

CECW-EG Engineer Regulation 1110-2-103	Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000	ER 1110-1-103 10 December 1981
	Engineering and Design STRONG-MOTION INSTRUMENTS FOR RECORDING EARTHQUAKE MOTIONS ON DAMS	
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DAEN-CWE-SG

Regulation
No. 1110-2-103

10 December 1981

Engineering and Design
STRONG-MOTION INSTRUMENTS FOR RECORDING
EARTHQUAKE MOTIONS ON DAMS

1. Purpose. This regulation provides requirements and guidance for installation and servicing of strong-motion instruments for recording earthquake motions on Corps of Engineers (CE) dams.
2. Applicability. This regulation applies to all field operating activities having civil works responsibilities.
3. References.
 - a. EM 1110-2-1908 Chapter 3, Part 2 of 2.
 - b. EM 1110-2-4300, Chapter 7.
4. General. All dams in seismic risk zones 2, 3, and 4 of the Seismic Risk Maps (Appendix A) should be instrumented for strong-motion earthquake measurements. Guidance on details of instrumentation location and selection is given in references 3a and 3b. By interagency agreement, the Seismic Engineering Branch (SEB) of the US Geological Survey (USGS) is responsible for the installation and maintenance of approximately 200 accelerographs located at Corps dams in the western coast region and surrounding areas of the United States. Those instruments located in the central and eastern United States areas will be installed and serviced by the Waterways Experiment Station (WES). Some non-Corps instruments in custody of the USGS, located in the WES service region, will be serviced by WES on a one-for-one tradeoff basis with USGS. This arrangement is beneficial because travel costs for maintenance of CE instruments are minimized. In an effort to increase the reliability and overall effectiveness of the Strong-Motion Instrumentation Program (SMIP), it will be necessary, periodically, to modify and/or upgrade various instruments as maintenance records dictate and as technological advances are made. On an annual basis, WES will prepare an Engineer Circular which will serve as a status report for the CE SMIP. Included therein will be current estimated costs for the installation and servicing of instruments and a tabulation of strong-motion instrumentation, both operational and planned. Charges for those services may be adjusted annually on the basis of actual cost experience. Transfer of funding authority to WES should be made on an annual basis via Intra-Army Order for Reimbursable Services (DA Form 2544), with expiration date no sooner than 31 January of the next calendar year.

This regulation supersedes ER 1110-2-103, 9 Aug 74

Presently, service visits will be made on a biannual basis, and billings to the districts against this authority will be made in the same manner. New instruments purchased by the field should be coordinated with USGS in the western region and WES in the central and eastern regions before procurement is made (See Appendix B for service agency.). WES and USGS may request that the instruments be shipped to their respective offices for calibration or modification before installation.

5. WES Responsibilities. WES will be responsible for: (a) maintaining records of instrument servicing and location, (b) reviewing instrument locations and type to assure conformance with OCE policy, (c) processing and analyzing records that will be obtained, (d) furnishing copies of records obtained to the district concerned, (e) coordinating with USGS and the districts to establish schedules for inspection visits, (f) billing districts for services provided, (g) reimbursing USGS for expenses incurred, (h) providing instrumentation services personnel for installation and maintenance of CE instruments not serviced by USGS, (i) providing (by letter) an annual cost estimate to each district served, and (j) providing a draft of an annual Engineer Circular on the status of the program to CDR USACE (DAEN-CWE-SG) WASH DC 20314 for Corps wide distribution.

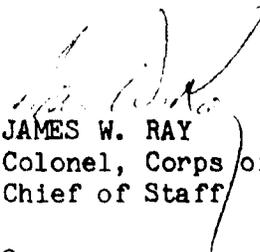
6. List of Seismic Instrument Installations. A tabulation of strong-motion instrumentation now operational or planned at CE projects is attached as Appendix B (revised March 1981). This list will be revised annually and published in the Engineer Circular discussed in paragraph 4. Districts should review the list and notify the WES (through their division) of any necessary corrections or additions. Copies of correspondence should be sent to CDR USACE (DAEN-CWE-SG) WASH DC 20314 for information.

7. Review of Instrument Plans. When a structure is selected for installation, WES should be furnished plans for reviews. These plans should include drawings showing instrument types, locations, and details of the instrument shelters and foundations. SEB, USGS, also should be furnished copies of the drawings showing instrument type and shelter details, for their review in those areas which they service. Information copies of correspondence should be furnished DAEN-CWE-SG.

