# Hydrologic Monitoring in the Lower Klamath Basin

Water Year 2007

Prepared by:
Monica Hiner and Micah Gibson
**Yurok Tribe**
**Environmental Program**
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**Acknowledgements**

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## Table of Contents

**List of Figures**

**List of Figures, continued**



**List of Tables**

## I. Introduction

This report summarizes hydrologic monitoring conducted by the Yurok Tribe Environmental Program (YTEP) during Water Year 2007 (WY07), which covers October 1, 2006 through September 30, 2007. YTEP operates real-time gaging stations in McGarvey Creek, Turwar Creek, Blue Creek, Tully Creek, and the Klamath River estuary (Figure 1). Hourly data from real-time sites can be accessed through YTEP's website at: http://exchange.yuroktribe.nsn.us/lrgsclient/stations/stations.html (all data is provisional and not to be cited or used for analysis until published in our annual Water Year Report).

YTEP's goal in operating gaging stations in tributaries to the Lower Klamath is to obtain a continuous record of streamflow, which can be estimated by creating a relationship, or rating curve, between gage height at the gaging station and discharge measurements taken at a range of water levels. In addition, data such as suspended sediment concentration (SSC) and turbidity are also monitored during the winter months, when most sediment transport occurs in watersheds. Watersheds can be impaired by excessive sediment loads, which can lead to changes in channel morphology, habitat degradation, loss of spawning habitat, and may influence salmonid migration. The objectives for conducting this monitoring are: 1) establish baseline conditions and long-term trends, 2) provide a basis for comparing inter-annual flow regimes as they relate to fisheries studies, and 3) to monitor long-term progress of restoration projects.

The gaging station in the Klamath River estuary is unique in that it is not used to monitor streamflow. Gage height in the estuary varies both seasonally and daily and is greatly influenced by tidal activity. YTEP's goal in operating this gaging station is to increase our knowledge of the estuary and investigate how tidal stage, river flow, and the location of the mouth affect the physical, chemical, and biological characteristics of the estuary.

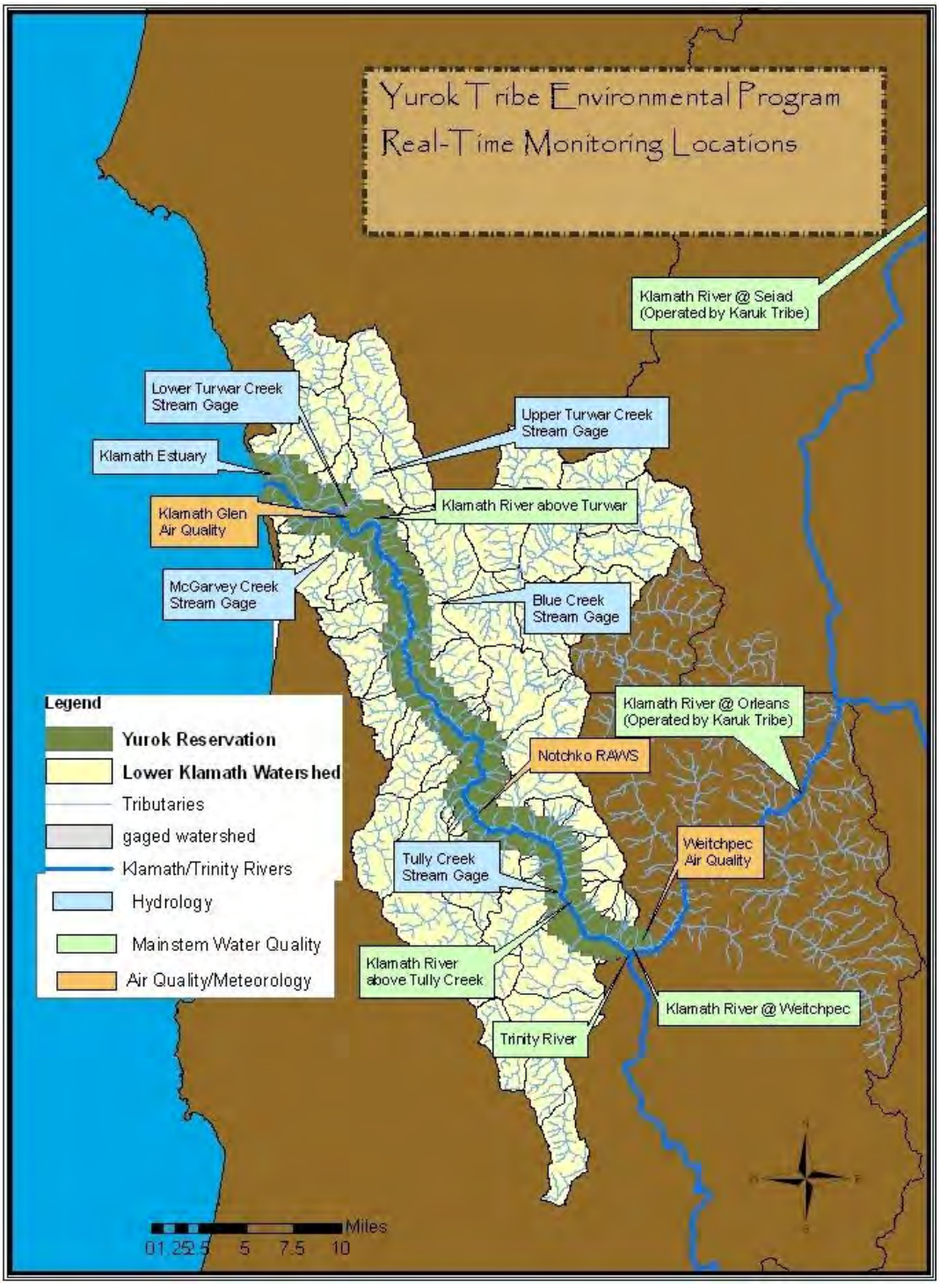


Figure 1. Locations of real-time monitoring stations operated by the Yurok Tribe Environmental Program during WY07.

## II. Quality Assurance

Data collected for this project is managed under quality assurance (QA) and quality control (QC) procedures that have been approved by the USEPA. YTEP's Quality Assurance Program Plan (QAPP) was finalized and has been implemented since 2001 (Yurok Tribe Environmental Program, 2001) and is overseen by YTEP's Program Director. The QAPP details the quality assurance and quality control procedures used to ensure and document that data is accurate, precise, complete, and representative of actual field conditions. The QAPP additionally describes the planning, implementation, and assessment criteria required for projects performed by YTEP for the generation, acquisition, and use of environmental data. Changes to the QAPP are approved by the Environmental Program Director.

In order to ensure comparability and accuracy of data, YTEP uses Standard Operating Procedures (SOP's) and follows USGS approved methods of data collection. YTEP also operates under an EPA approved Sampling and Analysis Plan (SAP) for bedload and suspended sediment (Yurok Tribe Environmental Program, 2003). Where an SOP does not exist for a certain instrument or procedure, YTEP follows the manufacturer's suggested procedures. Detailed logs are kept in waterproof field notebooks at each gaging station location and waterproof datasheets are used during data collection. In these records, any malfunctions, unusual circumstances, alteration of gage height, and/or other variations are noted.

Data is thoroughly reviewed once received from the sediment laboratory. YTEP is the primary organization responsible for data review, although the professional laboratory analyzing the sediment samples will also note potential problems with outliers or other anomalies in sample results. Information regarding QA/QC procedures for the laboratory is available upon request. One hundred percent of laboratory-generated data was checked on receipt by the Hydrologic Specialist for consistency and acceptability. Data is reviewed and finalized once data are merged or entered into a database,

The data manager will visually inspect all entered data sets to check for inconsistencies with original field or laboratory data sheets. Where inconsistencies are encountered, data will be re-entered and re-inspected until the entered data is found to be

satisfactory or results will be discarded. Any unusual values outside the range of norm will be flagged and all aspects of field data sheets, shipping handling and laboratory handling and testing will be reviewed. Outliers will be identified and removed from the dataset if deemed necessary by the QA Officer. The Project Manager will maintain field datasheets and notebooks in the event that the QA Officer needs to review any aspect of sampling for QA/QC purposes.

## III. Gaging Station Locations

Site selection criteria for gaging stations include spatial distribution, watershed restoration activities, proposed future development, and fisheries monitoring. Sites were located in the lower reaches of watersheds that characterize water quality and watershed health condition throughout the Lower Klamath. All tributaries currently monitored vary in size, geology, and geographic location and can potentially be used in the future to make inferences to neighboring watersheds. YTEP is in the process of developing baseline conditions to document the magnitude and duration of water quality impacts. The following reasons were used as selection criteria for gaging station locations:

1. *Spatial Distribution* – Sites located in the lower reaches of watersheds that characterize the water quality and watershed health condition throughout the lower Klamath.

2. *Activity Specific* – Sites located above and/or below activities that may potentially impact water quality.

3. *Watershed Restoration Activities* – Sites located in watersheds that have active or proposed restoration activities.

4. *Proposed Future Development* – Sites near locations of resource and proposed resource development.

Table 1. Selection criteria priority matrix for gaging station locations.

| Stream | Watershed | Primary Criteria | Secondary Criteria | Other |
|---|---|---|---|---|
| Blue | Blue | 1 | 3 | 2 |
| McGarvey | McGarvey | 3 | 1 | |
| Tully | Tully | 4 | 1 | 2 |
| U. Turwar | Turwar | 1 | 3 | 2 |
| L. Turwar | Turwar | 3 | 1 | 2 |

The McGarvey Creek gaging station has been in operation since December 1, 2001. The station is located at 41° 29' 11.29" north latitude, 124° 00' 34.46" west longitude, approximately 100 ft downstream of the confluence of the West Fork McGarvey and the mainstem. The total drainage area of the watershed is 5,667 acres (8.86 $mi^2$) (Figure 2, Figure 3). The gaging station captures flows from the upper 6.54 square miles of the watershed, which is 73.8% of the watershed. During winter storm events, flows are taken from a bridge crossing McGarvey Creek approximately ¼ mile downstream of the gaging station. Den Creek flows into McGarvey Creek directly upstream of the bridge, so flow measurements were taken in Den Creek and subtracted from the mainstem measurement during these events. McGarvey Creek was the first gaging station installed by the Yurok Tribe Environmental Program due to the widespread logging that had occurred in the watershed and planned restoration that has since occurred. The Yurok Tribal Fisheries Program (YTFP) operates an outmigrant trap just downstream of the McGarvey Creek Bridge and has also implemented a passive integrated transponder (PIT) monitoring project.

The Blue Creek gaging station has been in operation since April 2003 and is located at 41° 27' 00" north latitude, 123° 53' 40" west longitude, approximately ¼ mile downstream of the confluence of the West Fork of Blue Creek with the mainstem. Blue Creek was targeted because it is a unique watershed and is a major tributary to the Lower

Klamath River with a total drainage area of 80,321 acres (125.49 $mi^2$) (Figure 2, Figure 4). Extensive logging activities have and continue to occur in the Blue Creek watershed, along with restoration projects. The gaging station location captures activities from the upper 95.9% (120.32 $mi^2$) of the watershed. During storm events, flows are taken from the B10 Bridge approximately ½ mile downstream of the gaging station. YTFP also monitors outmigrating salmonids in Lower Blue Creek and conducts extensive spawner surveys during the fall and winter months in the mainstem, West Fork of Blue Creek, and Crescent City Fork of Blue Creek.

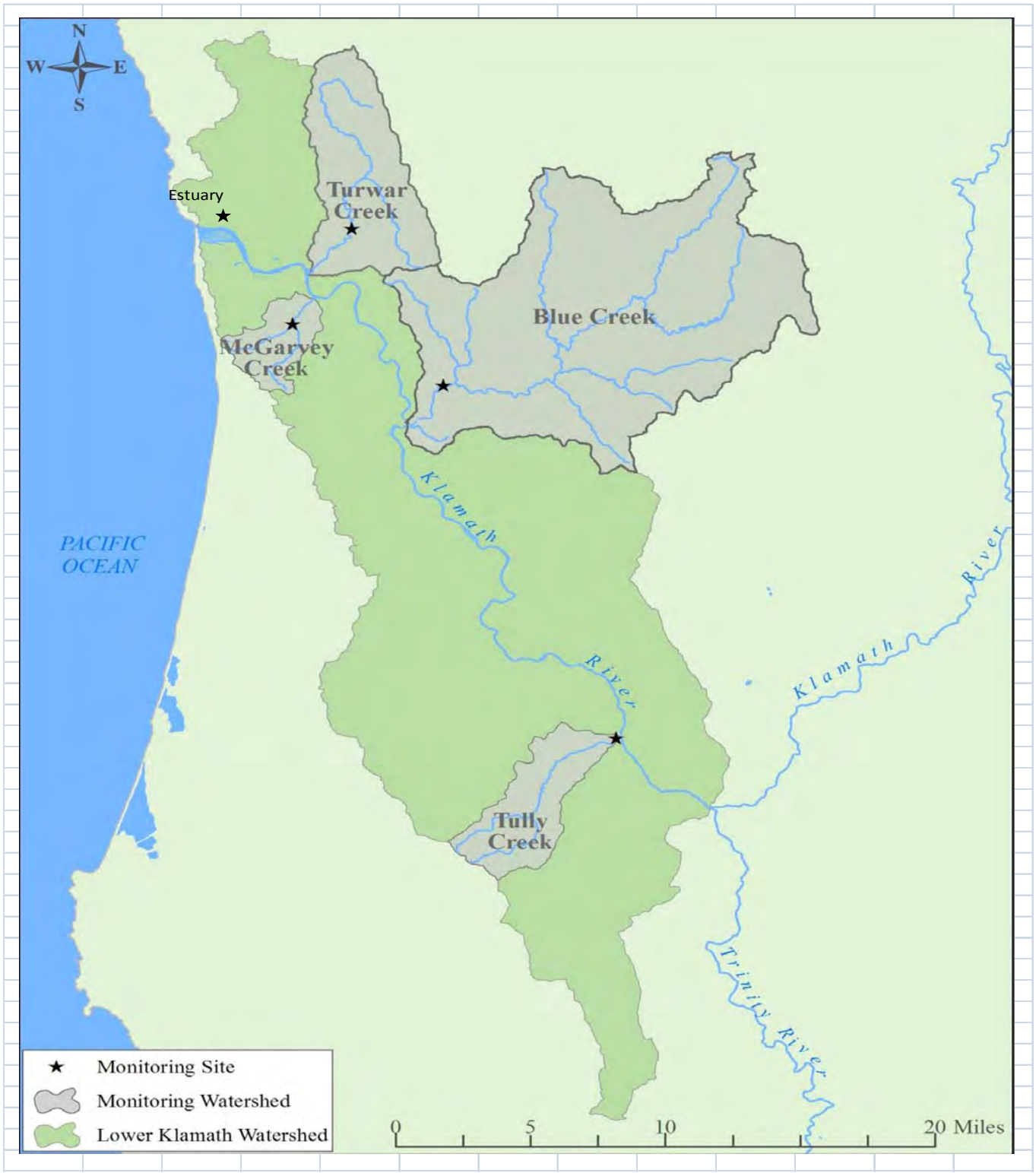


Figure 2. Watershed boundaries of Blue, McGarvey, Turwar, and Tully creeks and the location of YTEP gaging stations within these watersheds and the Klamath River Estuary.

Figure 3. McGarvey Creek gaging station turbidity boom and staff plate (downstream of turbidity boom on left bank).

Figure 4. Monica Hiner taking a flow measurement at the Blue Creek gaging station on May 23, 2006.

The Upper Turwar gaging station has been in operation since October 9th, 2003. The station is located at 41° 32' 6" north latitude, 123° 58' 43" west longitude. The gaging station is located 3.09 miles upstream of the mouth due to subsurface flows during summer months in the lower reach. This gage monitors the lower 19.4 % of the stream. . The total drainage area of the watershed is 20,380 acres (31.84 $mi^2$), and 81.6% (25.98 $mi^2$) of the watershed is upstream of the gaging station The location of this gaging station was selected because this site has flow year round and this stream contains spawning and rearing habitats for salmonids. This watershed also has upstream watershed restoration projects planned in the future.

The Lower Turwar gaging station was installed in October of 2007 to measure height, turbidity, and temperature. It will help us further understand the Turwar watershed and potentially see the result of intensive streambed restoration conducted by Yurok Tribe fisheries program that has been ongoing for almost 3 years. The total drainage area of the watershed is 20,380 acres (31.84 $mi^2$), and 99.4% (31.65 $mi^2$) of the watershed is upstream of the gaging station (Figure 2, Figure 5).

The Tully Creek gaging station has been in operation since February 11, 2005. The station is located at 41° 13' 42" north latitude, 123° 46' 32" west longitude and encompasses a drainage area of 11,267 acres (17.6 $mi^2$) (Figure 2, Figure 6). The site location is approximately ¼ mile upstream of the creek mouth and was selected to monitor the impacts of development adjacent to Tully Creek. Due to its proximity with the creek mouth, the gaging station captures activities from 99.6% (17.53 $mi^2$) of the watershed. During storm events, flows are taken from the Tully Creek Rd. Bridge approximately 200 ft. downstream of the gaging station.

YTEP also installed a gaging station in the Klamath River estuary on September 29, 2005 at 41° 32' 45" north latitude, 124° 04' 21" west longitude. The site is located approximately ½ mile inland from the Pacific Ocean at Requa. Water levels are recorded at this site; however, they are not used to calculate discharge. Gage height varies in the estuary seasonally as well as daily depending on many factors including river flow, tidal

stage and location of the river mouth. The goal of operating this site is to increase the knowledge about the estuary and investigate how tidal stage, river flow, and the location of the mouth affect the physical, chemical, and biological characteristics of the estuary.

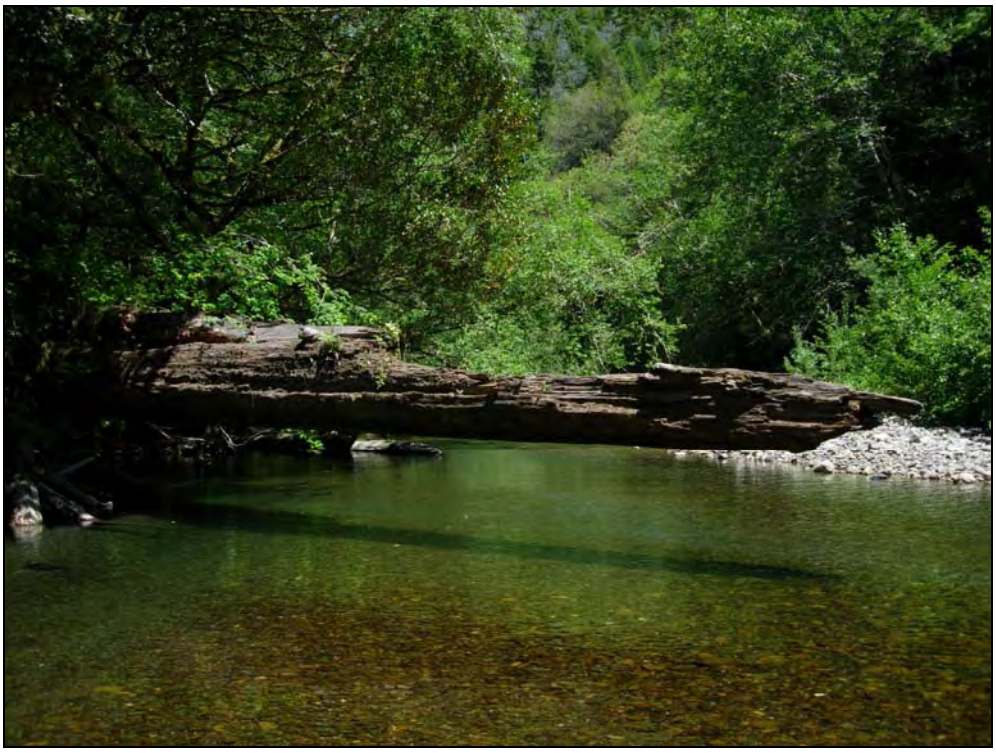

Figure 5. Turwar Creek gaging station looking upstream.

Figure 6. Kevin McKernan and Ken Lindke at the Tully Creek gaging station taking a staff plate measurement during a winter storm.

Figure 7. Gaging station located in the Klamath River estuary at Requa Resort.

## IV. Methods

Gage height was measured at computerized gaging stations using WaterLog® H-350XL Pressure Transducer/Data Collection Platforms at all gaging stations. The following parameters are measured at each site on a fifteen-minute time interval throughout the year: date, time, stage, air temperature (inside the gaging box), and battery voltage. Turbidity and water temperature are also measured in Turwar, McGarvey, and Blue creeks using a DTS-12 SDI turbidity sensor (Forest Technology Systems, Inc.). Daily and cumulative rainfall data are collected at Blue, McGarvey, and Tully creek stations using WaterLog® H-340 Tipping Bucket Rain Gauges.

During site visits, gage height was compared visually to water level on a fixed, graduated staff plate and adjusted accordingly when a difference greater than 5% was observed. If gage height was adjusted during site visits, it was noted in the site field notebook and the

data file was flagged accordingly. Data was downloaded from the gaging station using a SanDisk Compact Flash Memory Card. At sites with turbidity booms, the location of the turbidity probe was monitored and adjusted throughout the season to ensure that they were positioned above the streambed and approximately mid-water column depth to ensure accurate data collection.

Flow measurements were collected at or near each gaging station during monthly site visits and periodically during high flow events in winter months. Stream discharge was measured by wading, with a bridge crane, or with a bank operated cableway using USGS methodology (Buchanan and Somers 1969, Nolan and Sultz 2001). Discharge was measured using either a Price AA® or Pygmy® flow meter, depending on stream depth, and an AquaCalc® flow computer. During high flow measurements in Turwar and Blue Creeks, measurements were taken at a cableway installed at the gage site. In McGarvey and Tully Creeks, however, non-wadable flow measurements were taken from bridges downstream of the gage site using a sounding weight, crane, and B-reel. In McGarvey Creek the bridge is approximately ½ kilometer downstream of the gaging station, with Den Creek flowing into McGarvey Creek directly upstream of the bridge. During high flow measurements, a flow is also taken from Den Creek and subtracted from the total McGarvey flow so that discharge at the bridge is comparable with flow at the gaging station. The bridge over Tully Creek is less than ¼ kilometer downstream of the gaging station and there are no measurable sources of flow into Tully Creek between the two locations.

