SEDIMENT SOURCES IN THE LAKE TAHOE BASIN, CALIFORNIA-NEVADA--PRELIMINARY RESULTS OF A FOUR-YEAR STUDY, AUGUST 1983-SEPTEMBER 1987

by B.R. Hill, J.R. Hill, and K.M. Nolan

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CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION FACTORS

For the convenience of readers who prefer the inch-pound to metric and International System (SI) units, the following conversion factors are provided:

Multiply	by	To obtain
centimeters (cm)	0.3937	inches
cubic meters (m^3)	35.31	cubic feet
cubic meters per second (m^3/s)	35.31	cubic feet per second
degrees Celsius (°C)	1.8 °C + 32	degrees Fahrenheit
grams (g)	0.0022	pounds
kilometers (km)	0.621	miles
megagrams (Mg)	1.10	tons, short
meters (m)	3.28	feet
millimeters (mm)	0.039	inches
square kilometers (km^2)	0.386	square miles
square meters (m^2)	10.76	square feet

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called mean sea level.

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ABSTRACT

This report contains data collected during a 4-year study of sediment sources in four drainage basins tributary to Lake Tahoe, California-Nevada: Blackwood, General, Edgewood, and Logan House Creek basins. Data include changes in bank and bed positions at channel cross sections, results of stream-channel mapping, analyses of bank and bed material samples, tabulations of bed material point counts, measured rates of hillslope erosion, dimensions of gullies, suspended-sediment data collected during synoptic snowmelt sampling, and physiographic data for the four study basins.

INTRODUCTION

The protection of water quality in Lake Tahoe depends, in part, on controlling delivery of suspended sediment by tributaries. Large variations in sediment yields have been observed among streams for which sediment records are available, but little is known concerning the processes that control the supply of sediment to Lake Tahoe tributaries. Effective management of lands in the Lake Tahoe basin to improve lake water quality requires an understanding of these processes and their relative importance within tributary drainage basins.

This report presents preliminary data collected during a 4-year (water years 1984-87) study of sediment sources in four drainage basins tributary to Lake Tahoe (fig. 1). The four basins selected for the study are the Blackwood (figs. 2 and 3), General (fig. 4), Edgewood (figs. 5 and 6), and Logan House Creek basins (fig. 7). Data contained in this report describe the physiography, geology, erosional landforms, vegetation, streamflow, and suspended-sediment loads of the study basins (tables 1-4) and summarize results of repetitive surveys of stream-channel cross sections, ground mapping of selected characteristics of selected channel segments, measurements of ground surface lowering and surface erosion, and results of synoptic sampling of suspended-sediment discharge at selected sites within the Blackwood Creek basin. Data for the Blackwood Creek basin are given in tables 5-15, for the General Creek basin in tables 16-19, for the Edgewood Creek basin in tables 20-26, and for the Logan House Creek basin in tables 27-30.

This study was conducted by the U.S. Geological Survey in cooperation with the Tahoe Regional Planning Agency. Assistance in the field was provided by Julie H. Galton, Gerald L. Rockwell, Dennis J. O'Halloran, James A. Howle, Jon Major, Andrea Holland, Bill Hoffman, Mark Cramer, and Cecily C.Y. Chang. Julie H. Galton and James R. Mullen assisted with data analysis.

DETERMINATION OF SEDIMENT SOURCES

Basin Physiography

Basin physiographic characteristics (table 1A) were determined from 1:24,000-scale U.S. Geological Survey topographic maps except where noted. Drainage areas are reported for the areas upstream of the gaging stations (U.S. Geological Survey, 1982-87).

Calculations of areas for the determination of various basin characteristics described below were done with the dot-grid method. This method involves placing a transparent grid over a map of the area and counting the number of squares, or "dots," that fall within the area of interest. By multiplying the number of squares by the map-scale area represented by one "dot," the area is computed.

Elevations were determined from topographic maps. Contour intervals for these maps are 40 feet (12.2 meters), and precision of altitude determinations is 6.1 meters. Relief was calculated as the difference between the highest and lowest altitudes within each basin.

Hypsometric analysis index values were determined using the procedure outlined by Iwatsubo and others (1975). These numbers represent the vertical distance above the mouth of each basin, expressed as a percent of the total basin relief, that is higher than exactly half of the basin area.

Basin aspects were determined using the method of Iwatsubo and others (1975). These numbers reflect the general orientation of the basins. Aspects are reported as true azimuths in degrees with 0 and 360 degrees representing north.

Average land-surface slopes were determined using the line-intersection method of Wentworth (1930). Slopes are reported in degrees relative to the horizontal.

Drainage densities were calculated as the total length of stream channels in each basin divided by the basin area. Total channel lengths were measured from 1:24,000-scale topographic maps. Channels were measured along and upstream from blue-line channels (channels shown as blue lines on 1:24,000-scale topographic maps) following successive crenulations in contour lines until crenulations became indistinct. These channels include ephemeral channels which may not carry water during some years.

Main channel lengths are those reported by Jorgensen and others (1978). Stream-channel gradients were determined by obtaining the altitudes of the highest and lowest points along the main stream channels, as reported by Jorgensen and others (1978), subtracting to obtain the differences in altitudes, and dividing the differences by the main channel lengths. Stream-channel gradients are therefore reported as percentages, in contrast to land-surface slopes, which are reported in degrees.

Average annual precipitation values were determined using the precipitation map of the Tahoe Regional Planning Agency (1971a). Precipitation values halfway between lines of equal precipitation were used to calculate area-weighted averages by multiplying these values by the area between the corresponding successive lines of equal precipitation, as determined with a dot grid.

Basin geology (table 1B) was determined from the geological map of Matthews and Burnett (1971). The area underlain by each rock type was determined with a dot grid. Five rock types were delineated: glaciated granitic, decomposed granitic, volcanic, metamorphic, and surficial (primarily morainal, outwash, and alluvial deposits). Erosional landforms (table 2), including various types of landslides and talus fields, were mapped by using aerial photography taken in 1977 at a scale of 1:24,000 (Blackwood and General Creeks) or 1:15,840 (Edgewood and Logan House Creeks), with field checking (Deborah Harden, Department of Geology, California State University, San Jose, written commun., 1985). The area of each basin included in each erosional landform was determined with the dot-grid method. The same method was used to determine the percentages of each basin covered by four general vegetation types (bare ground, riparian, brush, coniferous forest) (table 3) using the vegetation map of the Tahoe Regional Planning Agency (1971b).

Channels

Channel Cross-Section Surveys

Channel cross sections were established to determine changes in streambank and bed cross-sectional area due to bank erosion and deposition and bed scour and fill. Cross sections were located along the main channels of each basin and along several tributary channels in the Blackwood Creek basin in groups of two or three at approximately equal intervals along the channels. Locations of cross-section groups are shown for each basin on figures 2, 4, 5, and 7. Within cross-section groups, individual cross sections were located at distances of 2-3 channel widths from adjacent cross sections.

Cross sections were monumented with lengths of metal fencepost or reinforcement rod (rebar). The elevation difference between the tops of the monuments was determined with a level and rod. Compass bearings were taken from one of the monuments to the other and the distance between the monuments was recorded; this allowed reestablishment of each cross section if one of the two monuments was lost. In addition, reference marks, usually consisting of nails driven into trees, were established at most cross sections to provide a means of relocating monuments. Monuments were marked by drilling small holes, in the case of fenceposts, or twisting wire, for rebar, to provide a consistent position for attaching the cloth tape during surveys.

Two methods were used to survey cross sections. At wide cross sections (generally wider than 25 m), a self-leveling level and rod were used to obtain elevations. A small bubble level was used to keep the rod vertical. Elevations were measured to the nearest 3 mm. Distances were read to the nearest 3 cm with a cloth tape. At cross sections of lesser width, where sagging of the cloth tape was not significant, elevations were read by holding the rod vertically against the cloth tape and reading the rod where it was intersected by the lower edge of the cloth tape. Precision of measurement for both distances and rod readings was 3 mm.

Cross-section data (tables 5, 16, 20, and 27) were entered into computer files and processed by a series of programs which converted the data from inch-pound into International System (SI) units, corrected horizontal distances for the differences between monument elevations (for the slope of the cloth tape), sorted the data, and plotted the most recent survey with the previous survey at the same cross-section. From these plots and notes made during field work, locations of upper and lower extents of banks were determined. Using these locations the changes in area between successive surveys for the left and right banks and bed were calculated with a computer graphics program. From these area changes, the rate of change between surveys was computed by dividing by the bank height, for bank changes, or by horizontal distance, for bed changes.

Channel Mapping

Stream channels were mapped (tables 6, 7, 17, 21, and 28) to determine the areas of eroding and stable stream banks, the area of the stream bed, and volumes of sediment storage in the channels. Bank heights were measured with a surveying rod, channel widths and lengths with a rod or a range-finder, and dimensions of storage elements with a rod. Storage elements consisted of active, semiactive, and inactive channel bars, storage behind organic debris, and storage in the active channel above the thalweg (lowest point in streambed). The average depths or heights of these storage elements were determined by measuring the height of each storage element above the thalweg with a surveying rod. The percentages of each bank that appeared to be eroding, stable, or armored were estimated. Measurement precision for rod measurements was 3 cm. For range-finder measurements precision varied between 0.15 and 1.5 m, with precision decreasing with distance.

Mapping was completed in reaches of variable length. Each reach was defined as a length of channel where the features that were measured were fairly uniform. Reaches were ended at places where changes were apparent, or where visibility was limited by vegetation or channel meanders. The entire main channels of Blackwood and General Creeks were mapped. Due to the narrow channels and nearly impassable riparian thickets in Edgewood and Logan House Creek basins, sampling of reaches was used. In both of these basins, slightly over 30 percent of the main channel length was mapped. This sampling technique was also used to select reaches for mapping along several tributaries in the Blackwood Creek basin. All mapped lengths of channels are shown on figures 3, 4, 5, and 7.

Bed and Bank Sampling

Samples of stream bank and bed material were collected at each cross-section to determine the weight percentage of bank and bed material with an intermediate grain diameter of 2 mm or less. An upper limit of 2 mm was used because this is the largest grain size that is normally transported as suspended sediment in the Lake Tahoe basin (U.S. Geological Survey, 1982-87).

Bank samples were collected by driving metal cans horizontally into the banks until the cans were completely filled with material. Samples were transferred to canvas bags and transported for processing.

Bulk density of bank samples (tables 8, 10, 18, 22, and 29) was determined by oven-drying the samples at approximately 65 °C for 24 hours, weighing the sample, and dividing by the volume of the sample collection can. Samples were then sieved through a 2-mm sieve, using a mechanical shaker for 10-20 minutes. The sediment remaining on the sieve was weighed and the mass of this fraction was subtracted from the total sample mass to give the mass of the fraction that was finer than 2 mm. This mass was divided by the total sample mass to give the percentage of the total sample that was finer than 2 mm.

