Title: Stream discharge in gaged watersheds at the HJ Andrews Experimental Forest, 1949 to present

Abstract:

Streamflow from selected small watersheds has been continuously monitored at the Andrews Forest beginning in November 1952 and the Lookout Creek Gauging Station has been maintained by the USGS since October, 1949. The objectives of this study include: (1) to evaluate long-term changes in hydrology associated with various management treatments, notably clearcut logging, selective logging, and burning; (2) to provide baseline data for affiliated precipitation and stream water chemistry and sediment transport studies; and (3) to characterize the hydrologic regime of old-growth forests at different elevations.

Streamflow records from small watersheds began in November 1952 at WS 1, 2, and 3 (60 to 100 ha), 1963 at WS 6, 7, and 8 (15 to 22 ha) 1968 at WS 9 and 10 (9 and 10 ha), 1980 at Mack Creek (580 ha), and 1949 at Lookout Creek (6242 ha). Data have been collected continuously since the start of data collection for all watersheds, with the exception of WS7, which was shut down as a cost-saving maneuver from WY1988 through WY1994. See https://andrewsforest.oregonstate.edu/research/infrastructure/watersheds for other information.

Raw instantaneous streamflow data in cubic feet per second (cfs) and mean flow at fine temporal intervals are available. Rating curves for fixed trapezoidal flumes are maintained for all small watersheds except Lookout Creek and allow calculation of mean and total flow. The USGS-maintained Lookout Creek relies on annual rating table development to reflect changes in the open channel for instantaneous flow calculation. Entity 1 includes a reconstructed history of USGS Lookout Creek hourly data beginning in 1950 and more recently 30 and 15 minute interval data. Calculated mean cfs and total flow for each watershed are available at daily (Entity 2), monthly (Entity 3), annual (Entity 4), and stream sampling (Entity 6) time intervals. An interactive program, FLOW (Entity 5), allows the user to download instantaneous, mean and total flow at requested time periods (e.g., 5 minute, 15 minute, hourly) for all watersheds except for Lookout Creek.

Keywords: hydrology; silviculture; floods; radio telemetry; disturbance; hydrologic processes; stream discharge; streamflow; long term monitoring; timber harvest; water; runoff; forest ecosystems; experimental forests; watersheds; streams; long term studies;

Date data commenced: 1949-10-01

Date data terminated: 2019-09-30

Principal Investigator: Sherri L. Johnson

List of Entities:

1. Corrected instantaneous stage height with flow calculations
2. Daily streamflow summaries
3. Monthly streamflow summaries
4. Annual streamflow summaries by wateryear (October 1 - September 30)
5. Instantaneous and total discharge for requested time intervals
6. Flow summaries for sediment and nutrient sampling periods
7. Discharge data calculated from discontinued rating curves (5 minute frequency data)

1. Corrected instantaneous stage height with flow calculations

Only Lookout Creek streamflow data is available through this entity from the Andrews Forest data catalog. Entity 5 (the interactive FLOW program) is available from our catalog to download high temporal resolution streamflow data for all other Andrews small watersheds. The full dataset (all watersheds) is available in this entity through the Environmental Data Initiative (EDI) portal. Please use the DOI in the citation to access the current dataset in EDI. Lookout Creek data available here: 1) Hourly data has been reconstructed from USGS and USFS streamflow charts and punch tapes (1950-1998), 2) USGS 30 minute data (1998-2010), and 3) USGS 15 minute data (2010-present).

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### 2. Daily streamflow summaries

Daily data can also be interactively viewed, downloaded, and graphically displayed using [ClimDB/HydroDB](https://climhy.lternet.edu/).

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### 3. Monthly streamflow summaries

Monthly data can also be interactively viewed, downloaded, and graphically displayed using [ClimDB/HydroDB](https://climhy.lternet.edu/).

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4. Annual streamflow summaries by wateryear (October 1 - September 30)

Annual data can also be interactively viewed, downloaded, and graphically displayed using <a href="https://climhydr.net" target="_blank">ClimDB/HydroDB</a>.

**Attribute List:**

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- **ESTDAYS** N N numeric(3,0) range 0.0000 31.0000 days
- **TOTAL_DAYS** N N numeric(3,0) range 0.0000 31.0000 days

5. Instantaneous and total discharge for requested time intervals

This is the interactive FLOW program which allows downloads of all Andrews small watersheds for any time period at user-specified time intervals. Rating equations can also be displayed. The full dataset (all watersheds) is available in this entity through the Environmental Data Initiative (EDI) portal. Please use the DOI in the citation to access the current dataset in EDI.