Flow measurements taken at each site were used to create a rating curve based on USGS methodology (Kennedy 1984). To estimate a continuous flow record at each gaging station, the rating curve equation was applied to gage height datum. Minimum, maximum, and average daily streamflow were calculated, and total monthly discharge in acre feet was calculated using the following formula:

$$\text{Acre Feet / Month} = \left\{\frac{(x)\text{cf}}{\text{sec}} * \frac{60\,\text{sec}}{\text{min}} * \frac{60\,\text{min}}{\text{hr}} * \frac{24\text{hr}}{\text{day}} * \frac{\#\,\text{days}}{\text{month}}\right\} * \frac{1\text{acrefoot}}{43{,}560\,\text{cf}}$$

YTEP also periodically collected suspended sediment samples at gaging stations during WY07. Depth integrated samples were collected using either a US-D-48 wadable sediment sampler or US-D-74 sampler attached to either a bank operated cableway or crane for non-wadable sampling. YTEP followed Equal Width Increment (EWI) methodology developed by USGS (Edwards and Glysson 1998). Sediment samples were analyzed by Graham Matthews and Associates (Arcata, California) following all USGS protocols to determine suspended sediment concentrations (SSC).

## V. Results and Discussion

### McGarvey Creek

#### *Discharge*

The rating curve for WY07 was generated using flow measurements taken between 11/07/06 – 07/11/07 (N = 47) and produced the following formula (Figure 8):

$y = 1.5667x^{4.3357}$, where $y$ = discharge in cfs and $x$ = gage height

Data points on the McGarvey Creek rating curve are the most scattered of all YTEP gaging stations due to changing streambed characteristics at the site. The highest flow measurement taken at McGarvey Creek during the water year was 72.7 cfs on 2/21/2007. The highest flow measurement on the rating curve was taken on 12/29/03 at 270.1 cfs. The lowest flow measured in McGarvey Creek during the water year was 1.29 cfs on 7/11/07 during summertime low flows (Figure 9). Gage data is missing from the continuous record between the dates of 10/13/2006 - 10/17/2006 and 12/21/2006 - 1/2/2007. (Figure 9)

The highest estimated flow in McGarvey Creek was 270.48 cfs on 12/13/06 at 13:45 (Figure 9). The storm peak was the response of 3.23 inches of rainfall between 12/11/06 and 12/13/06 (Figure 10). There were also two large peaks on 12/25/06 and 12/26/06 where there were 7.18 inches recorded. On 12/25/06 there were 4.34 inches and the next day 2.84 inches. Unfortunately we were unable to determine discharge due to the H355

logger malfunctioning. The logger was down from 12/21/06 at 15:00 until 1/2/07 at 11:00. (Figure 10)

The lowest estimated flows based on the rating curve equation were 1.29 cfs on 7/11/2007 (Table 2, Figure 9). Discharge from McGarvey Creek was highest overall during December and February, with 2,595 acre feet estimated discharged during December and 1,726 during February. This is an underestimate due to the H355 logger being down from 12/21/06 to 1/2/07 where we missed two storm events in the month of December. (Figure 10) Gaging records indicate that annual total acre feet discharged from McGarvey Creek was 10,522.97, this also is an underestimate due to missing gage data between 10/13/06 – 10/17/06 and 12/21/2006 – 1/2/2007. (Table 4)

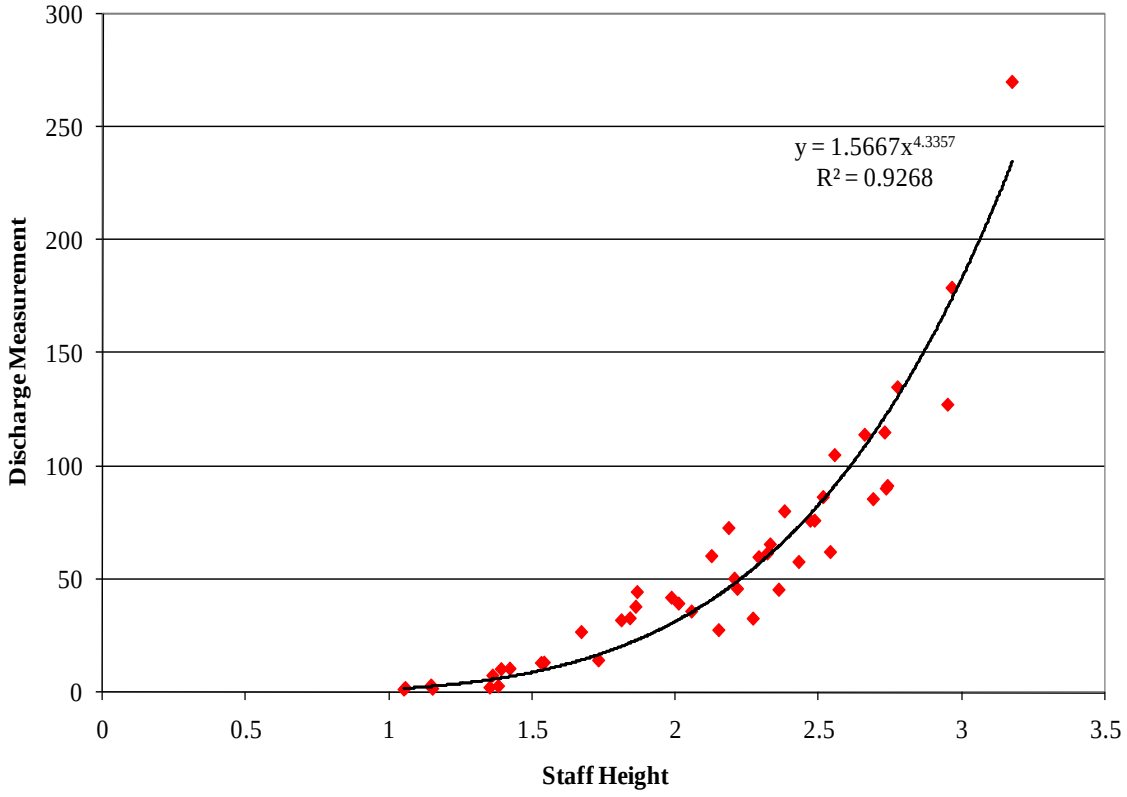


Figure 8. Discharge rating curve for McGarvey Creek using flow measurements taken between 12/07/01 – 7/11/07.

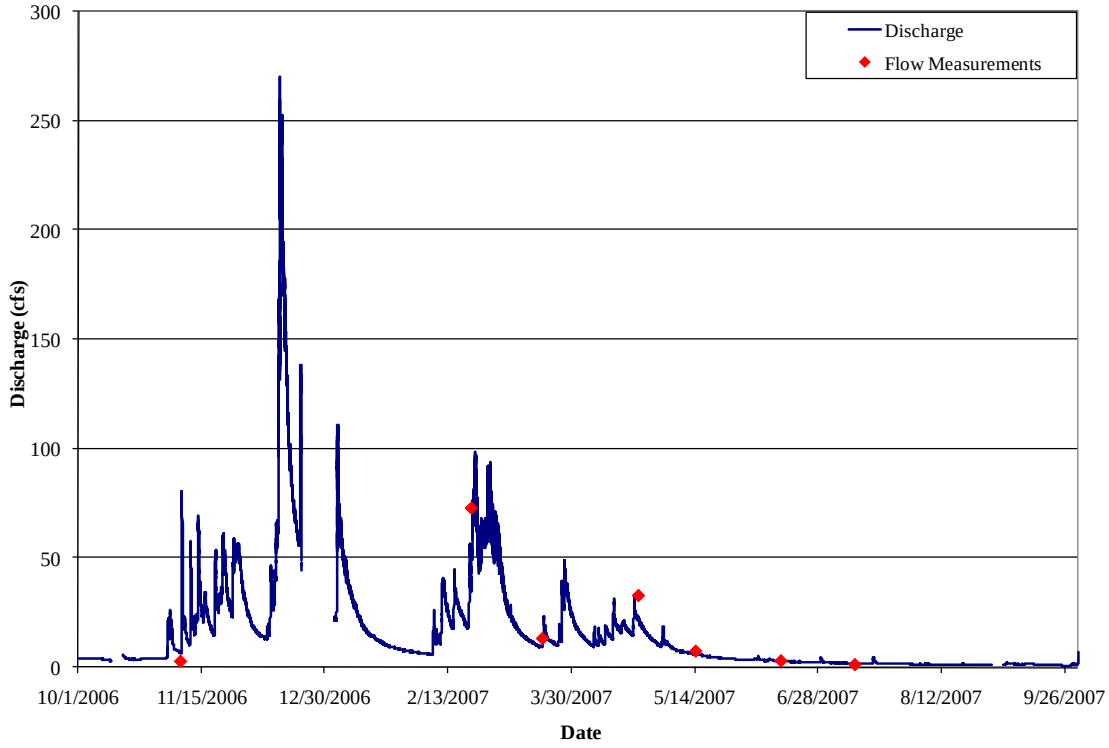


Figure 9. McGarvey Creek hydrograph and flow measurements for WY07.

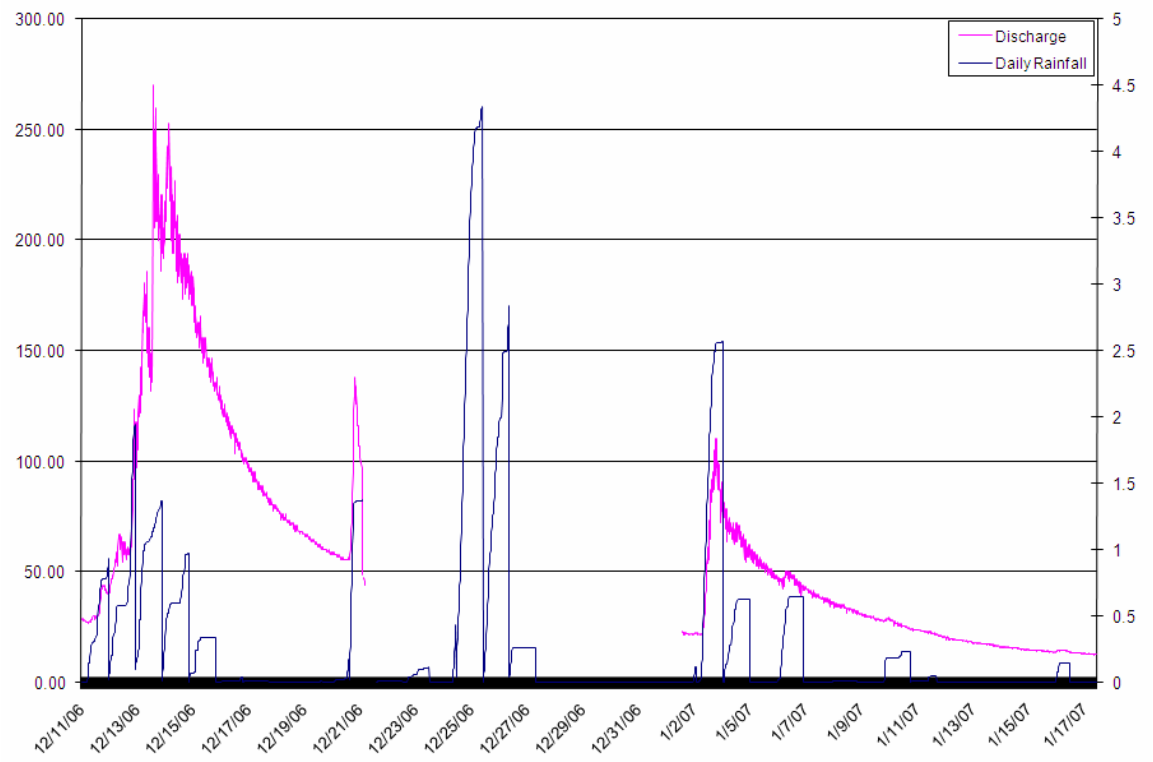


Figure 10. McGarvey Creek hydrograph and daily rainfall (inches), 12/11/06 – 1/17/07.

Table 2. Minimum daily discharge (cfs) values for McGarvey Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.11 | 4.11 | 24.74 | | 6.73 | 47.81 | 15.62 | 9.61 | 3.45 | 2.18 | 1.31 | 1.25 |
| 2 | 4.11 | 4.11 | 21.00 | 21.51 | 6.52 | 51.70 | 13.72 | 10.76 | 3.45 | 2.01 | 1.31 | 1.19 |
| 3 | 3.97 | 13.02 | 18.16 | 21.51 | 6.12 | 43.27 | 12.67 | 10.76 | 3.32 | 2.01 | 1.31 | 1.19 |
| 4 | 3.97 | 8.81 | 16.43 | 54.77 | 6.12 | 37.48 | 11.37 | 9.61 | 3.32 | 2.01 | 1.31 | 1.19 |
| 5 | 4.11 | 7.83 | 15.23 | 46.88 | 5.93 | 30.27 | 10.46 | 8.81 | 3.57 | 2.01 | 1.37 | 1.56 |
| 6 | 4.11 | 6.94 | 14.09 | 39.07 | 5.74 | 25.31 | 9.61 | 8.07 | 3.45 | 1.93 | 1.43 | 1.37 |
| 7 | 4.11 | 6.32 | 13.37 | 35.94 | 5.74 | 23.08 | 9.61 | 7.60 | 3.20 | 1.93 | 1.31 | 1.31 |
| 8 | 3.84 | 17.71 | 13.02 | 31.62 | 10.46 | 20.02 | 9.89 | 7.15 | 3.09 | 1.85 | 1.25 | 1.25 |
| 9 | 3.70 | 12.34 | 14.09 | 27.70 | 11.06 | 18.16 | 12.01 | 6.94 | 2.97 | 1.78 | 1.31 | 1.25 |
| 10 | 3.45 | 10.17 | 16.43 | 24.74 | 10.76 | 16.02 | 10.76 | 6.73 | 3.20 | 1.78 | 1.25 | 1.25 |
| 11 | 3.20 | 19.07 | 26.49 | 21.51 | 32.31 | 14.46 | 10.76 | 6.52 | 2.97 | 1.85 | 1.25 | 1.31 |
| 12 | 2.97 | 14.84 | 40.71 | 19.07 | 24.74 | 13.72 | 14.09 | 6.12 | 2.87 | 1.85 | 1.25 | 1.43 |
| 13 | 2.97 | 20.50 | 97.07 | 16.85 | 20.02 | 12.67 | 13.02 | 5.74 | 2.76 | 1.70 | 1.19 | 1.43 |
| 14 | | 27.09 | 173.26 | 15.23 | 18.16 | 11.68 | 13.37 | 5.56 | 2.76 | 1.63 | 1.19 | 1.31 |
| 15 | | 20.50 | 131.97 | 14.09 | 21.51 | 11.06 | 17.71 | 5.56 | 2.66 | 1.70 | 1.19 | 1.25 |
| 16 | | 25.31 | 102.04 | 13.72 | 27.09 | 10.17 | 16.02 | 5.21 | 2.66 | 1.56 | 1.19 | 1.19 |
| 17 | 4.41 | 19.54 | 81.82 | 12.34 | 23.62 | 9.61 | 16.02 | 5.04 | 2.55 | 1.63 | 1.14 | 1.14 |
| 18 | 3.84 | 16.02 | 68.49 | 11.68 | 21.00 | 9.34 | 17.28 | 4.72 | 2.46 | 2.36 | 1.14 | 1.09 |
| 19 | 3.70 | 14.46 | 60.20 | 11.06 | 18.61 | 9.34 | 16.43 | 4.72 | 2.46 | 1.93 | 1.14 | 1.04 |
| 20 | 3.70 | 26.49 | 55.83 | 10.46 | 18.16 | 13.72 | 14.84 | 4.72 | 2.46 | 1.85 | 1.37 | 0.94 |
| 21 | 3.57 | 25.31 | 44.15 | 9.89 | 35.19 | 12.34 | 14.46 | 4.41 | 2.36 | 1.78 | 1.25 | 0.90 |
| 22 | 3.57 | 28.96 | | 9.34 | 64.84 | 11.37 | 22.54 | 4.26 | 2.27 | 1.63 | 1.19 | 0.81 |
| 23 | 3.57 | 39.07 | | 9.07 | 50.71 | 10.76 | 20.02 | 3.97 | 2.27 | 1.63 | 1.19 | 0.77 |
| 24 | 3.84 | 28.96 | | 8.81 | 43.27 | 9.89 | 18.16 | 3.97 | 2.27 | 1.63 | 1.25 | 0.66 |
| 25 | 3.97 | 23.62 | | 8.31 | 48.76 | 10.17 | 16.02 | 3.97 | 2.18 | 1.63 | 1.25 | 0.59 |
| 26 | 3.97 | 22.54 | | 8.07 | 54.77 | 11.68 | 14.46 | 3.97 | 2.27 | 1.70 | 1.25 | 0.50 |
| 27 | 3.84 | 47.81 | | 7.83 | 57.98 | 26.49 | 13.02 | 3.84 | 2.18 | 1.63 | 1.25 | 0.42 |
| 28 | 3.84 | 47.81 | | 7.60 | 57.98 | 30.27 | 12.01 | 3.57 | 2.18 | 1.56 | 1.37 | 0.42 |
| 29 | 3.97 | 36.71 | | 7.38 | | 24.17 | 11.06 | 3.57 | 2.55 | 1.56 | 1.31 | 1.25 |
| 30 | 3.97 | 30.27 | | 7.15 | | 20.02 | 9.89 | 3.57 | 2.27 | 1.50 | 1.19 | 1.14 |
| 31 | 3.97 | | | 6.94 | | 17.71 | | 3.57 | | 1.37 | 1.25 | |
| | | | | | | | | | | | | |
| Monthly Statistics | | | | | | | | | | | | |
| Mean | 3.80 | 20.88 | 49.93 | 18.00 | 25.50 | 19.80 | 13.90 | 5.89 | 2.75 | 1.78 | 1.26 | 1.08 |
| Max | 4.41 | 47.81 | 173.26 | 54.77 | 64.84 | 51.70 | 22.54 | 10.76 | 3.57 | 2.36 | 1.43 | 1.56 |
| Min | 2.97 | 4.11 | 13.02 | 6.94 | 5.74 | 9.34 | 9.61 | 3.57 | 2.18 | 1.37 | 1.14 | 0.42 |

Table 3. Maximum daily discharge (cfs) values for McGarvey Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.26 | 4.11 | 30.27 | | 6.94 | 76.27 | 18.16 | 11.68 | 3.70 | 2.36 | 1.50 | 1.31 |
| 2 | 4.26 | 22.54 | 25.31 | 23.08 | 6.73 | 71.01 | 16.02 | 18.61 | 3.57 | 2.27 | 1.43 | 1.31 |
| 3 | 4.11 | 26.49 | 21.51 | 110.76 | 6.52 | 64.84 | 14.84 | 12.34 | 3.57 | 2.18 | 1.43 | 1.25 |
| 4 | 4.11 | 21.51 | 18.61 | 81.82 | 6.32 | 50.71 | 13.02 | 11.37 | 4.26 | 2.18 | 1.50 | 2.01 |
| 5 | 4.26 | 8.81 | 16.85 | 62.49 | 6.32 | 40.71 | 11.68 | 9.61 | 4.56 | 2.18 | 1.43 | 1.78 |
| 6 | 4.26 | 7.83 | 15.23 | 50.71 | 6.12 | 31.62 | 10.76 | 8.81 | 5.04 | 2.10 | 1.50 | 1.56 |
| 7 | 4.11 | 80.41 | 14.09 | 44.15 | 26.49 | 28.33 | 18.61 | 8.31 | 3.45 | 2.10 | 1.50 | 1.43 |
| 8 | 4.11 | 55.83 | 13.72 | 37.48 | 17.28 | 24.74 | 18.16 | 7.83 | 3.32 | 2.10 | 1.43 | 1.43 |
| 9 | 3.97 | 20.02 | 20.02 | 32.31 | 16.43 | 21.00 | 16.02 | 7.38 | 3.45 | 1.93 | 1.37 | 1.31 |
| 10 | 3.70 | 23.62 | 46.88 | 29.61 | 39.89 | 18.61 | 12.01 | 7.15 | 3.97 | 1.93 | 1.43 | 1.37 |
| 11 | 3.45 | 57.98 | 44.15 | 24.74 | 40.71 | 16.85 | 19.07 | 6.94 | 3.32 | 2.01 | 1.37 | 1.43 |
| 12 | 3.57 | 23.62 | 123.93 | 22.02 | 32.31 | 14.84 | 16.85 | 6.52 | 3.09 | 2.01 | 1.37 | 1.85 |
| 13 | 2.97 | 69.74 | 270.48 | 19.07 | 24.74 | 13.72 | 14.46 | 6.32 | 2.97 | 1.93 | 1.31 | 1.50 |
| 14 | | 62.49 | 253.04 | 17.28 | 21.51 | 13.02 | 31.62 | 5.93 | 2.97 | 1.85 | 1.31 | 1.50 |
| 15 | | 32.31 | 189.02 | 15.62 | 45.05 | 12.01 | 21.00 | 5.74 | 2.87 | 1.78 | 1.25 | 1.31 |
| 16 | | 34.45 | 138.26 | 14.84 | 31.62 | 11.37 | 18.16 | 5.56 | 2.87 | 1.78 | 1.25 | 1.25 |
| 17 | 5.74 | 25.89 | 103.74 | 14.09 | 27.70 | 10.46 | 21.00 | 5.38 | 2.76 | 2.46 | 1.25 | 1.19 |
| 18 | 4.41 | 19.54 | 83.26 | 12.67 | 24.74 | 9.89 | 21.51 | 5.21 | 2.66 | 4.88 | 1.19 | 1.14 |
| 19 | 3.84 | 35.94 | 71.01 | 12.01 | 21.00 | 23.62 | 18.16 | 5.04 | 2.66 | 2.36 | 1.56 | 1.09 |
| 20 | 3.84 | 53.73 | 61.34 | 11.37 | 56.90 | 22.02 | 16.43 | 4.88 | 2.55 | 1.93 | 1.50 | 1.04 |
| 21 | 3.84 | 33.73 | 138.26 | 10.76 | 72.30 | 14.09 | 33.01 | 4.72 | 2.66 | 1.93 | 1.43 | 0.99 |
| 22 | 3.70 | 61.34 | | 10.17 | 98.70 | 12.34 | 29.61 | 4.56 | 2.55 | 1.85 | 1.31 | 0.94 |
| 23 | 3.84 | 57.98 | | 9.61 | 97.07 | 11.68 | 23.08 | 4.41 | 2.46 | 1.78 | 1.31 | 0.85 |
| 24 | 3.97 | 39.89 | | 9.34 | 64.84 | 10.76 | 21.00 | 4.26 | 2.46 | 1.78 | 1.31 | 0.77 |
| 25 | 4.11 | 30.27 | | 8.81 | 68.49 | 20.02 | 18.61 | 4.11 | 2.36 | 1.70 | 1.37 | 0.70 |
| 26 | 3.97 | 59.08 | | 8.56 | 68.49 | 39.89 | 16.43 | 4.11 | 2.36 | 1.78 | 1.31 | 0.63 |
| 27 | 3.97 | 55.83 | | 8.31 | 92.28 | 48.76 | 14.84 | 4.11 | 2.36 | 1.78 | 1.43 | 0.56 |
| 28 | 3.97 | 56.90 | | 8.07 | 93.86 | 39.89 | 13.37 | 3.97 | 3.97 | 1.78 | 1.43 | 1.56 |
| 29 | 3.97 | 48.76 | | 7.60 | | 30.94 | 12.34 | 3.70 | 4.41 | 1.70 | 1.43 | 1.37 |
| 30 | 4.11 | 37.48 | | 7.38 | | 24.74 | 11.06 | 3.70 | 2.55 | 1.63 | 1.31 | 7.15 |
| 31 | 4.11 | | | 7.15 | | 21.00 | | 3.70 | | 1.56 | 1.25 | |
| | | | | | | | | | | | | |
| **Monthly Statistics** | | | | | | | | | | | | |
| Mean | 4.02 | 38.94 | 80.90 | 24.40 | 40.05 | 27.41 | 18.03 | 6.65 | 3.19 | 2.05 | 1.38 | 1.45 |
| Max | 5.74 | 80.41 | 270.48 | 110.76 | 98.70 | 76.27 | 33.01 | 18.61 | 5.04 | 4.88 | 1.56 | 7.15 |
| Min | 2.97 | 4.11 | 13.72 | 7.15 | 6.12 | 9.89 | 10.76 | 3.70 | 2.36 | 1.56 | 1.19 | 0.56 |

