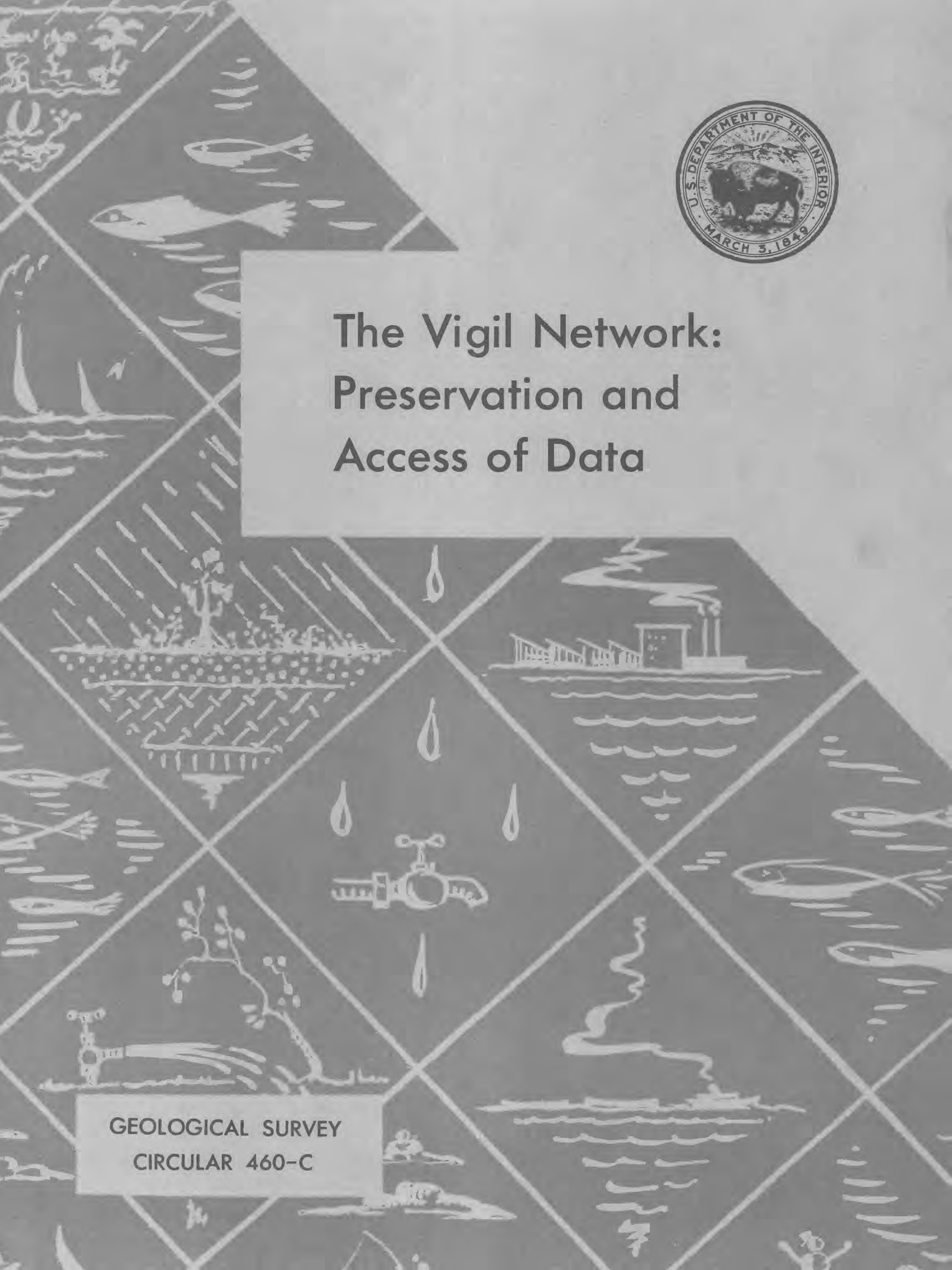

The Vigil Network: Preservation and Access of Data

GEOLOGICAL SURVEY
CIRCULAR 460-C

Part C

The Vigil Network: Preservation and Access of Data

By W. W. Emmett and R. F. Hadley

CONSERVATION NETWORKS

GEOLOGICAL SURVEY CIRCULAR 460-C

A U.S. contribution to the International Hydrological Decade

This volume complete in three parts

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United States Department of the Interior
STEWART L. UDALL, *Secretary*

Geological Survey
William T. Pecora, *Director*

Free on application to the U.S. Geological Survey, Washington, D.C. 20242

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PART C

THE VIGIL NETWORK: PRESERVATION AND ACCESS OF DATA

By W. W. Emmett and R. F. Hadley

PURPOSE OF THE VIGIL NETWORK

In the United States the recognition of a deficiency in detailed data on hydrologic and geomorphic processes led to the idea of establishing a network of small drainage basins and other selected sites where observations of basic processes would be made over long periods of time (Leopold, 1962a). The network of observational areas has been named the Vigil Network (Leopold, 1962b). Publications on this concept of relatively simple observations of landscape (Emmett, 1965; Hadley, 1965; Hadley and Lusby, 1967; Leopold and Emmett, 1965; Miller and Leopold, 1963) have included suggestions for installation, maintenance, and techniques of observation.

It is hoped that the Vigil Network can serve as a nucleus for international cooperation in hydrology—especially in long-term programs of landscape observations. At the first session of the Coordinating Council for the International Hydrological Decade held May 24–June 3, 1965, at UNESCO House in Paris, France, Vigil basins were recognized as one of the Decade projects for collection of basic data (UNESCO, 1965, p. 10–11). The Coordinating Council considers Vigil basins as a special kind in UNESCO's classification of experimental and representative basins. In addition to the 58 Vigil Network sites established in the United States (Hadley, 1965), there are several sites on other continents which help to encompass the wide variety of landscapes and environments of the world.

One of the principal objectives of the Vigil Network is to preserve the results of the field measurements for future generations of scientists. This paper presents the plan for filing the data from Vigil Network sites in a uniform manner in the designated repositories. The appendix of this paper is a sample copy of a file which has actually been submitted to the repositories. This particular sample is a more complete version of the data which Leopold and Emmett (1965) used to illustrate the need for establishing the repositories. The location of repositories is discussed later in this paper.

CONTENTS OF THE REPOSITORY FILE

In a file deposited in the international repositories, the description of the site location and the permanent bench marks installed should be explicit so that subsequent investigators can find the field location with a minimum of effort. The format of the data of the original survey should be similar to that suggested in this paper. For resurveys, if data collected before a file has been submitted to the repositories fall within the guidelines suggested below, this data should be included to allow a comparison of the first survey with later ones. After the file has been deposited, only data meeting the requirements discussed below should be submitted to the repositories.

The site location can best be described by a tabulated roadlog of distances using permanently identifiable features as beginning and intermediate references. As an example, the description by Leopold and Emmett (1965, p.

14) or on page 11 in the appendix of this report should enable any observer to reach that site. A location sketch map, or a topographic map if one is available, is also helpful to a new observer in relocating the site. In addition, a topographic map allows the observer to be preaware of some of the physical characteristics of the area. However, to minimize the bulk of the folders a page-size cutout or photocopy of the pertinent area within the topographic map sheet may suffice. If plane-table or other survey maps are made, they should be included if they can be conveniently reproduced to fit the file-folder dimensions. However, care must be taken not to reduce a map so much that legibility of the map and its explanations are affected. Even simple sketch maps of the area are handy to the fieldman in relocating bench marks and are appropriate for inclusion in the file.

The file should include a physical description of the site, consisting of data on the geology, soils, vegetation, climate, and topography. The reasons for choosing the area for the particular long-term measurements should also be given.

Ground photographs of pertinent views may be included, but must be adequately identified by the position of the camera and the date of the photograph. If the film negative is on file and available for loan, its location and means of borrowing should be detailed.

Most important is the inclusion of data sheets which show the bench-mark elevations and the initial surveys. Resurveys made before a file is submitted to the repositories may be included if they do not materially add to the bulk of the file. However, data from resurveys that indicate a definite trend or reversal in trend should be included even if they constitute several additional tables. To standardize the format for presenting such data, the next section of this paper shows suggested table headings for the more common types of observations. The units for the data may be either metric or English and should preferably be the units principally used in the country of the station. Within a file the units should be consistent.

After the file has been deposited in the repositories, subsequent data, photographs, or maps of resurveys should be submitted only if they show an important trend or change in the trend indicated by the data initially filed. This practice is to minimize maintenance efforts at the repositories and to keep individual files from becoming unnecessarily bulky with repetitious data.

Publications which relate to the studied area should be referenced in the file, but copies of the publications need not be included. References should be submitted to the repositories for publications issued after the date of filing.

A card index is available at each repository to facilitate retrieval of data on file. Details of submitting index cards with each file folder are discussed later in this paper.

TYPES OF OBSERVATIONS AND EXAMPLES OF TABULATIONS

Some observations made in the field by individual investigators are of a nonpermanent or short-term nature—for example, mass-movement observations on hillslopes using wooden dowels or glass beads (Hadley and Branson, 1965) and, in stream channels, the use of scour chains or painted rocks for channel-scour and particle-transport studies. If data of nonpermanent installations show significant results, however, they should be included in the repository file for the period of their collection provided that permanent bench marks are established in the basin. If possible, the locations of original bench marks should be detailed or shown on maps, so a later investigator can closely match the location of his measurements to that of the original measurements. The data can thus be used at a later time to compare results of similar studies for two periods even though the original installations cannot be exactly located or recovered. Data from sites having only nonpermanent installations should not be submitted to the repositories.

STREAM-CHANNEL AND VALLEY-FLOOR OBSERVATIONS

Observations of stream channels and valley floors are usually conducted by surveying profiles between permanently established bench marks. Thus, these bench marks must be adequately described and identifiable in the field. Commonly, a small metal tag may be affixed to the bench mark which describes the bench mark and its elevation. In instances where bench marks do not protrude above the ground surface or are otherwise not easily found, a triangulation net extending from easily identifiable features should be included so that bench marks may be relocated. On long profiles extending more than 300 feet (or 100 m), intermediate bench marks should be established so that the stationing of resurveys can be maintained identical to that of the initial survey. Also, longitudinal profiles are assumed to be along the stream thalweg unless specified differently. For cross-sectional surveys, it is standard practice to present the data from the left-bank (looking downstream) bench mark to the right-bank bench mark.

