

Flooding and Landslide Events Northern British Columbia 1820-2006

D. Septer

Province of British Columbia

Ministry of Environment

CONTENTS

- 1 Introduction
- 2 Scope
- 3 Information reliability
- 4 Organization of storm events
- 5 Community flooding and landslide archive
- 6 Chronological list of flooding and landslide events

Appendices

- 1 Geographical index by rivers, creeks and lakes.
- 2 Geographical index by community.
- 3 Reported fatalities caused by slope failures and snow avalanches in northern British Columbia.

Literature cited

1 Introduction

Weather is one of the most common topics of conversation. Landslides, snow avalanches and flooding events may have devastating impacts on property and can result in the loss of human life. A clear understanding of the magnitude and frequency of landslides, flooding and storm events may help in project planning, emergency planning and risk assessment. Thus the importance of storms, which create such events, will be of interest to a wide audience ranging from emergency measure planners and foresters to engineers and historians.

2 Scope

Historical information on weather events and their impacts is scattered throughout many different sources, including newspapers, technical reports and streamflow records. The intent of this report is to produce a chronological list of flooding and landslide events in the northern part of British Columbia. The area covered is north of a straight line running from Bella Bella in the west over Williams Lake and Blue River to the Rocky Mountains in the east. Some weather events causing fatalities in the adjacent Alaska panhandle have been included in the report.

3 Information reliability

News coverage of extreme storm events and subsequent damage may vary considerably in detail and accuracy. Although an effort has been made to be as accurate and complete as possible, the chronological list of such events contained in this report is far from complete. In a report with a time span and geographic area like this, many storm and flood events will have been missed.

Terminology used to describe mass wasting events often also varies widely in newspaper accounts. No effort has been made to confirm the correctness of the terms used in the original reports. Also as little as possible was changed in the original reporting. Eyewitness accounts and many reported cases of “worst flooding on record” are all in quotation marks by the author. Such information must be taken at face value.

The historical detail contained in this report is strictly raw data without any analysis of the events. Consequently, this information is only as good as originally reported. Thus all the details and quotations must stand on their own merit, without benefit of the author’s analysis or comment.

Unless stated otherwise, damage amounts are in dollar values of the time of the event.

4. Organization of storm events

All damage causing events are organised chronologically starting with the ca. 1820 event and ending with a storm event on December 18-19, 2006. Some extreme wind and snow storm events have also been included even though they did not cause flooding or landslide damage.

For information for a specific watercourse or community, refer to Appendix 1 and 2, respectively. A chronological list of some of the reported fatalities caused by slope failures and snow avalanches in northern British Columbia can be found in Appendix 3.

5. Community flooding and landslide archive

Personal memories, diaries, newspaper articles all contain valuable information on historical storm and flood events. Many such events have been recorded while others only remain in the memories of those affected. This local knowledge may also make this report and thus flood warnings more accurate and help planners in future flood prevention measures.

Additional information about any missed events can be send to the author’s address at P.O. Box 1000, Whaletown, BC - V0P 1Z0.

6. Chronological list of flooding and landslide events

Ca. 1820

Event type: Rockslide.

Precipitation: Not applicable.

Source: Morice 1904; Evans (unpublished data) (p. 7).

Sometime around 1820, a large rockslide formed a blockage in the Bulkley River at Hagwilget Canyon, 1.5 km upstream from its confluence with the Skeena River. (Evans (unpublished data).

Father Adrien Gabriel Morice, OMI describes the event as follows, “a large piece of rocky cliff overhanging the Bulkley (River) at a location now called Ackwilgate (Hagwilget)... having fallen across the stream, this barred it so completely that it formed a cataract of sufficient height to prevent the fish from getting up to the Moricetown fall. Threatened with starvation, the western Babines went in a body, armed *cap-a-pie*, and forcibly took the new terminus from its (Kitshkan) owners. In the course of time, the rock which was to give a name to the new place (Fallen Rock or Rocher DeBoule) wore away to such an extent that the salmon could return to their former haunts up the river, but the Babines or Ackwilgates have since retained possession of both Fisheries.” (Morice 1904).

Ca. 1852

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: deLagune 1972 (p. 276); Clague and Rampton 1982; Champagne-Aishihik Band 1988 (p. 6); Clarke 1989; Gabrielse and Yorath 1992; Evans (unpublished data) (p. 7).

In the northwest part of the Cordillera, the oral traditions of the Southern Tutchone people record a disastrous outburst flood in the St. Elias Mountains caused by the draining of Lake Alsek formed by the damming of Alsek River by Lowell Glacier (Clague and Rampton 1982; Champagne-Aishihik Band 1988). *1) In Neoglacial times, Lake Alsek filled and emptied several times. Its actual size depended primarily on the geometry of the Lowell Glacier ice dam (Clague and Rampton 1982).

In its last phase, about 1850, the pool elevation of Lake Alsek was approximately 595 m above sea level (a.s.l.). At this level, the lake was almost 200 m deep and 100 km long, extending into the Kaskawulsh and Dezadesh River valleys flooding the present site of Haines Junction (588 m a.s.l.) (Clague and Rampton 1982; Champagne-Aishihik Band 1988).

Around 1852, the glacier dam broke (deLagune 1972) suddenly releasing the water of Lake Alsek into the Alsek River. The glacial outburst flood, involving an approximate volume of 4,700 million m³ (Clarke 1989), “destroyed several Indian villages and killed countless people” (Champagne-Aishihik Band 1988) downstream of Lowell Glacier, including a settlement at the confluence of the Alsek and Tatshenshini rivers (Evans (unpublished data).

*1) Gabrielse and Yorath (1992) define the Canadian Cordillera as, “extending from the base of the Continental slope in the west to the western limit of undeformed strata underlying the Interior Plains, and from the Beaufort Sea in the north to the international boundary in the south.”

May 16, 1866

Event type: Landslide.

Precipitation: Not applicable.

Source: *Cariboo Sentinel*, May 17, 1866; Evans (unpublished data) (p. 5) Case History 1.

On May 16 around 3 p.m., a landslide came down near Barkerville. The event was described in the *Cariboo Sentinel*, making it the first located newspaper report of a damaging landslide in the Cordillera. (Evans (unpublished data).

“.... the denizens of Barkerville were startled at hearing a very unusual noise.... it was observed that a large portion of the earth on the Western hill side (sic) behind town was on the move carrying everything before it, until it was obstructed by the Hibernia Co.’s shaft house... water and mud forced an entrance through the back door of (Messrs. Floyd and Co.’s store) and swept right through it into the street destroying a great deal of goods. Messrs. Floyd and Co.’s loss will amount to \$500. (*Cariboo Sentinel*, May 17, 1866).

June 17, 1866

Event type: Debris flow.

Precipitation: Not available.

Source: Evans (unpublished data).

On June 17, a debris flow occurred at Van Winkle, near Quesnel. The water and debris flooded houses and buried a street. The debris flow was released by the breach of a landslide dam in Van Winkle Creek.

July 1875

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *British Columbian*, July 11, 1875.

The Fraser River at Quesnelmouth (Quesnel) rose 4 ft. (1.2 m) higher than was ever known before. It reached 33 ft. (9.9 m) above the low water mark, flooding several warehouses and other buildings.

July 5-7, 1891

Event type: Landslide dam failure and fatal slides.

Precipitation: Port Simpson (198.4 mm/3 days), July 5-7, 1891.

Source: *The Daily Columbian*, July 8 and 13, 1891; *Victoria Daily Colonist*, July 14, 1891; *The Metlakahtlan*, December 1891; B.C. Ministry of Energy, Mines and Petroleum Resources. 1993; Walbran 1909.

In early July, a freak summer rainstorm hit the area around present-day Prince Rupert. Though during the early summer of 1891 the weather had been warm and dry for some time, a sudden change took place on July 4 around midnight. During the three days of steady rain between July 5-7, Port Simpson, at the time the only location where weather records were kept, rainfall measured 194.8 mm in 72 hours. Possibly an even larger amount of rain may have fallen in the Inverness Channel area, southwest of Prince Rupert. According to one account, some 12 in. (over 300 mm) of rain fell in the 24 hours alone.

The three days of steady rain caused debris slides along the Inverness Channel. The North Pacific and Inverness salmon canneries, two of the 19 such canneries operating at the mouth of the Skeena River, were hit by mud and debris slides. Though the reports on fatalities differ, as many as 50 people may have perished as a result of these slides.

On July 6, at about 1 a.m., a large debris slide came down heading straight for the Inverness Cannery. The slide headed straight for the building occupied by plant manager Stapledon, his bookkeeper, and other white employees of the cannery. Within 15 yd. (13.5 m) of this building it deflected slightly to the left and passed the house within 6 ft. (2 m), leaving the yard jammed with boulders and large logs.

At about 2 a.m., a landslide was heard rumbling in the mountains above. Native Indian cannery workers sleeping in a string of shacks near the cannery fled in terror to the cannery building for refuge. Standing out in the river, its danger from slides was perceived to be considerably less than that of the small cabins on shore. When the turmoil above ceased and no debris reached the bottom of the mountain, the workers returned to their shacks.

A few hours later at 5:45, a loud, rushing noise was heard from the direction of the steep mountain behind the cannery. Within moments the debris was upon the doomed settlement, carrying everything before it into the slough close to the cannery. The occupants of one of the houses had time to get out of the building, but they were caught by the debris slide rushing down. In all, nine houses with their occupants were destroyed, including the mess house and the cannery foreman's residence.

The foreman's "Swedish wife," who was in the mess room at the time, was carried along with the mass of debris. The Native Indians claimed that in the destroyed houses were about 40 members of the Port Simpson, Sitka, Metlakahtla and Nitinat tribes, "all of whom were surely killed."

Later, the second of two slides hit the North Pacific Cannery. Suddenly, around 9 a.m. a loud crashing noise was heard up the hillside. In a few seconds, the Native Indian village at the cannery was virtually wiped out. In its place a conglomeration of mud, gravel, boulders and giant trees, twisted and broken, covered the area to a depth of 12-15 ft. (4-5 m). Only two cabins, outside of the path of the slide, remained standing. The slide heard earlier that morning had filled the gulch overhead, damming the water until it acquired sufficient weight to sweep everything in front of it.

The destruction caused by the slide was immense, with mud and debris nearly filling the slough. The slide just missed the cannery building by about 2 ft. (60 cm), some of the loose earth actually scraping the corner. Inside the cannery building was the foreman and about 60 Native Indians awaiting arrival of the boats that were expected during the slack time of the tide. The boats and their crews were fortunate enough to be out of reach of the slide. Had the slide struck the cannery, or occurred half an hour earlier, when all the people would have been in the mess house, the death toll here could have reached 100.

Initial reports in the *Daily Columbian* and *Victoria Daily Colonist* put the number of fatalities at eight. In December, *The Metlakahtlan* reported four women and five children killed by the slide. With the exception of one woman from Port Simpson, the other eight victims were members of Father Duncan's New Metlakahtla mission. One boy had his hip broken and 10 others were injured to some degree. One of the injured, a head of a family, died two days later.

Approximately 40 Native Indians and the foreman's wife were killed. By July 8, the bodies of 13 Indians were recovered. *1) The cannery steamer *Winnifred* took the bodies back to Metlakatla for burial. Most of the other Native Indian workers belonged to the Fort Simpson, Sitka and Nitinat tribes. Though the final count will never be known as many of the missing victims were either buried in the mud and debris or swept out to sea, the slides were definitely the deadliest to hit the British Columbia north coast.

The Inverness Cannery, just upstream along the 7-km strip in Inverness Passage known as cannery row, was hit by two debris slides. The Indian houses were swept away, killing nine Native Indians. The first one missed the dwelling of the white cannery employees. The second slide wiped out nine houses, including the mess house and the cannery foreman's residence.

*1) Capt. John T. Walbran noted that, "A heavy landslide occurred at Inverness (Woodcock's Landing) a few years ago when the cannery had a miraculous escape, and the next day another slide occurred at the North Pacific Cannery, a few miles up the passage, when eleven Indians lost their lives." No reference to this accident has been found, and though the details differ substantially, this may refer to the events that took place on July 6, 1891. It is interesting to note that the original Indian name for Woodcock's Landing (Inverness) was "Willaclough," meaning "the place of slides." (Walbran 1909).