Table 4. Average daily discharge (cfs) values for McGarvey Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.12 | 4.11 | 27.61 | | 6.83 | 61.17 | 16.97 | 10.28 | 3.56 | 2.28 | 1.44 | 1.26 |
| 2 | 4.12 | 7.18 | 23.12 | 22.10 | 6.57 | 61.83 | 14.95 | 12.59 | 3.52 | 2.17 | 1.38 | 1.25 |
| 3 | 3.98 | 18.48 | 19.62 | 54.17 | 6.36 | 54.26 | 13.46 | 11.44 | 3.42 | 2.06 | 1.38 | 1.23 |
| 4 | 4.02 | 13.17 | 17.39 | 67.78 | 6.17 | 43.66 | 12.15 | 10.34 | 3.53 | 2.06 | 1.39 | 1.61 |
| 5 | 4.17 | 8.18 | 15.88 | 53.09 | 6.09 | 35.17 | 11.12 | 9.23 | 3.92 | 2.08 | 1.42 | 1.66 |
| 6 | 4.21 | 7.50 | 14.58 | 46.73 | 5.93 | 28.38 | 10.24 | 8.55 | 3.93 | 2.01 | 1.46 | 1.46 |
| 7 | 4.11 | 18.54 | 13.79 | 39.65 | 10.54 | 25.59 | 12.73 | 7.97 | 3.34 | 2.00 | 1.43 | 1.34 |
| 8 | 3.98 | 25.14 | 13.37 | 34.22 | 12.75 | 21.78 | 11.25 | 7.44 | 3.17 | 1.94 | 1.34 | 1.31 |
| 9 | 3.86 | 15.01 | 16.14 | 29.75 | 12.57 | 19.50 | 13.66 | 7.25 | 3.16 | 1.87 | 1.35 | 1.28 |
| 10 | 3.59 | 11.51 | 35.12 | 26.84 | 18.42 | 17.26 | 11.30 | 7.00 | 3.62 | 1.87 | 1.32 | 1.29 |
| 11 | 3.33 | 30.46 | 32.32 | 23.18 | 36.89 | 15.59 | 14.93 | 6.68 | 3.13 | 1.93 | 1.32 | 1.36 |
| 12 | 3.12 | 17.53 | 59.71 | 20.21 | 27.96 | 14.31 | 15.34 | 6.41 | 2.96 | 1.98 | 1.31 | 1.46 |
| 13 | 2.97 | 32.65 | 164.67 | 17.99 | 22.38 | 13.27 | 13.79 | 6.03 | 2.85 | 1.85 | 1.25 | 1.49 |
| 14 | | 39.18 | 203.43 | 16.33 | 19.29 | 12.31 | 21.64 | 5.79 | 2.82 | 1.75 | 1.22 | 1.39 |
| 15 | | 24.13 | 155.95 | 14.89 | 34.44 | 11.55 | 19.36 | 5.66 | 2.74 | 1.75 | 1.22 | 1.28 |
| 16 | | 29.84 | 118.32 | 14.22 | 29.33 | 10.80 | 17.32 | 5.48 | 2.72 | 1.71 | 1.22 | 1.22 |
| 17 | 4.98 | 22.41 | 92.41 | 13.21 | 25.88 | 10.12 | 18.52 | 5.28 | 2.63 | 1.81 | 1.21 | 1.17 |
| 18 | 4.05 | 17.97 | 76.05 | 12.26 | 22.86 | 9.58 | 19.38 | 5.05 | 2.56 | 3.30 | 1.17 | 1.12 |
| 19 | 3.76 | 16.74 | 65.59 | 11.53 | 19.70 | 12.32 | 17.39 | 4.85 | 2.52 | 2.13 | 1.40 | 1.07 |
| 20 | 3.74 | 35.35 | 57.98 | 10.90 | 25.95 | 16.72 | 15.84 | 4.74 | 2.54 | 1.90 | 1.43 | 1.01 |
| 21 | 3.73 | 29.85 | 85.34 | 10.27 | 46.82 | 13.00 | 18.91 | 4.59 | 2.51 | 1.83 | 1.37 | 0.95 |
| 22 | 3.62 | 41.84 | | 9.74 | 78.75 | 11.89 | 24.99 | 4.39 | 2.41 | 1.74 | 1.28 | 0.88 |
| 23 | 3.75 | 48.11 | | 9.29 | 68.31 | 11.13 | 21.82 | 4.22 | 2.35 | 1.69 | 1.26 | 0.82 |
| 24 | 3.92 | 33.68 | | 8.97 | 51.77 | 10.46 | 19.58 | 4.09 | 2.34 | 1.71 | 1.28 | 0.74 |
| 25 | 3.97 | 27.06 | | 8.65 | 60.23 | 13.27 | 17.45 | 4.06 | 2.30 | 1.68 | 1.27 | 0.66 |
| 26 | 3.97 | 36.34 | | 8.40 | 61.48 | 20.78 | 15.55 | 4.06 | 2.30 | 1.70 | 1.28 | 0.58 |
| 27 | 3.97 | 52.75 | | 8.08 | 73.91 | 38.99 | 13.96 | 3.99 | 2.26 | 1.73 | 1.33 | 0.51 |
| 28 | 3.97 | 53.40 | | 7.73 | 72.46 | 34.45 | 12.71 | 3.78 | 2.42 | 1.68 | 1.38 | 0.90 |
| 29 | 3.97 | 42.55 | | 7.47 | | 27.33 | 11.63 | 3.64 | 3.25 | 1.61 | 1.34 | 1.32 |
| 30 | 4.06 | 33.18 | | 7.29 | | 22.50 | 10.58 | 3.62 | 2.41 | 1.57 | 1.27 | 1.63 |
| 31 | 4.11 | | | 7.05 | | 19.37 | | 3.64 | | 1.50 | 1.25 | |
| | | | | | | | | | | | | |
| **Monthly Statistics** | | | | | | | | | | | | |
| Total | 109.16 | 793.86 | 1,308.39 | 621.98 | 870.64 | 718.35 | 468.53 | 192.12 | 87.17 | 58.90 | 40.98 | 35.27 |
| Mean | 3.90 | 26.46 | 62.30 | 20.73 | 31.09 | 23.17 | 15.62 | 6.20 | 2.91 | 1.90 | 1.32 | 1.18 |
| Max | 4.98 | 53.40 | 203.43 | 67.78 | 78.75 | 61.83 | 24.99 | 12.59 | 3.93 | 3.30 | 1.46 | 1.66 |
| Min | 2.97 | 4.11 | 13.37 | 7.05 | 5.93 | 9.58 | 10.24 | 3.62 | 2.26 | 1.50 | 1.17 | 0.51 |
| Acre Feet | 216.52 | 1,574.60 | 2,595.14 | 1,233.68 | 1,726.89 | 1,424.82 | 929.31 | 381.07 | 172.89 | 116.83 | 81.27 | 69.95 |
| **Total Acre Feet for WY07** | | | 10,522.97 | | | | | | | | | |

*Rainfall*

The McGarvey Creek rain gage was installed on 10/12/05 at the gaging station. All rain was captured except 12/21/06 at 12:45 to 12/22/06 at 00:00 and then from 9/28/07 until 10/1/07 due to a plugged H-340 tipping bucket.

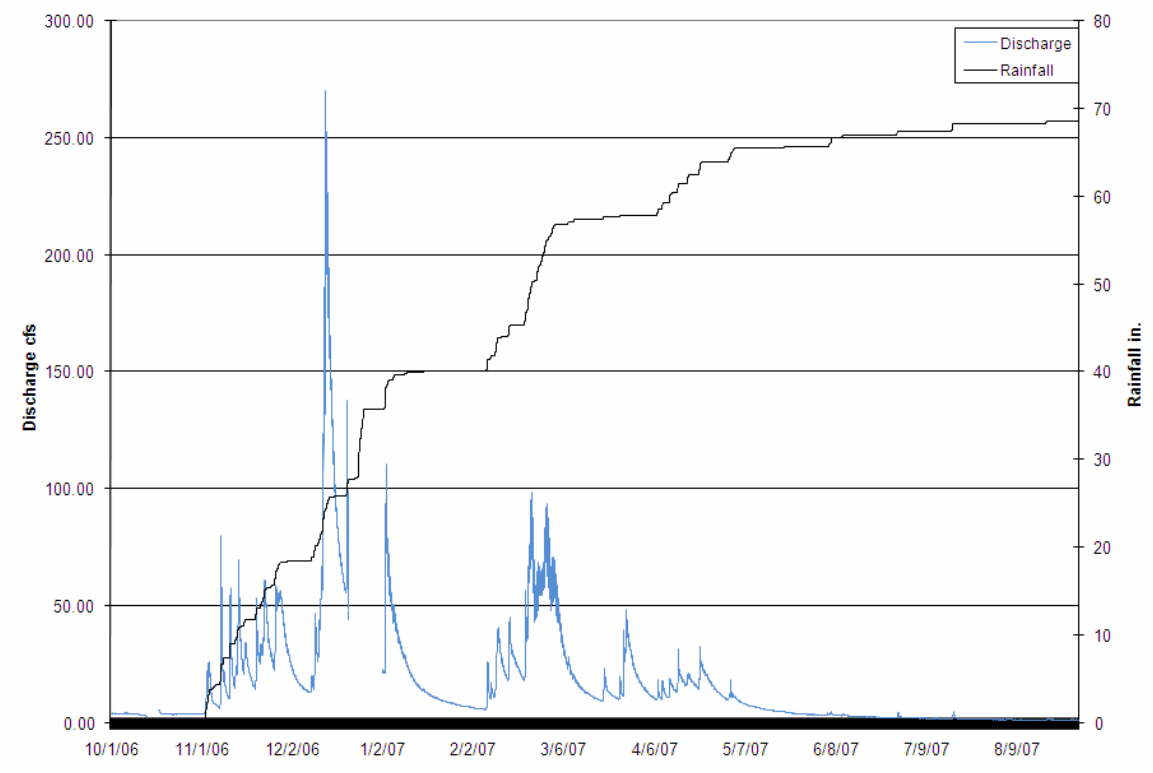


Figure 11. McGarvey Creek hydrograph and cumulative rainfall for WY07.

*Turbidity*

The turbidity probe was installed on 12/02/05. Turbidity data was missing from 7/28/07 to 9/25/07 due to the DTS-12 probe being sent in for recalibration and certification (Figure 12). Peaks in turbidity follow the hydrograph, with the highest observation on 12/25/06 of 266.58 NTU (Figure 12). The hydrograph does not reflect discharge due to the H355 logger being down on this date. During the last portion of the water year there is missing data because the DTS-12 was sent in for annual calibration and certification.

*Water Temperature*

Water temperature data was recorded simultaneously with turbidity data beginning 12/02/05. One distinct drop in temperature was observed on 1/14/07 corresponding to a drop in gage height due to lack of winter storm activity (Figure 13). The lowest temperature recorded was 5.5°C on 1/24/07 and the highest temperature observed during the water year was 15.8°C on 7/22/07 (Figure 13). Water temperature data ends on 9/28/07 due to the DTS-12 probe being sent in for annual calibration and certification.(Figure 13)

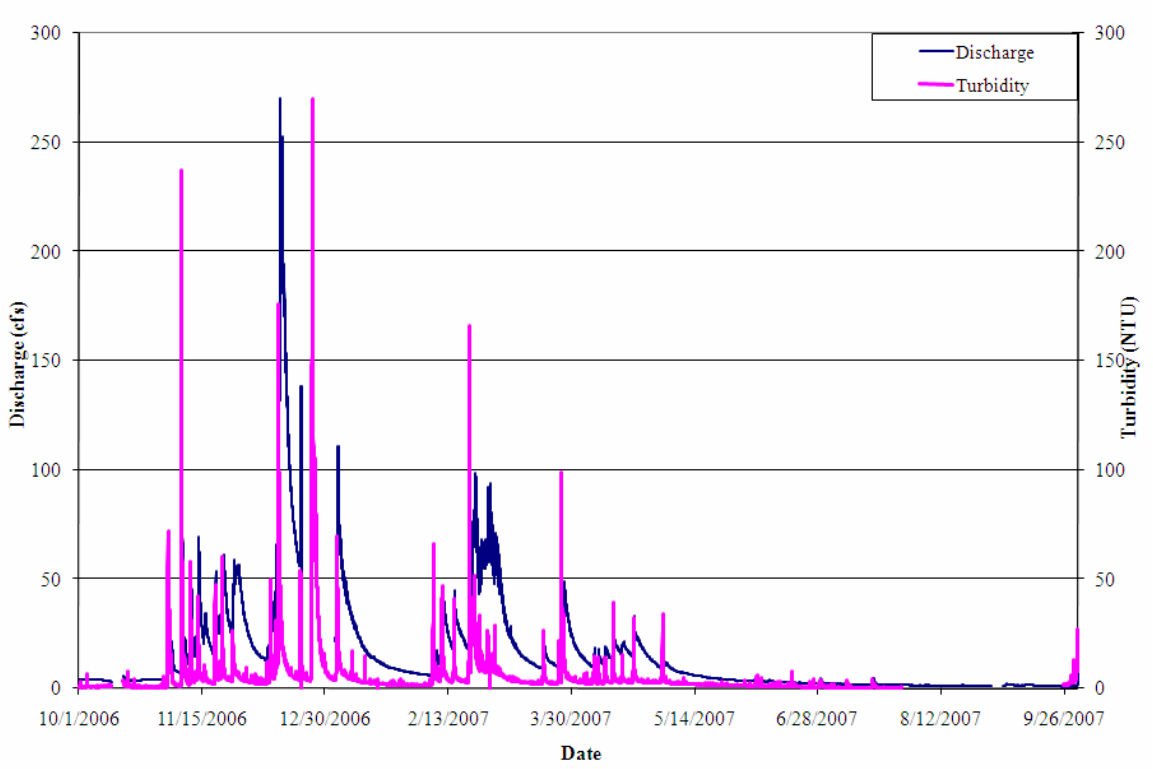


Figure 12. McGarvey Creek hydrograph and turbidity data for WY07.

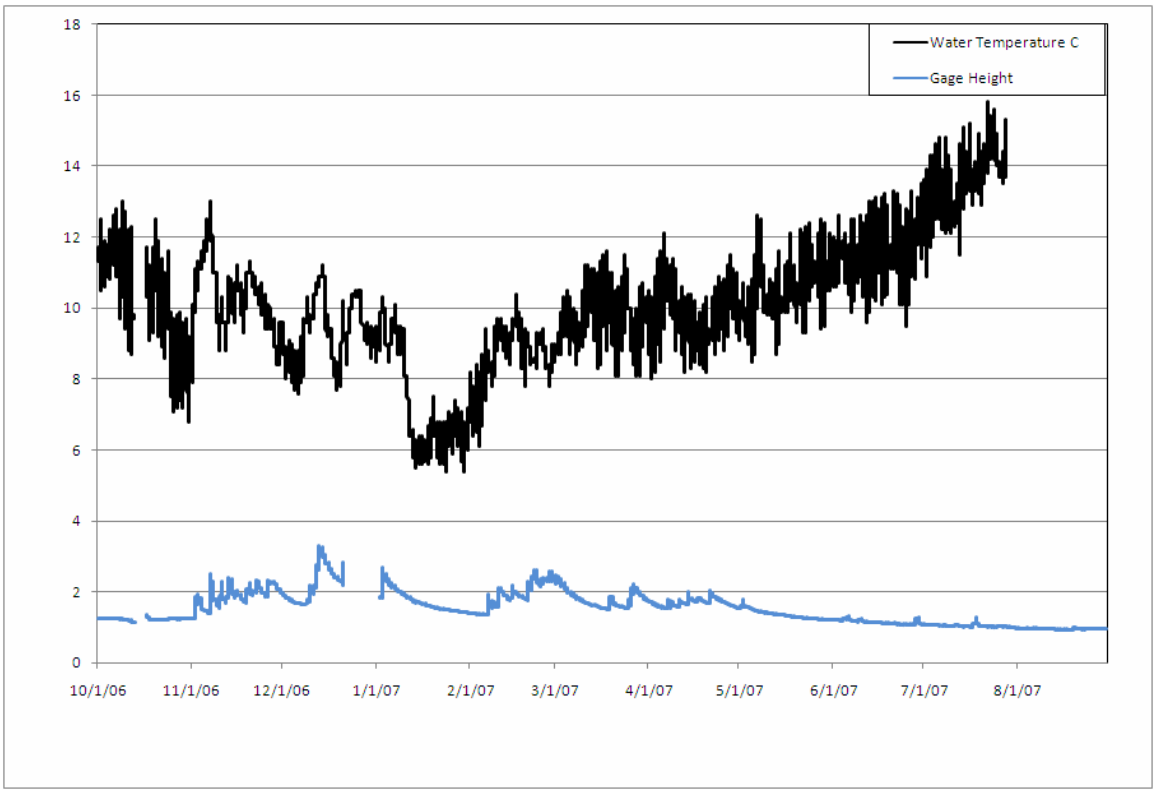

Figure 13. McGarvey Creek gage height and temperature data for WY07.

*Suspended Sediment*

Suspended sediment samples were collected during a storm event on 11/15/2006. The concentration of suspended sediment collected was 4.9 NTU. Due to the limited amount of data it is nearly impossible to correlate turbidity versus suspended sediment for this water year.

Table 5. Suspended sediment sample taken in McGarvey Creek during WY07.

| Bottle # | Date Sampled | Time Sampled | Sample ID | DIS or Grab | Turb1 NTU | Turb2 NTU | Turb3 NTU | Turb4 NTU | Turb5 NTU | SSC1 mg/l | Lab Code | Gage Height | Hydro Pos. | Remark Code | Remarks Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| McGA1+McGA2 | 11/15/06 | 14:57 | | DIS | 4.8 | 4.9 | | | | 7.25 | TE,TT | 2.05 | F | 5 | |

**Turwar Creek**

***Discharge***

The rating curve for WY07 was generated using flow measurements taken between 1/27/05 – 11/14/07 (N = 21) and produced the following formula (Figure 15):

$y = 43.515x^{2.7154}$, where $y$ = discharge in cfs and $x$ = gage height

The highest flow measurement taken in Turwar Creek during the water year was 2,680 cfs on 12/13/06. The highest flow measurement on the rating curve used to estimate discharge is 3132 cfs, taken on 12/14/06 (Figure 15). The lowest flow measurement on the rating curve was taken on 8/28/06 at 7.45 cfs (Figure 15, Figure 16).

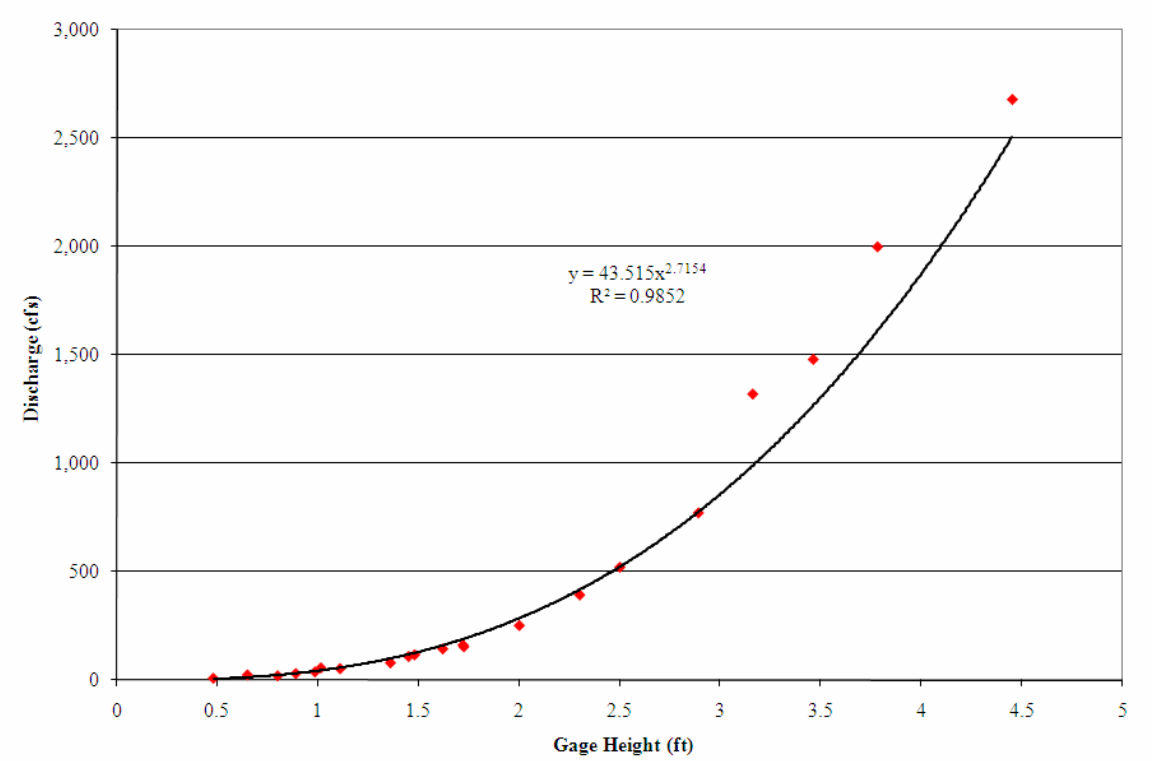


Figure 14. Discharge rating curve for Turwar Creek using flow measurements taken between 1/27/05 – 11/14/07.