The following skeleton tables (tables 1–3) are examples showing location of stream-channel cross sections and long-profile data. These tables are merely illustrative, and the data shown are by no means complete.

TABLE 1.—*Example of location, in feet, of stream-channel cross sections*

Cross-section station [1]	Left-bank BM elevation [2]	Distance between bench marks	Right-bank BM elevation [2]
0+00	91.49	60.0	90.95
3+00	98.77	50.0	100.75
6+00	110.35	85.0	111.61

[1] Station location is referred to 0+00 at the fence line at mouth of channel. For example, 3+00 means 300 feet upstream from the fence line.
[2] Elevations, in feet, are referenced to an arbitrary elevation of 100.00 feet at the top of *BM–A*. The term "bench mark" (BM) refers to a 4-foot steel rod, ½-inch diameter, driven into the ground and protruding about 6 inches.

TABLE 2.—*Example of cross-sectional survey of ground-surface elevation, in feet, station 0+00*

Distance from left-bank BM [1]	Elevation [2]				Remarks
	August 1962	June 1963	July 1965	June 1966	
0 (LB BM)	91.49	91.49	91.49	91.49	Elevations are for top of bench mark.
0.0	90.99	91.07	91.03	91.03	Elevations are for ground surface.
5.0	90.64	90.69	90.70	90.64	Do.
10.0	89.95	89.96	89.92	89.99	Do.

[1] Distance, in feet, from left-bank bench mark toward right-bank bench mark.
[2] Elevations are referenced to an arbitrary elevation of 100.00 ft at the top of *BM–A*.

TABLE 3.—*Example of long profile of channel-bed elevation, in feet*

Channel station [1]	Elevation [2]	
	August 1962	June 1966
0+00	88.32	88.36
0+25	88.58	88.64
0+50	89.18	89.24
0+75	89.68	89.72
1+00	90.12	90.20
1+25	90.98	91.05

[1] Station location is referred to 0+00 at the fence line at mouth of channel. For example, 1+00 means 100 ft upstream from the fence line.
[2] Elevations are referenced to an arbitrary elevation of 100.00 ft at the top of *BM–A*.

As previously mentioned, some types of observations are of a temporary nature, and the possibility of relocating them in the future is slight. However, if a significant short-term record is available at the time of filing with the repositories, they may be included to allow a comparison with later surveys even if reestablishment of the installation is necessary at the later survey. The initial investigator can decide whether or not these types of data should be included in the file. The following (tables 4–7) are suggested formats for several types of short-term measurements that are used in stream-channel and valley-floor observations.

TABLE 4.—*Example of channel scour and fill data measured by scour chains* [1]

Channel station [2] (feet)	August 10, 1962				August 15, 1963			
	Estimated peak discharge (cfs)	Scour (feet)	Fill (feet)	Net change (feet)	Estimated peak discharge (cfs)	Scour (feet)	Fill (feet)	Net change (feet)
0+00	13	0.06	0.11	0.05	20	0.04	0.04	0.00
1+00	11	.18	.17	−.01	17	.02	.07	.05
2+00	10	.11	.12	.01	15	.33	.36	.03

[1] For technique see Emmett (1965, p. 94–98), Leopold, Emmett, and Myrick (1966, p. 215–220), or Emmett and Leopold (1965, p. 400–404).
[2] Station location is referred to 0+00 at the fence line at mouth of channel. For example, 1+00 means 100 ft upstream from the fence line.

TABLE 5.—*Example of crest-stage gage record* [1]

Date of flow	Water-surface elevation [2] (feet)	Estimated depth (feet)	Estimated discharge (cfs)
July 1, 1962 ______	91.25	0.35	1.2
May 30, 1963 _____	91.09	.17	.6
June 26, 1963 _____	91.53	.76	3.1

[1] For technique see Leopold (1962, p. 3) or Emmett (1965, p. 105).
[2] Elevations are referenced to an arbitrary elevation of 100.00 ft at the top of *BM–A*.

TABLE 6.—*Example of bank-recession pins* [1]

Pin	Distance along bank from BM pin [2] (feet)	Protrusion [3] (feet)			
		July 17, 1962	February 12, 1963	May 31, 1963	July 1, 1963
1	9.0	0.62	0.21	0.36	0.50
2	11.1	.58	.38	.21	.81
3	15.4	.40	.19	.11	.72

[1] For technique see Emmett (1965, p. 93–94).
[2] BM pin is 10-in. spike in 24-in. maple tree near station 3+00; spike driven 8 in. above ground surface.
[3] Pins are redriven to protrude 0.10 ft from bank at time of each observation.

TABLE 7.—*Example of headcut retreat and enlargement* [1]

Line description	Distance from bench mark to bank (feet)							
	1962		1963		1964		1965	
	LB	RB	LB	RB	LB	RB	LB	RB
BM–D–BM–E	9.6	7.3	9.4	7.1	9.2	6.9	8.9	6.7
BM–F–BM–G	11.1	8.6	11.0	8.4	10.8	8.4	10.2	8.0

[1] For technique see Emmett (1965, p. 92–93) or Leopold, Emmett, and Myrick (1966, p. 229–232).

HILLSLOPE EROSION

The erosion of the surficial mantle on hillslopes with the resulting changes in profile shape, whether it be by subaerial erosion or mass movement, is often subtle; therefore, monitoring of hillslope profile over long periods has been neglected. Such observations need to be made in a variety of both climatic and lithologic environments to establish cause and effect relationships.

The data for hillslope observations to be placed in the repository files must include original surveys with location of permanent survey bench marks. The format of the following skeleton table is suggested.

TABLE 8.—*Example of hillslope profile of ground-surface elevation, in feet*

Distance from top of hillslope [1]	Elevation 1964	1965	1966	1967	Remarks
0	100.0	100.0	100.0	100.0	Elevations are for top of bench mark.
0	99.5	99.4	99.4	99.3	Elevations are for ground at base of bench mark.
5	96.4	96.3	96.3	96.3	Elevations are for ground surface.
*	*		*		* *
91	61.3	61.3	61.4	61.4	Elevations are for base of hillslope.

[1] Measurements, in feet, should be designated as slope distance or horizontal distance.

Because of the possibility of mass movement on hillslopes, more than one bench mark should be installed at each site to increase the accuracy in checking the elevation and position of markers as originally established.

There are types of observations in addition to hillslope profiles that furnish useful data on the erosion of landscapes. Although many of these observations do not lend themselves to standardized tabulation, they should be included in the repository file. Some of the types of observations being made are briefly summarized as an example.

The use of erosion pins or nails and washers to measure surficial erosion has proved to be a good supplement to profile surveys. The installation of erosion pins or nails, however, is a technique that requires annual maintenance and at best is subject to deterioration by rust and trampling by livestock. Therefore, the inclusion of erosion-pin data should be only a supplement to instrument surveys (see tables 15–16, appendix). Another point of caution is that erosion pins may be subject to heaving by frost action. Also, hillslopes composed of swelling clays can puff up and give negative exposure measurement after a period of alternate freezing and thawing. Therefore, repeat surveys in this type of material should always be made at the same time of the year.

RESERVOIR SEDIMENTATION

The use of small reservoirs on Vigil basins have proved very useful in studies of runoff and sediment yield and their relation to geomorphic characteristics. There are, however, some limitations that must be considered before choosing a reservoir as an observation station. The reservoir capacity–drainage area ratio should be sufficiently large to insure against spill during a flood having a recurrence interval of 50 years. This requirement allows direct measurement of runoff and sediment yield from the basin without estimating the volume of spill of both water and sediment. It should also improve the correlation of runoff and sediment yields with basin characteristics.

The following table formats (tables 9–10) for reservoir cross-section surveys and runoff and sediment yields should furnish adequate data for the repository file folder. In addition, a plan map or sketch of the reservoir showing location of bench marks and cross sections should accompany the data.

TABLE 9.—*Example of runoff and sediment yield to observation reservoir*

Period	Sediment yield Acre-feet	Sediment yield Acre-feet per square mile	Runoff Acre-feet	Runoff Acre-feet per square mile
July 1964–August 1965	3.779	12.81	24.80	105.1
September 1965–August 1966	1.169	3.96	17.92	75.9

TABLE 10.—*Example of reservoir survey by cross-section method, section A–A′, survey, in feet, of August 9, 1965*

Distance from left-bank BM	Water-surface elevation [1]	Depth	Elevation of reservoir floor [1]
1.0	67.00	0.00	67.00
10.0	67.00	.20	66.80
20.0	67.00	.60	66.40
30.0	67.00	1.00	66.00

[1] Elevations are referenced to an arbitrary elevation of 100.00 ft at the top of *BM–A*.

PRECIPITATION

If a Vigil station is near a meteorological station, the detailed climatological data can be used to supplement observations. However, most Vigil stations are in remote areas where precipitation data are scarce, particularly data on rainfall intensities. The minimum requirement should be a storage gage, charged with oil to reduce evaporation, where seasonal or annual precipitation can be measured. The suggested table (table 11) should be included in the repository file folder.

TABLE 11.—*Example of storage-type precipitation data*

Period	Precipitation, in inches	Remarks
April–October 1965	9.3	July was unusually wet.
November 1965–March 1966	3.7	Mostly snow.

VEGETATION MEASUREMENTS

Vegetation measurements and descriptions are essential for the extrapolation of results of hydrological studies. Of the hundreds of methods that have been used to measure vegetation, the ones that measure areal coverage and weight or volume are the most meaningful in hydrologic studies. In addition to live vegetation, soil-surface features such as quantities of mulch or litter, bare soil, and rock should be measured.

