U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Introduction to the San Francisco Bay Region, California, Landslide Folio

By SAN FRANCISCO BAY LANDSLIDE MAPPING TEAM[1]

Response to possible slope failure in the San Francisco Bay area is aided by digital maps of topography, landslides, and rainfall thresholds, together with data from the National Weather Service and the State Office of Emergency Services

OPEN-FILE REPORT 97-745 A

1997

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[1]MENLO PARK, CA 94025

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Summary

The U.S. Geological Survey (USGS) has initiated a program to provide digital data and plottable map files outlining areas of potential landslide activity in the ten-county San Francisco Bay region (Figure 1)[2]. The effort commenced in September 1997 and targeted a December completion to make the information available in advance of major storms anticipated from the 1997-1998 El Niño event. The San Francisco Bay Landslide Team's experience with catastrophic slope failures in prior winter storms, combined with the availability and first-hand knowledge of digital topographic, geologic, and climatologic data for the entire San Francisco Bay region, provides the basis for identifying areas potentially vulnerable to slope failure.

Three types of damaging landslide activity are addressed here: slides, earth flows, and debris flows. The nomenclature of slope failure is complex (Varnes, 1978). For present purposes we use the term *slide* to include both slumps and translational slides, and *earth flow* to represent flows of clayey earth (Wentworth and others, 1997). These kinds of landslides move slowly, in contrast to the rapid movement of *debris flows* (Ellen and others, 1997). Slides and earth flows deform the ground surface when they move and remain in the landscape as recognizable landslide masses, whereas debris flows run downslope to locations lower in the landscape and form separate, thin deposits that quickly become unrecognizable.

The six-part folio presented here features digital cartographic displays. Included are topography in shaded relief together with the road network and hydrography (Graham and Pike, 1997), mapped distribution of slides and earth flows (Wentworth and others, 1997), likely debris-flow source areas (Ellen and others, 1997), and rainfall thresholds for debris flows (Wilson and Jayko, 1997). Complementing the regional displays is an index to detailed maps that inventory Bay area landslides (Pike, 1997).

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[2]Sonoma, Napa, Solano, Marin, Contra Costa, San Francisco, San Mateo, Alameda, Santa Clara, and Santa Cruz

These maps and tabular data constitute the fundamental tools needed to assess potential slope-failure hazards in a regional context. Most of the information is mapped by counties at the 1:125,000 scale, which both communicates the degree of accuracy of many of the data and provides data at a level of generalization appropriate for emergency planning—the intial intended use of this Folio. The data are also presented at a scale of 1:275,000 to supply the necessary regional setting.

No paper maps accompany this document or the other five reports in the Landslide Folio. Rather, the Folio is released as a digital database that can be obtained by either (1) connecting with a USGS Web page, (2) through anonymous ftp (file transfer protocol) over the Internet, or (3) sending a request, accompanied by a blank magnetic tape, to USGS. Available in two data formats (ARC/INFO Export-compatible or PostScript), the map files can be plotted on the user's equipment or that of a commercial vendor. Technical details on all these options are provided later in this report.

The San Francisco Bay Region Landslide Folio comprises six separate but related reports, including this Introduction, keyed by letter to the same Open-file Report number as follows:

97-745 A. Introduction to the San Francisco Bay Region, California, Landslide Folio — by the San Francisco Bay Landslide Mapping Team

97-745 B. Shaded Relief Map of the San Francisco Bay Region, California — by Scott E. Graham and Richard J. Pike

97-745 C. Summary Distribution of Slides and Earth Flows in the San Francisco Bay Region, California — by Carl M. Wentworth, Scott E. Graham, Richard J. Pike, Gregg S. Beukelman, David W. Ramsey, and Andrew D. Barron

97-745 D. Index to Detailed Maps of Landslides in the San Francisco Bay Region, California — by Richard J. Pike

97-745 E. Map Showing Principal Debris Flow Source Areas in the San Francisco Bay Region, California — by Stephen D. Ellen, Robert K. Mark, Gerald F. Wieczorek, Carl M. Wentworth, David W. Ramsey, and Thomas E. May

97-745 F. Preliminary Maps Showing Rainfall Thresholds for Debris-Flow Activity, San Francisco Bay Region, California — by Raymond C. Wilson and Angela S. Jayko

The initial application of the folio, to identify areas that are most prone to landslide activity during major storms, is directed explicitly towards the emergency services community of the San Francisco Bay region. The combined strategy of USGS and cooperating agencies to locally assist emergency preparedness involves four key elements:

(1) a series of maps that specify localities susceptible to slides, earth flows, and debris flows,
(2) a map that shows rainfall characteristics likely to trigger debris flows,
(3) storm-specific precipitation data provided by the National Weather Service (NWS), and
(4) a communications network orchestrated by the State of California's Region II Office of Emergency Services (OES) during a major storm or when such a storm is predicted.

