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*Surface Water Data at
Los Alamos National Laboratory:
2001 Water Year*

*D. A. Shaul
D. Ortiz
M. R. Alexander
R. P. Romero
E. T. Riebsomer*



Los Alamos NM 87545

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by
**D. A. Shaull, D. Ortiz, M. R. Alexander, R. P. Romero, and
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ABSTRACT

The principal investigators collected and computed surface water discharge data from 34 stream-gaging stations that cover most of Los Alamos National Laboratory and one at Bandelier National Monument. Also included are discharge data from three springs—two that flow into Cañon del Valle and one that flows into Water Canyon—and peak flow data from 17 stations.

Introduction

This annual water data report from Los Alamos National Laboratory (LANL) contains flow data from 34 stream-gaging stations that cover most of the Laboratory's property. We focused data collection on the Laboratory's downstream boundary, approximated by New Mexico State Highway 4; the upstream boundary is approximated by New Mexico State Highway 501. Some of the gaging stations are within Laboratory boundaries and were originally installed to assist groups other than the Water Quality and Hydrology Group (ESH-18) that also conduct site-specific earth science research.

The network has been rebuilt from damages caused by the Cerro Grande Fire and the subsequent floods in the year 2000. Some of the stations were not replaced in time to record much or any record for this report. Only E245.5 was not published at all. The others (not enumerated here) are published with partial daily value tables.

We have added a new section listing peak flows for stations with enough data to have meaningful peak data. Usually, this is at least five years of record.

Water chemistry data from selected storm events occurring at some stations will be published in the 2001 "Los Alamos National Laboratory Environmental Surveillance Report."

Station Identification Numbers

The US Geological Survey (USGS), Water Resources Division, assigns a unique identification number to each stream-gaging station it establishes. All sites numbered since 1950 are part of the downstream order system. The downstream order system increases station numbers in the downstream direction along main streams, and, in the case of this report, their respective mouths to the Rio Grande.

This report adheres to the USGS convention of downstream order. Because of the close proximity of stations in this network, the first five digits of all station numbers are 08313. We have replaced this number string with the letter E in the station number partly to abbreviate and also to accommodate instrumentation.

Data Collection and Computation

A complete record-gaging station gathers records of stage and discharge measurements from streams or canals. In addition to gathering these stage and discharge measurements, we directly observe factors affecting the stage/discharge relation, consult weather records, and use other information that supplements base data in determining daily flow. Direct readings on a nonrecording gage or from the data logger provide integrated (5-minute) records of stage. We measure discharge with current meters, using methods adapted by the USGS as a result of experience accumulated since 1880. Standard textbooks describe these methods, as do *Water-Supply Paper 2175* and the *US Geological Survey Technique of Water Resources Investigations*, Book 3, Chapter A6.

We use stage/discharge relation curves to prepare rating tables that give the discharge for any stage measured at a stream-gaging station. When it is necessary to define discharge extremes outside the range of current meter measurements, we extend the curves using

- logarithmic plotting;
- velocity area studies;
- results of indirect measurements of peak discharge, such as slope area or contracted opening measurements and computations of flow over dams or weirs; or
- step backwater techniques.

Daily mean discharges are computed by applying daily mean gage height (stage) to the stage-discharge curves or tables. If the stage/discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is computed by the shifting-control method. In the shifting-control method, correction factors based on individual discharge measurements and notes by personnel taking the measurements are applied to the gage heights before discharges are determined from the curves or tables.

The shifting-control method is also used if the stage/discharge relation for a station is temporarily changed by the presence of aquatic growth or debris on the control. At some northern stream-gaging stations, the stage/discharge relation is affected by ice in the winter, and it becomes impossible to compute discharge in the usual manner. Discharge for the period of ice effect is computed on the basis of gage height record and occasional winter discharge measurements. Consideration is given to the available information about temperature and precipitation, notes of observations, and comparable discharge records for other stations in the same or nearby basins for comparable periods of time.

For some gaging stations, periods occur when no gage height record is obtained, or the recorded gage height is so faulty that it cannot be used to compute daily discharge or contents. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, etc. For such periods, the daily discharges are estimated on the basis of recorded range-in-stage, prior and subsequent records, discharge measurements, weather records, and record comparisons made against other stations in the same or nearby basins. Likewise, daily contents may be estimated from operator logs, prior and subsequent records, inflow-outflow studies, and other information.

