UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SEDIMENT DATA FOR STREAMS NEAR MOUNT ST. HELENS, WASHINGTON

Volume 1. 1980 Water-Year Data

By Randy L. Dinehart, John R. Ritter, and James M. Knott

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GEOLOGICAL SURVEY

Dallas Peck, Director

Cover: The Cowlitz River at Castle Rock gaging station, May 19, 1980.

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Multiply	By	To obtain
inches (in.)	2.54	centimeters (cm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers
square miles (mi^2)	2.590	square kilometers (km^2)
cubic yards (yd^3)	0.7646	cubic meters (m^3)
acre-feet (acre-ft)	0.001233	cubic hectometers (hm^3)
tons, short (2,000 lb)	0.9072	tonnes (t)
degrees Celsius (^oC)	1.8 after adding 32	degrees Fahrenheit (^oF)

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." NGVD of 1929 is referred to as sea level in this report.

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ABSTRACT

This report presents fluvial sediment data collected primarily in response to the eruption of Mount St. Helens. To monitor the sediment transported by streams in the Mount St. Helens area and the particle-size distributions of the sediment, the Water Resources Division of the U.S. Geological Survey initially established 18 fluvial sediment stations. In this report, concentrations and discharges of suspended sediment are given for 16 fluvial sediment stations (5 are in the Toutle River basin) and for 11 miscellaneous sampling sites. Also included are particle-size distributions of suspended sediment and bed material, water discharge, and water temperature for many of the sediment samples. Daily sediment discharges for the period May 18 to September 30 were calculated for Toutle River at Highway 99 near Castle Rock and Cowlitz River at Castle Rock. Over 150 million tons of sediment are estimated to have passed the Toutle River at Highway 99 station on May 18-19, 1980. High concentrations of suspended sediment persisted at several stations throughout the spring and summer of 1980.

INTRODUCTION

The eruption of Mount St. Helens on May 18, 1980, produced large deposits of easily erodible ash, debris flows and mudflows in the North Fork Toutle River basin and ash and mudflows in the South Fork Toutle, Kalama, and Lewis River basins (fig. 1). The deposits of the material from these flows are also easily erodible and are washed into streams in large volumes. The blast from the volcano exposed more material for erosion by killing vegetation over a wide area. Erosion of this material has produced extremely high concentrations and high sediment discharges in streams. This material has, in turn, filled sediment-retention structures, disrupted navigation, damaged fisheries, contaminated water supplies, damaged machinery, and reduced the flow-carrying capacities of stream channels. A chronology of events that may have affected sediment transport in the Mount St. Helens area is given in table 1.

To monitor the sediment transported by streams in the Mount St. Helens area and the particle-size distributions of the sediment, the Water Resources Division of the U.S. Geological Survey (USGS) initially established 18 fluvial sediment stations (fig. 1). The data presented include concentrations and discharges of suspended sediment, particle-size distributions of suspended sediment and bed material, and water discharge and water temperature for many of the sediment samples. Scales of particle sizes for sediment are defined in table 2.

This report is the first of a series published periodically so that sediment data collected by the USGS can be distributed as they become available. Calculations based on these data are provisional and may be changed as more information is obtained. This report presents only the data available through September 30, 1980, in the area shown in figure 1.

ACKNOWLEDGMENTS

The authors acknowledge the stream gagers of the Tacoma Field Office for their extraordinary efforts to obtain samples in the aftermath of the eruption, especially during the first hectic weeks.

TABLE 1.--Chronology of events in the Mount St. Helens area

[1]March 20, 1980	First earthquake reported. Earthquakes continued to build in number and magnitude.
[1]March 27	First eruption of steam and ash. This continued until April 18.
[1]May 7	Eruptions of steam and ash began again. Continued until May 14.
[1]May 18	Big landslide and explosive eruption accompanied by mudflows, large pyroclastic flows, flooding, and extensive ash deposit.
[1]May 25	Second substantial ash eruption, with some pyroclastic flows.
[1]June 12	Third substantial ash eruption, with some pyroclastic flows.
[1]July 22	Fourth substantial series of ash eruptions, accompanied by pyroclastic flows.
[1]August 7	Fifth substantial series of ash eruptions, accompanied by pyroclastic flow.
August 27	Breaching of Elk Rock Lake.
[2]September 30	As of this date 17,240,556 yd^3 of material had been dredged from the lower Toutle and Cowlitz Rivers.
[2]October 7	Completion of South Fork Toutle River sediment-retention dam.
[1]October 16	Sixth substantial series of ash eruptions, accompanied by pyroclastic flow.
November 7	Failure of spillway of North Fork Toutle River sediment-retention dam.
[2]November 20	Completion of North Fork Toutle River sediment-retention dam.
[2]December 25	Failure of North Fork Toutle River sediment-retention dam.

[1]From Fact Sheet - October 24, 1980, Mount St. Helens Geological Area Volcano Information, Forest Service, U.S. Dept. of Agriculture.

[2]Written communication, 1981, U.S. Army Corps of Engineers, Portland District.

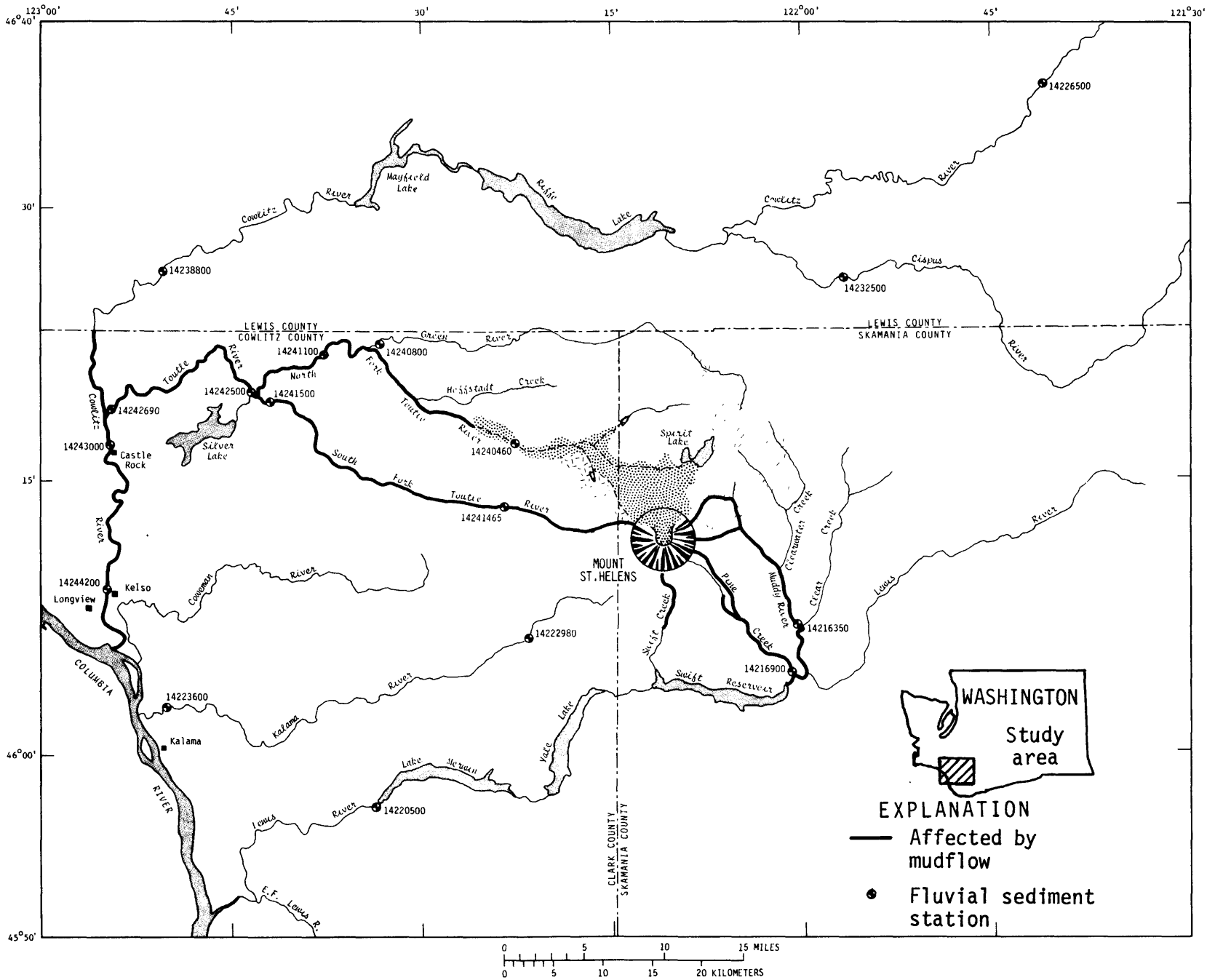

FIGURE 1.--Locations of fluvial sediment stations.

TABLE 2.--Scale of particle sizes for sediment

Class name	Millimeters	Micrometers	Phi value
Boulders	>256	.....	<-8
Cobbles	256 - 64	.....	-8 to -6
Gravel	64 - 2	.....	-6 to -1
Very coarse sand	2.0 - 1.0	2,000 - 1,000	-1 to 0
Coarse sand	1.0 - 0.50	1,000 - 500	0 to +1
Medium sand	0.50 - 0.25	500 - 250	+1 to +2
Fine sand	0.25 - 0.125	250 - 125	+2 to +3
Very fine sand	0.125 - 0.062	125 - 62	+3 to +4
Coarse silt	0.062 - 0.031	62 - 31	+4 to +5
Medium silt	0.031 - 0.016	31 - 16	+5 to +6
Fine silt	0.016 - 0.008	16 - 8	+6 to +7
Very fine silt	0.008 - 0.004	8 - 4	+7 to +8
Coarse clay	0.004 - 0.0020	4 - 2	+8 to +9
Medium clay	0.0020 - 0.0010	2 - 1	+9 to +10
Fine clay	0.0010 - 0.0005	1 - 0.5	+10 to +11
Very fine clay	0.0005 - 0.00024	0.5 - 0.24	+11 to +12
Colloids	<0.00024	<0.24	>+12

SEDIMENT-SAMPLING METHODS

The field techniques used for the collection of sediment data are described by Guy and Norman (1970), and techniques for the computation of sediment discharge by Porterfield (1972). Sediment samples of very high concentrations for May 18 and 19 were not obtained with sediment samplers; instead, weighted pint bottles were lowered 3 to 5 ft into the flow to obtain the samples.

Table 3 lists the types of data collected at the sites shown on figure 1. The available data for the stations listed here are given in three sections in the report--Toutle River basin, Cowlitz River basin excluding the Toutle River basin, and Lewis and Kalama River basins. The data for each station, when appropriate, are divided into instantaneous data, which represent conditions at the time of sampling; daily data, which represent the average conditions for each day; and particle sizes of bed material. Bed-material samples were collected at centroids of equal discharge at the cross section, where more than one analysis is shown for the collection date.

DESCRIPTION OF MOUNT ST. HELENS AREA

Altitudes ranged from less than 10 ft to almost 9,700 ft above the National Geodetic Vertical Datum of 1929 before the eruption. The eruption reduced the altitude of Mount St. Helens to 8,300 ft. The annual precipitation averages 45 inches (110 cm) at Kelso to 140 inches (360 cm) at Mount St. Helens. Most precipitation, in the higher altitudes, falls as snow from November through April and as rain the rest of the year. Winter floods are caused by heavy rains and rainfall-on-snow in the lower altitudes. The major streams drain mostly westward into the Columbia River, although the Cowlitz River flows southward for its last 20 mi (32 km). Lakes and reservoirs dot the landscape. Prior to the eruption, some of the human activities were logging and outdoor recreation.

TABLE 3.--Suspended-sediment-sampling frequency at fluvial sediment stations

Number	Station name	Suspended-sediment frequency	Particle size distributions obtained for:
14216350	Muddy R abv Clear Cr nr Cougar	Periodic	Susp. sed.; Bed material
14216900	Pine Cr at mouth nr Cougar	Periodic	Susp. sed.
14220500	Lewis R at Ariel	Periodic	--
*14222540	E. Fork Lewis R nr Battle Ground	Daily	Susp. sed.; Bed material
14222980	Kalama R blw Falls nr Cougar	Periodic	Susp. sed.
14223600	Kalama R abv Spencer Cr nr Kalama	Daily	Susp. sed.
14226500	Cowlitz R at Packwood	Daily	Susp. sed.
14232500	Cispus R nr Randle	Daily	Susp. sed.
14238800	Cowlitz R at Toledo	Periodic	--
14240460	N.F. Toutle R blw Elk Cr nr Spirit Lake	Periodic	Susp. sed.
**14240800	Green R at Mile 2 near Kid Valley	--	--
14241100	N.F. Toutle R at Kid Valley	Periodic	Susp. sed.; Bed material
**14241465	S.F. Toutle R abv Herrington Cr nr Spotted Buck Mtn.	--	--
14241500	S.F. Toutle R at Toutle	Periodic	Susp. sed.; Bed material
14242500	Toutle R nr Silver Lake	Periodic	Susp. sed.; Bed material
14242690	Toutle R at Highway 99 Bridge nr Castle Rock	Daily	Susp. sed.; Bed material
14243000	Cowlitz R at Castle Rock	Daily	Susp. sed.; Bed material
14244200	Cowlitz R at Kelso	Periodic	Susp. sed.; Bed material

* June-July 1980 only; not shown on figure 1.
** No data collected, 1980 water year.

TOUTLE RIVER BASIN

The Toutle River drainage area is 512 mi^2 (1,330 km^2). Prior to the eruption, the Toutle River was a typical Cascades Range stream, having a gravel bed, forested watershed, and headwaters at several glaciers. The eruption changed the rainfall-runoff relation in the basin, and the mudflows deposited sand over the gravel bed, both of which bear on the stream's high post-eruption sediment transport.

Intensive sediment sampling in the Toutle River basin began immediately following the eruption of Mount St. Helens on May 18, 1980. The devastation of the upper basin by the volcanic blast, the massive collapse of the volcano's north face into the North Fork Toutle River valley, and the deposits of the subsequent debris flows and mudflows provide a virtually unlimited supply of sediment available for transport.

The Toutle River transported about 2.1 million tons (1.9 million tonnes) of suspended sediment to the Cowlitz River between May 20 and September 30, 1980. Sediment-discharge data for the only available peak flows during this period were used to define a sediment-transport curve (fig. 2). The curve indicated that very high sediment discharge could be expected with normal storm runoff. Sediment-retention structures were built on the North Fork and South Fork Toutle, and the structures were nearly filled with sediment by December 1980.