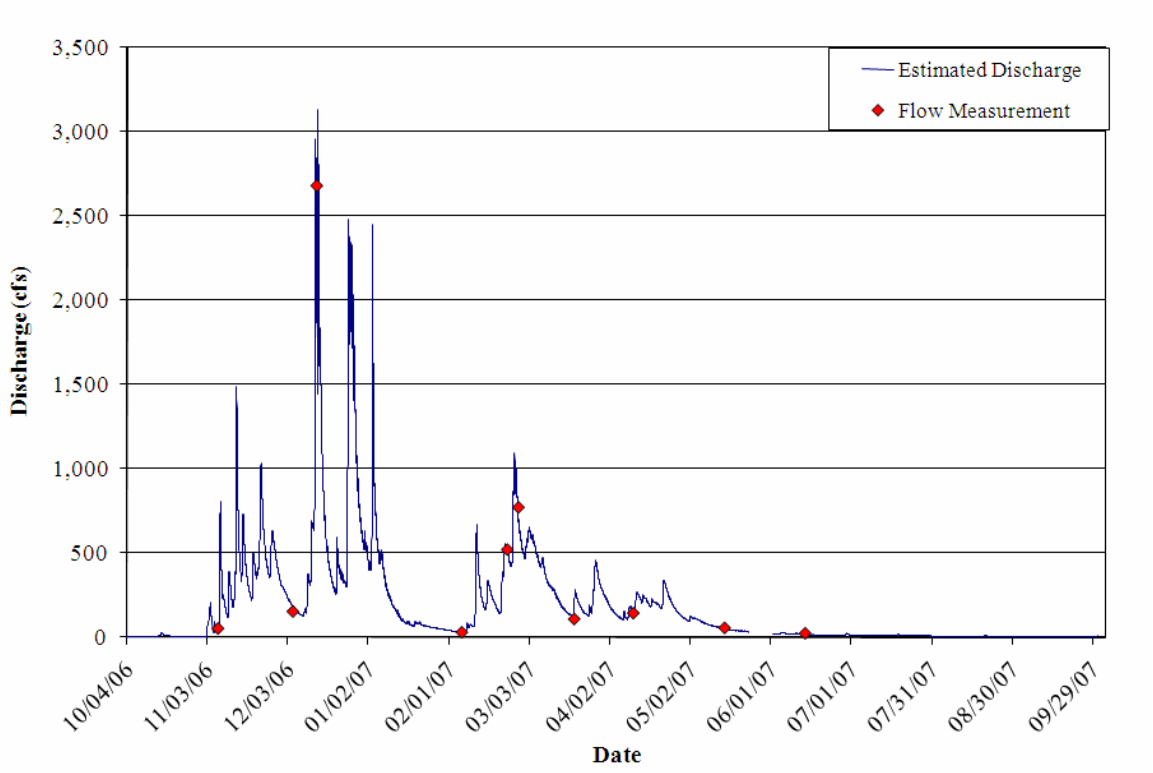


Figure 15. Turwar Creek hydrograph and flow measurements for WY07.

The highest flow event of the water year occurred on 12/14/06 and was a response to a storm that began in the afternoon of 12/13/06 and resulted in 3.3 inches of rain in 32 hours. (Blue creek rain gage) The estimated maximum discharge peaked at 3132.05 cfs; which is considered rather accurate since it is within 18% of a measured flow. (Figure 15). Two other notable storm events are evident in the hydrograph; one on 12/26/06 which peaked at 2298 cfs which was the result of 2.88 inches of rain in a 48 hour period and the other on 1/03/07 resulting in estimated flows of 2446 cfs from 3.55 inches of rain in a 24 hr. period. (Figure 15) (Both rain measurements come from Blue creek tipping bucket)

The lowest estimated flow in Turwar Creek was .35 cfs and occurred at the beginning of the water year on 10/13/06 during summer base flows (Figure 17, Table 6). Discharge from Turwar Creek was highest overall during November and December, with 20,694 acre feet estimated discharged during November and 40,486 acre feet during December. Annual total acre feet discharged from Turwar Creek was estimated to be 123,203 (Table 8).

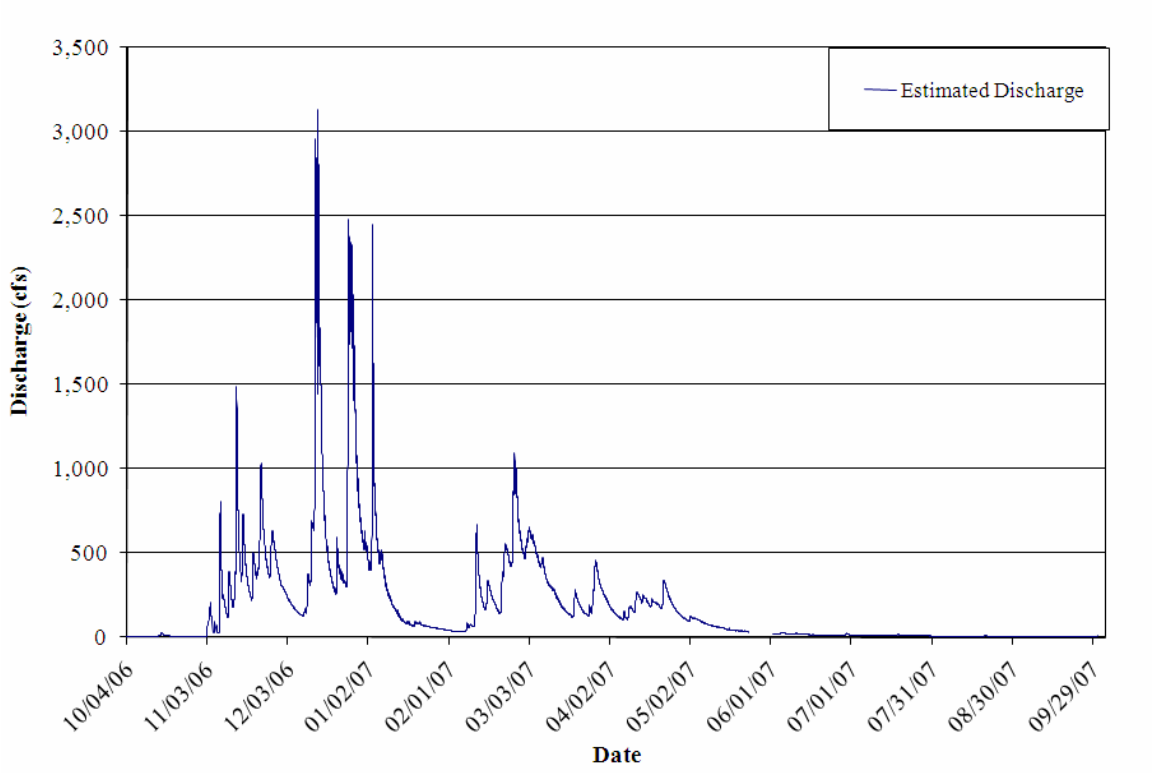


Figure 16. Turwar Creek hydrograph WY 07.

Table 6. Minimum daily discharge (cfs) values for Turwar Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.97 | 1.81 | 266.81 | 442.83 | 33.68 | 463.60 | 183.82 | 92.48 | 17.83 | 8.58 | 3.14 | 1.24 |
| 2 | 2.72 | 1.97 | 231.27 | 393.51 | 31.71 | 546.92 | 155.92 | 106.41 | 17.17 | 7.76 | 3.14 | 1.24 |
| 3 | 2.72 | 53.63 | 198.88 | 393.51 | 28.89 | 576.65 | 138.09 | 104.34 | 15.89 | 7.37 | 2.93 | 1.12 |
| 4 | 2.72 | 86.88 | 178.01 | 639.13 | 27.99 | 541.09 | 121.60 | 98.30 | 15.89 | 6.99 | 2.72 | 1.24 |
| 5 | 3.61 | 22.16 | 155.92 | 447.97 | 27.10 | 474.21 | 108.50 | 88.72 | 19.92 | 6.63 | 2.72 | 1.66 |
| 6 | 3.14 | 22.16 | 140.55 | 432.67 | 29.81 | 417.71 | 100.29 | 81.51 | 18.51 | 6.27 | 3.14 | 1.24 |
| 7 | 2.72 | 22.16 | 128.50 | 352.22 | 28.89 | 407.92 | 96.33 | 74.67 | 15.89 | 6.27 | 3.61 | 1.24 |
| 8 | 1.97 | 227.89 | 119.35 | 270.54 | 50.97 | 365.66 | 102.30 | 66.65 | 14.67 | 5.93 | 3.14 | 1.24 |
| 9 | 1.24 | 150.69 | 126.17 | 224.54 | 59.20 | 309.68 | 158.58 | 63.60 | 14.67 | 5.60 | 2.93 | 1.12 |
| 10 | 0.80 | 112.76 | 150.69 | 189.75 | 57.77 | 289.69 | 145.56 | 60.64 | 16.52 | 5.28 | 2.72 | 1.12 |
| 11 | 0.71 | 227.89 | 301.58 | 161.27 | 334.79 | 270.54 | 143.04 | 57.77 | 14.67 | 5.28 | 2.72 | 1.12 |
| 12 | 0.55 | 172.31 | 632.70 | 135.65 | 255.81 | 241.59 | 238.12 | 53.63 | 12.95 | 5.93 | 2.52 | 1.24 |
| 13 | 0.35 | 221.23 | 875.08 | 106.41 | 183.82 | 208.27 | 198.88 | 49.68 | 12.41 | 5.28 | 2.32 | 1.51 |
| 14 | 0.63 | 474.21 | 1442.15 | 92.48 | 158.58 | 180.90 | 201.98 | 42.34 | 11.37 | 4.98 | 2.14 | 1.37 |
| 15 | 1.01 | 326.28 | 972.75 | 81.51 | 189.75 | 161.27 | 208.27 | 41.19 | 10.87 | 4.98 | 2.14 | 1.24 |
| 16 | 5.93 | 442.83 | 639.13 | 76.34 | 241.59 | 143.04 | 178.01 | 38.95 | 10.87 | 4.98 | 2.14 | 1.24 |
| 17 | 8.58 | 326.28 | 468.88 | 66.65 | 195.81 | 130.86 | 172.31 | 36.78 | 10.39 | 4.98 | 2.14 | 1.24 |
| 18 | 5.28 | 245.10 | 361.15 | 63.60 | 161.27 | 117.13 | 198.88 | 33.68 | 9.46 | 7.76 | 2.14 | 1.12 |
| 19 | 4.13 | 214.69 | 293.62 | 60.64 | 140.55 | 114.93 | 189.75 | 33.68 | 9.46 | 6.99 | 2.14 | 1.01 |
| 20 | 3.37 | 379.42 | 248.64 | 74.67 | 140.55 | 214.69 | 169.51 | 32.69 | 9.46 | 6.63 | 3.61 | 1.01 |
| 21 | 2.72 | 343.43 | 248.64 | 68.21 | 356.67 | 178.01 | 163.99 | 30.75 | 9.46 | 6.63 | 2.93 | 1.01 |
| 22 | 2.32 | 403.08 | 343.43 | 63.60 | 501.40 | 153.29 | 285.80 | 27.99 | 9.01 | 5.60 | 2.72 | 0.90 |
| 23 | 2.32 | 619.96 | 322.08 | 60.64 | 422.66 | 133.24 | 238.12 | 26.24 | 8.58 | 5.28 | 2.32 | 1.01 |
| 24 | 2.32 | 447.97 | 293.62 | 56.37 | 417.71 | 119.35 | 205.11 |  | 8.58 | 5.28 | 1.97 | 1.01 |
| 25 | 1.97 | 356.67 | 334.79 | 53.63 | 828.68 | 119.35 | 175.15 |  | 8.17 | 4.98 | 1.97 | 0.90 |
| 26 | 1.97 | 347.81 | 1740.16 | 49.68 | 671.90 | 140.55 | 150.69 |  | 7.76 | 4.98 | 1.81 | 0.80 |
| 27 | 1.81 | 541.09 | 1399.40 | 47.15 | 546.92 | 270.54 | 133.24 |  | 7.37 | 4.68 | 1.81 | 0.80 |
| 28 | 1.51 | 422.66 | 898.89 | 44.71 | 479.57 | 330.52 | 117.13 |  | 7.37 | 4.40 | 1.66 | 0.80 |
| 29 | 1.51 | 343.43 | 685.30 | 42.34 |  | 278.10 | 106.41 |  | 13.51 | 4.13 | 1.51 | 1.12 |
| 30 | 1.51 | 293.62 | 558.69 | 40.06 |  | 241.59 | 96.33 |  | 9.46 | 3.87 | 1.37 | 1.12 |
| 31 | 1.51 |  | 512.55 | 36.78 |  | 211.46 |  |  |  | 3.61 | 1.24 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Monthly Statistics |  |  |  |  |  |  |  |  |  |  |  |  |
| Mean | 2.44 | 261.74 | 492.56 | 169.97 | 235.86 | 269.43 | 162.72 | 58.38 | 12.27 | 5.74 | 2.44 | 1.14 |
| Max | 8.58 | 619.96 | 1740.16 | 639.13 | 828.68 | 576.65 | 285.80 | 106.41 | 19.92 | 8.58 | 3.61 | 1.66 |
| Min | 0.35 | 1.81 | 119.35 | 36.78 | 27.10 | 114.93 | 96.33 | 26.24 | 7.37 | 3.61 | 1.24 | 0.80 |

Table 7. Maximum daily discharge (cfs) values for Turwar Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.72 | 2.14 | 297.59 | 564.64 | 36.78 | 564.64 | 217.94 | 121.60 | 19.21 | 9.46 | 3.87 | 1.51 |
| 2 | 3.14 | 50.97 | 266.81 | 453.14 | 33.68 | 652.11 | 183.82 | 123.87 | 18.51 | 9.01 | 3.37 | 1.51 |
| 3 | 2.93 | 183.82 | 231.27 | 2446.51 | 31.71 | 652.11 | 158.58 | 112.76 | 17.83 | 8.17 | 3.37 | 1.37 |
| 4 | 3.61 | 201.98 | 201.98 | 1104.16 | 29.81 | 607.38 | 140.55 | 108.50 | 22.94 | 7.76 | 3.14 | 2.52 |
| 5 | 3.87 | 90.59 | 178.01 | 652.11 | 32.69 | 552.79 | 123.87 | 98.30 | 22.94 | 7.37 | 3.14 | 2.14 |
| 6 | 3.61 | 65.11 | 158.58 | 518.18 | 31.71 | 490.41 | 110.62 | 90.59 | 21.40 | 7.37 | 3.61 | 1.66 |
| 7 | 3.14 | 806.07 | 140.55 | 501.40 | 86.88 | 468.88 | 153.29 | 83.27 | 18.51 | 6.63 | 3.87 | 1.37 |
| 8 | 2.52 | 639.13 | 128.50 | 361.15 | 74.67 | 468.88 | 158.58 | 76.34 | 15.89 | 6.63 | 3.61 | 1.37 |
| 9 | 1.97 | 238.12 | 166.73 | 281.93 | 73.02 | 370.21 | 180.90 | 71.39 | 17.17 | 6.27 | 3.37 | 1.37 |
| 10 | 1.24 | 221.23 | 374.80 | 241.59 | 330.52 | 317.91 | 175.15 | 66.65 | 19.92 | 5.93 | 3.14 | 1.37 |
| 11 | 0.90 | 384.08 | 692.07 | 189.75 | 665.27 | 297.59 | 252.21 | 62.11 | 16.52 | 5.93 | 2.93 | 1.37 |
| 12 | 0.71 | 227.89 | 851.68 | 161.27 | 407.92 | 281.93 | 263.11 | 59.20 | 14.67 | 6.27 | 2.93 | 1.51 |
| 13 | 0.71 | 1485.71 | 2959.08 | 143.04 | 255.81 | 248.64 | 238.12 | 56.37 | 13.51 | 6.63 | 2.72 | 1.66 |
| 14 | 1.01 | 1276.00 | 3132.05 | 110.62 | 192.77 | 217.94 | 252.21 | 52.29 | 12.95 | 5.60 | 2.52 | 1.66 |
| 15 | 5.60 | 474.21 | 1801.56 | 98.30 | 330.52 | 183.82 | 231.27 | 43.52 | 12.41 | 5.28 | 2.52 | 1.51 |
| 16 | 26.24 | 726.52 | 972.75 | 92.48 | 309.68 | 163.99 | 211.46 | 56.37 | 11.88 | 5.93 | 2.52 | 1.37 |
| 17 | 24.55 | 490.41 | 652.11 | 88.72 | 241.59 | 145.56 | 224.54 | 41.19 | 11.37 | 7.37 | 2.32 | 1.37 |
| 18 | 8.58 | 330.52 | 463.60 | 71.39 | 198.88 | 133.24 | 217.94 | 37.86 | 10.87 | 15.27 | 2.32 | 1.37 |
| 19 | 5.28 | 365.66 | 370.21 | 90.59 | 163.99 | 274.30 | 201.98 | 35.73 | 10.39 | 10.87 | 5.60 | 1.24 |
| 20 | 4.13 | 501.40 | 301.58 | 83.27 | 384.08 | 278.10 | 192.77 | 35.73 | 10.39 | 6.99 | 5.60 | 1.12 |
| 21 | 3.37 | 412.80 | 594.97 | 88.72 | 552.79 | 221.23 | 326.28 | 35.73 | 10.39 | 7.37 | 3.87 | 1.12 |
| 22 | 2.72 | 1032.77 | 417.71 | 69.79 | 552.79 | 178.01 | 334.79 | 36.78 | 9.91 | 6.99 | 3.14 | 1.12 |
| 23 | 2.52 | 1015.39 | 388.78 | 69.79 | 506.95 | 155.92 | 285.80 | 29.81 | 9.46 | 5.93 | 2.72 | 1.12 |
| 24 | 2.52 | 619.96 | 334.79 | 60.64 | 867.24 | 138.09 | 241.59 |  | 9.01 | 5.60 | 2.32 | 1.12 |
| 25 | 2.52 | 447.97 | 2476.76 | 57.77 | 1095.07 | 192.77 | 205.11 |  | 9.01 | 5.60 | 2.14 | 1.01 |
| 26 | 2.14 | 588.82 | 2342.49 | 53.63 | 998.19 | 281.93 | 175.15 |  | 8.58 | 5.28 | 2.14 | 1.01 |
| 27 | 1.97 | 632.70 | 2156.82 | 50.97 | 671.90 | 458.35 | 150.69 |  | 8.17 | 5.28 | 1.97 | 0.90 |
| 28 | 1.81 | 541.09 | 1442.15 | 48.41 | 564.64 | 432.67 | 133.24 |  | 17.83 | 4.98 | 1.97 | 1.51 |
| 29 | 1.51 | 422.66 | 964.36 | 45.92 |  | 334.79 | 119.35 |  | 24.55 | 4.68 | 1.81 | 1.37 |
| 30 | 1.66 | 343.43 | 712.61 | 42.34 |  | 281.93 | 108.50 |  | 12.95 | 4.40 | 1.66 | 9.91 |
| 31 | 1.81 |  | 626.31 | 40.06 |  | 245.10 |  |  |  | 4.13 | 1.51 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Monthly Statistics |  |  |  |  |  |  |  |  |  |  |  |  |
| Mean | 4.23 | 493.97 | 864.49 | 286.53 | 347.20 | 331.98 | 198.98 | 66.78 | 14.64 | 6.81 | 2.96 | 1.69 |
| Max | 26.24 | 1485.71 | 3132.05 | 2446.51 | 1095.07 | 652.11 | 334.79 | 123.87 | 24.55 | 15.27 | 5.60 | 9.91 |
| Min | 0.71 | 2.14 | 128.50 | 40.06 | 29.81 | 133.24 | 108.50 | 29.81 | 8.17 | 4.13 | 1.51 | 0.90 |