Accuracy of Records

Two factors determine the accuracy of streamflow records:

- stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and
- accuracy of measurements or stage, accuracy of discharge measurements, and interpretations of records.

Accuracy attributed to records is noted under "Remarks."

- Excellent—95% of daily discharges are within 5% of true value;
- Good—95% of daily discharges are within 10% of true value;
- Fair—95% of daily discharges are within 15% of true value; and
- Poor—records do not meet the criteria mentioned.

Differences in accuracy may be attributed to different parts of a given record.

The number of significant figures used to report daily mean discharges is based solely on the magnitude of the discharge value:

If—the value (ft ³ /s) is	Then—it is reported to
less than 1 ft ³ /s	nearest hundredth
1–10 ft ³ /s	nearest tenth
10–1000 ft ³ /s	whole number
above 1000 ft ³ /s	three significant figures

Data Presentation

The records published in this report are for each gaging station and comprise two parts:

- station manuscript description with photo and
- data table for the water year (October 1, 2000, to September 30, 2001).

The station manuscript provides data under various headings: station location, period of record, average discharge, historical extremes, record accuracy, and other points pertinent to station

operation and regulation. Each continuous record of discharge includes the following categories of descriptions.

Location. The most accurate and available maps provide location information. The location of the gage with respect to the vicinity's cultural and physical features is given, as well as a name that refers to place. For a few stations, the US Army Corps of Engineers or the Water Resources Council (*River Mileage Measurement*, Bulletin 14, rev. October 1968) provided river mileage. We define left and right banks from the perspective of facing downstream.

Drainage Area. The most accurate and available maps provide drainage area measurements. The accuracy of drainage area measurements varies, depending on the type of map available for this purpose.

Revised Records. Because of new information, published records occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all the reports in which revisions have been published for the station and the water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year as follows: (M) means that only instantaneous maximum discharge was revised; (m) means that only the instantaneous minimum was revised; and (P) means that only the peak discharge was revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

Period of Record. The period of record is the time during which published records exist for a station or its equivalent station. An equivalent station is one that was in operation at a time that the present station was not and was located so that records from it can reasonably be considered equivalent to records from the present station.

Gage. This section describes the type of gage in current use. The datum of the current gage referred to in the *National Geodetic Vertical Datum of 1929* (see Glossary) and a condensed history of the types, locations, and data of previous gages are given under this heading.

Remarks. The text presents information relative to the accuracy of the records, special methods of computation, conditions that affect natural flow at the station, and other pertinent information.

Average Discharge. The average discharge is the average of the annual mean discharge published after five years of record. Once it is published, it continues as a moving average.

Extremes for Period of Record. Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the same manner as the maximum.

Extremes Outside Period of Record. This section contains information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may have been obtained from other agencies, old data files, newspapers, or local citizens.

Extremes for Current Year. Extremes given here are similar to those for the period of record. The time for occurrence of peaks is expressed in 24-hour local standard time. For example, 12:30 A.M. is 0030 and 1:30 P.M. is 1330. The minimum for the current water year appears in this section.

Data Table of Daily Mean Values. The daily table of discharge records for stream gaging stations gives the mean discharge for each day of the water year. In the monthly summary for the table, the line headed "Total" gives the sum of the daily figures for each month; the line headed "Mean" gives the average flow in cubic feet per second for the month; and the lines headed "Max" and "Min" give the maximum and minimum daily mean discharges for each month and in acre feet, respectively, in the line headed "Ac-Ft."

References

Water-Supply Paper 2175 and the US Geological Survey Technique of Water Resources Investigations, Book 3, Chapter A6.

US Army Corps of Engineers, *River Mileage Measurement*, Bulletin 14, rev. October 1968.

National Geodetic Vertical Datum of 1929.