May-June 1894

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *British Columbian*, May 28, 29, 30 and 31, June 4 and 13, 1894; *Chilliwack Progress*, May 30, 1894; *The Omineca Herald and Terrace News*, October 29, 1947; *The Daily Alaska Empire*, May 29, 1948; *News Advertiser*, May 7, 1985; *The Cariboo Observer*, February 3, 1934; O'Neill 1960; Kopas 1970 (pp. 35-36; p. 251); Orchard 1983; Dr. A.S. Gottesfeld, pers. comm. June 1, 1994.

The spring of 1894 was cold and wet. Towards the end of May the weather turned hot and sultry (Orchard 1983). Rapid snowmelt caused province-wide flooding. The "Great Flood of 1894" in the Northwest continued for 57 days (*The Daily Alaska Empire*, May 29, 1948).

In a letter to the *Omineca Herald and Terrace News*, long-time Terrace resident Harry L. Frank called the "Great Flood of 1894" being less than the 1936 flood. According to Wiggs O'Neill, however, the 1894 flood was much bigger than the flood of 1936: "Our high-water of 1936 was a baby in comparison. There has never been a high-water to equal it since." The floodwaters of 1894 left drift logs on top of Ringbolt Island and on the walls of Kitselas Canyon. The steam paddle-wheel boat *Caledonia* had made it through the Canyon on its way upstream to Hazelton with a load of freight and a few passengers when the water started rapidly rising. Progress was severely hampered, and when finally driftwood began coming down, the situation was getting dangerous. Huge trees with their roots intact began to fill the river. When the vessel got to Kitwanga, within 25 mi. (40 km) of Hazelton, it was not even safe to lay at the bank of the river. Captain Bonser dropped down river and went up the Kitwancool River. Here the *Caledonia* tied up at a sheltered place, marooned for the duration of the high-water period. As the water began to recede, to avoid being stranded, each day the vessel dropped a short distance down the Kitwancool River. When getting back on the Skeena River, the flow of driftwood had stopped and the voyage to Hazelton was continued. When the vessel arrived back at headquarters in Port Simpson, a canoe search party was just being organised to look for the lost steamer. The vessel had been away well over a month, with no word of her, as there were no telegraph or telephone communications at the time (O'Neill 1960). A normal round trip would have taken about two weeks, suggesting about two weeks of extraordinary high-flow (Gottesfeld, pers. comm.).

The 1894 flood was one of the worst to hit the Bella Coola area. Kopas notes in his book "Bella Coola" : "The colonists saw the (Bella Coola) river rise at a terrific rate and flow past their camp bearing large trees complete with branches and roots. 'We don't have to go up the valley to see our land,' said one. 'The river is bringing it down to us.'" (Kopas 1970). *1)

Near Quesnel, floodwaters reached a spot on Front Street just below Senator Reid's residence, between the Abbott house and Cowan's warehouse. On the west side, the water removed fences and everything that was loose around Billy Boucher's house just above Mrs. Boucher's present (1934) dwelling. (*The Cariboo Observer*, February 3, 1934).

*1) Although this was the first recorded flood on the Bella Coola River, oral tradition of the local First Nation people mention an earlier flood. "Long, long ago, there was a tremendous rainstorm. The rivers flooded and the valleys filled with water. Almost all the people drowned, and the one canoe load of survivors landed on the utmost peak, this Noosgultz, which appeared above the stormy waters as a refuge, a solitary post to which to tie their canoe. They looped their canoe around the peak, but the sawing caused by winds and tides cut loose their craft, leaving the people marooned. Eventually the floodwaters subsided and the people descended to the village floor, starting this "Great Village," (as the explorer Alexander Mackenzie called the original Native settlement) and from here their descendents spread to the rest of the world." (Kopas 1970).

February 1898

Event type: Debris flow.

Precipitation: Not available.

Source: B.C. Ministry of Energy, Mines and Petroleum Resources 1993; Evans (unpublished data) (Case history 9).

In 1898, near Quesnel a sediment slump-flow (the Big Slide) damaged homes, farms and a highway. (B.C. Ministry of Energy, Mines and Petroleum Resources 1993).

Evans and Clague (1999) report three miners were being killed at Forks of Quesnelle (Quesnel) near 150 Mile House in February of that year.

May-June 1898

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: Asante 1972 (p. 174); Meziadin Environmental Advisory Team 1975 (Vol. 1, Part II p. 4.11); Dr. A.S. Gottesfeld, pers. comm. June 1, 1994; John Hipp, pers. comm. Dept. of Fisheries and Oceans, Terrace.

In 1898 a very bad flood was recorded in the Terrace area (Asante 1972). According to local Native Indians at Terrace, this flood was larger than the 1936 flood (Meziadin Environmental Advisory Team 1975). According to George Wright, Indian Chief and pilot on the Skeena River boats, Ferry Island near Terrace was under 15 ft. (4.5 m) of water (J. Hipp, pers. comm.).

In interviews conducted in 1985, Moricetown residents Tommy Michell and Johnny David indicated a severe flood hitting Moricetown around 1901. All the smokehouses were washed away (Gottesfeld, pers. comm.). It is not known whether this flood actually maybe referring to the one in 1898.

January 4-5, 1903

Event type: Flooding.

Precipitation: Kitimat Mission (41.9 mm/1 day), January 3, 1903.

Source: Sword 1904; *Terrace Review*, November 29, 1989.

Heavy rain for 26 hours caused Cold Water Creek near Terrace to rise 10 ft. (3 m). The creek swept away the dam from behind which the water for the hatchery was drawn (Sword 1904). *1)

* 1) This dam was also swept away in 1902. The hatchery at Trout River (now Lakelse River) was situated on the west side of the river at the mouth of Cold Water Creek, some 2 mi. (3.2 km) down from the lake. It was a large, two-storied building of saw milled lumber (Elsie Whitlow In: *Terrace Review*).

October 11-17, 1903

Event type: Dam burst flooding.

Precipitation: Port Simpson (68.0 mm/2 days) October 11-12, 1903; Kitimat Mission (314.1 mm/6 days), October 12-17, 1903; Masset (43.2 mm/2 days), October 13-14, 1903.

Source: *Na-Na-Kwa*, January 1904, No. 25; Sword 1904.

Heavy rainfall caused the hatchery dam in Cold Water Creek to give way on October 12. The eggs and fry had to be placed out in the Lakelse River (Sword 1904). The early part of October had very warm weather with much rain, which "swelled the rivers and streams to a great height ... the Old Village [was] completely surrounded and some of the people who were camped there ... came down to Kitamaat." (*Na-Na-Kwa*, January 1904).

September 6, 1904

Event type: Flooding.

Precipitation: Kitimat Mission (48.8 mm/1 day), September 6, 1904; Port Simpson (59.7 mm/1 day), September 6, 1904; Masset (27.9 mm/1 day), September 6, 1904.

Source: Sword 1905.

On September 6, a big freshet occurred near Lakelse River. The Skeena River Hatchery reported no damage (Sword 1905).

September 29-October 1, 1904

Event type: Flooding.

Precipitation: Kitimat Mission (115.3 mm/3 days), September 29-October 1, 1904.

Source: Sword 1905.

On October 1 another big freshet occurred near Lakelse River, again not causing any damage at the Skeena River Hatchery (Sword 1905).

November 12-14, 1904

Event type: Flooding.

Precipitation: Kitimat Mission (62.8 mm/3 days), November 12-14, 1904.

Source: Sword 1905.

Another big freshet occurred near Lakelse River on November 13. The water rose to within 1 in. (2.5 cm) of flooding the Skeena River Hatchery again. Some troughs were covered with as much as 3 in. (7.5 cm) of mud. It was estimated that several thousand fish eggs were lost after the mud covered them in some of the baskets (Sword 1905).

September 17-18, 1905

Event type: Flooding.

Precipitation: Kitimat Mission (113.5 mm/2 days), September 17-18, 1905.

Source: Whitwell 1906.

It rained very hard for several days causing a big flood that brought large cottonwood and spruce trees down the (Skeena) river. hatchery fences were smashed and one pen of fish, containing several hundreds of ripe sockeye salmon, was carried away entirely.

October 1-3, 1905

Event type: Flooding.

Precipitation: Kitimat Mission (64.0 mm/3 days), October 1-3, 1905.

Source: Whitwell 1906.

At the Skeena River Hatchery another flood occurred on October 1. Whitwell (1906) notes, "... in fact, nothing but floods and freshets since the fifth of August...." Heavy rains occurred, starting October 4.

November 12-14, 1905

Event type: Flooding.

Precipitation: Kitimat Mission (153.4 mm/3 days), November 12-14, 1905.

Source: Whitwell 1906.

On November 13 the hatchery experienced the worst flood of the season. Lakelse River and Coldwater Creek overflowed their banks. The hatchery floor was flooded with 2 in. (5 cm) of water (Whitwell 1906).

December 19-25, 1905

Event type: Flooding.

Precipitation: Kitimat Mission (111.3 mm/3 days), December 22-24, 1905; Port Simpson (45.7 mm/2 days), December 24-25, 1905.

Source: *Vancouver Daily Province*, December 19, 1905; Whitwell 1906; Tempest 1974.

According to Whitwell (1906) heavy rains occurred in the Terrace area until January 9, 1906.

Records kept by the B.C. Ministry Transportation and Highways, show that a moderate flood occurred on the Bella Coola River (Tempest 1974). Floodwaters caused by the "heaviest rains for many a year" washed out three bridges, delaying traffic. A large bridge crossing the Noosatsum (Nusatsum River), 600 ft. (180 m) in length went out with the flood. Other bridges carried away were those crossing the Neeleetsomy (Neeleetsconnoy) River and a stream called Draney Creek.

October 1, 1908

Event type: Debris flow.

Precipitation: Prince Rupert (138.2 mm/1 day), September 26, 1908.

Source: *The Empire*, October 3, 1908; Evans (unpublished data) (Case history 19).

During the week of September 26-October 3, Prince Rupert recorded 9.16 in. of rain with 5.44 in. (138.2 mm) falling on September 26. On September 28 and 30, Prince Rupert reported additional 1.84 in (46.7 mm) and 2.77 in. (70.4 mm), respectively (*The Empire*, October 3, 1908).

On October 1, a debris flow came down 0.5 mi. (800 m) west of Inverness Cannery. The torrent was released by the breach of a landslide dam in the creek above the site. One house was damaged and the Dominion Telegraph line destroyed. There were no fatalities. (Evans (unpublished data).

November 26-28, 1908

Event type: Rain-on-snow flooding.

Precipitation: Swanson Bay (172.2 mm/3 days), November 26-28, 1908; Prince Rupert (96.8 mm/2 days), November 27-28, 1908.

Source: *The Empire*, November 28, 1908; *The Victoria Daily Times*, November 30, 1908.

On November 26, Prince Rupert reported heavy rain and a southeast gale. Between November 26-27, 4.26 in. (108.2 mm) of rain was recorded. No reference to damage was found.

Heavy rains that followed a fall of snow caused the Bella Coola River to flood. One bridge was washed out and several others were damaged. The total damage was estimated at \$15,000. The Salaant (Salloompt) bridge at Hagensborg, which was about 300 ft. (90 m) long, was swept away. The Noosatsum (Nusatsum) bridge was also washed out and a number of smaller structures were destroyed. The Bella Coola River had not been as high for many years.

August, 1909

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Tarr and Martin 1914 (p. 158); Clague and Rampton 1982; Clarke 1982; Clarke et al. 1984; Clarke 1989; Clague and Evans 1994 (p. 23).

In August 1909, a major flood occurred on the Alsek River delta (Tarr and Martin 1914), which may have resulted from the draining of Lake Alsek. Eyewitness accounts of this flood clearly indicate that the rapid emptying of a glacier-dammed lake caused it. Potential ice-dammed lakes other than Lake Alsek may have been the source of these floodwaters. For example, a lake may have formed in Alsek Valley in British Columbia behind the toe of Tweedsmuir Glacier (Clague and Rampton 1982). *1)

An extremely large, self-dumping lake formed many times during a recent period of cooler climate that ended in the late nineteenth century. Lowell Glacier advanced or surged across Alsek River (Clague and Rampton 1982). Calculations using a paleohydrological simulation model (Clarke 1982; Clarke et al. 1984) indicate that the peak discharges of floods from Lake Alsek during the mid-nineteenth century were roughly 30,000 m³/s (Clarke

1989), which is about one third of the mean flow of Amazon River at its mouth. A jökulhlaup associated with an earlier phase of the lake had a peak discharge of about 470,000 m³/s (Clarke 1989).