Table 8. Average daily discharge (cfs) values for Turwar Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.39 | 1.97 | 281.45 | 503.77 | 35.32 | 502.78 | 198.04 | 99.29 | 18.19 | 9.30 | 3.59 | 1.37 |
| 2 | 2.91 | 5.99 | 248.67 | 421.83 | 32.64 | 596.13 | 168.93 | 114.86 | 17.79 | 8.54 | 3.30 | 1.32 |
| 3 | 2.84 | 100.64 | 215.33 | 1052.17 | 30.60 | 610.90 | 147.74 | 108.35 | 17.01 | 7.82 | 3.11 | 1.29 |
| 4 | 3.32 | 140.81 | 188.66 | 812.70 | 28.70 | 573.32 | 130.46 | 103.26 | 18.34 | 7.50 | 3.01 | 2.04 |
| 5 | 3.78 | 55.50 | 167.57 | 531.83 | 29.49 | 509.10 | 116.87 | 94.60 | 21.11 | 7.18 | 3.03 | 2.01 |
| 6 | 3.49 | 38.69 | 149.15 | 470.43 | 30.40 | 451.41 | 105.83 | 86.33 | 19.64 | 6.82 | 3.36 | 1.55 |
| 7 | 3.02 | 352.77 | 134.32 | 429.32 | 45.59 | 438.63 | 122.35 | 78.75 | 17.41 | 6.47 | 3.68 | 1.31 |
| 8 | 2.42 | 321.34 | 123.56 | 320.56 | 59.79 | 413.10 | 113.44 | 72.30 | 15.56 | 6.29 | 3.50 | 1.29 |
| 9 | 1.68 | 192.36 | 148.56 | 251.27 | 65.62 | 337.30 | 175.15 | 67.64 | 15.21 | 5.87 | 3.11 | 1.23 |
| 10 | 1.06 | 130.71 | 322.69 | 209.76 | 94.03 | 306.08 | 160.18 | 63.73 | 18.70 | 5.62 | 2.96 | 1.21 |
| 11 | 0.80 | 304.82 | 411.93 | 173.61 | 517.53 | 285.59 | 188.66 | 59.73 | 15.71 | 5.54 | 2.79 | 1.28 |
| 12 | 0.65 | 193.71 | 672.18 | 149.13 | 318.91 | 264.07 | 251.68 | 56.79 | 14.11 | 6.17 | 2.75 | 1.42 |
| 13 | 0.57 | 555.37 | 1884.48 | 123.54 | 214.01 | 232.15 | 218.15 | 53.19 | 13.06 | 6.09 | 2.57 | 1.63 |
| 14 | 0.81 | 737.06 | 1993.67 | 102.32 | 170.00 | 199.75 | 231.20 | 47.22 | 12.35 | 5.39 | 2.43 | 1.61 |
| 15 | 2.11 | 383.16 | 1332.84 | 87.90 | 296.22 | 171.73 | 221.09 | 42.73 | 11.67 | 5.18 | 2.28 | 1.41 |
| 16 | 12.65 | 605.11 | 787.60 | 81.25 | 274.26 | 153.32 | 192.99 | 41.74 | 11.50 | 5.45 | 2.20 | 1.31 |
| 17 | 14.70 | 396.44 | 539.70 | 73.82 | 218.90 | 138.11 | 197.02 | 38.61 | 11.08 | 5.57 | 2.18 | 1.32 |
| 18 | 6.48 | 282.77 | 410.71 | 66.23 | 181.14 | 125.21 | 206.16 | 36.43 | 10.40 | 12.88 | 2.16 | 1.23 |
| 19 | 4.59 | 243.45 | 329.15 | 74.60 | 150.17 | 150.52 | 197.72 | 35.03 | 9.94 | 8.45 | 3.77 | 1.12 |
| 20 | 3.80 | 439.16 | 271.63 | 79.58 | 204.23 | 247.38 | 181.36 | 34.22 | 9.85 | 6.66 | 4.63 | 1.08 |
| 21 | 3.14 | 377.16 | 440.86 | 72.95 | 421.42 | 196.38 | 195.65 | 33.04 | 10.12 | 7.10 | 3.42 | 1.05 |
| 22 | 2.63 | 638.26 | 379.86 | 66.21 | 528.19 | 165.50 | 315.24 | 30.26 | 9.42 | 6.57 | 2.88 | 1.02 |
| 23 | 2.37 | 804.59 | 356.81 | 63.07 | 456.93 | 143.41 | 263.34 | 28.67 | 9.01 | 5.58 | 2.57 | 1.08 |
| 24 | 2.45 | 525.39 | 315.80 | 59.21 | 528.96 | 128.53 | 221.43 | | 8.78 | 5.40 | 2.24 | 1.04 |
| 25 | 2.20 | 399.57 | 1441.25 | 55.46 | 966.19 | 152.04 | 189.63 | | 8.58 | 5.33 | 2.05 | 0.96 |
| 26 | 2.06 | 445.34 | 2040.20 | 52.50 | 795.30 | 197.40 | 162.60 | | 8.17 | 5.25 | 1.95 | 0.91 |
| 27 | 1.93 | 583.86 | 1694.23 | 49.52 | 608.55 | 382.04 | 141.74 | | 7.93 | 5.16 | 1.89 | 0.84 |
| 28 | 1.65 | 481.65 | 1147.89 | 46.66 | 516.59 | 376.92 | 125.98 | | 8.94 | 4.69 | 1.77 | 1.13 |
| 29 | 1.51 | 382.24 | 802.73 | 43.92 | | 304.98 | 113.10 | | 18.59 | 4.43 | 1.65 | 1.23 |
| 30 | 1.55 | 313.69 | 626.17 | 41.51 | | 262.84 | 101.54 | | 11.17 | 4.29 | 1.49 | 2.06 |
| 31 | 1.69 | | 552.17 | 38.53 | | 230.17 | | | | 3.95 | 1.41 | |
| | | | | | | | | | | | | |
| Monthly Statistics | | | | | | | | | | | | |
| Total | 97.26 | 10,433.56 | 20,411.84 | 6,605.17 | 7,819.70 | 9,246.80 | 5,355.26 | 1,426.77 | 399.35 | 196.54 | 83.74 | 39.32 |
| Mean | 3.14 | 347.79 | 658.45 | 213.07 | 279.28 | 298.28 | 178.51 | 62.03 | 13.31 | 6.34 | 2.70 | 1.31 |
| Max | 14.70 | 804.59 | 2,040.20 | 1,052.17 | 966.19 | 610.90 | 315.24 | 114.86 | 21.11 | 12.88 | 4.63 | 2.06 |
| Min | 0.57 | 1.97 | 123.56 | 38.53 | 28.70 | 125.21 | 101.54 | 28.67 | 7.93 | 3.95 | 1.41 | 0.84 |
| Acre Feet | 192.92 | 20,694.66 | 40,486.29 | 13,101.16 | 15,510.15 | 18,340.77 | 10,622.00 | 2,829.97 | 792.10 | 389.84 | 166.09 | 77.99 |
| Total Acre Feet for WY07 | | | 123,203.94 | | | | | | | | | |

*Rainfall*

YTEP does not currently operate a rain gage at the Turwar Creek gaging station. Total rain accumulation during WY07 from CDEC's Klamath River near Klamath (Turwar) was 65.88 inches (http://cdec.water.ca.gov, Figure 18). The largest accumulation of rainfall occurred during November, when 20.2 inches was recorded. Rainfall during December totaled 12.44 inches, and February also had steady rainfall with 12.84 inches observed. (Figure 17).

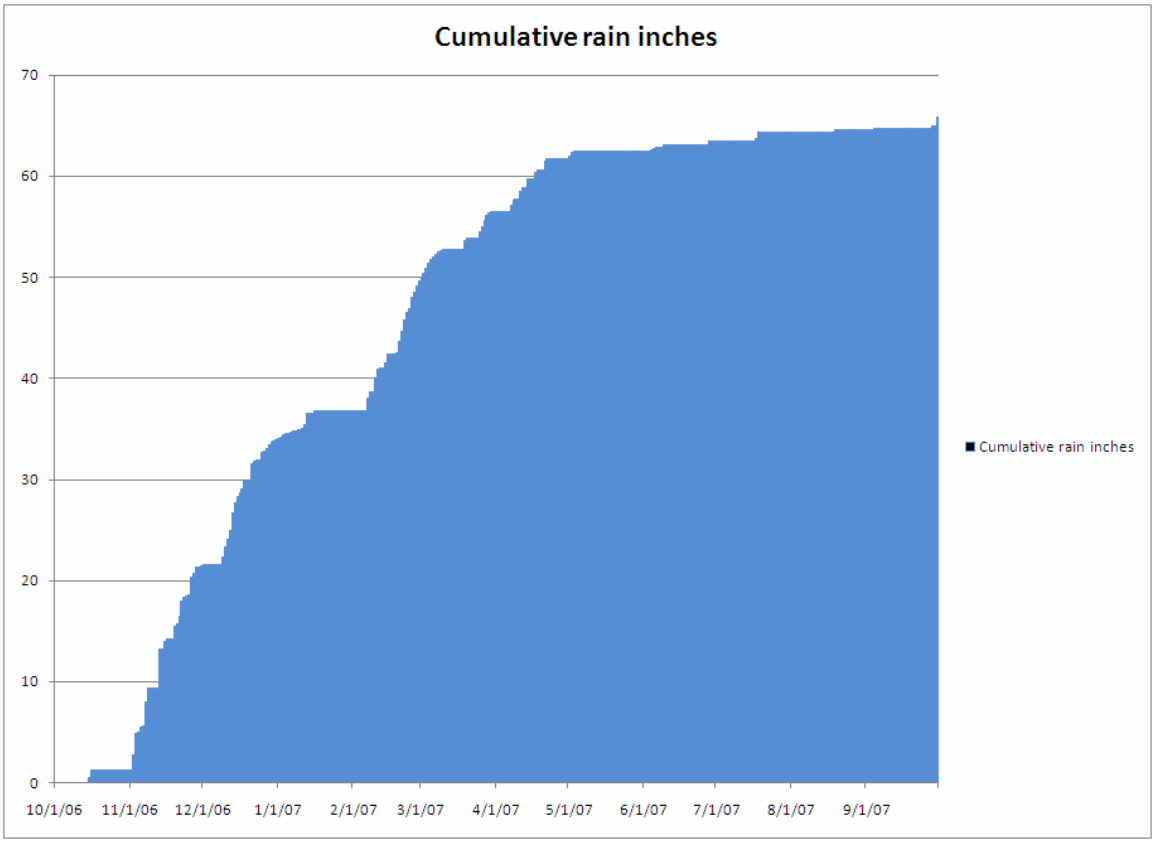


Figure 17. Cumulative rainfall recorded at CDEC's Klamath River near Klamath (Turwar) rain gage.

*Turbidity*

Turbidity peaks concurred with storm events during the water year (Figure 18). The highest turbidity measurement recorded was 374.0 NTU during a storm on 12/24/06. Turbidity also peaked during storm events on 12/13/06 (264 NTU) and 1/03/07 (114 NTU). Turbidity did not exceed 100 NTU between February and the end of the water year (Figure 18). Turbidity data recorded between 1/4/07 – 1/19/07 is missing due to the DTS-12 sensor being damaged and sent in for repairs from a winter storm

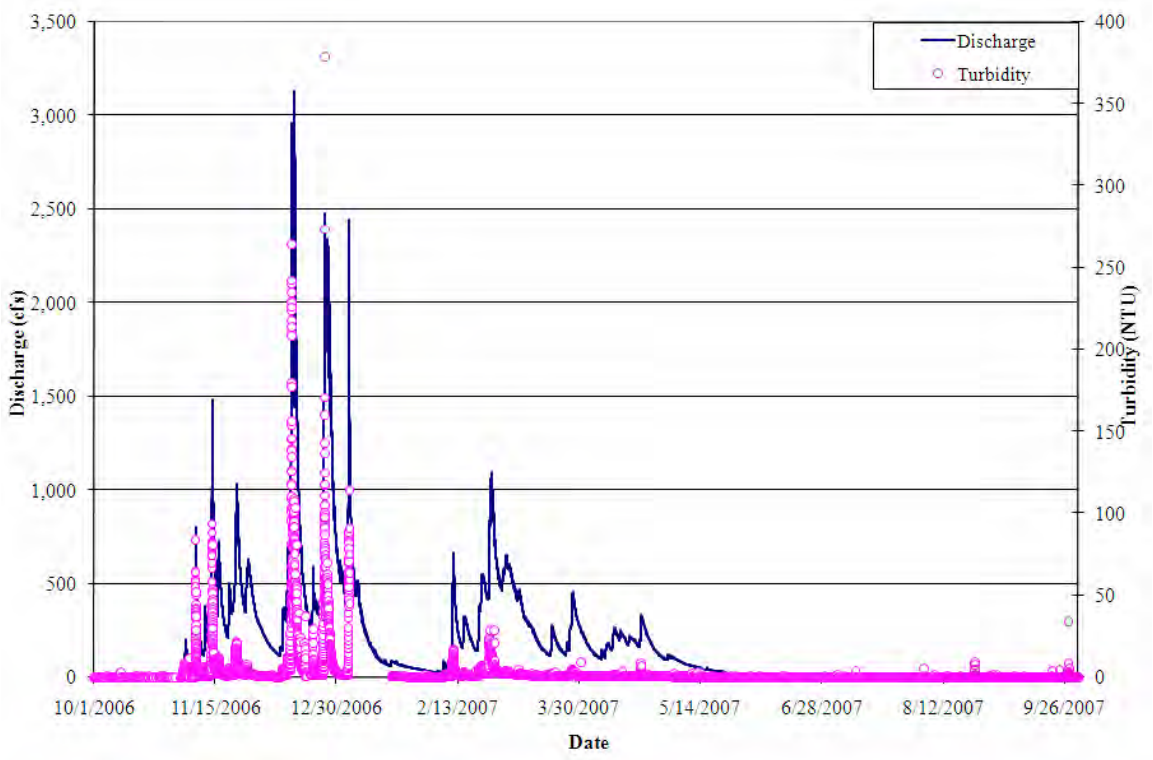


Figure 18. Turwar Creek hydrograph and turbidity data for WY07.

*Water Temperature*

Water temperature and turbidity were recorded simultaneously beginning 10/07/05. Temperatures at the beginning or the water year ranged between 9-13°C and gradually decreased between October and mid-January when temperatures dropped to 5.7°C (Figure 21). It is impossible to tell if it dropped in early January due to the DTS-12 being damaged and out for repairs from 1/4/07 - 1/19/07. Temperatures gradually rose during late February through the spring and summer months and water temperatures peaked in August (8/04/07) at 23.1°C (Figure 21).

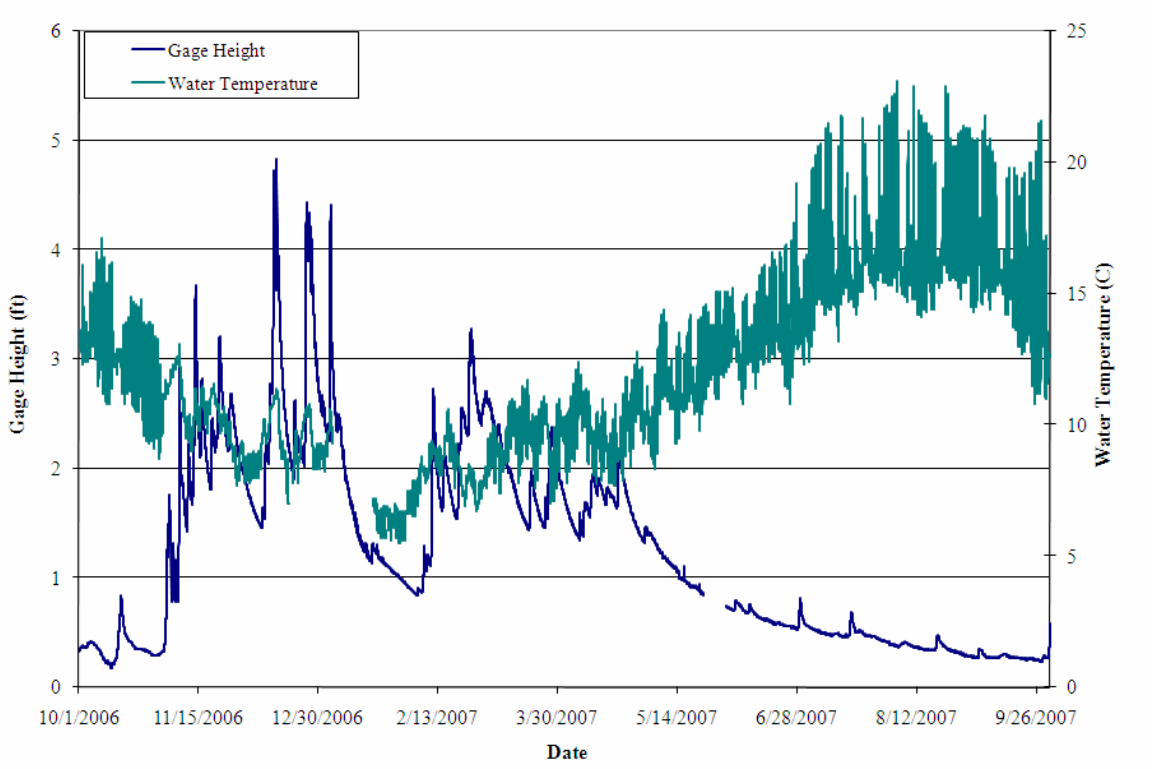


Figure 19. Turwar Creek gage height and temperature data for WY07.

*Suspended Sediment*

Suspended sediment samples were collected during two storms on 12/13/06 and 1/03/07. The storm on 12/13/06 was the first sizable storm during the water year. Two sets of samples were collected, one on the ascending, and one on the descending limb of the hydrograph. SSC ranged between 164 – 236 mg/L (Table 9). The second storm was sampled during the ascending limb of the hydrograph and SSC ranged between 197 – 266 mg/L for the sets of composite samples (Table 9). YTEP is in the process of refining our SSC collection methods which should provide a more accurate sample of storm events.

Table 9. Suspended sediment samples taken in Turwar Creek during WY07.

| SAMPLE ID | BOTTLE NUMBER | DATE | TIME | SSC (MG/L) | TURBIDITY LAB (NTU) | DTS-12 TURBIDITY (NTU) | GAGE HEIGHT | HYDROLOGICAL POSITION | DISCHARGE (CFS) |
|---|---|---|---|---|---|---|---|---|---|
| Tu_121306 | A1 | 12/13/2006 | 12:10 | 318 | 85 | 109.09 | 4.39 | F | *2680 |
| Tu_121306 | A2 | 12/13/2006 | 12:10 | | 85 | 109.09 | 4.39 | F | *2680 |
| Tu_121306 | A3 | 12/13/2006 | 12:10 | | 80 | 109.09 | 4.39 | F | *2680 |
| Tu_121306 | A4 | 12/13/2006 | 12:10 | | ISF | 109.09 | 4.39 | F | *2680 |
| Tu_121306 | B1 | 12/13/2006 | 13:00 | 299 | 75 | 103.12 | 4.26 | F | *2680 |
| Tu_121306 | B2 | 12/13/2006 | 13:00 | | 75 | 103.12 | 4.26 | F | *2680 |
| Tu_121306 | B3 | 12/13/2006 | 13:00 | | 70 | 103.12 | 4.26 | F | *2680 |
| Tu_121306 | C1 | 12/13/2006 | 13:45 | 264 | 65 | 92.58 | 4.23 | F | *2680 |
| Tu_121306 | C2 | 12/13/2006 | 13:45 | | 65 | 92.58 | 4.23 | F | *2680 |
| Tu_121306 | C3 | 12/13/2006 | 13:45 | | 65 | 92.58 | 4.23 | F | *2680 |
| Tu_121306 | D1 | 12/13/2006 | 14:30 | 307 | 60 | 87.48 | 4.2 | F | *2680 |
| Tu_121306 | D2 | 12/13/2006 | 14:30 | | 60 | 87.48 | 4.2 | F | *2680 |
| Tu_121306 | D3 | 12/13/2006 | 14:30 | | 65 | 87.48 | 4.2 | F | *2680 |
| Tu_010307 | A1 | 1/3/2007 | 13:00 | 333 | 45 | 59.14 | 3.73 | R | 1552.59 |
| Tu_010307 | A2 | 1/3/2007 | 13:00 | | 40 | 59.14 | 3.73 | R | 1552.59 |
| Tu_010307 | A3 | 1/3/2007 | 13:00 | | 40 | 59.14 | 3.73 | R | 1552.59 |
| Tu_010307 | A4 | 1/3/2007 | 13:00 | | ISF | 59.14 | 3.73 | R | 1552.59 |
| Tu_010307 | B1 | 1/3/2007 | 14:00 | 333 | 50 | 77.74 | 3.98 | R | 1851.66 |
| Tu_010307 | B2 | 1/3/2007 | 14:00 | | 55 | 77.74 | 3.98 | R | 1851.66 |
| Tu_010307 | B3 | 1/3/2007 | 14:00 | | 55 | 77.74 | 3.98 | R | 1851.66 |
| Tu_010307 | B4 | 1/3/2007 | 14:00 | | 50 | 77.74 | 3.98 | R | 1851.66 |
| Tu_010307 | C1 | 1/3/2007 | 14:45 | 425 | 65 | 84.35 | 4.16 | R | 2087.97 |
| Tu_010307 | C2 | 1/3/2007 | 14:45 | | 65 | 84.35 | 4.16 | R | 2087.97 |
| Tu_010307 | C3 | 1/3/2007 | 14:45 | | 60 | 84.35 | 4.16 | R | 2087.97 |
| Tu_010307 | C4 | 1/3/2007 | 14:45 | | 60 | 84.35 | 4.16 | R | 2087.97 |
| Tu_010307 | C5 | 1/3/2007 | 14:45 | | ISF | 84.35 | 4.16 | R | 2087.97 |

* Actual flow measurement taken

Hydrological postion R=Rising F=Falling S=Stable

**Blue Creek**

***Discharge***

The rating curve for WY07 was generated using flow measurements taken between 1/20/06 – 11/07/07 (N = 17) and produced the following formula:

$y = 8.9412x^{3.0969}$, where $y$ = discharge in cfs and $x$ = gage height

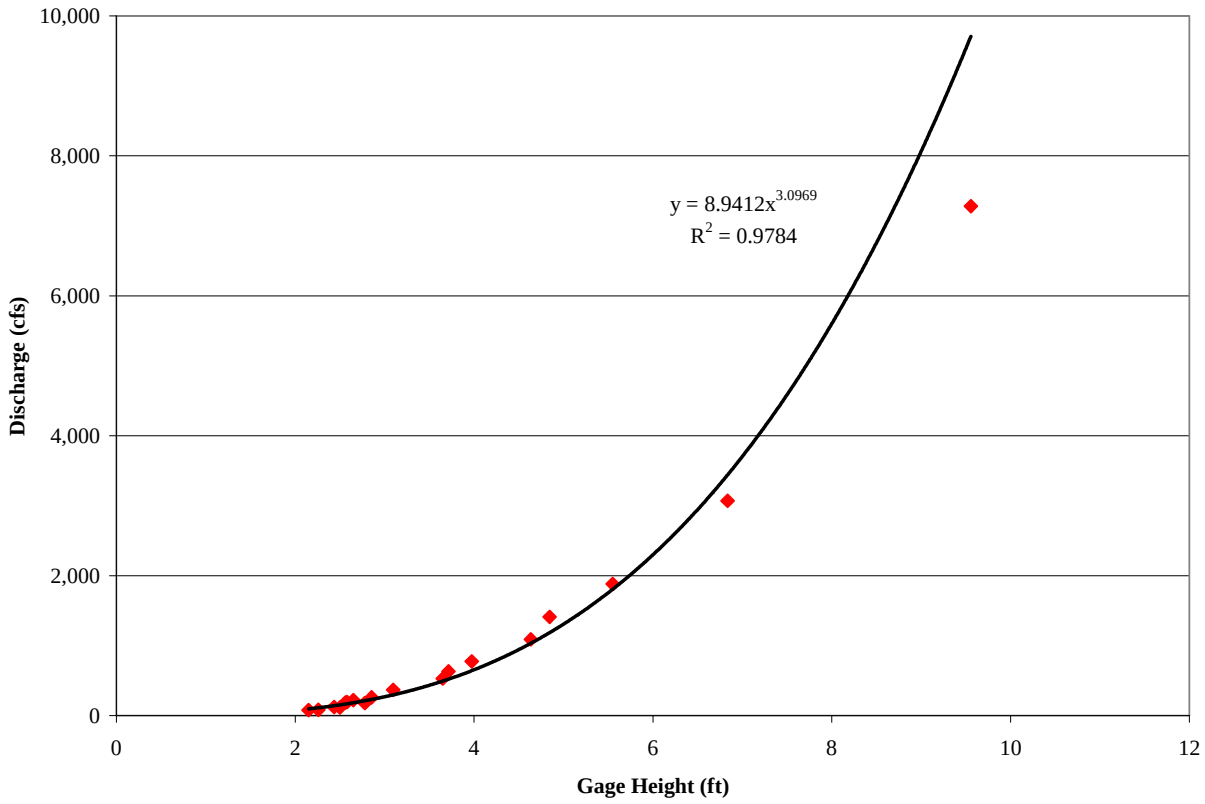


Figure 20. Discharge rating curve for Blue Creek using flow measurements taken between 1/20/06 – 11/07/07.

The highest flow measurement taken in Blue Creek during the water year was 7,280 cfs on 12/14/06, which is also the highest flow measurement on the rating curve (Figure 20, Figure 21). Several storm events exceeded measured flows, and the estimates of these discharges should be considered with caution because they are only as robust as the rating curve is (Figure 23).