The digital maps and other data released in this series of open-file reports fulfill the basic data of requirements 1 and 2 above. The function of the USGS information, within the cooperative plan worked out among USGS, NWS and OES for the 1997-98 California winter, is to provide a regional assessment of areas potentially at risk during severe storms. In the event of such storms, the USGS assessment will be folded into data on weather conditions from NWS.

Weather data, supplied by NWS at time intervals commensurate with storm vagaries, will be monitored jointly by USGS and OES. OES will in turn, according to an ongoing assessment of conditions, distribute landslide advisory notifications through their county-based information network. The USGS Team will receive feedback on landslide activity from OES-based operations across the Bay area. USGS, NWS, and OES will coordinate by telephone during significant storms or when such storms are predicted.

In sum, by combining rainfall information from NWS with USGS rainfall-threshold and landslide maps, OES-based response units will have a better sense of both the likelihood of landslide activity, particularly debris flows, and localities where the activity could occur.

Follow-on work anticipated by the Team and cooperating colleagues throughout the 1997-98 winter season includes monitoring locations of new debris flows and reactivated landslides. These fresh observations will enable USGS to test susceptibility models and further investigate relations of slope-failure processes to rainfall thresholds, digital topographic information, and the role of hillside materials' properties.

Because historically, quite apart from the presence of an El Niño event, landslide activity has accompanied all large winter storms in the San Francisco Bay region, the products in this folio are expected to be useful well beyond the 1997-98 El Niño season. Besides preparing the region for severe winters in 1998-99 and thereafter, the digital data presented here, as well as additional products to be created from them in the course of ongoing Team research, will be of value to land-use planning throughout the Bay region. In particular, they will contribute to identifying the risk arising from slope failure in areas of future development in this rapidly expanding urban area.

Special Note

The Team, in advance of this publication, received numerous inquiries regarding the efficacy of the information for appraising landslide susceptibility for individual land parcels. Although we recognize the need for such assessments, it is neither possible nor appropriate to render site-specific judgments based only on the generalized information released in this report. A licensed geotechnical engineer or engineering geologist should always be consulted to evaluate any issues of slope failure for house lots and other properties.

Acknowledgments

National Mapping Division personnel provided the many late-generation digital elevation models (DEM's) that enabled us to compile a uniformly high-quality 30-m DEM—the source of many of the maps in this folio—over the entire San Francisco Bay region. We thank these NMD colleagues for their patience in the face of our continual requests. Charlie Moore located long-forgotten reproducibles for the 1979 Nilson-Wright landslide compilation in the bowels of the Menlo Park document-storage facility. Staff of the USGS Menlo Park library located and obtained hard-to-find technical reports for the landslide-map index. Laura Zink and Joe Vigil assisted with design and execution of the Web page displaying many of the results of this study.

NOTE — Information For Those Who Don't Use Digital Map Databases

Those interested in the contents of this folio who do not use a Geographic Information System (GIS) that reads ARC/INFO (Environmental Systems Research Institute, Redlands, California) EXPORT files, can still obtain the information: PostScript plot files containing images of much of the data in the digital database, as well as PostScript plot files of the explanatory text, have been included in the database package (please see the section "PostScript Plot Files" below).

> Those who have computer capability can access the PostScript plot files in any of the three ways described below to access the digital data (please see the section "Obtaining the Digital Data"), including through the Western Region Geologic Information Server Web Page.
>
> For those without computer access, we can provide users with the PostScript plot files on digital tape that can be used by other vendors (please see the section "Obtaining Plots from a Commercial Vendor"). U.S. Geological Survey is also planning to provide a plot-on-demand service for plot files such as the ones in this report through Open-File Services (please see the section “Obtaining plots from Open-File Services”).