When conditions permitted, bed-material samples were collected and processed in the same manner as bank samples. More often, however, this was not possible due to large particle sizes and low-cohesion bed material. Under these conditions, bed material bulk density was determined by scooping a small depression in exposed bed material, lining the depression with plastic sheeting, and filling the depression with water. The volume of water added was measured to give the volume of the material excavated from the depression. The excavated material was placed in a plastic bucket and weighed with a spring scale. Bulk density (wet) was then calculated as the mass of excavated material divided by the volume of the excavated depression. This method was not entirely satisfactory, as volume determinations were somewhat subjective and samples were not dried prior to weighing. For remote sites with coarse bed material, however, this appeared to be the only practical method. Excavated material was wet-sieved in the field to determine the percentage of bed sediment finer than 2 mm. The slight amount of water retained with the coarse fraction caused an undetermined underestimation of the percent of bed material finer than 2 mm.

Point counts (Wolman, 1955) were made of surface bed material at all sets of cross sections (tables 9, 19, 23, and 30). Approximately 100 points were sampled for each count. Counts were made in both 1983 and 1984. Material finer than 1 mm intermediate grain diameter was classed by assessing texture by "feel."

Hillslopes

Erosion Pins

Erosion-pin arrays were established at various locations within the Blackwood and Edgewood Creek basins (figs. 2 and 5) to determine rates of land surface lowering by hillslope processes. Erosion-pin arrays are monumented with lengths of metal fenceposts or rebar driven into the ground in pairs. These pairs are installed along hillslope contours in sets of three pairs per site. The pairs are offset so that no pair is directly above another. The relative elevations of erosion-pin monuments were established with a level and rod. Changes in land-surface elevation (tables 11 and 24) were measured by placing a specially fabricated aluminum bracket between the two monuments of each pair. This bracket attached to the monuments at a consistent elevation relative to the tops of the monuments. A metal rod was dropped through each of the ten holes drilled across the length of the bracket, and the height of the rod that remained above the bracket after the rod had contacted the land surface was measured with a ruler. Measurement precision was 1 mm. Many of the monuments were resurveyed to check for possible changes in monument elevation due to frost heave or other causes; these were found to be negligible. Changes in average rod height above the bracket therefore represent changes in the average land-surface elevation between erosion pin array monuments, with a decrease in rod height indicating lowering of the land surface. Average change for an erosion-pin array was considered to be positive if the net change was a decrease in rod height, that is, if the ground surface had been lowered between successive measurements.

Erosion Boxes

Erosion boxes were installed at most of the erosion-pin sites to measure directly the rate of sediment transport on hillslopes. Erosion-box sites are shown on figures 2 and 5. Numerous difficulties with these boxes, most notably vandalism, frost heaving, and crushing due to snow accumulation, necessitated trying several designs for the erosion boxes. All boxes were 30 cm long and were installed flush with the ground surface along hillslope contours. Boxes were either uncovered galvanized steel, covered metal boxes that were painted green, or galvanized metal boxes that were covered with plywood. These types are designated as "uncovered FS," "green covered," and "covered FS" respectively. The uncovered FS boxes were not limited to any size range of sediment, but the green covered boxes could accommodate only particles smaller than 2 cm due to the size of the slot between box and cover, and the covered FS boxes were limited to particles smaller than 4 cm. All boxes had small holes on their upslope sides to allow water to exit; on the uncovered FS and green covered boxes, these holes were screened with a 0.032 mm mesh. Covered FS boxes were not screened.

Each erosion box was visited yearly and any accumulated sediment was removed. Samples were oven-dried or air-dried prior to processing. Samples were weighed and sieved with a 2-mm sieve on a mechanical shaker for 10 to 20 minutes. The sediment remaining on the sieve was then weighed. The mass of sediment retained on the screen was subtracted from the total sample mass and divided by total sample mass to give the percentage of sample finer than 2 mm. Hillslope sediment transport rate was calculated as mass of sediment finer than 2 mm per unit width of hillslope per year. Erosion-box data are shown in tables 12 and 25.

Gullies

Gullies were mapped in parts of the Blackwood and Edgewood Creek basins. Locations of gullies and areas mapped are shown in figures 3 and 6 and dimensions of gullies are given in tables 13, 14, and 26. Gullies were located by walking roads, trails, and unroaded areas. Gullies were considered to consist of any channel which had steep sides, a width/depth ratio of approximately 3.0 or less, a depth of greater than 0.3 m, and seemingly active headward erosion or a clear association with disturbances such as road drainage. Gullies were located on aerial photos and topographic maps by comparing features marked on the photos and maps with those visible on the ground, and occasionally by taking compass bearings on landmarks. Gullies were all too small to be visible on the aerial photos.

Gully dimensions were measured with a range finder and surveying rod. Precisions are the same as those given for channel mapping. The land-surface gradient along the gully was measured using an abney level.

Synoptic Sediment Sampling

During spring snowmelt in 1987, a program of synoptic sampling was conducted in Blackwood Creek. Synoptic sampling sites are shown on figure 3. Sampling consisted of making water-discharge measurements and concurrent suspended-sediment sampling (table 15). Water-discharge measurements were made using standard current-meter measurement techniques as described by Rantz and others (1983). Suspended sediment samples were collected using the EWI method (U.S. Geological Survey, 1977).

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page 11 follows

ILLUSTRATIONS

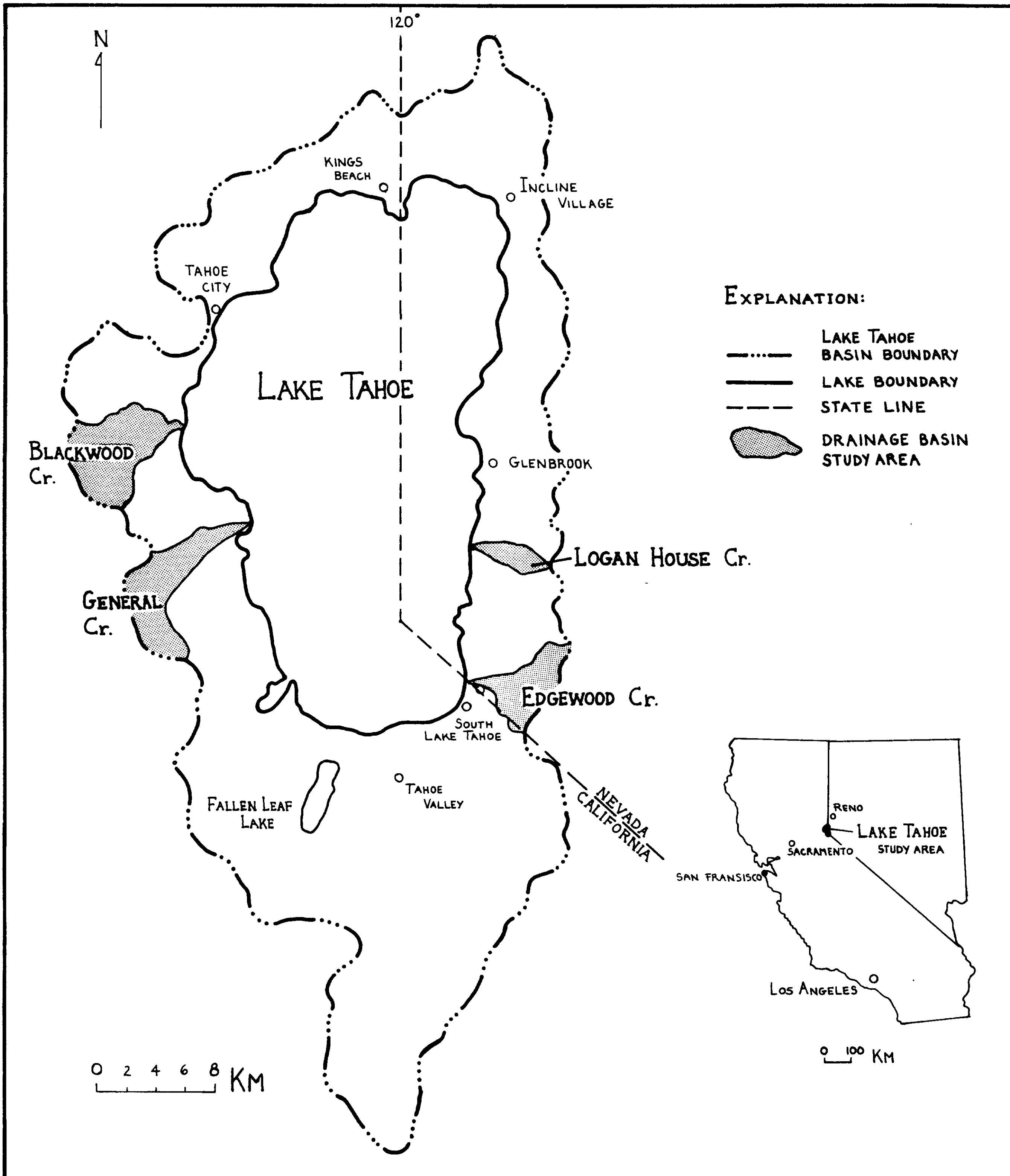

Figure 1. Location of study basins in the Lake Tahoe basin.

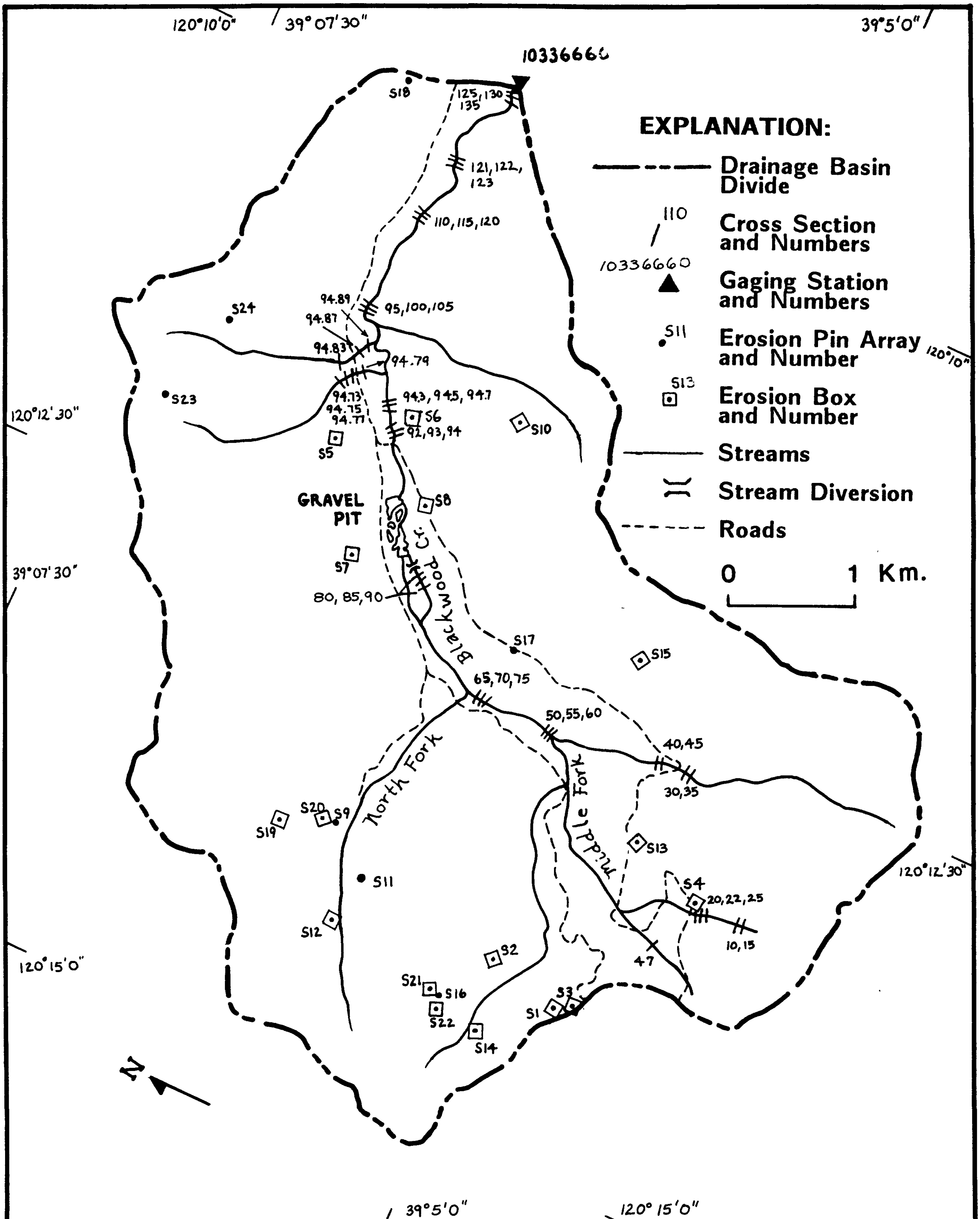

Figure 2. Location of channel cross sections and hillslope-erosion sites in the Blackwood Creek basin.

