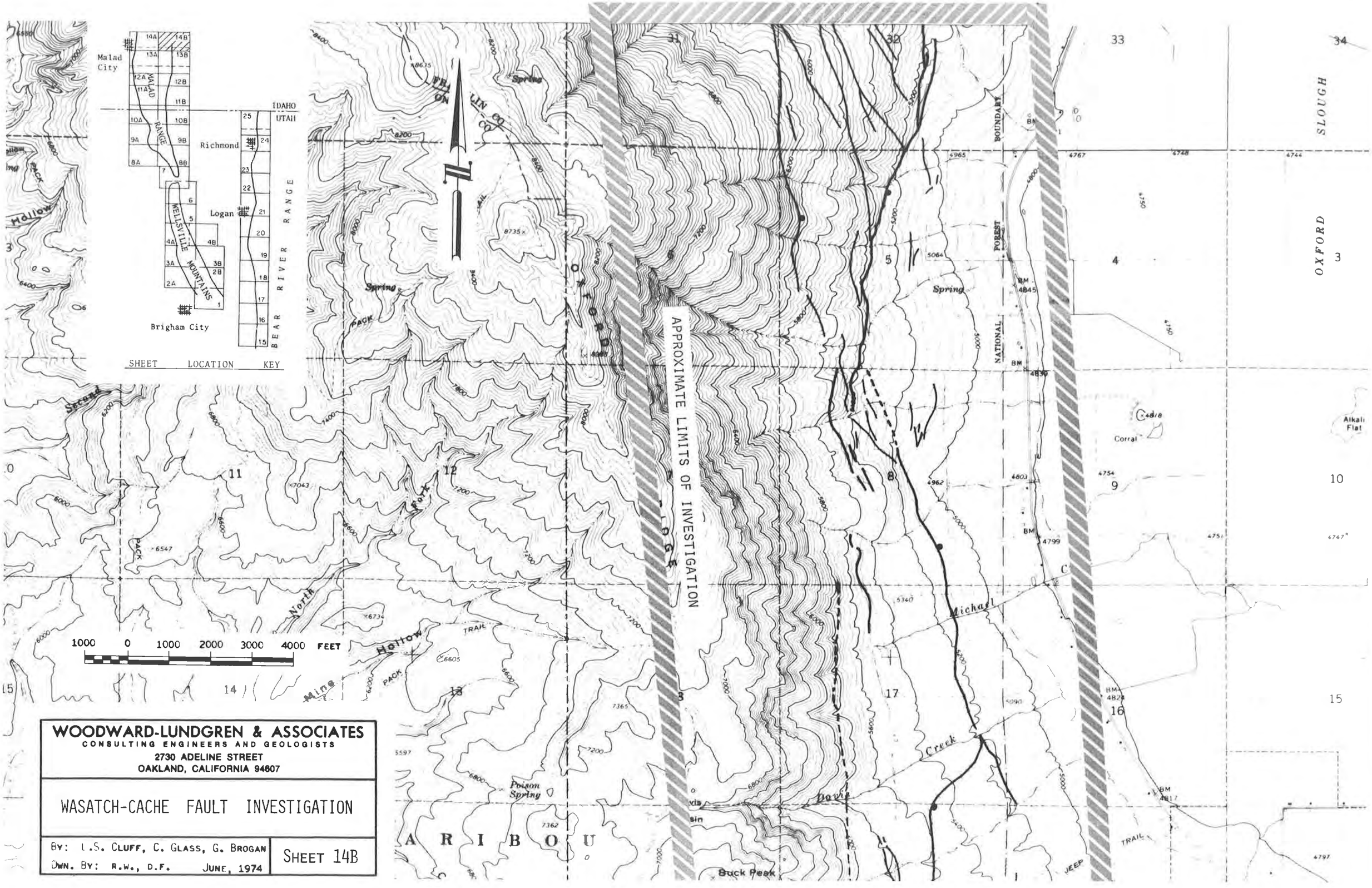
SHEET 14A



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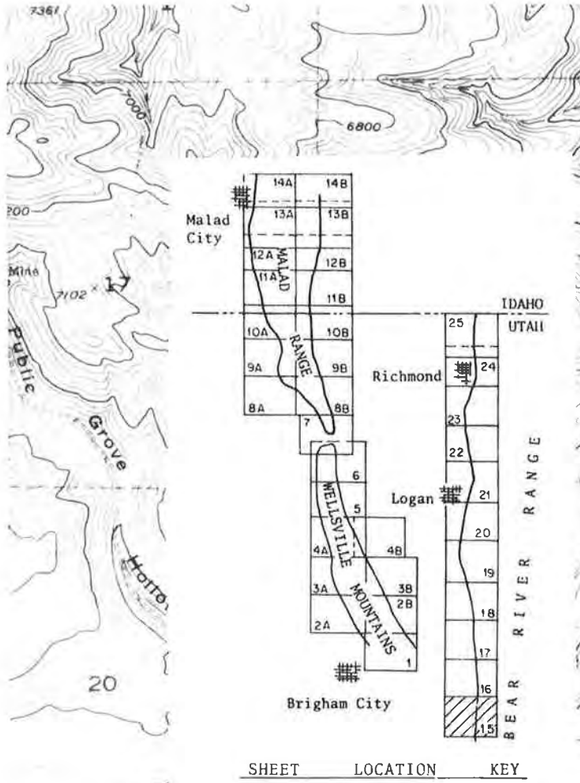