Although Lake Alsek no longer exists, it would re-form if Lowell Glacier were to surge about 1 km. A major blockage of Alsek River might inundate the town of Haines Junction and sections of Haines Road and Alaska Highway (Clague and Evans 1994).

*1) Although Lowell Glacier may have impounded a small lake in the early years of this century, no lake existed in Alsek Valley after 1917 (Clague and Rampton 1982).

September 13-15, 1909

Event type: Flooding?

Precipitation: Swanson Bay (182.4 mm/3 days), September 13-15, 1909; Prince Rupert (180.8 mm/2 days), September 14-15, 1909; Port Simpson (116.0 mm/2 days), September 14-15, 1909; Ikeda Bay (90.9 mm/2 days), September 14-15, 1909.

Source: *The Empire*, September 18, 1909.

On September 15, Prince Rupert recorded 5.11 in. (129.8 mm) of rain in a 24-hour period. Three buildings in Prince Rupert collapsed.

December 11-12, 1910

Event type: Snow avalanche.

Precipitation: Prince Rupert (92.7 mm/2 days), December 11-12, 1910; Swanson Bay (243.4 mm/2 days), December 11-12, 1910; Prince Rupert (55.1 mm/1 day), December 12, 1910.

Source: *The Prince Rupert Optimist*, December 13, 1910.

Prince Rupert reported 1.56 in. (39.6 mm) of rain on December 13. A snowslide some 60 mi. (96 km) east of Prince Rupert interrupted the telegraph service.

March 12-13, 1911

Event type: Snow and debris slides.

Precipitation: Swanson Bay (130.0 mm/1 day), March 12, 1911; Prince Rupert (163.0 mm/2 days), March 12-13, 1911.

Source: *The Prince Rupert Optimist*, March 12 and 13, 1911; *The Omineca Herald*, March 11, 1911; *The Evening Empire*, March 13, 1911.

On March 12, Prince Rupert reported 3.14 in. (79.8 mm) of rain and on March 13, 3.84 in. (97.5 mm). The first Grand Trunk Pacific (GTP) train of the season reached Prince Rupert after the rotary plow cleared the line. The worst snow and debris slides were at Mile 43 and Mile 46.

March 27-29, 1911

Event type: Snow avalanches.

Precipitation: Prince Rupert (116.8 mm/3 days), March 27-29, 1911; Swanson Bay (203.7 mm/3 days), March 27-29, 1911.

Source: *The Evening Empire*, March 13, 1911; *Island Colonist*, March 23, 1911.

On March 28, Prince Rupert reported 2.89 in. (73.4) of rain. Many snowslides occurred on the GTP rail line. The slides were at Mile 42, 42.5, and 43, with small slides between Mile 41-44 and a big slide at Mile 44. A total of 275 men were working at clearing the line.

May 1911

Event type: Snow avalanches.

Precipitation: Not applicable.

Source: *Victoria Daily Times*, May 20, 1911.

Around the middle of May, snow avalanches covered the GTP railway track of the mail line under construction east of Prince Rupert. The line considered by railroad engineers as the most difficult and expensive piece of track building in Canada, was built to within 50 mi. (80 km) of Hazelton when avalanches blocked the line. The slides, which piled drifts up to 100 ft. (30 m) deep, were "mingled with boulders that weighed several tons." It was estimated it would cost \$30,000 to clear the line. "Centrifugal snow ploughs were unable to make a dent in the drift.... and the wreckage shoveled by slow stages into the Skeena River."

June 1911

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Prince George Citizen*, May 31, 1928; *The Daily Colonist*, May 20, 1939.

Spring runoff caused the Fraser River at Prince George to rise to a record level of 25 ft. causing the city to flood. According to water level taken by J. Simonson, in 1911 the gauge at South Fort George reached a high mark of 18 ft. (*Prince George Citizen*, May 31, 1928).

June 11, 1913

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Vancouver World*, July 16, 1911.

On June 11, Tête Jaune flooded due to the sudden rise of the Fraser River. Heavy rains during the previous few days caused a sharp rise in the water levels. In Main Street, the water was 6 ft. (1.8 m) deep and still rising. (*The Vancouver World*).

March 31-April 2, 1912

Event type: Severe storm.

Precipitation: Ikeda Bay (68.6 mm/2 days), March 31-April 1, 1912; Swanson Bay (189.3 mm/2 days), March 31-April 2, 1912; Prince Rupert (117.1 mm/2 days), April 1-2, 1912.

Source: *The Daily News*, April 2, 3, and 4, 1912; *The Evening Empire*, April 1, 2, and 3, 1912.

On April 1, Prince Rupert recorded 2.04 in. (51.8 mm) of rain and 3.18 in. (80.8 mm). On April 4, a “blizzard” dumped 7.5 in. (19.1 cm) of snow on Prince Rupert. The Vancouver-bound S.S. *Chelohsin* was badly damaged during the heavy gale. The ship was driven on the rocks in the Skeena Slough south of Prince Rupert.

October 1-2, 10-11, 1913

Event type: Landslide.

Precipitation: Bella Coola (55.4 mm/2 days), October 1-2, 1913; Bella Coola (66.0 mm/2 days), October 10-11, 1913.

Source: *Bella Coola Courier*, October 4 and 18, 1913.

Bella Coola recorded a total rainfall of 8.11 in. (206.0 mm) for September. A landslide occurred 35 mi. (56 km) up the valley above the Gibson Ranch during the first half of October. It damaged a portion of the wagon road, cutting off the upper valley.

October 29-November 3, 1913

Event type: Rain-on-snow flooding.

Precipitation: Bella Coola (58.7 mm/1 day), October 22, 1913; Masset (47.0 mm/1 day), November 3, 1913.

Source: *The Daily News*, November 3, 1913; *The Omineca Herald*, November 7, 1913; *The Morning Sun*, November 3, 1913.

Three days of rain caused several large snowslides on Rocher de Boule near New Hazelton.

In the Bella Coola area, incessant rains on snow caused the “most serious flood that the oldest settlers have ever known.” On October 29, the Neeleetsconnoy River and other streams started rising rapidly. By 3 p.m., large streams of water were running down the main streets. The river, which peaked at 6 p.m., seemed to have changed its course running through town at a depth of over 2 ft. (60 cm). The stream carried a horse and wagon engaged in rescue operations for 40 yd. (36 m) before becoming jammed in a pile of logs. Only with great difficulty the men and horse were extricated (*Bella Coola Courier* In: *The Daily News*).

November 30-December 3, 1913

Event type: Rain-on-snow flooding.

Precipitation: Ikeda Bay (282.4 mm/4 days), November 30-December 3, 1913; Terrace (157.0 mm/3 days), December 1-3, 1913.

Source: *The Omineca Herald*, December 5, 1913; Varley 1981 (pp. 132-133).

Debris slides and washouts interrupted the rail traffic between Terrace-Smithers. The train passengers were transferred to a special train. Foley, Welch & Stewart’s derrick and crew cleared a big landslide at Mile 125, 5 mi. (8 km) east of Pacific. The slide was several feet high. Other damage consisted of a washout at Woodcock, a big slide just west of Sealy, and six small slides west and a big slide just east of the big tunnel between New Hazelton-Bulkley Canyon.

Heavy rains caused the Kitimat River to flood roads near Kitimaat Village. The Anderson’s ranch along the west side of Kowthpega (Anderson’s) Creek had its landing and boathouse carried downstream. (Varley 1981).

December 8-9, 1913

Event type: Debris flows.

Precipitation: Ikeda Bay (247.0 mm/4 days), December 6-9, 1913; Prince Rupert (112.3 mm/1 day), December 8, 1913; Terrace (38.1 mm/1 day), December 8, 1913.

Source: *The Daily News*, December 8 and 9, 1913; *The Omineca Herald*, December 5, 12 and 19, 1913; *Queen Charlotte Islander*, December 10 and 17, 1913; *The Interior News*, December 13 and 20, 1913.

On December 9, Prince Rupert reported 3.86 in. (98.0 mm) of rain and 1.35 in. (34.3 mm) on December 10. The rail line sustained heavy damage, interrupting the rail traffic for over two weeks. The train passengers were held up for a week and some interior points were running short on food supplies. Many mudslides occurred along the railroad as far east as Moricetown. *1) The big slide at the hill cut at Mud Creek required pile driving over the full distance. On the east side, 300 ft. (100 m) of the hill went out. A pile bridge was erected and two steam shovels had to be brought in to widen the cuts several hundred feet. At the big cut at Duncanon, a few miles east of Hazelton, mudslides and several small slides occurred at the lower part of the railroad.

On the Queen Charlotte Islands a slide blocked the Nadu road. It was cleared by the provincial government. The storm on the night of December 8 caused some damage. The gasoline launch *Johnnie*, belonging to the Tingley Bros., broke from its mooring. It sustained considerable damage after being blown across the lake to Ship Island.

*1) To avoid the “gumbo” slides, the railway company considered abandoning the present grade in favour of the surveyed Old Copper River route (*The Daily News*, December 8, 1913).

February 24-28, 1914

Event type: Flooding.

Precipitation: Ikeda Bay (273.2 mm/5 days), February 24-28, 1914; Prince Rupert (133.0 mm/3 days), February 25-27, 1914; Prince Rupert (65.0 mm/1 day), February 26, 1914.

Source: *The Daily News*, February 26, 1914; *The Evening Empire*, February 25, 26, and 27, 1914.

Prince Rupert reported 1.81 in. (46.0 mm) of rain on February 25, 1.57 in. (39.9 mm) on February 26, and 1.38 in. (35.1 mm) on February 27. The excavation job on the new Post Office site was flooded out.

November 20-25, 1914

Event type: Rain-on-snow flooding and landslides.

Precipitation: Ikeda Bay (237.3 mm/5 days), November 20-24, 1914; Prince Rupert (116.8 mm/4 days), November 21-24, 1914; Terrace (147.0 mm/4 days), November 22-25, 1914.

Source: *The Omineca Herald*, November 27, 1914; *The Interior News*, November 28, 1914; Varley 1981 (pp. 134-136 and 223).

As a result of incessant rains on November 22 and 23, trains were blocked by slides east and west of Smithers. The Bulkley River rose significantly, carrying large quantities of trees and driftwood. Old-timers claimed this “the biggest rain on record here at this season.” For the week ending November 25, Hazelton reported 2.55 in. (64.8 mm) of rain. The heavy snowfall turned into rain, causing slides a few miles east of New Hazelton. The train traffic was interrupted, delaying the westbound train for 36 hours.

Very warm weather, combined with two days of heavy rain, a 25 ft.-(7.5 m) tide, and a full moon, caused heavy flood damage near Kitamaat Village. Roads and the Anderson ranch were flooded. *1) The water came so high that it flooded the valley for miles around. The Kitimat River cut a whole swath of timber from the Hallet and Mitchell logging operation, 2 mi. (3.2 km) upstream from the Anderson ranch. A big logjam formed at the head of Kouwthpega (Anderson’s) Creek. The water was running wild down the low land just upstream. The backed-up river directed its flow westward through Little Klupa Creek (Varley 1981).

*1) The southwestern corner of the Anderson ranch has changed drastically since. By 1952, Kouwthpega Creek cut west as far as the corner of the front lawn and had taken the cabin, the barn, and the entire barnyard (Varley 1981).

March 16-19, 1915

Event type: Mudslide.

Precipitation: Prince Rupert (92.8 mm/4 days), March 16-19, 1915; Terrace (28.2 mm/1 day), March 17, 1915; Ikeda Bay (92.2 mm/2 days), March 17-18, 1915.

Source: *The Omineca Herald*, March 19, 1915.

On March 17, just east of New Hazelton, the spring’s first major mudslide occurred. The passenger train was held up for 24 hours. Two ditchers were involved in clearing the slide.

Winter 1915-1916

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: Anthony L’Orsa, pers. comm. June 12, 1995.