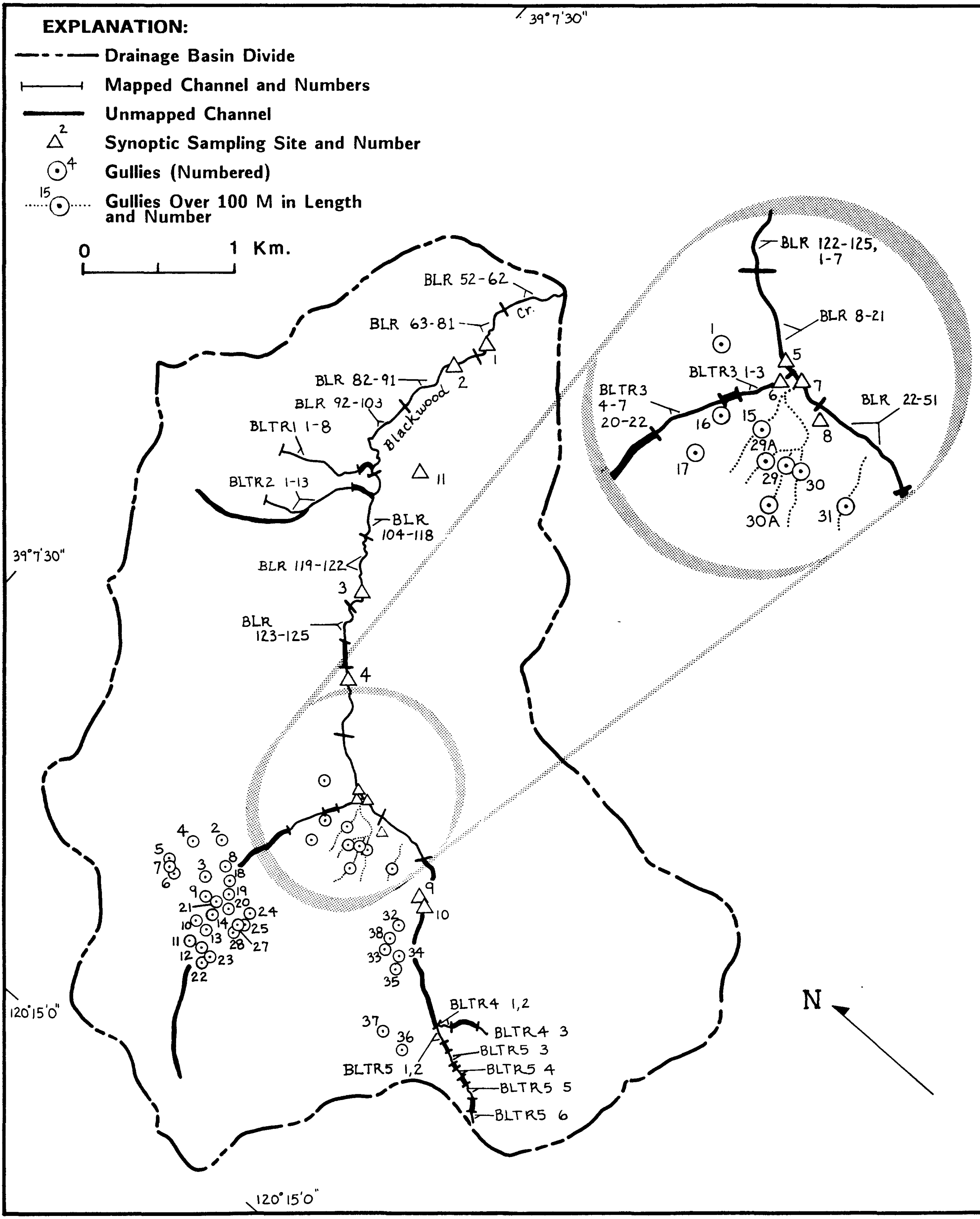

Figure 3. Location of mapped channel reaches, mapped gullies, and synoptic sampling sites in the Blackwood Creek basin.

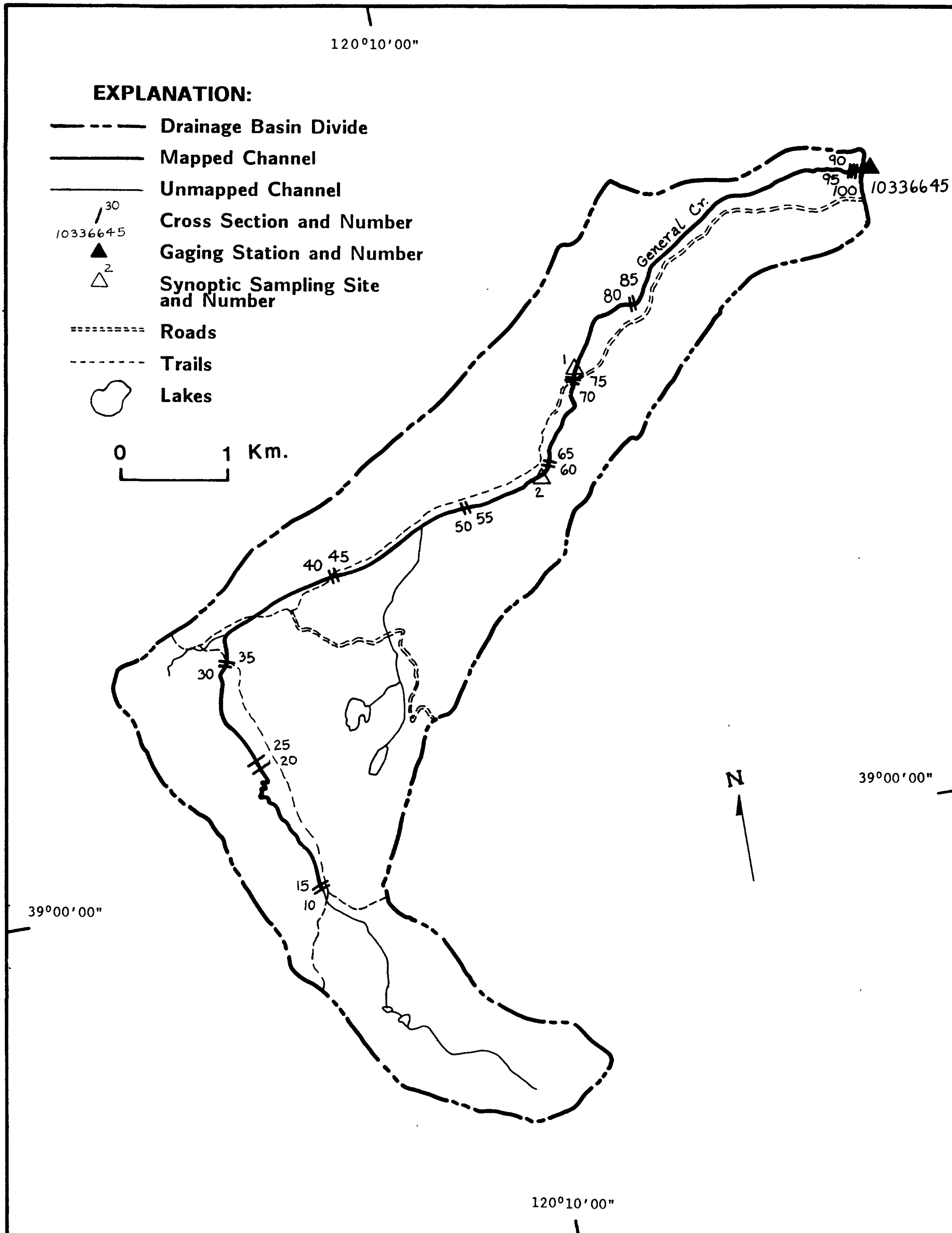

Figure 4. Location of channel cross sections, mapped channel reaches, and synoptic sampling sites in the General Creek basin.