Description of the Digital Database

Database Contents

The digital database for this Folio has two parts. The first comprises the map databases themselves and the supporting data, including base maps, map explanation and description, and references. All the digital databases are in the same map projection and coordinate system and therefore will correctly register to one another in a GIS. (The projection is the Universal Transverse Mercator (UTM) zone 10, NAD27 datum, in meters.) The second part of the Folio's digital data package consists of PostScript plot files of the maps.

I. DIGITAL DATABASE PACKAGE

Part I of the Folio database includes map database files and supporting digital material. For maps of shaded relief, slides and earth flows, and debris-flow sources, a separate COVERAGE (ARC/INFO vector digital map database) or GRID (ARC/INFO raster digital map database) is included for each of the ten counties in the San Francisco Bay region, as well as one for the Bay region as a whole. Note that not every county has every dataset. In some instances no data of that type were present in the county, so that dataset was omitted. For the rainfall-threshold for debris-flows map and the quadrangle map accompanying the index of reports on existing landslides, only the coverage or grid for the entire Bay region is included. Furthermore, ASCII text files of the position of Rain-gage and Alert-stations (from the rainfall-threshold maps) are included in addition to point coverages.

Details of the data format for each set of map databases are found in the related digital map-description pamphlet, also included in the digital database package. The coverages, along with their associated INFO directory have been converted to uncompressed ARC/INFO export files. ARC export files promote ease of data handling, and are usable by some Geographic Information Systems in addition to ARC/INFO (see below for a discussion of working with export files). The GRIDs have been packaged in tar (tape archive) files. The ARC export files and the associated ARC/INFO coverages and directories, as well as the additional digital material included in the digital database package, are described below:

Data Files:

ARC/INFO export file, text file, or tar file	Size of gzip compressed export, text, or tar file (uncompressed)	Resultant Coverage or Grid	Description of Coverage or Grid

OPEN-FILE REPORT 97-745 B, SHADED RELIEF MAP OF THE SAN FRANCISCO BAY REGION, CALIFORNIA

• By S.E. Graham and R.J. Pike

Shaded relief map databases are GRIDS:

sfbr-sr.tar	23.6 MB (28.8)	sfbr-sr/	Shaded relief map of the San Francisco Bay Region
al-sr.tar	2.0 MB (2.5)	al-sr/	Shaded relief map of Alameda County
cc-sr.tar	1.9 MB (2.5)	cc-sr/	Contra Costa County
ma-sr.tar	1.6 MB (2.0)	ma-sr/	Marin County
na-sr.tar	2.5 MB (2.9)	na-sr/	Napa County
scl-sr.tar	4.2 MB (4.8)	scl-sr/	Santa Clara County
scr-sr.tar	1.6 MB (1.9)	scr-sr/	Santa Cruz County

sf-sr.tar	0.2 MB (0.3)	sf-sr/	San Francisco County
sm-sr.tar	1.4 MB (1.7)	sm-sr/	San Mateo County
sol-sr.tar	1.7 MB (2.6)	sol-sr/	Solano County
son-sr.tar	4.6 MB (5.3)	son-sr/	Sonoma County

sfbr-srlt.tar	12.5 MB (24.0)	sfbr-srlt/	A lighter-toned version of the shaded relief map of the San Francisco Bay Region for use as a base map
al-srlt.tar	1.2 MB (2.3)	al-srlt/	A lighter-toned version of the shaded relief map of Alameda County for use as a base map
cc-srlt.tar	1.1 MB (2.2)	cc-srlt/	Contra Costa County
ma-srlt.tar	0.9 MB (1.9)	ma-srlt/	Marin County
na-srlt.tar	1.4 MB (2.7)	na-srlt/	Napa County
scl-srlt.tar	2.2 MB (4.3)	scl-srlt/	Santa Clara County
scr-srlt.tar	0.9 MB (1.8)	scr-srlt/	Santa Cruz County
sf-srlt.tar	0.1 MB (0.3)	sf-srlt/	San Francisco County
sm-srlt.tar	0.7 MB (1.6)	sm-srlt/	San Mateo County
sol-srlt.tar	0.8 MB (1.7)	sol-srlt/	Solano County
son-srlt.tar	2.5 MB (5.0)	son-srlt/	Sonoma County