SHEET 14B



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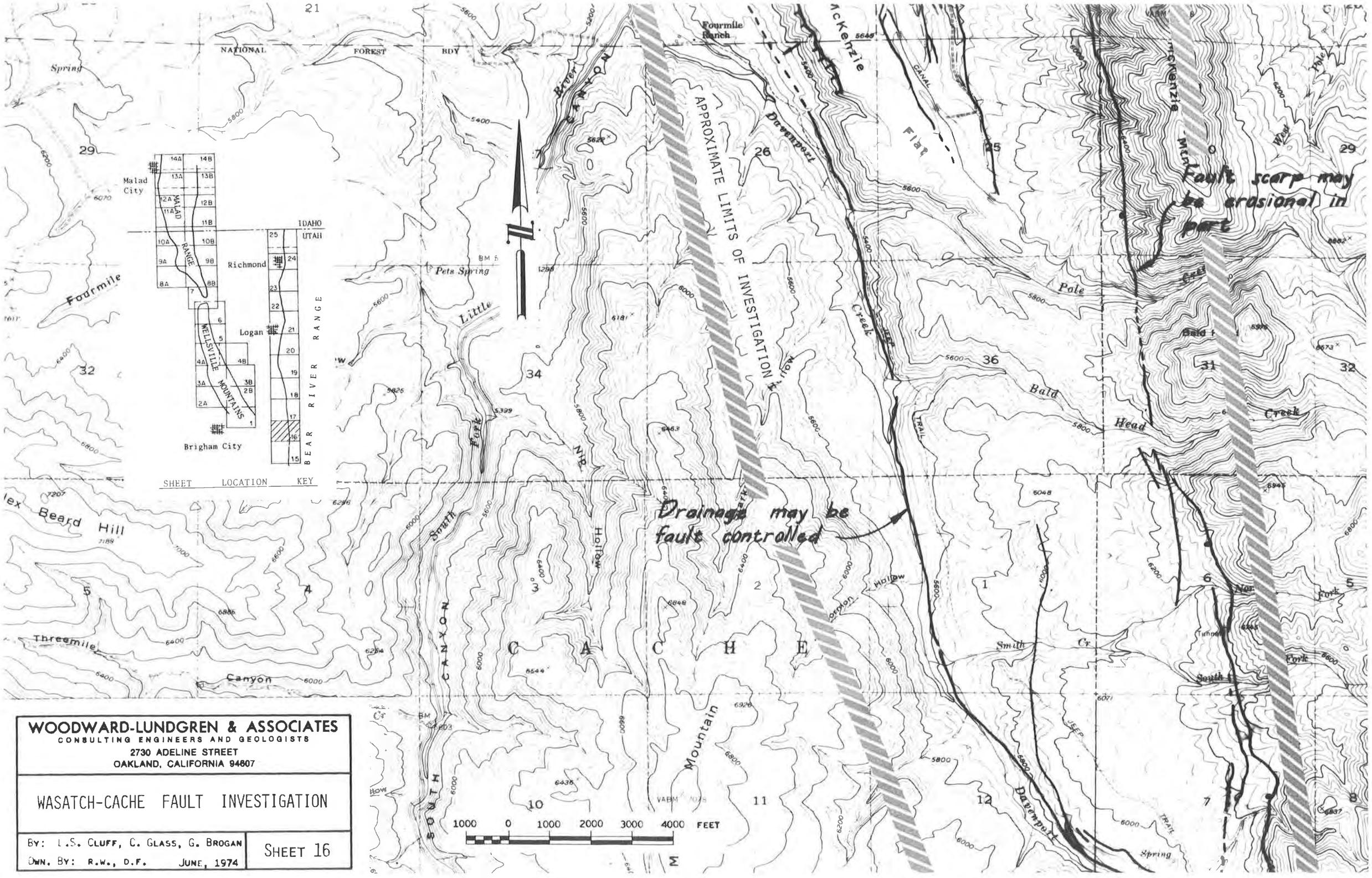
SHEET 15



