National Park Service
U.S. Department of the Interior

Mount Rainier National Park
Natural and Cultural Resources

55210 238th Avenue E.
Ashford, WA 98304-9751

360-569-6781 phone
360-569-6749 fax

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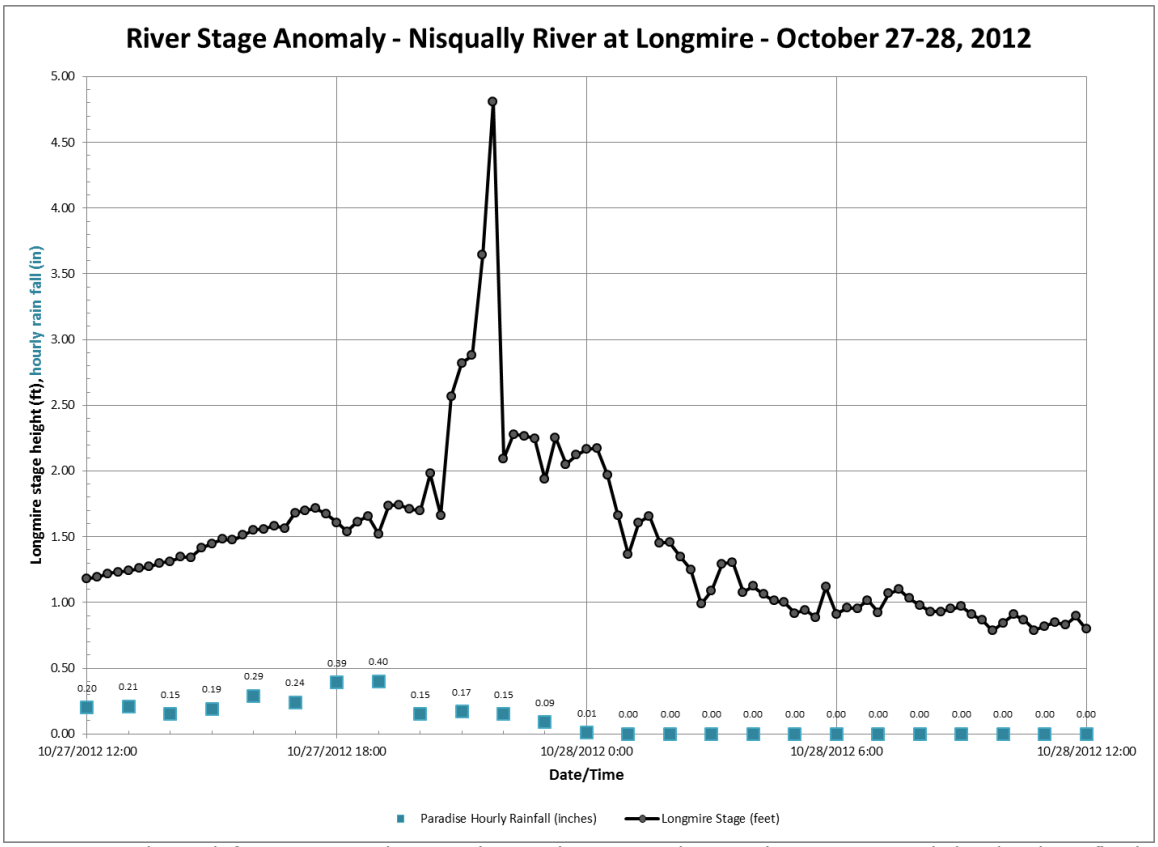
Contact: Scott Beason, Park Geologist

Small glacial outburst flood occurs on Mount Rainier – October 27, 2012

A small glacial outburst flood occurred at Mount Rainier National Park on Saturday, October 27, 2012 at approximately 9:00 PM. This event, while significant, was localized in scale, caused no damage to park facilities, and was not volcanic in origin. It likely originated from the Nisqually Glacier as result of moderate to intense rainfall. A stream gage located at Longmire registered a 2.8 foot (0.85 meter) rise in river water level (Figure 1) between 8:30 and 9:45 pm and the spike was seen on other gages downstream of the park. Field data (Figure 2) concurs with the stream gage and shows evidence of a several-foot surge of water in the Nisqually River.