OPEN-FILE REPORT 97-745 C, SUMMARY DISTRIBUTION OF SLIDES AND EARTH FLOWS IN THE SAN FRANCISCO BAY REGION, CALIFORNIA

- By C.M. Wentworth, S.E. Graham, R.J. Pike, G.S. Beukelman, D.W. Ramsey, and A.D. Barron

Slide and earth flow map databases are COVERAGES:

sfbr-sef.e00	11 MB (38)	sfbr-sef/	Slides and earth flows map of the San Francisco Bay Region
al-sef.e00	1.4 MB (4.8)	al-sef/	Slides and earth flows map of Alameda County
cc-sef.e00	1.5 MB (5.2)	cc-sef/	Contra Costa County
ma-sef.e00	1.4 MB (4.9)	ma-sef/	Marin County
na-sef.e00	1.1 MB (3.8)	na-sef/	Napa County
scl-sef.e00	2.6 MB (9.1)	scl-sef/	Santa Clara County
scr-sef.e00	0.7 MB (2.5)	scr-sef/	Santa Cruz County
sf-sef.e00	83 kB (0.3 MB)	sf-sef/	San Francisco County
sm-sef.e00	0.7 MB (2.6)	sm-sef/	San Mateo County
sol-sef.e00	0.8 MB (2.8)	sol-sef/	Solano County
son-sef.e00	2.3 MB (8.1)	son-sef/	Sonoma County

OPEN-FILE REPORT 97-745 D, INDEX TO DETAILED MAPS OF LANDSLIDES IN THE SAN FRANCISCO BAY REGION, CALIFORNIA

- By R.J. Pike

The quadrangle index map database is a COVERAGE:

sfbr-qi.e00	0.3 MB (1.1)	sfbr-qi/	Quadrangle index map of the San Francisco Bay Region

OPEN-FILE REPORT 97-745 E, MAP OF DEBRIS-FLOW SOURCE AREAS IN THE SAN FRANCISCO BAY REGION, CALIFORNIA

- By S.D. Ellen, R.K. Mark, G.F. Wieczorek, C.M. Wentworth, D.W. Ramsey, and T.E. May

Principal predicted debris flow source area map databases are GRIDS:

sfbr-df.tar	4.3 MB (11.1)	sfbr-df/	Predicted debris-flow source areas map of the San Francisco Bay Region
al-df.tar	0.4 MB (1.3)	al-df/	Predicted debris flow-source areas map of Alameda County
cc-df.tar	0.4 MB (0.9)	cc-df/	Contra Costa County

ma-df.tar	0.3 MB (0.9)	ma-df/	Marin County
na-df.tar	0.5 MB (1.6)	na-df/	Napa County
scl-df.tar	0.8 MB (2.2)	scl-df/	Santa Clara County
scr-df.tar	0.3 MB (0.7)	scr-df/	Santa Cruz County
sf-df.tar	29 kB (112 kB)	sf-df/	San Francisco County
sm-df.tar	0.3 MB (0.7)	sm-df/	San Mateo County
sol-df.tar	0.4 MB (0.9)	sol-df/	Solano County
son-df.tar	0.8 MB (2.2)	son-df/	Sonoma County

1982 debris-flow sources and extent-of-mapping map databases are COVERAGES:

sfbr-dfs.e00	700 kB (5.9 MB)	sfbr-dfs/	Map of the sources of debris flows triggered in the storm of January 1982 in the San Francisco Bay Region
al-dfs.e00	51 kB (0.4 MB)	al-dfs/	Map of sources of debris flows triggered in the storm of January 1982 in Alameda County
cc-dfs.e00	135 kB (1.0 MB)	cc-dfs/	Contra Costa County
ma-dfs.e00	192 kB (1.5 MB)	ma-dfs/	Marin County
na-dfs.e00	46 kB (0.3 MB)	na-dfs/	Napa County
scl-dfs.e00	63 kB (0.5 MB)	scl-dfs/	Santa Clara County
scr-dfs.e00	1 kB (3 kB)	scr-dfs/	Santa Cruz County
sm-dfs.e00	183 kB (1.5 MB)	sm-dfs/	San Mateo County
sol-dfs.e00	68 kB (0.5 MB)	sol-dfs/	Solano County
son-dfs.e00	28 kB (0.2 MB)	son-dfs/	Sonoma County

