EVALUATION OF STREAMS IN SELECTED COMMUNITIES FOR THE APPLICATION OF LIMITED-DETAIL STUDY METHODS FOR FLOOD-INSURANCE STUDIES

U.S. GEOLOGICAL SURVEY

Water-Resources Investigation Report 85-4098

Prepared in cooperation with the
U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY

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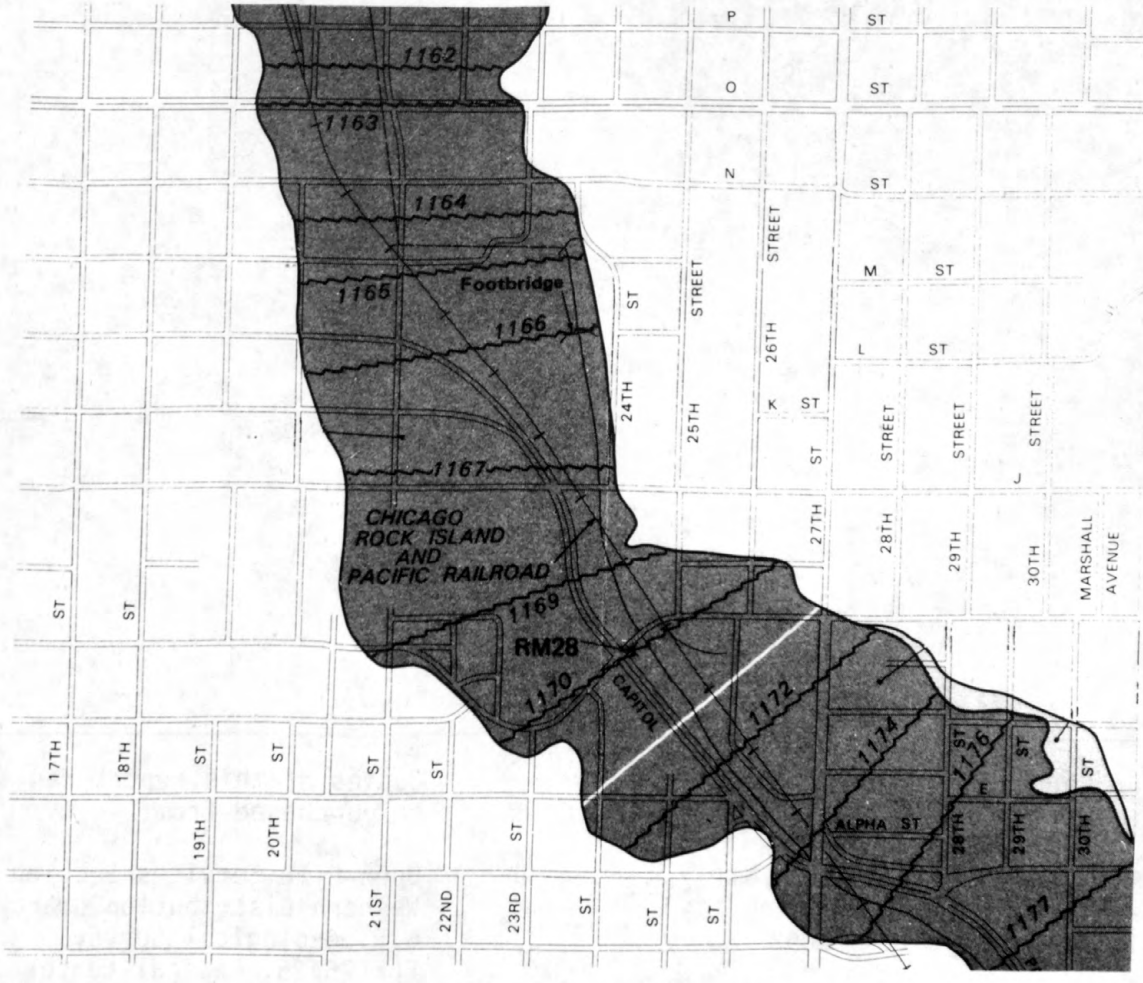

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UNITED STATES DEPARTMENT OF THE INTERIOR

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by Ernest D. Cobb

ABSTRACT

The U.S. Geological Survey evaluated streams in 2,349 communities during March through September 1984 for the application of limited-detail flood-insurance study methods; that is, methods that require less effort and cost than detailed studies. Limited-detail study methods were found to be appropriate for streams in 1,705 communities, while detailed studies were appropriate in 62 communities and no studies were appropriate for streams in 582 communities. The total length of streams for which limited-detail studies are recommended is 9,327 miles with a corresponding cost of $23,007,000. This results in average estimated costs for conducting limited-detail studies of $2,500 per mile of studied stream length. The purpose of this report is to document the limited-detail study methods and the results of the evaluation.

INTRODUCTION

The Federal Emergency Management Agency (FEMA) indicated a need to conduct flood-insurance studies using limited-detail study (LDS) methods in order to substantially reduce the cost below those for detailed studies. This need was based on the fact that the communities remaining to be studied by FEMA for purposes of the National Flood Insurance program contained, in general, lower flood-plain development than those communities that had already been studied and would, therefore, not warrant the expenditures of funding associated with traditional full-detail studies. Discussions between the Geological Survey and FEMA began on November 30, 1983, on the evaluation of streams in selected communities for the application of LDS methods. On the basis of a letter of intent by FEMA dated February 7, 1984, and a formal inter-agency agreement (EMW-84-E-1649) dated March 26, 1984, the Geological Survey agreed to evaluate streams in 2,349 communities nationwide (see fig. 1). These communities were identified by FEMA's Regional offices in 1983 as needing a study. The purpose of this document is to present the approach used and the results of the evaluations.

APPROACH

Lists of communities in which streams were to be evaluated, along with guidelines to be followed in the evaluation, were sent to the appropriate Geological Survey District Offices in February 1984. An interim report was provided to FEMA on May 11, 1984, for streams in 752 communities, or 32 percent of the communities for which evaluations were made. A second interim report was provided to FEMA for streams in a total of 1,800 communities, or 77 percent of the communities for which evaluations were made, on July 31, 1984. This report provides information for streams evaluated in all 2,349 communities.