During the winter 1915-16, a snow avalanche on the southeastern shoulder of Mount Cronin killed a man carrying mail for the Cronin mine. *1)

*1) Old-timers named the avalanche track “Dead Man’s Gulch”.

March 6-10, 1916

Precipitation: Bella Coola (135.6 mm/4 days), March 7-10, 1916.

Source: *Bella Coola Courier*, March 11, 1916; MacKellar, J. 1963. Ocean Falls. PABC, MSS 2173, Vol. 1, folder 1, Provincial Archives Victoria, B.C.

The Bella Coola area experienced heavy rain followed by 8 in. (20.3 cm) of snow. The telegraph and telephone lines in the valley were down for several days.

On March 6 and 7, Ocean Falls reported heavy snowstorms. On March 7, there was about 18 to 20 in. (45.7 to 50.8 cm) of snow on the ground. The bad weather continued on March 8 and on March 9 the steamer *Camosun* was reported in trouble near Prince Rupert (MacKellar 1963).

June 1916

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Omineca Herald*, June 23, 1916; *The Interior News*, June 24, 1916; Asante 1972 (p. 174); Dr. A.S. Gottesfeld, pers. comm. June 1, 1994.

The Skeena River water level rose dramatically during the spring runoff (Asante 1972). Warm temperatures caused the high water levels.

In interviews conducted in 1985, Moricetown residents Emma Michell and Jenny Naziel remembered a severe flood hitting Moricetown. The flood removed all the structures on the lower terrace. The floodwaters swept behind Louie Tommy's smokehouse right through the gully called "stoop" and removed all the smokehouses. This event was estimated to have happened between 1914-1918. (Gottesfeld, pers. comm.). It is possible that this reported flood actually happened during June 1916.

The warm weather also caused a sudden rise in the waters of the Telkwa and Bulkley rivers. For several days a flood was feared. The Telkwa River went on a rampage at its mouth and cut a new channel under the government bridge. One of the bents of the Telkwa River bridge washed out around June 20. One span of the long bridge was carried away and the traffic over the short road was suspended.

Late March 1917

Event type: Non-fatal avalanche.

Precipitation: Not applicable.

Source: *The Daily Province*, March 30, 1917.

A snowslide near the mouth of the Rocher de Boule mine near Hazelton buried three women, including the wife of the mine's superintendent. They were swept many feet under a "great volume of snow and completely disappeared." Mine employees "made record time in digging out the women who were nearly smothered."

October 1-5, 1917

Event type: Rain-on-snow flooding.

Precipitation: Ikeda Bay (169.7 mm/3 days), October 1-3, 1917; Bella Coola (55.6 mm/1 day), October 2, 1917; Stewart (158.9 mm/4 days), October 2-5, 1917.

Source: *The Evening Empire*, October 2, 3 and 4, 1917; *The Daily Province*, October 22, 1917; *The Vancouver Daily Sun*, October 23, 1917; Kopas 1970 (p. 266); Provincial Archives Microfilm B-1918 Letter, October 10, 1917. Indian Agent (Bella Coola) to Dept. of Indian Affairs. Provincial Archives, Victoria; File G-0-3 Letter, March 9, 1936. J. C. Brady (Dist. Eng. Prince Rupert) to A. Dixon (Chief Engineer Victoria). B.C. Ministry of Transportation and Highways, Terrace, B.C.

Between October 2-4, severe weather was reported in Hecate Strait and beyond, hampering the halibut fishing. On October 2, a gale blew in a plate glass window in the former Acme premises on 2nd Avenue, Prince Rupert. Railway track damaged near Tyee by the recent storms caused the westbound train to arrive four hours late in Prince Rupert.

The Bella Coola valley was struck by flooding. One bridge about 3 mi. (4.8 km) up the Bella Coola River and several smaller ones further up the river were washed away. According to Kopas (1970), floodwaters took out the Four Mile bridge. Iver Fourgner, Indian Agent at Bella Coola noted, "The greatest damage done was by a tributary stream the Neeleetscunny (Neeleetsconnoy), which overflowed its banks due to the destruction of a wingdam and flooded the townsite. Two stores, the Hospital, schoolhouse, Indian Agent's office and other buildings were damaged slightly, and water covered all ground floors. Some foundations were weakened. The provincial road was destroyed and turned into a riverbed."

The Indian Agent in Bella Coola described the situation in a letter this way: "Several days of incessant rain with warm westerly winds melting the snow in the mountains. Bella Coola on October 2 experienced the worst flood in its [23-year] history. As a result a dam was carried away in the Neeleetsconnoy River, and at 6:00 p.m. the agency grounds were covered with swift flowing water, tearing down fences and filling our basement with more than 4 ft. (1.2 m) of water. No human lives were lost but many animals [were]. Great damage was done to roads and bridges...." The expenditures for the Bella Coola Valley roads for 1917 were \$1,001.50 for labour and \$33.35 for material (J.C. Brady 1936).

The flood indirectly damaged the Union Steamship Company *Camosun* when the vessel hit submerged wreckage believed to be a tree stump. The vessel had to be towed back to Vancouver with a stripped propeller and bent shafts. (*The Daily Province*, October 22, 1917).

October 28-November 19, 1917

Event type: Rain-on-snow flooding.

Precipitation: Ikeda Bay (1062.6 mm/23 days), October 28-November 19, 1917; Swanson Bay (2395.2 mm/25 days), October 28-November 21, 1917; Prince Rupert (517.7 mm/21 days), October 30-November 19, 1917; Masset (438.4 mm/20 days), October 21/November 19, 1917; Queen Charlotte City (72.1 mm/1 day), October 31, 1917; Bella Coola (183.9 mm/3 days), November 2-4, 1917; Anyox (119.4 mm/1 day), November 6, 1917; Anyox (476.0 mm/10 days), November 12-21, 1917; Ikeda Bay (414.5 mm/6 days), November 13-18, 1917; Stewart (246.2 mm/6 days), November 15-20, 1917; Bella Coola (130.0 mm/3 days), November 20-22, 1917.

Source: *The Daily News*, October 31, November 1, 2, 3, 5, 8, 9, 12, 20, 21, 1917; *The Evening Empire*, November 5, 6, 9, 10, 12, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 26 and 29, December 1, 1917; *Interior News*, November 3 and 24, 1917; *The Omineca Herald*, November 2, 9, 16 and 23, 1917; *The Alaska Daily Empire*, November 22, 1917; Moeran 1923 (pp. 206-208); Pincock 1951; Wicks 1976; Phillips 1990 (p. 64); Environment Canada, Meteorological Branch, Monthly Record; C.C. Perry (Indian Agent, Nass Agency), Diary entries for November 5, 8, 16 and 26, 1917. Provincial Archives, Victoria; Letter No. 592, December 20, 1917. C.C. Perry to Ass. Deputy and Secretary Dept. of Indian Affairs, Ottawa. Provincial Archives, Victoria.

In the fall, continuous wet and stormy weather caused heavy damage all along the coast, including the Alaska panhandle and the interior. On November 17, Swanson Bay, south of Prince Rupert, recorded 10.6 in. (268.2 mm) of rain in 24 hours (Pincock 1951). In November 1917, Swanson Bay also set the Canadian record of the greatest precipitation in one month with 2,235.5 mm of rain (Phillips 1990). Terrace received over 5 in. (127 mm) of rain between November 1-5 and Anyox reported rain and snow for weeks. According to *The Omineca Herald*, the rain had been general for the previous two months. The rivers and streams were even higher than the highest mark reached in the big spring flood of 1893 (1894?). The Skeena River reached "levels higher than any white man could remember." It was reported to have reached its highest level since 1894, covering Haysport with debris. The river did not start dropping until November 22.

The Grand Trunk Pacific (GTP) was tied up because the rail line between Prince Rupert-Smithers was heavily damaged. High waters of the Skeena River washed out and damaged a couple of bridges. Slides and washouts blocked traffic between Kitwanga-Prince Rupert for several weeks. Passengers for Prince Rupert and other coastal points had to travel by way of Prince George and Vancouver. A landslide along the railroad at Kwinita also took the telegraph line down. Other slides occurred 15 mi. (24 km) east of Prince Rupert and several debris slides 30 mi. (48 km) east of Inverness. There were a total of four slides within 100 mi. (160 km) of Prince Rupert. A passenger train got caught between two slides. Washouts occurred at Pacific and elsewhere along the Skeena River. Around November 5, the pilings of the Kitsumkalum railroad bridge were loosened, interrupting the rail traffic.

On November 13 at 11 p.m., a large debris slide came down at Inverness. It covered the track for 600 ft. (180 m) and was 40 ft. (12 m) deep. It wiped out the telegraph line for six pole lengths. The S.S. *Prince Albert* took passengers, luggage, and mail to the Sunnyside Cannery, just east of Inverness, to meet the eastbound train. The ship also took the westbound passengers, luggage, and mail back to Prince Rupert. On November 23, the slide was cleared by two steamshovels working on both ends. Hundreds of men from the coast to Jasper were employed to repair the damage. Rail traffic was resumed on December 1.

The slide that came down at Inverness also hit the Inverness Cannery. The messhouse, bunkhouses and the accountant's residence and other property were damaged. Fortunately the cannery was closed for the season. Some residents had just left for Prince Rupert that evening. One man asleep in the caretaker's cabin escaped unharmed by cutting a hole in the roof (Wicks 1976).

Heavy damage also occurred elsewhere. In Prince Rupert a house on 1st Avenue and the Port Edward shingle mill were blown down. The Bella Coola area sustained heavy damage due to flooding. The Kitsault River came up high and threatened Alice Arm.

The Nass Valley flooded to a depth of 10-24 ft. (3-8 m), wiping out the village of Aiyansh. The flooding there was due to a natural logjam. It caused a heavy loss of livestock and property damage. Some of the houses floated away and the residents moved 2 mi. (3.2 km) upstream to Gitlakdamiks (New Aiyansh). The Indian Agent, C.C. Perry, described the situation as follows: "For 66 consecutive days rain storms continued, with devastating winds. Unprecedented Nass River flood did considerable damage to Aiyansh and Gitlakdamiks reserve...." (Perry, diary entry of November 26, 1917). The weather in November had been "... the worst known in 50 years. Floods have been widespread and their effects have been serious in some of the reserves, particularly on the Nass River. The village of Aiyansh has been breached in two places ... all the Indians' cattle and horses were drowned... the potato crop and hay have been washed away.... Many of the houses were carried away bodily. Gravestones were washed out from the graveyard and piled up with fences and other debris in the village ... at Lak-alzap (Greenville) and at Gwinoha the villages have suffered severely... the three villages will amalgamate and the Nass Indian centre will be Gitlakdamiks where the ground is higher." (C.C. Perry, letter December 20, 1917). Moeran (1923) described the flood in his

biography about James Benjamin McCullagh, minister with the Church Missionary Society at Aiyansh: “September 1917 was an unusually wet month, October was still more so, 16 in. (406.4 mm) having been reckoned as the downfall. Before the melted snow came from the mountains the [Nass] river was already in full spate and absolutely unnavigable. By the middle of November the river was awful to behold. On the afternoon of Sunday, the 18th, tidings came that the river had broken through near Gitlakdamiks and was rushing down behind Aiyansh.... By Tuesday morning there were over 10 ft. (3 m) of water in the house.... By Wednesday the flood began to show signs of abating... they found the mission house [at Aiyansh] in a deplorable condition ... everything inside was ruined, including the winter’s supply of provisions which had only just been stored. The missionary’s printing office was completely submerged ... his precious books, including the backwoods library, were reduced to a muddy pulp. Some of the other houses in the village had been carried away entirely by the flood. The sawmill and many of the buildings were swept away and the debris scattered all over the country.” In order to avoid future flooding through the breach made in the bank below Gitlakdamiks, it was decided to move the houses from Aiyansh to Gitlakdamiks. In turn each house was pulled down, the lumber carted on sleighs along the Gospel road and rebuilt on a new allotted space. The removal of the mission house was delayed till enough money could be raised for the move. The people suffered much from the cold winter and the lack of proper food, as they had no means of replenishing their potato stock of the barrels and boxes of provisions destroyed or carried away by the flood. When the news of the disaster reached England early in 1918, sympathy and substantial help came from many quarters (Moeran 1923).