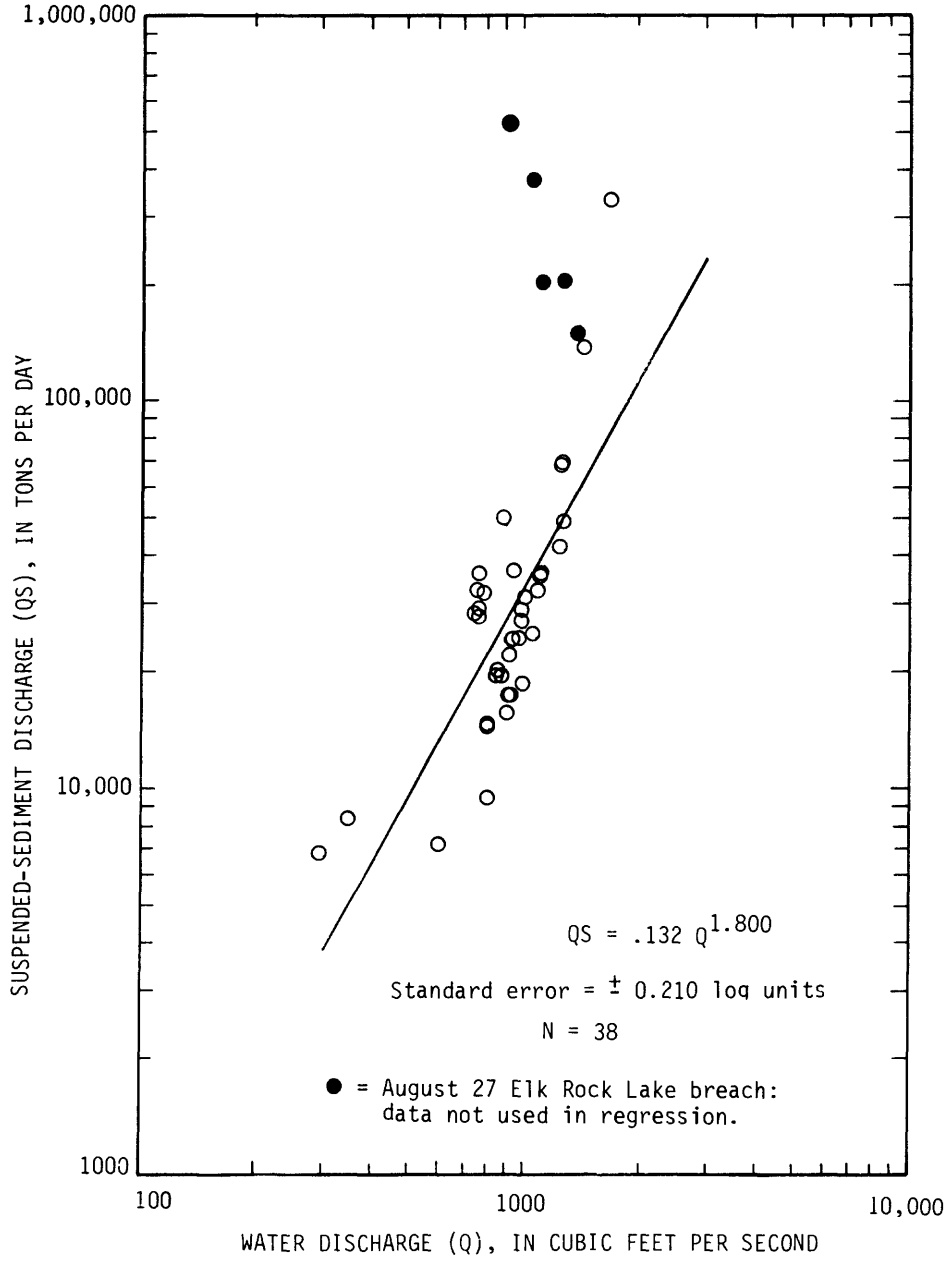

FIGURE 2.--Suspended-sediment transport curve for Toutle River at Highway 99 bridge near Castle Rock.

Station No. 14240460, North Fork Toutle River below Elk Creek near Spirit Lake, WA

LOCATION AND OPERATION.--Ungaged sampling site at Forest Service road bridge 0.5 mi (0.8 km) below Elk Creek and 13 mi (21 km) southeast of Kid Valley, Cowlitz County. Station moved 1.2 mi (1.9 km) downstream to rock outcrop following emplacement of debris pile on May 18, 1980. Water-stage recorder in operation Sept. 23, 1980. Gage house lost in high water December 26, 1980.

DRAINAGE AREA.--83 mi^2 (215 km^2).

ELEVATION.--1,690 ft (515 m) at gage, from altimeter.

SEDIMENT SAMPLING.--Suspended-sediment samples taken periodically.

Summary

During 1980 water year, suspended sediment was sampled in March, April, and May prior to the mudflow, and once, June 6, following the mudflow event.

14240460 - NF TOUTLE R BELOW ELK CR NR SPIRIT LAKE, WASH

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
MAR 28...	1730	5.2	--	5	--	--
APR 19...	0945	8.0	840	32	73	47
MAY 06...	1300	8.0	1000	48	130	42
JUN 06...	1130	9.5	3.0	182	1.5	28

Station No. 14241100, North Fork Toutle River at Kid Valley near Toutle, WA

LOCATION AND OPERATION.--Shelter located on right bank at Highway 505 bridge crossing 0.8 mi (1.3 km) southwest of Kid Valley, Cowlitz County. Station established May 24, 1980. Water-stage recorder connected to GOES data-collection platform.

DRAINAGE AREA.--284 mi^2 (736 km^2).

ELEVATION.--575.8 ft (175.5 m), gage datum.

SEDIMENT SAMPLING.--Suspended-sediment and bed-material samples taken periodically.

Summary

Suspended sediment was sampled June through September 1980. Data were collected at this station on August 27, the day of the Elk Rock Lake breach. The particle-size data for August 27 and September 2 indicate that most suspended sediment was silt and clay.

14241100 - N.F. TOUTLE RIVER AT KID VALLEY, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
JUN											
06...	1030	8.9	500	4100	5540	8	8	14	23	34	48
JUL											
30...	1145	17.0	170	887	407	--	--	--	--	--	22
AUG											
27...	1530	--	200	9820	5300	--	--	--	--	--	--
27...	1635	--	2100	558000	3160000	--	--	--	--	--	--
27...	1646	--	1770	568000	2710000	--	--	--	--	--	--
27...	1650	--	1560	472000	1990000	--	--	--	--	--	--
27...	1700	--	1420	416000	1590000	--	--	--	--	--	--
27...	1740	--	523	344000	486000	--	--	--	--	--	--
29...	1425	17.8	135	3440	1250	--	--	--	--	--	--
SEP											
02...	1505	--	774	22100	46200	15	21	36	54	69	82
30...	1340	16.2	274	4800	3550	--	--	--	--	--	--

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
JUN										
06...	--	62	--	86	--	98	--	100	--	--
JUL										
30...	--	50	--	84	--	100	--	--	--	--
AUG										
27...	85	--	92	--	97	--	99	--	100	--
27...	52	--	69	--	90	--	98	--	100	--
27...	54	--	71	--	89	--	97	--	99	100
27...	60	--	78	--	94	--	99	--	100	--
27...	63	--	80	--	96	--	100	--	--	--
27...	78	--	92	--	98	--	100	--	--	--
29...	62	--	78	--	94	--	99	--	99	--
SEP										
02...	--	93	--	99	--	100	--	--	--	--
30...	--	--	--	--	--	--	--	--	--	--

14241100 - N.F. TOUTLE RIVER AT KID VALLEY, WASH.

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	NUMBER OF SAMPLING POINTS	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
AUG							
29...	1440	17.8	1	135	1	2	3
29...	1445	17.8	1	135	0	1	13
29...	1450	17.8	1	135	0	2	22
29...	1455	17.8	1	135	0	3	32

DATE	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
AUG							
29...	8	19	43	70	87	93	100
29...	44	67	81	90	95	100	--
29...	61	77	87	92	95	100	--
29...	80	98	100	--	--	--	--

Station No. 14241500, South Fork Toutle River at Toutle, WA

LOCATION AND OPERATION.--Ungaged sampling site located at Harry Gardner bridge 0.5 mi (0.8 km) southwest of Toutle, Cowlitz County, and 0.1 mi (0.2 km) downstream from site of old gaging station (discontinued December 1957).

DRAINAGE AREA.--118 mi^2 (305 km^2).

ELEVATION.--565 ft (170 m) at bridge.

SEDIMENT SAMPLING.--Station first sampled for sediment during May 18, 1980, mudflow. Suspended-sediment and bed-material samples taken periodically.

Summary

The few samples collected at this station show that high concentrations persisted in the South Fork through September. The sediment sample of May 18 was taken about 3 hours after the passage of the South Fork mudflow. Median particle size was fine sand and most of the sediment being moved was sand. In contrast, median particle size was in the silt range for suspended sediment collected during low flows of July and August. The median size of bed material collected on August 1 ranged from fine to coarse sand.

14241500 - SOUTH FORK TOUTLE RIVER AT TOUTLE, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM
MAY										
18...	1330	--	500	1060000	1430000	3	4	7	13	19
JUL										
30...	1045	14.8	120	17300	5610	11	11	15	30	48
30...	1050	14.8	120	16400	5310	2	8	16	29	48
AUG										
01...	1605	25.3	110	12500	3710	--	--	--	--	--
01...	1606	25.3	110	11700	3480	11	12	14	33	58
01...	1607	25.3	110	13300	3950	9	11	12	28	50
01...	1608	25.3	110	14100	4190	9	10	15	28	48
13...	1530	20.2	103	12700	3530	--	--	--	--	--
13...	1600	20.2	103	14700	4090	--	--	--	--	--
SEP										
17...	1420	22.0	68	8310	1530	--	--	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
MAY										
18...	--	31	--	48	--	70	--	87	96	99
JUL										
30...	74	--	91	--	98	--	100	--	--	--
30...	76	--	93	--	98	--	100	--	--	--
AUG										
01...	--	--	--	--	--	--	--	--	--	--
01...	85	86	97	96	100	99	--	100	--	--
01...	77	79	92	92	99	98	100	100	--	--
01...	72	74	95	93	100	99	--	100	--	--
13...	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--
SEP										
17...	--	--	--	--	--	--	--	--	--	--

14241500 - SOUTH FORK TOUTLE RIVER AT TOUTLE, WASH.

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	NUMBER OF SAMPLING POINTS	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
AUG							
01...	1555	25.3	1	110	1	4	25
01...	1600	25.3	1	110	1	3	20
01...	1605	25.3	1	110	1	6	34
01...	1610	25.3	1	110	4	19	56

DATE	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
AUG							
01...	37	50	63	74	84	96	100
01...	69	92	97	99	100	--	--
01...	70	86	94	98	98	99	100
01...	78	89	96	99	100	--	--

Station No. 14242500, Toutle River near Silver Lake, WA

LOCATION AND OPERATION.--Shelter located on right bank 0.8 mi (1.3 km) downstream from the confluence of North and South Fork, 4.9 mi (7.9 km) northeast of Silver Lake, Cowlitz County, and at river mile 16.4. Station operated October 1919 to December 1923, September 1929 to May 1980. Gage house lost in N.F. Toutle mudflow on May 18, 1980. New gage in operation September 26, 1980. Gage house lost in high water December 26, 1980. Water-stage recorder connected to GOES data-collection platform.

DRAINAGE AREA.--474 mi^2 (1,230 km^2).

ELEVATION.--407 ft (124 m), gage datum.

SEDIMENT SAMPLING.--Suspended-sediment and bed-material samples taken periodically.

Summary

Suspended sediment and bed-material samples were obtained on September 17 during 1980 water year. The suspended-sediment concentration was high even though the flow was fairly low, and the sediment was mostly silt. The bed material was well sorted and the median size ranged from fine to medium sand.

14242500 - TOUTLE RIVER NEAR SILVER LAKE, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM
SEP 17...	1320	16.8	282	7810	5950	9	14

DATE	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM
SEP 17...	24	40	55	68	85	98	100

14242500 - TOUTLE RIVER NEAR SILVER LAKE, WASH.

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	NUMBER OF SAMPLING POINTS	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
SEP							
17...	1450	16.8	1	282	6	42	88
17...	1455	16.8	1	282	7	41	97
17...	1500	16.8	1	282	1	3	13
17...	1505	16.8	1	282	0	3	16

DATE	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM
SEP						
17...	100	--	--	--	--	--
17...	100	--	--	--	--	--
17...	53	91	98	100	--	--
17...	54	82	89	95	97	100

Station No. 14242690, Toutle River at Highway 99 Bridge near Castle Rock, WA

LOCATION AND OPERATION.--Water-stage recorder at right bank on upstream side of U.S. Highway 99 bridge, 3.0 mi (4.8 km) north of Castle Rock and at river mile 1.0. Station was a State Department of Ecology water-quality site 1971-72, 1974-75. New gage in operation June 2, 1980.

DRAINAGE AREA.--512 mi^2 (1,330 km^2).

ELEVATION.--53 ft (162 m) at gage.

SEDIMENT SAMPLING.--Daily suspended-sediment samples taken through August 20; samples after August 20 taken periodically. Bed-material samples taken periodically.

Summary

The impact of the mudflows at this site can be seen from the concentrations and loads on May 18-19 in the accompanying tables. The enormous quantity of sediment estimated for those days (153,000,000 tons) was based on a peak flow of 102,000 ft^3/s on May 18, 1980. The mean daily and peak flows for May 18 and 19 are preliminary estimates and are subject to revision.

The mudflow sample collected on May 18 had a concentration of 1,770,000 mg/L. The daily mean concentration never fell below 3,000 mg/L between May 18 and September 30. The high concentrations on August 27-28 coincide with the breaching of Elk Rock Lake. Particle-size analyses show that the mudflow (May 18-19) contained mostly sand, whereas the samples collected after the mudflows show that the suspended sediment was chiefly silt.

14242690 - TOUTLE R AT HIWAY 99 BRIDGE NR CASTLE ROCK, WA.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
MAR											
29...	1100	7.5	1950	5	26	--	--	--	--	--	--
APR											
19...	1330	10.9	2820	30	228	--	--	--	--	--	--
MAY											
06...	1645	11.6	1910	7	36	--	--	--	--	--	--
18...	2045	--	60000	1770000	2.87E+08	1	1	1	2	3	--
19...	0945	33.0	2000	1320000	7130000	3	4	8	13	19	--
20...	1000	15.0	880	21100	50100	16	33	49	68	88	100
21...	0915	14.4	740	14100	28200	16	28	43	63	83	99
21...	1125	14.5	750	16000	32400	16	22	36	53	72	96
21...	1325	14.8	760	14200	29100	18	23	38	56	77	96
21...	1630	15.4	780	15200	32000	17	20	36	53	74	93
22...	1230	11.8	760	17500	35900	--	--	--	--	--	--
22...	1235	11.8	760	13500	27700	14	25	39	54	78	85
25...	1630	10.8	850	8820	20200	--	--	--	--	--	--
27...	1600	11.4	1260	14400	49000	16	17	20	39	52	--
27...	1915	11.2	1230	12700	42200	--	--	--	--	--	--
28...	1245	11.6	1100	11900	35300	11	11	21	32	48	--
29...	1500	12.6	930	9670	24300	10	11	17	30	42	--
29...	1810	13.0	910	8940	22000	--	--	--	--	--	--
30...	1030	11.8	870	8320	19500	9	14	23	34	44	--
30...	1900	16.2	840	8650	19600	--	--	--	--	--	--
31...	1530	11.0	800	6770	14600	12	13	21	33	50	68
31...	1700	14.8	800	6610	14300	--	--	--	--	--	--
JUN											
01...	1540	11.2	960	9420	24400	10	10	17	27	42	66
01...	1810	13.8	1000	11500	31100	--	--	--	--	--	--
02...	1600	12.6	1240	20400	68300	13	17	28	42	59	76
02...	1830	12.5	1250	20500	69200	--	--	--	--	--	--
03...	1600	13.7	1100	12100	35900	--	--	--	--	--	--
03...	1830	13.8	1080	11100	32400	--	--	--	--	--	--
04...	1600	--	980	10900	28800	10	10	16	26	40	61
04...	1800	16.0	980	10200	27000	--	--	--	--	--	--
05...	1215	11.3	910	7090	17400	--	--	--	--	--	--
06...	1000	10.0	920	7010	17400	9	9	13	24	37	51
06...	1710	14.0	910	7040	17300	--	--	--	--	--	--
07...	1650	14.0	900	6410	15600	--	--	--	--	--	--
08...	1730	16.4	1420	35900	138000	--	--	--	--	--	--
09...	1800	15.4	1050	8870	25100	--	--	--	--	--	--
10...	1450	15.6	990	7010	18700	8	10	17	26	37	61