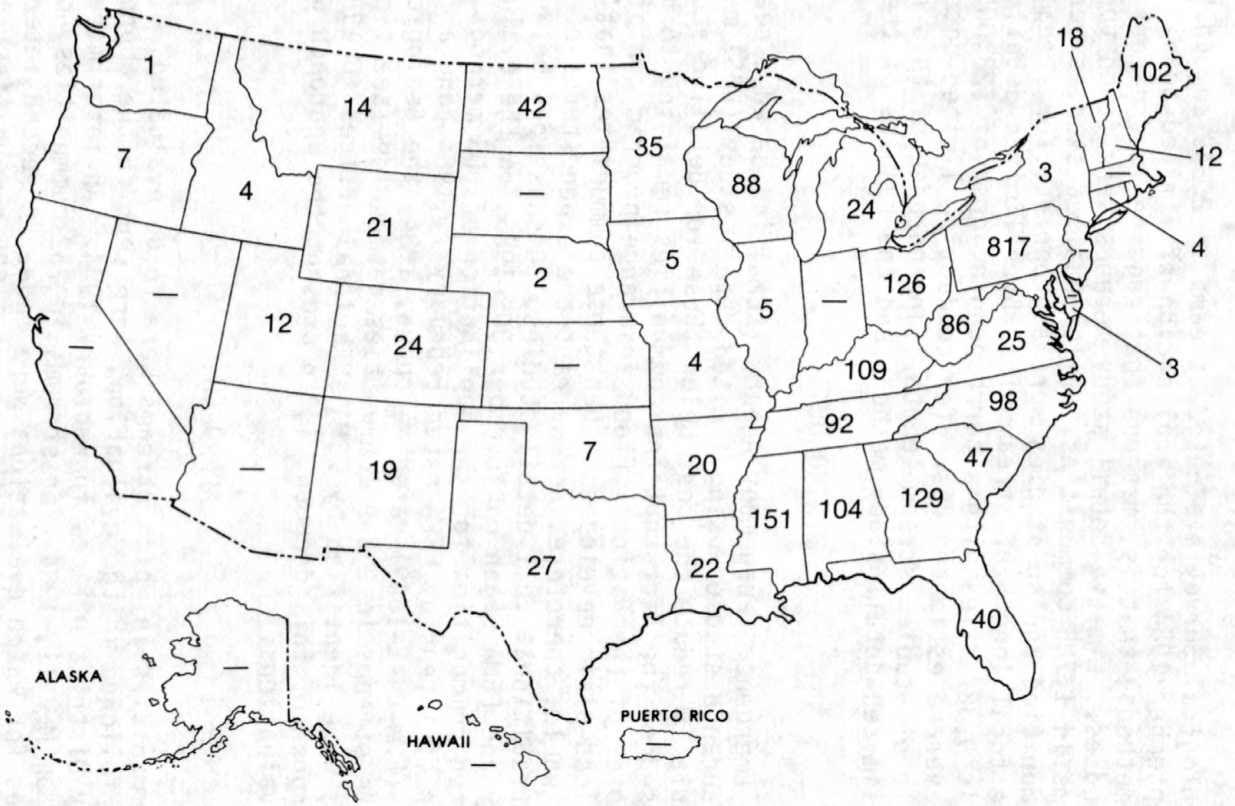

Figure 1. — Number of communities, by State, for which streams were evaluated.

The Geological Survey Districts determined for each community, the stream reaches in the community for which LDS methods could be applied, and the approximate cost of application. Much of the evaluations were made based on information from maps, knowledge of the area, and other information readily available. Some communities were visited, as needed, to provide information not obtained by other means.

Appendix A provides a summary of communities, by State, where evaluations were made. Following is an explanation of the information shown on the evaluation summaries.

Communities were categorized as follows:

Community Type	Description
1	Villages, boroughs, towns, and cities
2	Townships
3	Parishes and counties

The number of each type of community where streams were evaluated is shown, by State, in the appendix.

Evaluation information is shown for different LDS methods. The LDS codes and their description follows.

LDS Code	Description
S	Simplified Step-Backwater Method.

This method is closest to the method commonly used in the detailed flood-insurance studies. Cross sections are spaced further apart where possible, few or no sections are obtained for profile convergence purposes, cross sections are interpolated where the channel is fairly uniform or gradually converging or diverging, and bridge and culvert configurations are superimposed on valley cross sections where the valley section is fairly uniform through the bridge or culvert area. Slope-conveyance methods are often used to estimate starting elevations for the simplified step-backwater method.

H Historical Floods Method.

This method utilizes available historical flood information. Information may be available in reports or on maps that have been prepared for major floods, from high-water marks, from gaging station data, or from miscellaneous discharge measurements made in the study area. Historical flood information may often be found in Geological Survey flood or data reports or in Geological Survey files. The information may also be available in reports or files of other agencies. In all cases the information must be evaluated for accuracy and applicability to the present conditions.

LDS Code	Description

Historical information may be used directly if it approximates a 100-year flood. Otherwise, the 100-year flood profile will have to be determined by interpolation or extrapolation. Sometimes historical information is not adequate in itself to define a 100-year flood profile. In this situation, the historical information may be used with another method and may be of value in defining water-surface slope and roughness coefficients.

C Slope-Conveyance Method.

This method is similar to the simplified step-backwater method. A primary difference is that the energy gradients are not balanced. This method is used on long, fairly uniform reaches, at the start of a simplified step-backwater study reach, or with historical information.

One of the problems with this method is the estimation of the energy slope. This can be estimated with information from high-water marks, historical data, discharge measurements, or, generally as a last resort, from topographic maps.

D Depth-Frequency Method.

This method was generally only recommended for the community evaluations for areas where a depth-frequency study had already been made. Most depth-frequency studies determine the depth of the 100-year flood above the elevation of the 50-percent flow duration. These depths are then regionalized based on physiographic or other characteristics.

The depth-frequency method is not applicable at bridges, contractions, in areas of backwater from downstream obstructions, or in channels modified by man's activities. The method should be used only in channels that are similar to those used in the depth-frequency study. For example, if the study was made using information only from alluvial channels, the method should not be applied to channels in rocky, mountainous areas.

The base profile used for application of the depth-frequency method can usually be established by surveying a low-water profile through the study reach. This profile will approximate the water-level elevation of the 50-percent duration flow. A rough approximation of the base profile can be obtained from a topographic map if the contours are fairly close together. The contours at stream crossings generally represent low-flow elevations.