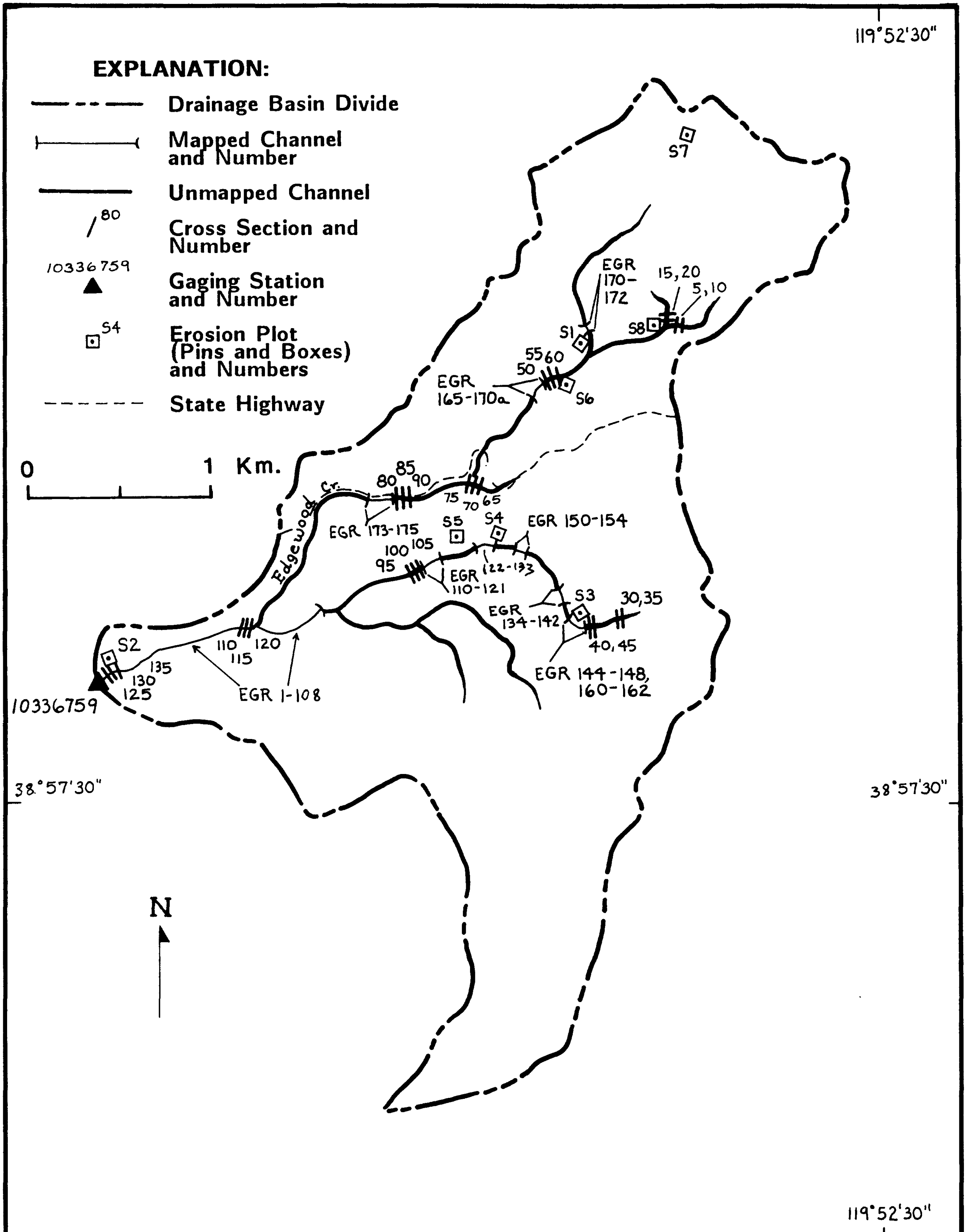

Figure 5. Location of channel cross sections, mapped channel reaches, and hillslope-erosion sites in the Edgewood Creek basin.

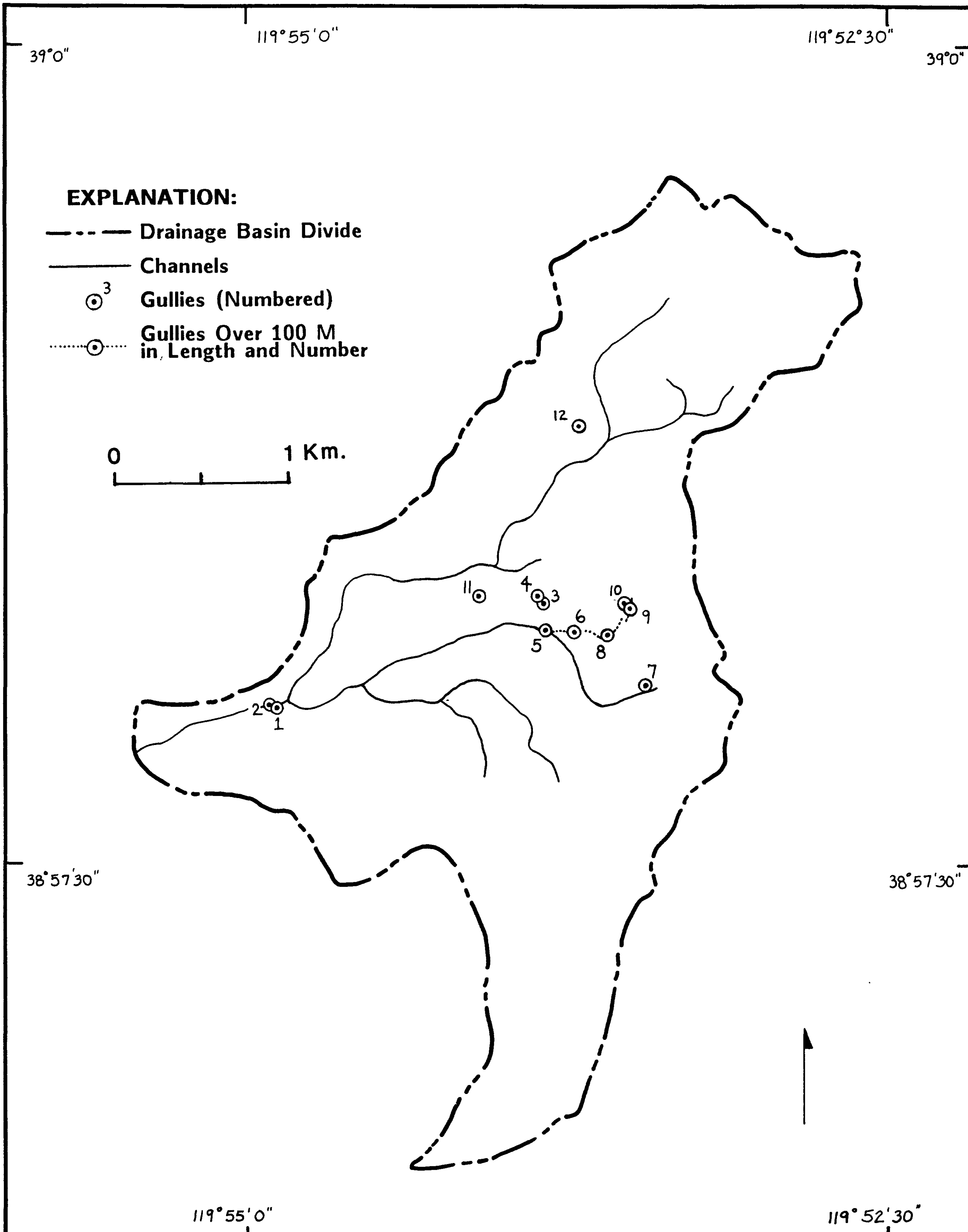

Figure 6. Location of mapped gullies in the Edgewood Creek basin.

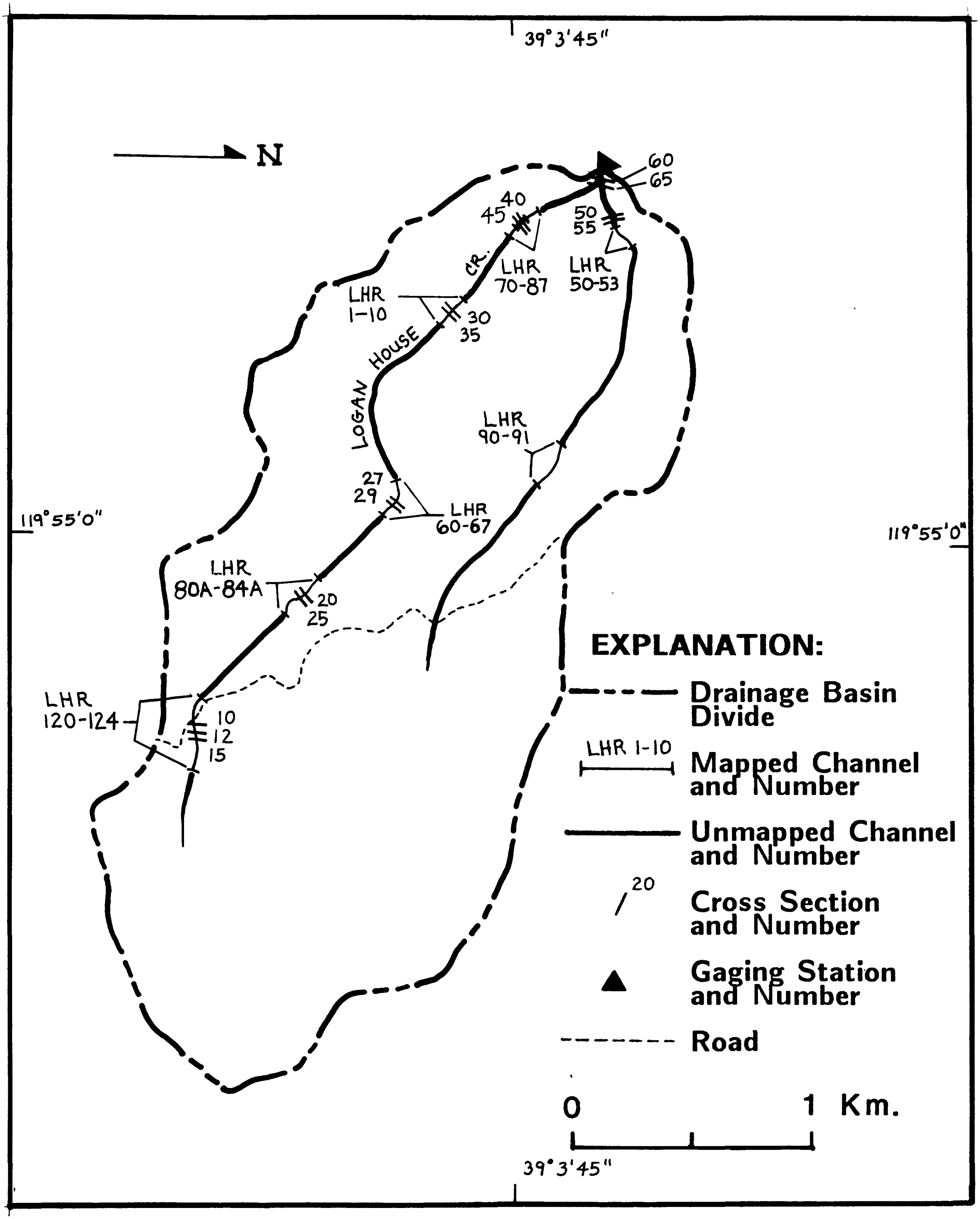

Figure 7. Location of channel cross sections and mapped channel reaches in the Logan House Creek basin.

TABLES

Table 1.--Characteristics of four study basins

A. Physiographic Data

[m, meter; mm, millimeter; km, kilometer; km^2, square kilometer]

Basin	Drainage area (km^2)	Mean elevation (m)	Relief (m)	Hypsometric analysis index	Aspect (degrees)	Land-surface slope (degrees)	Drainage density (km/km^2)	Main channel length (km)	Channel gradient (percent)	Average annual precipitation (mm)
BLACKWOOD	29.8	2,195	807	0.390	45	17.8	8.8	9.8	4.7	1,397
GENERAL	19.3	2,195	760	.390	45	12.2	4.9	14.6	3.5	1,270
EDGEWOOD	8.3	2,195	1025	.340	270	17.7	13.1	7.4	10.0	584
LOGAN HOUSE	5.4	2,347	789	.570	293	15.0	7.1	3.5	14.0	635

B. Geologic Data

[Data expressed as percentage of total basin area, from mapping of Matthews and Burnett (1971)]

Basin	Glaciated granitic	Decomposed granitic	Volcanic	Metamorphic	Surficial
BLACKWOOD	0	0	50.3	10.3	39.4
GENERAL	65.0	0	0	0	35.0
EDGEWOOD	0	94.0	0	0	6.0
LOGAN HOUSE	0	69.0	0	31.0	0

Table 2.--Erosional landforms in four study basins

[Data expressed as percentage of total basin area from mapping of Deborah Harden, California State University, San Jose, California]

Basin	Debris slide	Questionable debris slide	Debris flow	Questionable debris flow	Rock fall	Active fan	Older fan	Snow avalanche	Talus
BLACKWOOD	0.003	0.004	0	0	0	0.001	0.01	0.003	0.03
GENERAL	0	.001	0	.0009	0	0	0	0	.003
EDGEWOOD	.003	.003	0	.002	.003	0	0	0	.003
LOGAN HOUSE	.001	0	.0007	0	0	0	0	0	0