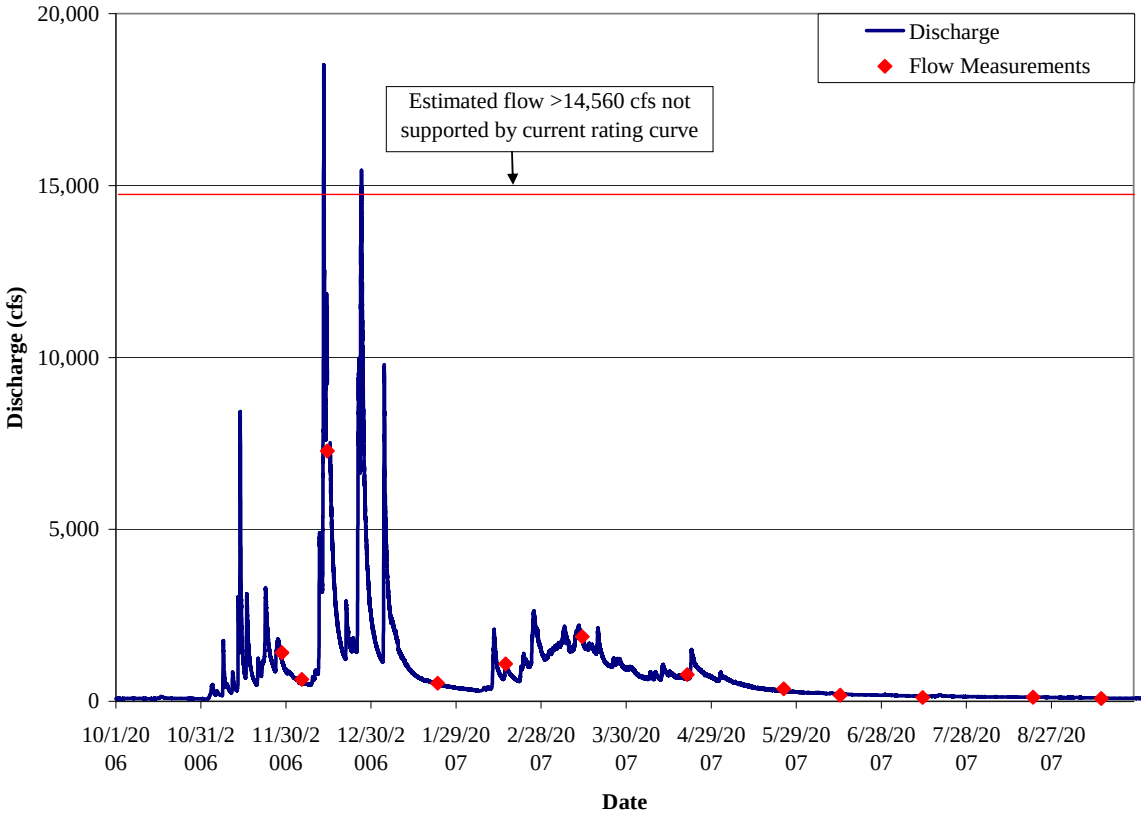


Figure 21. Blue Creek hydrograph and flow measurements for WY07.

The lowest estimated flow in Blue Creek was 67.41 cfs during the beginning of the water year on 10/31/06 (Figure 23, Table 10). October also yielded the lowest estimated acre feet discharged of any month during the water year (5,078 acre feet). Discharge was highest during December, when an estimated 184,697 acre feet were discharged from the Blue Creek watershed (Table 12). Annual total acre feet discharged from Blue Creek was estimated to be 557,176 (Table 12).

Table 10. Minimum daily discharge (cfs) values for Blue Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 77.69 | 67.41 | 766.89 | 1322.53 | 344.07 | 1203.94 | 842.63 | 590.85 | 246.97 | 170.35 | 127.72 | 104.22 |
| 2 | 77.69 | 67.41 | 669.83 | 1158.59 | 334.33 | 1266.25 | 766.89 | 680.18 | 241.77 | 166.31 | 127.72 | 104.22 |
| 3 | 77.69 | 138.05 | 614.81 | 1136.36 | 324.78 | 1363.75 | 706.52 | 659.59 | 236.64 | 164.31 | 126.05 | 104.22 |
| 4 | 78.89 | 193.77 | 522.77 | 3263.44 | 318.51 | 1466.21 | 664.70 | 614.81 | 236.64 | 162.33 | 126.05 | 104.22 |
| 5 | 80.11 | 180.74 | 514.11 | 2309.36 | 303.21 | 1519.35 | 644.43 | 581.45 | 241.77 | 160.37 | 126.05 | 107.17 |
| 6 | 81.34 | 191.56 | 492.90 | 2124.23 | 300.21 | 1573.77 | 639.43 | 540.37 | 236.64 | 158.42 | 127.72 | 104.22 |
| 7 | 82.58 | 160.37 | 484.59 | 1824.88 | 334.33 | 1648.36 | 649.45 | 522.77 | 226.61 | 156.49 | 126.05 | 104.22 |
| 8 | 81.34 | 417.70 | 464.21 | 1405.83 | 337.56 | 1676.94 | 629.50 | 488.73 | 221.70 | 152.68 | 124.40 | 102.76 |
| 9 | 78.89 | 318.51 | 497.10 | 1250.47 | 357.35 | 1466.21 | 711.87 | 468.24 | 219.28 | 150.79 | 124.40 | 101.33 |
| 10 | 77.69 | 241.77 | 629.50 | 1114.42 | 354.00 | 1440.13 | 629.50 | 444.43 | 226.61 | 148.93 | 122.76 | 101.33 |
| 11 | 77.69 | 334.33 | 783.94 | 988.76 | 1211.61 | 1466.21 | 619.68 | 425.22 | 216.87 | 148.93 | 121.14 | 99.90 |
| 12 | 76.50 | 309.27 | 3174.05 | 873.06 | 879.23 | 1824.88 | 830.66 | 417.70 | 209.75 | 150.79 | 119.53 | 101.33 |
| 13 | 76.50 | 452.27 | 4974.72 | 795.45 | 695.90 | 1835.05 | 744.55 | 388.51 | 205.10 | 147.08 | 119.53 | 91.63 |
| 14 | 77.69 | 1085.61 | 7602.24 | 733.55 | 634.45 | 1638.91 | 744.55 | 374.44 | 202.80 | 145.24 | 117.93 | 91.63 |
| 15 | 78.89 | 669.83 | 5556.59 | 674.99 | 711.87 | 1519.35 | 722.66 | 367.54 | 200.52 | 143.42 | 117.93 | 90.30 |
| 16 | 88.98 | 1151.15 | 3385.26 | 634.45 | 807.08 | 1492.62 | 669.83 | 354.00 | 198.25 | 143.42 | 117.93 | 90.30 |
| 17 | 102.76 | 795.45 | 2369.38 | 595.59 | 706.52 | 1546.40 | 669.83 | 344.07 | 193.77 | 143.42 | 116.35 | 90.30 |
| 18 | 88.98 | 562.94 | 1754.79 | 576.78 | 634.45 | 1422.91 | 674.99 | 331.12 | 191.56 | 160.37 | 116.35 | 88.98 |
| 19 | 85.10 | 472.29 | 1405.83 | 553.84 | 586.14 | 1372.10 | 644.43 | 324.78 | 189.36 | 154.58 | 117.93 | 88.98 |
| 20 | 82.58 | 739.04 | 1227.06 | 531.52 | 576.78 | 1483.78 | 634.45 | 321.63 | 187.18 | 148.93 | 129.41 | 87.67 |
| 21 | 81.34 | 728.09 | 1219.32 | 501.31 | 923.28 | 1219.32 | 659.59 | 312.33 | 185.02 | 147.08 | 121.14 | 86.38 |
| 22 | 80.11 | 1136.36 | 1466.21 | 480.46 | 1107.17 | 1099.95 | 1173.58 | 303.21 | 182.87 | 143.42 | 117.93 | 86.38 |
| 23 | 80.11 | 1564.61 | 1440.13 | 464.21 | 982.07 | 1022.65 | 982.07 | 294.27 | 182.87 | 141.61 | 114.78 | 86.38 |
| 24 | 80.11 | 1151.15 | 1431.50 | 444.43 | 1009.00 | 988.76 | 891.67 | 288.41 | 182.87 | 139.82 | 113.23 | 85.10 |
| 25 | 78.89 | 904.22 | 1474.98 | 429.01 | 1970.71 | 1009.00 | 836.63 | 282.63 | 180.74 | 138.05 | 111.70 | 83.83 |
| 26 | 77.69 | 854.72 | 6634.04 | 410.26 | 1744.93 | 1057.31 | 750.10 | 276.93 | 176.54 | 136.29 | 110.17 | 83.83 |
| 27 | 77.69 | 1440.13 | 5407.03 | 395.67 | 1492.62 | 1092.77 | 728.09 | 274.11 | 174.46 | 136.29 | 110.17 | 82.58 |
| 28 | 77.69 | 1043.35 | 3462.95 | 384.96 | 1274.19 | 975.42 | 690.64 | 265.77 | 174.46 | 132.82 | 108.66 | 82.58 |
| 29 | 76.50 | 873.06 | 2467.60 | 374.44 | | 916.90 | 644.43 | 260.30 | 185.02 | 132.82 | 107.17 | 86.38 |
| 30 | 76.50 | 801.25 | 1928.27 | 364.13 | | 904.22 | 600.36 | 254.91 | 174.46 | 131.10 | 105.69 | 86.38 |
| 31 | 67.41 | | 1555.48 | 357.35 | | 929.69 | | 249.60 | | 129.41 | 105.69 | |
| | | | | | | | | | | | | |
| **Monthly Statistics** | | | | | | | | | | | | |
| Mean | 80.12 | 634.88 | 2141.23 | 918.53 | 759.16 | 1336.87 | 726.59 | 396.87 | 204.30 | 147.93 | 118.69 | 93.62 |
| Max | 102.76 | 1564.61 | 7602.24 | 3263.44 | 1970.71 | 1835.05 | 1173.58 | 680.18 | 246.97 | 170.35 | 129.41 | 107.17 |
| Min | 67.41 | 67.41 | 464.21 | 357.35 | 300.21 | 904.22 | 600.36 | 249.60 | 174.46 | 129.41 | 105.69 | 82.58 |

Table 11. Maximum daily discharge (cfs) values for Blue Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 78.89 | 68.51 | 873.06 | 1592.20 | 367.54 | 1298.21 | 988.76 | 685.39 | 254.91 | 176.54 | 131.10 | 110.17 |
| 2 | 78.89 | 134.55 | 778.23 | 1338.91 | 357.35 | 1474.98 | 897.93 | 848.66 | 252.24 | 172.40 | 132.82 | 108.66 |
| 3 | 78.89 | 452.27 | 690.64 | 9785.58 | 347.36 | 1510.40 | 801.25 | 728.09 | 249.60 | 168.32 | 131.10 | 108.66 |
| 4 | 81.34 | 488.73 | 624.58 | 5999.31 | 334.33 | 1620.12 | 739.04 | 695.90 | 249.60 | 166.31 | 129.41 | 111.70 |
| 5 | 82.58 | 303.21 | 540.37 | 3354.53 | 331.12 | 1657.85 | 722.66 | 639.43 | 254.91 | 164.31 | 129.41 | 111.70 |
| 6 | 86.38 | 241.77 | 531.52 | 2418.15 | 303.21 | 1705.86 | 706.52 | 605.15 | 254.91 | 162.33 | 129.41 | 108.66 |
| 7 | 85.10 | 1764.69 | 518.43 | 2169.53 | 399.28 | 2079.57 | 860.80 | 576.78 | 244.36 | 160.37 | 131.10 | 107.17 |
| 8 | 82.58 | 1555.48 | 497.10 | 1886.45 | 402.92 | 2180.96 | 750.10 | 535.94 | 229.09 | 158.42 | 129.41 | 105.69 |
| 9 | 81.34 | 501.31 | 706.52 | 1483.78 | 417.70 | 1886.45 | 860.80 | 540.37 | 229.09 | 158.42 | 127.72 | 105.69 |
| 10 | 78.89 | 321.63 | 904.22 | 1298.21 | 1143.74 | 1592.20 | 739.04 | 505.56 | 241.77 | 154.58 | 127.72 | 104.22 |
| 11 | 78.89 | 854.72 | 4895.13 | 1143.74 | 2090.67 | 1845.25 | 1057.31 | 480.46 | 226.61 | 152.68 | 126.05 | 104.22 |
| 12 | 77.69 | 436.67 | 4994.76 | 1022.65 | 1314.39 | 2079.57 | 1071.40 | 460.21 | 216.87 | 154.58 | 126.05 | 107.17 |
| 13 | 78.89 | 8430.97 | 18513.28 | 897.93 | 897.93 | 2203.94 | 873.06 | 448.34 | 212.11 | 152.68 | 124.40 | 105.69 |
| 14 | 78.89 | 5999.31 | 11847.06 | 807.08 | 722.66 | 1992.16 | 873.06 | 417.70 | 209.75 | 148.93 | 122.76 | 92.97 |
| 15 | 88.98 | 1085.61 | 7522.53 | 739.04 | 1064.34 | 1764.69 | 818.81 | 402.92 | 205.10 | 147.08 | 121.14 | 91.63 |
| 16 | 141.61 | 3129.98 | 5665.12 | 690.64 | 962.20 | 1686.54 | 750.10 | 392.08 | 202.80 | 147.08 | 121.14 | 91.63 |
| 17 | 138.05 | 1440.13 | 3638.08 | 654.51 | 807.08 | 1676.94 | 772.55 | 377.93 | 202.80 | 158.42 | 121.14 | 91.63 |
| 18 | 102.76 | 789.68 | 2393.68 | 619.68 | 717.25 | 1657.85 | 755.67 | 367.54 | 196.00 | 187.18 | 119.53 | 91.63 |
| 19 | 88.98 | 722.66 | 1814.75 | 605.15 | 639.43 | 2124.23 | 711.87 | 354.00 | 193.77 | 174.46 | 158.42 | 90.30 |
| 20 | 86.38 | 1250.47 | 1448.79 | 572.14 | 1015.81 | 2146.80 | 695.90 | 350.67 | 193.77 | 154.58 | 156.49 | 88.98 |
| 21 | 83.83 | 1181.12 | 2915.83 | 540.37 | 1388.90 | 1519.35 | 1466.21 | 350.67 | 191.56 | 148.93 | 129.41 | 88.98 |
| 22 | 81.34 | 3308.77 | 2068.50 | 514.11 | 1314.39 | 1242.63 | 1510.40 | 318.51 | 189.36 | 148.93 | 124.40 | 87.67 |
| 23 | 81.34 | 2957.84 | 1845.25 | 492.90 | 1136.36 | 1129.01 | 1188.69 | 324.78 | 187.18 | 145.24 | 119.53 | 87.67 |
| 24 | 80.11 | 1601.47 | 1715.57 | 472.29 | 2024.64 | 1064.34 | 1015.81 | 300.21 | 189.36 | 143.42 | 116.35 | 86.38 |
| 25 | 80.11 | 1151.15 | 9944.62 | 452.27 | 2633.02 | 1258.34 | 942.60 | 294.27 | 187.18 | 143.42 | 114.78 | 86.38 |
| 26 | 78.89 | 1725.32 | 15440.33 | 436.67 | 2203.94 | 1242.63 | 860.80 | 288.41 | 185.02 | 139.82 | 113.23 | 85.10 |
| 27 | 78.89 | 1814.75 | 10766.10 | 425.22 | 1845.25 | 1242.63 | 801.25 | 282.63 | 180.74 | 139.82 | 113.23 | 83.83 |
| 28 | 78.89 | 1448.79 | 5599.83 | 410.26 | 1501.49 | 1166.07 | 772.55 | 279.77 | 189.36 | 138.05 | 111.70 | 87.67 |
| 29 | 77.69 | 1099.95 | 3557.75 | 395.67 | | 1015.81 | 728.09 | 271.31 | 200.52 | 136.29 | 110.17 | 88.98 |
| 30 | 77.69 | 929.69 | 2517.72 | 384.96 | | 988.76 | 680.18 | 265.77 | 185.02 | 134.55 | 108.66 | 122.76 |
| 31 | 78.89 | | 1981.42 | 374.44 | | 1015.81 | | 260.30 | | 132.82 | 108.66 | |
| | | | | | | | | | | | | |
| Monthly Statistics | | | | | | | | | | | | |
| Mean | 85.60 | 1573.04 | 4120.99 | 1418.66 | 1024.44 | 1582.90 | 880.44 | 440.31 | 213.51 | 153.90 | 124.72 | 98.12 |
| Max | 141.61 | 8430.97 | 18513.28 | 9785.58 | 2633.02 | 2203.94 | 1510.40 | 848.66 | 254.91 | 187.18 | 158.42 | 122.76 |
| Min | 77.69 | 68.51 | 497.10 | 374.44 | 303.21 | 988.76 | 680.18 | 260.30 | 180.74 | 132.82 | 108.66 | 83.83 |

Table 12. Average daily discharge (cfs) value for Blue Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 77.95 | 68.20 | 811.28 | 1447.07 | 354.56 | 1242.22 | 913.26 | 616.38 | 251.77 | 173.55 | 129.83 | 106.33 |
| 2 | 78.21 | 80.61 | 720.51 | 1239.62 | 345.27 | 1346.38 | 813.79 | 760.16 | 247.40 | 169.61 | 130.04 | 107.32 |
| 3 | 78.47 | 272.53 | 648.93 | 3952.58 | 336.61 | 1425.86 | 743.92 | 697.39 | 242.76 | 166.75 | 129.05 | 107.01 |
| 4 | 79.74 | 316.09 | 577.02 | 4299.89 | 327.64 | 1533.11 | 704.80 | 652.14 | 242.33 | 164.98 | 128.23 | 109.07 |
| 5 | 81.85 | 238.74 | 527.13 | 2779.14 | 316.15 | 1584.31 | 681.86 | 612.54 | 247.68 | 163.03 | 127.90 | 109.70 |
| 6 | 83.27 | 205.65 | 519.96 | 2303.42 | 302.53 | 1641.57 | 668.76 | 564.04 | 245.91 | 160.51 | 128.84 | 106.95 |
| 7 | 84.06 | 352.89 | 501.84 | 2000.25 | 376.49 | 1806.15 | 749.34 | 541.44 | 234.37 | 158.48 | 129.25 | 105.16 |
| 8 | 82.16 | 666.40 | 484.24 | 1637.73 | 363.95 | 1954.17 | 680.45 | 515.19 | 225.40 | 156.61 | 127.77 | 104.74 |
| 9 | 80.26 | 417.42 | 621.98 | 1361.67 | 392.98 | 1675.35 | 783.17 | 505.96 | 222.11 | 153.96 | 126.26 | 103.57 |
| 10 | 78.58 | 272.16 | 827.81 | 1216.02 | 462.12 | 1502.70 | 683.11 | 476.83 | 234.74 | 151.83 | 124.93 | 102.83 |
| 11 | 77.89 | 582.13 | 1559.42 | 1055.27 | 1641.76 | 1586.62 | 789.03 | 458.88 | 221.37 | 151.11 | 123.56 | 102.57 |
| 12 | 77.58 | 352.96 | 3905.51 | 934.79 | 1034.76 | 1937.06 | 930.96 | 441.79 | 214.78 | 152.99 | 122.90 | 103.32 |
| 13 | 77.63 | 2674.42 | 10500.49 | 841.07 | 779.72 | 2030.20 | 806.71 | 410.11 | 210.10 | 151.07 | 121.71 | 98.91 |
| 14 | 78.03 | 2227.56 | 9775.21 | 769.89 | 672.09 | 1810.76 | 816.11 | 389.36 | 206.02 | 147.65 | 120.70 | 91.98 |
| 15 | 81.50 | 816.42 | 6492.59 | 708.19 | 936.40 | 1596.06 | 768.89 | 378.36 | 202.68 | 145.11 | 119.81 | 91.28 |
| 16 | 108.88 | 2113.12 | 4381.42 | 665.02 | 869.47 | 1566.32 | 710.31 | 369.22 | 200.68 | 144.86 | 119.08 | 90.35 |
| 17 | 120.97 | 1039.02 | 2854.01 | 621.67 | 755.49 | 1610.48 | 717.31 | 354.98 | 197.50 | 146.58 | 118.69 | 90.72 |
| 18 | 94.66 | 662.25 | 2053.47 | 600.11 | 674.61 | 1507.99 | 705.41 | 343.18 | 194.44 | 180.32 | 118.69 | 90.03 |
| 19 | 87.36 | 526.18 | 1603.60 | 581.01 | 611.93 | 1532.08 | 680.78 | 334.10 | 191.79 | 162.03 | 134.87 | 89.17 |
| 20 | 84.74 | 988.97 | 1322.36 | 550.36 | 687.40 | 1740.83 | 668.97 | 329.33 | 190.75 | 151.30 | 142.36 | 88.59 |
| 21 | 82.44 | 904.62 | 2099.14 | 522.09 | 1098.30 | 1348.54 | 829.86 | 324.12 | 189.59 | 148.27 | 124.61 | 87.33 |
| 22 | 81.08 | 1782.42 | 1680.34 | 498.19 | 1198.76 | 1152.54 | 1325.85 | 310.61 | 186.48 | 146.21 | 120.25 | 86.42 |
| 23 | 80.15 | 2125.28 | 1622.75 | 476.83 | 1037.43 | 1068.16 | 1051.70 | 304.28 | 184.59 | 143.40 | 117.34 | 86.58 |
| 24 | 80.11 | 1339.17 | 1536.78 | 459.75 | 1267.73 | 1027.37 | 951.01 | 295.03 | 185.87 | 142.29 | 115.11 | 86.02 |
| 25 | 79.50 | 1024.36 | 5477.24 | 442.28 | 2366.11 | 1133.75 | 882.20 | 289.54 | 183.76 | 140.90 | 113.33 | 84.98 |
| 26 | 78.80 | 1204.74 | 11188.87 | 427.23 | 1983.99 | 1144.51 | 805.74 | 284.52 | 181.38 | 139.06 | 112.14 | 84.61 |
| 27 | 78.23 | 1649.25 | 7562.32 | 412.08 | 1639.80 | 1174.60 | 761.62 | 279.71 | 178.28 | 137.50 | 111.46 | 83.66 |
| 28 | 77.71 | 1220.52 | 4375.11 | 397.96 | 1363.32 | 1055.49 | 729.91 | 273.00 | 177.25 | 135.63 | 110.42 | 85.50 |
| 29 | 77.60 | 962.48 | 2942.92 | 385.10 | | 964.53 | 684.31 | 265.88 | 192.89 | 134.35 | 108.96 | 87.48 |
| 30 | 77.60 | 844.32 | 2189.79 | 374.41 | | 944.09 | 641.09 | 260.41 | 179.90 | 133.75 | 107.43 | 93.06 |
| 31 | 73.26 | | 1753.86 | 364.66 | | 971.34 | | 256.08 | | 132.10 | 106.66 | |
| | | | | | | | | | | | | |
| **Monthly Statistics** | | | | | | | | | | | | |
| **Total** | 2560.28 | 27,930.86 | 93,117.90 | 34,325.35 | 24,197.38 | 44,615.14 | 23,680.20 | 12,894.56 | 6,264.58 | 4,685.81 | 3,772.19 | 2,865.24 |
| **Mean** | 82.59 | 931.03 | 3,003.80 | 1,107.27 | 864.19 | 1,439.20 | 789.34 | 415.95 | 208.82 | 151.16 | 121.68 | 95.51 |
| **Max** | 120.97 | 2,674.42 | 11,188.87 | 4,299.89 | 2,366.11 | 2,030.20 | 1,325.85 | 760.16 | 251.77 | 180.32 | 142.36 | 109.70 |
| **Min** | 73.26 | 68.20 | 484.24 | 364.66 | 302.53 | 944.09 | 641.09 | 256.08 | 177.25 | 132.10 | 106.66 | 83.66 |
| **Acre Feet** | 5078.23 | 55,400.06 | 184,696.65 | 68,083.34 | 47,994.80 | 88,492.83 | 46,968.99 | 25,575.99 | 12,425.62 | 9,294.17 | 7,482.03 | 5,683.13 |
| **Total Acre Feet for WY07** | | | 557,175.84 | | | | | | | | | |

*Rainfall*

The Blue Creek rain gage was installed on 10/25/05 at the gaging station. Cumulative rainfall at Blue Creek during the water year was 85.94 inches. November and December were the wettest months, with 22.06 inches of rain falling in November and 20.66 in December. This is a little different then past water years where December and January were typically the wettest months. Although March had the second highest average monthly discharge there was only 6.03 inches of rain for the entire month. This could be attributed to the snow melt coming through the watershed. The wettest day of the water year was 12/25/07 when 4.4 inches of rain was recorded (Figure 24).