The point quadrat method (Levy and Madden, 1933) can be used to measure foliage cover of herbs and low shrubs. For hydrological studies it is suggested that only the first hit as pins are pushed toward the soil surface be recorded. This method permits calculation, from tabulated data (table 12), of percentage cover per species and percentage of soil surface occupied by mulch or litter, rock, and bare soil. For calculation of foliage volumes the height of each plant unit should be measured and recorded. For measurement of possible vegetation changes over time, permanent metal stakes should be installed 100 feet (30 m) apart.

The permanent 100-foot transect suggested above may be used as one edge of a rectangular plot for sampling woody species (Canfield, 1941). For each woody plant the length of the tape covered by live foliage should be recorded. For trees and large shrubs the depth of crown or foliage should also be recorded, and for both trees and shrubs heights should be recorded.

REPOSITORY INFORMATION

Arrangements have been completed with two organizations to serve as permanent repositories for basic data on Vigil Network sites. The two permanent repositories will be the Library, U.S. Geological Survey, Washington, D.C., U.S.A., and the Library, Laboratory of Geomorphology, University of Uppsala, Uppsala, Sweden. It is anticipated that an eastern European country will soon make available facilties to establish a third repository.

The purpose of these permanent repositories is to prevent loss of data by neglect, fire, or other causes and to give scientists easy access to the data. The repositories will enable scientists to find field locations where observations of geomorphic processes over time are being made. Several procedures and data arrangements are suggested in this paper so that data can be submitted in standardized format. One benefit of standardization is that the material to be sent to the repositories can be prepared in a very simple fashion. The principal items include written descriptions and maps which will allow a person to find bench marks in the field. In addition, at least the original set of data taken at each observation point is tabulated so that future researchers will know the initial field conditions.

Data for each study site will be placed in a folder and kept on file in the repositories. A card index file will be provided so that a visitor can look up which investigators and what areas are represented in the filed material. Investigators are requested to fill out the form in the pocket of this report to facilitate the task of entering information on cross-indexing cards in a uniform manner. Card number and type should be left blank, and the date is date of submittal. One copy of the index card should be included with each file folder. Another copy should be sent to R. F. Hadley, coordinator of Vigil Network activities in the United States (address shown on p. 7).

Both repositories are ready to receive material for permanent filing. Scientists are urged to prepare their data in the manner suggested in this paper, and to submit one copy to each

TABLE 12.—*Example of field data sheet and data calculations for vegetation measurements*

Project ______________________ Observers ______________________ Sample No. ______________________
Location ______________________ Vegetation type ______________________ Soil texture ______________________
Exposure ______________________ Slope percent ______________________ Elevation ______________________
Date ______________________

Woody vegetation

Species	Intercept (feet) From	Intercept (feet) To	Length (feet)	Height (feet)	Crown depth (feet)	Foliage[1] (cu ft)
Juut	4	19	5	15	10	196.4
Pied	21	30	9	12	8	508.9
Arpu	36	57	21	3	2	692.7
Cort	58	64	6	3	2	56.5
Qupa	71	79	8	9	7	351.9

Foliage volume, in cubic feet, transect[1]--- 1,806.4
1,806.4 ÷ 100 = 18.1 cu ft per ft = 18.1 acre-ft of foliage per acre.

Herbaceous and ground cover

Frame	Mulch	Bare	Rock	Erle	Lyph	Bogr	Ardi	Boer	Total
				Species					
1	5			3		2			10
2	4	1		1	3		1		10
3	5		1	2		2			10
4	3	3		4					10
5	4	1	3			2			10
6	4	1			2	3			10
7	3	2	2	2			1		10
8	2		2	1		2		3	10
9	1	1		3	3			2	10
10	5			2		1		2	10
11	3		3		2	2			10
12	4	2		1		3			10
13	1	1		2		2	3	1	10
14	4		1	1		4			10
15	2	4		3				1	10
16	4					1	4	1	10
17	2	1	2		1	2	2		10
18	3		1		2	2	1	1	10
19	1	3			1		2	3	10
20	2	2	2			4			10
21	3	3			1	3			10
22	2		3		5				10
23	2	1			3	1	1		10
24	2				2		3	3	10
25	4	3			3				10
26	3				4		3		10
27	6	2				2			10
28		2			3	3	2		10
29	9						1		10
30	6	1					3		10
Total--	99	34	20	25	35	41	26	17	300
Percent cover-	33.0	11.3	6.7	8.3	11.7	13.7	8.7	5.7	
Average height (feet)-				1	0.5	0.3	0.4	0.5	
Average width (feet)--				1	.5	.3	.4	.5	
Volume[1]------------				2.1	.7	.3	.3	.4	3.8

3.8 ÷ 50 = 0.076 cu ft per ft = 0.076 acre-ft per acre.
18.1 + 0.076 = 18.176 acre-ft of foliage per acre.

[1] **Formulas for calculating foliage volumes:**

a. **Woody vegetation:**
Volume of foliage = $\pi r^2 h$ = formula for volume of a cylinder.
$\Sigma(r^2 \times \pi \times$ crown depth) = foliage volume per 100-foot plot.
Foliage volume per 100 feet ÷ 100 = cubic feet of foliage per foot of line intercept = acre feet of foliage per acre.

b. **Herbaceous vegetation:**
Volume of foliage = percent cover per species × height of species × $r^2 \times \pi$.
Volume of foliage ÷ length of line, in feet = cubic feet of foliage per foot of intercept line = acre feet of foliage per acre.
Σ(Volume of foliage of woody plants + volume of foliage of herbaceous plants) = volume of foliage per acre.
Volume of foliage per acre × acres per basin = volume of foliage per basin.

of the repositories. These submissions can be addressed as follows:

Vigil Network Repository
Library
U.S. Geological Survey
Washington, D.C. 20242, U.S.A.

and

Vigil Network Repository
c/o The Director
Laboratory of Geomorphology
University of Uppsala
Uppsala, Sweden

For additional information regarding the Vigil Network, the procedure for transmittal of folders to the repositories, a sample copy of a file folder (appendix) prepared for submission to a repository, or additional copies of the author-and-location-index file cards, write directly to the authors of this publication.

William W. Emmett
U.S. Geological Survey
Washington, D.C. 20242, U.S.A.

or

Richard F. Hadley
U.S. Geological Survey
Building 25, Federal Center
Denver, Colorado 80225, U.S.A.

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APPENDIX: SAMPLE OF DATA FOR PERMANENT FILING IN THE INTERNATIONAL REPOSITORIES

VIGIL NETWORK SITE: LAST DAY GULLY NEAR HUDSON, WYO., U.S.A.

SUBMITTED BY: WILLIAM W. EMMETT AND LUNA B. LEOPOLD
U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242

VIGIL NETWORK SITE
INDEX CARD

Card No. ______
Type ______
Date Dec. 1, 1967

te name Last Day Gully Location Hudson, Wyoming, U.S.A.

incipal site investigator William W. Emmett Address U.S. Geological Survey, Washington, D.C. 20242

rposes (check; if more than one, number in order of importance):
annel change 1 Erosion 2 Sedimentation 3 Mass movement 4 Vegetation 5
umber and type of observations (if applicable, write number of such installations):

Stream channels

annel cross sections 16
our chains 3
ed profile 1
ater-surface profile ______
scharge:
Crest-stage gage 1
Gaging station ______
Suspended sediment ______
Chemical ______
her (specify) ______

Vegetation

ansects ______
adrats 1
asses 1, shrubs 1,
trees ______
ee-ring data ______
her (specify) ______

Hillslopes

Erosion stakes 2 lines
Mass-movement pins 2 lines
Painted rock lines ______
Cliff-recession markers ______
Profiles ______
Water runoff ______
Other (specify) ______

Other

Reservoir sedimentation ______
Rain gage ______
Soil chemistry ______
Soil moisture ______
Particle size:
Streambed 4
Bank ______
Hillslope ______
Pollen ______
Other (specify) ______

*Further data**

If a basin, drainage area 55 acres
If a plot ______
Elev 5,150 feet
Ann. precipitation 10 inches
Relief 142 feet
Geology:

Vegetation:

Hydrology:

Photography: Ground and low-altitude aerial.
Other:

* Include units of measurement, metric or English

VIGIL NETWORK SITE: LAST DAY GULLY NEAR HUDSON, WYO., U.S.A.

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Last Day Gully is an example of a small ephemeral basin which has alternately degraded and aggraded in post-Pleistocene time, presumably in response to changes in climate. It terminates in a small alluvial fan on top of a 15-foot alluvial terrace in the valley of the Popo Agie River. The planimetric map of figure 1 illustrates the general configuration of Last Day Gully.

Because similar gullies in small basins are common and because their visual aspect alone does not indicate whether in the present climate these gullies are aggrading, stable, or degrading, this one was chosen for long-term observation as part of the Vigil Network.

This site is an ephemeral wash, or gully, about 1 mile northeast of Hudson, Wyo., NW 1/4 sec. 6, T. 2 S., R. 3 E. (lat 42°55′33″ N., long 108°34′19″ W.). It is included on the topographic maps published by the U.S. Geological Survey entitled "Hudson, Wyo.," scale 1:24,000 and "Lander, Wyo.," scale 1:250,000 (parts of both appear in this folder, figs. 2–3). The main channel extends about 3,400 feet from the watershed divide to its end. The gully terminates in a semicircular alluvial fan. The gully bed is sandy silt and nearly free of vegetation. Vegetation adjacent to the channel consists of a mixture of low shrubs and grasses. Predominant shrubs are sagebrush (*Artemisia tridentata Nutt.*) and cactuses (*Opuntia* spp.). Grasses generally belong to the grama species (*Bouteloua*). Total vegetation cover varies but averages about 30–35 percent. The total area within the watershed is about 55 acres. The average elevation is 5,150 feet above sea level, and the relief between the watershed divide and the alluvial fan is 142 feet. Precipitation averages about 10 inches per year.