Table 3.--Vegetation cover in four study basins

[Data expressed as percentage of total basin area from mapping of Tahoe Regional Planning Agency (1971b)]

Basin	Bare and alpine	Riparian	Brush	Forest
BLACKWOOD	16	5	7	72
GENERAL	7	61	2	30
EDGEWOOD	3	1	0	96
LOGAN HOUSE	0	16	9	75

Table 4.--Streamflow and sediment data for study basins, 1984-85

[Data from U.S. Geological Survey, 1986, 1987; m^3/s, cubic meter per second; Mg, megagram]

Basin	Period of record (water years)		Mean daily Streamflow (m^3/s)		Suspended sediment load (Mg)	
	Streamflow	Sediment	1984	1985	1984	1985
BLACKWOOD	1961-85	1975-85	1.58	0.74	1,290	355
GENERAL	1981-85	1981-85	.68	.33	165	45.6
EDGEWOOD	1983-85	1983-85	.10	.06	52.7	28.4
LOGAN HOUSE	1984-85	1984-85	.03	.02	3.86	2.60

Table 5.--Changes at monumented stream cross sections, Blackwood Creek basin, 1983-86

[Numbers are average changes in horizontal position of left and right banks and vertical position of bed, in meters, between successive surveys made during summers of the indicated years. Positive numbers indicate bank retreat or bed scour. Total changes for the 2-year period 1984-86 are shown for cross sections that were not surveyed in 1985. n.b. indicates no bank defined; --, indicates no data available; *, indicates data missing due to site vandalism]

Cross section (fig. 2)	Left bank				Right bank			
	1983-84	1984-85	1985-86	1984-86	1983-84	1984-85	1985-86	1984-86
10	0.008	0.005	0.070	--	0.063	0.026	0.00	--
15	0.076	-0.071	0.265	--	0.091	0.019	0.067	--
20	-0.031	--	--	0.021	-0.184	--	0.030	n.b.
22	0.013	-0.117	0.023	--	-0.112	-0.144	-0.245	--
25	-0.173	--	--	-0.040	-0.040	--	--	-0.416
30	0.073	--	--	*	0.00	--	--	*
35	0.136	0.192	0.170	--	-0.090	-0.081	-0.301	--
40	0.026	--	--	0.091	0.113	--	--	0.012
45	-0.189	0.108	0.076	--	-0.026	0.033	0.012	--
47	--	0.101	-0.053	--	--	-0.125	-0.015	--
50	-0.086	--	--	0.144	0.063	--	--	-0.123
55	-0.089	-0.078	-0.013	--	0.044	-0.006	0.093	--
60	-0.022	--	--	-0.018	0.117	--	--	-0.095
65	--	--	--	-0.032	--	--	--	-0.070
70	--	0.113	0.904	--	--	-0.199	-0.062	--
75	--	--	--	-0.871	--	--	--	-0.208
80	0.015	--	--	0.113	-0.110	--	--	0.656
85	0.084	0.121	-0.017	--	0.266	0.083	0.151	--
90	0.025	--	--	0.074	-0.162	--	--	2.925
92	0.169	--	--	0.098	-0.010	--	--	0.003
93	0.017	-0.012	-0.005	--	--	--	0.022	--
94	--	--	--	0.026	--	--	--	0.082
94.3	--	--	--	6.667	--	--	--	-0.165
94.5	--	*	0.156	--	--	*	0.451	--
94.7	--	--	--	-0.023	--	--	--	-0.015
95	--	--	--	0.312	--	--	--	0.047
100	-0.013	0.030	0.97	--	-0.068	-0.026	0.073	--
105	0.042	--	--	0.302	-0.091	--	--	0.085
110	0.086	*	-0.082	--	0.081	*	2.853	--
115	0.073	0.103	0.306	--	0.057	.041	1.478	--
120	0.019	0.175	2.827	--	0.248	-0.051	-0.186	--
121	--	--	--	0.063	--	--	--	0.189
122	--	-0.195	0.233	--	--	0.020	0.161	--
123	--	--	--	0.026	--	--	--	-0.288
125	-0.032	--	--	0.080	-0.123	--	--	0.098
130	0.460	-0.062	0.223	--	0.106	-0.042	-0.085	--
135	0.074	--	--	0.235	-0.078	--	--	0.093

Table 5.--Changes at monumented stream cross sections, Blackwood Creek basin, 1983-1986--Continued

[--, indicates no data available; *, indicates missing data due to site vandalism]

Cross section (fig. 2)	Bed			
	1983-84	1984-85	1985-86	1984-86
10	0.019	-0.007	0.028	--
15	0.069	-0.030	0.00	--
20	0.127	--	--	-0.009
22	0.098	0.017	-0.021	--
25	0.011	--	--	-0.045
30	0.021	*	*	*
35	-0.001	-0.023	0.002	--
40	0.010	--	--	-0.036
45	-0.032	0.016	-0.028	--
47	--	0.010	-0.024	--
50	-0.013	--	--	0.022
55	-0.026	0.006	0.004	--
60	0.026	--	--	-0.064
65	--	--	--	0.018
70	--	-0.010	-0.045	--
75	--	--	--	-0.011
80	0.021	--	--	-0.097
85	0.007	-0.001	-0.034	--
90	-0.023	--	--	-0.457
92	0.056	--	--	0.00
93	0.008	0.003	-0.145	--
94	--	--	--	0.024
94.3	--	--	--	-0.197
94.5	--	*	-0.050	--
94.7	--	--	--	0.009
95	--	--	--	0.451
100	0.00	0.004	0.045	--
105	0.396	--	--	0.122
110	-0.047	*	-0.035	--
115	0.017	0.037	-0.058	--
120	-0.036	-0.030	-0.195	--
121	--	--	--	0.038
122	--	-0.006	0.004	--
123	--	--	--	-0.028
125	0.018	--	--	0.111
130	-0.022	0.002	-0.006	--
135	-0.006	--	--	0.235

Table 6.--Selected characteristics of mapped channel reaches, Blackwood Creek

[Data include measured volumes of stored sediment and estimated areas of eroding banks, stable banks, and active channel bed. Active channel storage and bars include sediment judged to be potentially available for transport each year. Semiactive bars include sediment stabilized by annual vegetation and considered potentially available for transport by mean annual peak flows. Inactive bars consist of sediment stabilized by perennial vegetation or protected by armoring and is considered available for transport only by infrequent high flows. m, meter; m^2, square meter; m^3, cubic meter]

			Sediment stored in:				Sediment stored behind	Area of:		
Composite reach	Mapped reaches (fig. 3)	Reach length (m)	Active channel (m^3)	Active bars (m^3)	Semiactive bars (m^3)	Inactive bars (m^3)	organic debris (m^3)	Eroding banks (m^2)	Stable banks (m^2)	Active bed (m^2)
1	52-62	645	458.9	213.4	392.1	264.2	108.3	378	296	3,175
2	63-81	721	292.5	3,370.4	794.4	1,053.4	0.0	877	684	7,319
3	82-91	743	38.6	5,011.8	1,431.5	0.0	0.0	1,464	484	11,107
4	92-103	395	153.1	775.0	361.7	75.0	0.0	389	313	4,300
5	104-118	942	242.8	1,496.0	322.7	0.0	55.0	1,511	288	10,428
6	119-122	862	519.9	1,456.2	1,686.2	1,027.9	28.8	1,032	833	9,341
7	123-125, 1-7	743	658.2	2,694.2	997.8	0.0	1,095.2	613	471	11,313
8	8-21	777	676.2	333.4	99.6	0.0	1,425.9	708	385	6,347
9	22-51	645	356.1	817.1	238.4	0.0	0.0	949	444	5,778
Total:		6,398	3,396.3	1,6167.0	6,324.4	2,420.5	2,713.2	7,921	4,198	69,108

Table 7.--Channel mapping results for selected reaches of Blackwood Creek tributaries

[Data include measured volumes of stored sediment and estimated areas of eroding banks, stable banks, and active channel bed. Active storage includes sediment judged potentially available for transport each year. Semiactive storage includes sediment stabilized by annual vegetation and organic debris and is considered potentially available for transport by mean annual peak flows. m, meter; m^2, square meter; m^3, cubic meter]

		Sediment stored in:		Area of:		
Mapped reach (fig. 3)	Reach length (m)	Active storage (m^3)	Semiactive storage (m^3)	Eroding banks (m^2)	Stable banks (m^2)	Active bed (m^2)
BLTR5 1,2	136.9	24.7	5.1	79.0	2.3	557.4
3	67.1	12.1	3.9	10.8	1.8	198.3
4	76.2	0.7	0.8	33.0	0.9	218.3
5	64.3	0	0.4	5.4	1.9	156.8
6	49.1	0	9.9	32.9	1.0	184.0
BLTR4 1,2	130.4	13.1	8.4	41.6	150.8	431.9
3	88.1	15.7	2.4	11.5	103.9	257.8
BLTR3 1-3	157.0	44.6	19.3	304.1	87.7	902.9
4-7, 20-22	289.6	54.8	11.3	109.5	547.3	1,702.6
BLTR2 1-13	917.5	181.4	62.2	1,077.0	636.9	2,839.5
BLTR1 1-8	625.5	11.4	31.0	342.3	120.9	1,185.0

Table 8.--Bulk density and percentage of particles finer than 2 millimeters intermediate grain diameter for stream bank and bed samples from the main channel of Blackwood Creek

[Mg/m³, megagrams per cubic meter; mm, millimeter; --, no data available]

Cross-section group (fig. 2)	Bank: Bulk density (Mg/m^3)	Bank: Percentage finer than 2 mm	Bed: Bulk density (Mg/m^3)	Bed: Percentage finer than 2 mm
50-60	1.33	86	1.73	16
65-75	1.02	61	--	--
65-75	.87	87	2.33	7
80-90	1.83	41	--	--
80-90	.94	95	2.53	12
80-90	--	7	--	--
80-90	.94	95	--	--
92-94	--	28	--	--
92-94	.70	86	2.28	4
94.3-94.7	1.15	58	1.91	9
95-105	1.03	80	2.16	19
110-120	.70	99	2.19	21
110-120	1.49	21	--	--
110-120	.75	99	--	--
121-123	.70	97	--	--
121-123	--	--	1.96	29

Table 9.--Point count data for bed material at cross section groups in the Blackwood Creek basin, 1983-84

[Table shows percent of bed material in size classes defined by lower class limits and total number of points for each count]

Cross section group (fig. 2)	Year	Intermediate grain diameter of lower class limit, in millimeters: 0.002	0.062	2	4	8	16	32	64	128	>256	Total number of points
10-15	1983	0	1	0	0	7	16	35	15	23	3	100
10-15	1984	0	3	0	3	5	15	23	27	19	5	100
20-25	1983	0	0	1	1	6	15	11	19	24	24	101
20-25	1984	0	0	0	0	5	7	17	19	32	20	100
50-60	1983	0	6	3	7	6	12	11	9	20	26	120
50-60	1984	3	7	4	12	13	11	16	14	7	13	100
65-75	1984	1	4	1	1	6	12	28	27	15	6	105
80-90	1983	0	2	0	3	12	22	22	30	10	0	105
80-90	1984	0	1	2	4	9	13	27	32	12	0	105
94.3-94.7	1984	0	6	1	2	15	37	36	2	1	0	100
95-105	1983	0	27	1	5	12	17	13	7	9	9	137
110-120	1984	8	10	0	3	18	24	25	11	1	0	100
125-135	1983	0	14	0	2	17	24	14	13	14	0	90