**Attribute List:**

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- **INST_Q** N Y numeric(8,3) range 0.0000 8000.0000 cfs
- **MEAN_Q** N Y numeric(8,3) range 0.0000 500.0000 cfs
- **MEAN_Q_AREA** N Y numeric(7,3) range 0.0000 400.0000 cfsm
### 5. Flow summaries for sediment and nutrient sampling periods

Total flow is summarized, generally in 3 week periods, for inclusion with stream sampling data in CF002.

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### 7. Discharge data calculated from discontinued rating curves (5 minute frequency data)

This data was online previously but has been deprecated in favor of new rating equations: WS1, 2, 3 (WY1999-2016); WS 8 (WY 1988-2016); and WS10 (WY 1997 - 2016)

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Attributes Definitions:
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DATE
  Date

DATE_TIME
  Date and time (PST) of stage height measurement

END_DATETIME
  Ending date and time of proportional sampling period

EQN_SET_CODE
  Equation set code describes the rating equation set and version used to calculate streamflow

ESTCODE
  Estimate code

ESTDAYS
  Number of days estimated in the summary period

EVENT_CODE
  Indicates that a comment exists independently for this date and time, and is typically the installation or removal of a v-notch or other change in rating curves used, or a site maintenance visit

FORMAT
  Entity number

INST_Q
  Instantaneous flow as cubic feet per second (cfs)

INST_Q_AREA
  Instantaneous flow as cubic feet per second per square mile (cfsm)

INTERVAL
  Time interval in minutes (length of time since previous stage value)

MAX_Q
  Maximum cubic feet per second (cfs) for this date (entity 2) or month (entity 3) or year (entity 4)

MEAN_Q
  Mean flow as cubic feet per second (cfs) for the preceding time interval (entity 1, 5) or this date (entity 2) or month (entity 3) or year (entity 4)

MEAN_Q_AREA
  Mean flow as cubic feet per second per square mile (cfsm) for the preceding time interval (entity 1, 5) or this date (entity 2) or month (entity 3) or year (entity 4)

MIN_Q
  Minimum cubic feet per second (cfs) for this date (entity 2) or month (entity 3) or year (entity 4)

MONTH
  Calendar month

SITECODE
  Site code
STAGE
Stage height

STCODE
Study code

TOTAL_DAYS
Total days of non-missing record included in the summary period

TOTAL_Q
Total flow in cubic feet for the preceding time interval

TOTAL_Q_AREA
Total flow as inches of water (over the watershed area) for this date (entity 2) or month (entity 3) or year (entity 4)

TOTAL_Q_INT
Total flow as inches of water (over the watershed area) for the preceding time interval

TOTAL_Q_SMPL
Total flow as inches of water during proportional sampling period (over the watershed area)

WATERYEAR
Wateryear: October 1 - September 30

YEAR
Calendar year

Enumerated Domains:

Enumerated Domain for Attribute: ESTCODE
A Accepted value
M Missing value
E Estimated value
P Provisional data (subject to change)
Q Questionable value
S Proportional nutrient sample removed