Previous Los Alamos National Laboratory reports in this series—"Surface Water Data at Los Alamos National Laboratory" for water years 1995–2000

1995: LA-13177-PR (August 1996)

1996: LA-13234-PR (November 1996)

1997: LA-13403-PR (January 1996)

1998: LA-13551-PR (February 1999)

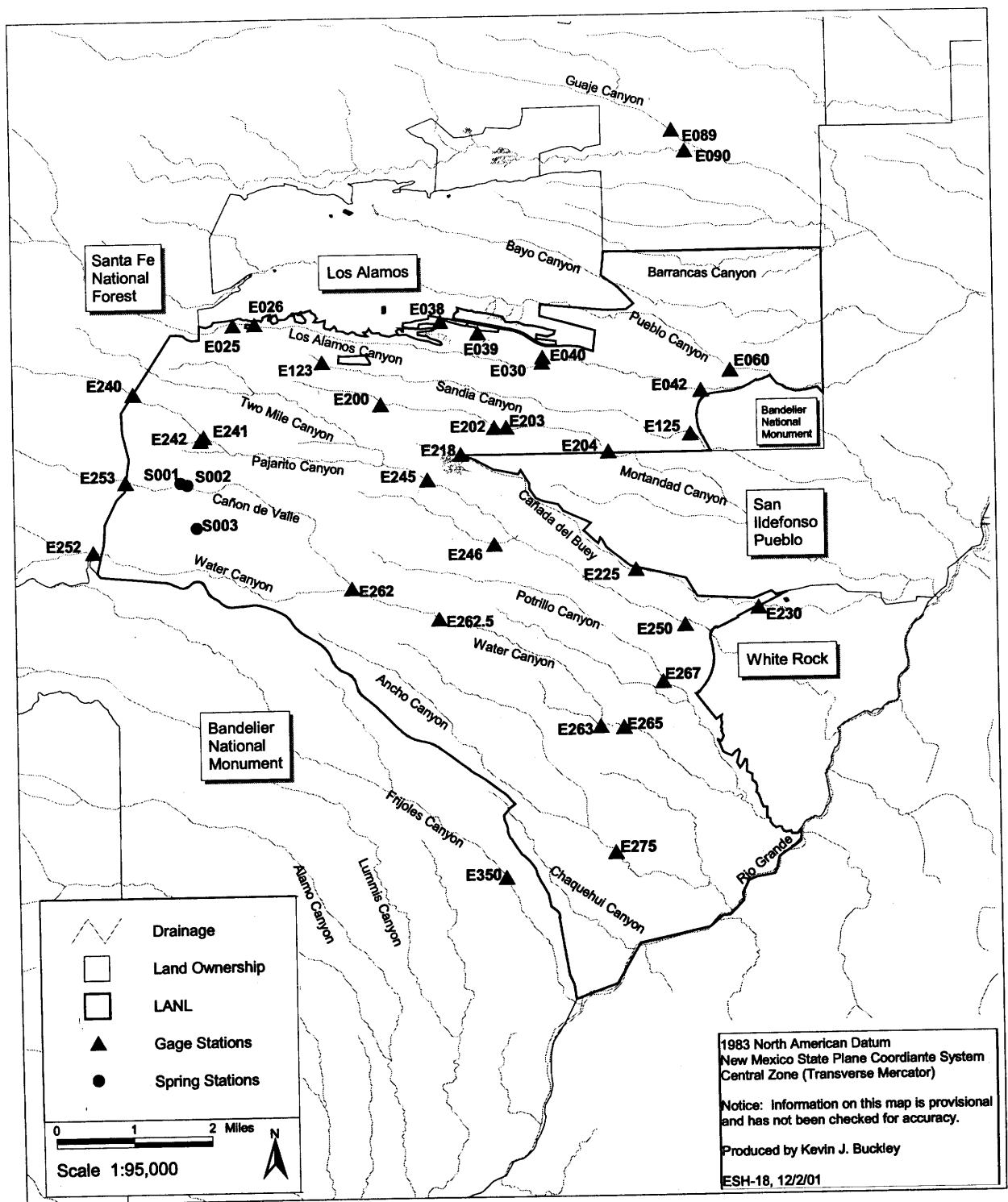
1999: LA-13706-PR (April 2000)

2000: LA-13814-PR (July 2001)

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Gaging Stations at Los Alamos National Laboratory