8. Guidance for Design of Seismograph Installations. Guidelines for design of seismograph installations are contained in references 3a and 3b above, copies of which may be obtained from WES. Other details may be clarified by contacting the Commander and Director, US Army Engineer Waterways Experiment Station, ATTN: WESGH, P.O. Box 631, Vicksburg, MS 39180.

FOR THE COMMANDER:

2 Appendixes
APP A - Maps
APP B - Tabulation


JAMES W. RAY
Colonel, Corps of Engineers
Chief of Staff

I-V

APPENDIX A

ER 1110-2-103
10 Dec 81

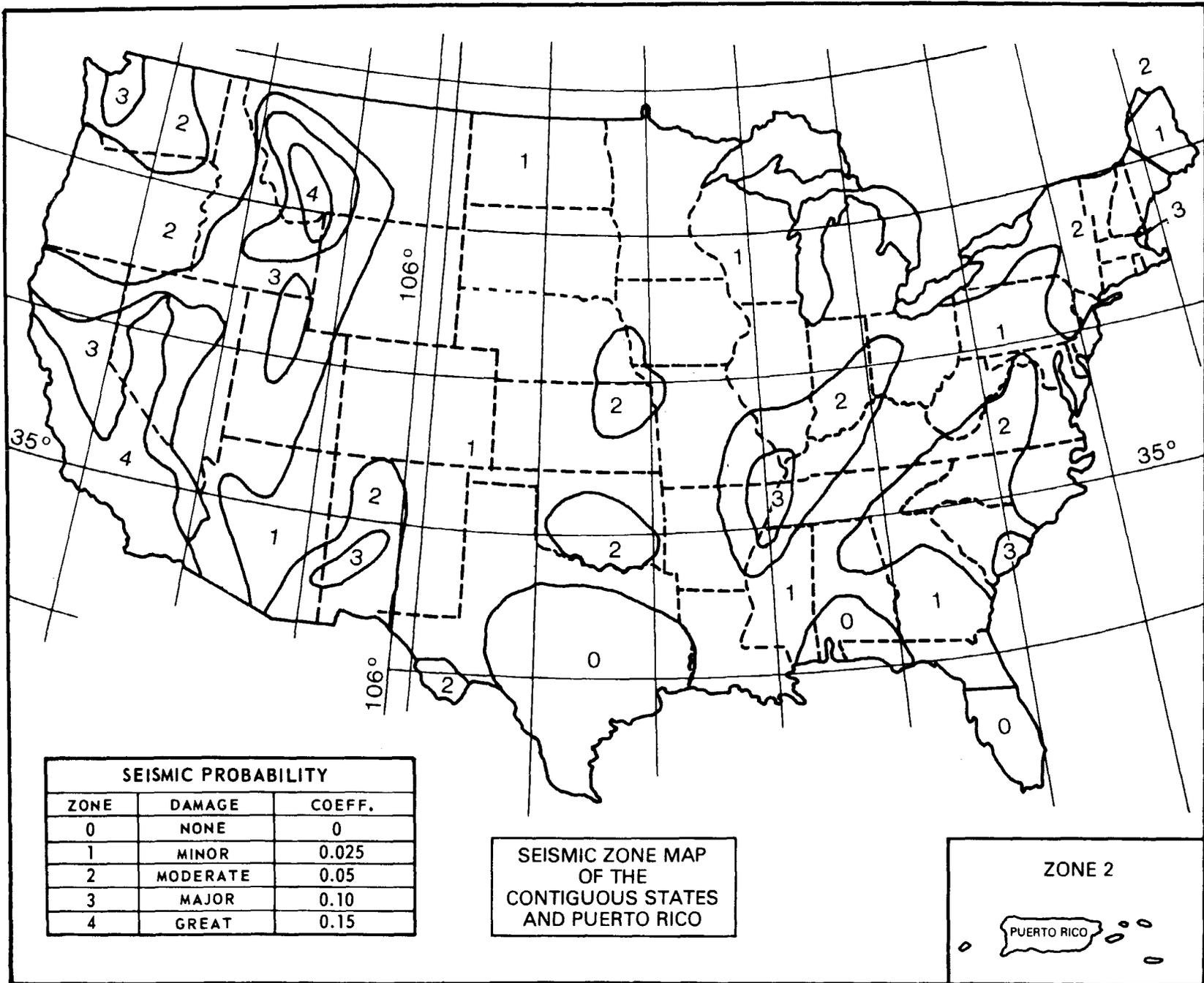


Figure A-1

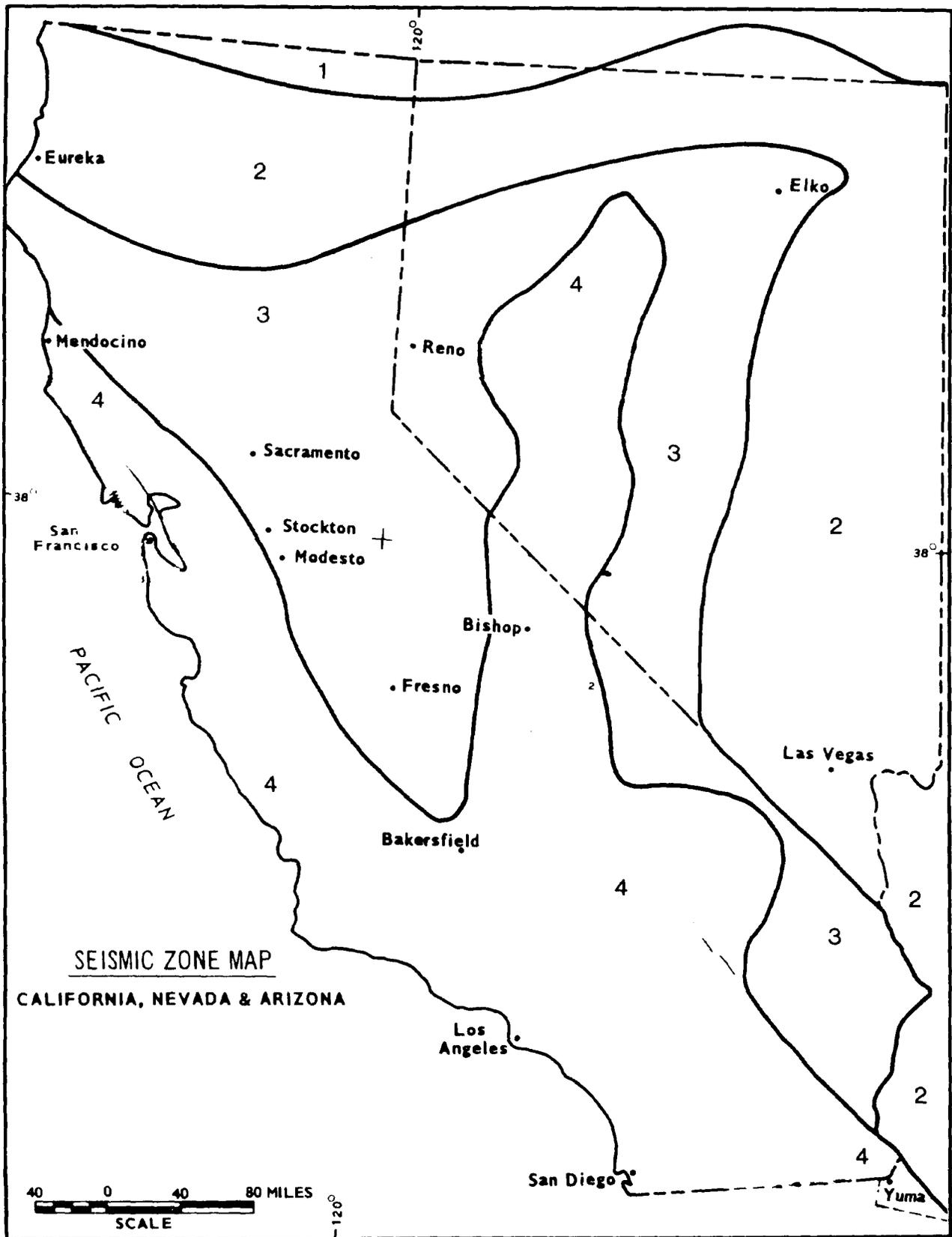


Figure A-2

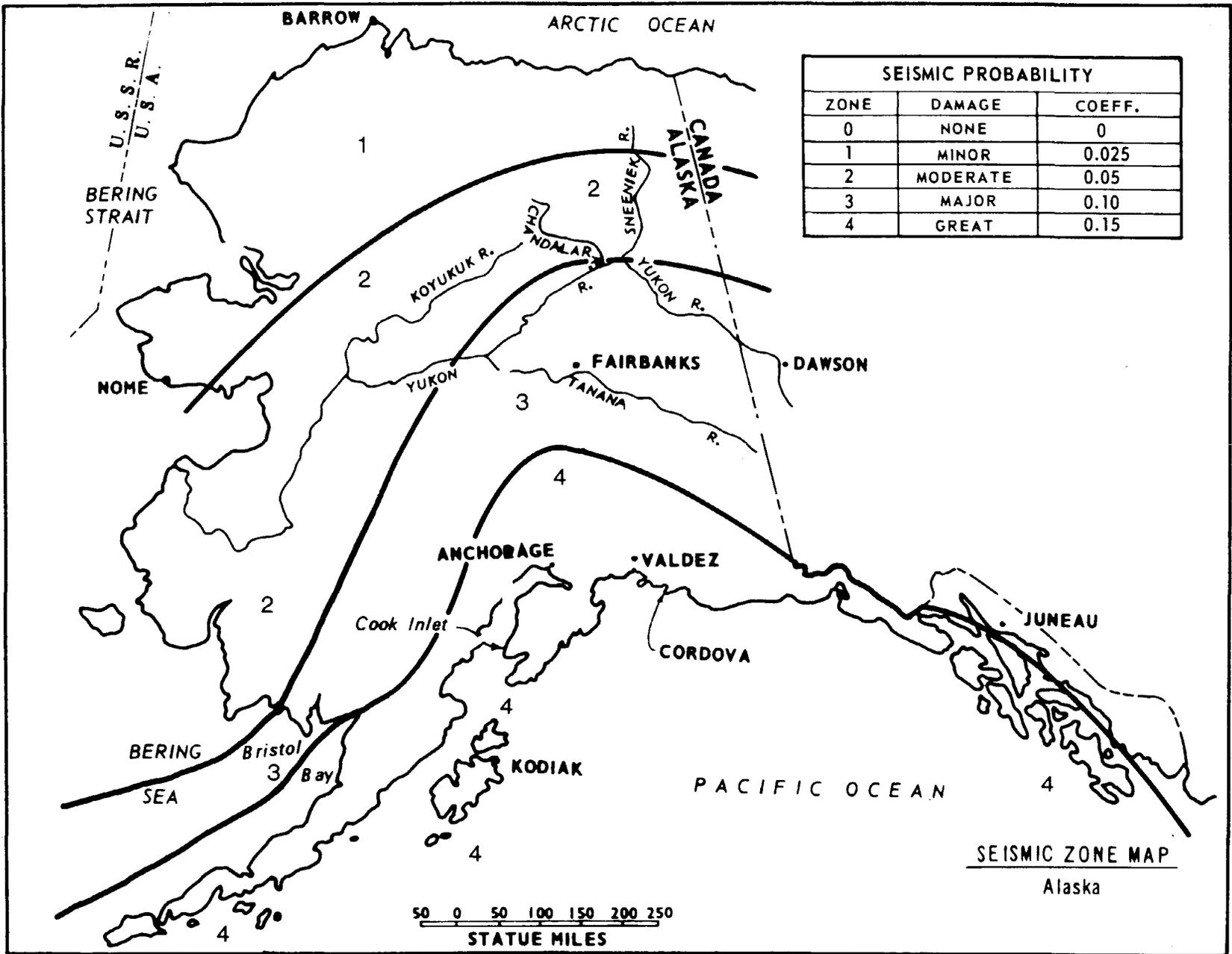
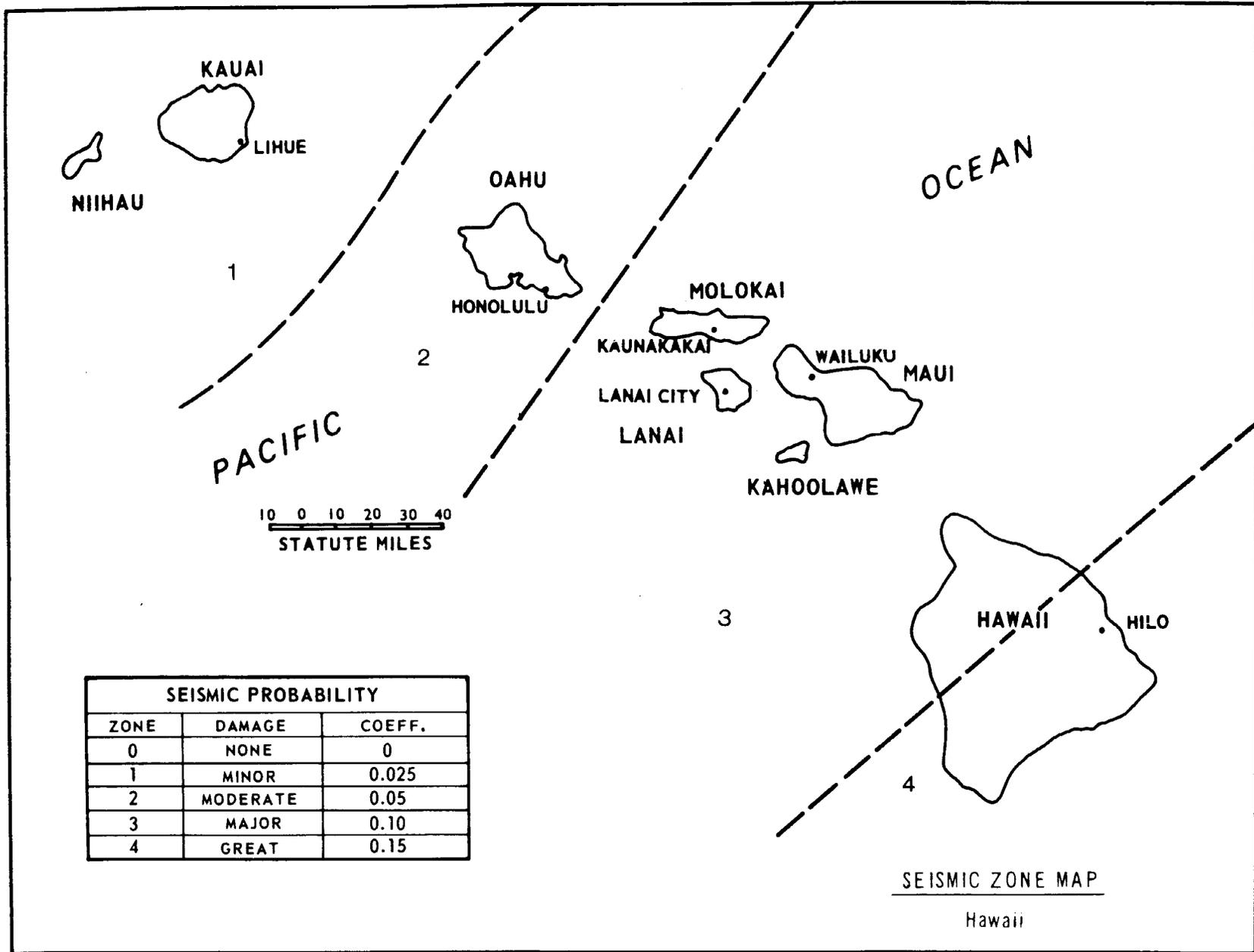