R Reservoirs Method.

There are two approaches using this LDS method. The first is used where 100-year flood elevations are needed in the reservoir area. In this approach, a rating is determined for

LDS Code	Description

the outlet from the reservoir. The stage for the 100-year flood peak is then determined and that stage is used to define the 100-year flood elevation around the reservoir. It is assumed in this case that reservoir storage is small and has little affect on the 100-year flood peak. The method is not applicable where this assumption is significantly violated.

The second approach is used where 100-year flood stages are needed downstream from a reservoir. Flows must be routed through the reservoir and the 100-year flow downstream from the reservoir determined. This method is not used as an LDS method downstream from large complex reservoirs.

O Information from Other Studies.

Information is obtained from other studies. This may be information resulting from model or other types of studies. The information must be evaluated for its adequacy and applicability to current conditions. If the profile from this other information cannot be tied to a datum, it may still be of value for estimating water-surface slopes and roughness coefficients.

T Tidal-Flooding Method.

This method is only used in coastal areas that are protected from significant wave action. The method uses 100-year tide information provided by other agencies such as the National Oceanic and Atmospheric Administration. That elevation is then applied to maps. This method was recommended only in two States in the community evaluations.

P Profile-Interpolation Method.

This method is used to interpolate the 100-year profile between stream segments where the 100-year profile is already defined. This method is applicable generally only for short stream segments, the length depending on the uniformity of the channel and channel slopes.

In addition, combinations of methods are recommended for many stream reaches. For example, historic information might be recommended for use with a slope-conveyance method to define the 100-year water-surface profile.

RESULTS

Evaluations of streams in all 2,349 communities are summarized in this report. Table 1 lists, by State, the number of communities for which streams were evaluated and the number of communities for which streams were recommended for limited-detail study, detailed study, or no study. Recommendations were made to conduct detailed studies on streams in communities that involved

complex hydrologic or hydraulic problems. Recommendations that streams in a community did not need a study were based on the lack of adequate sized streams in the community or that the community was located above the area of inundation. Table 2 provides a summary, by State, of the total miles of streams that can be studied using LDS methods and the total cost of applying the methods.

The total length of streams for which LDS methods are recommended is 9,327 miles with a corresponding cost of $23,007,000. This results in an average cost of $2,500 per mile of studied stream length. Table 3 provides a summary, by State, of the miles of streams for which selected LDS methods are recommended.

Figures 2 and 3 show the average stream miles and associated costs for studies on streams in communities for which LDS methods are recommended. The variation in average costs is a reflection of the average miles of stream in each community to be studied, the recommended LDS, and the difficulty of conducting studies in a particular State.

SUMMARY

This report provides a summary of the results of an evaluation of streams in 2,349 communities for the application of LDS methods. Of the 2,349 communities, streams in 1,705 communities are suitable for the application of LDS methods, streams in 62 communities should have detailed studies, and streams in 582 communities need no study. Estimates of total length of streams for which LDS methods are recommended are 9,327 miles with a corresponding cost for LDS method application of $23,007,000.

Table 1.--Number of communities, by State, for which streams were evaluated, and recommended actions

State	Total number evaluated	Number of communities with streams recommended for:		
		Limited-detail studies	Detailed studies	No study
Alabama	104	66	0	38
Arkansas	20	19	1	0
Colorado	24	16	1	7
Connecticut	4	4	0	0
Florida	40	27	0	13
Georgia	129	87	0	42
Idaho	4	3	0	1
Illinois	5	4	0	1
Iowa	5	4	1	0
Kentucky	109	83	3	23
Louisiana	22	8	2	12
Maine[1/]	102	59	34	9
Maryland	3	3	0	0
Michigan	24	9	10	5
Minnesota	35	9	1	25
Mississippi	151	101	0	50
Missouri	4	4	0	0
Montana	14	10	0	4
Nebraska	2	2	0	0
New Hampshire	12	12	0	0
New Mexico	19	8	7	4
New York	3	3	0	0
North Carolina	98	58	0	40
North Dakota	42	21	0	21
Ohio	126	109	0	17
Oklahoma	7	6	0	1
Oregon	7	1	0	6
Pennsylvania	817	657	0	160
South Carolina	47	28	0	19
Tennessee	92	52	2	38
Texas	27	11	0	16
Utah	12	12	0	0
Vermont	18	14	0	4
Virginia	25	21	0	4
Washington	1	0	0	1
West Virginia	86	82	0	4
Wisconsin	88	74	0	14
Wyoming	21	18	0	3
	2,349	1,705	62	582

1/ A storm surge analysis is needed for areas in 34 coastal communities in Maine. Limited-detail studies can be applied to some riverine parts of five of these communities.

Table 2.--Summary, by State, of miles of streams and cost for limited-detail studies

State	Miles	Cost (thousands of dollars)
Alabama	258	785
Arkansas	264	442
Colorado	31	251
Connecticut	40	45
Florida	127	790
Georgia	535	1,162
Idaho	70	181
Illinois	6	10
Iowa	207	29
Kentucky	621	2,383
Louisiana	31	230
Maine	892	725
Maryland	4	18
Michigan	35	47
Minnesota	129	210
Mississippi	265	1,078
Missouri	13	60
Montana	66	150
Nebraska	100	79
New Hampshire	248	235
New Mexico	32	148
New York	23	70
North Carolina	135	333
North Dakota	64	226
Ohio	438	1,933
Oklahoma	44	126
Oregon	14	18
Pennsylvania	1,920	4,061
South Carolina	101	283
Tennessee	198	488
Texas	36	71
Utah	715	1,715
Vermont	205	249
Virginia	181	656
Washington	0	0
West Virginia	789	2,737
Wisconsin	374	589
Wyoming	116	394
Totals	9,327	$23,007

Table 3.--Summary, by State, of evaluated miles of streams for the application of limited-detail study methods