sfbr-dfml.e00	56 kB (196 kB)	sfbr-dfml/	Map of the approximate extent of mapping of 1982 debris flows in the San Francisco Bay Region
ma-dfml.e00	2 kB (5 kB)	ma-dfml/	Marin County
na-dfml.e00	2 kB (7kB)	na-dfml/	Napa County
scl-dfml.e00	22 kB (74 kB)	scl-dfml/	Santa Clara County
sol-dfml.e00	5 kB (15 kB)	sol-dfml/	Solano County
son-dfml.e00	1 kB (4 kB)	son-dfml/	Sonoma County

OPEN-FILE REPORT 97-745 F, PRELIMINARY MAPS SHOWING RAINFALL THRESHOLDS FOR DEBRIS-FLOW ACTIVITY, SAN FRANCISCO BAY REGION, CALIFORNIA

• By R.C. Wilson and A.S. Jayko

Rainfall-threshold map databases are GRIDS

sfbr-rt6.tar	10.8 MB (29.8)	sfbr-rt6/	Map of 6-hour rainfall thresholds for debris flows in the San Francisco Bay region
sfbr-rt24.tar	10.7 MB (28.3)	sfbr-rt24/	Map of 24-hour rainfall thresholds for debris flows in the San Francisco Bay region

Rain-gage and Alert-station locations and rainfall-threshold contours are COVERAGES

sfbr-rtg.e00	2 kB (9 kB)	sfbr-rtg/	Map of location of rainfall gages in the San Francisco Bay region
sfbr-rta.e00	7 kB (79 kB)	sfbr-rta/	Map of location of Alert stations in the San Francisco Bay region
sfbr-rt6c.e00	81 kB (283 kB)	sfbr-rt6c/	Map of contours of 6-hour rainfall thresholds for debris flows in the San Francisco Bay region
sfbr-rt24c.e00	173 kB (440 kB)	sfbr-rt24c/	Map of contours of 24-hour rainfall thresholds for debris flows in the San Francisco Bay region

Rain-gage and Alert-station locations are also included as ASCII text files

sfbr-rtg.txt	0.8 kB (1.4 kB)	ASCII text file of the location of rainfall gages in the San Francisco Bay region
sfbr-rta.txt	1 kB (2.3 kB)	ASCII text file of the location of Alert stations in the San Francisco Bay region

OPEN-FILE REPORTS 97-745 B-F

The following supporting directory is not included in the database package, but is produced in the process of reconverting the export files into ARC coverages or removing grid databases from tar files:

info/	INFO directory containing files supporting the databases.

PAMPHLETS:

The database package also includes the following PostScript and ASCII text files:

Filename	Size of gzip compressed file (uncompressed)	Description of file
sfbrlsf-db.ps	668 kB (1.5 MB)	A PostScript plotfile of this pamphlet.
sfbrlsf-db.txt	14 kB (37 kB)	A text-only file containing an unformatted version of sfbrlsf-db.ps.
sfbr-sr-dbdesc.ps	92 kB (259)	A PostScript plotfile of the digital map-description pamphlet for Open-File Report 97-745 B, Shaded relief map of the San Francisco Bay Region, California.
sfbr-sr-dbdesc.txt	7 kB (17)	A text only file containing an unformatted version of sfbr-sr-dbdesc.ps
sfbr-sef-dbdesc.ps	132 kB (457)	A PostScript plotfile of the digital map-description pamphlet for Open-File Report 97-745 C, Summary distribution of slides and earth flows in the San Francisco Bay Region, California.
sfbr-sef-dbdesc. txt	9 kB (23)	A text only file containing an unformatted version of sfbr-sef-dbdesc.ps
sfbr-sef-fig1.ps	101 kB (351)	A PostScript plotfile of the figure included in sfbr-sef-dbdesc.ps, for those using the text-only version of the pamphlet.
sfbr-qi-dbdesc.ps	126 kB (393)	A PostScript plotfile of the digital map-description pamphlet for Open-File Report 97-745 D, Quadrangle index map and Index to detailed maps of landslides in the San Francisco Bay Region, California.
sfbr-qi-dbdesc.txt	19 kB (53)	A text only file containing an unformatted version of