To reach the site of Last Day Gully, one may start at the center of the village of Hudson, Wyo. (see Hudson, Wyo., 1:24,000 topographic map, fig. 2), proceed east on State Highway 789 for three-quarters of a mile, and then turn north onto an unimproved side road. This road becomes a one-lane steel bridge crossing the Popo Agie River 200 yards from the junction with State Highway 789. After crossing the bridge one proceeds about 700 yards, leaves his automobile, and walks westerly along a fence, bearing N. 20° E. At a distance of 400 feet along the fence is the mouth of Last Day Gully, where the channel terminates in a low-angle fan. The alluvial fan and fence line are indicated in the upper left of the enclosed planimetric map of Last Day Gully (fig. 1). The permanent reference points along the stream, consisting of 1/2-inch diameter steel rods driven in the ground and protruding about 6 inches above the ground surface, are noted on the map by a small solid dot at each end of the lines marking the cross sections.

The principal measurements consist of 16 cross-channel land-surface profiles surveyed at locations specified in table 1 of this file (p. 17) and are also shown on the planimetric map (fig. 1). At the time of preparation of this file, four field surveys had been made; August 6–8, 1962, June 9–10, 1963, July 26, 1965, and June 18, 1966. Elevations from these surveys are listed in the next series of tables (tables 2–17). In addition to having bench marks, two of the cross sections were instrumented with 10-inch-long steel pins driven into the ground at given locations (sections *A–B* and *E–D*). Values of erosion can be determined accurately at these pins and are given in the tables for sections, *A–B* and *E–D* in lieu of elevations from annual resurveys (tables 15–16). It is emphasized that these 10-inch-long pins will not maintain their permanence if left unattended during periods of erosion that cause degradation exceeding the length of the pins.

In addition, a longitudinal profile of the main channel bed was surveyed over a distance of 3,575 feet beginning 150 feet below the fence line near the junction of the channel mouth and its alluvial fan. These data are found in table 18 of this file.

Other observations are being made, including depth of channel scour, height of floodflow, retreat of channel headcuts, and mass movement on slopes. Channel scour is measured by scour chains at stations 3+00, 6+00, and 9+00. The scour-fill record is incomplete because of the annual basis for resurvey. Scour, followed by slightly greater fill, is responsible for an overall aggradation of the channel bed. Height of floodflow is recorded on a crest-stage gage at station 1+50. Mass movement is being observed on two lines of pins installed near *BM–D*. These are indicated on the planimetric map (fig. 1) enclosed in this file. Annual surveys from the time of their installation in 1963 to 1967 show no significant downhill movement of the pins.

The file of original field data includes a planimetric map (simplified reproduction, fig. 1) made by planetable survey of the channel in 1962 and black-and-white and color photographs taken from 1962 to 1966. Film negatives and the original planetable survey are on file with William W. Emmett, U.S. Geological Survey, Washington, D.C. 20242, U.S.A. Prints are available for the cost of reproduction.

The following publications are partly devoted to information about Last Day Gully:

Emmett, W. W., 1965, The Vigil Network: Methods of measurement and a sampling of data collected: Symposium of Budapest, Internat. Assoc. Sci. Hydrology Pub. 66, p. 89–106.

Leopold, L. B., and Emmett, W. W., 1965, Vigil Network sites: A sample of data for permanent filing: Internat. Assoc. Sci. Hydrology Bull., v. 10, no. 3, p. 12–21.

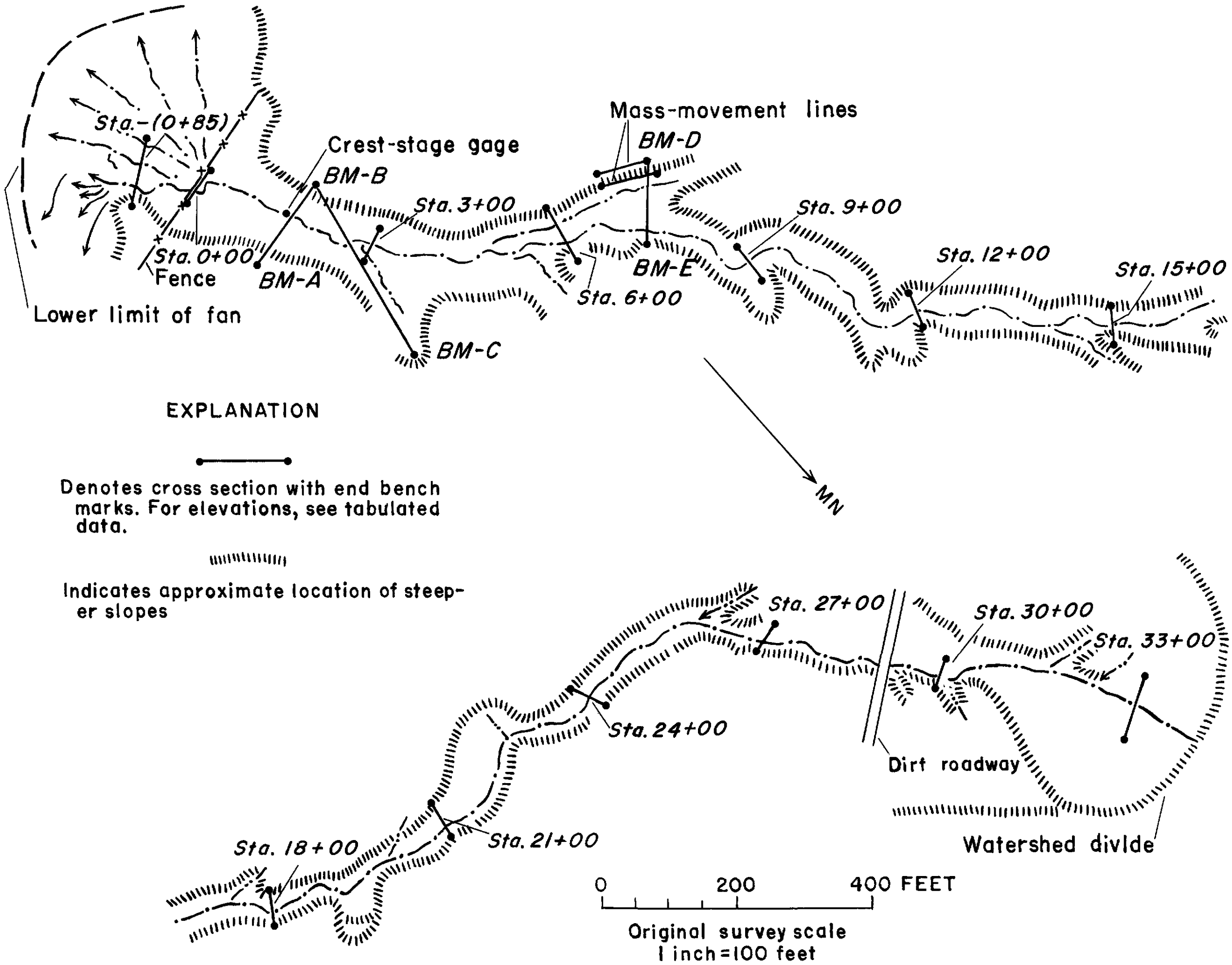

FIGURE 1.—Planimetric map of Last Day Gully, Wyo.

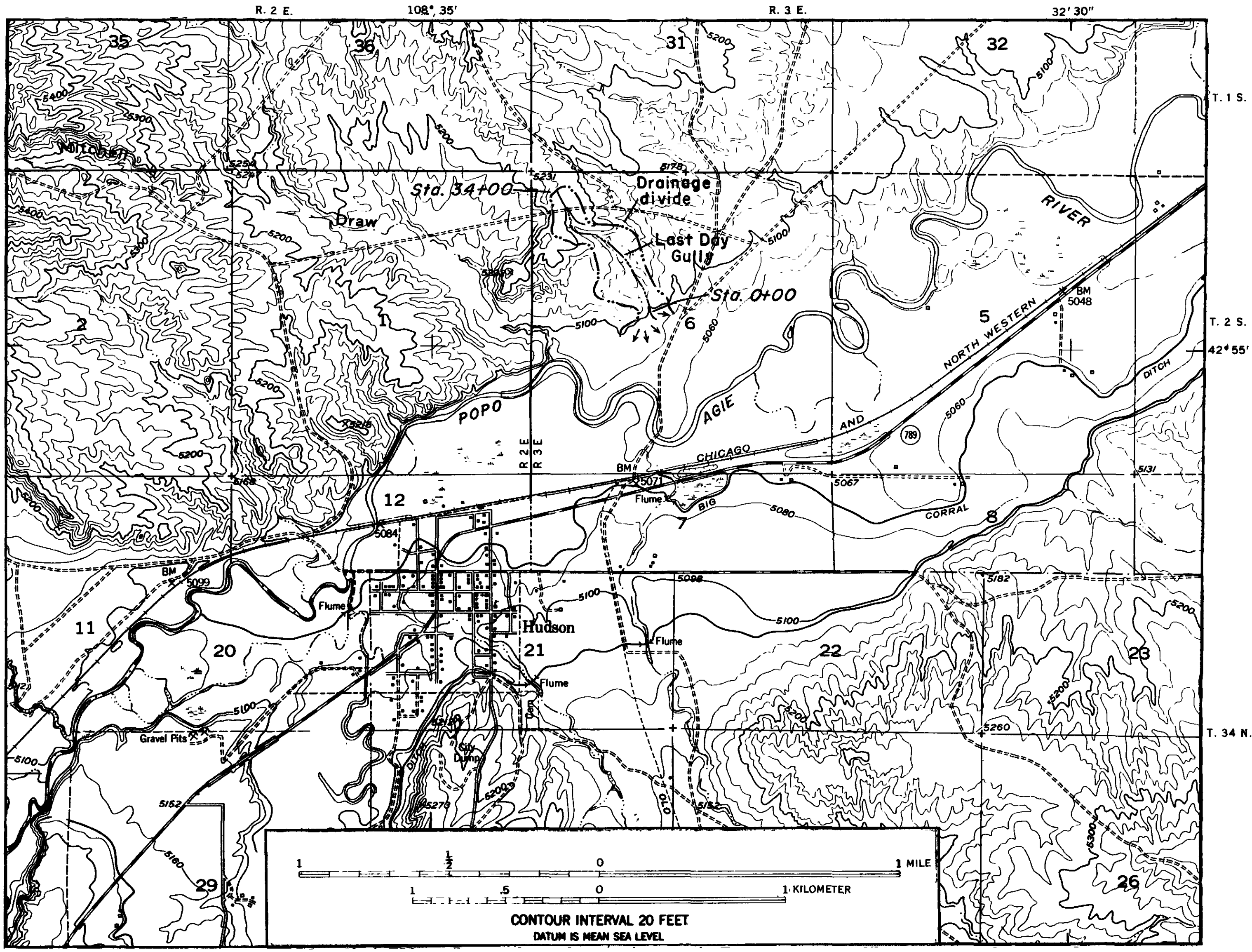

FIGURE 2.—Part of Hudson, Wyo., 1:24,000 U.S. Geological Survey topographic quadrangle map, showing location of Last Day Gully.