State	Limited-detail study method[1]									
	S	H	C	D	R	O	T	P	S+H	S+C
Alabama	137	34	8	18	-	-	-	-	14	4
Arkansas	173	86	1	-	-	-	-	-	-	4
Colorado	31	-	-	-	-	-	-	-	-	-
Connecticut	10	-	-	30	-	-	-	-	-	-
Florida	29	13	1	7	-	-	3	-	69	-
Georgia	448	16	-	25	-	-	-	-	41	5
Idaho	70	-	-	-	-	-	-	-	-	-
Illinois	-	-	1	3	2	-	-	-	-	-
Iowa	3	-	-	204	-	-	-	-	-	-
Kentucky	324	226	-	-	-	-	-	-	54	-
Louisiana	14	3	2	-	-	-	-	-	-	11
Maine	32	317	-	-	65	50	-	-	28	-
Maryland[2]	2	-	-	2	-	-	-	-	-	-
Michigan	2	32	-	2	-	-	-	-	-	-
Minnesota	18	20	-	-	57	-	-	-	34	-
Mississippi	112	45	91	18	-	-	-	-	-	-
Missouri	7	3	2	-	-	-	-	-	-	-
Montana	46	8	-	2	-	9	-	-	-	-
Nebraska	8	92	-	-	-	-	-	-	-	-
New Hampshire	-	17	-	40	-	-	-	-	87	-
New Mexico	32	-	-	-	-	-	-	-	-	-
New York	-	-	-	-	-	-	-	-	-	-
North Carolina	27	2	-	65	-	-	-	-	-	-
North Dakota	64	-	-	-	-	-	-	-	-	-
Ohio	308	86	-	1	8	10	-	-	24	1
Oklahoma	16	-	-	28	-	-	-	-	-	-
Oregon	14	-	-	-	-	-	-	-	-	-
Pennsylvania	117	1	-	414	-	-	-	94	-	2
South Carolina	87	5	-	-	4	5	-	-	-	-
Tennessee	148	22	-	4	-	-	-	-	13	-
Texas	31	4	-	-	-	-	-	-	-	-
Utah	715	-	-	-	-	-	-	-	-	-
Vermont	47	34	-	-	-	-	-	-	25	-
Virginia	100	8	-	24	-	-	49	-	-	-
Washington	-	-	-	-	-	-	-	-	-	-
West Virginia	333	29	-	163	-	240	-	-	4	-
Wisconsin	75	4	2	-	-	1	-	-	10	5
Wyoming	116	-	-	-	-	-	-	-	-	-
Totals	3,696	1,107	108	1,050	136	315	52	94	403	32
Percentage	40	12	1	11	1	3	1	1	4	0

Table 3.--Summary, by State, of evaluated miles of streams for the application of limited-detail study methods--(continued)

State	Limited-detail study method[1/]										
	S+D	S+R	S+O	S+P	H+R	H+O	C+D	D+P	S+H +R	S+D +P	X
Alabama	2	-	-	-	-	-	33	-	-	-	7
Arkansas	-	-	-	-	-	-	-	-	-	-	-
Colorado	-	-	-	-	-	-	-	-	-	-	-
Connecticut	-	-	-	-	-	-	-	-	-	-	-
Florida	5	-	-	-	-	-	-	-	-	-	-
Georgia	-	-	-	-	-	-	-	-	-	-	-
Idaho	-	-	-	-	-	-	-	-	-	-	-
Illinois	-	-	-	-	-	-	-	-	-	-	-
Iowa	-	-	-	-	-	-	-	-	-	-	-
Kentucky	-	16	-	-	-	-	-	-	-	-	-
Louisiana	-	-	-	-	-	-	-	-	-	-	-
Maine	20	42	26	-	150	26	-	-	7	-	76
Maryland	-	-	-	-	-	-	-	-	-	-	-
Michigan	-	-	-	-	-	-	-	-	-	-	-
Minnesota	-	-	-	-	-	-	-	-	-	-	-
Mississippi	-	-	-	-	-	-	-	-	-	-	-
Missouri	-	-	-	-	-	-	-	-	-	-	-
Montana	-	-	-	-	-	-	-	-	-	-	-
Nebraska	-	-	-	-	-	-	-	-	-	-	-
New Hampshire	88	-	-	-	-	-	-	-	-	-	15
New Mexico	-	-	-	-	-	-	-	-	-	-	-
New York	21	-	-	3	-	-	-	-	-	-	-
North Carolina	41	-	-	-	-	-	-	-	-	-	-
North Dakota	-	-	-	-	-	-	-	-	-	-	-
Ohio	1	-	2	-	-	-	-	-	-	-	-
Oklahoma	-	-	-	-	-	-	-	-	-	-	-
Oregon	-	-	-	-	-	-	-	-	-	-	-
Pennsylvania	630	-	-	89	-	-	-	242	-	279	52
South Carolina	-	-	-	-	-	-	-	-	-	-	-
Tennessee	2	-	-	-	-	-	10	-	-	-	-
Texas	-	-	-	-	-	-	-	-	-	-	-
Utah	-	-	-	-	-	-	-	-	-	-	-
Vermont	-	-	30	-	-	67	-	-	-	-	2
Virginia	-	-	-	-	-	-	-	-	-	-	-

Table 3.--Summary, by State, of evaluated miles of streams for the application of limited-detail study methods--(continued)

State	Limited-detail study method[1/]										
	S+D	S+R	S+O	S+P	H+R	H+O	C+D	D+P	S+H +R	S+D +P	X
Washington	-	-	-	-	-	-	-	-	-	-	-
West Virginia	20	-	-	-	-	-	-	-	-	-	-
Wisconsin	185	-	-	79	-	-	7	-	-	-	3
Wyoming	-	-	-	-	-	-	-	-	-	-	-
Totals	1,015	58	58	171	150	93	50	242	74	279	155
Percentage	11	1	1	2	2	1	1	3	1	3	2

1/ S--Simplified step-backwater method
H--Historical floods method
C--Slope-conveyance method
D--Depth-frequency method
R--Reservoirs method
O--Information from other studies
T--Tidal-flooding method
P--Profile-interpolation method
X--Other methods

2/ Includes riverine parts of coastal communities.