**Summary of Discharges from Stream-Monitoring Stations
at Los Alamos National Laboratory**

Water Year 2001
October 1, 2000, to September 30, 2001

Canyon Sites	Days with Flow	Volume in Ac-Ft	Instantaneous Max in ft ³ /s
E025 Upper Los Alamos	241	505	185
E026 Los Alamos Canyon below Ice Rink**	201	463	185
E030 Middle Los Alamos	162	510	60
E038 DP Canyon above TA-21	122	107	208
E039 DP Canyon below Meadow	136	133	77
E040 DP Canyon at Mouth	52	18	33
E042 Lower Los Alamos*	137	537	146
E060 Pueblo*	365	850	1,440
E089 Guaje Canyon above Rendija Canyon**	32	73	644
E090 Rendija Canyon at Mouth**	7	93	2,120
E123 Sandia Canyon below Wetlands	365	342	50
E125 Sandia*	0	0	0
E200 Middle Mortandad	255	55	49
E202 Mortandad, above Sediment Traps	4	0.6	0.23
E203 Mortandad, below Sediment Traps	0	0	0
E204 Lower Mortandad*	0	0	0
E218 Cañada del Buey near TA-46	67	11	20
E225 Upper Cañada del Buey	0	0	0
E230 Lower Cañada del Buey*	6	2.2	8.1
E240 Upper Pajarito**	60	88	154
E241 Pajarito at TA-22**	81	7.6	108
E242 Starmer's Gulch at TA-22	365	117	103
E245 Middle Pajarito	140	290	137
E246 Three Mile Canyon at TA-18	40	15.2	25
E250 Lower Pajarito*	81	104	22
E252 Upper Water**	193	157	255
E253 Upper Cañon del Valle**	50	34	19
E262 Cañon del Valle at Mouth	67	7.9	26
E262.5 Water Canyon below Area AB**	22	14	50
E263 Water Canyon at State Rd. 4	53	180	87
E265 Lower Water*	55	122	96
E267 Potrillo*	4	1.4	6.8
E275 Ancho*	5	0.9	34
E350 Frijoles at Bandelier	365	950	14

*Station at downstream Laboratory boundary.

**Based on partial year of record.

E025 Los Alamos Canyon at Los Alamos, NM

Location. Lat 35°52'50", long 106°19'45", in SE 1/4 SE 1/4 sec. 17, T. 19 N, R. 6 E, Los Alamos County, on right bank 1.5 mi downstream from Los Alamos Reservoir, and 0.4 mi upstream from "Rainbow" bridge on Diamond Drive over Los Alamos Canyon.

Drainage Area. 7.12 mi².

Period of Record. October 1, 1993, through September 30, 2001.

Gage. Data logger and 2-ft Parshall Flume. Elevation of gage is 7,237 ft above *National Geodetic Vertical Datum of 1929*, from GPS survey.

Remarks. Water discharge records good except for estimated daily discharges, which are poor. Flow partially controlled by Los Alamos Reservoir 1.5 mi upstream.

Average Discharge. 7 years, 0.324 ft³/s, 235 acre-ft/yr.

Extremes for Period of Record. Maximum discharge 185 ft³/s, August 9, 2001, gage height not determined. No flow at times.

Extremes for Current Water Year. Maximum discharge 185 ft³/s at 1535 hrs, August 9, gage height not determined. No flow at times.