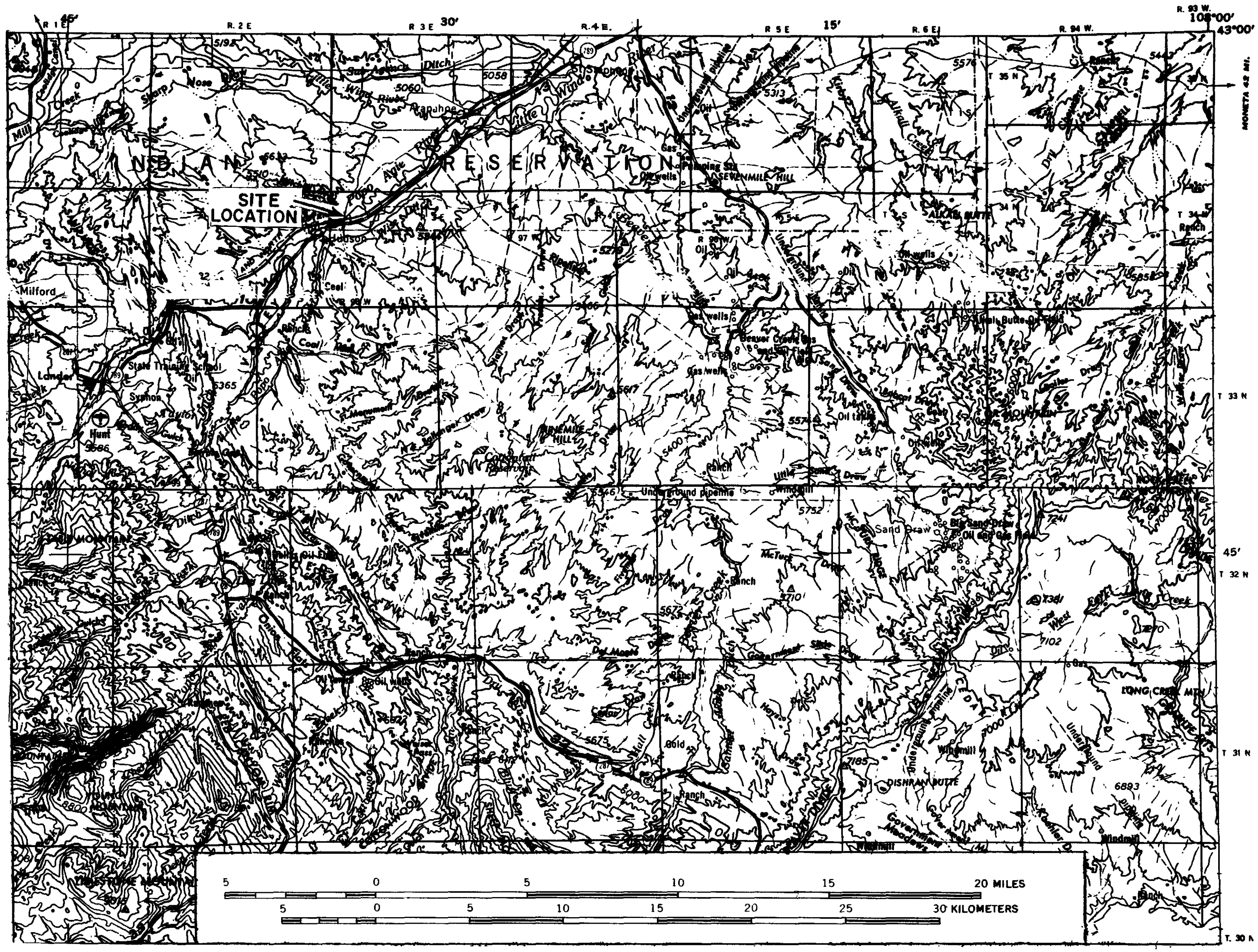

Figure 3.—Part of Lander, Wyo., 1:250,000 U.S. Geological Survey topographic map, showing location of Last Day Gully.

EXPLANATION OF COLUMN HEADINGS IN TABLES 1–18

Cross-section station and channel station: Station location is referred to 0+00 at the fence line at mouth of main channel. For example, 3+00 means 300 feet upstream from the fence line. Stations along gully at which the cross sections *A–B*, *C–B*, and *E–D* occur are respectively 1+60, 2+50, and 7+20 feet.

LB BM description: LB means left bank, facing downstream. LB BM is the left-bank bench mark, or reference point. The term "bench mark (BM)" refers to a 4-foot steel rod, ½-inch diameter, driven into the ground and protruding about 6 inches. All bench marks have a brass identification tag attached which is imprinted with the bench-mark description, elevation, and LDG (an abbreviation for Last Day Gully).

RB BM description: Right-bank bench mark, or reference point. *See also* LB BM description.

LB BM and RB BM elevation: Elevations, in feet, are referenced to an arbitrary elevation of 100.00 feet at the top of *BM–A*. The adding of 5,000 feet gives the approximate elevation above sea level.

Distance from LB BM: Distance, in feet, from left-bank bench mark toward right-bank bench mark.

Elevation: Bench-mark elevations refer to the tops of the bench marks, and other elevations refer to the ground surface. Yearly variations in elevation for a given position on a sloping surface may not necessarily imply erosion or deposition of that amount because slight leeway in lateral placing of level rod gives variation in elevation. However, for flat or nearly flat surfaces, such as the channel bed, variations probably record actual changes. *See also* LB BM and RB BM elevation.

Erosion: Actual values, in feet, measured from pins driven into the ground. Negative values indicate deposition rather than erosion.

TABLE 1.—*Cross-section information*

[See explanation of column headings preceding tables]

Table	Cross-section station	LB BM description	LB BM elevation (feet)	Distance between bench marks (feet)	RB BM description	RB BM elevation (feet)
2	−(0+85)	LB −0.85	89.03	100.0	RB −0.85	87.53
3	0+00	0	91.49	60.0	0	90.95
4	3+00	3	98.77	50.0	3	100.75
5	6+00	6	110.35	85.0	6	111.61
6	9+00	9	119.10	50.0	9	118.20
7	12+00	12	132.66	50.0	12	132.98
8	15+00	15	143.47	50.0	15	142.28
9	18+00	18	153.62	50.2	18	153.61
10	21+00	21	166.74	50.0	21	167.58
11	24+00	24	178.48	50.0	24	178.71
12	27+00	27	192.72	50.0	27	193.32
13	30+00	30	204.14	50.0	30	206.54
14	33+00	33	220.83	100.0	33	220.68
15	*A–B*	*A*	100.00	142.0	*B*	107.54
16	*E–D*	*E*	115.46	120.0	*D*	119.16
17	*C–B*	*C*	110.83	282.0	*B*	107.54

TABLE 2.—*Cross-sectional survey of ground-surface elevation, in feet, station* − *(0+85)*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	89.03	89.03	89.03	89.03
0.0	88.54	88.55	88.59	88.53
5.0	88.30	88.28	88.23	88.14
10.0	87.56	87.55	87.64	87.65
13.0	—	—	—	87.39
15.0	87.06	87.10	87.38	87.24
16.0	—	—	—	86.92
16.5	—	—	86.43	86.45
17.5	—	86.35	—	—
17.8	86.33	—	—	86.32
18.0	—	—	86.30	86.48
19.0	—	—	—	86.66
20.0	86.52	86.67	86.67	—
21.3	86.05	—	—	—
22.0	—	—	—	86.54
22.6	86.03	—	—	—
23.0	—	—	—	86.05
23.5	86.21	—	—	—
25.0	86.29	85.91	86.06	86.05
27.0	85.88	—	—	—
27.2	—	85.77	—	—
28.0	—	85.78	—	85.97
28.5	85.85	—	—	—
29.5	—	—	—	86.01
30.0	86.35	86.38	86.14	86.12
31.0	—	—	—	86.20
32.0	—	—	—	86.05
35.0	86.19	86.25	86.14	86.22
40.0	86.20	86.32	86.17	86.19
41.5	85.95	—	—	—
42.0	—	—	—	86.32
44.0	86.10	86.25	—	—
45.0	—	86.31	86.44	86.39
47.0	86.62	—	—	86.78
47.5	—	86.72	—	—
48.0	—	—	—	86.64
49.0	—	—	—	86.52
50.0	86.61	86.64	86.65	86.71
52.0	86.97	—	—	—
55.0	86.94	86.95	86.98	86.92
60.0	86.92	86.92	87.00	86.87
62.0	—	—	—	87.08
65.0	87.00	87.05	87.00	86.94
70.0	87.03	87.12	86.90	86.85
73.0	—	—	—	86.87
73.5	—	87.17	—	—
75.0	86.89	86.95	86.88	86.90
76.5	—	86.81	—	—
77.0	—	—	—	86.75
80.0	86.85	86.99	86.86	86.77
85.0	86.85	86.85	86.81	86.81
90.0	86.92	86.91	86.87	86.90
95.0	86.92	86.89	86.87	86.88
100.0	86.88	86.87	86.83	86.87
100 (RB BM)	87.53	87.53	87.50	87.54