Figure A-3

A-3



A-4

Figure A-4

STRONG-MOTION INSTRUMENTATION AT CE PROJECTS OPERATIONAL OR PLANNED
AND TO BE SERVICED BY SEISMIC ENGINEERING

Division	District	Project	Type ⁽¹⁾	H (m)	State	Accelerographs		Seismoscopes		Peak Accel.		Serviced By	
						Operational	Planned	Oper.	Plan.	Oper.	Plan.	USGS	WES
NPD	Portland	Cougar	r.f.	136	OR	6-SMA-1	--	--	--	--	--	X	--
		Green Peter	c.	111	OR	2-AR-240	--	5	--	Damage	--	X	--
		Lookout Point	g.f.	83	OR	1-SMA-1	--	--	--	--	--	X	--
		Lost Creek	e.	104	OR	6-SMA-1	--	--	--	--	--	X	--
		Blue River	e. & r.	83	OR	6-RFT-350	--	--	--	--	--	X	--
		Detroit	e. & r.	83	OR	5-SMA-1	--	--	--	--	--	X	--
		Hills Creek	c.	138	OR	3-SMA-1	--	--	--	--	--	X	--
		Bonneville	e. & g.	103	OR	3-SMA-1	--	--	--	--	--	X	--
		Applegate	gr.	60	OR	1-RFT-350	1	--	--	--	--	X	--
	Seattle	Libby	gr.	136	MT	4-RFT-250 ⁽²⁾	--	--	--	--	--	X	--
		Chief Joseph	c.	70	WA	3-SMA-1*	--	--	--	--	--	X	--
		Howard Hanson	r.f.	235	WA	2 ⁽³⁾ ; 3-SMA-1	--	--	--	--	--	X	--
		Mud Mountain	e.	130	WA	3-SMA-1	--	--	--	--	--	X	--
		Wynoochee	c.	55	WA	3-SMA-1	--	--	--	--	--	X	--
	Walla	Dworshak	c.	219	ID	4-SMA-1	--	--	--	--	6	X	--
		Lower Granite	e. & gr.	78	WA	5-SMA-1	--	--	--	--	5	X	--
		Lucky Peak	e.	104	ID	4-SMA-1	--	--	--	--	--	X	--
Alaska	Moose Creek	r.f.	40	AK	1-SMA-1	--	--	--	--	--	X	--	
SPD	Los Angeles	Alamo	e.	86	AZ	2-RFT-250	1	2	--	--	--	X	--
		Brea	e.	27	CA	3-SMA-1	--	--	--	--	--	X	--
		Carbon Canyon	e.	30	CA	3-SMA-1	--	--	--	--	--	X	--
		Mojave	e.	61	CA	4-SMA-1**	--	--	--	--	--	X	--
		Prado	e.	37	CA	3-SMA-1	--	--	--	--	--	X	--
		Salinas	c.	41	CA	1-SMA-1	--	--	--	--	--	X	--
		San Antonio	e.	49	CA	3-SMA-1	--	--	--	--	--	X	--
		Sepulvada	e.	17	CA	2-RFT-250	--	--	--	--	--	X	--
		Whittier Narrows	e.	17	CA	2-SMA-1	--	--	--	--	--	X	--

* Two SMA-1 accelerographs were temporarily disconnected because of their proximity to a construction site.

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** Power Supply became a severe problem; had to abandon this project.

(1) e. = earth, c. = concrete, r.f. = rock-fill, g.f. = gravel fill, e. & r. = earth and rock, e. & g = earth and gravel, gr. = gravity, and e.f. = earth fill.

(2) Installed by District personnel but to be serviced by USGS beginning FY 76.

(3) Tape recorded units, not serviced by USGS.