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DWN. BY: R.W., D.F. JUNE, 1974

SHEET 16

Shoreline may be fault controlled

Streams appear to be structurally controlled

Zones of landslides and slope instability

APPROXIMATE LIMITS OF INVESTIGATION

Paradise

Avon

Malad City

Richmond

Logan

Brigham City

IDAHO

UTAH

MALAD RANGE

WELLSVILLE MOUNTAINS

BEAR RIVER RANGE

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

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SHEET 17

Surface expression of fault is in part eroded

APPROXIMATE LIMITS OF INVESTIGATION

SHEET LOCATION KEY

Malad City
Richmond
Logan
Brigham City
IDAHO
UTAH
MALAD RANGE
MELLSVILLE MOUNTAINS
BEAR RIVER RANGE

1000 0 1000 2000 3000 4000 FEET

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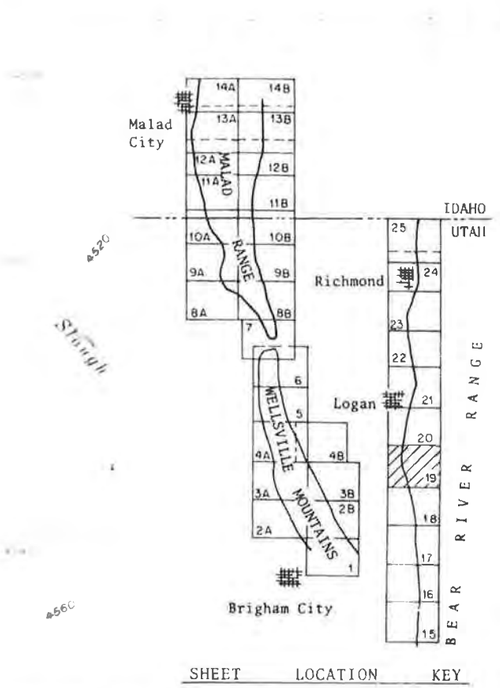
OAKLAND, CALIFORNIA 94607

WASATCH-CACHE FAULT INVESTIGATION

BY: L.S. CLUFF, C. GLASS, G. BROGAN
DWN. BY: R.W., D.F. JUNE, 1974

SHEET 18



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CONSULTING ENGINEERS AND GEOLOGISTS
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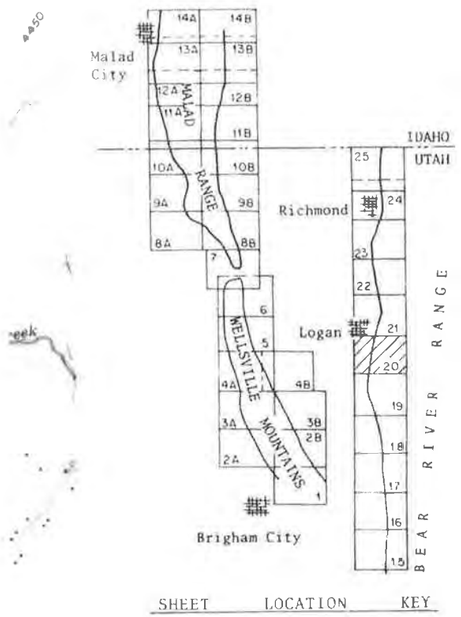
SHEET 19

Potentially unstable landslide deposits with post-landslide faulting.