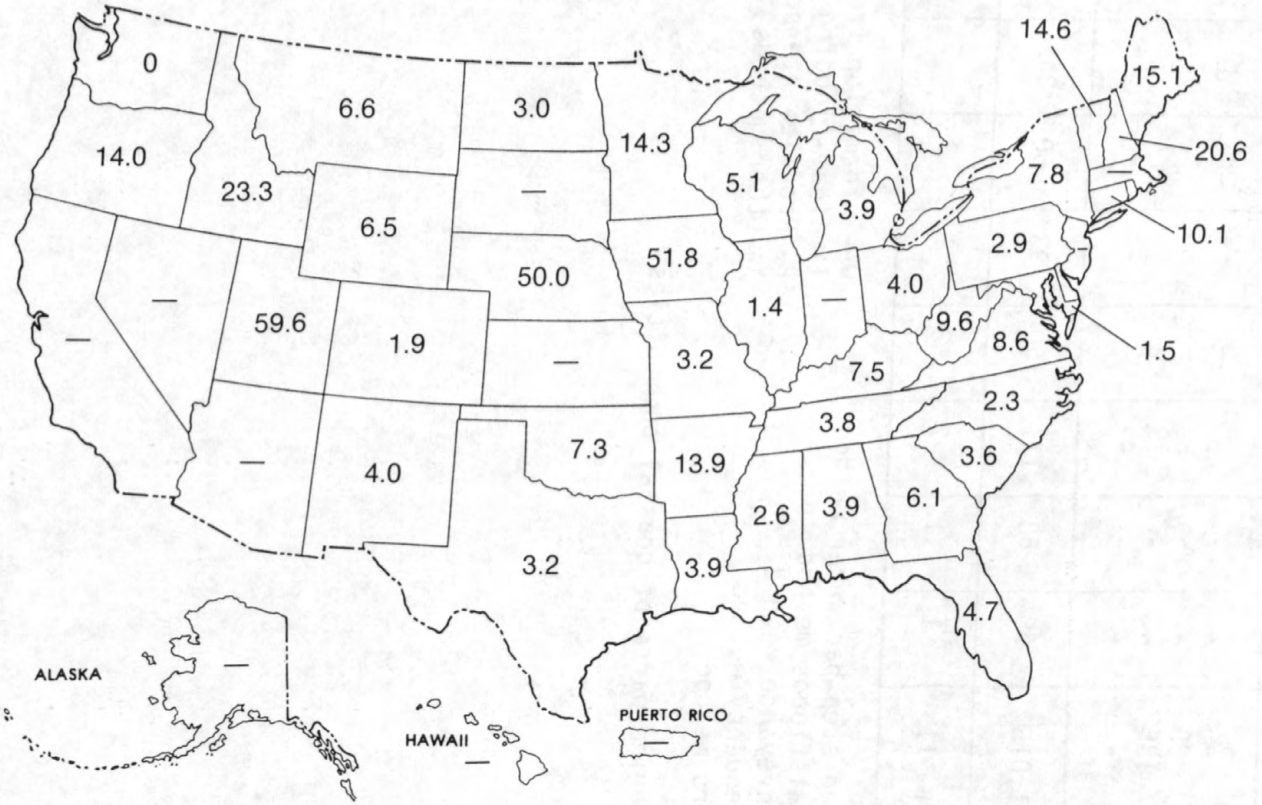

Figure 2. — Average stream miles, by State, for streams in communities for which limited-detail studies are recommended.

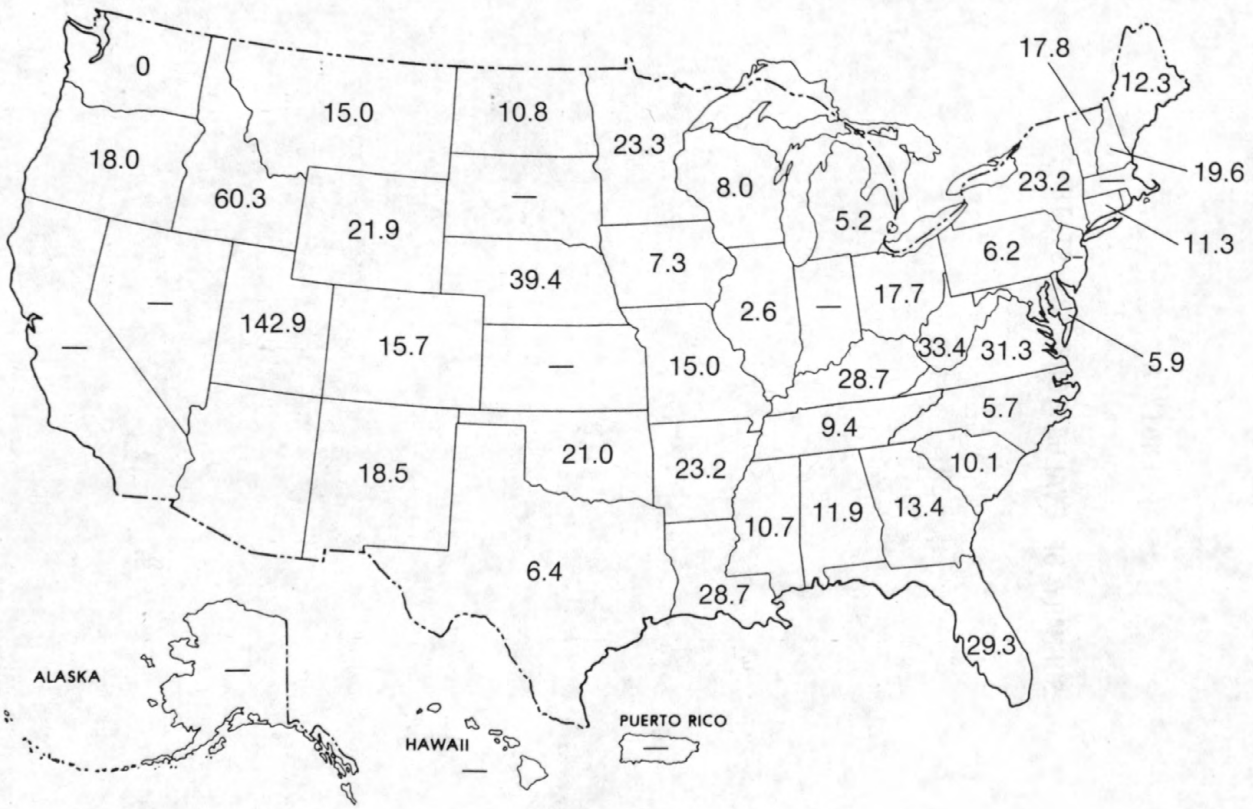

Figure 3. — Average cost, in thousands of dollars, by State, for the application of limited-detail methods on streams in communities for which limited-detail studies are recommended.