In the Bulkley Valley, a “hurricane,” as described by Alex “Doc” Clapperton, inspector of the road construction near Telkwa, downed countless trees and damaged many ranch buildings. This “greatest gale in the Bulkley Valley” demolished the new barn at the Sealy Ranch. The gale also did considerable damage in the town of Smithers, breaking windows and upsetting buildings. Much timber was blown down as well. Telephone and telegraph wires were put out of commission. High waters in the Bulkley River caused some damage to one of the supports of the Telkwa River bridge. The bridge over the Bulkley River at Telkwa was badly damaged. All the extra supports that were put in during the summer of 1916 washed away. Some smaller bridges further upstream were reported washed out or damaged. Roads through the Telkwa district were almost impassable.

At New Hazelton, high water and driftwood threatened the new bridge over the Bulkley River. On November 20, water levels started to recede slightly. Further upstream from New Hazelton two government bridges, at Kispiox and the Skeena River bridge were rendered unsafe. It was proposed to move the old ferry from the Bulkley River to the Skeena River, where it would cross from the old bank building. On the Roche de Boule tramline three towers were blown down, and a horse belonging to mining surveyor Dalby B. Morkill was blown over a cliff.

On the Queen Charlotte Islands the stormy weather lasted for two weeks. T. Deasy of Masset described it in *The Daily News* as “One fair day out of 14 bad ones.” Serious slides occurred on the Woden River (Watun Creek), 5 mi. (8 km) south of Masset. They wiped out a hotel, a dwelling belonging to Rev. Fr. McDonald, and a store once used by Grange. None of these buildings were occupied at the time. The launch *Deeban* with three Native Indians, Stephen Ryan, and Peter and Richmond Robertson from Metlakatla went missing while searching for another Indian boat missing since November 1. The latter returned safely soon after the other boat left. On November 8, pieces of the launch and the rowboat in tow were found on the south shore of Dundas Island. On November 16, Stephen Ryan, the lone survivor, was found. He had been living on rainwater and two potatoes for 16 days.

1917

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *Prince George Citizen*, November 29; December 2, 1921.

In 1917, an icejam at the junction of the Nechako and Fraser rivers caused flooding in low-lying portions of Prince George. The flooding was described as “slightly less serious” than the icejam flooding of November 1921. *1)

*1) In his January 1915 report to the government, Col. Thompson noted that the townsite of Prince George or that portion of it located on what he termed “the Nechaco Flats” would be liable to damage from the action of water and ice under certain climatic conditions. “Some persons report extreme high water and ice shoves occurring frequently about the first of January. I am inclined to the view that at great intervals, the territory is more endangered by ice shoves and resultant high water overflow, than by the June-July freshets. Like many northern streams, the Nechaco and the Fraser are both subject to three forms of ice: sheet, frazil and anchor. The junction of these rivers occurs just at the northeast of the townsite. The Nechaco coming from the northwest and the Fraser coming in general course from the southeast. The scourings of the Nechaco Flats and the channel surrounding Connaught Park (making an island of a large part of Prince George, a part of South Fort George together with a part of the lands of the Hudson’s Bay Company) bear testimony to the battle of the waters of the two rivers, either in ice throes or in spring flood. The river we imagine frozen from shore to shore and the junction of the two and down to a trifle below the railroad bridge, then generally open through the narrow section to below South Fort George, then closed again. Owing to windy weather frazil ice will have been forming for some time on the rapids above, in both rivers. This floating down, adheres to the underside of the sheet across the river, slowly constricting the channel. For several clear cold nights anchor ice forms. A slightly warmer day comes, when the anchor ice rises, and, floating down, adds to the underburden and overburden of the sheet ice, and the water of the river must find some other outlet than the ordinary river

channel. This it obtains across the Nechaco Flats and round Connaught Park hill, falling back into the main channel below the Hudson's Bay quarters (*Prince George Citizen*, November 29; December 2, 1921).

Late December- early January 1918

Event type: Fatal snow avalanche.

Precipitation: Queen Charlotte City (86.9 mm/1 day), December 26, 1917.

Source: *The Daily News*, December 27, 28, 29 and 31, 1917; January 2, 3, 4 and 5, 1918; *The British Columbian*, December 31, 1917.

On December 27, the westbound train into Prince Rupert was delayed by half a day. Downed wires interrupted the telegraph service. On December 31 a slide at Kwinitsa interrupted the telegraph service and train traffic. The regular train service was interrupted until January 5, 1918.

On the morning of December 28, a snowslide killed two men, employees of the New Hazelton Gold Cobalt Company of Vancouver. The victims were on their way up the Rocher de Boule mountain to work.

Late December-early January avalanches between Prince Rupert-Terrace blocked the rail line and cut the telegraph wires. The westbound train scheduled to arrive in Prince Rupert on the evening of December 30 was cancelled. On January 2, slides still blocked the rail line. It was difficult to clear the track at Kwinitsa and with the telegraph lines down as well, there was little information on the situation. The slides were greater than first expected and the difficulties to get the telegraph wires through were "considerable." On January 4, the tracks were cleared again and some rail traffic resumed.

Late summer 1918

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Dawson 1889; Kerr 1948.

A glacial outburst flood from Flood Glacier was reported to have taken place during the late summer, raising the Stikine River from a low stage to a half flood. The flood was caused by the sudden discharge of the waters of Flood Lake. *1) This ice-dammed body of water was about 2 mi. (3.2 km) long and occupied a tributary valley from which the tributary glacier had melted away (Kerr 1948).

*1) Before 1918, these floods occurred almost annually (Dawson 1889). Lack of floods in more recent years is probably due to the formation of a high-level outlet that keeps the pressure down (Kerr 1948).

January 1919

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Interior News*, February 1, 1919; Bourgon 1979.

Around January 1919, ice in the Bulkley River jammed at the turn near the bridge at Hubert, just east of Telkwa. The backed-up water flooded the flats upstream and thin layers of ice were deposited. One chunk of ice as big as a house was in one of the fields until haying season (Bourgon 1979). The icejam also took out two spans of the bridge across the Bulkley River at Hubert.

The business section along the river at Telkwa was also flooded. A photograph taken later in the winter of 1919 shows the road along the river littered with chunks of ice.

Late May-early June 1920

Event type: Spring runoff flooding?

Precipitation: Not applicable.

Source: *Prince George Citizen*, May 31, 1945.

In 1920, heavy winter snows, late spring, little April-May runoff, warm days and nights in late May and June, accompanied by heavy thunderstorms built up water levels to danger points (*Prince George Citizen*, May 31, 1945).

August 5-6, 1920

Event type: Flooding.

Precipitation: Stewart (136.2 mm/2 days), August 5-6, 1917.

Source: *Portland Canal News*, August 7 and 14, 1920.

On August 5, the heavy rains of the previous few days interfered considerably with development and prospecting near Stewart. The Bear River and its tributaries overflowed their banks. Roads and trails up the Bear and Salmon valleys became almost impassable. The main wagon bridge a mile (1.6 km) above Stewart was damaged by high water. Reports from Prince Rupert indicate that the storm was general.

August 12-13, 1920

Event type: Flooding and landslides.

Precipitation: Stewart (169.4 mm/2 days) August 12-13, 1920.

Source: *Portland Canal News*, August 14 and 21, 1920; Muralt 1985.

A fierce four-day rainstorm struck the northwest coast area, causing widespread damage. Slides and washouts closed down traffic on the Dolly Varden Mines Railway for several days. The Portland Canal Short Line, 65 mi. (117 km) north of Alice Arm, sustained heavy damage. Four new bridges on the recently rebuilt and restored line were completely destroyed and portions of the grade washed out. This rail line did not see operation again until 1929 (Muralt 1985).

The rainstorms that occurred during the previous two weeks were described as the “worst in the memory of the oldest inhabitants of the district.” Four days of steady rain were reported during the previous week. The downpour lasted for many hours and at times approached a cloudburst. Rivers overflowed their banks, destroying bridges and making roads impassable. The worst damage occurred up Bear River where three railroad bridges were out of commission, as well as the wagon bridges over Glacier Creek and American Creek. The main wagon bridge a mile (1.6 km) above Stewart sustained more damage.

As a result of the storm, mining development was seriously interrupted. It would be weeks before all bridges could be repaired. As a temporary measure cables were strung, enabling prospectors and operators to get supplies to the mining properties.

October 7-8, 1921

Event type: Rain-on-snow flooding.

Precipitation: Stewart (161.1 mm/2 days) October 7-8, 1921.

Source: *Portland Canal News*, October 14, 1921.

Heavy rains washed all the recent snow off the mountains. On October 8, the Bear River, American Creek, and Marmot River bridges washed out by sudden flooding. Considerable damage was done to roads and trails, some of which entirely washed out in places. At the 7 Mile bar, the Salmon River Road completely washed out. About 1 mi. (1.6 km) below this point the river ran down the road, tearing up the corduroy for 0.5 mi. (800 m) and depositing it through the woods.

Just above Hyder, Alaska, at 1 Mile bar, the Salmon River overflowed its banks and swept down through the north end of the town, doing extensive damage to the road and private property. The river cut away considerable property behind the O'Connor building on the Forest Reserve, necessitating the moving of several buildings. A large portion of the Salmon River Glacier evidently broke away during the high water. Large icebergs were washed down the river as far as Eleven Mile.

November 28-29, 1921

Event type: Icejam flooding.

Source: *Prince George Citizen*, November 29; December 2, 1921; *The Daily News*, December 3 and 4, 1921; *The Vancouver Sun*, January 16, 1970.

A heavy icejam on the Nechako River near Prince George in the shallow water at the junction of the Fraser River flooded the main tracks and yard of the Canadian National Railway (CNR). By noon on November 27, the main line was under water for some of the distance between George Street and the western end of the yards. The low-lying properties in the vicinity of the station were flooded. Parts of Chinatown were flooded “halfway up the doors of the premises.” By blowing a channel through the grades just west of the roundhouse, a lot of water was drained off the important sections of the yards where the tracks lead to the coal bunkers and water tank. At the station of the Imperial Oil Company, on the team tracks, the residence of the local agent was flooded over the windowsills.

At the Cache, an island at the confluence of the Nechako and Fraser rivers, many houses flooded. *1) The city powerhouse was endangered. Some of the machinery had to be moved to higher ground. The Nechako River bridge was threatened when the water and ice became level with its floor. The bridge moved slightly out of alignment. Trenches were blasted to blow out a channel for the water. After the outlet was made in the icejam, the water receded steadily. Though getting through the inundated sections had to be done with care, train traffic was not delayed.

*1) The Cache or Island Cache is a small community (approximately 400 people in 1970) to the north of Prince George city limits. It is properly known as Cottonwood Island. (*The Vancouver Sun*, January 16, 1970).

December 3-5, 1921

Event type: Severe storm.

Precipitation: Stewart (188.0 mm/3 days), December 3-5, 1921.

Source: *The Daily News*, December 3 and 4, 1921; *Portland Canal News*, December 9, 1921; Muralt 1985.

A storm on December 3-4, with winds of 60 mph (96 km/h), delayed shipping along the north coast. The *Princess Mary* had to return to Ketchikan, Alaska. The U.S. Revenue cutter *Snohomish* had to take shelter at Prince Rupert.

Due to the heavy snowstorm in Stewart it took nearly two days to unload and load the S.S. *Amur*. It was necessary to keep a crew of men continually shoveling snow, which fell at the rate of 1 in. (2.5 cm) an hour for 72 hours. A rainstorm closed the Dolly Varden Mine railway down completely, even to speeder traffic (Muralt 1985). *1)

*1) On July 1, 1922, the Government of British Columbia began repairs on the rail line under the direction of J. Anderson. The line was put in shape for light traffic, enabling the Alice Arm mining community to start operations for the 1922 season (Muralt 1985).

September 25-30, 1922

Event type: Fatal debris flow.

Precipitation: Bella Coola (72.1 mm/1 day), September 25, 1922; Prince Rupert (19.1 mm/1 day), September 29, 1922; Bella Coola (103.9 mm/2 days), September 29-30, 1922.