TABLE 3.—*Cross-sectional survey of ground-surface elevation, in feet, station 0+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	91.49	91.49	91.49	91.49
0.0	90.99	91.07	91.03	91.03
5.0	90.64	90.69	90.70	90.64
9.0	—	—	—	90.28
10.0	89.95	89.96	89.92	89.99
15.0	89.44	89.47	89.52	89.44
20.0	89.41	89.42	89.39	89.38
22.0	89.33	—	89.14	89.36
22.3	—	89.23	—	—
22.4	88.57	—	—	—
23.0	—	—	—	88.73
23.4	88.30	—	—	—
23.5	—	88.54	88.68	—
25.0	—	88.53	—	88.63
26.0	88.31	—	—	—
26.5	—	88.64	—	—
27.0	—	—	88.71	—
27.5	—	—	88.97	—
27.6	88.95	—	—	—
29.5	—	—	—	89.22
30.0	88.59	88.98	89.05	—
32.0	88.67	—	—	89.02
32.7	—	88.87	—	—
33.8	89.13	—	—	—
34.0	—	89.19	—	—
35.0	89.28	89.25	89.25	89.29
38.0	—	—	—	89.81
40.0	89.93	89.93	89.91	89.91
45.0	90.25	90.27	90.37	90.27
50.0	90.34	90.38	90.28	90.27
55.0	90.25	90.27	90.27	90.25
60.0	90.43	90.50	90.40	90.39
60 (RB BM)	90.95	90.95	90.93	90.96

TABLE 4.—*Cross-sectional survey of ground-surface elevation, in feet, station 3+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	98.77	98.77	98.77	98.77
0.0	98.30	98.36	98.33	98.28
5.0	98.18	98.26	98.20	98.18
10.0	97.88	98.00	98.00	97.92
12.0	—	—	—	97.62
15.0	97.75	97.79	97.71	97.74
20.0	97.63	97.68	97.76	97.72
24.0	—	—	97.00	97.16
24.3	—	97.16	—	—
25.0	96.64	96.48	—	—
25.4	95.95	—	—	—
25.8	—	95.80	—	—
26.0	—	—	95.77	95.81
27.0	95.42	—	—	—
27.8	95.45	95.55	95.35	95.60
28.5	—	—	95.50	—
30.0	95.45	95.57	—	95.62
30.8	96.06	—	95.62	—
31.7	—	95.56	—	—
35.0	97.66	97.59	—	97.55
37.0	—	—	98.26	98.24
40.0	98.46	98.46	98.42	98.38
45.0	98.96	98.96	98.96	98.91
50.0	100.01	100.03	100.02	100.00
50 (RB BM)	100.75	100.77	100.75	100.75

TABLE 5.—*Cross-sectional survey of ground-surface elevation, in feet, station 6+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	110.35	110.35	110.35	110.35
0.0	109.98	110.04	110.01	109.95
5.0	108.71	108.73	108.76	108.75
10.0	107.86	107.84	107.80	107.82
15.0	106.99	107.00	107.15	107.16
16.5	—	—	106.97	—
16.7	—	106.65	—	—

TABLE 5.—*Cross-sectional survey of ground-surface elevation, in feet, station 6+00*—Continued

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
17.0	106.37	—	—	106.84
20.0	—	104.21	—	—
20.5	—	—	—	103.86
20.9	—	103.64	—	—
21.0	103.64	—	103.80	—
21.9	—	—	—	103.66
22.9	103.60	103.60	103.59	103.61
23.0	—	103.60	103.59	—
24.3	103.66	103.56	—	—
24.5	—	—	103.69	103.75
25.0	—	103.98	—	—
26.0	104.75	—	—	—
28.0	—	—	—	105.97
29.0	—	—	106.34	—
30.0	106.31	106.32	—	106.41
35.0	106.59	106.63	106.58	106.58
40.0	106.49	106.44	106.42	106.42
45.0	105.95	105.95	105.98	105.90
50.0	106.01	106.00	105.91	105.99
54.0	—	—	105.98	—
55.0	105.60	105.68	—	105.68
58.0	104.62	—	—	104.68
58.3	—	104.72	—	—
59.0	—	104.47	104.44	104.51
59.5	104.57	—	—	—
60.0	—	104.94	—	—
62.5	106.23	106.24	—	—
63.0	—	—	106.41	106.43
65.0	106.84	106.81	—	—
67.0	—	—	—	107.24
70.0	107.61	107.65	107.62	107.62
75.0	108.40	108.32	108.33	108.38
80.0	109.36	109.47	109.44	109.53
85.0	110.71	110.67	110.80	110.69
85 (RB BM)	111.61	111.61	111.60	111.61

TABLE 6.—*Cross-sectional survey of ground-surface elevation, in feet, station 9+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	119.10	119.10	119.10	119.10
0.0	118.26	118.30	118.26	118.25
5.0	118.03	118.04	118.01	117.99
10.0	117.69	117.73	117.66	117.64
12.5	—	—	117.33	117.33
15.0	117.45	117.47	117.46	117.45
16.5	—	—	—	116.88
18.0	—	—	115.90	115.86
18.2	115.69	—	—	—
19.0	—	—	—	115.92
19.5	—	—	116.72	—
20.0	116.60	116.61	—	116.71
21.0	—	—	116.28	116.25
25.0	115.69	115.70	—	115.64
25.5	—	—	115.60	—
25.8	115.61	—	—	—
26.3	—	115.38	—	—
26.7	—	114.96	—	—
27.0	—	—	114.75	114.80
27.3	114.73	—	—	—
27.7	114.74	115.12	114.72	114.72
28.1	114.72	—	—	—
28.4	—	115.12	—	—
28.5	—	—	114.80	—
30.0	115.22	115.22	—	115.26
31.0	—	—	115.53	—
32.0	—	116.17	—	—
33.0	—	—	—	16.96
33.5	—	—	117.04	—
33.8	117.10	117.12	—	—
35.0	117.13	117.12	—	117.10
40.0	116.84	116.93	116.82	116.86
45.0	116.97	116.99	116.99	116.97
50.0	117.44	117.47	117.44	117.42
50 (RB BM)	118.20	118.21	118.20	118.20

TABLE 7.—*Cross-sectional survey of ground-surface elevation, in feet, station 12+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	132.66	132.66	132.66	132.66
0.0	132.16	132.23	132.20	132.18
5.0	130.57	130.59	130.57	130.60
7.8	—	129.86	—	—
10.0	128.96	129.01	128.96	128.94
14.5	—	—	127.80	—
14.6	—	127.71	—	—
15.0	127.71	126.81	126.83	127.79
15.5	126.71	—	—	126.53
18.0	—	124.77	—	—
18.9	—	123.80	—	—
20.0	123.72	123.48	—	—
20.6	123.23	—	—	—
21.0	—	123.37	123.13	123.15
22.5	—	—	123.13	—
22.9	123.13	—	123.28	—
23.0	—	—	124.39	123.19
23.3	—	123.40	—	—
23.8	—	124.53	—	—
24.0	124.47	—	—	123.69
24.5	—	—	—	124.86
25.0	—	125.14	—	—
27.0	—	—	—	126.27
27.7	—	126.29	—	—
28.0	—	—	—	127.81
28.2	126.88	—	—	—
28.5	—	—	126.78	—
28.6	127.74	—	—	—
28.9	—	127.76	—	—
29.0	—	—	127.85	—
30.0	128.10	128.16	—	128.09
35.0	128.88	128.94	128.84	128.99
40.0	129.94	129.95	129.91	129.90
43.0	—	—	130.98	—
45.0	131.18	131.22	131.23	131.20
50.0	132.37	132.45	132.43	132.43
50 (RB BM)	132.98	132.99	132.98	132.99

TABLE 8.—*Cross-sectional survey of ground-surface elevation, in feet, station 15+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	143.47	143.47	143.47	143.47
0.0	142.82	142.84	142.88	142.82
5.0	141.69	141.65	141.61	141.63
7.5	—	141.07	—	—
10.0	140.03	139.99	140.05	140.07
15.0	138.81	138.74	138.83	138.88
20.0	138.84	138.71	138.73	138.74
22.6	—	138.37	138.18	—
23.0	—	—	134.32	—
23.5	138.08	—	—	—
23.6	—	134.25	—	—
24.0	135.96	—	—	138.26
24.3	—	133.58	—	—
24.5	—	—	134.26	—
24.7	—	132.83	—	—
25.0	135.90	132.98	133.28	133.85
25.8	—	133.15	—	—
26.0	136.15	135.98	—	—
27.0	—	135.91	133.14	134.01
27.1	—	—	135.72	—
27.5	136.31	—	136.32	136.00
27.7	—	136.37	—	—
27.8	138.19	—	—	—
27.9	—	138.37	—	—
28.0	—	—	138.26	136.29
28.3	—	—	—	136.42
30.0	138.75	138.74	138.68	138.67
35.0	138.77	138.74	138.74	138.74
40.0	140.15	140.26	140.28	140.13
45.0	141.22	141.26	141.20	141.22
50.0	141.77	141.92	141.89	141.82
50 (RB BM)	142.28	142.29	142.28	142.29

TABLE 9.—*Cross-sectional survey of ground-surface elevation, in feet, station 18+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	153.62	153.62	153.62	153.62
0.0	152.98	152.94	152.91	152.90
5.0	151.30	151.34	151.33	151.34
10.0	150.96	150.97	150.92	150.89
13.0	—	—	150.56	—
13.5	150.63	—	—	150.49
15.0	149.79	149.66	149.70	149.72
15.3	—	149.23	—	—
15.4	149.25	149.14	148.84	149.03
15.7	—	148.89	—	—
16.4	—	148.84	—	—
16.5	149.18	—	148.72	148.72
16.6	—	150.03	149.96	149.99
16.7	149.88	—	—	—
20.0	150.33	150.23	150.32	150.29
25.0	150.47	150.53	150.52	150.52
30.0	150.48	150.57	150.50	150.51
35.0	150.33	150.35	150.36	150.34
40.0	151.00	150.99	151.01	150.97
45.0	152.33	152.23	152.24	152.25
50.2	153.08	153.11	153.04	153.08
50.2 (RB BM)	153.61	153.61	153.59	153.61