Figure B-1

B-1

APPENDIX B

10 Dec 81

Division	District	Project	Type ⁽¹⁾	H (m)	State	Accelerographs		Seismoscopes		Peak Accel.		Serviced By	
						Operational	Planned	Oper.	Plan.	Oper.	Plan.	USGS	WES
SPD	Los Angeles	Mathews Canyon			NV	--	3-SMA-1	--	--	--	--	--	--
		Painted Rock			AZ	--	3-SMA-1	--	--	--	--	--	--
		Pine Canyon			NV	--	3-SMA-1	--	--	--	--	--	--
		Tat Momolikot			AZ	--	3-SMA-1	--	--	--	--	--	--
		Whitlow Ranch			AZ	--	3-SMA-1	--	--	--	--	--	--
	Sacramento	Black Butte	e.	43	CA	2-RFT-250	3	2	--	--	--	X	--
						2-RFT-350	--	--	--	--	--	X	--
		Isabella	e.	56	CA	5-RFT-250	6	5	--	--	--	X	--
						1-RFT-350	--	--	--	--	--	X	--
		Martis Creek	e.f.	35	CA	5-SMA-1	2	--	--	--	--	X	--
		New Hogan	e. & r.	64	CA	2-RFT-250	3	2	--	--	--	X	--
						1-RFT-350	--	--	--	--	--	X	--
		Pine Flat	c.	134	CA	3-RFT-250	--	2	--	--	--	X	--
						1-RFT-350	--	--	--	--	--	X	--
		Terminus	e.	76	CA	3-RFT-250	3	3	--	--	--	X	--
				1-RFT-350	--	--	--	--	--	X	--		
Buchanan	r.f.	205	CA	4-SMA-1	3	--	--	--	--	X	--		
Hidden	e.	163	CA	2-SMA-1	5	--	--	--	--	X	--		
New Melones Lake			CA	5-SMA-1	1-SMA-1	--	--	--	--	X	--		
Success	e.	43	CA	6-SMA-1	--	--	--	--	--	X	--		
San Francisco	Coyote	e.	50	CA	3-RFT-250	--	--	--	--	--	X	--	
	Warm Springs	e.	97	CA	3-SMA-1	--	--	3	--	--	X	--	
MRD	Kansas City	Tuttle Creek	e.	47	KS	5-SMA-1	--	--	--	--	--	--	X
		Milford Dam	e. & r.f.	43	KS	5-SMA-1	--	--	--	--	--	--	X
		Truman Dam	e.	40	MO	2-SMA-1	--	--	--	--	--	--	X
		Harlan County	e. & gr.	32	NE	2-SMA-1	--	--	--	--	--	--	X
		Kanopolis	r.f.	39	MO	2-SMA-1	--	--	--	--	--	--	X
	Omaha	Fort Peck Dam	e.	76	MT	3-SMA-1	1-SMA-1	--	--	--	--	X	--
		Garrison Dam	e.g.	62	ND	3-SMA-1	--	--	--	--	--	X	--
		Oahe Dam	e.	75	SD	3-SMA-1	--	--	--	--	--	X	--
		Big Bend Dam	e.	29	SD	3-SMA-1	--	--	--	--	--	X	--
		Fort Randall		50	SD	3-SMA-1	--	--	--	--	--	X	--
Gavins Point Dam	e.	23	NE	3-SMA-1	--	--	--	--	--	X	--		
Cherry Creek Dam	e.	58	CO	3-SMA-1	--	--	--	--	--	X	--		
Chatfield Dam	e.	45	CO	5-SMA-1	--	--	--	--	--	X	--		
Bear Creek Dam	e.	17	CO	3-SMA-1	--	--	--	--	--	X	--		
SWD	Albuquerque	Cochiti	e.	77	NM	7-SMA-1	--	8	--	--	X	--	
	Little Rock	Norfolk	c.	71	AR	2-SMA-1	--	--	--	--	--	X	
	Tulsa	Kaw Dam	e.	37	OK	2-SMA-1	--	--	--	--	--	X	
NCD	Buffalo	Mt. Morris	gr.	75	NY	3-SMA-1	--	2	--	--	--	X	

B-2

Figure B-1 - continued.