Source: *The Daily News*, October 5-6, 1922; *The Victoria Daily Times*, October 4, 1922; *The Daily Colonist*, October 5, 1922; *The Evening Empire*, October 2 and 5, 1922; Evans, unpublished data.

On September 29, the Bella Coola River flooded its banks. Bella Coola, a town of 175 people, was flooded with 4-6 ft. (1.2-1.8 m) of water and mud. Hotel Brynoldsen was undermined and washed out. A logjam formed in a bend a short distance above town. It diverted the main flow of water, thereby saving the town. The bridges leading from the settlement to the waterfront were swept away. According to an officer of the Union Steamship *Camosun*, Bella Coola was completely submerged on October 1. The ship was unable to take on passengers who were cut off from the dock by the high waters. The passengers and some small parcels of freight and baggage were loaded two days later with the assistance of "Indians using their shovel nose" canoes. There was no reported loss of lives.

The unusually heavy rains caused a very large landslide at Eicho Harbour, east of Ocean Falls. The slide, which came down on October 1, had an estimated width of 100 ft. (30 m) and a length of 1,200 ft. (360 m). A heavy mound of earth covered most of the houses. Five men, who were in a bunkhouse that was buried by the slide, were killed. Of the victims, four were buried alive and one was swept into the sea and presumably drowned. Rescue crews had not recovered the bodies of the five victims on October 5. The Davies residence was pushed into Dean Channel, where it was found floating with Mr. and Mrs. Davies alive. According to Evans (unpublished data), a debris flow occurred at Eicho Harbour on September 22.

February 23-28, 1923

Event type: Severe storm.

Precipitation: Prince Rupert (311.9 mm/6 days), February 23-28, 1923.

Source: *The Evening Empire*, February 26 and March 1, 1923; *The Daily News*, February 24, 26, 27 and 28; March 1 and 2, 1923.

A storm with heavy wind and rain lasting for two days interrupted commercial fishing. Smaller than usual halibut catches were marketed. On February 27, Prince Rupert reported 4.65 in. (118.1 mm) of rain. The telephone service was affected by a leak in the underground cable.

Near Juneau, Alaska, snowslides from Mount Juneau blocked the Basin Road. *1)

*1) Debris flows from Mount Roberts near Juneau on January 2, 1920, and November 23, 1936, destroyed buildings and killed four and 15 people, respectively. Snow avalanches down Snowslide Creek near Juneau in January 1922 and on December 31, 1974, killed one man each. On January 10, 1971, an avalanche on Mt. Juneau killed a climber. A snow avalanche down Cross Bay Creek near Juneau on February 7, 1974 killed a machine operator.

November 3-5, 1923

Event type: Landslide.

Precipitation: Queen Charlotte City (97.3 mm/2 days), November 3-4, 1923; Anyox (244.9 mm/2 days), November 3-4, 1923; Prince Rupert (147.8 mm/3 days), November 3-5, 1923; Prince Rupert (84.3 mm/1 day), November 5, 1923.

Source: *The Daily News*, November 5, 6 and 8, 1923; *The Interior News*, November 7, 1923.

On November 5, the S.S. *Prince John* of the CNR arrived in Prince Rupert after a stormy passage up the coast, which took two days longer than usual. In the north Bering Sea and Arctic Sea, whalers reported gales and ground swells. The gales were of the "longest duration ever known" and the ground swells were due to an earthquake in Japan.

In Anyox, 10 in. (254 mm) of rain fell between the mornings of November 3-5. On November 5, a landslide swept away about 50 ft. (15 m) of the 6 ft. (1.8 m) diameter waterline between the dam and the powerhouse. This caused the smelter and mine to shut down for five days. As a safety precaution the residents of the flats section of the town were moved in with families at the higher part of town. In the Stewart area the Salmon River road sustained considerable damage. Bridges and culverts were washed out and the road was temporarily made impassable, holding up traffic for several days. At the Premier Mine, 18 in. (45.7 cm) of snow fell.

Repeated rainfalls turned the main highways in the Smithers district into "seas of mud." Main Street was reported "to have started to run east and west in places."

November 13-15, 1923

Event type: Severe storms.

Precipitation: Queen Charlotte City (122.9 mm/3 days), November 13-15, 1923.

Source: *The Daily News*, November 17, 1923.

During early part of November, the Queen Charlotte Islands were raged by severe storms. Thirteen in. (330 mm) of rain fell in Skidegate Inlet during a period of 15 days. In one day alone, 2.8 in. (71.1 mm) fell. The lineman of the Dominion Telegraph line had to use a raft along the line near the Port Clements-Tlell road. During the heavy storm on November 9-10, the launch *Viola S* sustained damage to its hull while anchored at low tide. The light at Sand Point in Masset Inlet was wrecked during the storm on November 14. The S.S. *Kennicot* was wrecked near Queen Charlotte City. The S.S. *Princess Mary* of the CPR, inbound from Alaska, was delayed by the stormy weather.

December 1-5, 1923

Event type: Severe storm.

Precipitation: Terrace (72.4 mm/1 day), December 1, 1923; Prince Rupert (199.4 mm/5 days), December 1-5, 1923; Terrace (210.1 mm/5 days), December 1-5, 1923.

Source: *The Evening Empire*, December 3, and 4, 1923; *The Daily News*, December 1, 3 and 6, 1923; *The Omineca Herald*, December 7, 1923; *The Terrace News*, December 7, 1923; *The Alaska Daily Empire*, December 3, 1923.

On December 1, a gale with a force of 50 mph (80.5 km/h) with gusts of 70 mph (112.7 km/h) caused property damage in Prince Rupert. In the Westview area, Atlin Avenue/17th Street was worst hit. Three blocks of telephone and hydro poles were flattened, putting some 100 telephone poles out of commission. On Alfred Street some greenhouses were damaged. The train traffic was delayed due to a slide at Shames.

The shipping was held up by delayed arrivals of the Prince John from the Queen Charlotte Islands and the *Princess Mary* from the Alaska. The S.S. *North Western* was delayed for three days by heavy storms. On December 4, a boat was found upside down. It was feared that a Kitkatla man was drowned in this mishap.

The road near the Terrace Bandstand was washed away on December 1. Logging roads were blocked by fallen timber.

On December 6, Ocean Falls reported very heavy precipitation during the previous few days. On that date the water level behind the new dam came within 15 ft. (4.5 m) of the top, a level higher than that of the old dam.

January 4-6, 1924

Event type: Non-fatal snow avalanche.

Precipitation: Prince Rupert (114.1 mm/2 days) January 4-5, 1924; Aiyansh (67.3 mm/2 days) January 4-5, 1924; Stewart (114.3 mm/2 days) January 5-6, 1924.

Source: *The Evening Empire*, January 4, 1924; *The Daily News*, January 4 and 5, 1924; *The Portland Canal News*, January 11, 1924; B.C. Ministry of Transportation and Highways 1980.

A big snowstorm over the weekend blocked practically all the roads in the Stewart district. Frank Bowler narrowly escaped injury, getting caught in a snowslide just north of the Old Wharf. The slide, which was 300 yd. (275 m) long and up to 20 ft. (6 m) deep, completely buried the stage outfit. The snow was very light. A big stump on the upper side of the road broke its full force, preventing the horses, sled and driver from being swept into the river. It took almost "a score of men" and several teams two days to open the road to the wharf. Due to snowslides on the upper end of the Salmon Valley Road, the Crawford Transfer Co. stage was held up for several days at the Premier Mine.

January 22-25, 1924

Event type: Snow avalanches.

Precipitation: Stewart (132.1 mm/4 days), January 22-25, 1924.

Source: *Portland Canal News*, January 25, 1924.

On January 19, due to heavy snowfall during the weekend, the Stewart-Hyder road was again blocked with snowslides. On January 20, some 15 men and two teams worked all day to clear it.

February 10, 1924

Event type: Severe storm.

Precipitation: Not applicable.

Source: *The Daily News*, February 11, 1924; *The British Columbian*, February 12, 1924.

On October 12, Prince Rupert was hit by "one of the most destructive gales in her history." Wind speeds averaged 50 mph (80 km/h) with gust up to 70-80 mph. (112-128 km/h). The gale lifted about half of the roof of the overhead approach to the Prince Rupert railway station. The wind swept up land turned over long stretches of sidewalk near the Post Office and the B.C. Undertakers and along 3rd Avenue and McBride Street. Gusts tore loose 150 ft. (45 m) of the 16-ft. (4.8 m) wide plank sidewalk on 2nd Avenue. The north-facing roof end and the ceiling of the sitting

room on the top floor of the residence of Frank Morris were torn out. "Everything was over in less than a second," Morris said. At about 3 p.m., Imperial Oil Co.'s large tanker *R.J. Hanna* broke loose from its moorings.

It appeared that most of the damage was not done by the direct force of the "sou'wester" but by a series of whirlwinds. The sidewalk between the Post Office and Glennie's store was blown across the street in a direct easterly direction. The sidewalks on 2nd Avenue near the B.C. Undertakers were hurled in a westerly direction, while the overhead crossing at the railway station was blown directly north. This would lead to suppose the storm was cyclonic in nature, the centre being some distance from Prince Rupert (*The Daily News*, February 11, 1924).

August 23-26, 1924

Event type: Flooding.

Precipitation: Bella Coola (196.7 mm/4 days), August 23-26, 1924.

Source: *The Daily News*, August 27, 1924; Kopas 1970 (p. 266).

In 1924, there was a series of three floods on the Bella Coola River. Kopas (1970) notes the first one occurred in August, which "contrary to all laws of nature, tore up the town. The Bella Coola River flooded, and the Necleetsconnoy brought down huge batteries of trees and rocks which it hurled against the bridges, buildings and roads." (Kopas 1970). Starting August 24, floodwaters washed out a number of buildings, leaving many of the settlers isolated. After one of the bridges washed away, access to the wharf was cut off.

Only a short time earlier, there had been a flood that did much damage in the valley. At that time it was suggested that the village should be moved to the other side of the river. This was to prevent future isolation, as the bridge was likely to be washed out at any time when the water would rise again.

December 9-13, 1924

Event type: Flooding.

Precipitation: Ocean Falls (238.4 mm/5 days), December 9-13, 1924; Aiyansh (24.4 mm/1 day), December 10, 1924; Bella Coola (159.8 mm/3 days), December 11-13, 1924.

Source: Kopas 1970 (p. 266); Tempest 1974.

According to records kept by the B.C. Ministry of Transportation and Highways, a moderate flood occurred on the Bella Coola River (Tempest 1974).

This was probably the third of a series of floods on the Bella Coola River that Kopas mentions in his book "Bella Coola." (Kopas 1970)

December 2-7, 1925

Event type: Flooding.

Precipitation: Ocean Falls (430.9 mm/4 days), December 2-5, 1925; Terrace (53.1 mm/1 day), December 5, 1925; Anyox (188.0 mm/3 days), December 4-6, 1925; Aiyansh (154.2 mm/4 days), December 4-7, 1924;

Source: File 35-40-14 Letter January 12, 1926, C. L. Dimock (Ass. Dist. Eng. Smithers) to G. C. Mackay (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace, B.C.

Early December extreme high water took out the Cedar River bridge No. 40. The crib on the north side became undermined and the rock fill washed out.

January, 1926

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Marcus 1960.

In January, a glacial outburst flood occurred on Tulsequah Lake. The unusual winter outburst flood was attributed to an exceptionally warm winter preceded by heavy autumn rains. An early prospector reported it to George Bacon of Tulsequah. The prospector stated that floodwaters rose 12 ft. (3.6 m) and that huge ice blocks were carried many miles downstream. It was not known whether this was a true glacial outburst flood, but climatic data seem to corroborate the statement. The normally small winter discharge and/or frozenness of the Taku River also lend credence to the story (Marcus 1960).

February 8-10, 1926

Event type: Flooding and landslides.

Precipitation: Terrace (106.4 mm/3 days) February 8-10, 1926; Prince Rupert (36.1 mm/2 days), February 8-9, 1926.

Source: *The Terrace News*, February 8-9, 1926; File 35-90-34 Letter, March 12, 1926, Dist. Eng. Prince Rupert to C. L. Dimock (Ass. Dist. Eng.). B.C. Ministry of Transportation and Highways, Terrace.