APPENDIX A

SUMMARY OF EVALUATIONS, BY STATE

EVALUATION SUMMARY

STATE: Alabama

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/84 TOWNSHIPS: 0 COUNTIES: 2/20 TOTAL: 104

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	132.0	$ 605,210
	H	34.0	22,000
	C	7.6	15,490
	D	17.2	18,750
	S+H	11.9	32,860
	S+C	4.0	12,230
	S+D	2.5	2,500
	C+D	32.7	36,520
	S+C+D	7.3	9,000
		249.2	$ 754,560
3	S	5.3	$ 17,600
	H	3/	7,000
	D	1.0	1,000
	S+H	2.0	4,400
		8.3	$ 30,000
Totals		257.5	$ 784,560

1/ No studies recommended for streams in 21 towns.
2/ No studies recommended for streams in 17 counties.
3/ Historical data will be applied to 10 sinkholes to determine the 100-year flood elevation.

EVALUATION SUMMARY

STATE: Arkansas

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/ 12 TOWNSHIPS: 0 COUNTIES: 8 TOTAL: 20

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	32.4	$ 68,740
	H	27.0	20,600
		59.4	$ 89,340
3	S	140.8	$ 309,880
	H	59.0	29,100
	C	1.0	1,300
	S+C	3.5	12,120
		204.3	$ 352,400
Totals		263.7	$ 441,740

1/ A detailed study is recommended for streams in one town.

EVALUATION SUMMARY

STATE: Colorado

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/20 TOWNSHIPS: 0 COUNTIES: 2/4 TOTAL: 24

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	22.69	$ 193,620
3	S	8.0	57,830
Totals		30.69	$ 251,450

1/ No studies recommended for streams in five towns and a detailed study recommended for streams in one town.

2/ No studies recommended for streams in two counties.

EVALUATION SUMMARY

STATE: Connecticut

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 4 TOWNSHIPS: 0 COUNTIES: 0 TOTAL: 4

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	10.0	$ 30,000
	D	30.5	15,250
Totals		40.5	$ 45,250

EVALUATION SUMMARY

STATE: Florida

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/2 TOWNSHIPS: 0 COUNTIES: 2/8 TOTAL: 40

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	29.0	$ 276,000
	H	12.1	48,780
	C	0.5	8,180
	D	6.9	18,040
	T	2.7	40,000
	S+H	3.9	82,000
	D 3/	---	85,000
	S+H 3/	1.7	85,000
		56.8	$ 643,000
3	H	1.0	$ 2,000
	S+H	63.8	60,000
	S+D 3/	5.0	85,000
		69.8	$ 147,000
Totals		126.6	$ 790,000

1/ No studies recommended for streams in nine towns.

2/ No studies recommended for streams in four counties.

3/ Includes lakes for which the shoreline mileage is not included.

EVALUATION SUMMARY

STATE: Georgia

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/102 TOWNSHIPS: 0 COUNTIES: 2/27 TOTAL: 129

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	283.2	$ 673,800
	H	16.3	21,200
	D	17.5	20,400
	S+H	41.0	83,300
	S+C	5.3	9,000
		363.3	$ 807,700
3	S	164.4	$ 348,300
	D	7.3	6,300
		171.7	$ 354,600
Totals		535.0	$1,162,300

1/ No studies recommended for streams in 22 towns.

2/ No studies recommended for streams in 20 counties.

EVALUATION SUMMARY

STATE: Idaho

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1 TOWNSHIPS: 0 COUNTIES: 1/3 TOTAL: 4

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	4.0	$ 20,000
3	S	66.0	161,000
Totals		70.0	$ 181,000

1/ No study recommended for streams in one county.

EVALUATION SUMMARY

STATE: Illinois

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/5 TOWNSHIPS: 0 COUNTIES: 0 TOTAL: 5

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	C	0.6	$ 4,750
	D	3.1	3,500
	R	1.9	2,000
Totals		5.6	$ 10,250

1/ No study recommended for streams in one town.

EVALUATION SUMMARY

STATE: Iowa

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/3 TOWNSHIPS: 0 COUNTIES: 2 TOTAL: 5

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	3.26	$ 19,840
3	D	204.0	9,440
Totals		207.26	$ 29,280

1/ A detailed study is recommended for streams in one town.

EVALUATION SUMMARY

STATE: Kentucky

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/86 TOWNSHIPS: 0 COUNTIES: 2/23 TOTAL: 109

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	247.0	$ 1,339,930
	H	99.2	199,680
	S+H	31.6	152,620
	S+R	15.9	79,920
		393.7	$ 1,772,150
3	S	77.2	$ 397,030
	H	127.0	112,880
	S+H	22.9	100,680
		227.1	$ 610,590
Totals		620.8	$ 2,382,740

1/ No studies recommended for streams in 14 towns and detailed studies recommended for streams in 2 towns.

2/ No studies recommended for streams in nine counties and a detailed study recommended for streams in one county.

EVALUATION SUMMARY

STATE: Louisiana

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/12 TOWNSHIPS: 0 PARISHES: 2/10 TOTAL: 22

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	12.0	$ 64,000
	H	-----	500
	S+C	8.45	92,700
		20.45	$ 157,200
3	S	2.5	$ 20,800
	H	3.0	3,300
	C	2.5	20,800
	S+C	2.75	27,500
		10.75	$ 72,400
Totals		31.20	$ 229,600

1/ No studies recommended for streams in five towns and detailed studies recommended for streams in two towns.

2/ No studies recommended for streams in seven parishes.

EVALUATION SUMMARY

STATE: Maine

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 33 (coastal)[1/]
68 (other)[2/]
TOWNSHIPS: 1 (coastal) COUNTIES: 0 TOTAL: 102

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1 (coastal)	S+SSM	6.0	$ 18,000
	H+SSM	8.1	3,800
	R+SSM	15.3	9,050
		29.4	$ 30,850
2 (coastal)	---	0	0
Totals (coastal)		29.4	$ 30,850

1/ Coastal communities affected by storm surge. Areas of all 34 coastal communities require the use of a storm surge model (SSM). Five of the 34 communities (Camden, Northport, Rockland, Rockport, and Surry) have some stream reaches for which LDS methods can be applied. The values shown are for those stream reaches.

2/ No studies recommended for streams in four towns. Streams in one of the four towns are being studied as part of a detailed study that is in progress.