While this event was small, it highlights one of the many hazards at Mount Rainier. It also shows that potentially destructive and hazardous events can occur even during "small" storms that are common in the fall and winter at Mount Rainier. Workers and visitors near rivers should always be aware of geologic hazards. Remember, if you feel the ground shaking or hear a freight train coming down the valley, get uphill as quickly as you can!



▲Figure 1. Hydrograph from Longmire showing a large spike in stage elevation during a presumed glacial outburst flood, 9:45 PM, October 27, 2012.

Where did this occur and when did it happen?

This event occurred on the Nisqually River, originating from the Nisqually Glacier on Saturday, October 27, 2012 around 9:00 PM. It was recorded on stream gages both in and outside of the park.

How did it form?

A glacial outburst flood, or jökulhlaup, is a large, abrupt release of water from a glacier. The exact mechanisms through which water moves through glaciers and how these events occur are not well known. Regardless, we do know that stagnant ice and, specifically, slowing ice on the lower glacier combined with faster ice on the upper glacier, has been associated with these events in the past. During the last two years, one of the projects being conducted by geologists at Mount Rainier National Park is measuring and interpreting the surface velocity of the Nisqually Glacier. Preliminary results indicate that the lower glacier is slowing while the upper glacier has sped up in the last year. This is consistent with the Saturday night event, and suggests future events could occur. Preliminary results from a glacier mapping project, also in progress at the park, indicates that other park glaciers are also potentially at elevated risk of outburst flooding. Glacial outburst floods are not technically landslides, but typically entrain vast amounts of debris as they flow downstream. They usually turn into debris flows, the most destructive form of landslides.

In the past, outburst floods have occurred during warm, dry periods in the summer (with usually high melt) and during fall storms. Rainfall intensity during the storm was the likely driver of this event. Precipitation intensity in the hours before the flood passed Longmire was in the 0.40 inch/hour range. This event occurred during a relatively small storm, compared to the size of storms the park has experienced in the recent past. Careful monitoring of rivers is crucial to detecting and understanding glacial outburst floods. This is the 1st step to predicting future events, a goal of the Geology Program.

What were the effects?

In this case, the effects of this glacial outburst flood were small and isolated to river areas only. No park infrastructure was affected by the event. The stage, or height, of the Nisqually River increased by up to almost three feet during the event. The event lasted less than 1 hour and the peak of the flood passed within 15 minutes. One individual located in Longmire noticed that the river got very loud Saturday night, due to increased flow and boulders rolling around and crashing into one another in the bed of the river. Following the peak, the river's stage dropped back down to pre-flood levels. It is likely that some channel rearrangement and alteration occurred, and repeat photography will be used to verify this.

It is also possible that the lower Nisqually Glacier has changed. Field visits on Sunday to the Nisqually Vista Trail revealed a dark streak on the surface of the lower glacier that may be from a stream on top of glacial ice (a supraglacial stream). When the weather permits, we will investigate further.

How do we know it happened?

Stream flow of several park rivers is regularly monitored by park geologists inside the park, and by other agencies outside of the park. This event was discovered when analyzing data downloaded from a stream gage installed in the Nisqually River near Longmire on Monday, October 29. Upon processing the data, a large peak was noted in the hydrograph (figure, above), and then correlated with data from other stream gages.

Several field visits occurred after the event and found "trim lines" in river sediment (Figure 2), evidence of the maximum height of water.

▲Figure 2. Field evidence of high flow in the form of a trim line near Cougar Rock along the Nisqually River, upstream of Longmire. Similar trim lines were seen in the riverbed at Longmire and Lower Van Trump Hairpin. The flood did not originate in any tributaries of the Nisqually (Photo: Laura Walkup/NPS).

Do I need to be concerned?

It is important to note that we do not believe the glacial outburst flood was caused by a geothermal or volcanic event, however it underscores that caution is needed when near the river. This event could have been completely unnoticed if stream monitoring equipment had not been in place.

In the recent past, much larger glacial outburst floods have occurred in the park. Large glacial outburst floods occurred in the 1950s and caused flooding in Longmire on at least two occasions. Because of this, and the potential for future events in the park, we all need to be aware of volcanic and geologic hazards at Mount Rainier. Always know your evacuation plan and know what to do if you feel the ground shaking. Information and maps about evacuation routes can be found in Section 8 of the 2012 Employee Safety Handbook, found on the park intranet.

Who do I contact for more information?

If you have any questions about this event or would like to report future events, please contact:
Scott Beason, Park Geologist, 360-569-6781, Scott_Beason@nps.gov

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