Recent heavy rains caused damage to roads in the Terrace-Kitwanga area. Slides occurred on the Hodkin's Road and on the hill at Terrace.

Ca. 1927-1930

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Clague and Mathews 1992; Clague and Evans 1994 (p. 23).

Between 1927-1930, the last flood(s) occurred from Tide Lake, resulting from the breach of a moraine dam. *1) Situated in the northern Coast Mountains, the lake was impounded by Frank Mackie Glacier and its Neoglacial end moraine. Much of the sediment underlying the floor of Tide Lake was transported by subglacial and proglacial meltwater streams flowing from nearby glaciers. During the last phase of the lake, large subaqueous fans were built in front of Berendon and Frank Mackie glaciers, and deltas formed on the east side of the basin. Outburst floods from Tide Lake in the nineteenth and early twentieth centuries devastated Bowser River valley as far downstream as Bowser Lake. The flood in the mid to late 1800s (see ca. 1852 event) is reported to have completely destroyed an Indian settlement that was never reoccupied (Clague and Mathews 1992; Clague and Evans 1994).

*1) Tide Lake, which was once the largest ice-dammed lake in British Columbia, does not exist today. At its maximum, the lake was 9 km long, up to 1.8 km wide, 200 m deep at the ice dam, and had a volume of approximately 1.0 km³ (Clague and Mathews 1992). Like Lake Alsek, it could form again if the glaciers that formerly dammed them re-advanced (Clague and Evans 1994).

October 12-15, 1927

Event type: Flooding.

Precipitation: Aiyansh (29.5 mm/1 day), October 12, 1927; Terrace (62.2 mm/1 day), October 12, 1927; Prince Rupert (81.2 mm/4 days), October 12-15, 1927; Terrace (34.0 mm/1 day), October 14, 1927.

Source: Report, October 12, 1927. H.C. Whitaker (Locating Eng.) to G.C. Mackay (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace.

Due to heavy rain on October 12 and 13, the Exstew River rose 8 ft. (2.4 m) overnight, October 12-13. A highway location reconnaissance party had three paddles of their canoe swept away. As the river was still too strong for a canoe on October 14, the survey upstream was continued on foot. On October 15, again heavy rain was reported. When snow was to within 200 ft. (60 m) of camp the next day, the survey was abandoned for that year.

January 7-12, 1928

Event type: Non-fatal snow avalanche.

Precipitation: Ocean Falls (186.6 mm/2 days), January 7-8, 1928; Terrace (196.4 mm/5 days), January 7-11, 1928; Swanson Bay (371.9 mm/5 days), January 7-11, 1928; Aiyansh (51.0 mm/2 days), January 8-9, 1928; Bella Coola (160.5 mm/5 days), January 8-12, 1928; Stewart (170.7 mm/5 days), January 8-12, 1928; Prince Rupert (47.2 mm/1 day), January 9, 1928.

Source: *The Daily Colonist*, January 8, 1928; *The Terrace News*, January 11, 1928; *The Omineca Herald*, January 11, 1928; *The Interior News*, January 11, 1928; *Portland Canal News*, January 20, 1928.

Hazelton reported heavy rain with a 60^o F (33^o C) rise in temperature overnight. The train traffic was delayed due to a slide at Usk. In the Terrace area, the roads were reported in bad shape, especially at Park Hill. The big Horse Shoe drain was jammed with ice, flooding the area.

Near Stewart an avalanche came down between the first and second cabins on the new road where rock cliffs tower almost overhead for 60 ft. (18 m). The avalanche hit two Crawford Transfer Co. teams led by Percy Dietrich and Alex McDonald, hauling empty sleighs returning from the Big Missouri mine. The snow completely buried the front team and partially buried the second team. With strenuous digging the horses were extricated after being immersed for two hours. The sleighs and harness were recovered later.

Following a two-week cold snap, rain occurred in the Smithers area. It caused much of the deep snow to disappear.

Late May 1928

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Prince George Citizen*, May 31, 1928; Asante 1972 (p. 25); Environment Canada 1991.

During the spring runoff, the Skeena River changed its course on Amsbury Flats, 17 mi. (27.2 km) west of Terrace. The sawmill built here in 1917, operated until the summer of 1928. When the Skeena River changed its course, the machinery had to be moved before the mill site was washed away (Asante 1972).

On May 23, the Bulkley River near Hazelton recorded a maximum daily discharge of 858 m³/s. On June 13, the Skeena River at Usk recorded a maximum discharge of 3,910 m³/s (Environment Canada 1991).

During the last few days of May, the Fraser River rose and caused flooding at Prince George. Floodwaters forced residents on the east side of George Street to resort to rafts and canoes. Despite the considerable inconvenience by May 31 very little damage was reported. On May 30, cooler weather caused a slight drop of the water level to 16.2 ft. at the gauge at South Fort George *1)

*1) The highest mark recorded during the spring of 1928 was 16.6 ft. According to water level taken by J. Simonson, in 1911 the gauge at South Fort George reached a high mark of 18 ft. (*Prince George Citizen*, May 31, 1928).

November 27-28, 1929

Event type: Rockslide.

Precipitation: Aiyansh (61.2 mm/1 day), November 27, 1929; Prince Rupert (113.8 mm/2 days), November 27-28, 1929.

Source: *Evening Empire*, November 28, 29 and 30, December 2 and 3, 1929; *The Interior News*, December 4 and 11, 1929; *The Omineca Herald*, November 27, December 4, 1929.

Hazelton reported the “heaviest rain in [the] district for several years.” On November 28, the heavy wind and a rockslide in the Bulkley Canyon delayed the train traffic. The big rockslide at the second tunnel east of New Hazelton was described as “one of the biggest this part of the line for years.” The passengers, mail, and express were transferred over the slide. Combined with a train collision at Jasper, the train traffic was interrupted for a week. The 150-ft. (50 m) long and 25-ft. (7.5 m) deep slide was cleared on December 3, and traffic resumed.

June 8-10, 1930

Event type: Flooding.

Precipitation: Masset (20.3 mm/1 day), June 8, 1930; Swanson Bay (141.5 mm/2 days), June 8-9, 1930; Terrace (31.0 mm/2 days), June 8-9, 1930; Prince Rupert (55.7 mm/3 days), June 8-10, 1930.

Source: *The Daily News*, June 10 and 11, 1930; *Evening Empire*, June 10 and 11, 1930.

The heavy rains on June 10 caused slides between Haysport-Terrace. The telegraphic communications were interrupted between June 10-11.

The construction work at the Power Corporation of Canada dam at Falls River was delayed. High floodwaters of the Falls River during the previous days washed over the cofferdams that were being used in the construction. After pumping these out, the pouring of the concrete could be resumed.

May 4, 1931

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Interior News*, April 29, May 6, 1931; *Evening Empire*, May 5, 1931; Environment Canada 1991; Letter, May 4, 1931, V.A. Sahlstrom (Secretary Walcott Conservative Assn.) to R. Reid (Supt. of Roads, Burns Lake) Provincial Archives, Victoria.

Smithers reported a week of warm weather at the end of April. On May 4, the Bulkley River near Houston recorded a maximum daily discharge of 53.8 m³/s (Environment Canada 1991). In Walcott, a small settlement between Telkwa-Houston, children residing on the west side of the Bulkley River were unable to attend school due to the flooded condition of the river. *1)

The Skeena highway west of Hazelton was in very dangerous condition due to large rock and mudslides near Kitwanga. Travelers were advised not to go much beyond Skeena Crossing.

Early on May 4, eastbound train No. 6 hit a rockslide about 1 mi. (1.6 km) east of Amsbury. The locomotive and three fishcars derailed. The engineer and the fireman jumped to safety. The passenger coaches did not derail. One trespasser riding on a fishcar was killed.

*1) The ferry at Walcott had been condemned as unsafe for public use. In 1932, it was replaced by the present suspension bridge. This structure was originally built in 1913 as a vehicular bridge across the canyon at Hagwilget near Hazelton.

June 17-19, 1931

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Omineca Herald*, June 10 and 24, 1931; *The Terrace News*, June 24, 1931; *Evening Empire*, June 19, 20 and 22, 1931; *The Interior News*, June 24, 1931; Environment Canada 1991.

As a result of warm weather, the Skeena and Bulkley rivers rose several feet during the first week of June. May and early June were very dry in the Hazelton area. During May, less than an inch (25.4 mm) of rain fell and there was no precipitation until June 10. In the middle of June, continuing hot weather and some very heavy rains brought the Skeena and Bulkley rivers up to record levels. On June 19, the Skeena River at Usk recorded a maximum discharge of 4,730 m³/s (Environment Canada 1991). According to an old timer, the Skeena was the “highest in 40 years.” It was described as being “the highest in the memory of the oldest white residents.”

Serious flood conditions occurred in the Hazelton area near the 4th Cabin on the Telegraph line. North of Hazelton, wide areas were reported under 4 ft. (1.2 m) of water. The Government Yukon Telegraph line suffered some damage from washouts along the river. On the lower Skeena the water rose to the highest levels in 15 years. In the low-lying area of Usk the business and residential section was flooded.

The basement of the Lee Bethurem store flooded to within a few inches from the floor. The lighting plant at the Shackleton Hotel had to be elevated to keep it out of the water. Several residents were forced to leave their homes. On June 19 the waters started to recede. The Ferry across the Skeena at Hazelton was carried downstream to Ritchie on June 19. A few days later it floated further down and got hung up at Pacific.

On the morning of June 19 the Braun's Island bridge went out. Using his boat, Frank Floyd improvised a temporary ferry service. On the same day, the motorboat belonging to J. Agar was carried away by the floodwaters. On June 19, the Dannauer bridge at Copper City was endangered. Men worked all day to keep the drift cleared away, saving the structure. A big logjam formed on the upriver side of the Skeena bridge at Terrace. The old Copper City Road and the Remo road on the south side of the river were flooded in places. Buildings at the old ferry landing were flooded. On June 20, four younger children of the Hamer family were evacuated.

October 29-31, 1931

Event type: Flooding.

Precipitation: Ocean Falls (211.8 mm/3 days), October 29-31, 1931.

Source: *The Daily News*, November 2, 1931; *Evening Empire*, November 4, 1931; *The Informer*, November 20, 1976; Ramsey 1971 (p. 133).

On October 29, heavy rain near Terrace caused flooding on Hatchery (Granite) Creek. The staff at the Lakelse Hatchery had to work throughout the night of October 29-30 to protect the hatchery from being swept away. Additional help from Terrace was required.

During the gale on October 31-November 1, two large Davis rafts from the Queen Charlotte Islands broke adrift from their moorings at Captain's Cove. The cribs which contained some 3 million ft. (84,900 m³) of logs were found three days later about 5 mi. (8 km) west of Captain's Cove.

According to Erik Gustav Herman, long-time resident of Ocean Falls, on Halloween night 1931 was the worst disaster in Ocean Falls. "Everything washed out, the bridge and the fire hall went. There was an apartment beside the fire hall; all the people had to be evacuated." (Herman *In: The Informer*, November 20, 1976).

The level of Link Lake rose to an alarming height and the only thing to avoid a catastrophe was to open all 13 taintor gates. With a roar, the wall of water rushed down to the waterfront, taking with it parts of the railway system. In a wild disarray it jammed against the bridge and threatened to cut the millsite off from the townsite.

Against appalling conditions, gangs of men went to work to free the jam, while others went about evacuating people and equipment from threatened areas. On the townsite side, the riverbank was washed away, endangering one of the old bunkhouses and threatening the firehall, the foreman's bunkhouse and the dentists' office. Around No. 1 powerhouse, considerable erosion damage was done. (Ramsey 1971).

January 4-6, 1932

Event type: Rain-on-snow and snow avalanches.

Precipitation: Stewart (142.0 mm/3 days), January 4-6, 1932; Falls River (141.2 mm/2 days), January 5-6, 1932; Aiyansh (44.5 mm/1 day), January 6, 1932.

Source: *The Stewart News*, January 8, 1932.