14242690 - TOUTLE R AT HIWAY 99 BRIDGE NR CASTLE ROCK, WA.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
MAR										
29...	--	--	--	--	--	--	--	--	--	--
APR										
19...	--	--	--	--	--	--	--	--	--	--
MAY										
06...	--	--	--	--	--	--	--	--	--	--
18...	4	--	15	--	33	--	51	--	64	74
19...	26	--	39	--	58	--	74	--	88	96
20...	--	--	--	--	--	--	--	--	--	--
21...	--	100	--	--	--	--	--	--	--	--
21...	--	100	--	--	--	--	--	--	--	--
21...	--	100	--	--	--	--	--	--	--	--
21...	--	100	--	--	--	--	--	--	--	--
22...	--	--	--	--	--	--	--	--	--	--
22...	--	91	--	100	--	--	--	--	--	--
25...	--	--	--	--	--	--	--	--	--	--
27...	73	--	96	--	100	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
28...	68	--	95	--	100	--	--	--	--	--
29...	50	--	91	--	99	--	100	--	--	--
29...	--	--	--	--	--	--	--	--	--	--
30...	62	--	90	--	100	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--	--
31...	--	92	--	100	--	--	--	--	--	--
31...	--	--	--	--	--	--	--	--	--	--
JUN										
01...	--	93	--	99	--	100	--	--	--	--
01...	--	--	--	--	--	--	--	--	--	--
02...	--	98	--	100	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--
04...	--	91	--	99	--	100	--	--	--	--
04...	--	--	--	--	--	--	--	--	--	--
05...	--	--	--	--	--	--	--	--	--	--
06...	--	84	--	94	--	99	--	100	--	--
06...	--	--	--	--	--	--	--	--	--	--
07...	--	--	--	--	--	--	--	--	--	--
08...	--	--	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--	--	--
10...	--	90	--	100	--	--	--	--	--	--

14242690 - TOUTLE R AT HIWAY 99 BRIDGE NR CASTLE ROCK, WA.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM
JUN							
19...	1215	15.8	800	4410	9530	11	12
25...	1735	17.0	930	14500	36400	13	19
JUL							
02...	1500	17.6	600	4440	7190	11	12
23...	1430	20.2	350	8870	8380	16	23
AUG							
27...	2015	--	1100	68800	204000	2	2
27...	2050	--	1360	40800	150000	--	--
27...	2130	--	1260	60600	206000	--	--
27...	2200	--	1040	134000	376000	10	17
27...	2220	--	900	216000	525000	--	--
SEP							
02...	1030	13.7	1650	75100	335000	--	--
17...	1700	19.2	295	8560	6820	18	32

DATE	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM
JUN							
19...	14	26	40	58	87	99	100
25...	33	51	68	86	96	100	--
JUL							
02...	19	36	51	64	88	97	100
23...	41	61	80	91	98	100	--
AUG							
27...	5	11	26	40	81	95	100
27...	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--
27...	30	51	74	87	96	100	--
27...	--	--	--	--	--	--	--
SEP							
02...	--	--	--	--	--	--	--
17...	51	69	79	86	90	96	100

STATION NUMBER 14242690 TOUTLE R AT HIWAY 99 BRIDGE NR CASTLE ROCK, WA. STREAM SOURCE AGENCY USGS
LATITUDE 461910 LONGITUDE 1225427 DRAINAGE AREA 511.00 DATUM STATE 53 COUNTY 015

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		APRIL			MAY			JUNE	
1				---	---	---	890	8630	20700
2				---	---	---	1220	20600	67700
3				---	---	---	1140	13500	40800
4				---	---	---	1010	10700	29200
5				---	---	---	930	7350	18500
6				---	---	---	920	7000	17400
7				---	---	---	910	6600	16200
8				---	---	---	1430	29000	118000
9				---	---	---	1090	12100	36300
10				---	---	---	1000	7250	19600
11				---	---	---	950	8300	21300
12				---	---	---	930	7200	18100
13				---	---	---	930	13000	32600
14				---	---	---	890	7680	18500
15				---	---	---	870	6200	14600
16				---	---	---	920	8630	21600
17				---	---	---	930	15900	39800
18				16000	560000	71800000	850	6900	15800
19				18000	960000	81500000	800	4600	9940
20				870	26100	59200	770	4600	9560
21				760	11000	32800	790	6800	14500
22				780	9800	37900	740	6000	12000
23				770	9300	31200	680	5600	10300
24				750	8800	16200	650	4800	8420
25				820	8800	19500	860	10800	26000
26				1350	33400	127000	740	8400	16800
27				1320	22900	84000	710	8000	15300
28				1100	11800	35000	680	6600	12100
29				950	9750	25000	660	4400	7840
30				860	8200	19000	650	5000	8770
31				800	7000	15100	---	---	---
TOTAL				45130	---	153801900	26540	---	718230

STATION NUMBER 14242690 TOUTLE R AT HIWAY 99 BRIDGE NR CASTLE ROCK, WA. STREAM SOURCE AGENCY USGS
LATITUDE 461910 LONGITUDE 1225427 DRAINAGE AREA 511.00 DATUM STATE 53 COUNTY 015

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JULY			AUGUST			SEPTEMBER	
1	630	5200	8850	280	5800	4380	620	8600	14400
2	600	5000	8100	300	6600	5350	1410	46500	187000
3	580	4600	7200	310	5800	4850	740	12200	24400
4	640	4100	7080	310	4200	3520	410	9600	10600
5	600	4200	6800	290	3250	2540	350	9200	8690
6	540	3400	4960	280	3700	2800	340	9000	8260
7	530	4200	6010	270	3400	2480	580	10800	17200
8	510	4800	6610	360	5200	5050	420	9200	10400
9	500	4000	5400	340	4000	3670	360	8200	7970
10	500	3200	4320	300	3800	3080	350	8000	7560
11	500	3800	5130	280	3700	2800	340	8000	7340
12	500	3400	4590	270	7200	5250	340	8000	7340
13	490	3000	3970	270	9600	7000	460	9100	11300
14	470	3300	4190	260	6800	4770	520	10000	14000
15	450	3200	3890	260	6000	4210	420	9600	10900
16	440	3600	4280	260	6200	4350	340	9100	8350
17	430	4200	4880	290	5200	4070	300	8750	7090
18	410	3200	3540	350	11300	11300	300	8400	6800
19	390	3000	3160	310	12200	10200	300	8100	6560
20	380	4200	4310	260	6100	4280	910	14300	38800
21	370	7200	7190	260	4600	3230	950	14000	35900
22	370	8400	8390	260	4000	2810	500	10000	13500
23	350	8600	8130	250	4000	2700	410	7700	8520
24	340	6600	6060	250	4000	2700	400	6350	6860
25	330	6200	5520	250	4000	2700	390	5200	5480
26	320	7800	6740	280	4400	3330	380	4200	4310
27	310	8000	6700	480	28400	51700	380	3900	4000
28	300	8300	6720	460	17300	23200	370	3900	3900
29	290	7400	5790	390	9500	10000	360	3900	3790
30	290	5800	4540	390	8600	9060	360	3900	3790
31	290	5000	3920	640	10900	19100	---	---	---
TOTAL	13650	---	176970	9760	---	226480	14310	---	505010
PERIOD	109390		155428590						

14242690 - TOUTLE R AT HIWAY 99 BRIDGE NR CASTLE ROCK, WA.

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	NUMBER OF SAMPLING POINTS	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. FALL DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. FALL DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. FALL DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
MAY										
30...	1035	11.8	1	870	--	1	--	26	--	96
30...	1040	11.8	1	870	--	1	--	7	--	43
30...	1045	11.8	1	870	--	2	--	22	--	86
30...	1050	11.8	1	870	--	2	--	29	--	97
30...	1053	11.8	1	870	--	6	--	44	--	96
30...	1055	11.8	1	870	--	3	--	33	--	98
JUN										
10...	1415	15.6	1	990	--	2	--	12	--	45
10...	1416	15.6	1	990	--	3	--	17	--	70
10...	1420	15.6	1	990	--	6	--	35	--	90
10...	1425	15.6	1	990	--	5	--	26	--	88
10...	1426	15.6	1	990	--	1	--	6	--	43
10...	1430	15.6	1	990	--	2	--	20	--	90
JUL										
23...	1511	20.2	1	350	0	--	16	--	94	--
23...	1513	20.2	1	350	0	--	11	--	87	--
23...	1514	20.2	1	350	0	--	9	--	86	--
23...	1515	20.2	1	350	1	--	9	--	88	--
23...	1516	20.2	1	350	0	--	1	--	11	--
SEP										
17...	1715	19.2	1	300	--	1	--	1	--	4
17...	1717	19.2	1	300	--	--	--	0	--	2
17...	1719	19.2	1	300	--	1	--	1	--	4
17...	1721	19.2	1	300	--	0	--	1	--	18

(continued)

14242690--continued

DATE	BED MAT. FALL DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. FALL DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 64.0 MM
MAY										
30...	--	100	--	--	--	--	--	--	--	--
30...	--	86	--	93	95	96	98	100	--	--
30...	--	98	--	99	99	99	100	--	--	--
30...	--	100	--	--	--	--	--	--	--	--
30...	--	100	--	--	--	--	--	--	--	--
30...	--	100	--	--	--	--	--	--	--	--
JUN										
10...	--	80	--	95	100	--	--	--	--	--
10...	--	97	--	99	99	99	99	100	--	--
10...	--	99	--	100	--	--	--	--	--	--
10...	--	99	--	100	--	--	--	--	--	--
10...	--	63	--	68	75	83	91	98	100	--
10...	--	98	--	99	99	100	--	--	--	--
JUL										
23...	99	--	99	--	99	99	99	100	--	--
23...	96	--	100	--	--	--	--	--	--	--
23...	98	--	100	--	--	--	--	--	--	--
23...	99	--	100	--	--	--	--	--	--	--
23...	42	--	75	--	96	99	100	--	--	--
SEP										
17...	--	11	--	19	26	35	45	78	100	--
17...	--	7	--	19	42	65	81	95	100	--
17...	--	17	--	47	74	87	93	100	--	--
17...	--	54	--	65	67	68	69	71	78	100

COWLITZ RIVER BASIN
(excluding the Toutle River basin)

The Cowlitz River basin, which includes the Toutle River, has an area of about 2,480 mi^2 (6,400 km^2). The headwaters of the Cowlitz are on Mount Rainier. The flow of the upper Cowlitz River is regulated by two reservoirs (fig. 1), Riffe Lake, which has a usable capacity of 1,686,300 acre-ft (1,600 hm^3), and Mayfield Reservoir, which has a usable capacity of 21,380 acre-ft (264 hm^3). The eruption spread volcanic ash on the basin, and the mudflows in the Toutle River affected the Cowlitz River from the Lewis-Cowlitz County line to the mouth. Most of the volcanic ash transported by the streams in the upper Cowlitz Basin was deposited in the downstream reservoirs. Regular sediment sampling on the Cowlitz River began the day after the eruption.

Station No. 14226500, Cowlitz River at Packwood, WA

LOCATION AND OPERATION.--Water-stage recorder on left bank downstream of Forest Service bridge, 0.6 mi (1.0 km) northwest of Packwood and at mile 126.5. Station established at present site September 1929.

DRAINAGE AREA.--287 mi^2 (743 km^2).

ELEVATION.--1,048 ft (319.4 m), gage datum.

SEDIMENT SAMPLING.--Daily suspended-sediment samples.

Summary

The suspended-sediment concentrations were above 100 mg/L from July 8 to September 17. These fairly high concentrations may be due to glacial flour from Mt. Rainier as well as erosion of volcanic ash. Samples taken in late May show no high concentrations, nor do the samples taken on June 12, a day of ash eruption. However, concentration levels rose on July 22 and August 7, a possible indication of the effects of the ash eruption on those days. The particle-size analysis shows that most of the suspended sediment at that time was finer than sand. From May 27 through September 30, the Cowlitz River transported 77,300 tons of suspended sediment past this site.

14226500 - COWLITZ RIVER AT PACKWOOD, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM
MAY									
28...	1215	9.8	1380	17	63	--	--	--	--
29...	0945	8.7	1580	22	94	--	--	--	--
30...	1000	9.2	1640	16	71	--	--	--	--
31...	0930	8.4	2320	44	276	--	--	--	--
JUN									
03...	1015	7.5	1750	13	61	--	--	--	--
04...	0945	7.4	1560	10	42	--	--	--	--
05...	1230	8.0	1510	9	37	--	--	--	--
06...	0955	--	1370	8	30	--	--	--	--
09...	0955	7.2	2230	37	223	--	--	--	--
10...	0950	6.1	2270	26	159	--	--	--	--
11...	1005	6.7	2540	44	302	--	--	--	--
12...	1230	6.1	2270	32	196	--	--	--	--
13...	1000	6.1	1940	15	79	--	--	--	--
16...	0915	6.1	2890	162	1260	--	--	--	--
16...	1310	10.2	2680	90	651	--	--	--	--
17...	0945	8.6	2920	92	725	--	--	--	--
18...	0930	8.2	2630	68	483	--	--	--	--
19...	1010	8.6	2570	84	583	--	--	--	--
20...	0930	8.2	2650	79	565	--	--	--	--
23...	0925	7.9	1750	44	208	--	--	--	--
24...	0935	9.1	1550	201	841	--	--	--	--
25...	1045	8.9	2130	210	1210	84	91	97	100
26...	1325	9.6	1510	36	147	--	--	--	--
27...	1140	8.2	1470	30	119	--	--	--	--
30...	0930	9.0	1430	28	108	--	--	--	--
JUL									
01...	0945	10.6	1490	40	161	--	--	--	--
01...	1515	13.8	1590	36	155	--	--	--	--
02...	0945	9.6	1720	69	320	--	--	--	--
07...	0915	9.8	1220	71	234	--	--	--	--
08...	0950	11.0	1270	130	446	--	--	--	--
09...	0930	10.6	1310	204	722	--	--	--	--
10...	0930	9.6	1220	244	804	--	--	--	--
11...	0920	8.7	1000	124	335	--	--	--	--
14...	1515	11.6	965	158	412	--	--	--	--
15...	0930	10.6	965	146	380	--	--	--	--
16...	0920	10.6	974	276	726	--	--	--	--
17...	0940	10.7	938	341	864	--	--	--	--
18...	0920	10.8	947	252	644	--	--	--	--

(continued)

14226500--continued

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)
JUL					
21...	1220	14.2	911	507	1250
22...	0925	12.0	965	800	2080
23...	1050	12.0	1000	778	2100
25...	0945	10.9	900	406	987
28...	0915	10.8	860	558	1300
29...	0905	10.2	860	639	1480
30...	1020	11.1	820	394	872
31...	1015	10.8	800	343	741
31...	1215	12.8	800	355	767
AUG					
01...	0930	9.9	750	612	1240
04...	1410	14.7	660	202	360
05...	1130	10.8	640	212	366
06...	1130	11.1	620	170	285
07...	1150	12.2	600	189	306
08...	1230	12.4	600	282	457
11...	1325	14.6	600	377	611
12...	0920	10.7	640	664	1150
13...	1130	11.8	640	531	918
18...	0900	10.8	630	1690	2880
19...	1605	14.4	541	231	337
20...	0935	10.3	555	322	483
21...	1135	11.4	527	296	421
22...	1135	11.5	555	231	346
26...	1250	9.8	534	166	239
27...	1410	10.6	558	244	368
28...	1155	9.9	384	233	242
SEP					
02...	1550	9.7	814	1250	2750
03...	1155	11.5	500	243	328
04...	1200	11.0	431	205	239
08...	1500	14.4	390	138	145
09...	1600	14.7	395	317	338
10...	1145	11.4	425	233	267
17...	1220	11.8	368	152	151
19...	1400	9.2	340	90	83
26...	1430	12.4	388	83	87