Enumerated Domain for Attribute: STCODE
HF004 Study code HF004

Enumerated Domain for Attribute: EQN_SET_CODE
1 GSWS01, Equation set A, version 1, current version, original flume 1952-1956
2 GSWS01, Equation set B, version 1, current version, main flume 1956-Present
3 GSWS01, Equation set C, version 1, current version, v-notch 1999-Present
4 GSWS02, Equation set A, version 1, current version, main flume 1952-Present
5 GSWS02, Equation set B, version 1, current version, v-notch 1999-Present
6 GSWS03, Equation set A, version 1, current version, main flume 1952-Present
7 GSWS03, Equation set B, version 1, current version, main flume post-flood 1964-1966
8 GSWS03, Equation set C, version 1, current version, v-notch 1999-Present
9 summers only
10 GSWS06, Equation set A, version 1, current version, original H-flume
11 1963-1997
12 GSWS06, Equation set B, version 1, current version, main flume 1997-Present
13 summers only
14 GSWS06, Equation set C, version 1, current version, v-notch 1998-Present
15 summers only
16 GSWS07, Equation set A, version 1, current version, original H-flume
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19 summers only
20 GSWS07, Equation set C, version 1, current version, v-notch 1998-Present
21 summers only
22 GSWS08, Equation set A, version 1, current version, original H-flume
23 1963-1987
24 GSWS08, Equation set B, version 1, old version, main flume 1987-Present
25 summers only
26 GSWS08, Equation set C, version 1, current version, v-notch 1997-Present
27 summers only
28 GSWS09, Equation set A, version 1, current version, original H-flume
29 1968-1973
30 GSWS09, Equation set B, version 1, old version, original v-notch 1973-1979
31 summers only
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33 summers only
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35 summers only
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37 summers only
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39 summers only
40 GSWS10, Equation set A, version 1, current version, original H-flume
41 1968-1973
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43 summers only
44 GSWS10, Equation set B, version 2, current version, original v-notch 1973-1979
45 summers only
46 GSWS10, Equation set C, version 1, old version, main flume 1973-Present
47 summers only
48 GSWS10, Equation set C, version 2, current version, main flume 1973-Present
49 summers only
50 GSWSMA, Equation set A, version 1, older version, main flume 1979-1995
51 summers only
52 GSWSMA, Equation set A, version 2, old version, main flume 1979-1995
53 summers only
54 GSWSMA, Equation set A, version 3, old version, main flume 1979-1995 prior to fish ladder
55 summers only
56 GSWSMA, Equation set A, version 4, current version, main flume 1995-Present represents concurrent fish ladder operation; equations are the same as version 3
57 summers only
58 GSWSMC, combined Mack Creek main flume + fish ladder (sum of eqn sets 34-35)
59 summers only
60 GSLOOK, USGS rating tables for Lookout Creek near Blue River (14161500)
61 summers only
62 GSTIDB, USGS rating tables for Blue River below Tidbits Creek (14161100)
63 summers only
64 GSLOOK, USGS rating table a for Lookout Creek near Blue River (14161500); reconstructed rating curve 0
65 summers only
66 GSLOOK, USGS rating table b for Lookout Creek near Blue River (14161500); reconstructed rating curve 1
67 summers only
GSLOOK, USGS rating table c for Lookout Creek near Blue River (14161500); reconstructed rating curve 2
GSLOOK, USGS rating table d for Lookout Creek near Blue River (14161500); reconstructed rating curve 3
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GSLOOK, USGS rating table 4 for Lookout Creek near Blue River (14161500); reconstructed rating curve 10
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GSLOOK, USGS rating table 17 for Lookout Creek near Blue River (14161500); reconstructed rating curve 23
GSLOOK, USGS rating table 18 for Lookout Creek near Blue River (14161500); reconstructed rating curve 24
GSWS01, Equation set D, version 1, current version, main flume 1999-Present (replacement for eqn_set_code=' 2')
GSWS02, Equation set C, version 1, current version, main flume 1999-Present (replacement for eqn_set_code=' 4')
GSWS03, Equation set D, version 1, current version, main flume 1999-Present (replacement for eqn_set_code=' 6')
GSWS08, Equation set D, version 1, current version, main flume 1999-Present (replacement for eqn_set_code=' 17')
GSWS10, Equation set E, version 1, current version, main flume 1999-Present (replacement for eqn_set_code=' 28')

Enumerated Domain for Attribute: EVENT_CODE

NA No event is reported (not applicable)

INSREM Installation or removal of a v-notch weir, or a change in rating equations applied
MAINTE A maintenance event has occurred (e.g., site visit)
WEATHR A weather event is affecting the stream discharge measurement

Enumerated Domain for Attribute: ESTCODE
A Accepted value
M Missing value
E Estimated value
P Provisional data (subject to change)
Q Questionable value
S Proportional nutrient sample removed

Enumerated Domain for Attribute: STCODE
HF004 Study code HF004
Proportional nutrient sample removed