		sfbr-qi-dbdesc.ps
sfbr-df-dbdesc.ps	29 kB (74)	A PostScript plotfile of the digital map-description pamphlet for Open-File Report 97-745 E, Map of debris-flow source areas in the San Francisco Bay Region, California.
sfbr-df-dbdesc.txt	7 kB (15)	A text only file containing an unformatted version of sfbr-df-dbdesc.ps
sfbr-rt-dbdesc.ps	541 kB (1.1 MB)	A PostScript plotfile of the digital map-description pamphlet for Open-File Report 97-745 F, Preliminary maps showing rainfall thresholds for debris-flow activity, San Francisco Bay Region, California.
sfbr-rt-dbdesc.txt	17 kB (41 kB)	A text only file containing an unformatted version of sfbr-rt-dbdesc.ps
import.aml	not gzip (1 kB)	ASCII text file in ARC Macro Language to convert ARC export files to ARC coverages in ARC/INFO.

II. POSTSCRIPT PLOTFILE PACKAGE

A second digital data package is also available, which contains the PostScript images described below:

PostScript plot file	Size of gzip compressed plot file (uncompressed)	Description of plotfile

OPEN-FILE REPORT 97-745 B, SHADED RELIEF MAP OF THE SAN FRANCISCO BAY REGION, CALIFORNIA

• By S.E. Graham and R.J. Pike

sfbr-sr.ps	33.9 MB (131)	Shaded relief map of the San Francisco Bay Region
al-sr.ps	6.4 MB (22.3)	Shaded relief map of Alameda County
cc-sr.ps	6.1 MB (20.8)	Contra Costa County
ma-sr.ps	4.4 MB (16.4)	Marin County
na-sr.ps	5.5 MB (17.8)	Napa County
scl-sr.ps	9.0 MB (27.4)	Santa Clara County
scr-sr.ps	4.3 MB (15.9)	Santa Cruz County
sf-sr.ps	1.6 MB (6.7)	San Francisco County
sm-sr.ps	4.2 MB (14.9)	San Mateo County
sol-sr.ps	4.9 MB (19.1)	Solano County
son-sr.ps	8.7 MB (31.1)	Sonoma County

OPEN-FILE REPORT 97-745 C SUMMARY DISTRIBUTION OF SLIDES AND EARTH FLOWS IN THE SAN FRANCISCO BAY REGION, CALIFORNIA

• By C.M. Wentworth, S.E. Graham, R.J. Pike, G.S. Beukelman, D.W. Ramsey, and A.D. Barron

sfbr-sef.ps	43.1 MB (369)	Slides and earth flows map of the San Francisco Bay Region

al-sef.ps	10.4 MB (52.0)	Slides and earth flows map of Alameda County
cc-sef.ps	9.0 MB (47.4)	Contra Costa County
ma-sef.ps	6.9 MB (40.5)	Marin County
na-sef.ps	9.8 MB (45.7)	Napa County
scl-sef.ps	13.6 MB (68.0)	Santa Clara County
scr-sef.ps	7.6 MB (38.9)	Santa Cruz County
sf-sef.ps	2.9 MB (14.6)	San Francisco County
sm-sef.ps	6.3 MB (36.6)	San Mateo County
sol-sef.ps	7.9 MB (48.1)	Solano County
son-sef.ps	13.9 MB (84.1)	Sonoma County

OPEN-FILE REPORT 97-745 D, INDEX TO DETAILED MAPS OF LANDSLIDES IN THE SAN FRANCISCO BAY REGION, CALIFORNIA

• By R.J. Pike

sfbr-qi.ps	29.6 MB (141)	Quadrangle index map of the San Francisco Bay Region

OPEN-FILE REPORT 97-745 E, MAP OF DEBRIS FLOW SOURCE AREAS IN THE SAN FRANCISCO BAY REGION, CALIFORNIA

• By S.D. Ellen, R.K. Mark, G.F. Wieczorek, C.M. Wentworth, D.W. Ramsey, and T.E. May

sfbr-df.ps	48.5 MB (456)	Debris flow sources map of the San Francisco Bay Region
al-df.ps	12.6 MB (72.7)	Debris flow sources map of Alameda County
cc-df.ps	11.2 MB (71.4)	Contra Costa County
ma-df.ps	9.1 MB (65.1)	Marin County
na-df.ps	11.9 MB (63.1)	Napa County
scl-df.ps	16.1 MB (86.3)	Santa Clara County
scr-df.ps	10.2 MB (66.3)	Santa Cruz County
sf-df.ps	3.7 MB (20.0)	San Francisco County
sm-df.ps	9.1 MB (65.4)	San Mateo County
sol-df.ps	10.1 MB (68.3)	Solano County
son-df.ps	16.2 MB (107)	Sonoma County