STATION NUMBER 14226500 COWLITZ RIVER AT PACKWOOD, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 463647 LONGITUDE 1214041 DRAINAGE AREA 287.00 DATUM 1048.00 STATE 53 COUNTY 041

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

PROVISIONAL DATA

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		APRIL			MAY			JUNE	
1					---	---	2940	61	490
2					---	---	2330	31	195
3					---	---	1750	14	66
4					---	---	1560	10	42
5					---	---	1520	10	41
6					---	---	1380	17	63
7					---	---	1400	11	42
8					---	---	1770	18	91
9					---	---	2330	41	258
10					---	---	2500	38	271
11					---	---	2630	49	353
12					---	---	2340	34	215
13					---	---	2020	23	129
14					---	---	2220	46	276
15					---	---	2580	120	1000
16					---	---	3170	226	2030
17					---	---	3100	139	1240
18					---	---	2920	121	1020
19					---	---	2940	149	1240
20					---	---	2890	124	1010
21					---	---	2600	85	623
22					---	---	2160	44	257
23					---	---	1760	47	223
24					---	---	1560	60	253
25					---	---	1890	100	520
26					---	---	1600	42	181
27				1500	19	77	1490	33	133
28				1410	18	69	1490	38	153
29				1580	24	102	1590	44	189
30				1820	25	130	1520	42	172
31				2570	53	374	---	---	---
TOTAL				8880	---	752	63950	---	12776

STATION NUMBER 14226500 COWLITZ RIVER AT PACKWOOD, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 463647 LONGITUDE 1214041 DRAINAGE AREA 287.00 DATUM 1048.00 STATE 53 COUNTY 041

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

PROVISIONAL DATA

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JULY			AUGUST			SEPTEMBER	
1	1750	42	198	750	660	1340	558	400	1100
2	1920	51	264	700	610	1150	1060	2010	6780
3	1590	50	215	680	330	606	538	315	458
4	1270	50	171	660	212	378	494	220	293
5	1190	60	193	640	207	358	498	220	296
6	1270	94	331	620	177	296	521	230	324
7	1340	107	406	600	227	368	563	250	380
8	1430	156	617	600	358	580	474	182	233
9	1410	248	948	580	440	689	456	323	398
10	1190	231	742	580	440	689	513	288	399
11	1040	125	351	600	530	859	497	270	362
12	1040	130	365	640	685	1180	431	210	244
13	1060	150	429	640	583	1010	389	200	210
14	1030	163	453	630	500	850	461	250	311
15	974	150	394	598	300	484	408	200	220
16	1010	310	845	562	250	379	416	200	225
17	992	330	884	562	200	303	442	200	239
18	1000	310	837	630	1140	2030	411	180	200
19	929	390	978	541	317	463	407	218	361
20	938	370	937	555	379	568	820	720	1600
21	1070	490	1420	527	352	501	563	220	334
22	1080	830	2420	555	294	441	442	160	191
23	1000	830	2240	562	350	531	418	120	135
24	950	610	1560	548	350	518	402	100	109
25	900	450	1090	527	330	470	401	100	108
26	840	520	1180	514	222	308	425	90	103
27	840	600	1360	534	235	339	440	100	119
28	860	634	1470	413	237	264	399	90	97
29	860	674	1570	352	200	190	413	120	134
30	820	476	1050	416	190	213	488	250	329
31	800	457	987	472	170	217	---	---	---
TOTAL	34393	---	26905	17788	---	18572	14748	---	16292
PERIOD	492902		75297						

Station No. 14232500, Cispus River near Randle, WA

LOCATION AND OPERATION.--Water-stage recorder in Gifford Pinchot National Forest, on left bank 60 ft (18 m) upstream from bridge to Tower Rock ranger station, 8.0 mi (12.9 km) southeast of Randle, and at mile 15.8. Station established near present site September 1929.

DRAINAGE AREA.--321 mi^2 (831 km^2).

ELEVATION.--1,222 ft (372 m).

SEDIMENT SAMPLING.--Daily suspended-sediment samples taken.

Summary

Daily suspended-sediment samples were collected at this station to monitor the effects of erosion of volcanic ash on suspended-sediment discharges. After collection began, the volcano erupted three times in the 1980 water year--June 12, July 22, and August 7 (table 1). Suspended-sediment concentrations and discharges increased substantially after each eruption. The two particle-size analyses indicate that most suspended sediment was silt and clay. The Cispus River transported 29,500 tons (26,800 tonnes) of suspended sediment past this site between June 1 and September 30, 1980.

14232500 - CISPUS RIVER NEAR RANDLE, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM
JUN								
04...	1405	13.0	1290	90	313	--	--	--
05...	1530	10.0	1280	80	276	--	--	--
06...	1500	--	1240	71	238	--	--	--
09...	1445	--	1300	86	302	--	--	--
10...	1445	15.0	1300	86	302	--	--	--
11...	1530	14.0	1290	84	293	--	--	--
12...	1530	10.0	1460	1290	5090	--	--	--
13...	0930	8.0	1470	318	1260	--	--	--
16...	1600	10.4	1430	400	1540	20	24	34
17...	1530	13.0	1470	322	1280	--	--	--
18...	1530	13.0	1430	214	826	--	--	--
19...	1515	13.0	1410	171	651	--	--	--
24...	1500	12.0	1110	92	276	--	--	--
26...	1610	11.0	1180	120	382	--	--	--
27...	1545	10.0	1140	109	336	--	--	--
JUL								
01...	1240	13.4	1080	123	359	--	--	--
01...	1715	16.0	1030	90	250	--	--	--
07...	1630	18.0	854	62	143	--	--	--
09...	1510	13.0	888	87	209	--	--	--
10...	1630	13.0	838	57	129	--	--	--
11...	1545	11.0	814	58	127	--	--	--
14...	1545	13.0	742	54	108	--	--	--
15...	1515	16.0	734	44	87	--	--	--
16...	1520	16.0	742	64	128	--	--	--
17...	1630	17.5	703	45	85	--	--	--
18...	1215	14.0	710	52	100	--	--	--
22...	1510	18.0	703	157	298	--	--	--
23...	1145	16.0	696	275	517	--	--	--
AUG								
18...	1530	11.0	469	340	431	--	--	--
27...	1600	12.5	412	247	275	--	--	--
28...	1615	13.0	375	23	23	--	--	--
SEP								
02...	1600	11.5	570	444	683	--	--	--
03...	1600	15.0	406	70	77	--	--	--
05...	1430	15.5	370	40	40	--	--	--
08...	1600	15.0	350	43	41	--	--	--
09...	1600	17.0	340	33	30	--	--	--
10...	1400	16.0	340	44	40	--	--	--
11...	1530	15.0	331	40	36			
12...	1600	14.0	336	28	25			
15...	1515	15.0	345	68	63			
18...	1545	11.0	322	22	19			
22...	1530	10.5	360	16	16			
23...	1530	14.0	355	14	13			
24...	1530	14.5	336	10	9.1			
30...	1530	13.5	350	47	44			

14232500 - CISPUS RIVER NEAR RANDLE, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
JUN								
04...	--	--	--	--	--	--	--	--
05...	--	--	--	--	--	--	--	--
06...	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--
11...	--	--	--	--	--	--	--	--
12...	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--
16...	48	67	81	86	89	95	99	100
17...	--	--	--	--	--	--	--	--
18...	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--
JUL								
01...	--	--	71	73	78	92	98	100
01...	--	--	--	--	--	--	--	--
07...	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--
11...	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--
15...	--	--	--	--	--	--	--	--
16...	--	--	--	--	--	--	--	--
17...	--	--	--	--	--	--	--	--
18...	--	--	--	--	--	--	--	--
22...	--	--	--	--	--	--	--	--
23...	--	--	--	--	--	--	--	--
AUG								
18...	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--
28...	--	--	--	--	--	--	--	--
SEP								
02...	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--
05...	--	--	--	--	--	--	--	--
08...	--	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--

STATION NUMBER 14232500 CISPUS RIVER NEAR RANDLE, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 462630 LONGITUDE 1215146 DRAINAGE AREA 321.00 DATUM 1221.60 STATE 53 COUNTY 041

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

PROVISIONAL DATA

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		APRIL			MAY			JUNE	
1							1460	120	473
2							1450	110	431
3							1370	100	370
4							1290	98	341
5							1280	91	314
6							1240	73	244
7							1210	70	229
8							1280	110	380
9							1310	100	354
10							1310	97	343
11							1310	96	340
12							1370	527	2060
13							1460	342	1350
14							1500	357	1450
15							1450	265	1050
16							1500	454	1850
17							1520	355	1460
18							1480	254	1020
19							1440	174	688
20							1430	150	579
21							1390	120	450
22							1300	110	386
23							1200	100	324
24							1120	94	284
25							1350	174	639
26							1190	125	402
27							1150	110	342
28							1110	100	300
29							1110	110	330
30							1090	110	324
31							---	---	---
TOTAL							39670	---	19107

STATION NUMBER 14232500 CISPUS RIVER NEAR RANDLE, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 462630 LONGITUDE 1215146 DRAINAGE AREA 321.00 DATUM 1221.60 STATE 53 COUNTY 041

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

PROVISIONAL DATA

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JULY			AUGUST			SEPTEMBER	
1	1060	121	346	563	67	102	395	110	124
2	1060	110	315	557	55	83	570	579	928
3	1080	110	321	537	45	65	423	104	119
4	969	100	262	511	36	50	390	50	53
5	906	90	220	505	35	48	380	40	41
6	888	80	192	487	34	45	380	40	41
7	870	73	171	469	100	127	401	50	54
8	915	90	222	481	150	195	365	43	42
9	915	98	242	469	90	114	350	33	31
10	870	67	157	469	85	108	350	44	42
11	830	67	150	469	80	101	350	40	38
12	766	65	134	463	78	98	345	28	26
13	742	63	126	463	60	75	340	25	23
14	758	62	127	463	59	74	385	40	42
15	750	50	101	457	51	63	355	35	34
16	766	73	151	457	50	62	331	30	27
17	734	53	105	445	50	60	335	25	23
18	710	54	104	493	317	427	331	22	20
19	703	50	95	440	130	154	326	9	7.9
20	718	55	107	434	43	50	451	201	256
21	718	55	107	412	45	50	417	65	73
22	742	165	327	406	45	49	370	20	20
23	710	276	545	401	45	49	355	14	13
24	647	84	147	418	45	51	340	10	9.2
25	633	75	128	406	47	52	331	10	8.9
26	626	75	127	395	59	63	331	10	8.9
27	619	70	117	412	78	87	326	10	8.8
28	612	65	107	385	30	31	326	10	8.8
29	598	65	105	365	30	30	331	10	8.9
30	570	60	92	380	35	36	350	47	44
31	570	63	97	428	80	92	---	---	---
TOTAL	24055	---	5547	14040	---	2691	11030	---	2175.4
PERIOD	88795		29520.4						

Station No. 14238800, Cowlitz River at Toledo, WA

LOCATION AND OPERATION.--Water-stage recorder on right bank at State Highway 505 bridge in Toledo, and at mile 33.7.

DRAINAGE AREA.--1,461 mi^2 (3,784 km^2).

ELEVATION.--85.8 ft (26.2 m), gage datum.

SEDIMENT SAMPLING.--Suspended-sediment samples taken periodically.

Summary

This station is downstream of Riffe Lake and Mayfield Reservoir and upstream of the Toutle River (fig. 1). The accompanying table shows that the suspended-sediment concentrations were very low and did not change after the eruption. Most Mount St. Helens sediment eroding into the Cowlitz River above this station is trapped by the reservoirs.

14238800 - COWLITZ RIVER AT TOLEDO, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)
OCT 10...	1250	10.5	--	1	--
NOV 14...	1235	8.9	--	3	--
DEC 11...	1215	8.4	--	11	--
JAN 15...	1230	5.7	--	8	--
FEB 05...	1140	4.8	--	5	--
MAR 17...	0930	6.2	--	5	--
APR 08...	1510	8.3	--	5	--
MAY 13...	1345	9.6	5600	3	45
JUN 11...	1540	10.2	5040	4	54
JUL 08...	1210	10.8	4120	3	33
AUG 12...	0945	11.6	2700	2	15
SEP 16...	1245	12.5	3800	9	92

Station No. 14243000, Cowlitz River at Castle Rock, WA

LOCATION AND OPERATION.--Shelter located on left bank 50 ft (15.2 m) downstream from highway bridge in Castle Rock, Cowlitz County, 2.7 mi (4.5 km) downstream from the mouth of the Toutle River and at mile 17.3. Shelter installed May 23, 1980. Stilling well gage on right bank at same location was damaged by May 18 mudflow. Station operated December 1926 to date. Water-stage recorder connected to GOES data-collection platform.

DRAINAGE AREA.--2,238 mi^2 (5,796 km^2).

ELEVATION.--20.2 ft (6.2 m), gage datum.

SEDIMENT SAMPLING.--Daily suspended-sediment samples taken. Bed-material samples taken periodically.

Summary

The Cowlitz River transported 142 million tons (129 million tonnes) of suspended sediment past Castle Rock from May 18 through September 30, 1980. This amount is less than that calculated for the Toutle River (155 million tons), and most of this deficit occurred during the days of the mudflow, May 18 and 19. The difference in sediment loads may be attributed to deposition between the two sites, the changing of some of the suspended-sediment load of the Toutle River to bedload in the Cowlitz, and the accuracy of the methods of computation. The sediment discharge for May 18-19 was based on a peak flow of 97,000 ft^3/s. The mean daily and peak flows for those two days are preliminary estimates and are subject to revision.

Concentrations after May 18 remained high for the rest of the water year, never dropping below 700 mg/L. Particle-size analyses of the suspended sediment indicate that the percentage of sand ranged from 6 to 77 percent, and that the sediment transported on May 19 became progressively finer. The bed material was chiefly medium to coarse sand.