TABLE 10.—*Cross-sectional survey of ground-surface elevation, in feet, station 21+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	166.74	166.74	166.74	166.74
0.0	166.04	166.08	166.06	166.09
5.0	164.21	164.01	164.20	164.21
8.0	—	—	161.95	—
8.5	161.85	—	—	—
8.6	—	161.79	—	—
9.0	—	—	161.60	161.79
10.0	161.54	161.61	—	—
10.5	—	—	161.56	—
15.0	161.74	161.77	161.75	161.75
18.0	—	—	161.82	—
20.0	162.25	162.26	—	162.23
22.0	—	—	162.62	—
25.0	162.80	162.83	—	162.79
27.0	—	—	162.97	—
30.0	163.59	163.68	—	163.57
32.0	—	—	163.83	—
35.0	164.75	164.83	—	164.75
37.0	—	—	165.79	—
37.2	—	165.90	—	—
37.5	—	—	—	165.82
38.0	165.77	—	—	—
40.0	166.05	166.17	166.13	166.19
45.0	166.70	166.72	166.73	166.71
50.0	167.02	167.03	167.02	167.02
50 (RB BM)	167.58	167.58	167.57	167.59

TABLE 11.—*Cross-sectional survey of ground-surface elevation, in feet, station 24+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	178.48	178.48	178.48	178.48
0.0	178.06	178.01	177.98	177.96
5.0	175.83	175.80	175.82	175.75
7.5	—	—	174.60	—
8.0	174.44	—	—	174.55
10.0	174.38	174.35	174.20	174.26
10.7	—	174.12	—	—
11.7	—	173.76	—	—
13.0	—	—	173.48	—
14.0	173.38	—	—	—
15.0	—	173.40	—	173.35
17.0	173.13	—	173.15	—
18.0	—	173.23	173.19	—
20.0	—	173.19	173.00	173.04
20.2	173.03	—	—	—
23.0	—	—	174.92	—
23.3	—	175.01	—	—

TABLE 11.—*Cross-sectional survey of ground-surface elevation, in feet, station 24+00*—Continued

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
23.6	174.96	—	—	—
24.0	—	—	—	174.98
25.0	175.23	175.49	—	—
26.5	—	—	175.67	—
30.0	176.17	176.23	176.18	176.12
35.0	177.22	177.31	177.30	177.24
40.0	177.75	177.76	177.73	177.82
45.0	178.02	178.01	178.00	178.01
50.0	177.99	178.00	177.97	177.99
50 (RB BM)	178.71	178.71	178.69	178.72

TABLE 12.—*Cross-sectional survey of ground-surface elevation, in feet, station 27+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	192.72	192.72	192.72	192.72
0.0	191.97	192.01	192.04	192.03
5.0	190.35	190.28	190.28	190.21
8.0	—	189.25	—	—
10.0	187.89	188.10	187.90	188.10
13.1	186.16	—	—	—
13.4	—	185.95	—	—
13.5	—	—	186.03	185.93
13.8	—	185.02	—	—
14.0	—	—	—	185.38
14.2	184.89	—	—	—
14.5	—	—	185.12	—
15.0	—	185.06	—	—
15.5	184.95	—	—	—
16.0	—	185.27	185.10	185.16
16.5	186.14	186.32	—	—
17.0	—	—	185.50	185.52
17.1	—	—	186.15	186.28
20.0	187.45	187.46	187.45	187.46
25.0	188.98	189.08	188.85	188.89
30.0	190.53	190.53	190.51	190.44
35.0	191.83	191.85	191.74	191.77
40.0	192.39	192.43	192.41	192.41
45.0	192.71	192.73	192.70	192.71
50.0	192.89	192.96	192.95	192.94
50 (RB BM)	193.32	193.34	193.32	193.33

TABLE 13.—*Cross-sectional survey of ground-surface elevation, in feet, station 30+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	204.14	204.14	204.14	204.14
0.0	203.38	203.48	203.46	203.43
5.0	204.50	202.56	202.58	202.64
10.0	201.74	201.71	201.68	201.76
15.0	—	200.82	200.82	200.81
15.4	—	200.65	—	—
15.5	200.72	—	—	—
17.5	—	—	198.40	198.60
17.7	—	198.28	—	—
17.8	198.20	—	—	—
20.0	—	198.51	—	—
21.0	198.45	—	198.51	—
21.4	—	198.50	—	—
21.5	—	—	—	198.48
23.0	200.21	—	—	200.20
23.1	—	200.17	—	—
23.5	—	—	200.29	—
25.0	200.78	200.96	—	—
27.0	—	201.43	201.49	201.40
30.0	201.83	201.83	201.86	201.90
35.0	202.90	202.82	202.84	202.88
40.0	203.92	203.82	203.83	203.85
45.0	204.79	204.77	204.75	204.76
50.0	205.24	205.31	205.32	205.32
50 (RB BM)	206.44	206.44	206.44	206.45

TABLE 14.—*Cross-sectional survey of ground-surface elevation, in feet, station 33+00*

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation			
	Aug. 1962	June 1963	July 1965	June 1966
0 (LB BM)	220.83	220.83	220.83	220.83
0.0	220.39	220.43	220.40	220.39
5.0	220.03	220.08	220.03	220.02
10.0	219.78	219.83	219.81	219.80
15.0	219.51	219.59	219.49	219.42
20.0	219.17	219.13	219.11	219.15
25.0	218.91	218.90	218.96	219.01
30.0	218.55	218.58	218.60	218.61
35.0	218.84	218.84	218.86	218.84
40.0	218.60	218.72	218.61	218.62
45.0	218.48	218.65	218.58	218.46
50.0	218.25	218.29	218.24	218.25
55.0	218.71	218.71	218.66	218.71
60.0	218.99	219.00	219.02	219.10
65.0	219.26	219.29	219.33	219.33
70.0	219.79	219.77	219.78	219.82
75.0	219.41	219.40	219.41	219.43
80.0	219.67	219.70	219.69	219.66
85.0	219.68	219.82	219.79	219.69
90.0	219.68	219.67	219.67	219.68
95.0	219.68	219.70	219.67	219.73
100.0	219.63	219.69	219.69	219.70
100 (RB BM)	220.68	220.66	220.67	220.68

TABLE 15.—*Cross-sectional survey of ground-surface elevation and erosion, in feet, station* A–B

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation	Erosion, Aug. 1962—		
	Aug. 1962	June 1963	July 1965	June 1966
0 (*BM-A*)	100.00	—	—	—
0.0	99.66	0.010	0.010	0.010
5.0	99.51	.010	.015	.015
10.0	99.20	.010	.010	.010
15.0	98.75	.000	—.010	—.010
20.0	98.16	—.010	—.020	—.020
25.0	97.46	.015	.005	.005
30.0	96.45	.015	.015	.015
35.0	95.86	.010	.020	.020
40.0	95.24	.010	.025	.025
45.0	94.82	.010	.015	.015
50.0	94.58	.030	.030	.030
55.0	94.67	.010	.015	.015
60.0	94.78	.010	.025	.025
65.0	94.50	.000	—.015	—.015
70.0	94.55	.005	.000	.000
75.0	94.53	.000	—.030	—.030
77.0	94.07	—	—	—
78.0	93.33	—	—	—
79.3	91.70	—	—	—
80.0[1]	91.74	—.100	—.270	—.355
82.0	91.86	—	—	—
82.2	92.41	—	—	—
85.0	93.23	.020	.005	.030
90.0	94.56	.050	.035	.055
95.0	95.46	.050	.055	.055
100.0	96.64	.050	.065	.065
105.0	97.84	.020	.055	.035
110.0	98.88	.030	.045	.045
115.0	100.16	—.020	—.005	—.005
120.0	101.70	.025	.040	.050
125.0	103.37	.115	.115	.150
130.0	104.37	.005	—.015	—.015
135.0	105.31	.010	.010	.010
140.0	105.84	.025	.065	.085
142.0	105.71	.020	.005	.005
142 (*BM-B*)	107.54	—	—	—

[1] Channel bed.

TABLE 16.—*Cross-sectional survey of ground-surface elevation and erosion, in feet, station* E–D

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation	Erosion, Aug. 1962—		
	Aug. 1962	June 1963	July 1965	June 1966
0 (*BM-E*)	115.46	—	—	—
0.0	114.82	0.040	0.050	0.050
5.0	113.91	.010	.010	.010

TABLE 16.—*Cross-sectional survey of ground-surface elevation and erosion, in feet, station* E–D—Continued

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation	Erosion, Aug. 1962—		
	Aug. 1962	June 1963	July 1965	June 1966
10.0[1]	112.53	0.060	0.085	0.120
12.0	111.71	.070	.090	.140
14.0	110.45	.060	.090	.100
16.0[2]	109.36	.180	.520	.630
16.7	108.73	—	—	—
17.0	107.78	—	—	—
18.0[3]	107.23	—.020	—.220	—.260
19.5	107.39	—	—	—
20.0	107.79	.230	.180	.095
22.0	108.51	—	—.230	—.230
24.0	109.66	—	.000	.000
24.2	110.09	—	—	—
26.0	110.45	.015	.020	.020
28.0	110.84	.040	.040	.040
30.0	111.17	.010	.000	.000
35.0	111.54	.000	.005	—.005
40.0	111.40	.000	.005	.005
45.0	111.52	.000	—.005	—.005
50.0	111.77	.015	.035	.020
55.0	112.30	.010	.005	.005
60.0	111.78	.020	.035	.035
65.0	111.09	.015	—.005	—.005
70.0	110.37	.025	.020	.020
75.0	110.05	.025	.015	.015
80.0	110.66	.000	—.025	—.025
85.0	111.13	.010	.015	.015
90.0	111.38	.000	.010	.000
95.0	112.08	.010	—.005	—.005
100.0	113.40	.020	.030	.030
105.0	114.58	.000	—.015	—.015
110.0	116.22	—.025	—.060	—.060
112.0	116.98	.000	.010	.010
114.0	117.63	.000	.010	.010
116.0	117.97	.015	.020	.020
118.0	118.44	.020	.080	.080
120.0	118.85	.000	.005	.025
120 (*BM-D*)	119.16	—	—	—

[1] Channel wall.
[2] Steep bank.
[3] Channel bed.