B-3

Division	District	Project	Type ⁽¹⁾	H (m)	State	Accelerographs		Seismoscopes		Peak Accel.		Serviced By		
						Operational	Planned	Oper.	Plan.	Oper.	Plan.	USGS	WES	
LMVD	Memphis	Wappapello	e.	33	MO	3-SMA-1	--	6	--	--	--	X	--	
	St. Louis	Rend Lake	e.	17	IL	3-SMA-1	--	6	--	--	--	X	--	
	Vicksburg	Arkabutla	Sardis	e.	29	MS	3-SMA-1	--	6	--	--	--	--	X
Sardis			e.	35	MS	3-SMA-1	--	5	--	--	--	--	X	
ORD	Pittsburgh	Kinzua	e. & gr.	55	PA	3-SMA-1	--	--	--	--	--	--	X	
		Tionesta	e.	47	PA	1-SMA-1	--	--	--	--	--	--	X	
		East Branch	e.	56	PA	1-SMA-1	--	--	--	--	--	--	X	
		Michael J. Kirwan	e.	25	OH	1-SMA-1	--	--	--	--	--	--	X	
		R. D. Bailey			WV	--	4-SMA-1	--	--	--	1	--	--	
		Bluestone			WV	--	1-SMA-1	--	--	--	--	--	--	
		J. W. Flannagan			VA	--	5-SMA-1	--	--	--	--	--	--	
	Louisville	Brookville	e. & r.f.	55	IN	3-SMA-1	--	--	--	1	--	--	--	X
		Cagles Mill	e.	45	IN	2-RFT-350	1-RFT-350	--	--	1	--	--	--	X
		Cannelton L&D		47	IN	2-SMA-1	--	--	--	1	--	--	--	X
		Monroe	e. & r.f.	28	IN	3-RFT-350	--	--	--	1	--	--	--	X
		Newburgh L&D			IN	2-SMA-1	--	--	--	1	--	--	--	X
		Patoka			IN	2-RFT-350	--	--	--	1	--	--	--	X
		Uniontown L&D			IN	2-SMA-1	--	--	--	1	--	--	--	X
		Nolin River	e. & r.f.	50	KY	3-SMA-1	--	--	--	1	--	--	--	X
	Nashville	Rough River	e. & r.f.	45	KY	3-SMA-1	--	--	--	1	--	--	--	X
		Smithland L&D			IL	5-RFT-350	--	2	--	1	1	--	--	X
Wolf Creek		e. & c.	79	KY	5-SMA-1*	--	2	--	1	--	--	--	X	
Center Hill		e. & c.	76	TN	5-SMA-1	--	2	--	1	--	--	--	X	
Barkley		e. & gr.	48	KY	6-SMA-1	--	2	--	1	--	--	--	X	
NED	J. Percy Priest	e. & c.	40	TN	5-SMA-1**	--	2	--	1	--	--	--	X	
	Dale Hollow	gr.	61	TN	4-SMA-1	--	2	--	1	--	--	--	X	
	Laurel River	r.f.	86	KY	2-SMA-1	1	--	--	1	--	--	--	X	
	Martin's Fork			KY	4-SMA-1	--	--	--	2	--	--	--	X	
	Ball Mt. Lake	e. & r.	81	VT	3-SMA-1	--	--	--	1	--	--	--	X	
	Colebrook R. Lake	e.	66	CT	--	2-RFT-350	--	--	--	--	--	--	--	
	Littleville Lake	e.	51	MA	3-RFT-350	--	--	--	--	--	--	--	X	
Franklin Falls	e.	54	NH	3-RFT-350	--	--	--	--	--	--	--	X		
Union Village	e.	54	VT	3-SMA-1	--	--	--	--	--	--	--	X		
Everett	e.	43	NH	3-SMA-1	--	--	--	--	--	--	--	X		
Hodges Village	e.	18	MA	3-SMA-1	--	--	--	--	--	--	--	X		
Knightville	e.	18	MA	3-SMA-1	--	--	--	--	--	--	--	X		
Surry Mt.	e.	28	NH	3-SMA-1	--	--	--	--	--	--	--	X		
N. Hartland	e.	38	VT	2-SMA-1	1-SMA-1	--	--	--	--	--	--	--	X	
N. Springfield	e.	58	VT	3-SMA-1	--	--	--	--	--	--	--	--	X	
Townsend Lake	e.	42	VT	3-SMA-1	--	--	--	--	--	--	--	--	X	

* One SMA was temporarily disconnected because of its proximity to a construction site.

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** One SMA was damaged beyond repair by explosion and flooding.

Figure B-1 - continued.

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Division	District	Project	Type ⁽¹⁾	H (m)	State	Accelerographs		Seismoscopes		Peak Accel.		Serviced By		
						Operational	Planned	Oper.	Plan.	Oper.	Plan.	USGS	WES	
NAD	Baltimore	Arkport	e.	36	NY	--	2	--	--	--	2	--	--	
	New York	Waterbury	e.	48	VT	--	3	--	--	--	1	--	--	
		Wrightsville	e.		VT	--	3	--	--	--	1	--	--	
	Norfolk	Gathright	r.f.	78	VA	4-RFT-350	--	2	--	--	--	--	X	
SAD	Jacksonville	Buckman Lock			FL	1-SMA-1	--	--	--	--	--	--	X	
		Corrillos			PR	1-SMA-1	--	--	--	--	--	X	--	
Mobile	Allatoona	Arch-gr.		66	GA	3-SMA-1	--	--	--	--	--	--	X	
	Buford	e.		70	GA	2-SMA-1	--	--	--	--	--	--	X	
	Walter F. George	e. & gr.		45	GA	1-SMA-1	--	--	--	--	--	--	X	
	Coffeeville	e. & gr.		27	AL	1-SMA-1	--	--	--	--	1	--	X	
	Carters	e. & r.f.		138	GA	3-SMA-1	--	--	--	--	--	--	X	
	Savannah	Clark Hill	c. & e.		61	GA	6-SMA-1	--	2	--	2	--	--	X
		Hartwell	c. & e.		73	GA	4-SMA-1	--	1	--	2	--	--	X
R. B. Russell		c. & e.		73	SC	1-RFT-350 1-RFT-350	--	1	--	2	--	--	X	
Wilmington	John H. Kerr				VA	--	5	--	--	--	--	--	X	
	Philpott				VA	--	2	--	--	--	--	--	X	
	W. Kerr Scott	e.		45	SC	3-RFT-350	--	2	--	1	--	--	X	

B-4

Figure B-1 - continued.