14243000 - COWLITZ R AT CASTLE ROCK, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
MAY											
19...	0850	--	22000	847000	5.03E+07	7	7	14	21	29	--
19...	1020	23.0	14000	436000	1.65E+07	13	13	24	38	53	--
19...	1105	22.5	11000	320000	9500000	14	20	31	48	66	--
19...	1205	21.4	9000	284000	6900000	15	17	31	46	62	--
19...	1310	19.5	8000	164000	3540000	19	20	38	58	77	--
19...	1405	18.1	8000	142000	3070000	20	20	38	57	77	--
19...	1500	15.9	7000	117000	2210000	16	20	37	56	76	--
19...	1645	15.2	6200	93400	1560000	14	22	36	56	78	94
20...	0815	11.5	6200	11600	194000	--	--	--	--	--	--
20...	1530	11.8	6200	8170	137000	--	--	--	--	--	--
21...	0830	9.8	8060	3390	73800	--	--	--	--	--	--
22...	1020	--	7320	10500	208000	6	9	14	18	29	--
22...	1600	9.8	7920	6500	139000	--	--	--	--	--	--
23...	1530	9.8	9140	3640	89800	--	--	--	--	--	--
24...	1400	--	9950	4260	114000	--	--	--	--	--	--
25...	1300	9.6	8200	6590	146000	--	--	--	--	--	--
26...	1400	--	9360	3820	96500	--	--	--	--	--	--
27...	1030	8.7	9950	4590	123000	10	12	21	31	44	62
28...	1030	--	9110	4360	107000	6	6	8	14	21	30
29...	1030	10.4	7220	2780	54200	6	7	14	21	32	45
30...	0830	9.4	6980	2100	39600	7	9	13	19	32	47
31...	1130	11.2	6410	2010	34800	8	14	21	31	41	56
JUN											
01...	1100	12.0	6110	1930	31800	6	9	15	22	33	55
02...	1400	--	6170	9670	161000	12	18	31	47	60	70
03...	1000	8.6	6200	3140	52600	--	--	--	--	--	--
04...	1600	10.2	5960	2450	39400	11	11	13	26	42	62
05...	0940	--	6170	2040	34000	--	--	--	--	--	--
06...	0830	--	6020	1860	30200	6	7	12	20	30	45
10...	1325	12.2	6650	2140	38400	10	11	15	20	29	40
11...	1340	11.6	6290	1610	27300	--	--	--	--	--	--
12...	0710	11.0	6320	1640	28000	--	--	--	--	--	--
13...	0700	10.0	6470	6140	107000	--	--	--	--	--	--
14...	0705	10.0	6260	3360	56800	--	--	--	--	--	--
15...	0745	10.5	6470	2480	43300	--	--	--	--	--	--
16...	0705	11.7	6500	3200	56200	--	--	--	--	--	--
17...	0700	10.0	7290	2660	52400	--	--	--	--	--	--
17...	1130	10.5	7310	4140	81700	16	22	37	55	72	76
18...	0700	10.8	7600	1820	37300	--	--	--	--	--	--
19...	0705	11.0	7570	2120	43300	--	--	--	--	--	--

14243000 - COWLITZ R AT CASTLE ROCK, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. FALL DIAM. % FINER THAN 2.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
MAY											
19...	39	--	53	--	70	--	84	--	92	--	97
19...	68	--	86	--	96	--	99	--	100	--	--
19...	83	--	97	--	100	--	--	--	--	--	--
19...	75	--	91	--	98	--	100	--	--	--	--
19...	88	--	90	--	99	--	100	--	--	--	--
19...	92	--	98	--	100	--	--	--	--	--	--
19...	90	--	97	--	99	--	99	--	100	--	--
19...	--	99	--	100	--	--	--	--	--	--	--
20...	--	--	--	--	--	--	--	--	--	--	--
20...	--	--	--	--	--	--	--	--	--	--	--
21...	35	--	--	--	--	--	--	--	--	--	--
22...	40	--	62	--	85	--	97	--	100	--	--
22...	--	--	--	--	--	--	--	--	--	--	--
23...	44	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--	--
25...	82	--	--	--	--	--	--	--	--	--	--
26...	23	--	--	--	--	--	--	--	--	--	--
27...	--	78	--	95	--	99	--	100	--	--	--
28...	--	42	--	79	--	95	--	99	--	100	--
29...	--	63	--	80	--	93	--	98	--	100	--
30...	--	68	--	87	--	98	--	100	--	--	--
31...	--	74	--	88	--	98	--	100	--	--	--
JUN											
01...	--	73	--	84	--	98	--	100	--	--	--
02...	--	82	--	87	--	94	--	100	--	--	--
03...	--	--	--	--	--	--	--	--	--	--	--
04...	--	88	--	97	--	100	--	--	--	--	--
05...	--	--	--	--	--	--	--	--	--	--	--
06...	--	70	--	88	--	97	--	100	--	--	--
10...	40	63	63	82	82	94	94	100	100	--	--
11...	--	--	--	--	--	--	--	--	--	--	--
12...	--	--	--	--	--	--	--	--	--	--	--
13...	--	--	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--	--	--
15...	--	--	--	--	--	--	--	--	--	--	--
16...	--	--	--	--	--	--	--	--	--	--	--
17...	--	--	--	--	--	--	--	--	--	--	--
17...	--	87	--	95	--	99	--	100	--	--	--
18...	--	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--	--

14243000 - COWLITZ R AT CASTLE ROCK, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM
JUN								
20...	0705	12.0	7400	2070	41400	--	--	--
23...	0710	12.0	7570	1950	39900	--	--	--
24...	0705	10.0	7200	1290	25100	11	12	14
25...	0745	12.0	6800	1150	21100	--	--	--
26...	0705	--	6560	2160	38300	--	--	--
26...	1110	--	6560	2440	43200	--	--	--
27...	0710	--	6710	2760	50000	--	--	--
30...	0710	--	6290	998	16900	--	--	--
JUL								
01...	0710	--	5960	1150	18500	--	--	--
02...	0705	--	5840	1130	17800	--	--	--
02...	1720	--	5750	691	10700	--	--	--
03...	0705	12.0	5480	821	12100	--	--	--
04...	0725	12.0	5300	900	12900	--	--	--
07...	0720	--	5360	1340	19400	--	--	--
08...	0715	--	5150	789	11000	--	--	--
09...	0730	--	4160	1110	12500	--	--	--
10...	0705	--	3680	1490	14800	--	--	--
24...	1200	14.6	3200	1200	10400	--	--	--
AUG								
11...	1230	15.4	3010	1130	9180	--	--	--
21...	0705	13.0	3300	2280	20300	--	--	--
SEP								
04...	1405	--	3700	2350	23500	16	19	30
11...	1950	--	3330	2000	18000	--	--	--
30...	1325	11.6	6300	1610	27400	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM
JUN							
20...	--	--	--	--	--	--	--
23...	--	--	--	--	--	--	--
24...	18	24	41	60	78	98	100
25...	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--
JUL							
01...	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--
04...	--	--	--	--	--	--	--
07...	--	--	--	--	--	--	--
08...	--	--	--	--	--	--	--
09...	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--
AUG							
11...	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--
SEP							
04...	43	61	83	90	96	99	100
11...	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--

STATION NUMBER 14243000 COWLITZ R AT CASTLE ROCK, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 461630 LONGITUDE 1225448 DRAINAGE AREA 2238.00 DATUM 20.20 STATE 53 COUNTY 015

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

PROVISIONAL DATA

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		APRIL			MAY			JUNE	
1	7420			6510	---	---	6230	2600	43700
2	7270			6440	---	---	6230	7910	134000
3	7180			6360	---	---	6200	3150	52700
4	7180			6310	---	---	6020	2500	40600
5	7610			6900	---	---	6170	2050	34200
6	8700			12100	---	---	6020	1850	30100
7	9060			12000	---	---	6020	2150	34900
8	8690			11800	---	---	6980	10000	200000
9	10500			10800	---	---	6980	5500	105000
10	11600			8670	---	---	6650	2300	41300
11	10300			8580	---	---	6410	1600	27700
12	9480			8200	---	---	6440	3300	58000
13	9310			6950	---	---	6530	5450	96100
14	9520			7100	---	---	6380	3150	54300
15	10000			8960	---	---	6320	2620	44700
16	9070			7250	---	---	6530	3390	59800
17	8460			6680	---	---	7260	2400	47000
18	8000			15000	330000	37300000	7680	1900	39400
19	8120			30000	640000	99500000	7680	2080	43100
20	11800			6200	11000	184000	7570	2040	41700
21	10800			8200	3200	70800	7540	2200	44800
22	10500			7600	2800	57500	7400	1990	39800
23	9570			9100	5000	123000	7430	2010	40300
24	8970			9390	6800	172000	7400	2000	40000
25	8360			8320	7000	157000	6740	2000	36400
26	7770			8970	6500	157000	6560	2420	42900
27	7380			9840	4450	118000	6620	2500	44700
28	7280			9080	3950	96800	6380	1550	26700
29	7090			7360	2790	55400	6260	1020	17200
30	6780			6920	2100	39200	6170	1000	16700
31	---			6380	2090	36000	---	---	---
TOTAL	263770			283970	---	38066700	200800	---	1577800

STATION NUMBER 14243000 COWLITZ R AT CASTLE ROCK, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 461630 LONGITUDE 1225448 DRAINAGE AREA 2238.00 DATUM 20.20 STATE 53 COUNTY 015

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

PROVISIONAL DATA

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JULY			AUGUST			SEPTEMBER	
1	5960	1090	17500	3100	1100	9210	4000	3000	32400
2	5720	900	13900	3100	1100	9210	5000	15000	203000
3	5480	800	11800	3100	1000	8370	4100	3500	38700
4	5420	1100	16100	3100	950	7950	3700	2300	23000
5	5480	1550	22900	3100	900	7530	3600	2000	19400
6	5390	1420	20700	3100	900	7530	3600	2000	19400
7	5240	1200	17000	3100	900	7530	3800	2500	25700
8	5000	750	10100	3100	1200	10000	3700	2300	23000
9	4310	1210	14100	3100	900	7530	3600	2100	20400
10	3770	1330	13500	3000	820	6640	3600	2000	19400
11	3200	1200	10400	3000	1150	9310	3600	1900	18500
12	3180	1100	9440	3100	1300	10900	3600	1900	18500
13	3230	1100	9590	3100	1600	13400	3700	2300	23000
14	3320	1200	10800	2900	1300	10200	3800	2500	25700
15	3440	1200	11100	2700	1200	8750	3700	2200	22000
16	3350	1200	10900	2600	1100	7720	4300	2300	26700
17	3320	1100	9860	2600	700	4910	4700	2300	29200
18	3300	1100	9800	2800	1600	12100	4800	2300	29800
19	3300	1000	8910	2700	1000	7290	4900	2300	30400
20	3300	1000	8910	2900	1200	9400	5600	4000	60500
21	3300	1300	11600	3000	2400	19400	5600	3700	55900
22	3300	1400	12500	3400	2600	23900	5200	2800	39300
23	3300	1400	12500	3500	2500	23600	5100	2500	34400
24	3200	870	7520	3500	2300	21700	5500	2300	34200
25	3200	900	7780	3400	2200	20200	5600	2100	31800
26	3100	1200	10000	3400	2200	20200	5900	2000	31900
27	3100	1200	10000	3700	6000	59900	5800	1900	29800
28	3100	1200	10000	3700	4000	40000	5800	1800	28200
29	3100	1100	9210	3600	3000	29200	5800	1700	26600
30	3100	1000	8370	3600	2800	27200	6100	1600	26400
31	3100	1000	8370	4000	3400	36700	---	---	---
TOTAL	119610	---	365160	98100	---	497480	137800	---	1047200
PERIOD	2967260		141554340						

14243000 - COWLITZ R AT CASTLE ROCK, WASH.

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	NUMBER OF SAMPLING POINTS	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
MAY							
30...	1140	--	1	6800	0	1	8
30...	1145	--	1	6800	0	1	9
30...	1150	--	1	6800	0	1	10
30...	1155	--	1	6800	1	3	16
30...	1200	--	1	6800	1	3	21
30...	1205	--	1	6800	1	2	15
JUN							
10...	1310	12.2	1	6650	0	2	8
10...	1315	12.2	1	6650	0	2	12
10...	1320	12.2	1	6650	0	1	4
10...	1325	12.2	1	6650	0	1	6
10...	1330	12.2	1	6650	0	3	31
10...	1335	12.2	1	6650	0	1	5
JUL							
24...	1145	14.6	1	3200	1	17	90
24...	1150	14.6	1	3200	0	1	4
24...	1155	14.6	1	3200	--	0	4
24...	1200	14.6	1	3200	1	2	7
24...	1205	14.6	1	3200	--	0	6
24...	1210	14.6	1	3200	--	0	9

DATE	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
MAY							
30...	27	50	71	82	88	96	100
30...	37	76	94	98	100	--	--
30...	57	90	100	--	--	--	--
30...	68	96	100	--	--	--	--
30...	76	93	98	99	100	--	--
30...	76	94	99	100	--	--	--
JUN							
10...	27	66	89	94	97	100	--
10...	70	96	99	100	--	--	--
10...	26	77	98	100	--	--	--
10...	29	65	88	95	99	100	--
10...	88	100	--	--	--	--	--
10...	30	83	95	97	99	100	--
JUL							
24...	93	98	100	--	--	--	--
24...	22	56	80	88	94	98	100
24...	27	62	82	91	96	100	--
24...	38	73	86	92	95	98	100
24...	37	71	84	87	92	98	100
24...	46	87	97	99	100	--	--

Station No. 14244200, Cowlitz River at Kelso, WA

LOCATION AND OPERATION.--Ungaged sampling site located at Main Street bridge between Kelso and West Kelso, 3.6 mi (5.8 km) upstream from Coweman River and at mile 4.9. Water-quality data collected by Washington Department of Ecology 1960-66, 1971-75, 1977. Operated as a USGS NASQAN site since January 1978.

DRAINAGE AREA.--2,349 mi^2 (6,084 km^2).

ELEVATION.--35.3 ft (10.8 m) at bridge.

SEDIMENT SAMPLING.--Suspended-sediment and bed-material samples taken periodically.

Summary

Samples of suspended sediment have been collected monthly at this station since January 1978 as part of the NASQAN program. As shown in the accompanying table, the suspended-sediment concentrations and transport after May 18 were much higher than those before that date, even though most water discharges were lower. A comparison of the samples collected on November 20, 1979, and June 10, 1980, shows that the Cowlitz was transporting over 100 times more sediment at similar streamflow after the eruption than before the eruption. This is further shown in a comparison of sediment-transport curves drawn from pre- and post-eruption data (fig. 3).

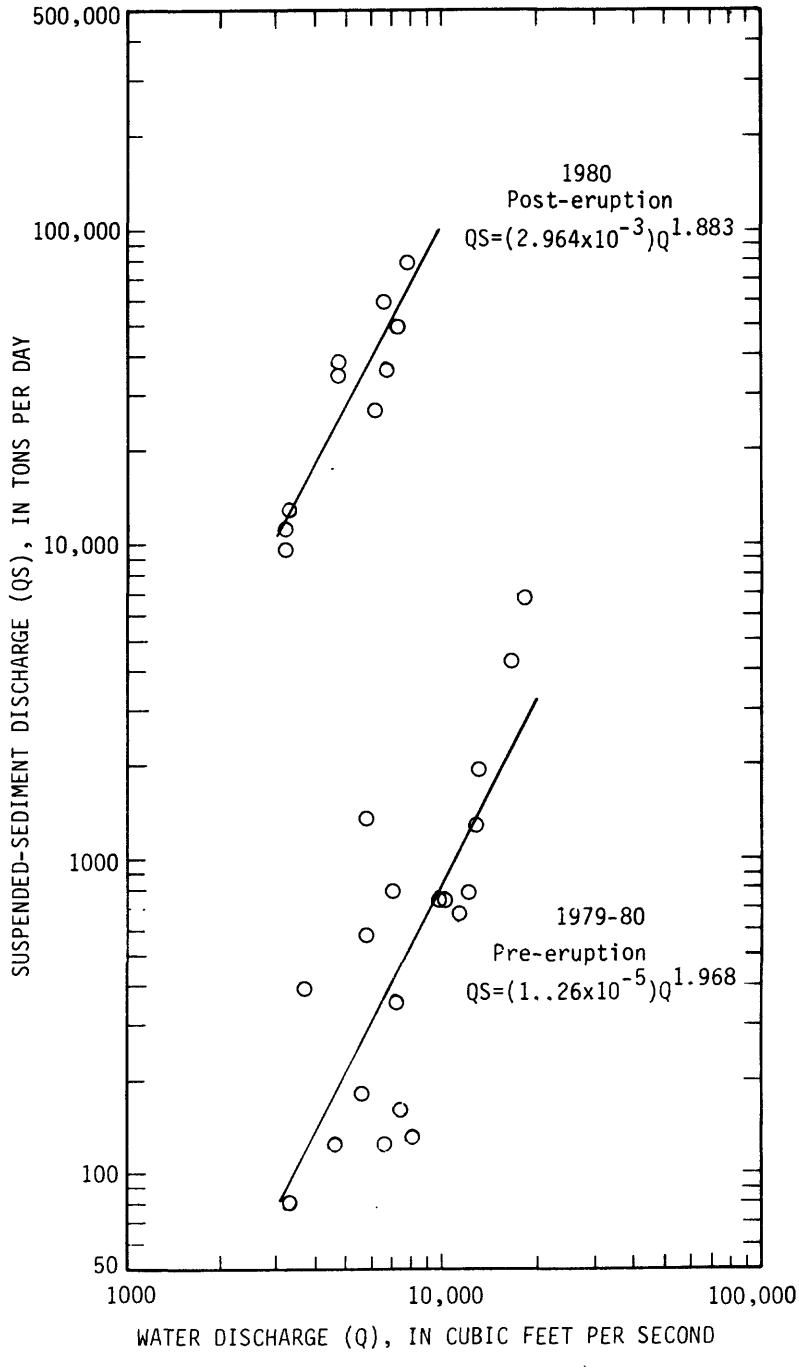

FIGURE 3.--Pre- and post-eruption suspended-sediment transport curves for Cowlitz River at Kelso.