OPEN-FILE REPORT 97-745 F PRELIMINARY MAPS SHOWING RAINFALL THRESHOLDS FOR DEBRIS-FLOW ACTIVITY, SAN FRANCISCO BAY REGION, CALIFORNIA

• By R.C. Wilson and A.S. Jayko

sfbr-rt6.ps	2.7 MB (41.1)	Map of 6-hour rainfall thresholds for debris flows in the San Francisco Bay Region
sfbr-rt24.ps	2.9 MB (41.1)	Map of 24-hour rainfall thresholds for debris flows in the San Francisco Bay Region

Database Release Format

The databases in this Folio were compiled in ARC/INFO, a commercial Geographic Information System (Environmental Systems Research Institute, Redlands, California), with version 3.0 of the menu interface ALACARTE (Fitzgibbon and Wentworth, 1991, Fitzgibbon, 1991, Wentworth and Fitzgibbon, 1991). The files are in either GRID (ARC/INFO raster data) format or COVERAGE (ARC/INFO vector data) format. Coverages are stored in uncompressed ARC export format (ARC/INFO version 7.x). ARC/INFO export files (files with the .e00 extension) can be converted into ARC/INFO coverages in ARC/INFO (see below) and can be read by some other Geographic Information Systems, such as MapInfo via ArcLink and ESRI's ArcView (version 1.0 for Windows 3.1 to 3.11 is available for free from ESRI's web site: http://www.esri.com). Grids are stored in tar (UNIX tape archive) files containing both the grid and info directories used by ARC/INFO for each grid database. A tar utility is required to extract the database from the tar file. This utility is included in most UNIX systems, and can be obtained free of charge over the Internet from Internet Literacy's Common Internet File Formats Webpage (http://www.matisse.net/files/formats.html). The digital compilation was done in version 7.0.4 of ARC/INFO with version 3.0 of the menu interface ALACARTE (Fitzgibbon and Wentworth, 1991, Fitzgibbon, 1991, Wentworth and Fitzgibbon, 1991). The PostScript plotfiles for maps were produced by the 'postscript' command with compression set to zero in ARC/INFO version 7.0.4. The PostScript plotfiles for pamphlets were produced in Microsoft Word 6.0 using the Destination PostScript File option from the Print command. All data files have been compressed, and may be uncompressed with **gzip**, which is available free of charge over the Internet via links from the USGS Public Domain Software page (http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/public.html)

Obtaining the Digital Data

The digital data can be obtained in any of three ways:

a. From the Western Region Geologic Information Web Page.
b. Anonymous ftp over the Internet
c. Sending a tape with request

• To obtain the Export, Tar, PostScript, or Text files from the USGS Web Pages:

The U.S. Geological Survey now supports a set of graphical pages on the World Wide Web. Digital publications (including this one) can be accessed via these pages. The location of the main Web page for the entire USGS is

http://www.usgs.gov

The Web server for digital publications from the Western Region is

http://wrgis.wr.usgs.gov

Go to

http://wrgis.wr.usgs.gov/open-file/of97-745

to access this publication. Besides providing easy access to the entire digital database, the Western Region Web page also affords easy access to the PostScript plot files for those who do not use digital databases (see below).

• To obtain the Export, Tar, PostScript, or Text files by ftp:

The files in these reports are stored on the U.S. Geological Survey Western Region FTP server. The Internet ftp address of this server is:

ftp://wrgis.wr.usgs.gov

The user should log in with the user name 'anonymous' and then input their e-mail address as the password. This will give the user access to all the publications available via ftp from this server.

The files in this report are stored in the subdirectory:

pub/open-file/of97-745

• Export, Tar, PostScript, or Text files can be obtained by sending a tape with request and return address to:

San Francisco Bay Region Landslide Folio
c/o Database Coordinator
U.S. Geological Survey
345 Middlefield Road, M/S 975
Menlo Park, CA 94025

Do not omit any part of this address!