E025 Los Alamos Canyon at Los Alamos, NM

Daily Mean Discharge in Cubic Feet per Second

Water Year October 2000 to September 2001

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	2.0	0	0	0	0.52	3.3	2.4	0.07	0	0.29	0.03*
2	0	3.8	0	0	0	0.44	4.0	2.4	0.06	2.2	0.29	0.02*
3	0	2.0	0	0	0	0.39	4.5	2.3	0.05	0.47	0.15	0.02*
4	0	0.12	0	0	0	0.36	4.8	2.3	0.05	0.18	0.05	0.02*
5	0	0.08	0	0	0	0.37	4.4	2.1	0.05	0.19	0.16	0.01*
6	0	0.04	0	0	0	0.48	4.5	1.8	0.05	0.20	0.09	0.01*
7	0	0.02	0	0	0	0.89	3.7	1.7	0.05	0.18	0.14	0.01*
8	0	0.01	0	0	0	1.1	3.2	1.4	0.06	0.19	0.54	0*
9	0	0.01	0	0	0	1.1	3.1	1.4	0.06	0.20	5.5	0*
10	0	0	0	0	0	1.2	3.2	1.3	0.05	0.21	0.58	0.03*
11	0	0	0	0	0	1.2	2.97	1.2	0.05	0.22	0.38	0.10
12	0	0	0	0	0	1.1	2.6	1.1	0.04	0.24	0.42	0.14
13	0	0	0	0	0	0.99	2.2	1.0	0.03	0.57	0.48	0.11
14	0	0	0	0	0	1.9	2.0	1.1	1.9	1.3	0.49	0.29
15	0	0	0	0	0	1.2	2.1	0.97	3.3	0.43	0.63	0.13
16	0	0	0	0	0*	1.5	2.4	0.88	1.4	0.07	0.87	0.14
17	0	0	0	0	0	1.6	2.8	0.80	0.13	0	0.50	0.10
18	0	0	0	0	0	1.4	3.2	0.75	0.08	0	0.23	0.11
19	0	0	0	0	0	1.3	3.6	0.75	0.07	0	0.26	0.10
20	0	0	0	0	0.54	1.4	3.7	0.60	0.37	0	0.58	0.10
21	0	0	0	0	1.0	2.4	3.6	0.50	0.06	0	0.97	0.10
22	0	0	0	0	1.1	3.6	3.2	0.45	0.06	0	1.2	0.10
23	5.2*	0	0	0	1.3	4.2	2.7	0.38	0.06	0	0.14	0.13
24	1.1*	0	0	0	1.3	4.3	2.2	0.31	0.05	0	0.06	0.08
25	1.3*	0	0	0	1.1	4.7	2.0	0.25	0.04	0	0.06	0.13
26	1.1	0	0	0	0.97	5.1	2.1	0.21	0.03*	1.2	0.05	0.09
27	1.1	0	0	0	0.84	4.9	2.3	0.17	0	0.77	0.05	0.08
28	2.5	0	0	0	0.70	4.2	2.4	0.15	0	0.57	0.05	0.07
29	1.3	0	0	0	—	3.6	2.6	0.13	0	0.56	0.05	0.05
30	0.89	0	0	0	—	3.0	2.6	0.10	0	0.58	0.04	0.05
31	0.64	—	0	0	—	2.8	—	0.07	—	0.37	0.04	—
Total	15.13	8.08	0	0	8.85	63.24	91.9	30.97	8.22	10.90	15.34	2.35
Mean	0.49	0.27	0	0	0.32	2.04	3.06	1.0	0.27	0.35	0.49	0.078
Max	5.2	3.8	0	0	1.3	5.1	4.8	2.4	3.3	2.2	5.5	0.29
Min	0	0	0	0	0	0.36	2.0	0.07	0	0	0.04	0
Ac-Ft	30	16	0	0	18	125	182	61	16	22	31	4.8
Wtr Year	2001	Total	254.98	Mean	0.70	Max	5.5	Min	0	Ac-Ft	505	
Cal Year	2000	Total	72.18	Mean	0.20	Max	13	Min	0	Ac-Ft	143	

*Estimated.

E026 Los Alamos Canyon below Ice Rink

Location. Lat 35°52'49" long 106°19'30", in 1/4 SE, 1/4 NW sec. 17, T. 19 N, R. 6 E, Los Alamos County, on left bank 0.3 mi upstream from "Rainbow" bridge on Diamond Drive over Los Alamos Canyon and 1.55 mi downstream from Los Alamos Reservoir.

Drainage Area. 7.12 mi².