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<thead>
<tr>
<th>Enumerated Domain for Attribute: <strong>STCODE</strong></th>
<th>HF004 Study code HF004</th>
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<td><strong>Enumerated Domain for Attribute: EQN_SET_CODE</strong></td>
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<td>1. GSWS01, Equation set A, version 1, current version, original flume 1952-1956</td>
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<tr>
<td>2. GSWS01, Equation set B, version 1, current version, main flume 1956-Present</td>
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<td>3. GSWS01, Equation set C, version 1, current version, v-notch 1999-Present summers only</td>
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<tr>
<td>4. GSWS02, Equation set A, version 1, current version, main flume 1952-Present</td>
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<td>5. GSWS02, Equation set B, version 1, current version, v-notch 1999-Present summers only</td>
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<td>6. GSWS03, Equation set A, version 1, current version, main flume 1952-Present</td>
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<td>7. GSWS03, Equation set B, version 1, current version, main flume post-flood 1964-1966</td>
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<td>8. GSWS03, Equation set C, version 1, current version, v-notch 1999-Present summers only</td>
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<td>10. GSWS06, Equation set B, version 1, current version, main flume 1997-Present summers only</td>
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<td>13. GSWS07, Equation set B, version 1, current version, main flume 1997-Present summers only</td>
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<td>14. GSWS07, Equation set C, version 1, current version, v-notch 1998-Present summers only</td>
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<td>15. GSWS08, Equation set A, version 1, current version, original H-flume 1963-1987</td>
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<td>16. GSWS08, Equation set B, version 1, old version, main flume 1987-Present summers only</td>
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<td>17. GSWS08, Equation set C, version 1, current version, v-notch 1997-Present summers only</td>
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<td>18. GSWS09, Equation set A, version 1, current version, original H-flume 1968-1973</td>
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<td>19. GSWS09, Equation set B, version 1, old version, original v-notch 1973-1979 summers only</td>
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<td>20. GSWS09, Equation set B, version 2, current version, original v-notch 1973-1979 summers only</td>
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<td>21. GSWS09, Equation set C, version 1, old version, main flume 1973-1979 summers only</td>
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<td>22. GSWS09, Equation set C, version 2, current version, main flume 1973-Present summers only</td>
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<td>23. GSWS09, Equation set C, version 2, current version, main flume 1973-Present summers only</td>
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<td>24. GSWS10, Equation set A, version 1, current version, v-notch 1997-Present summers only</td>
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<td>25. GSWS10, Equation set A, version 1, current version, original H-flume 1968-1973</td>
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<td>26. GSWS10, Equation set B, version 1, current version, original v-notch 1973-1979 summers only</td>
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<td>27. GSWS10, Equation set C, version 1, old version, main flume 1973-Present summers only</td>
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<td>28. GSWS10, Equation set C, version 2, current version, main flume 1973-Present summers only</td>
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<td>29. GSWS10, Equation set D, version 1, current version, v-notch 1997-Present summers only</td>
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<td>30. GSWSMA, Equation set A, version 1, older version, main flume 1979-1995</td>
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GSWSMA, Equation set A, version 2, old version, main flume 1979-1995
GSWSMA, Equation set A, version 3, old version, main flume 1979-1995 prior to fish ladder
GSWSMF, Equation set A, version 1, old version, fish ladder 1995-Present
GSWSMF, Equation set A, version 2, current version, fish ladder 1995-Present
GSWSMA, Equation set A, version 4, current version, main flume 1995-Present represents concurrent fish ladder operation; equations are the same as version 3
GSWSMC, combined Mack Creek main flume + fish ladder (sum of eqn sets 34+35)
GSLOOK, USGS rating tables for Lookout Creek near Blue River (14161500)
GSTIDB, USGS rating tables for Blue River below Tidbits Creek (14161100)
GSLOOK, USGS rating table a for Lookout Creek near Blue River (14161500); reconstructed rating curve 0
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GSLOOK, USGS rating table d for Lookout Creek near Blue River (14161500); reconstructed rating curve 3
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GSLOOK, USGS rating table f for Lookout Creek near Blue River (14161500); original version; extended forward through WY 1956
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GSLOOK, USFS rating table g for Lookout Creek near Blue River (14161500); reconstructed rating curve 6
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GSWS01, Equation set D, version 1, current version, main flume 1999-Present (replacement for eqn_set_code='2')
GSWS02, Equation set C, version 1, current version, main flume 1999-Present (replacement for eqn_set_code='4')
GSWS03, Equation set D, version 1, current version, main flume 1999-Present (replacement for eqn_set_code='6')
GSWS08, Equation set D, version 1, current version, main flume 1999-Present (replacement for eqn_set_code='17')
GSWS10, Equation set E, version 1, current version, main flume 1999-Present (replacement for eqn_set_code='28')