14244200 - COWLITZ RIVER AT KELSO, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM
OCT									
23...	1330	10.6	5790	37	578	--	--	--	--
NOV									
20...	0930	8.4	7180	18	349	--	--	--	--
DEC									
26...	1500	7.6	18100	137	6700	--	--	--	--
JAN									
22...	1330	4.6	11300	22	671	--	--	--	--
FEB									
19...	1430	5.8	13000	55	1930	--	--	--	--
MAR									
18...	1300	6.8	12100	24	784	--	--	--	--
APR									
16...	1400	9.4	10100	27	736	--	--	--	--
MAY									
30...	1230	10.9	6570	3300	58500	7	10	16	26
JUN									
10...	1015	11.4	7300	2460	48500	11	13	20	29
12...	1230	11.4	6740	1940	35300	9	9	14	26
17...	1600	12.3	7790	3700	77800	17	24	35	55
25...	1100	16.4	6200	1570	26300	4	7	14	25
JUL									
23...	1000	15.6	3220	1100	9560	--	--	--	--
23...	1030	15.8	3220	1280	11100	--	--	--	--
AUG									
22...	1200	13.6	3300	1440	12800	--	--	--	--
SEP									
18...	1115	13.0	4740	2680	34300	--	--	--	--
18...	1120	13.0	4740	2930	37500	18	28	44	63

14244200 - COWLITZ RIVER AT KELSO, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. FALL DIAM. % FINER THAN 2.00 MM
OCT								
23...	--	--	93	--	--	--	--	--
NOV								
20...	--	--	--	--	--	--	--	--
DEC								
26...	--	--	21	--	--	--	--	--
JAN								
22...	--	--	56	--	--	--	--	--
FEB								
19...	--	--	35	--	--	--	--	--
MAR								
18...	--	--	43	--	--	--	--	--
APR								
16...	--	--	40	--	--	--	--	--
MAY								
30...	36	59	--	90	99	100	--	--
JUN								
10...	42	69	--	93	98	100	--	--
12...	33	59	--	93	99	100	--	--
17...	66	79	--	95	99	100	--	--
25...	37	56	56	90	97	100	--	--
JUL								
23...	--	72	--	78	84	98	99	100
23...	--	--	--	--	--	--	--	--
AUG								
22...	--	--	--	--	--	--	--	--
SEP								
18...	--	--	--	--	--	--	--	--
18...	80	88	--	89	92	99	100	--

14244200 - COWLITZ RIVER AT KELSO, WASH.

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	NUMBER OF SAMPLING POINTS	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM
MAY							
30...	1805	--	1	2	5	25	52
30...	1810	--	1	1	8	33	71
30...	1815	--	1	8	12	21	42
30...	1820	--	1	1	3	11	35
30...	1825	--	1	1	8	68	98
30...	1830	--	1	1	3	24	53
JUN							
10...	0915	11.4	1	9	58	92	96
10...	0920	11.4	1	1	3	10	43
10...	0925	11.4	1	1	3	10	35
10...	0930	11.4	1	0	1	3	16
10...	0935	11.4	1	1	3	10	28
10...	0940	11.4	1	0	1	4	16
JUL							
23...	1050	15.6	1	0	1	2	22
23...	1055	15.6	1	0	1	7	34
23...	1100	15.6	1	0	1	10	47
23...	1105	15.6	1	4	23	63	90
23...	1110	15.6	1	7	33	90	99
23...	1115	15.6	1	2	3	7	32
SEP							
18...	1320	13.0	1	0	1	13	65
18...	1325	13.0	1	0	1	7	51
18...	1330	13.0	1	--	0	2	37
18...	1335	13.0	1	0	1	19	86
18...	1340	13.0	1	0	1	5	37
18...	1345	13.0	1	1	4	15	35

14244200 - COWLITZ RIVER AT KELSO, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
MAY						
30...	73	90	96	100	--	--
30...	90	98	99	100	--	--
30...	65	91	98	100	--	--
30...	56	79	93	99	100	--
30...	100	--	--	--	--	--
30...	72	76	83	92	96	100
JUN						
10...	98	99	100	--	--	--
10...	75	87	93	98	100	--
10...	66	86	94	97	99	100
10...	57	91	97	99	100	--
10...	47	62	72	82	93	100
10...	41	64	78	90	97	100
JUL						
23...	59	76	87	95	100	--
23...	56	70	81	87	90	100
23...	76	93	98	100	--	--
23...	96	97	98	99	100	--
23...	100	--	--	--	--	--
23...	65	87	96	100	--	--
SEP						
18...	90	97	99	100	--	--
18...	83	94	96	98	100	--
18...	75	89	95	99	100	--
18...	99	100	--	--	--	--
18...	67	90	97	99	100	--
18...	69	91	98	99	100	--

LEWIS AND KALAMA RIVER BASINS

The Lewis River basin has an area of 1,046 mi^2 (2,710 km^2). The headwaters of several tributaries to the Lewis River are on Mount St. Helens. Two of the tributaries included in the sampling program, Muddy River and Pine Creek, carried mudflows after the eruption (fig. 1). Three reservoirs, Swift Reservoir--capacity 446,550 acre-ft (551 hm^3), Yale Lake--capacity 189,530 acre-ft (234 hm^3), and Lake Merwin--capacity 246,000 acre-ft (303 hm^3), are downstream from these tributaries and upstream from the station on the Lewis River at Ariel.

The Kalama River, which drains southwestward from Mount St. Helens, has a drainage basin of 205 mi^2 (530 km^2). The upper part of the river had mudflows following the eruption. Sediment samples are collected at two stations (fig. 1).

Station No. 14216350, Muddy River above Clear Creek near Cougar, WA

LOCATION AND OPERATION.--Water-stage recorder connected to GOES data-collection platform. Shelter located in Skamania County about 14 mi (22.5 km) northeast of Cougar, on rock outcrop 0.25 mi (0.40 km) downstream from former Forest Service Road 125 crossing. Station originally established at bridge upstream on August 1, 1980, moved to present site on December 19, 1980.

DRAINAGE AREA.--80 mi^2 (207 km^2).

ELEVATION.--1,300 ft (400 m) at gage, from topographic map.

SEDIMENT SAMPLING.--Suspended-sediment and bed-material samples taken periodically.

Summary

Suspended sediment and bed material were sampled at this station only on August 29 during the 1980 water year. The predominant size of the sediment was silt and clay. Only the bed material near the left bank was unconsolidated enough to be collected.

14216350 - MUDDY RIVER AB CLEAR CR NR COUGAR, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM
AUG 29...	1300	14.0	110	1170	347	15	18

DATE	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM
AUG 29...	26	38	50	64	78	96	100

14216350 - MUDDY RIVER AB CLEAR CR NR COUGAR, WASH.

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	NUMBER OF SAMPLING POINTS	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM
AUG 29...	1250	1	110	3	6	20	52

DATE	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
AUG 29...	82	84	85	86	88	100

Station No. 14216900, Pine Creek at Mouth near Cougar, WA

LOCATION AND OPERATION.--Shelter located in Skamania County about 13 mi (21 km) east of Cougar, on right bank 150 ft (15 m) upstream from Forest Service Road 125 crossing. Station established June 25, 1980. Water-stage recorder connected to GOES data collection platform.

DRAINAGE AREA.--26.0 mi^2 (67.3 km^2).

ELEVATION.--1,070 ft (330 m) at gage, from topographic map.

SEDIMENT SAMPLING.--Suspended-sediment samples taken periodically.

Summary

Mudflows passed down Pine Creek soon after the May 18 eruption. The sample collected on June 6 showed that the stream still carried a high concentration of suspended sediment, most of which was sand.

14216900 - PINE CREEK AT MOUTH NEAR COUGAR, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
MAR											
29...	1715	4.6	--	5	--	--	--	--	--	--	--
30...	0930	4.7	--	4	--	--	--	--	--	--	--
APR											
18...	1315	11.0	--	11	--	--	--	--	--	--	--
MAY											
07...	1430	10.4	179	4	1.9	--	--	--	--	--	--
JUN											
06...	1510	9.2	140	8900	3360	3	5	7	11	16	--
JUL											
29...	1015	8.9	270	215	157	--	--	--	--	--	--
AUG											
29...	1145	10.0	138	1240	462	6	7	10	14	21	33

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. FALL DIAM. % FINER THAN 2.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
MAR											
29...	58	--	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--	--	--
APR											
18...	--	--	--	--	--	--	--	--	--	--	--
MAY											
07...	--	--	--	--	--	--	--	--	--	--	--
JUN											
06...	24	--	34	--	53	--	74	--	89	--	96
JUL											
29...	--	--	--	--	--	--	--	--	--	--	--
AUG											
29...	--	48	--	69	--	93	--	98	--	100	--

Station No. 14220500, Lewis River at Ariel, WA

LOCATION AND OPERATION.--Water-stage recorder in Cowlitz County on right bank 0.4 mi (0.6 km) southeast of Ariel, 0.5 mi (0.8 km) downstream from Ariel Dam and powerplant, and at mile 19.0. Station established at present site April 1930.

DRAINAGE AREA.--731 mi^2 (1,893 km^2).

ELEVATION.--44.0 ft (13.4 m) gage datum.

SEDIMENT SAMPLING.--Suspended-sediment samples taken periodically.

Summary

The low concentrations indicate that the three reservoirs above this station (fig. 1) have trapped most of the sediment transported by the mudflows on Muddy River, Pine Creek, and Swift Creek.

14220500 - LEWIS RIVER AT ARIEL, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)
OCT					
22...	1600	15.2	3110	2	17
DEC					
27...	1200	6.8	6390	1	17
JAN					
23...	1100	5.4	6120	2	33
FEB					
20...	1200	3.5	5850	4	63
MAR					
17...	1400	4.6	--	2	--
APR					
17...	1000	6.1	--	1	--
MAY					
19...	1700	9.4	1980	1	5.3
22...	1045	8.0	8020	2	43
28...	1630	9.8	8760	10	237
JUN					
11...	1100	9.8	2990	3	24
11...	1100	9.8	2990	3	24
18...	1030	10.4	2150	3	17
25...	1430	--	--	4	--
JUL					
18...	0900	--	--	3	--
AUG					
21...	1030	11.3	879	3	7.1

Station No. 14222540, East Fork Lewis River near Battle Ground, WA

LOCATION AND OPERATION.--Ungaged sampling site in Clark County at Lewisville Highway bridge, 2.0 mi (1.2 km) north of Dollar Corner, and at mile 12.8. Discharge routed from upstream gaging station.

DRAINAGE AREA.--151 mi^2 (391 km^2).

ELEVATION.--140 ft (42.7 m) at bridge, from topographic map.

SEDIMENT SAMPLING.--Daily suspended-sediment samples taken.

Summary

The drainage basin was little affected by the May 18 eruption. The concentrations of suspended sediment were low from May 30 to July 30, and may be representative of concentrations that rivers in the area might have had if the eruption had not occurred. The ash eruption of June 12 deposited about one-half inch of ash throughout the basin. The bed material is composed of gravel and cobble; only the material at the left bank was fine enough to be collected.

14222540 - EAST FORK LEWIS RIVER NR BATTLEGROUND, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM
MAY									
30...	1520	12.0	407	6	6.6	--	--	--	--
31...	0920	--	359	8	7.8	--	--	--	--
JUN									
01...	0915	10.4	400	10	11	--	--	--	--
02...	0930	10.8	428	6	6.9	--	--	--	--
03...	0920	9.6	465	6	7.5	--	--	--	--
04...	2015	12.6	424	7	8.0	--	--	--	--
05...	1930	11.0	388	4	4.2	--	--	--	--
06...	0910	10.4	359	8	7.8	--	--	--	--
07...	1740	13.4	347	5	4.7	--	--	--	--
08...	1230	13.8	354	8	7.6	--	--	--	--
09...	1035	13.6	308	4	3.3	--	--	--	--
10...	1200	13.2	262	8	5.7	--	--	--	--
11...	0845	12.6	268	8	5.8	--	--	--	--
11...	1900	15.8	242	6	3.9	--	--	--	--
12...	0935	12.6	234	6	3.8	--	--	--	--
13...	1820	11.2	390	123	130	--	--	--	--
14...	0750	10.6	464	40	50	--	--	--	--
15...	1900	13.8	387	19	20	--	--	--	--
16...	2015	11.8	363	14	14	--	--	--	--
17...	1830	14.6	348	14	13	--	--	--	--
18...	1625	16.4	312	11	9.3	--	--	--	--
19...	2030	16.2	285	10	7.7	--	--	--	--
20...	1915	15.4	297	7	5.6	--	--	--	--
21...	1930	15.8	278	6	4.5	--	--	--	--
22...	1900	15.6	261	17	12	--	--	--	--
23...	2100	14.4	260	82	58	--	--	--	--
24...	1940	--	255	32	22	--	--	--	--
25...	0915	12.6	440	56	67	61	71	94	100
26...	1500	14.0	301	6	4.9	--	--	--	--
27...	1845	14.4	296	3	2.4	--	--	--	--
28...	1025	13.6	273	3	2.2	--	--	--	--
29...	1300	16.4	254	8	5.5	--	--	--	--
30...	0830	14.2	241	20	13	--	--	--	--
JUL									
01...	0830	14.6	274	3	2.2	--	--	--	--
02...	1220	15.6	217	4	2.3	--	--	--	--
03...	0920	14.1	217	4	2.3	--	--	--	--
04...	1730	14.8	290	6	4.7	--	--	--	--
05...	0920	13.6	244	2	1.3	--	--	--	--
06...	0850	13.6	215	6	3.5				
07...	0830	14.8	200	9	4.9				
08...	0820	16.0	188	6	3.0				
09...	1620	16.6	183	11	5.4				
10...	1700	18.2	185	4	2.0				
11...	1925	16.9	174	6	2.8				
12...	0800	14.2	169	4	1.8				
13...	2005	17.8	161	3	1.3				
14...	0915	15.4	158	2	.85				
15...	1830	21.0	156	4	1.7				
16...	1700	19.2	145	2	.78				
17...	0905	14.8	143	4	1.5				
18...	0545	14.7	138	2	.75				
19...	0920	--	133	3	1.1				
20...	2100	21.8	133	18	6.5				
21...	0725	18.0	125	4	1.3				
22...	2100	21.2	116	4	1.3				
23...	1955	21.4	113	6	1.8				
24...	1930	21.5	108	5	1.5				
25...	1600	22.8	105	6	1.7				
26...	2050	23.2	102	6	1.7				
27...	0815	18.4	98	6	1.6				
28...	1800	24.4	94	8	2.0				
29...	1850	23.4	91	9	2.2				
30...	2030	22.8	90	6	1.5				

14222540 - EAST FORK LEWIS RIVER NR BATTLEGROUND, WASH.

PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	NUMBER OF SAMPLING POINTS	STREAMFLOW, INSTANTANEOUS (CFS)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
JUN 11...	0900	1	268	1	3	8

	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM
	21	32	40	51	69	100

Station No. 14222980, Kalama River below Falls near Cougar, WA

LOCATION AND OPERATION.--Shelter located in Cowlitz County 0.5 mi (0.8 km) below Falls, 4.8 mi (7.6 km) northwest of Cougar at Kalama River Road crossing on left upstream bank. Station previously operated 1969-71. Present gage installed June 4, 1980. Water-stage recorder connected to GOES data-collection platform.

DRAINAGE AREA.--37.4 mi^2 (96.9 km^2).

ELEVATION.--1,300 ft (396 m) at gage, from topographic map.

SEDIMENT SAMPLING.--Suspended-sediment samples taken periodically.

Summary

The data collected at this station indicate that the suspended-sediment concentrations did not remain high after the eruption. USGS personnel observed ash on the streambed there following the June 12 ash eruption.

14222980 - KALAMA RIVER BELOW FALLS NEAR COUGAR, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM
APR									
18...	1515	8.5	--	5	--	--	--	--	--
JUN									
06...	1630	7.0	--	176	--	--	--	--	--
12...	0930	--	200	61	33	90	99	100	--
16...	1500	6.9	200	353	191	65	77	78	100
AUG									
21...	1600	8.0	111	34	10	--	--	--	--

Station No. 14223600, Kalama River above Spencer Creek near Kalama, WA

LOCATION AND DESCRIPTION.--Ungaged sampling site at Modrow Road bridge, 0.6 mi (1.0 km) upstream from Spencer Cr, 2.1 mi (3.4 km) north of Kalama City limits, and at mi 2.8. Discharge routed from gaging station 1.3 mi upstream. Station established May 30, 1980.

DRAINAGE AREA.--202 mi^2 (325 km^2).

SEDIMENT SAMPLING.--Daily suspended-sediment samples taken.

Summary

The Kalama River, draining from the southwest flank of Mount St. Helens, transported 5,780 tons of suspended sediment from May 30 through September 30. Concentrations of suspended sediment rarely exceeded 100 mg/L, indicating that the river was not as much affected by the May 18 eruption as some of the other streams in the area. One peculiarity of this site is that the sediment-discharge peak lags the water-discharge peak by several hours. The two particle-size analyses of the suspended-sediment show that about half of the sediment is clay-size, an indication that much of the load was composed of ash at the times of sampling.

14223600 - KALAMA RIVER ABV SPENCER CR NEAR KALAMA, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
MAY											
21...	1625	--	--	53	--	--	--	--	--	--	--
30...	1655	13.9	566	22	34	--	--	--	--	--	--
31...	1730	13.8	542	22	32	--	--	--	--	--	--
JUN											
01...	1610	12.6	536	20	29	--	--	--	--	--	--
02...	1540	10.3	590	26	41	--	--	--	--	--	--
03...	1155	10.8	578	20	31	--	--	--	--	--	--
04...	1635	12.6	548	14	21	--	--	--	--	--	--
05...	1820	11.6	525	12	17	--	--	--	--	--	--
06...	1715	11.6	515	38	53	--	--	--	--	--	--
07...	1655	13.0	515	25	35	--	--	--	--	--	--
08...	1745	14.0	668	60	108	--	--	--	--	--	--
09...	1635	14.0	536	30	43	--	--	--	--	--	--
10...	1145	12.0	515	37	51	--	--	--	--	--	--
11...	1600	14.0	495	20	27	--	--	--	--	--	--
12...	1655	12.9	495	20	27	--	--	--	--	--	--
13...	1205	10.6	510	22	30	--	--	--	--	--	--
14...	1610	11.1	505	1140	1550	--	--	--	--	--	--
15...	1635	13.2	490	92	122	--	--	--	--	--	--
16...	1525	11.1	490	68	90	--	--	--	--	--	--
17...	1945	13.1	465	58	73	--	--	--	--	--	--
18...	1750	15.4	450	42	51	--	--	--	--	--	--
19...	1645	16.4	435	56	66	--	--	--	--	--	--
20...	1600	16.2	425	32	37	--	--	--	--	--	--
21...	1745	15.1	415	26	29	--	--	--	--	--	--
22...	1915	15.0	405	20	22	--	--	--	--	--	--
23...	1615	14.2	400	23	25	--	--	--	--	--	--
25...	1240	13.4	515	34	47	--	--	--	--	--	--
26...	1440	12.6	420	629	713	--	--	--	--	--	--
26...	1450	12.6	420	605	686	42	66	89	98	99	100
26...	1710	13.8	420	297	337	--	--	--	--	--	--
27...	1510	12.6	430	46	53	--	--	--	--	--	--
28...	1330	13.8	415	29	32	--	--	--	--	--	--
29...	1700	16.2	395	36	38	--	--	--	--	--	--
30...	1340	15.6	376	65	66	--	--	--	--	--	--
JUL											
02...	1650	16.2	366	21	21	--	--	--	--	--	--
03...	1430	14.8	362	29	28	--	--	--	--	--	--
04...	1900	13.0	445	31	37	--	--	--	--	--	--
05...	1500	15.6	395	45	48	--	--	--	--	--	--

14223600 - KALAMA RIVER ABV SPENCER CR NEAR KALAMA, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)
JUL					
06...	1745	17.4	366	30	30
07...	1730	18.2	362	13	13
08...	1645	18.4	353	12	11
09...	1620	15.6	340	22	20
10...	0545	13.6	340	26	24
11...	1045	13.8	322	13	11
12...	0945	13.6	322	13	11
13...	1215	17.0	317	12	10
14...	1625	15.4	312	10	8.4
15...	0545	14.4	312	13	11
16...	1730	17.0	308	15	12
17...	1000	14.6	299	92	74
18...	1630	18.2	286	105	81
19...	1340	16.6	286	14	11
20...	1745	18.8	282	10	7.6
21...	0545	16.6	274	12	8.9
22...	0545	18.8	270	11	8.0
23...	0545	17.4	270	11	8.0
24...	0600	16.2	266	13	9.3
24...	0940	15.6	258	10	7.0
25...	0600	18.4	250	11	7.4
26...	1230	18.2	258	11	7.7
27...	1945	19.2	246	10	6.6
28...	0545	17.6	242	13	8.5
29...	0600	16.6	238	10	6.4
30...	0600	16.6	234	22	14
31...	0600	16.0	242	27	18
AUG					
01...	0600	15.0	238	9	5.8
02...	1100	16.4	238	15	9.6
03...	1300	15.6	242	10	6.5
05...	0600	15.6	226	9	5.5
06...	0600	14.8	238	12	7.7
07...	0600	13.2	230	8	5.0
08...	1100	17.0	274	11	8.1
09...	1500	19.6	230	8	5.0
10...	1130	17.8	218	7	4.1
11...	0615	16.6	210	6	3.4
12...	0630	16.4	210	9	5.1
13...	0600	15.4	210	9	5.1

14223600 - KALAMA RIVER ABV SPENCER CR NEAR KALAMA, WASH.

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
AUG											
14...	1650	18.2	218	13	7.7	--	--	--	--	--	--
15...	0600	13.6	214	7	4.0	--	--	--	--	--	--
16...	1810	15.4	218	182	107	--	--	--	--	--	--
17...	0900	14.4	210	69	39	--	--	--	--	--	--
18...	1130	14.6	238	8	5.1	--	--	--	--	--	--
19...	1730	16.6	214	8	4.6	--	--	--	--	--	--
20...	1750	16.5	203	9	4.9	--	--	--	--	--	--
21...	1940	16.4	206	11	6.1	--	--	--	--	--	--
22...	1100	14.6	200	8	4.3	--	--	--	--	--	--
23...	1510	17.6	200	124	67	--	--	--	--	--	--
24...	1440	16.8	200	6	3.2	--	--	--	--	--	--
25...	1630	18.0	200	19	10	--	--	--	--	--	--
26...	1650	16.8	196	6	3.2	--	--	--	--	--	--
27...	1635	15.8	242	5	3.3	--	--	--	--	--	--
28...	1645	14.4	218	44	26	--	--	--	--	--	--
29...	0830	11.4	203	14	7.7	--	--	--	--	--	--
30...	0800	12.4	200	200	108	--	--	--	--	--	--
31...	0800	12.6	294	10	7.9	--	--	--	--	--	--
SEP											
01...	0745	11.6	222	12	7.2	--	--	--	--	--	--
02...	1905	13.4	371	28	28	--	--	--	--	--	--
03...	1700	15.1	270	1100	802	47	49	95	98	98	100
04...	1115	12.8	246	82	54	--	--	--	--	--	--
15...	1735	14.6	210	160	91	--	--	--	--	--	--
16...	1730	15.6	206	12	6.7	--	--	--	--	--	--
17...	1625	15.8	206	15	8.3	--	--	--	--	--	--
18...	1700	14.0	206	25	14	--	--	--	--	--	--
19...	1645	13.0	218	14	8.2	--	--	--	--	--	--
20...	1415	12.2	490	98	130	--	--	--	--	--	--
21...	1625	13.0	366	124	123	--	--	--	--	--	--
22...	1620	12.8	326	33	29	--	--	--	--	--	--
23...	1545	12.8	294	22	17	--	--	--	--	--	--
24...	1720	13.8	278	32	24	--	--	--	--	--	--
25...	1415	14.4	262	16	11	--	--	--	--	--	--
26...	1610	14.0	246	12	8.0	--	--	--	--	--	--
29...	1645	14.0	234	10	6.3	--	--	--	--	--	--
30...	1645	14.6	238	10	6.4	--	--	--	--	--	--
30...	1900	13.6	238	11	7.1	--	--	--	--	--	--

STATION NUMBER 14223600 KALAMA RIVER ABV SPENCER CR NEAR KALAMA, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 460250 LONGITUDE 1225011 DRAINAGE AREA 202.00 DATUM STATE 53 COUNTY 015

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		APRIL			MAY			JUNE	
1				---	---	---	516	20	28
2				---	---	---	557	25	38
3				---	---	---	562	20	30
4				---	---	---	535	16	23
5				---	---	---	515	13	18
6				---	---	---	503	30	41
7				---	---	---	497	28	38
8				---	---	---	624	55	93
9				---	---	---	533	60	86
10				---	---	---	501	34	46
11				---	---	---	480	24	31
12				---	---	---	476	20	26
13				---	---	---	493	27	36
14				---	---	---	493	1400	1860
15				---	---	---	479	150	194
16				---	---	---	470	73	93
17				---	---	---	461	60	75
18				---	---	---	446	46	55
19				---	---	---	434	38	45
20				---	---	---	424	33	38
21				---	---	---	415	27	30
22				---	---	---	408	22	24
23				---	---	---	403	22	24
24				---	---	---	403	23	25
25				---	---	---	469	35	44
26				---	---	---	420	390	442
27				---	---	---	425	60	69
28				---	---	---	412	30	33
29				---	---	---	393	34	36
30				556	25	38	375	60	61
31				532	22	32	---	---	---
TOTAL				1088	---	70	14122	---	3682

STATION NUMBER 14223600 KALAMA RIVER ABV SPENCER CR NEAR KALAMA, WASH. STREAM SOURCE AGENCY USGS
LATITUDE 460250 LONGITUDE 1225011 DRAINAGE AREA 202.00 DATUM STATE 53 COUNTY 015

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JULY			AUGUST			SEPTEMBER	
1	366	35	35	241	10	6.5	227	15	9.2
2	364	25	25	240	13	8.4	408	20	21
3	363	26	25	242	10	6.5	279	742	530
4	418	31	35	232	9	5.6	245	148	98
5	399	42	45	232	10	6.3	233	10	6.3
6	371	40	40	235	11	7.0	222	8	4.8
7	358	17	16	231	9	5.6	252	12	8.2
8	348	12	11	248	20	13	227	30	18
9	340	18	17	230	14	8.7	216	10	5.8
10	336	24	22	221	7	4.2	204	8	4.4
11	325	13	11	214	7	4.0	201	6	3.3
12	321	13	11	214	9	5.2	208	8	4.5
13	317	12	10	216	8	4.7	211	8	4.6
14	315	11	9.4	218	10	5.9	239	10	6.5
15	314	14	12	214	7	4.0	220	91	54
16	306	15	12	212	77	44	207	22	12
17	297	15	12	211	60	34	207	16	8.9
18	283	15	11	232	12	7.5	207	20	11
19	281	14	11	217	11	6.4	221	17	10
20	282	12	9.1	204	9	5.0	430	106	120
21	276	12	8.9	205	10	5.5	380	180	185
22	273	11	8.1	200	8	4.3	329	45	40
23	270	11	8.0	201	22	12	301	24	20
24	262	11	7.8	200	8	4.3	278	29	22
25	254	11	7.5	196	16	8.5	263	19	13
26	253	11	7.5	194	9	4.7	246	12	8.0
27	247	10	6.7	221	6	3.6	238	10	6.4
28	243	11	7.2	229	34	21	239	10	6.5
29	239	10	6.5	202	16	8.7	236	10	6.4
30	236	22	14	209	35	20	232	10	6.3
31	239	10	6.5	266	28	20	---	---	---
TOTAL	9496	---	468.2	6827	---	305.1	7606	---	1254.1
PERIOD	39139		5779						

MISCELLANEOUS SAMPLING SITES

Following the eruption of steam and ash on March 27, 1980, suspended-sediment samples were collected at five sites in the Mount St. Helens area prior to the May 18 eruption. Four of these sites were sampled in June and July, 1980. Sites on newly impacted streams were also sampled in June and July, 1980. Sediment data from these investigations are summarized in the accompanying tables.