TABLE 17.—*Cross-sectional survey of ground-surface elevation, in feet, station* C–B

[See explanation of column headings preceding tables]

Distance from LB BM	Elevation Aug. 1962	Distance from LB BM	Elevation Aug. 1962
0 (*BM-C*)	110.83	165.0	97.24
0.0	110.45	168.0	97.23
5.0	110.03	170.0	96.54
10.0	109.28	174.0	95.89
15.0	108.44	174.5	96.72
20.0	107.52	177.5	96.73
25.0	106.64	178.5	95.77
30.0	105.45	180.0	95.38
35.0	104.69	181.7	94.75
40.0	104.76	185.0	94.95
45.0	104.24	186.2	94.97
50.0	104.02	187.5	95.49
55.0	103.96	190.0	95.91
60.0	103.81	195.0	96.30
65.0	103.71	200.0	96.57
70.0	103.35	205.0	97.37
75.0	102.97	210.0	98.20
80.0	102.68	215.0	98.98
85.0	102.56	220.0	99.29
90.0	102.03	225.0	99.80
95.0	101.77	230.0	100.70
100.0	101.51	235.0	101.79
105.0	101.18	240.0	102.83
110.0	100.90	245.0	103.52
115.0	100.62	250.0	103.92
120.0	100.35	255.0	104.45
125.0	100.11	260.0	105.08
130.0	99.83	265.0	105.31
135.0	99.26	270.0	105.61
140.0	98.88	275.0	105.81
145.0	98.50	280.0	105.79
150.0	98.27	282.0	105.66
155.0	98.12	282 (*BM-B*)	107.54
160.0	97.66		

TABLE 18.—*Long profile of channel-bed elevation, in feet, survey of August 7, 1962*

[See explanation of column headings preceding tables]

Channel station	Elevation	Channel station	Elevation
−(1+50)	83.95	8+75	113.93
−(1+25)	84.02	9+00	114.71
−(1+10)	84.73	9+25	115.73
−(1+00)	85.31	9+50	116.69
−(0+75)	86.46	9+75	117.28
−(0+50)	87.20	10+00	117.77
−(0+25)	87.92	10+25	118.48
0+00	88.32	10+50	119.00
0+25	88.58	10+75	119.61
0+50	89.18	11+00	120.38
0+75	89.68	11+25	120.98
1+00	90.12	11+50	121.64
1+25	90.98	11+75	122.31
1+50	91.41	12+00	123.13
1+75	92.01	12+25	124.10
2+00	92.87	12+50	124.86
2+25	93.32	12+75	125.93
2+50	94.26	13+00	127.04
2+75	94.96	13+25	127.86
3+00	95.43	13+50	128.55
3+25	95.90	13+75	129.48
3+50	96.60	14+00	130.13
3+75	97.35	14+25	131.42
4+00	97.99	14+50	132.26
4+25	98.71	14+75	133.45
4+50	99.74	15+00	134.82
4+75	100.49	15+00	136.19
5+00	100.96	15+20	137.59
5+25	101.49	15+20	139.15
5+50	102.05	15+25	139.66
5+75	102.78	15+50	140.34
6+00	103.59	15+75	141.03
6+25	104.21	16+00	142.07
6+50	104.93	16+25	143.12
6+75	105.87	16+50	144.41
7+00	106.58	16+75	145.44
7+25	107.22	17+00	146.04
7+50	108.10	17+25	146.73
7+75	109.06	17+50	147.26
8+00	109.64	17+75	148.00
8+25	111.19	18+00	149.21
8+50	112.30		

TABLE 18.—*Long profile of channel-bed elevation, in feet, survey of August 7, 1962*—Continued

[See explanation of column headings preceding tables]

Channel station	Elevation	Channel station	Elevation
18+25	150.84	26+50	183.28
18+50	151.07	26+75	183.95
18+75	151.90	27+00	184.84
18+75	151.90	27+25	186.83
19+00	152.48	27+50	187.71
19+25	154.20	27+75	188.87
19+50	155.04	28+00	190.03
19+75	155.49	28+25	190.64
20+00	156.26	28+50	191.00
20+25	156.95	28+75	191.80
20+50	158.12	28+96	192.47
20+75	158.73	28+97	193.33
20+81	158.26	29+00	193.56
20+85	159.91	29+12	194.52
21+00	161.55	29+16	196.89
21+25	162.08	29+25	196.48
21+50	162.75	29+32	195.91
21+75	164.19	29+50	197.44
22+00	164.95	29+75	197.85
22+25	165.27	30+00	198.20
22+50	165.60	30+25	198.60
22+75	166.16	30+35	199.35
23+00	166.90	30+35	201.64
23+25	168.50	30+50	202.55
23+46	169.66	30+75	203.80
23+47	170.06	31+00	204.83
23+48	170.82	31+25	205.64
23+50	171.01	31+50	207.53
23+75	172.16	31+75	209.23
24+00	173.05	32+00	210.96
24+25	174.42	32+25	211.97
24+50	174.98	32+30	212.40
24+75	176.29	32+32	213.80
25+00	177.53	32+50	215.17
25+25	178.49	32+75	216.85
25+50	179.58	33+00	218.20
25+75	180.33	33+25	219.97
25+83	180.62	33+50	221.92
25+87	181.37	33+75	223.91
26+00	181.95	34+00	226.05
26+25	182.64	34+25	223.49

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Scour chains ____
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Water-surface profile ____
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Vegetation

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Quadrats ____
Grasses ____, shrubs ____,
  trees ____
Tree-ring data ____
Other (specify) ______

Hillslopes

Erosion stakes ______
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Painted rock lines ______
Cliff-recession markers ______
Profiles ______
Water runoff ______
Other (specify) ______

Other

Reservoir sedimentation ______
Rain gage ______
Soil chemistry ______
Soil moisture ______
Particle size:
  Streambed ______
  Bank ______
  Hillslope ______
Pollen ______
Other (specify) ______

*Further data**

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If a plot ______
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Other (specify) __________

Vegetation

Transects _____
Quadrats _____
Grasses _____, shrubs _____,
trees _____
Tree-ring data _____
Other (specify) __________

Hillslopes

Erosion stakes __________
Mass-movement pins __________
Painted rock lines __________
Cliff-recession markers __________
Profiles __________
Water runoff __________
Other (specify) __________

Other

Reservoir sedimentation __________
Rain gage __________
Soil chemistry __________
Soil moisture __________
Particle size:
- Streambed __________
- Bank __________
- Hillslope __________

Pollen __________
Other (specify) __________

*Further data**

If a basin, drainage area __________
If a plot __________
Elev __________
Ann. precipitation __________
Relief __________
Geology:

Vegetation:

Hydrology:

Photography:

Other:

* Include units of measurement, metric or English

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Channel change ____ Erosion ____ Sedimentation ____ Mass movement ____ Vegetation ____
Number and type of observations (if applicable, write number of such installations):

Stream channels

Channel cross sections ____
Scour chains ____
Bed profile ____
Water-surface profile ____
Discharge:
- Crest-stage gage ____
- Gaging station ____
- Suspended sediment ____
- Chemical ____

Other (specify) ________

Vegetation

Transects ____
Quadrats ____
Grasses ____, shrubs ____, trees ____
Tree-ring data ____
Other (specify) ________

Hillslopes

Erosion stakes ________
Mass-movement pins ________
Painted rock lines ________
Cliff-recession markers ________
Profiles ________
Water runoff ________
Other (specify) ________

Other

Reservoir sedimentation ________
Rain gage ________
Soil chemistry ________
Soil moisture ________
Particle size:
- Streambed ________
- Bank ________
- Hillslope ________

Pollen ________
Other (specify) ________

*Further data**

If a basin, drainage area ________
If a plot ________
Elev ________
Ann. precipitation ________
Relief ________
Geology:

Vegetation:

Hydrology:

Photography:

Other:

* Include units of measurement, metric or English

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Type ________
Date ________

Site name ________ Location ________

Principal site investigator ________ Address ________

Purposes (check; if more than one, number in order of importance):
Channel change _____ Erosion _____ Sedimentation _____ Mass movement _____ Vegetation _____
Number and type of observations (if applicable, write number of such installations):

Stream channels

Channel cross sections _____
Scour chains _____
Bed profile _____
Water-surface profile _____
Discharge:
Crest-stage gage _____
Gaging station _____
Suspended sediment _____
Chemical _____
Other (specify) ________

Vegetation

Transects _____
Quadrats _____
Grasses _____, shrubs _____,
trees _____
Tree-ring data _____
Other (specify) ________

Hillslopes

Erosion stakes ________
Mass-movement pins ________
Painted rock lines ________
Cliff-recession markers ________
Profiles ________
Water runoff ________
Other (specify) ________

Other

Reservoir sedimentation ________
Rain gage ________
Soil chemistry ________
Soil moisture ________
Particle size:
Streambed ________
Bank ________
Hillslope ________
Pollen ________
Other (specify) ________

*Further data**

If a basin, drainage area ________
If a plot ________
Elev ________
Ann. precipitation ________
Relief ________
Geology:

Vegetation:

Hydrology:

Photography:

Other:

* Include units of measurement, metric or English

VIGIL NETWORK SITE
INDEX CARD

Card No. ____________
Type ____________
Date ____________

Site name ____________ Location ____________

Principal site investigator ____________ Address ____________

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Channel change ____ Erosion ____ Sedimentation ____ Mass movement ____ Vegetation ____
Number and type of observations (if applicable, write number of such installations):

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Vegetation

Transects ____
Quadrats ____
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