STATE: Maine (Continued)

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1 (other)	S	26.5	$ 85,500
	H	308.7	202,650
	R	49.5	21,900
	O	50.5	9,100
	S+H	28.0	55,000
	S+D	20.5	61,740
	S+R	42.3	41,000
	S+O	26.5	35,650
	H+R	149.5	66,250
	H+O	26.0	11,000
	R+O	25.0	6,000
	S+H+R	74.1	60,350
	S+H+O	17.0	14,300
	S+D+R	18.5	23,400
		862.6	$ 693,840
Totals (coastal + other)		892.0	$ 724,690

EVALUATION SUMMARY

STATE: Maryland

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 3 TOWNSHIPS: 0 COUNTIES: 0 TOTAL: 3

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	2.2	$ 11,760
	D	2.2	5,800
Totals		4.4	$ 17,560

EVALUATION SUMMARY

STATE: Michigan

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/16 TOWNSHIPS: 2/8 COUNTIES: 0 TOTAL: 24

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	1.8	$ 22,200
	H	5.85	8,720
	D	0.9	1,600
		8.55	$ 32,520
2	H	26.0	$ 12,250
	D	0.8	2,400
		26.8	$ 14,650
Totals		35.35	$ 47,170

1/ No studies recommended for streams in three towns and detailed studies recommended for streams in seven towns.

2/ No studies recommended for streams in two townships and detailed studies recommended for streams in three townships.

EVALUATION SUMMARY

STATE: Minnesota

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/1 TOWNSHIPS: 0 COUNTIES: 2/34 TOTAL: 35

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	17.7	$ 70,300
	H	20.5	56,400
	R	56.8	44,900
	S+H	34.0	37,900
Totals		129.0	$ 209,500

1/ Detailed study recommended for streams in one town.

2/ No studies recommended for streams in 25 counties.

EVALUATION SUMMARY

STATE: Mississippi

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/110 TOWNSHIPS: 0 COUNTIES: 2/41 TOTAL: 151

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	80.8	$ 406,900
	H	25.6	75,500
	C	57.8	264,200
	D	5.1	21,400
		169.3	$ 768,000
3	S	31.0	$ 141,200
	H	19.0	42,500
	C	32.9	117,800
	D	13.0	8,000
		95.9	$ 309,500
Totals		265.2	$1,077,500

1/ No studies recommended for streams in 32 towns.

2/ No studies recommended for streams in 18 counties.

EVALUATION SUMMARY

STATE: Missouri

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 4 TOWNSHIPS: 0 COUNTIES: 0 TOTAL: 4

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	7.25	$ 52,000
	H	3.4	5,500
	C	2.0	2,500
Totals		12.65	$ 60,000

EVALUATION SUMMARY

STATE: Montana

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/9 TOWNSHIPS: 0 COUNTIES: 2/5 TOTAL: 14

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	24.0	$ 82,060
	H	0.5	2,000
		24.5	$ 84,060
3	S	22.5	$ 43,440
	H	8.0	6,000
	D	2.0	6,000
	O	9.0	10,800
		41.5	$ 66,240
Totals		66.0	$ 150,300

1/ No studies recommended for streams in three towns.

2/ No study recommended for streams in one county.

EVALUATION SUMMARY

STATE: Nebraska

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 0 TOWNSHIPS: 0 COUNTIES: 2 TOTAL: 2

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
3	S	8.0	$ 20,300
	H	92.0	58,400
Totals		100.0	$ 78,700

EVALUATION SUMMARY

STATE: New Hampshire

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 12 TOWNSHIPS: 0 COUNTIES: 0 TOTAL: 12

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	H	17.0	$ 10,500
	D	40.0	6,000
	S+H	87.0	128,300
	S+D	88.5	74,300
	S+H+D	15.0	16,250
Totals		247.5	$ 235,350

EVALUATION SUMMARY

STATE: New Mexico

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/11 TOWNSHIPS: 0 COUNTIES: 2/8 TOTAL: 19

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	13.5	$ 55,500
3	S	18.5	92,500
Totals		32.0	$ 148,000

1/ No study recommended for streams in one town and detailed studies recommended for streams in six towns.

2/ No study recommended for streams in three counties and a detailed study recommended for streams in one county.

EVALUATION SUMMARY

STATE: New York

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 3 TOWNSHIPS: 0 COUNTIES: 0 TOTAL: 3

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S+D	20.6	$ 59,600
	S+P	2.7	10,000
Totals		23.3	$ 69,600

EVALUATION SUMMARY

STATE: North Carolina

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/69 TOWNSHIPS: 0 COUNTIES: 2/29 TOTAL: 98

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	24.26	$ 103,465
	H	1.5	3,000
	D	20.67	51,660
	S+D	19.1	45,300
		65.53	$ 203,430
3	S	2.7	$ 14,090
	D	44.66	65,280
	S+D	22.25	50,560
		69.61	$ 129,930
Totals		135.14	$ 333,360

1/ No studies recommended for streams in 30 towns.

2/ No studies recommended for streams in 10 counties.

EVALUATION SUMMARY

STATE: North Dakota

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/15 TOWNSHIPS: 2/24 COUNTIES: 3 TOTAL: 42

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	40.0	$ 141,400
2	S	10.0	35,000
3	S	14.0	49,850
Totals		64.0	$ 226,250

1/ No studies recommended for streams in two towns.

2/ No studies recommended for streams in 19 townships.

EVALUATION SUMMARY

STATE: Ohio

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/89 TOWNSHIPS: 0 COUNTIES: 2/37 TOTAL: 126

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	195.2	$ 996,350
	H	16.6	25,950
	D	0.7	3,000
	O	3.7	7,400
	S+H	18.1	69,300
	S+D	0.9	4,350
	S+O	2.2	11,500
		237.4	$1,117,850
3	S	112.6	$ 582,650
	H	69.0	177,120
	R	8.0	9,470
	O	6.1	12,360
	S+H	4.5	24,500
	S+C	0.5	9,200
		200.7	$ 815,300
Totals		438.1	$1,933,150

1/ No studies recommended for streams in 10 towns.

2/ No studies recommended for streams in seven counties.

EVALUATION SUMMARY

STATE: Oklahoma

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 6 TOWNSHIPS: 0 COUNTIES: 1/1 TOTAL: 7

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	16.4	$ 103,550
	D	27.5	22,300
Totals		43.9	$ 125,850

1/ No study recommended for streams in one county.