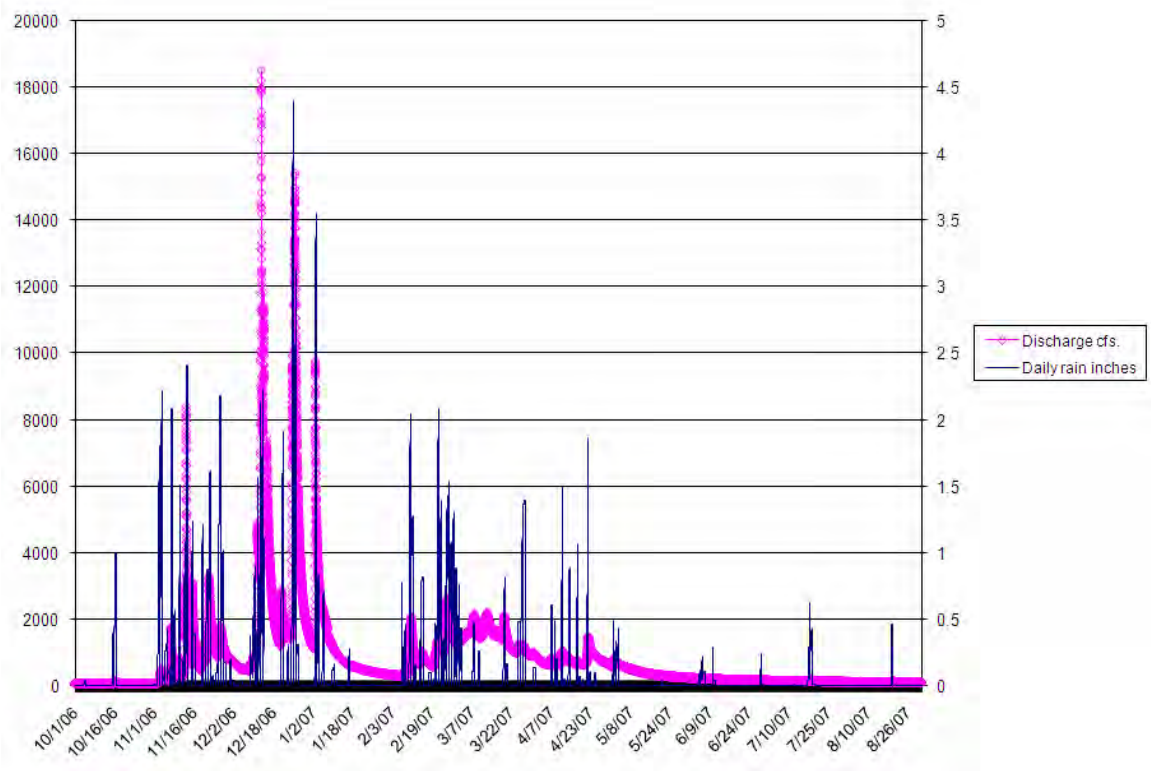


Figure 22. Blue Creek hydrograph and daily rainfall for WY07.

*Turbidity*

Turbidity is hard to analyze this year due to the fact that during the two of the biggest storms of the year we experienced machine malfunction and were unable to capture accurate turbidity readings. The rain on 12/13/06 was 2.23 inches in 24 hours and the storm on 12/25/06 and 12/26/06 was 7.53 inches. Both storms show a rapid increase in discharge but the corresponding data for turbidity cannot be trusted. (Figure 23)

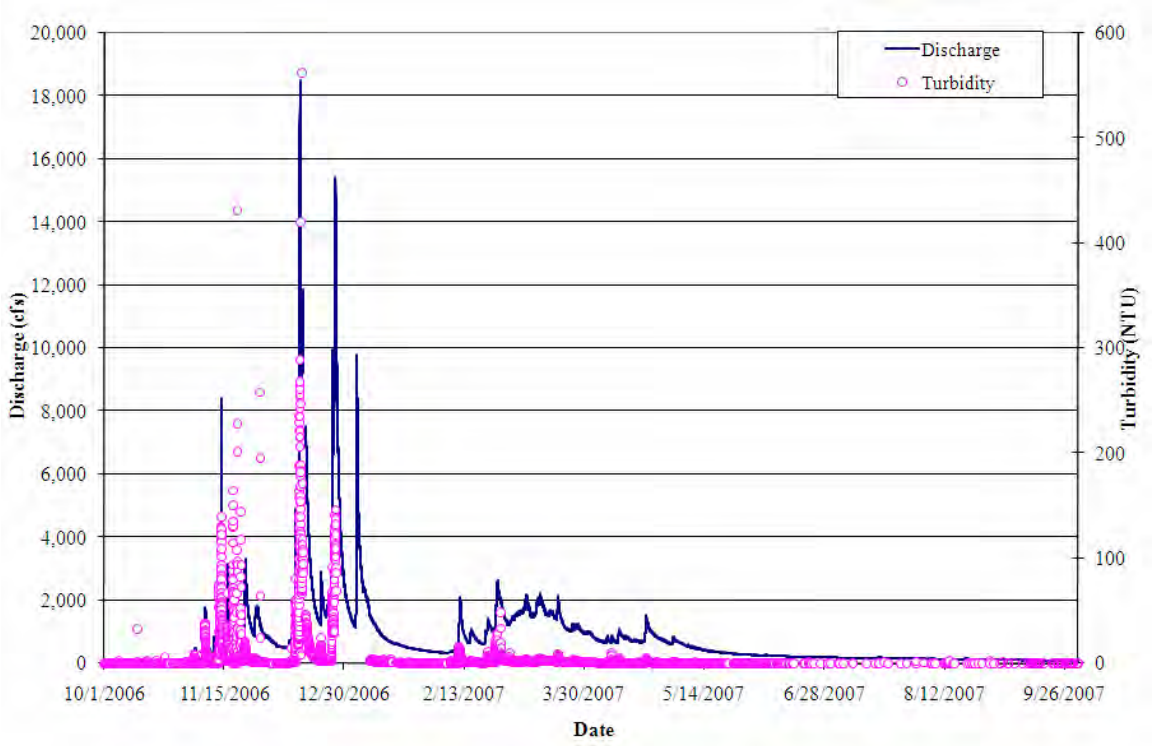


Figure 23. Blue Creek discharge and turbidity values WY 07.

*Water Temperature*

Water temperature in Blue Creek ranged widely from 4.6°C on 1/13/2007 to a high of 20°C on 8/2/2007 and 8/30/2007. Temperatures began to gradually decline at the beginning of October all the way into January when temperatures began to slowly and gradually rise again. (Figure 24)Data is missing sporadically in December and January due to the DTS-12 probe being out of the water and on 12/13/2006 the data cable to the DTS-12 sheared off, but was repaired on 12/15/2006 (Figure 24).

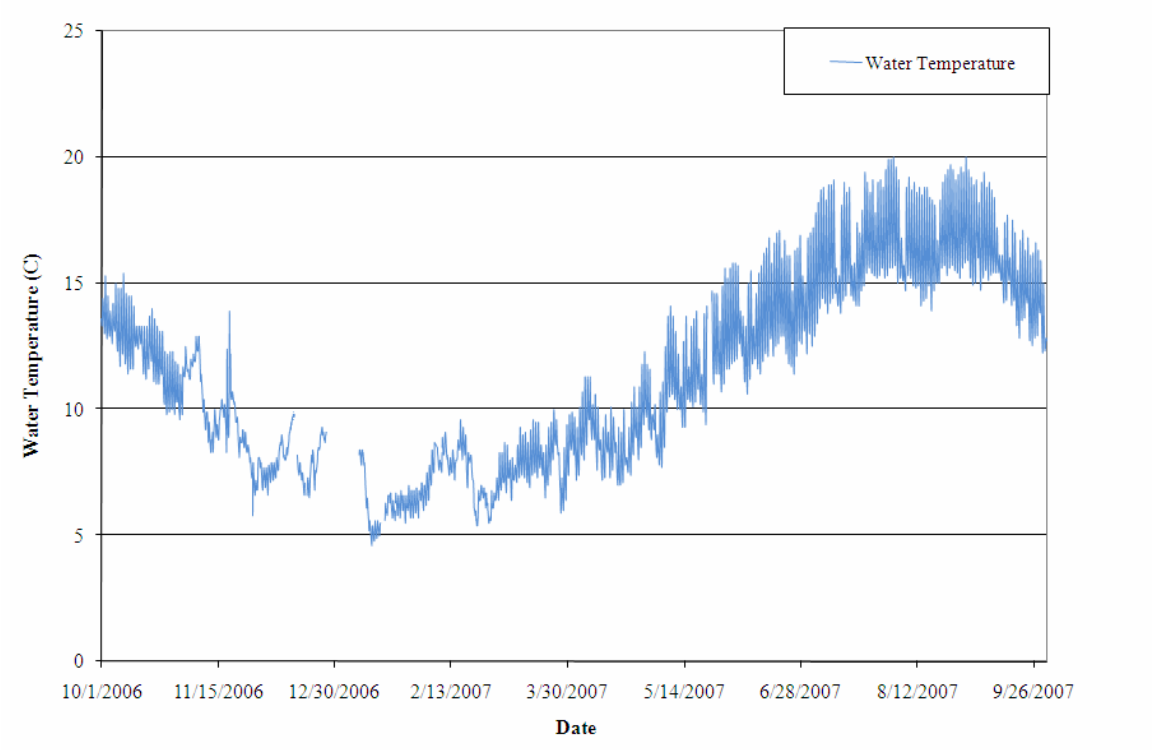


Figure 24. Blue Creek water temperature values WY 07.

*Suspended Sediment*

No suspended sediment samples were collected from Blue Creek during WY07.

**Tully Creek**

***Discharge***

The rating curve for WY07 was generated using flow measurements taken between 7/08/05 – 9/4/07 (N = 13). Flow measurements that create the curve range between 1.47 – 274 cfs and include stage heights between 3.9 – 6.5 ft. The rating curve produced the following formula (Figure 26)

$y = 36.689x^2 - 274.32x + 513.66$, where $y$ = discharge in cfs and $x$ = gage height

Since very few flow measurements have been taken in Tully Creek, and even fewer during major storm events, a reliable rating curve was generated using a polynomial curve instead of a power curve like all of the other tributary sites(Figure 25). The largest peak in the hydrograph occurred on 12/26/06(1584 cfs.) This estimated flow cannot be completely trusted since it exceeds our highest measured flow by more than 100% (Figure 26).

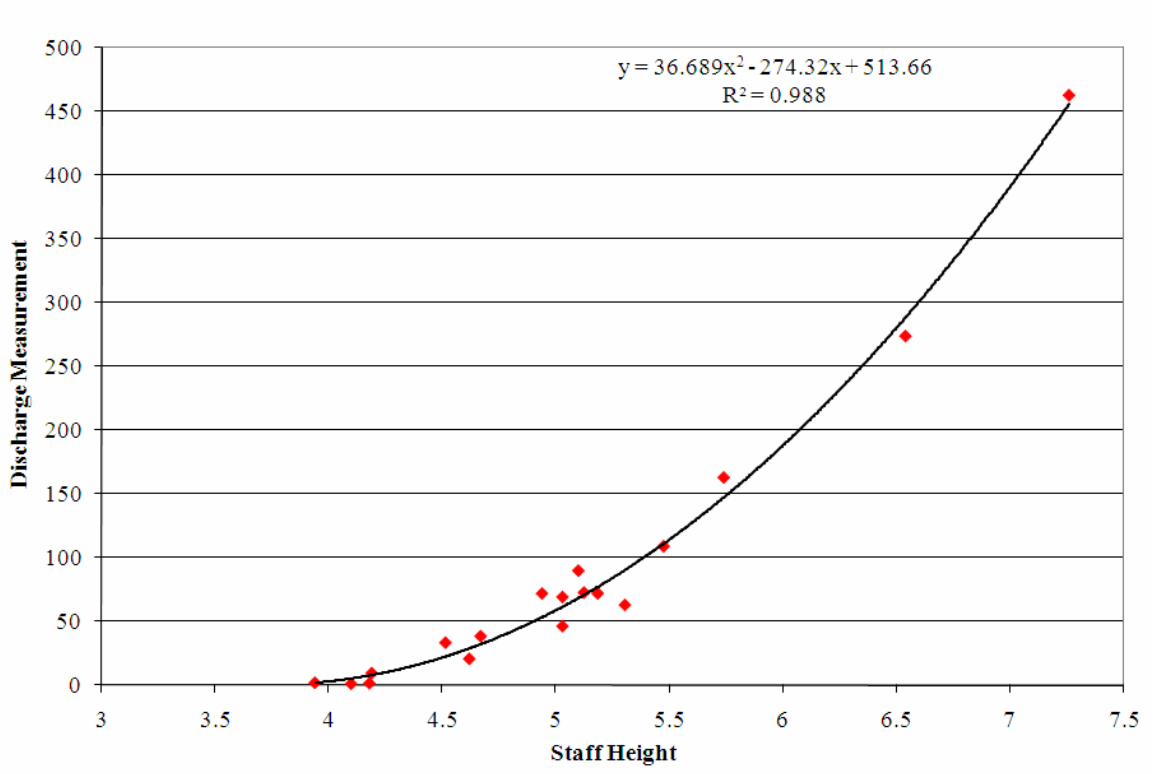


Figure 25. Discharge rating curve for Tully Creek using flow measurements taken between 7/08/05 – 9/4/07.

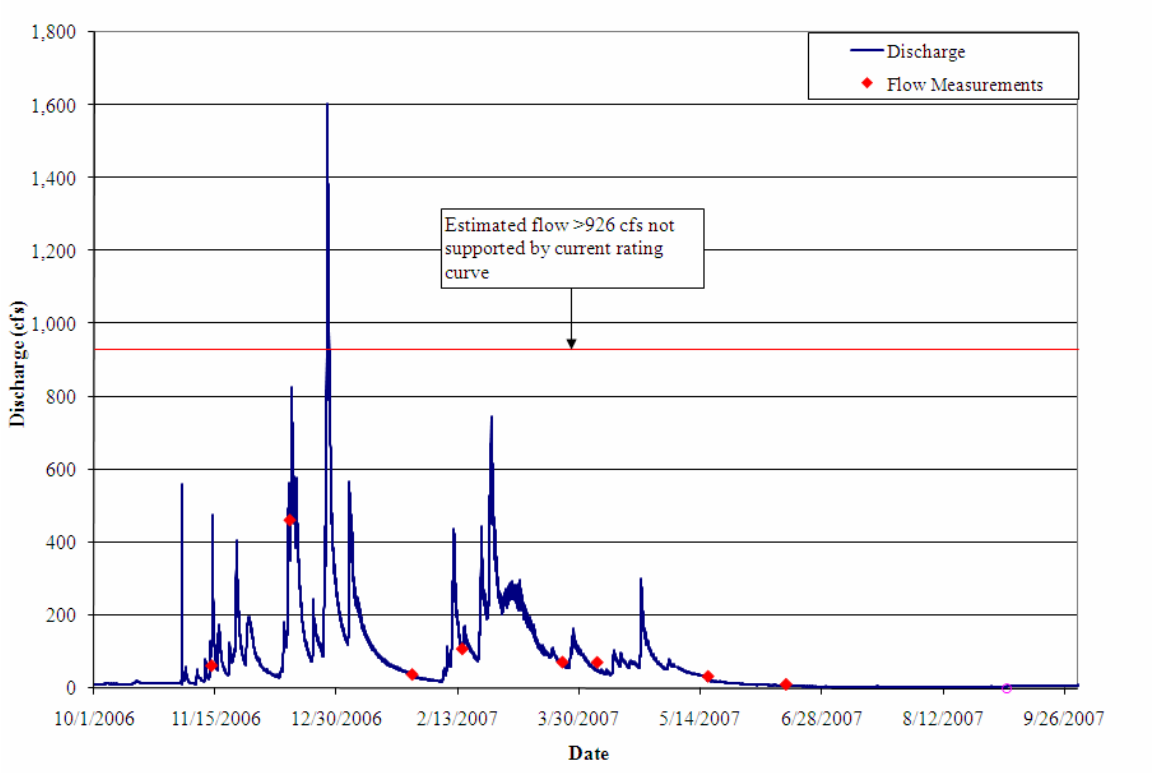


Figure 26. Tully Creek gage height during WY07.

Table 13. Minimum daily discharge for Tully Creek WY07

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.05 | 13.73 | 64.01 | 143.50 | 23.30 | 205.51 | 71.94 | 52.98 | 8.71 | 2.38 | 0.90 | 1.08 |
| 2 | 9.76 | 8.71 | 52.98 | 122.63 | 23.30 | 230.48 | 64.01 | 64.97 | 8.37 | 2.24 | 0.92 | 1.03 |
| 3 | 10.12 | 21.07 | 48.70 | 123.97 | 21.62 | 221.40 | 58.36 | 62.10 | 8.05 | 2.10 | 0.95 | 1.08 |
| 4 | 10.87 | 20.53 | 43.81 | 344.78 | 21.07 | 243.51 | 51.25 | 61.15 | 8.05 | 1.97 | 0.98 | 1.08 |
| 5 | 11.65 | 14.17 | 38.44 | 228.65 | 19.47 | 245.40 | 48.70 | 56.54 | 9.05 | 1.85 | 0.98 | 5.96 |
| 6 | 11.65 | 12.46 | 34.82 | 210.74 | 19.47 | 223.20 | 43.81 | 52.11 | 9.40 | 1.63 | 0.95 | 5.69 |
| 7 | 11.65 | 11.26 | 33.42 | 186.89 | 19.47 | 216.03 | 43.02 | 48.70 | 8.05 | 1.53 | 0.92 | 5.43 |
| 8 | 11.65 | 26.88 | 30.71 | 158.34 | 35.53 | 214.26 | 40.70 | 44.61 | 7.41 | 1.44 | 0.95 | 5.43 |
| 9 | 11.26 | 23.30 | 36.97 | 142.06 | 61.15 | 190.21 | 41.46 | 43.02 | 7.41 | 1.27 | 0.95 | 5.43 |
| 10 | 10.50 | 18.44 | 49.55 | 126.67 | 61.15 | 170.73 | 36.24 | 40.70 | 7.73 | 1.20 | 0.98 | 5.43 |
| 11 | 10.12 | 26.88 | 114.74 | 113.45 | 237.89 | 164.48 | 39.93 | 38.44 | 6.81 | 1.20 | 1.02 | 5.43 |
| 12 | 10.12 | 26.26 | 349.29 | 102.18 | 178.72 | 153.81 | 78.20 | 38.44 | 6.24 | 1.44 | 1.07 | 5.43 |
| 13 | 10.50 | 46.23 | 432.93 | 92.66 | 121.30 | 130.78 | 61.15 | 35.53 | 5.69 | 1.35 | 1.07 | 5.69 |
| 14 | 10.50 | 91.51 | 384.03 | 86.95 | 107.12 | 110.90 | 63.05 | 34.11 | 5.17 | 1.20 | 1.12 | 5.96 |
| 15 | 10.87 | 50.39 | 329.24 | 77.14 | 118.65 | 103.41 | 69.91 | 32.73 | 5.17 | 1.14 | 1.12 | 5.69 |
| 16 | 15.07 | 91.51 | 216.03 | 72.96 | 116.04 | 97.37 | 59.29 | 21.07 | 4.93 | 1.14 | 1.12 | 5.69 |
| 17 | 15.53 | 60.21 | 142.06 | 65.94 | 102.18 | 92.66 | 57.45 | 20.00 | 4.69 | 1.14 | 1.18 | 5.69 |
| 18 | 14.17 | 42.24 | 113.45 | 62.10 | 86.95 | 86.95 | 67.91 | 18.44 | 4.23 | 2.24 | 1.18 | 5.69 |
| 19 | 13.73 | 35.53 | 90.36 | 60.21 | 81.43 | 84.72 | 64.97 | 18.44 | 4.01 | 1.85 | 1.18 | 5.69 |
| 20 | 13.73 | 56.54 | 75.04 | 56.54 | 75.04 | 91.51 | 59.29 | 18.44 | 3.80 | 1.53 | 1.02 | 5.96 |
| 21 | 13.30 | 71.94 | 78.20 | 52.98 | 146.41 | 79.27 | 57.45 | 16.95 | 3.80 | 1.35 | 1.07 | 5.69 |
| 22 | 12.88 | 99.76 | 132.17 | 49.55 | 225.01 | 71.94 | 158.34 | 15.99 | 3.60 | 1.27 | 1.12 | 5.43 |
| 23 | 12.88 | 155.31 | 112.17 | 45.41 | 191.88 | 63.05 | 121.30 | 14.62 | 3.60 | 1.20 | 1.18 | 5.43 |
| 24 | 12.88 | 95.00 | 88.08 | 44.61 | 196.93 | 59.29 | 109.63 | 13.73 | 3.60 | 1.14 | 1.33 | 5.17 |
| 25 | 12.88 | 68.91 | 90.36 | 42.24 | 466.28 | 58.36 | 90.36 | 12.88 | 3.22 | 1.03 | 1.41 | 5.17 |
| 26 | 12.88 | 64.97 | 335.86 | 32.05 | 335.86 | 58.36 | 80.34 | 12.46 | 3.03 | 1.03 | 1.41 | 5.17 |
| 27 | 12.88 | 175.50 | 476.79 | 31.38 | 262.75 | 97.37 | 71.94 | 12.46 | 2.86 | 0.96 | 1.50 | 5.17 |
| 28 | 13.30 | 126.67 | 335.86 | 28.13 | 223.20 | 110.90 | 64.01 | 11.26 | 2.86 | 0.93 | 1.60 | 5.17 |
| 29 | 13.30 | 92.66 | 262.75 | 27.50 |  | 97.37 | 59.29 | 10.50 | 2.86 | 0.93 | 1.70 | 5.96 |
| 30 | 13.30 | 79.27 | 208.99 | 26.26 |  | 92.66 | 54.75 | 10.12 | 2.70 | 0.91 | 1.70 | 6.24 |
| 31 | 13.30 |  | 170.73 | 24.47 |  | 83.62 |  | 9.40 |  | 0.90 | 1.20 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Monthly Statistics |  |  |  |  |  |  |  |  |  |  |  |  |
| Mean | 12.14 | 57.60 | 160.40 | 96.22 | 127.83 | 133.85 | 66.27 | 30.42 | 5.50 | 1.40 | 1.15 | 4.97 |
| Max | 15.53 | 175.50 | 476.79 | 344.78 | 466.28 | 245.40 | 158.34 | 64.97 | 9.40 | 2.38 | 1.70 | 6.24 |
| Min | 9.05 | 8.71 | 30.71 | 24.47 | 19.47 | 58.36 | 36.24 | 9.40 | 2.70 | 0.90 | 0.90 | 1.03 |