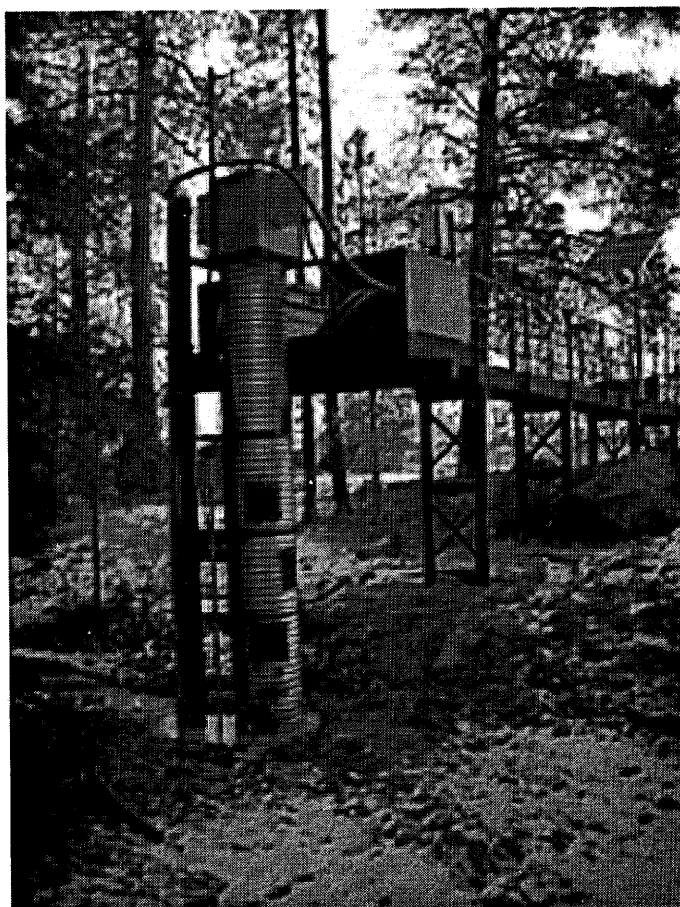
Period of Record. February 26 to October 30, 2001.

Gage. Data logger with cellular telemetry. Elevation of gage is 7,200 ft above *National Geodetic Vertical Datum of 1929*.

Remarks. Records fair below 5.0 ft³/s and good above 20 ft³/s, except for estimated daily discharges, which are poor.

Extremes for Period of Record. Maximum discharge 185 ft³/s, August 9, 2001, gage height 1.52 ft; no flow most of time.

Extremes for Current Water Year. Maximum discharge 185 ft³/s at 1545 hrs, August 9, gage height 1.52 ft; no flow most of time.



E350 Rio de los Frijoles at Bandelier

Location. Lat 35°46'37.0", long 106°16'9.6", Ramon Vigil Grant, Sandoval County, in Bandelier National Monument, on right bank 800 ft downstream from Monument Headquarters, 6.5 mi south of Los Alamos, 18.5 mi northwest of Santa Fe, and at river mile 2.0.

Drainage Area. 18.16 mi².

Period of Record. July 1963 to September 1969; July 1977 to September 1982; May 1993 to September 1996; and October 1998 to September 30, 2001.

Gage. Data logger and concrete control. Elevation of gage is 6,046 ft above *National Geodetic Vertical Datum of 1929*, from GPS Survey.

Remarks. Water discharge records good, except those for winter period, which are poor. One small diversion from left bank about 1.0 mi upstream for irrigation of small orchard. The La Mesa fire, which occurred during mid June 1977, burned about 40% of the forest cover of this watershed.

Extremes for Period of Record. Maximum discharge 3,030 ft³/s, July 21, 1978, gage height 6.34 ft, site and datum then in use. Minimum daily discharge 0.15 ft³/s July 9, 1989.

Extremes for Current Water Year. Maximum discharge 14 ft³/s at 1910 hrs, July 2, gage height 2.28 ft. Maximum gage height 2.36 ft, January 19, backwater from ice. Minimum daily 0.24 ft³/s, September 29.