Table 10.--Bulk density and percentage of particles finer than 2 millimeters intermediate grain diameter for stream bank and bed samples in tributaries of the Blackwood Creek basin

[Mg/m^3, megagrams per cubic meter; mm, millimeter; --, no data available]

Cross section group (fig. 2)	Bank		Bed	
	Bulk density (Mg/m^3)	Percentage finer than 2 mm	Bulk density (Mg/m^3)	Percentage finer than 2 mm
10-15	0.64	81	1.01	11
20-25	--	21	2.22	11
35-45	--	42	1.87	10
94.73-94.79	.91	76	--	--
94.83-94.89	.87	71	--	--

Table 11.--Hillslope-erosion pin data for the Blackwood Creek basin

[Numbers are changes in land-surface elevation, in millimeters, between successive surveys made in the summer or autumn of the indicated years. Positive numbers represent a decrease in land-surface elevation. Aspect: N, north; S, south; --, indicates data missing due to site vandalism]

Pin array (fig. 2)	Number of pins	Average elevation change	Standard deviation	Minimum elevation change	Maximum elevation change	Aspect	Hill slope angle (degrees)	Ground cover
				1984-85				
S1	50	8.98	7.51	-8.00	25.00	N	19	BARE
S2	30	-1.63	10.87	-25.00	18.00	S	19	SHRUB
S3	30	1.77	6.94	-15.00	15.00	N	17	BARE
S4	30	-0.80	4.80	-7.00	19.00	N	19	FOREST
S5	26	17.46	9.27	-1.00	49.00	S	29	BARE
S6	30	-3.57	17.04	-45.00	20.00	N	16	FOREST
S7	30	2.37	17.18	-39.00	48.00	S	20	BARE
S8	30	-14.03	22.95	-70.00	16.00	N	13	SHRUB
S9	30	-2.27	23.59	-107.00	29.00	S	25	FOREST
S10	30	2.07	8.23	-14.00	31.00	N	26	FOREST
S11	30	-2.37	4.31	-14.00	5.00	N	28	FOREST
S12	30	-2.00	9.94	-31.00	24.00	S	28	FOREST
S13	30	5.47	14.95	-15.00	57.00	N	23	FOREST
S14	30	0.40	9.63	-18.00	22.00	N	32	FOREST
S15	30	2.03	11.44	-23.00	26.00	N	17	SHRUB
S16	30	0.83	4.82	-12.00	15.00	S	16	FOREST
S17	30	-6.97	18.97	-96.00	14.00	N	15	SHRUB
S18	30	-1.93	5.75	-16.00	10.00	S	14	FOREST
S19	30	1.37	12.13	-33.00	24.00	S	13	BARE
S20	30	-1.67	16.23	-42.00	27.00	S	31	SHRUB
S21	10	2.50	11.17	-15.00	28.00	S	13	SHRUB
S22	20	0.10	7.68	-27.00	16.00	S	12	SHRUB
S23	30	1.63	5.90	-12.00	16.00	S	23	FOREST
S24	30	4.97	7.88	-10.00	28.00	S	27	SHRUB
				1985-86				
S1	0	--	--	--	--	--	--	--
S2	30	-0.30	12.69	-37.00	23.00	S	19	SHRUB
S3	30	-2.03	6.69	-15.00	9.00	N	17	BARE
S4	30	0.00	3.62	-12.00	6.00	N	19	FOREST
S5	26	-13.08	14.63	-62.00	20.00	S	29	BARE
S6	20	-0.65	3.54	-8.00	6.00	N	16	FOREST
S7	30	-0.20	20.04	-45.00	67.00	S	20	BARE
S8	30	4.90	23.36	-48.00	80.00	N	13	SHRUB
S9	30	1.90	19.17	-26.00	89.00	S	25	FOREST
S10	30	2.07	8.23	-14.00	31.00	N	26	FOREST
S11	30	-1.30	4.09	-12.00	5.00	N	28	FOREST
S12	30	0.53	10.25	-33.00	15.00	S	28	FOREST
S13	30	2.03	7.41	-11.00	18.00	N	23	FOREST
S14	30	-0.73	5.88	-13.00	12.00	N	32	FOREST
S15	30	1.30	9.01	-17.00	28.00	N	17	SHRUB
S16	30	-1.47	6.24	-21.00	12.00	S	16	FOREST
S17	30	5.87	8.75	-7.00	34.00	N	15	SHRUB
S18	--	--	--	--	--	--	--	--
S19	30	1.77	12.08	-22.00	19.00	S	13	BARE
S20	30	0.50	20.33	-59.00	32.00	S	31	SHRUB
S21	10	8.90	12.19	-13.00	26.00	S	13	SHRUB
S22	20	-3.45	13.53	-27.00	21.00	S	12	SHRUB
S23	--	--	--	--	--	--	--	--
S24	30	-2.33	8.94	-25.00	12.00	S	27	SHRUB

Table 12.--Erosion-box data for hillslope sites in the Blackwood Creek basin

[Data shown are amount of soil collected in erosion boxes during indicated years, and amount consisting of soil particles finer than 2 millimeters intermediate grain diameter. Also listed are calculated rates of hill-slope transport of particles finer than 2 millimeters per meter width of hillslope per year. g, gram; mm, millimeter; [(g/m)/a], grams per meter per annum; --, indicates data missing due to site vandalism]

Station (fig. 2)	Total mass (g)	Percentage of particles finer than 2 mm	Mass finer than 2 mm (g)	Hillslope transport rate [(g/m)/a]
		Water year 1985		
S1	43.5	20.0	8.7	28.5
S2	199.2	32.0	63.7	209.1
S4	3.5	73.0	2.5	8.4
S5	--	--	--	--
S8	2118.9	54.0	1,144.2	3,754.0
S9	--	--	--	--
S10	0.8	60.0	0.5	1.6
S13	--	--	--	--
Average	473.2	47.8	243.9	800.3
		Water year 1986		
S1	93.3	12.0	11.2	36.7
S2	147.8	46.0	68.0	223.1
S4	--	--	--	--
S5	974.2	39.0	379.9	1246.5
S8	4,131.4	61.0	2,520.2	8,268.2
S9	81.4	7.0	5.7	18.7
S10	1.1	49.0	0.5	1.8
S13	3.4	99.0	3.4	11.0
Average	776.1	44.7	427.0	1,400.9
		Water year 1987		
S1	176.3	22.7	40.0	131.2
S2	137.9	25.9	35.7	117.1
S3	44.2	38.0	16.8	55.1
S4a	40.4	81.1	32.8	107.6
S4b	43.3	80.6	34.9	114.5
S5	1,762.4	49.8	878.5	2,882.2
S8a	192.3	48.7	93.6	307.1
S8b	97.9	62.5	61.2	200.8
S10	0.9	100.0	0.9	3.0
S12	188.9	20.3	38.3	125.7
S13	8.4	88.1	7.4	24.3
S15	19.0	69.5	13.2	43.3
S19	120.8	54.5	65.8	215.9
S20	12.5	64.8	8.1	26.6
S21	5,574.0	63.8	3,556.0	11,666.7
S22	5,455.4	63.9	3,486.0	11,437.0
Average	867.2	58.4	523.0	1,716.0

Table 13.--Dimensions of gullies mapped in the North Fork Blackwood Creek basin

[m, meter; m^3, cubic meter]

Gully (fig. 3)	Length (m)	Average depth (m)	Average width (m)	Volume (m^3)
1	61.3	0.5	1.1	32.8
2	15.2	0.3	0.7	3.4
3	17.4	0.1	0.5	0.8
4	19.5	0.1	1.4	3.3
5	7.3	0.2	0.7	0.8
6	64.3	0.2	0.9	10.4
7	30.5	0.1	0.7	2.6
8	122.8	0.2	1.1	33.8
9	18.3	0.1	1.0	2.3
10	11.6	0.2	1.2	2.5
11	121.9	0.3	1.2	45.3
11a	152.4	0.3	1.2	56.6
11b	76.2	0.2	1.3	18.3
12	14.0	0.1	0.9	1.5
13	12.2	0.1	1.0	1.1
14	33.5	0.2	0.8	4.2
16	52.4	0.7	1.6	56.8
17	6.1	0.3	0.8	1.7
18	29.0	0.4	0.9	10.1
19	32.6	0.3	1.3	13.0
20	139.3	0.8	1.7	181.2
21	8.5	0.4	0.9	2.9
22	13.1	0.3	1.2	4.9
23	15.9	0.3	1.4	6.0
24	10.7	0.9	1.8	16.7
25	68.9	0.4	0.9	27.8
26	5.2	0.2	0.3	0.3
27	14.0	0.3	0.4	1.7
28	2.1	0.2	1.1	0.6
Total				543.2

Table 14.--Dimensions of gullies mapped in the Middle Fork Blackwood Creek basin

[m, meter; m^3, cubic meter]

Gully (Fig. 3)	Length (m)	Average depth (m)	Average width (m)	Volume (m^3)
15	483.1	0.9	1.6	700.2
29	350.5	0.6	2.3	512.9
29a	6.7	0.3	1.6	3.2
30	460.2	0.8	2.5	887.2
30a	61.3	0.7	0.8	33.8
31	37.8	0.2	0.8	7.3
32	38.4	0.5	1.0	18.3
33	67.7	0.2	1.0	14.1
34	116.7	0.5	1.6	87.8
35	15.2	0.4	4.7	28.5
36	10.7	0.6	0.9	5.4
37	20.1	0.3	1.2	6.6
38	59.7	0.3	0.5	9.4
Total				2,314.8

Table 15.--Suspended-sediment concentrations and discharges at synoptic snowmelt sites, Blackwood Creek basin, spring 1987

[mg/L, milligrams per liter; m^3/s, cubic meters per second; Mg/d, megagrams per day]

Station name	Station number (fig. 3)	Date	Time (hours)	Streamflow (m^3/s)	Sediment concentration (mg/L)	Sediment discharge (Mg/d)
Below debris	1	4/28	1500	3.31	25	7.16
			1700	3.79	37	12.10
			1900	3.88	63	21.10
		4/29	1745	3.54	42	12.90
			1958	3.82	43	14.20
At meadows	2	4/29	1510	3.68	25	7.96
			1725	4.02	45	15.70
Below ponds	3	4/28	1530	3.40	17	5.00
			1700	3.43	13	3.85
			1900	3.62	17	5.33
		4/29	1700	3.74	12	3.88
Above diversion	4	4/28	1720	3.20	15	4.15
			1905	3.43	12	3.56
Main Channel below North Fork	5	4/28	1510	2.57	15	3.34
			1740	2.92	17	4.29
North Fork	6	4/28	1345	0.50	12	0.51
Middle Fork	7	4/27	1810	1.50	226	29.20
Middle Fork gullies	8	4/27	1955	0.10	31	0.26

Table 16.--Changes at monumented stream cross sections, General Creek basin, 1983-86