NOTE: Be sure to include with your request the exact names, as listed above, of the export files or plotfiles you require. An Open-File Report number is not sufficient, unless you are requesting all the database and pamphlet files for that report (as many as 35 files!).

The compressed tar file will be returned on the tape. The acceptable tape types are:

1/4 inch, 150 MB cartridge tape
2.3 or 5.0 GB, 8 mm Exabyte tape.

The files will be stored on the tape in a directory called ‘sfbrlsfol’ using the UNIX tar (tape archive) utility. A tar utility is required to extract the directory from the tape. This utility is included in most UNIX systems, or can be obtained free of charge for most types of computers via the Internet from Internet Literacy's Common Internet File Formats Web page:

http://www.matisse.net/files/formats.html

The extracted directory will contain the files you requested.

PostScript Plot Files

The database is in ARC EXPORT and GRID format, and therefore requires use of a GIS that can read or import those formats in order to access the information contained within it. For those who don't have access to such a system we have included a separate data package with PostScript plot files. Because this release is primarily a digital database, the plot files (and plots derived therefrom) have not been edited to conform to U.S. Geological Survey standards. Small units have not been labeled with leaders and in some instances map features or annotation overlap. Sample plots by the authors have proven to be quite legible and useful, however. These plot files are available in any of the three ways described above, including the World Wide Web pages.

The PostScript images of maps are 34 inches wide by 34 inches high, so they require a large plotter to produce paper copies at the intended scale. The PostScript files for the digital map description pamphlets are on 8.5 by 11 inch pages, printable by a standard PostScript compatible printer.

NOTE: All plot files have been compressed, and may be uncompressed, with **gzip**, which is available free of charge over the Internet via

http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/public.html

Obtaining Plots from a Commercial Vendor

Those interested in the San Francisco Bay Region Landslide Folio, but who use neither a computer nor the Internet, can still obtain the information. We will provide the PostScript plot files on digital tape (details below) for use by commercial vendors who can make large-format plots. Send a blank tape with request and return address to:

San Francisco Bay Region Landslide Folio
c/o Database Coordinator
U.S. Geological Survey
345 Middlefield Road, M/S 975
Menlo Park, CA 94025

Do not omit any part of this address!

NOTE: Be sure to include with your request the exact names, as listed in the Database Contents section above, of the plotfiles you require. An Open-File Report number and its letter alone are not sufficient, unless you are requesting all plotfiles for that report (as many as 11 plotfiles per report!).

The compressed tar file will be returned on the tape. The acceptable tape types are:

1/4 inch, 150 MB cartridge tape
2.3 or 5.0 GB, 8 mm Exabyte tape.

Make sure your vendor is capable of reading these tape types and PostScript plot files. Important information regarding tape file format is included in the section "PostScript Plot Files" above, so be certain to provide a copy of this document to your vendor.

Obtaining Plots from USGS Open-File Services

NOTE: As of this writing, plot-on-demand is **not available** from USGS. Although anticipated in the first quarter of 1998, this service may not begin until later in the year.

U.S. Geological Survey is planning to provide a plot-on-demand service for map files, such as those described in this report, through Open-File Services. In order to obtain plots, contact Open-File Services at:

USGS Information Services
Box 25286
Denver Federal Center
Denver, CO 80225-0046

(303) 202-4200
1-800-USA-MAPS

FAX: (303) 202-4695

e-mail: infoservices@usgs.gov

Be sure to include with your request the Open-File Report number **and** the exact names, as listed in the Database Contents section above, of the plotfiles you require. An Open-File Report number and its letter alone are not sufficient, unless you are requesting plots of all the plotfiles for that report (as many as 11 plotfiles!).

Converting ARC export files

ARC export files are converted to ARC coverages using the ARC command IMPORT with the option COVER. To ease conversion and maintain naming conventions, we have included an ASCII text file in ARC Macro Language that will convert all of the export files in the database into coverages and create the associated INFO directory. From the ARC command line type:

Arc: &run import.aml

ARC export files can also be read by some other Geographic Information Systems. Please consult your GIS documentation to see if you can use ARC export files and the procedure to import them.

References Cited

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Figure 1. Index map of the San Francisco Bay region