Shoreline may be fault controlled



APPROXIMATE LIMITS OF INVESTIGATION

1000 0 1000 2000 3000 4000 FEET

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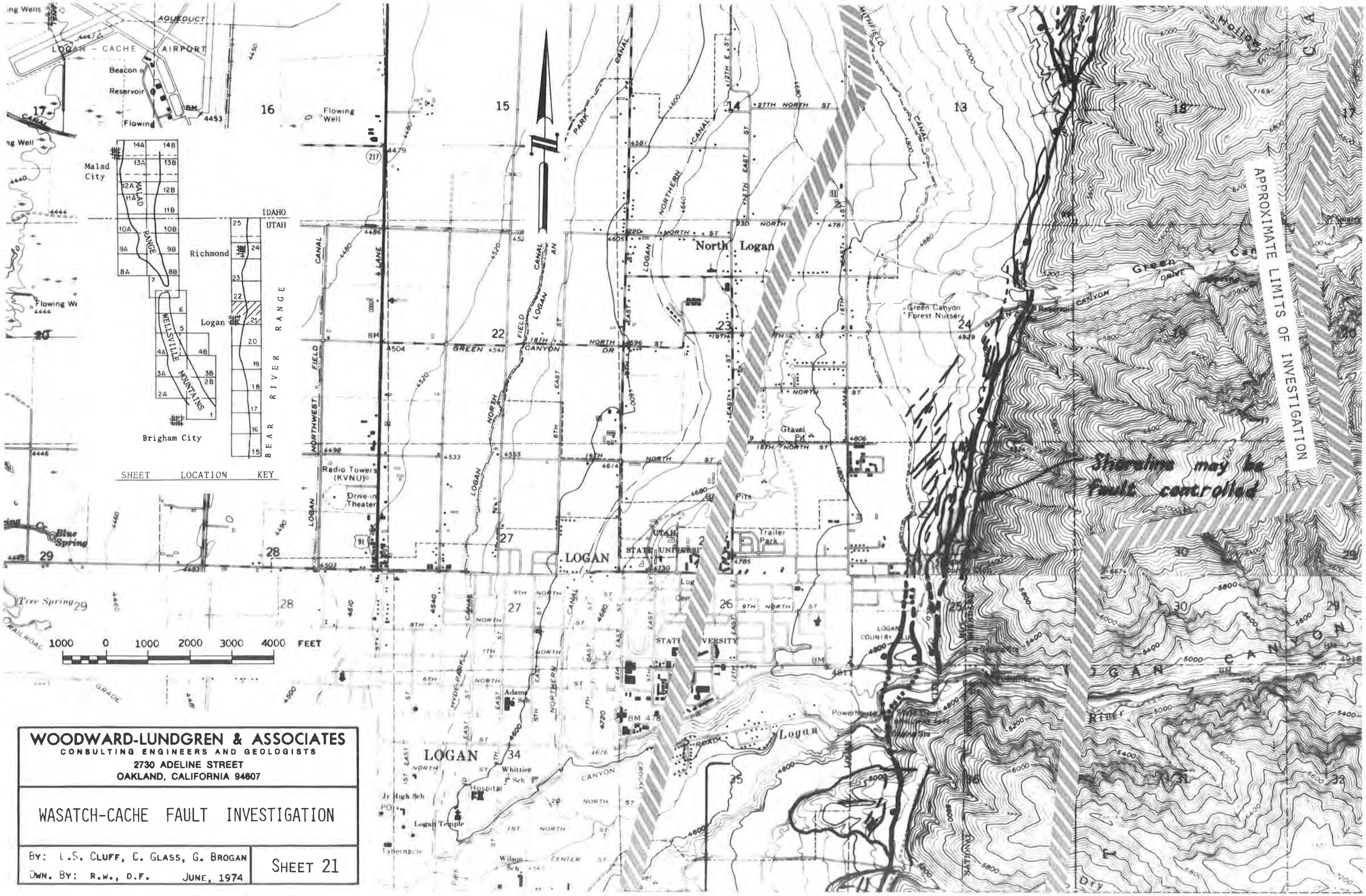

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APPROXIMATE LIMITS OF INVESTIGATION

SHEET LOCATION KEY

1000 0 1000 2000 3000 4000 FEET

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Shoreline may be fault controlled

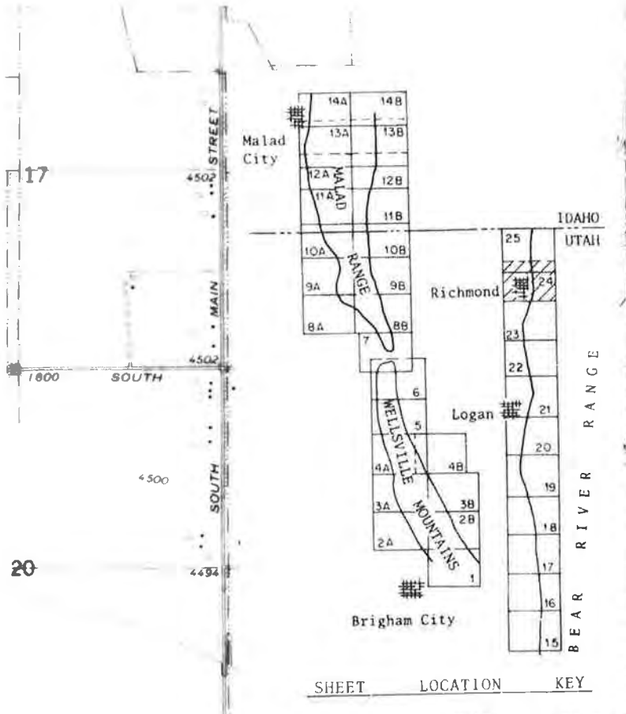
1000 0 1000 2000 3000 4000 FEET

SHEET LOCATION KEY

Malad City
Richmond
Logan
Brigham City
IDAHO
UTAH
MALAD RANGE
WELLSVILLE MOUNTAINS
BEAR RIVER RANGE