Table 14. Maximum daily discharge for Tully Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10.12 | 14.17 | 86.95 | 175.50 | 26.88 | 254.97 | 88.08 | 68.91 | 10.50 | 3.03 | 0.91 | 1.44 |
| 2 | 10.87 | 22.73 | 67.91 | 147.88 | 25.66 | 272.64 | 77.14 | 81.43 | 10.12 | 2.86 | 0.90 | 1.14 |
| 3 | 11.26 | 62.10 | 53.86 | 562.24 | 24.47 | 280.69 | 67.91 | 68.91 | 9.76 | 2.70 | 0.90 | 1.20 |
| 4 | 12.06 | 61.15 | 53.86 | 474.15 | 23.30 | 292.98 | 60.21 | 65.94 | 9.40 | 2.54 | 0.91 | 6.24 |
| 5 | 12.88 | 20.00 | 45.41 | 349.29 | 22.73 | 295.05 | 54.75 | 60.21 | 9.76 | 2.24 | 0.91 | 6.52 |
| 6 | 12.88 | 14.17 | 39.93 | 254.97 | 22.17 | 284.76 | 51.25 | 57.45 | 10.87 | 2.10 | 0.91 | 6.24 |
| 7 | 12.46 | 26.88 | 38.44 | 236.02 | 56.54 | 299.22 | 52.98 | 53.86 | 9.76 | 1.85 | 0.89 | 5.96 |
| 8 | 12.46 | 52.98 | 41.46 | 200.34 | 117.34 | 272.64 | 47.87 | 50.39 | 8.71 | 1.74 | 0.90 | 5.96 |
| 9 | 12.06 | 29.41 | 58.36 | 173.91 | 116.04 | 239.75 | 52.98 | 47.04 | 8.37 | 1.53 | 0.91 | 5.96 |
| 10 | 11.65 | 26.26 | 185.24 | 147.88 | 295.05 | 219.60 | 45.41 | 44.61 | 8.71 | 1.44 | 0.92 | 5.96 |
| 11 | 10.87 | 81.43 | 490.10 | 132.17 | 435.45 | 198.63 | 107.12 | 43.02 | 8.05 | 1.44 | 0.92 | 5.96 |
| 12 | 10.87 | 45.41 | 559.38 | 119.97 | 288.85 | 188.54 | 97.37 | 40.70 | 7.41 | 1.63 | 0.95 | 5.96 |
| 13 | 10.87 | 474.15 | 815.34 | 108.37 | 183.60 | 172.32 | 79.27 | 39.18 | 6.81 | 1.85 | 0.95 | 6.24 |
| 14 | 11.26 | 360.69 | 576.69 | 99.76 | 128.04 | 143.50 | 98.56 | 36.97 | 6.52 | 1.53 | 0.98 | 6.52 |
| 15 | 15.53 | 91.51 | 559.38 | 90.36 | 172.32 | 122.63 | 83.62 | 34.82 | 6.24 | 1.35 | 1.02 | 6.52 |
| 16 | 20.53 | 177.11 | 342.54 | 85.83 | 139.20 | 119.97 | 74.00 | 34.11 | 5.96 | 1.35 | 1.02 | 6.24 |
| 17 | 20.53 | 107.12 | 226.83 | 78.20 | 118.65 | 109.63 | 80.34 | 22.17 | 5.69 | 2.10 | 1.02 | 6.24 |
| 18 | 15.53 | 61.15 | 144.95 | 70.92 | 105.87 | 99.76 | 79.27 | 21.07 | 5.17 | 5.96 | 1.07 | 6.24 |
| 19 | 14.17 | 53.86 | 116.04 | 66.93 | 92.66 | 109.63 | 75.04 | 20.00 | 4.93 | 2.54 | 0.91 | 6.52 |
| 20 | 14.17 | 129.40 | 90.36 | 64.01 | 147.88 | 114.74 | 68.91 | 19.47 | 4.69 | 1.97 | 0.91 | 6.52 |
| 21 | 13.73 | 107.12 | 245.40 | 60.21 | 443.06 | 93.83 | 292.98 | 20.00 | 4.69 | 1.74 | 0.95 | 6.24 |
| 22 | 13.30 | 403.24 | 175.50 | 56.54 | 349.29 | 82.52 | 301.32 | 17.94 | 4.46 | 1.53 | 0.98 | 5.96 |
| 23 | 13.30 | 351.56 | 140.63 | 52.98 | 249.21 | 76.08 | 167.59 | 16.95 | 4.23 | 1.35 | 1.02 | 5.96 |
| 24 | 13.30 | 159.86 | 122.63 | 51.25 | 525.55 | 68.91 | 136.36 | 15.53 | 4.23 | 1.27 | 1.12 | 5.96 |
| 25 | 13.30 | 97.37 | 443.06 | 47.87 | 737.77 | 69.91 | 113.45 | 15.07 | 4.01 | 1.20 | 1.18 | 5.69 |
| 26 | 13.30 | 181.96 | 1570.89 | 45.41 | 520.02 | 113.45 | 97.37 | 14.62 | 3.80 | 1.14 | 1.25 | 5.69 |
| 27 | 13.30 | 196.93 | 1075.33 | 35.53 | 369.94 | 167.59 | 86.95 | 14.17 | 3.40 | 1.14 | 1.33 | 5.43 |
| 28 | 13.30 | 183.60 | 517.26 | 33.42 | 272.64 | 159.86 | 75.04 | 13.73 | 3.40 | 1.03 | 1.33 | 6.52 |
| 29 | 13.73 | 132.17 | 340.31 | 31.38 |  | 121.30 | 67.91 | 12.46 | 4.01 | 1.03 | 1.50 | 6.52 |
| 30 | 13.73 | 97.37 | 272.64 | 29.41 |  | 107.12 | 61.15 | 11.65 | 3.80 | 0.99 | 1.74 | 10.87 |
| 31 | 14.17 |  | 216.03 | 28.13 |  | 96.18 |  | 11.26 |  | 0.96 | 1.44 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Monthly Statistics |  |  |  |  |  |  |  |  |  |  |  |  |
| Mean | 13.28 | 127.43 | 313.31 | 132.61 | 214.65 | 169.30 | 94.74 | 34.63 | 6.58 | 1.84 | 1.05 | 5.81 |
| Max | 20.53 | 474.15 | 1570.89 | 562.24 | 737.77 | 299.22 | 301.32 | 81.43 | 10.87 | 5.96 | 1.74 | 10.87 |
| Min | 10.12 | 14.17 | 38.44 | 28.13 | 22.17 | 68.91 | 45.41 | 11.26 | 3.40 | 0.96 | 0.89 | 1.14 |

Table 15. Average daily discharge for Tully Creek WY07.

| Day | October | November | December | January | February | March | April | May | June | July | August | September |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.65 | 14.14 | 73.60 | 158.59 | 25.53 | 228.37 | 80.77 | 58.73 | 9.89 | 2.78 | 0.90 | 1.29 |
| 2 | 10.31 | 17.07 | 58.73 | 135.61 | 24.31 | 251.04 | 70.85 | 71.95 | 9.39 | 2.58 | 0.90 | 1.08 |
| 3 | 10.82 | 31.40 | 51.13 | 281.41 | 23.13 | 255.73 | 62.81 | 66.11 | 8.94 | 2.38 | 0.91 | 1.11 |
| 4 | 11.36 | 33.44 | 47.84 | 410.41 | 22.16 | 267.47 | 56.86 | 63.74 | 8.95 | 2.26 | 0.93 | 2.21 |
| 5 | 12.28 | 16.68 | 41.94 | 279.38 | 21.35 | 269.57 | 52.04 | 57.45 | 9.50 | 2.07 | 0.93 | 6.17 |
| 6 | 12.34 | 13.44 | 37.33 | 237.83 | 20.70 | 256.92 | 47.97 | 55.31 | 10.03 | 1.85 | 0.92 | 5.97 |
| 7 | 12.14 | 14.41 | 35.31 | 211.93 | 31.85 | 258.84 | 48.52 | 51.66 | 9.06 | 1.68 | 0.90 | 5.74 |
| 8 | 12.01 | 36.63 | 37.17 | 177.02 | 51.40 | 244.54 | 44.19 | 48.20 | 8.24 | 1.58 | 0.91 | 5.73 |
| 9 | 11.77 | 27.03 | 47.54 | 153.14 | 82.33 | 213.56 | 47.54 | 45.67 | 7.78 | 1.44 | 0.92 | 5.66 |
| 10 | 11.15 | 20.31 | 131.91 | 137.41 | 108.72 | 197.89 | 41.64 | 43.30 | 8.31 | 1.32 | 0.94 | 5.57 |
| 11 | 10.70 | 51.91 | 186.70 | 121.77 | 334.13 | 183.39 | 65.61 | 41.20 | 7.68 | 1.30 | 0.97 | 5.59 |
| 12 | 10.64 | 31.32 | 421.08 | 110.69 | 215.54 | 170.34 | 86.97 | 39.57 | 7.01 | 1.57 | 0.99 | 5.75 |
| 13 | 10.66 | 146.29 | 592.39 | 101.23 | 147.37 | 150.95 | 71.55 | 37.71 | 6.42 | 1.62 | 1.01 | 6.08 |
| 14 | 10.78 | 169.34 | 480.05 | 93.02 | 114.99 | 126.98 | 83.48 | 35.97 | 5.95 | 1.37 | 1.03 | 6.22 |
| 15 | 12.75 | 67.10 | 423.17 | 84.37 | 146.23 | 113.23 | 77.63 | 33.95 | 5.64 | 1.24 | 1.06 | 6.14 |
| 16 | 17.70 | 138.01 | 267.72 | 78.06 | 126.80 | 109.01 | 67.56 | 27.88 | 5.42 | 1.23 | 1.07 | 6.00 |
| 17 | 17.77 | 77.64 | 175.75 | 72.22 | 110.33 | 102.42 | 67.63 | 21.22 | 5.21 | 1.34 | 1.09 | 5.97 |
| 18 | 14.83 | 51.53 | 126.79 | 67.08 | 98.22 | 93.97 | 74.07 | 20.07 | 4.82 | 3.92 | 1.11 | 5.94 |
| 19 | 14.01 | 40.09 | 101.42 | 63.23 | 87.33 | 91.88 | 70.12 | 19.36 | 4.46 | 2.28 | 0.97 | 6.12 |
| 20 | 13.81 | 97.32 | 82.40 | 60.22 | 89.61 | 100.50 | 64.42 | 19.05 | 4.23 | 1.80 | 0.93 | 6.31 |
| 21 | 13.59 | 85.81 | 168.00 | 56.73 | 272.96 | 86.36 | 102.73 | 18.71 | 4.22 | 1.60 | 0.99 | 5.94 |
| 22 | 13.23 | 194.15 | 150.09 | 52.77 | 267.76 | 78.02 | 211.08 | 17.08 | 4.08 | 1.42 | 1.04 | 5.77 |
| 23 | 13.03 | 234.40 | 123.52 | 49.56 | 212.92 | 71.03 | 147.11 | 16.04 | 3.90 | 1.28 | 1.10 | 5.78 |
| 24 | 13.03 | 123.65 | 104.87 | 47.26 | 300.32 | 64.72 | 124.63 | 14.94 | 3.81 | 1.21 | 1.18 | 5.60 |
| 25 | 13.02 | 81.52 | 266.95 | 45.22 | 594.75 | 64.13 | 102.03 | 14.35 | 3.70 | 1.14 | 1.27 | 5.45 |
| 26 | 12.90 | 115.35 | 898.95 | 39.75 | 414.22 | 77.77 | 89.83 | 13.73 | 3.35 | 1.08 | 1.34 | 5.42 |
| 27 | 13.21 | 184.81 | 742.33 | 33.35 | 306.04 | 131.29 | 79.29 | 13.27 | 3.18 | 1.04 | 1.38 | 5.35 |
| 28 | 13.30 | 154.50 | 408.24 | 31.24 | 250.64 | 125.47 | 70.28 | 12.71 | 3.06 | 0.99 | 1.44 | 5.80 |
| 29 | 13.36 | 108.57 | 301.61 | 29.25 | | 108.63 | 63.87 | 11.64 | 3.58 | 0.96 | 1.53 | 6.39 |
| 30 | 13.56 | 85.66 | 237.81 | 28.11 | | 101.28 | 58.41 | 10.95 | 3.33 | 0.95 | 1.09 | 7.04 |
| 31 | 13.74 | | 192.09 | 26.80 | | 91.33 | | 10.42 | | 0.92 | 1.31 | |
| | | | | | | | | | | | | |
| **Monthly Statistics** | | | | | | | | | | | | |
| **Total** | 393.46 | 2,463.51 | 7,014.42 | 3,474.67 | 4,501.64 | 4,686.64 | 2,331.51 | 1,011.95 | 183.16 | 50.21 | 33.08 | 159.19 |
| **Mean** | 12.69 | 82.12 | 226.27 | 112.09 | 160.77 | 151.18 | 77.72 | 32.64 | 6.11 | 1.62 | 1.07 | 5.31 |
| **Max** | 17.77 | 234.40 | 898.95 | 410.41 | 594.75 | 269.57 | 211.08 | 71.95 | 10.03 | 3.92 | 1.53 | 7.04 |
| **Min** | 9.65 | 13.44 | 35.31 | 26.80 | 20.70 | 64.13 | 41.64 | 10.42 | 3.06 | 0.92 | 0.90 | 1.08 |
| **Acre Feet** | 780.41 | 4,886.30 | 13,912.89 | 6,891.91 | 8,928.86 | 9,295.82 | 4,624.48 | 2,007.17 | 363.29 | 99.60 | 65.62 | 315.75 |
| **Total Acre Feet for WY06** | | | 52,172.11 | | | | | | | | | |

Figure 27. Tully Creek gage station condition pre-flood (October 2004).


Figure 28. Tully Creek gage station condition on January 5, 2006.

*Turbidity and Water Temperature*

Turbidity and water temperature were not monitored in Tully Creek during WY07.

*Suspended Sediment*

No suspended sediment samples were taken during WY07

**Klamath River Estuary**

Water levels in the Klamath River estuary were tidally influenced during the entire water year. During periods of low flow, water levels in the estuary followed tidal signatures when compared with Crescent City tidal data (National Oceanic and Atmospheric Administration) but the lowest tides were greater in the ocean than in the estuary. This could be due to mouth location, flows, or even sand built up high enough to restrict the flow of the river at low tides. During high flow events, water levels in the estuary rose along with discharge, and followed the tidal influence even closer than low tides.

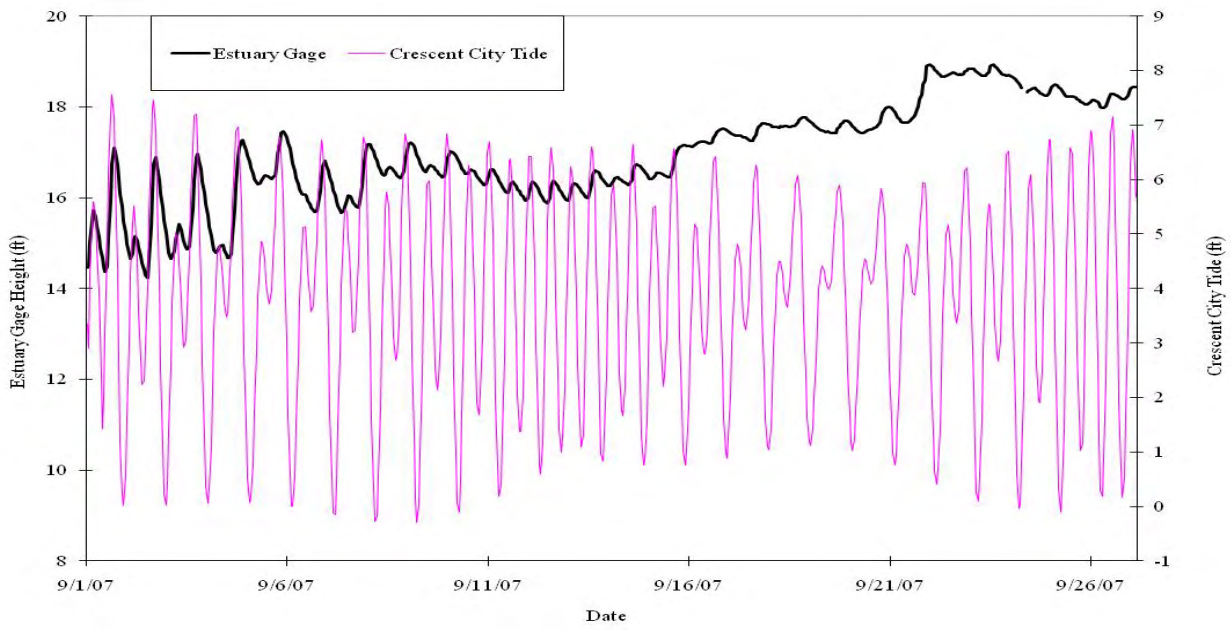


Figure 29. Klamath Estuary and Crescent City tides when the mouth shifts to the south constricting flow and minimizing tidal influence.

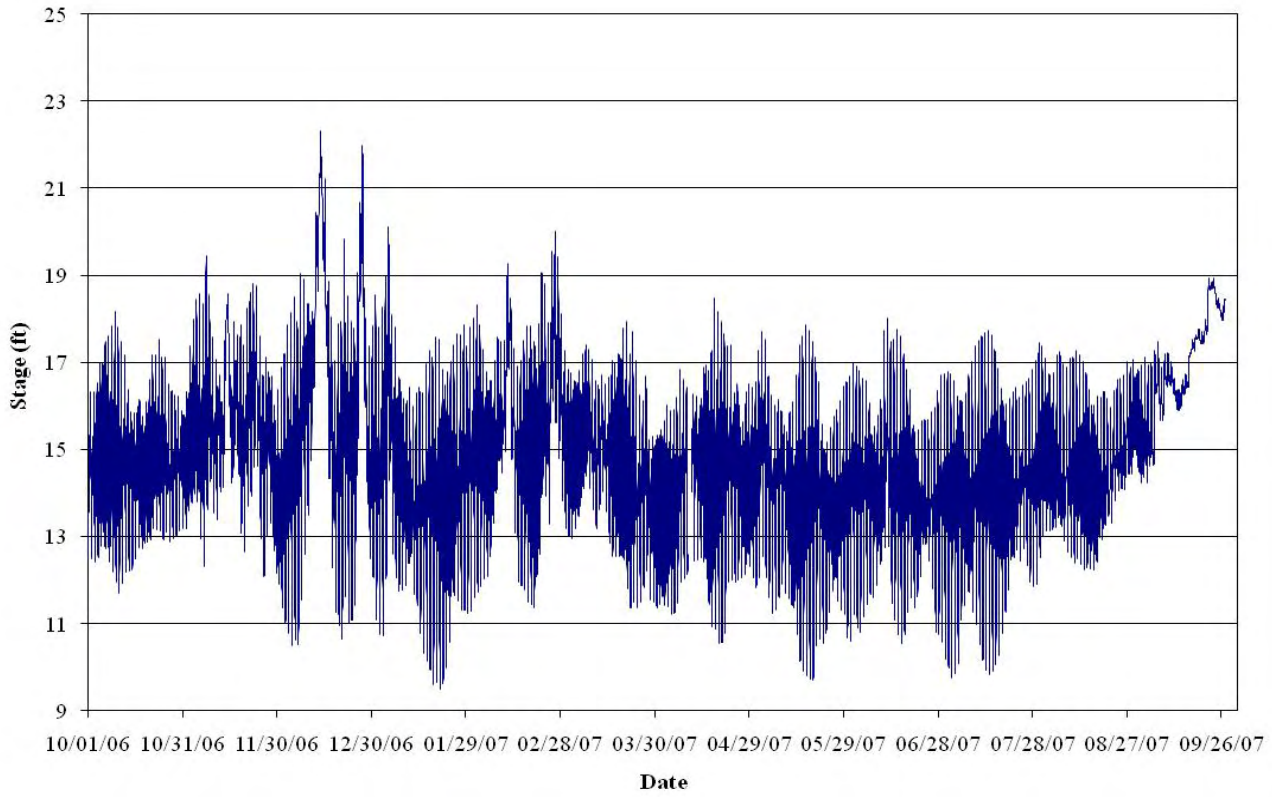


Figure 30. Stage at the Klamath River Estuary WY 07

**Discussion**

In the beginning of September the mouth shifted in such a way that the tidal influence became very minimal. Not only was it minimal, the estuary stage slowly rose due to the constriction and location of the mouth. (see figure 31) On October 3rd the sand spit breached in the middle allowing the tidal fluctuations to effect water levels in the estuary again and stage dropped accordingly.(see figure 32)

Figure 31. Build up of sand moved the mouth of the river to the south constricting flow and minimizing tidal influence. 10/2/2007

Figure 32. Breach at the mouth on 10/3/2007 at 7:30 am.

Figures 32,33,34,35,36,37 Klamath Estuary 8/10/2007-10/5/2007

8/10/2007

8/13/2007

9/4/2007

9/25/2007

10/3/2007

10/5/2007

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