[Numbers are average changes in horizontal position of left and right banks and vertical position of bed, in meters, between successive surveys made during summers of the indicated years. Positive numbers indicate bank retreat or bed scour. --, indicates no data available]

Cross section (fig. 4)	Left bank 1983-84	Left bank 1984-85	Left bank 1985-86	Right bank 1983-84	Right bank 1984-85	Right bank 1985-86	Bed 1983-84	Bed 1984-85	Bed 1985-86
10	--	-0.019	0.089	--	0.005	0.003	--	-0.047	0.072
15	--	0.004	-0.092	--	-0.067	0.000	--	-0.010	0.054
20	-0.016	0.018	--	0.129	-0.285	0.011	0.036	-0.013	0.018
25	-0.049	0.095	-0.138	0.051	-0.185	--	0.007	-0.020	0.015
30	-0.144	0.248	--	-0.142	0.143	--	-0.010	0.064	-0.090
35	0.112	-0.054	0.013	-0.210	0.039	--	-0.012	0.021	-0.015
40	0.005	0.086	-0.0006	-0.019	-0.013	0.040	0.016	-0.012	-0.014
45	0.000	-0.082	--	0.031	0.014	0.092	0.003	0.076	-0.051
50	0.043	-0.062	--	-0.116	0.044	0.023	0.017	0.008	-0.034
55a	0.111	-0.045	--	-0.050	0.032	--	-0.027	-0.004	0.004
55b	-0.079	0.036	--	-0.230	-0.225	--	0.012	-0.014	--
60	-0.022	0.042	--	0.009	0.055	-0.064	0.015	0.004	0.041
65	0.017	0.046	-0.013	0.094	-0.272	0.202	-0.022	-0.007	0.037
70	0.018	-0.012	-0.086	0.021	0.023	0.012	-0.019	-0.008	-0.198
75	0.024	0.018	0.080	0.060	-0.060	-0.034	-0.004	0.003	0.021
80	0.687	--	--	-0.674	--	--	0.082	--	--
85	0.025	0.039	-0.001	0.098	0.039	0.188	-0.031	0.002	-0.075
90	-0.103	0.035	0.078	-0.015	0.021	0.052	0.036	-0.031	0.002
95	0.086	-0.031	--	0.078	-0.050	0.048	0.002	-0.005	-0.003
100	0.065	-0.057	0.092	-0.082	0.062	-0.052	-0.021	-0.010	-0.019

Table 17.--Channel mapping results for entire main channel of General Creek

[Data include measured volumes of stored sediment and estimated areas of eroding banks, stable banks, and active channel bed. Active channel storage and bars include sediment judged to be potentially available for transport each year. Semiactive bars include sediment stabilized by annual vegetation and considered potentially available for transport by mean annual peak flows. Inactive bars consist of sediment stabilized by perennial vegetation or protected by armoring and is considered available for transport only by infrequent high flows. m, meter; m^2, square meter; m^3, cubic meter]

Composite reach	Mapped reaches (fig. 4)	Reach length (m)	Sediment stored in: Active channel (m^3)	Active bars (m^3)	Semiactive bars (m^3)	Inactive bars (m^3)	Sediment stored behind organic debris (m^3)	Area of: Eroding banks (m^2)	Stable banks (m^2)	Active bed (m^2)
1	506-605	3,070	784.9	415.1	18.2	17.1	48.8	978.0	1,499.5	16,597.0
2	453-505	1,350	346.4	88.5	2.0	0	24.6	117.1	478.0	7,327.5
3	390-452	1,100	358.0	47.4	5.6	0	3.8	104.9	391.4	5,142.1
4	292-389	1,240	511.8	402.1	0.1	105.4	24.6	176.7	810.3	7,368.4
5	250-291	1,100	451.5	527.8	73.7	4.43	21.3	359.5	540.0	6,415.0
6	218-249	950	276.8	120.9	19.3	0	86.7	253.7	541.3	4,547.2
7	112-217	1,420	207.4	87.2	0	0	781.3	553.1	756.1	6,050.4
8	27-111	1,760	516.3	430.1	77.1	139.1	147.9	808.5	1,068.7	9,161.1
9	1-26	800	287.2	292.6	14.0	0	137.4	663.5	346.0	4,874.6
Total:		12,790	3,740.3	2,411.7	210.0	266.0	1,576.4	4,015.0	6,431.3	6,7483.3

Table 18.--Bulk density and percentage of particles finer than 2 millimeters intermediate grain size for stream bank and bed samples in the General Creek basin

[Mg/m³, megagrams per cubic meter; mm, millimeters; --, indicates data not available]

Cross-section group (fig. 4)	Bulk density (Mg/m³)	Percent finer than 2 mm	Bulk density (Mg/m³)	Percent finer than 2 mm
10-15	0.66	96	1.49	32
20-25	.84	97	1.05	88
30-35	1.26	57	1.44	47
40-45	--	17	2.31	7
50-55	1.08	70	1.57	27
60-65	.68	100	2.33	9
70-75	.67	98	1.51	22
85	--	66	2.19	5
90-100	.95	98	2.01	51

Table 19.--Point-count data for bed material at cross-section groups in the General Creek basin, 1983-84

[Table shows percentage of bed material in size classes defined by lower class limits and total number of points for each count]

Cross section number (fig. 4)	Year	Intermediate grain diameter of lower class limit, in millimeters										Total number of points
		0.002	0.062	2	4	8	16	32	64	128	>256	
10-15	1984	0	67	0	0	10	8	1	3	5	6	100
20-25	1984	0	36	0	2	4	12	10	18	12	6	100
30-35	1983	0	10	3	2	6	15	14	12	15	23	100
30-35	1984	0	11	2	0	7	14	14	26	11	15	100
40-45	1983	0	7	3	2	2	1	11	15	17	42	100
40-45	1984	0	1	3	4	2	10	8	18	17	37	100
50-55	1983	0	3	0	2	6	11	25	38	14	1	100
50-55	1984	0	3	2	1	7	17	25	33	8	4	100
60-65	1983	0	15	0	3	7	12	18	14	16	15	100
60-65	1984	0	12	1	0	6	17	19	16	16	13	100
70-75	1983	0	4	0	0	4	39	40	6	4	2	99
70-75	1984	0	10	0	1	16	24	31	4	12	2	100
80-85	1983	0	9	2	3	1	6	35	31	12	1	100
80-85	1984	4	14	2	1	3	13	29	30	4	0	100
90-100	1983	0	26	0	0	11	12	26	17	5	3	102

Table 20.--Changes at monumented stream cross sections, Edgewood Creek basin, 1983-86

[Numbers are average changes in horizontal position of left and right banks and vertical position of bed in meters between successive surveys made during summers of the indicated years. Positive numbers indicate bank retreat or bed scour. n.b. indicates no bank defined; --, indicates no data available]

Cross section (fig. 5)	Left bank			Right bank			Bed		
	1983-84	1984-85	1985-86	1983-84	1984-85	1985-86	1983-84	1984-85	1985-86
5	0.069	-0.020	-0.176	0.024	-0.081	0.028	0.003	-0.016	-0.016
10	0.286	0.094	0.002	0.126	-0.048	0.036	-0.203	-0.011	0.004
15	0.068	-0.054	-0.005	-0.154	0.044	0.077	-0.074	0.018	-0.049
20	0.066	-0.066	-0.079	-0.127	0.116	0.121	-0.104	0.030	-0.034
30	-0.034	0.027	-0.048	0.031	-0.059	0.028	-0.007	0.003	0.019
35	-0.048	0.037	-0.018	0.019	-0.667	0.117	0.007	0.049	0.100
40	0.014	0.043	0.019	--	--	--	0.027	-0.014	-0.015
45	0.058	0.065	0.024	0.068	0.015	-0.018	0.075	-0.005	0.023
50	0.019	0.000	-0.016	0.015	0.018	0.078	0.034	-0.006	0.028
55	0.000	0.067	-0.016	-0.034	0.090	0.029	0.054	0.033	0.001
60	-0.016	-0.019	-0.006	-0.421	-0.036	0.045	-0.079	-0.001	0.014
65	0.207	-0.063	-0.117	0.257	-0.101	0.015	0.153	-0.015	0.029
70	-0.420	0.050	0.121	0.066	-0.778	-0.105	0.309	-0.070	-0.070
75	--	--	-0.198	--	--	0.031	--	--	-0.036
80	0.016	-0.028	-0.034	-0.082	-0.032	-0.034	-0.042	0.001	-0.006
85L	0.000	0.036	-0.024	-0.062	0.033	0.022	-0.032	0.027	0.043
85R	0.056	-0.286	--	0.020	-0.159	--	-0.027	-0.032	--
90	-0.230	-0.347	0.099	-0.023	0.095	n.b.	-0.044	-0.006	0.014
95	0.000	0.062	-0.017	0.042	-0.057	0.000	-0.009	0.042	0.021
100	0.037	0.010	-0.052	-0.033	0.000	-0.013	-0.063	0.030	0.013
105	-0.031	0.058	0.0047	-0.038	0.030	-0.012	0.074	0.054	-0.027
110	-0.064	0.121	0.006	0.010	-0.053	0.006	-0.024	0.021	-0.002
115	0.026	0.006	0.011	0.100	-0.108	0.064	0.043	-0.033	-0.005
120	-0.023	0.000	0.038	0.242	0.108	0.027	-0.026	-0.610	0.003
125	0.025	-0.024	0.024	0.018	0.006	-0.042	-0.009	-0.001	-0.005
130	0.028	-0.062	0.011	0.026	0.029	0.008	-0.054	-0.047	0.055
135	0.016	0.010	-0.050	-0.038	-0.010	0.042	-0.044	-0.048	0.090

Table 21.--Channel mapping results for selected reaches of Edgewood Creek

[Data include measured volumes of stored sediment and estimated areas of eroding banks, stable banks, and active channel bed. Active channel storage and bars include sediment judged to be potentially available for transport each year. Semiactive bars includes sediment stabilized by annual vegetation and considered potentially available for transport by mean annual peak flows. Inactive bars consist of sediment stabilized by perennial vegetation or protected by armoring and is considered available for transport only by infrequent high flows. m, meter; m^2, square meter; m^3, cubic meter]

Composite reach	Mapped reaches (fig. 5)	Reach length (m)	Sediment stored in: Active channel (m^3)	Active bars (m^3)	Semiactive bars (m^3)	Inactive bars (m^3)	Sediment stored behind organic debris (m^3)	Area of: Eroding banks (m^2)	Stable banks (m^2)	Active bed (m^2)
1	132-142 144-148 160-162	198	11.8	1.0	0.8	0	15.2	64.1	52.0	225.0
2	61-74 80-108 110-133 150-154	717	44.9	.7	1.8	0	65.0	153.0	165.2	1,104.0
3	165-172	141	4.8	0	0	0	8.1	38.5	40.2	221.0
4	173-175	132	6.9	.1	0	0	1.3	46.7	106.5	142.0
5	42-60	470	84.8	.1	.6	1.0	19.8	444.1	209.6	1,247.0
6	1-41	508	37.6	15.0	20.0	0	5.2	389.5	133.3	950.0

Table 22.--Bulk density and percentage of particles finer than 2 millimeters intermediate grain diameter for stream bank and bed samples from the channels of the Edgewood Creek basin

[Mg/m³, megagram per cubic meter; mm, millimeter; --, indicates no data available]