EVALUATION SUMMARY

STATE: Oregon

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/6 TOWNSHIPS: 0 COUNTIES: 1 TOTAL: 7

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
3	S	14.0	$ 18,000

1/ No studies recommended for streams in any of the six towns.

EVALUATION SUMMARY

STATE: Pennsylvania

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/ 202 TOWNSHIPS: 2/ 615 COUNTIES: 0 TOTAL: 817

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	56.6	$ 382,760
	D	27.9	56,120
	P	19.7	43,580
	S+C	1.7	15,760
	S+D	125.1	547,660
	S+P	10.1	50,200
	D+P	7.3	9,460
	S+D+P	7.1	26,600
		255.5	$1,132,140

1/ No studies recommended for streams in 26 towns.

2/ No studies recommended for streams in 134 townships.

STATE: Pennsylvania (Continued)

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
2	S	60.7	$ 304,060
	H	1.2	1,980
	D	385.8	474,200
	P	74.2	61,050
	S+D	504.4	1,220,930
	S+P	79.3	120,920
	H+P	4.4	3,570
	D+P	234.7	184,620
	S+H+P	15.9	20,000
	S+D+P	272.1	501,420
	H+D+P	23.2	16,920
	S+C+D+P	8.8	19,160
		1,664.7	$2,928,830
Totals		1,920.2	$4,060,970

EVALUATION SUMMARY

STATE: South Carolina

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/38 TOWNSHIPS: 0 COUNTIES: 2/9 TOTAL: 47

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	69.3	$ 219,280
	H	5.0	6,190
	R	4.5	5,750
	O	5.0	1,110
		83.8	$ 232,330
3	S	17.35	$ 50,900
Totals		101.15	$ 283,230

1/ No studies recommended for streams in 12 towns.

2/ No studies recommended for streams in seven counties.

EVALUATION SUMMARY

STATE: Tennessee

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/76 TOWNSHIPS: 0 COUNTIES: 2/16 TOTAL: 92

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	127.27	$ 396,650
	H	16.5	11,575
	D	1.2	1,300
	S+H	12.7	15,300
	S+D	1.9	2,250
		159.57	$ 427,075
3	S	20.85	55,125
	H	5.5	2,100
	D	2.8	1,000
	C+D	9.5	2,500
		38.65	$ 60,725
Totals		198.22	$ 487,800

1/ No studies recommended for streams in 28 towns and detailed studies recommended for streams in 2 towns.

2/ No studies recommended for streams in 10 counties.

EVALUATION SUMMARY

STATE: Texas

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/19 TOWNSHIPS: 0 COUNTIES: 2/8 TOTAL: 27

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	31.0	$ 62,430
	H	2.0	5,150
		33.0	$ 67,580
3	H	2.5	$ 3,200
Totals		35.5	$ 70,780

1/ No studies recommended for streams in nine towns.

2/ No studies recommended for streams in seven counties.

EVALUATION SUMMARY

STATE: Utah

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 4 TOWNSHIPS: 0 COUNTIES: 8 TOTAL: 12

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	13.7	$ 87,900
3	S	701.0	$1,627,000
Totals		714.7	$1,714,900

EVALUATION SUMMARY

STATE: Vermont

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/18 TOWNSHIPS: 0 COUNTIES: 0 TOTAL: 18

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	47.0	$ 151,000
	H	33.5	20,750
	S+H	25.0	44,750
	S+O	30.5	15,200
	H+O	67.0	13,900
	C+O	2.0	3,000
Totals		205.0	$ 248,600

1/ No studies recommended for streams in four towns.

EVALUATION SUMMARY

STATE: Virginia

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/6 TOWNSHIPS: 0 COUNTIES: 2/19 TOTAL: 25

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	3.0	$ 22,900
	T	15.2	44,900
		18.2	$ 67,800
3	S	96.9	$ 402,950
	H	8.4	31,400
	D	24.0	57,600
	T	33.9	96,700
		163.2	$ 588,650
Totals		181.4	$ 656,450

1/ No study recommended for streams in one town.

2/ No studies recommended for streams in three counties.

EVALUATION SUMMARY

STATE: Washington

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 0 TOWNSHIPS: 0 COUNTIES: 1/1 TOTAL: 1

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
			$

1/ No study recommended for streams in the one county.

EVALUATION SUMMARY

STATE: West Virginia

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/63 TOWNSHIPS: 0 COUNTIES: 2/23 TOTAL: 86

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	68.6	$ 400,100
	H	5.3	17,100
	D	12.6	34,700
	O 3/	30.5	88,100
	S+H	3.5	17,200
	S+D	0.5	3,600
		121.0	$ 560,800
3	S	264.3	$1,400,900
	H	24.0	91,300
	D	150.5	195,350
	O 3/	209.5	451,200
	S+D	19.5	37,500
		667.8	$2,176,250
Totals		788.8	$2,737,050

1/ No studies recommended for streams in three towns.

2/ No study recommended for streams in one county.

3/ Flow and profile data from U.S. Army Corps of Engineers and modified as necessary.

EVALUATION SUMMARY

STATE: Wisconsin

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/77 TOWNSHIPS: 0 COUNTIES: 2/11 TOTAL: 88

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	COST
1	S	53.6	$ 187,190
	H	4.5	22,240
	C	1.6	8,240
	O	0.5	2,520
	S+H	9.6	17,210
	S+C	4.9	16,500
	S+D	58.6	124,730
	C+D	6.8	6,460
	S+C+D	3.0	7,100
		143.1	$ 392,190
3	S	21.5	48,400
	S+D	126.0	98,400
	S+P	79.0	43,700
		226.5	$ 190,500
Totals		369.6	$ 582,690
Projected totals		374	$ 589,000

1/ No studies recommended for streams in 13 towns.

2/ No study recommended for streams in one county.

EVALUATION SUMMARY

STATE: Wyoming

NUMBER OF COMMUNITIES FOR WHICH STREAMS WERE EVALUATED:

TOWNS: 1/17 TOWNSHIPS: 0 COUNTIES: 2/4 TOTAL: 21

RESULTS:

COMMUNITY TYPE	LDS	TOTALS MILES	TOTALS COST
1	S	96.2	$ 320,210
3	S	20.3	74,180
Totals		116.5	$ 394,390

1/ No study recommended for streams in one town.

2/ No studies recommended for streams in two counties.