ANALYSES OF MISCELLANEOUS STATIONS

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
14216100 - MUDDY RIVER ABOVE SMITH CREEK NEAR COUGAR, WASH. (LAT 46 00 02 LONG 122 03 12)											
MAR , 1980											
29...	1615	4.4	--	23	--	--	--	--	--	--	--
30...	1140	4.5	--	14	--	--	--	--	--	--	--
APR											
18...	1030	5.8	95	63	16	--	--	--	--	--	--
MAY											
07...	1100	6.4	87	2030	475	--	--	--	--	--	--
JUL											
29...	0835	6.4	--	2410	--	6	9	20	41	60	79
14216200 - SMITH CREEK AT MOUTH NEAR COUGAR, WASH. (LAT 46 00 02 LONG 122 03 10)											
MAR , 1980											
29...	1500	5.0	--	88	--	--	--	--	--	--	--
30...	1045	4.5	--	21	--	--	--	--	--	--	--
APR											
18...	1115	8.0	477	52	67	--	--	--	--	--	--
MAY											
07...	1015	5.6	246	352	234	--	--	--	--	--	--
JUL											
29...	0920	13.8	--	5480	--	11	18	30	50	68	81
461053122030700 - MUDDY RIVER BLW SMITH CK NEAR COUGAR, WA (LAT 46 10 53 LONG 122 03 07)											
JUL , 1980											
29...	0855	10.0	--	3960	--	7	9	15	22	30	--

ANALYSES OF MISCELLANEOUS STATIONS

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. FALL DIAM. % FINER THAN 2.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
14216100 - MUDDY RIVER ABOVE SMITH CREEK NEAR COUGAR, WASH. (LAT 46 00 02 LONG 122 03 12)											
MAR , 1980											
29...	59	--	--	--	--	--	--	--	--	--	--
30...	64	--	--	--	--	--	--	--	--	--	--
APR											
18...	44	--	--	--	--	--	--	--	--	--	--
MAY											
07...	13	--	--	--	--	--	--	--	--	--	--
JUL											
29...	--	88	--	95	--	100	--	--	--	--	--
14216200 - SMITH CREEK AT MOUTH NEAR COUGAR, WASH. (LAT 46 00 02 LONG 122 03 10)											
MAR , 1980											
29...	89	--	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--	--	--
APR											
18...	54	--	--	--	--	--	--	--	--	--	--
MAY											
07...	48	--	--	--	--	--	--	--	--	--	--
JUL											
29...	--	89	--	95	--	100	--	--	--	--	--
461053122030700 - MUDDY RIVER BLW SMITH CK NEAR COUGAR, WA (LAT 46 10 53 LONG 122 03 07)											
JUL , 1980											
29...	38	--	46	--	61	--	91	--	100	--	--

ANALYSES OF MISCELLANEOUS STATIONS

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
14241460 - SF TOUTLE R BLW DISAPPNTMENT CR NR SPIRIT LK, WA (LAT 46 12 44 LONG 122 19 41)											
MAR , 1980											
29...	0830	3.7	--	6	--	--	--	--	--	--	--
APR											
19...	0800	8.4	350	10	9.4	--	--	--	--	--	--
MAY											
06...	1500	9.6	300	18	15	--	--	--	--	--	--
JUN											
06...	1550	8.9	80	232	50	--	--	--	--	--	--
461215122171600 - SF TOUTLE NEAR DISAPPOINTMENT CK (CLEAR SIDE) (LAT 46 12 15 LONG 122 17 16)											
JUL , 1980											
29...	1130	12.0	--	22	--	--	--	--	--	--	--
461219122171900 - SF TOUTLE NEAR DISAPPOINTMENT CK (MUDDY SIDE) (LAT 46 12 19 LONG 122 17 19)											
JUL , 1980											
29...	1200	15.1	--	29700	--	6	6	7	14	23	--
14240310 - NF TOUTLE R AT OUTFLOW OF SPIRIT LAKE, WASH (LAT 46 15 47 LONG 122 09 45)											
MAR , 1980											
28...	1600	2.6	--	1	--	--	--	--	--	--	--
APR											
19...	1045	5.0	111	5	1.5	--	--	--	--	--	--
MAY											
06...	1045	7.2	259	4	2.8	--	--	--	--	--	--

ANALYSES OF MISCELLANEOUS STATIONS

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. FALL DIAM. % FINER THAN 2.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
14241460 - SF TOUTLE R BLW DISAPPNTMENT CR NR SPIRIT LK, WA (LAT 46 12 44 LONG 122 19 41)											
MAR , 1980											
29...	--	--	--	--	--	--	--	--	--	--	--
APR											
19...	--	--	--	--	--	--	--	--	--	--	--
MAY											
06...	--	--	--	--	--	--	--	--	--	--	--
JUN											
06...	33	--	44	--	64	--	88	--	99	--	100
461215122171600 - SF TOUTLE NEAR DISAPPOINTMENT CK (CLEAR SIDE) (LAT 46 12 15 LONG 122 17 16)											
JUL , 1980											
29...	--	--	--	--	--	--	--	--	--	--	--
461219122171900 - SF TOUTLE NEAR DISAPPOINTMENT CK (MUDDY SIDE) (LAT 46 12 19 LONG 122 17 19)											
JUL , 1980											
29...	36	--	57	--	84	--	97	--	100	--	--
14240310 - NF TOUTLE R AT OUTFLOW OF SPIRIT LAKE, WASH (LAT 46 15 47 LONG 122 09 45)											
MAR , 1980											
28...	--	--	--	--	--	--	--	--	--	--	--
APR											
19...	--	--	--	--	--	--	--	--	--	--	--
MAY											
06...	--	--	--	--	--	--	--	--	--	--	--

ANALYSES OF MISCELLANEOUS STATIONS

DATE	TIME	TEMPERATURE, WATER (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM
14240350 - COLDWATER CREEK NEAR SPIRIT LAKE, WASH. (LAT 46 17 35 LONG 122 15 35)											
JUN , 1980 06...	1400	8.9	34	3960	364	11	17	21	31	36	44
14240440 - CASTLE CR TWO MILES ABV MOUTH NR SPIRIT LK, WA (LAT 46 15 47 LONG 122 16 37)											
JUL , 1980 29...	1400	22.4	--	128	--	--	--	--	--	--	--
461758122253100 - NF TOUTLE BLW DEBRIS DAM (LEFT SIDE) (LAT 46 17 58 LONG 122 25 31)											
JUL , 1980 30...	1315	19.2	--	56	--	--	--	--	--	--	--
461825122250900 - NF TOUTLE BLW DEBRIS DAM (RIGHT SIDE) (LAT 46 18 25 LONG 122 25 09)											
JUL , 1980 30...	1430	20.4	--	198	--	--	--	--	--	--	--

ANALYSES OF MISCELLANEOUS STATIONS

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. FALL DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. FALL DIAM. % FINER THAN 2.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
14240350 - COLDWATER CREEK NEAR SPIRIT LAKE, WASH. (LAT 46 17 35 LONG 122 15 35)											
JUN , 1980											
06...	--	56	--	78	--	94	--	99	--	100	--
14240440 - CASTLE CR TWO MILES ABV MOUTH NR SPIRIT LK, WA (LAT 46 15 47 LONG 122 16 37)											
JUL , 1980											
29...	--	--	--	--	--	--	--	--	--	--	--
461758122253100 - NF TOUTLE BLW DEBRIS DAM (LEFT SIDE) (LAT 46 17 58 LONG 122 25 31)											
JUL , 1980											
30...	--	--	--	--	--	--	--	--	--	--	--
461825122250900 - NF TOUTLE BLW DEBRIS DAM (RIGHT SIDE) (LAT 46 18 25 LONG 122 25 09)											
JUL , 1980											
30...	--	--	--	--	--	--	--	--	--	--	--

SUMMARY

The major eruption of Mount St. Helens changed the hydrologic character of many streams in the area. The May 18-19 mudflows moved enormous amounts of material down the river channels and deposited mainly sand-size material along their courses. The devastation of the upper Toutle River basin left a virtually unlimited supply of sediment available for transport. High concentrations of suspended sediment persisted in the Toutle River and in the Cowlitz River below the Toutle throughout the spring and summer of 1980. Suspended-sediment collected at Cispus River near Randle and Cowlitz River at Packwood was mostly silt-and-clay size, indicating erosion of volcanic ash from the large ashfall region north of the volcano. This report is the first of a series to be published periodically so that sediment data collected by the USGS can be distributed as they become available. Future reports will include the winter peak flows in the Toutle River basin and will contain improved definition of sediment-transport relations for several streams.

REFERENCES

Guy, H.P., and Norman, V.W., 1970, Field methods for fluvial sediment measurements: U.S. Geological Survey Techniques Water-Resources Investigations, Book 3, Chapter C, 59 p.

Office of Water Data Coordination, 1977, National handbook of recommended methods for water data acquisition: Chapter 3, 100 p.

Porterfield, George, 1972, Computation of fluvial-sediment discharge: U.S. Geological Survey Techniques Water-Resources Investigations, Book 3, Chapter C3, 66 p.

DEFINITIONS

The following are definitions of terms that are used in this series of reports. Most are from the "National Handbook of Recommended Methods for Water Data Acquisition" (Office of Water Data Coordination, 1977).

Alluvial deposit. Clay, silt, sand, gravel, or other sediment deposited by the action of running or receding water.

Alluvial stream. A stream whose channel boundary is composed of appreciable quantities of the sediments transported by the flow, and which generally changes its bed forms as the rate of flow changes.

Antidunes. A series of generally sinusoidal-shaped bed forms that commonly move upstream accompanied by in-phase waves on the water surface. Antidunes develop in a sand-bed stream when the Froude number is close to or greater than one.

Bedload. Material moving on or near the streambed by rolling, sliding, and sometimes making brief excursions into the flow a few diameters above the bed.

Bedload discharge. The quantity of bedload passing a transect in a unit of time.

Bed material. The sediment mixture of which the bed is composed. In alluvial streams bed-material particles are likely to be moved at any moment or during some future flow condition.

Boulder. See table 2.

Clay. See table 2.

Cobbles. See table 2.

Composite sample. A sample formed by combining two or more individual samples, or representative portions thereof.

Concentration of sediment. The ratio of the mass of dry sediment in a water-sediment mixture to the mass of the mixture. This ratio is expressed in this report as milligrams per liter.

Daily sediment discharge. See sediment discharge.

Daily sediment station. Station where sufficient samples are collected to compute daily sediment discharges.

Deposition. The mechanical or chemical processes through which sediments accumulate in a resting place.

Depth-integrated sample. A discharge-weighted (velocity-weighted)sample of water-sediment mixture collected at one or more verticals in accordance with the technique of depth integration.

Depth integrating, suspended-sediment sampler. An instrument capable of collecting a water-sediment mixture isokinetically as its intake is traversed across the flow: hence, a sampler suitable for performing depth integration.

Depth-integration. A method of sampling at every point throughout the sampled depth whereby a water-sediment mixture is collected so that the contribution to the sample from each point is proportional to the stream velocity at the point.

Diameter, standard fall. See standard fall diameter.

Diameter, standard sediment. See standard sedimentation diameter.

Dip sample. A sample collected from the surface of a stream, usually done only when other sampling methods cannot be used.

Discharge-weighted concentration. The dry mass (weight) of sediment in a unit volume of stream discharge, or the ratio of the mass discharge (dry) of sediment to the mass discharge of water-sediment mixture.

Drainage basin. The area tributary to or draining to a lake, stream, or measuring site.

Dunes. Bed forms with a triangular profile that advance downstream due to net deposition of particles on the steep downstream slope. Dunes move downstream at velocities that are small relative to the streamflow velocity.

Equal-discharge-increment (EDI) method. A procedure for obtaining the discharge-weighted suspended-sediment concentration of flow at a transect by: (1) performing depth integration at the centers of equal-flow segments across the transect, and (2) using a vertical transit rate at each sampling vertical that provides equal sample volumes from all flow segments.

Equal-width-increment (EWI) method. A procedure for obtaining the discharge-weighted suspended-sediment concentration of flow at a transect by: (1) performing depth integration at a series of verticals equally spaced across the transect, and (2) using the same vertical transit rate at all sampling verticals.

Erosion. The wearing way of the land surface by detachment and movement of soil and rock fragments through the action of moving water and other geological agents.

Fall diameter. See standard fall diameter.

Fall velocity. The falling or settling rate of a particle in a given medium.

Fine material. Particles of a size finer than the particles present in appreciable quantities in the bed material; normally silt and clay particles (particles finer than 0.062 mm).

Fine-material load. That part of the total sediment load that is composed of particles of a finer size than the particles present in appreciable quantities in the bed material. Normally, the fine-material load consists of material finer than 0.062 mm.

Fluvial. (1) Pertaining to streams. (2) Growing or living in streams or ponds. (3) Produced by river action, as a fluvial plain.

Fluvial sediment. Particles derived from rocks or biological materials that are transported by, suspended in, or deposited by streams.

Gage height. The water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station. A selected cross section of a stream channel where one or more variables are measured continuously or periodically to index discharge and other parameters.

Gravel. See table 2.

Hyperconcentrations. Sediment concentrations greater than 500,000 mg/L.

Instantaneous sediment discharge. See sediment discharge.

Isokinetic sampling. To sample in such a way that the water-sediment mixture moves with no acceleration as it leaves the ambient flow and enters the sampler intake.

Mudflow. A flowage of heterogeneous debris lubricated with a large amount of water, usually following a former stream course.

Multi-vertical samples. Depth-integrated samples collected at more than one vertical in a cross section of a stream.

Partial-depth samples. Depth-integrated samples collected from less than the entire water column at a vertical.

Particle size. A linear dimension, usually designated as "diameter," used to characterize the size of a particle.

Particle-size distribution. The frequency distribution of the relative amounts of particles in a sample that are within specified size ranges, or a cumulative frequency distribution of the relative amounts of particles coarser or finer than specified sizes. Relative amounts are usually expressed as percentages by mass.

Periodic samples. Samples collected less frequently than needed for computing a daily record. These samples are usually used for instantaneous measurements only.

Plane bed. A sedimentary bed without elevations or depressions larger than the maximum size of the bed material.

Point-integrating sediment sampler. An instrument capable of collecting a water-sediment mixture isokinetically for a specified period of time by opening and closing while under water. An instrument suitable for performing point integration.

Point-integrated sample (point sample). A sample of water-sediment mixture collected at a relatively fixed point in accordance with the technique of point integration.

Point integration. A method of sampling at a relatively fixed point whereby the water-sediment mixture is withdrawn isokinetically for a specified period of time.

Pumping sampler. A sampler with which the water-sediment mixture is withdrawn through a pipe or hose, the intake of which is placed at the desired sampling point.

Reservoir. An impounded body of water or a controlled lake where water is collected and stored.

Runoff. Flow that is discharged from the area by stream channels--sometimes subdivided into surface runoff, ground-water runoff, and seepage.

Sampled zone. That part of a transect presumed to be wholly represented by sediment samples.

Sampling vertical. An approximately vertical path from the water surface to the bottom, along which one or more samples are collected to define various properties of the flow, such as sediment concentration.

Sand. See table 2.

Scour. The enlargement of a flow section by the removal of boundary material through the action of the fluid in motion.

Sediment. Particles derived from rocks or biological materials that have been transported by a fluid.

Sedimentation. A broad term that pertains to the five fundamental processes responsible for the formation of sedimentary rocks: (1) weathering, (2) detachment, (3) transportation, (4) deposition (sedimentation), and (5) diagenesis; and to the gravitational setting of suspended particles that are heavier than water.

Sediment discharge. The mass or volume of sediment (usually mass) passing a stream transect in a unit of time. The term may be qualified, for example, as suspended-sediment discharge, bedload discharge, or total-sediment discharge. Instantaneous sediment discharge is the quantity of sediment passing a stream transect at the time the sediment sample is collected. Daily sediment discharge is the quantity of sediment passing a stream transect on that day. Both types of discharge are usually expressed in units of tons per day.

Sediment sample. A quantity of water-sediment mixture or deposited sediment that is collected to characterize some property or properties of the sampled medium.

Sediment-transport curve. A line showing the relation between water discharge and sediment discharge.

Sediment yield. The total sediment outflow from a drainage basin in a specific period of time. It includes bedload as well as suspended load, and usually is expressed in terms of mass, or volume per unit of time.

Sieve diameter. The smallest standard sieve opening size through which a given particle of sediment will pass.

Silt. See table 2.

Single-vertical sample. A depth-integrated sample collected at only one vertical in the cross section of a stream.

Specific gravity. Ratio of the mass of any volume of a substance to the mass of an equal volume of water at $4^{o}C$.

Split sample. A single sample separated into two or more individual parts in a manner that each part is representative of the original sample.

Standard fall diameter. Sometimes simply fall diameter. The diameter of a sphere that has a specific gravity of 2.65 and has the same standard fall velocity as the particle.

Stream discharge. The quantity of flow passing a stream transect in a unit of time. (The flow contains both dissolved solids and sediment.)

Suspended sediment. Sediment that is carried in suspension by the turbulent components of the fluid or by Brownian movement.

Suspended-sediment concentration. See concentration of sediment.

Suspended-sediment discharge. The quantity of suspended sediment passing a transect in a unit of time.

Suspended-sediment sample. See sediment sample.

Suspended-sediment sampler. Device to sample flow and its suspended-sediment load.

Total-sediment discharge. The total quantity of sediment passing a section in a unit of time.

Total-sediment load (total load). All of the sediment in transport; that part moving as suspended load plus that moving as bedload.

Transect. A sample area, cross section, or line chosen as the basis for studying one or more characteristics of a particle assemblage.

Transportation (sediment). The complex processes of moving sediment particles from place to place. The principal transporting agents are flowing water and wind.

Unmeasured sediment discharge. The difference between total sediment discharge and measured suspended-sediment discharge.

Unsampled zone. A part of a transect that is not wholly represented by sediment samples. (See sampled zone.)

Vertical. See sampling vertical.

Water discharge. See stream discharge.