APPROXIMATE LIMITS OF INVESTIGATION

Storage Bin
Gravel Pit
Spring
Substation
Water Tank
Corbett Spring
Nebo
Creek
Canyon
Birch
Smithfield
Summit
NORTHERN UNION PACIFIC
LOGAN
91
CACHE NATIONAL FOREST



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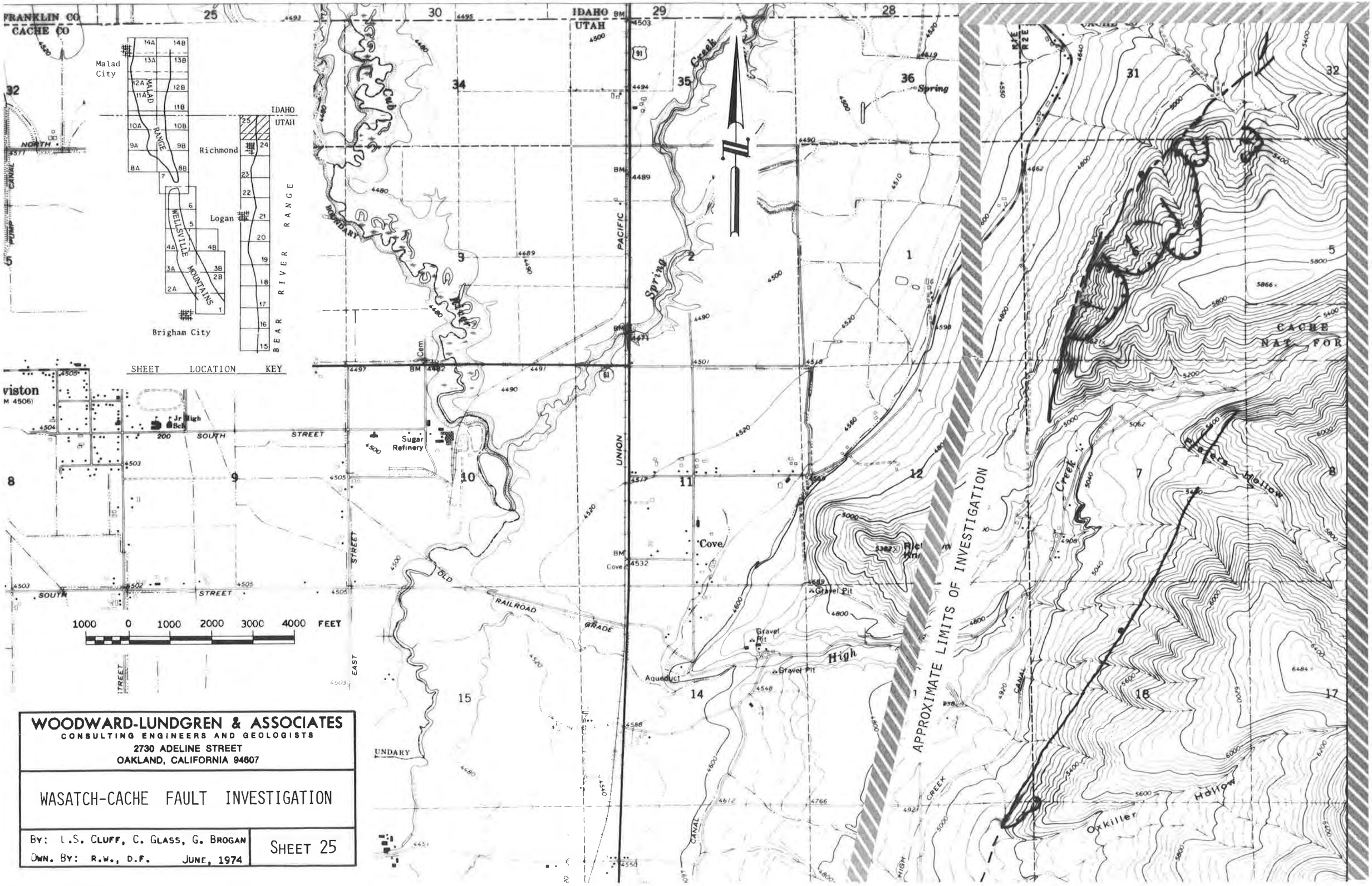
SHEET 24



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SHEET 25