E350 Rio de los Frijoles at Bandelier

Daily Mean Discharge in Cubic Feet per Second

Water Year October 2000 to September 2001

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.37	1.3	0.94	0.84	0.82	1.1	3.8	2.7	1.1	0.43	0.39	0.44
2	0.35	1.3	0.90	0.92	0.88	1.1	4.2	2.5	1.0	1.0	0.41	0.38
3	0.35	1.3	0.86	0.90	0.90	1.2	5.0	2.4	1.0	0.49	0.81	0.34
4	0.38	1.4	0.76	0.89	0.98	1.2	6.8	2.6	0.99	0.37	0.57	0.32
5	0.43	1.5	0.80	0.88	0.96	1.3	7.3	2.4	0.96	0.32	0.46	0.32
6	0.46	1.4	0.82	0.86	0.92	1.4	7.8	2.1	0.94	0.31	0.36	0.34
7	0.57	1.4	0.80	0.85	0.94	1.7	7.3	2.0	0.91	0.29	0.36	0.27
8	0.76	1.4	0.78	0.94	1.0	1.6	6.9	1.9	0.89	0.27	0.44	0.27
9	0.75	1.3	0.73	1.0	0.98	2.0	6.6	1.9	0.87	0.28	0.45	0.30
10	0.75	1.3	0.70	1.1	0.96	2.1	6.6	1.8	0.84	0.31	0.61	0.31
11	0.87	1.3	0.66	1.2	0.94	2.2	6.5	1.7	0.82	0.27	0.51	0.28
12	1.3	1.3	0.64	1.2	0.96	2.1	6.2	1.6	0.80	0.26	0.78	0.27
13	0.87	0.82	0.62	1.1	1.0	2.2	5.7	1.6	0.78	0.41	0.57	0.28
14	0.78	0.91	0.59	1.0	1.1	1.9	5.2	1.6	0.76	0.71	0.72	0.36
15	0.77	1.3	0.58	1.0	1.0	2.0	4.8	1.5	0.74	0.49	0.56	0.38
16	0.76	1.2	0.54	0.98	0.95	2.0	4.7	1.5	0.72	0.41	0.59	0.37
17	0.78	1.1	0.47	0.96	0.96	1.9	4.8	1.5	0.70	0.43	0.57	0.37
18	0.78	0.96	0.36	0.98	1.0	1.7	5.1	1.4	0.68	0.53	0.48	0.31
19	0.78	1.1	0.42	0.94	1.1	1.7	5.2	1.4	0.66	0.50	0.44	0.29
20	0.78	1.2	0.44	0.90	1.1	1.7	5.7	1.4	0.64	0.54	0.42	0.28
21	0.77	1.7	0.46	0.89	1.1	1.9	5.6	1.4	0.62	0.46	0.39	0.28
22	0.74	1.2	0.45	0.90	1.0	2.2	5.6	1.4	0.60	0.46	0.40	0.29
23	1.6	1.1	0.54	0.91	1.1	2.5	5.1	1.3	0.58	0.54	0.39	0.26
24	1.8	1.2	0.60	0.92	1.0	2.6	4.7	1.3	0.57	0.37	0.35	0.26
25	1.3	1.1	0.66	0.90	1.1	2.6	4.2	1.3	0.55	0.39	0.35	0.27
26	1.1	1.2	0.72	0.89	1.0	3.0	4.0	1.2	0.51	0.41	0.38	0.29
27	1.7	1.1	0.76	0.87	1.0	3.3	3.8	1.2	0.55	0.50	0.34	0.31
28	2.3	1.1	0.92	0.86	1.1	3.7	3.5	1.2	0.51	0.42	0.38	0.27
29	1.6	1.1	0.84	0.84	—	3.8	3.2	1.2	0.45	0.34	0.39	0.24
30	1.3	1.0	0.80	0.82	—	3.8	3.0	1.1	0.41	0.37	0.40	0.25
31	1.2	—	0.76	0.80	—	3.8	—	1.1	—	0.33	0.41	—
Total	29.05	36.59	20.92	29.04	27.85	67.3	158.9	51.2	22.15	13.21	14.68	9.20
Mean	0.94	1.22	0.67	0.94	0.99	2.17	5.30	1.65	0.74	0.43	0.47	0.31
Max	2.3	1.7	0.94	1.2	1.1	3.8	7.8	2.7	1.1	1.0	0.81	0.44
Min	0.35	0.82	0.36	0.80	0.82	1.1	3.0	1.1	0.41	0.26	0.34	0.24
Ac-Ft	58	72	42	58	55	134	313	102	44	26	29	18
Wtr Year	2001	Total	480.09	Mean	1.32	Max	7.8	Min	0.24	Ac-Ft	950	
Cal Year	2000	Total	283.91	Mean	0.78	Max	3.3	Min	0.22	Ac-Ft	564	