Cross-section group (fig. 5)	Bulk density (Mg/m³)	Percentage finer than 2 mm	Bulk density (Mg/m³)	Percentage finer than 2 mm
30-35	1.01	98	1.50	70
40-45	--	--	--	--
95-105	.48	95	.81	99
50-60	.45	99	.72	93
65-75	--	--	1.11	65
80-90	.80	91	1.17	95
110-120	.69	70	--	38
125-135	.57	90	--	93

Table 23.--Point-count data for bed material at cross-section groups in the Edgewood Creek basin, 1983-84

[Table shows percentage of bed material in size classes defined by lower class limits and total number of points for each count]

Cross section group (fig. 5)	Year	Intermediate grain diameter of lower class limit, in millimeters										Total number of points
		0.002	0.062	2	4	8	16	32	64	128	>256	
40-45	1983	7	48	19	13	11	2	0	0	0	0	100
40-45	1984	11	30	12	19	26	2	0	0	0	0	100
50-60	1983	58	37	3	1	1	0	0	0	0	0	101
50-60	1984	47	36	7	9	0	0	1	0	0	0	100
80-90	1983	9	49	13	12	7	3	6	2	0	0	101
110	1983	3	50	0	0	0	5	30	13	0	0	40
110	1984	32	17	0	20	5	10	10	5	0	0	40
115	1983	0	45	0	0	0	10	13	3	17	13	40
115	1984	5	28	0	3	7	13	15	7	13	10	40
120	1983	0	32	3	17	20	13	10	0	0	5	40
120	1984	17	3	5	23	17	20	7	3	0	5	40
125-135	1983	0	62	2	18	11	5	1	1	0	0	100
125-135	1984	4	43	28	23	1	1	0	0	0	0	100

Table 24.--Hillslope erosion pin data for the Edgewood Creek Basin

[Numbers are changes in land surface elevation, in millimeters, between successive surveys made in the summer or autumn of the indicated years. Positive numbers represent a decrease in land surface elevation, i.e., net erosion. Aspect N, north; S, south; --, indicates data not available]

Pin array (fig. 5)	Number of pins	Average elevation change	Standard deviation	Minimum elevation	Maximum elevation	Aspect	Hill slope angle (degrees)	Ground cover
				1984-85				
S1	50	8.98	7.51	-8.00	25.00	S	20	FOREST
S2	30	-1.63	10.87	-25.00	18.00	S	19	FOREST
S3	30	5.77	8.66	-7.00	32.00	S	23	BARE
S4	30	6.70	6.75	-7.00	30.00	S	22	FOREST
S5	30	10.17	13.47	-9.00	47.00	S	23	FOREST
S6	30	4.53	8.99	-17.00	22.00	N	21	FOREST
S7	30	1.80	20.36	-31.00	94.00	S	25	SHRUB
S8	30	12.13	11.42	-18.00	40.00	--	--	--
				1985-86				
S1	50	2.86	8.83	-23.00	17.00	S	20	FOREST
S2	30	-8.77	11.27	-46.00	13.00	S	19	FOREST
S3	30	5.60	17.68	-21.00	64.00	S	23	BARE
S4	30	-1.73	11.72	-36.00	22.00	S	22	FOREST
S5	30	1.17	9.73	-22.00	19.00	S	23	FOREST
S6	30	5.70	17.78	-22.00	69.00	N	21	FOREST
S7	30	29.10	28.71	-78.00	77.00	S	25	SHRUB
S8	30	-2.33	17.23	-38.00	55.00	--	--	--

Table 25.--Erosion-box data for hillslope sites in the Edgewood Creek basin

[Data shown are amount of soil collected in erosion boxes during indicated years, and amount consisting of soil particles finer than 2 millimeters intermediate grain diameter. Also listed are calculated rates of hillslope transport of particles finer than 2 millimeters per meter width of hillslope per year. g, gram; mm, millimeter; [(g/m)/a], grams per meter per annum; --, indicates data missing due to site vandalism]

Station (fig. 5)	Total mass (g)	Percentage of particles finer than 2 mm	Mass finer than 2 mm (g)	Hillslope transport rate [(g/m)/a]
		Water year 1985		
S6	3.8	88.0	--	--
S8	76.0	81.0	--	--
		Water year 1986		
S1	--	--	--	--
S2	--	--	--	--
S3	139.6	52.0	72.5	238
S4a	80.8	51.0	41.2	135
S4b	--	--	--	--
S5	34.3	62.0	21.2	70
S6	--	--	--	--
S7	49.0	83.0	40.7	133
S8a	9.0	87.0	7.8	26
S8b	6.3	95.0	6.0	20
		Water year 1987		
EG-S1	363.8	47.8	182.5	599
EG-S2	0	--	0	0
EG-S3	45.4	52.0	23.6	77
EG-S4a	215.2	50.6	108.8	357
EG-S4b	116.6	51.2	59.7	196
EG-S5	163.7	51.3	85.0	279
EG-S7	--	--	--	--
EG-S8	--	--	--	--

Table 26.--Dimensions of gullies mapped in the Edgewood Creek basin

[m, meter; m^3, cubic meter]

Gully (fig. 6)	Length (m)	Average depth (m)	Average width (m)	Volume (m^3)
1	6.4	0.4	0.3	0.8
2	27.4	.5	.2	3.7
3	57.9	.9	.2	9.7
4	36.6	.9	.2	8.2
5	7.9	1.6	.6	7.3
6	79.6	2.7	.7	153.0
7	50.3	1.2	.3	17.8
8	141.7	1.2	.3	50.0
9	51.8	1.7	.5	45.8
10	8.8	.9	.3	2.2
11	14.3	2.9	.3	12.6
12	17.1	1.6	.3	9.1
Total ----				320.0

Table 27.--Changes at monumented stream cross sections, Logan House Creek basin, 1983-86

[Numbers are average changes in horizontal position of left and right banks and vertical position of bed between successive surveys made during summers of the indicated years in meters, with positive numbers indicating bank retreat or bed scour. --, indicates no data available; *, indicates data missing due to site vandalism]

Cross section (fig. 7)	Left bank			Right bank			Bed		
	1983-84	1984-85	1985-86	1983-84	1984-85	1985-86	1983-84	1984-85	1985-86
10	0.005	0.005	*	-0.008	-0.011	*	-0.001	0.044	*
12	0.001	-0.002	-0.052	0.003	-0.020	0.002	0.001	-0.011	0.022
15	0.000	-0.001	-0.020	0.000	0.001	0.016	-0.001	-0.004	-0.002
20	-0.015	-0.016	-0.036	-0.007	0.003	-0.031	0.017	-0.019	-0.002
25	0.010	-0.020	-0.020	0.006	-0.006	0.021	0.069	-0.077	0.014
27	--	-0.007	-0.012	--	-0.009	0.018	--	0.001	-0.003
29	--	-0.015	*	--	-0.008	*	--	-0.020	*
30	-0.010	-0.002	-0.008	0.001	0.001	0.012	-0.007	-0.008	0.020
35	0.021	-0.038	-0.029	0.000	-0.004	0.042	-0.006	0.007	-0.005
40	0.026	-0.008	-0.142	-0.006	0.002	-0.019	-0.040	-0.027	-0.009
45	0.003	0.010	-0.078	-0.011	-0.003	-0.002	0.019	-0.017	-0.004
50	-0.001	0.009	-0.054	0.020	-0.009	-0.001	-0.009	-0.015	-0.178
55	0.008	0.020	-0.079	-0.021	-0.002	0.026	0.023	0.017	0.048
60	0.010	-0.013	0.006	-0.001	0.028	0.032	0.019	0.018	-0.039
65	0.002	0.012	-0.038	0.050	-0.020	0.017	-0.011	0.075	-0.051
75	--	0.152	--	--	0.034	--	--	-0.057	--
80	--	0.034	--	--	-0.023	--	--	-0.240	--

Table 28.--Channel mapping results for selected reaches of Logan House Creek

[Data include measured volumes of stored sediment and estimated areas of eroding banks, stable banks, and active channel bed. Active channel storage and bars include sediment judged to be potentially available for transport each year. Semiactive bars include sediment stabilized by annual vegetation and considered potentially available for transport by mean annual peak flows. Inactive bars consist of sediment stabilized by perennial vegetation or protected by armoring and is considered available for transport only by infrequent high flows. m, meter; m^2, square meter; m^3, cubic meter]

Composite reach	Mapped reaches (fig. 7)	Reach length (m)	Sediment stored in: Active channel (m^3)	Active bars (m^3)	Semi-active bars (m^3)	Inactive bars (m^3)	Sediment stored behind organic debris (m^3)	Area of: Eroding banks (m^2)	Stable banks (m^2)	Active bed (m^2)
1	120-124	220	1.3	0.1	0	0	1.6	68.6	21.4	169.8
2	80a-84a	213	7.3	0	0	0	1.2	43.5	29.2	150.0
3	60-67	203	4.5	0	0	0	8.4	50.5	53.7	196.7
4	1-10	229	4.1	.3	.1	0	11.0	72.6	35.3	204.1
5	70-87	279	4.2	.6	.2	0	14.0	91.7	17.0	290.5
6a	50-53	106	13.3	0	0	0	9.2	79.9	58.7	115.2
6b	90-91	201	7.9	1.0	4.1	0	4.8	59.1	32.4	263.6
7	31-38	202	6.1	.9	0	0.7	14.5	84.2	42.0	204.8

Table 29.--Bulk density and percentage of particles finer than 2 millimeters intermediate grain diameter for stream bank and bed samples in the Logan House Creek basin

[mm, millimeter; Mg/m³, megagrams per cubic meter; --, indicates no data available]

Cross section group (fig. 7)	Bulk density (Mg/m³)	Percentage finer than 2 mm	Bulk density (Mg/m³)	Percentage finer than 2 mm
10-15	0.18	89	--	22
20-25	.21	99	1.57	54
27-29	.17	100	1.60	40
30-35	.34	99	1.70	35
40-45	.15	92	1.84	25
50-55	.96	88	1.63	24
60-65	.80	79	1.57	37

Table 30.--Point-count data for bed material at cross-section groups in the Logan House Creek basin, 1983-84

[Table shows percent of bed material in size classes defined by lower class limits and total number of points for each count]

Cross section group (fig. 7)	Year	Intermediate grain diameter of lower class limit, in millimeters										Total number of points
		0.002	0.062	2	4	8	16	32	64	128	>256	
10-15	1983	0	2	3	2	6	24	30	27	6	0	100
10-15	1984	0	0	0	0	12	33	34	19	2	0	100
20-25	1983	18	43	6	19	13	1	0	0	0	0	100
20-25	1984	21	52	1	7	18	1	0	0	0	0	100
27-29	1984	0	67	3	8	8	3	4	6	1	0	100
30-35	1983	0	2	3	14	14	22	32	11	2	0	100
30-35	1984	4	2	6	9	23	23	29	3	1	0	100
40-45	1983	0	4	0	2	11	12	19	31	15	6	100
40-45	1984	4	3	3	10	15	14	14	24	8	5	100
50-55	1983	1	12	0	2	22	31	25	8	0	0	101
50-55	1984	0	29	2	3	15	22	22	7	0	0	100
60-65	1983	0	7	2	9	20	18	15	18	7	4	100
60-65	1984	1	21	4	4	11	13	20	20	3	3	100