Enumerated Domain for Attribute: ESTCODE
A Accepted value
M Missing value
E Estimated value
P Provisional data (subject to change)
Q Questionable value
S Proportional nutrient sample removed

Enumerated Domain for Attribute: STCODE
HF004 Study code HF004

Enumerated Domain for Attribute: ESTCODE
A Accepted value
M Missing value
E Estimated value
P Provisional data (subject to change)
Q Questionable value
S Proportional nutrient sample removed

Enumerated Domain for Attribute: STCODE
HF004 Study code HF004

Enumerated Domain for Attribute: EQN_SET_CODE
1 GSWS01, Equation set A, version 1, current version, original flume 1952-1956
2 GSWS01, Equation set B, version 1, current version, main flume 1956-Present
3 GSWS01, Equation set C, version 1, current version, v-notch 1999-Present summers only
4 GSWS02, Equation set A, version 1, current version, main flume 1952-Present
5 GSWS02, Equation set B, version 1, current version, v-notch 1999-Present summers only
6 GSWS03, Equation set A, version 1, current version, main flume 1952-Present
7 GSWS03, Equation set B, version 1, current version, main flume post-flood 1964-1966
GSWS03, Equation set C, version 1, current version, v-notch 1999-Present summers only

GSWS06, Equation set A, version 1, current version, original H-flume 1963-1997

GSWS06, Equation set B, version 1, current version, main flume 1997-Present

GSWS06, Equation set C, version 1, current version, v-notch 1998-Present summers only


GSWS07, Equation set B, version 1, current version, main flume 1997-Present

GSWS07, Equation set C, version 1, current version, v-notch 1998-Present summers only

GSWS08, Equation set A, version 1, current version, original H-flume 1963-1987

GSWS08, Equation set B, version 1, old version, main flume 1987-Present

GSWS08, Equation set B, version 2, current version, main flume 1987-Present

GSWS08, Equation set C, version 1, current version, v-notch 1997-Present summers only

GSWS09, Equation set A, version 1, current version, original H-flume 1968-1973

GSWS09, Equation set B, version 1, old version, original v-notch 1973-1979 summers only

GSWS09, Equation set B, version 2, current version, original v-notch 1973-1979 summers only

GSWS09, Equation set C, version 1, old version, main flume 1973-Present

GSWS09, Equation set C, version 2, current version, main flume 1973-Present

GSWS09, Equation set D, version 1, current version, v-notch 1997-Present summers only

GSWS10, Equation set A, version 1, current version, original H-flume 1968-1973

GSWS10, Equation set B, version 1, current version, original v-notch 1973-1979 summers only

GSWS10, Equation set C, version 1, old version, main flume 1973-Present

GSWS10, Equation set C, version 2, current version, main flume 1973-Present

GSWS10, Equation set D, version 1, current version, v-notch 1997-Present summers only

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GSTIDB, USGS rating tables for Blue River below Tidbits Creek (14161100)

GSLOOK, USGS rating table a for Lookout Creek near Blue River (14161500); reconstructed rating curve 0

GSLOOK, USGS rating table b for Lookout Creek near Blue River (14161500); reconstructed rating curve 1
41 GSLOOK, USGS rating table c for Lookout Creek near Blue River (14161500); reconstructed rating curve 2
42 GSLOOK, USGS rating table d for Lookout Creek near Blue River (14161500); reconstructed rating curve 3
43 GSLOOK, USGS rating table e for Lookout Creek near Blue River (14161500); reconstructed rating curve 4
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52 GSLOOK, USGS rating table 4 for Lookout Creek near Blue River (14161500); reconstructed rating curve 10
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68 GSWS02, Equation set C, version 1, current version, main flume 1999-Present (replacement for eqn_set_code=' 4')
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70 GSWS08, Equation set D, version 1, current version, main flume 1999-Present (replacement for eqn_set_code=' 17')
71 GSWS10, Equation set E, version 1, current version, main flume 1999-Present (replacement for eqn_set_code=' 28')

Enumerated Domain for Attribute: EVENT_CODE
- NA: No event is reported (not applicable)
- INSREM: Installation or removal of a v-notch weir, or a change in rating equations applied
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<thead>
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<th>A maintenance event has occurred (e.g., site visit)</th>
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