In early January, Stewart experienced one of the heaviest snowfalls in some years. The snowfall was followed by heavy rain. Several small snowslides came down between the town and the dock. Traffic was temporarily blocked in nearly all directions. A considerable number of men were employed by the U.S. Government, Crawford Transfer Co., the Premier Gold Mining Co., and Big Missouri to make the Salmon River road passable. Late on January 7, the road was passable for sleighs as far as the Texas Creek bridge. From that point on for about 2 mi. (3.2 km), where the road is cut out of the steep mountainside, masses of snow had sloughed into it. The road was not expected to be reopened until January 10. Local officials of the Public Works Department had problems opening the road to the unemployment camps, some 17 mi. (27.2 km) up the Bear Valley. The Northern B.C. Power Co. was working with increased staff practically around the clock all week to maintain its service. Heavy wet snow was a constant threat to wires and poles.

January 22-25, 1932

Event type: Severe storm.

Precipitation: Bella Coola (156.3 mm/3 days), January 22-24, 1932; Swanson Bay (209.3 mm/3 days), January 22-24, 1932; Falls River (147.3 mm/2 days), January 23-24, 1932; Queen Charlotte City (126.0 mm/2 days), January 23-24, 1932; Ocean Falls (110.7 mm/2 days), January 23-24; Stewart (119.4 mm/3 days), January 23-25, 1932; Terrace (50.8 mm/1 day), January 24, 1932.

Source: *The Daily News*, January 25, 1932; *Evening Empire*, January 22 and 25, 1932; *The Stewart News*, January 29, 1932.

On the night of January 23-24, Prince Rupert was hit by a southeast gale with torrential rain. Power and telephone lines in the city were damaged, causing power and telephone interruptions. On January 24, the telephone line between the city and Digby Island was out for a few hours. The storm caused minor damage along the waterfront. Some boats at the dry dock and fisheries floats were damaged. The fishing vessel *Sileen*, (formerly the *Ellen Wing*) of

the Royal Fish Co., moored at the dry dock, sustained minor damage. The Prince Rupert garage moved 3 ft. (90 cm) and was wrecked, while Rothwell's garage and others were damaged. The plate glass window of the Fraser & Payne store on 3rd Avenue was smashed.

Recent heavy snow near Stewart closed the Premier Gold mine road between Mile 9-13, making the mine accessible only by aerial tram.

Near Juneau, Alaska, a big snowslide was reported from the Snowslide Gulch. The slide, which measured a length of 250 ft. (75 m) and a height of 15 ft. (4.5 m), came down on the Thane Road.

February 20-26, 1932

Event type: Snow avalanches.

Precipitation: Stewart (144.8 mm/3 days), February 20-22, 1932; Aiyansh (108.4 mm/4 days), February 20-23, 1932; Ocean Falls (543.0 mm/6 days), February 21-26, 1932; Namu (127.0 mm/1day), February 22, 1932; Falls River (222.2 mm/4 days), February 22-25, 1932.

Source: *The British Columbian*, February 22, 1932; *The Stewart News*, February 26, 1932.

Stewart experienced the "most severe snowstorm in the memory of some of the oldest residents." Between the morning of February 21 and the evening of February 23, some 5 ft. (1.5 m) of dry snow fell on 4 ft. (1.2 m) of already packed snow. The dry snow would not pack, and was hard to remove, resulting in trails and roads blocked in all directions. Many slides occurred in the area.

During the night of February 22, the Silverado slide came down. The slide, which moved thousands of tons of snow, came from an elevation of at least 5,000 ft. (1,500 m). For the first time since about February 5, 1910, it swept straight over the foot of the mountain, wiping out the Mill Power Plant of the Northern B.C. Power Co. This plant was recently partially destroyed by a fire. The toe of the large pile of snow was about 600 ft. (180 m) out beyond the plant. The winds caused by the slide must have been terrific. Pieces of the intake flume and other remnants were said to have been blown as much as 1,000 ft. (300 m) out onto the flat near the bottom of the hill. Striking salt water at the foot of the mountain, the slide reportedly sent a wave across the bay, striking Hyder, Alaska, much like a small tidal wave.

On February 22, the road between Stewart and the dock was kept open with difficulty, but the next day it was completely blocked with slides. Government crews, assisted by volunteers from the Crawford Transfer, Rennie & Young, and independent freighters, worked for two days to clear the road. Late on February 24, it was reopened, but the heavy rains, which started on the previous evening, made the road nearly impassable. The heavy snowfall blocked oil transportation between the dock and the Dunwell power plant. Precautionary measures were taken to guard against a possible shortage of oil at the Dunwell plant. The Northern B.C. Power Company closed the Dunwell power plant from midnight to 7 a.m. until the roads reopened to allow the usual supply of oil to reach Dunwell.

Around February 20, snowslides buried bunkhouses and three men at the Jumbo mine near Wrangell, Alaska. The slide left one man dead while the condition of the others entombed with him are unknown (*The British Columbian*, February 22, 1932).

August 18-21, 1932

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Kerr 1936 (p. 4 and pp. 16-18).

Starting around August 18, a large flood, caused by the sudden draining of a lake, swept down the Talsekwe Valley. *1) The water continued to rise steadily until the morning of August 21. By this time it filled the valley about 1 mi. (1.6 km) wide, from wall to wall. In the old channels where the depth had been 1-2 ft. (30-60 cm), it was now 5-6 ft. (1.5 to 1.8 m) the current was 10-15 mph (16-24 km/h). The water shot from an aperture in the lower end of the glacier, which was afterwards found to be some 75 ft. (22.5 m) wide and 50 ft. (15 m) high, cutting partly in the glacier ice and partly in the gravel below. Its force rolled down the valley in a series of huge combers, sweeping with it blocks of ice up to 20 ft. (6 m) in diameter and huge boulders. Large numbers of mature trees were swept away and the river was filled with huge cottonwood trees up to 100 ft. (30 m) in length.

At the junction with the Taku River the waters of the latter were backed up for miles. At Tulsequah, about 0.5 mi. (800 m) above the junction, the Taku River rose many feet above normal high water levels. During the morning of August 21, the waters started to drop. During the flood many changes took place. Old channels were completely gone, and new channels up to 15 ft. (4.5 m) in depth had been cut in the coarsest gravels. Forested islands completely disappeared, and large piles of logs and newly uprooted trees were scattered everywhere (Kerr 1936). Near Tulsequah Chief landing, the river broke out of its channel, cutting through a wooded area into the lower Shazah Valley. Most of the water started flowing into the former channel of Shazah Creek, leaving this creek dammed above its mouth. As a result, Shazah Creek became lake-like above its mouth, with the possibility of a large lake forming (Kerr 1948).

*1) Similar floods occur periodically, most commonly in the late summer when ice activity and volume of melting are greatest. Prior to 1932, floods for which dates are available occurred in 1910 and 1929. They issued from approximately the same place, about one quarter mile (400 m) west of a rock island at the glacier front (Kerr 1936).

November 16-19, 1932

Event type: Rain-on-snow flooding and snow avalanches.

Precipitation: Swanson Bay (127.0 mm/2 days) November 16-17, 1932; Falls River (149.3 mm/3 days), November 16-18, 1932; Ocean Falls (377 mm/3 days), November 16-18, 1932; Kitimat Mission (114.3 mm/2 days) November 17-18, 1932; Aiyansh (82.8 mm/2 days), November 17-18, 1932; Prince Rupert (112.8 mm/2 days) November 17-18, 1932; Bella Coola 147.1 mm/3 days November 17-19, 1932; Namu (214.4 mm/3 days), November 17-19, 1932.

Source: *Evening Empire*, November 19 and 21, 1932; *The Daily News*, November 17, 18, 19 and 22, 1932; *Vancouver Daily Province*, November 20, 23 and 25, 1932; *The Daily Colonist*, November 23 and 25, 1932; Tempest 1974; File G.0.7. Dept. Public Works Ann. Rep. 1932-33, May 10, 1933. B.C. Ministry of Transportation and Highways, Terrace.

On November 17, heavy rain fell in Prince Rupert and heavy snow east of Haysport. Some points along the Skeena River had 3 to 4 ft. (1 to 1.2 m) snowdrifts on the rail line bringing down the telegraph wires. On November 18, a large slide came down on the tracks just west of Amsbury Station. It was 100 ft. (30 m) long and 15 ft. (4.5 m) deep. Heavy snowfalls and warm rain occurred on November 19, interrupting the rail traffic and telegraphic communications. The westbound train was held at Smithers. Three major slides occurred on November 19, one being 200 ft. (60 m) long and 25 ft. (7.5 m) deep; the other two measured a length of 100 ft. (30 m) and a depth of 15 ft. (4.5 m). Between Pitman-Exstew, six slides and washouts occurred. Shames River and other rivers flowing into the lower Skeena River were at record levels. The interior reported 6 in. (15 cm) diameter of ice around some of the telegraph wires. On November 21, the telegraph communications between Hazelton and the Yukon were interrupted by heavy snowfalls. The rail traffic was restored on November 22.

Near Terrace a washout occurred at Granite Creek. It created several channels where there was only one before. The Department of Public Works recommended an investigation to decide on a better location higher upstream.

On November 16, Ocean Falls reported 5 in. (127.0 mm) of rain in 24 hours. Even after the sluice gates were opened, the water remained high. The S.S. *Adelaide* felt the effects of the high water flowing towards sea.

According to records kept by the B.C. Ministry of Transportation Highways, a moderate flood occurred on the Bella Coola River (Tempest 1974). The flood was caused by almost a week of torrential rains and chinook winds that melted snow in the mountains. The heaviest damage occurred near Bella Coola-Hagensborg where bridges were destroyed and roads made impassable. Damage to the road between Bella Coola-Hagensborg was estimated at approximately \$3,000. Two bridges, one of which had been condemned several years previous and a new cable bridge constructed earlier in the year, were carried away. Sixteen ac. (6.4 ha) of land in the vicinity were washed away. At Hagensborg, the Bella Coola River broke through the river protection work above this farming community. Houses were endangered and hundreds of acres of land inundated. No loss of lives was reported, but crops stored in underground cellars were lost.

November 22-24, 1932

Event type: Rain-on-snow flooding.

Precipitation: Swanson Bay (81.8 mm/1 day) November 22, 1932; Kitimat Mission (77.5 mm/1 day) November 22, 1932; Falls River (128.0 mm/2 days), November 22-23, 1932; Aiyansh (44.2 mm/2 days), November 22-23, 1932; Cape St. James (45.7 mm/1 day) November 23, 1932; Terrace (72.1 mm/1 day) November 24, 1932.

Source: *The Vancouver Daily Province*, November 24, 25 and 26, 1932; *The Terrace News*, November 30 and December 7, 1932; *Evening Empire*, November 23, 1932.

On November 24, floodwaters of the Bella Coola River threatened Hagensborg. The renewal of abnormal rainfall during the previous 36 hours caused further property damage. It brought the river far above its normal levels and swept away protective dams. Many people had to again vacate their homes. Farm homes abandoned during the previous week's flood and reoccupied on November 19-20 were endangered again. Overnight November 25-26 with colder temperatures, floodwaters receded.

Near Terrace, part of the hatchery road was washed away by the recent floods. The 13 Mile ferry and probably also the 23 Mile ferry went out due to the sudden and unseasonable high water. A. Jacobson, owner-operator of a sawmill at Shames, reported to have sustained heavy losses in livestock, merchandise, and other property in the recent heavy rainstorms. The road conditions following the heavy storm caused a number of minor car accidents.

November 9-13, 1933

Event type: Rain-on-snow flooding.

Precipitation: Ocean Falls (158.8 mm/2 days), November 9-10, 1933; Aiyansh (161.5 mm/4 days), November 9-12, 1933; Swanson Bay (300.5 mm/4 days), November 9-12, 1933; Prince Rupert (201.2 mm/4 days), November 10-13, 1933; Falls River (239.8 mm/4 days), November 10-13, 1933; Anyox (206.8 mm/4 days), November 10-13, 1933; Terrace (73.1 mm/2 days), November 12-13, 1933.

Source: *The Daily News*, November 13, 14 and 15, 1933; *The Omineca Herald*, November 15, 1933; *Evening Empire*, November 13, 14, 15, 16, 17 and 18, 1933; *The Interior News*, November 15, 1933; Letter, November 28, 1933, A. A. McLean (Acting Gen. Foreman) to J. C. Brady (Dist. Eng. Prince Rupert), B.C. Ministry of Transportation and Highways, Terrace; File 2-20-0 Letters, November 13, 20, 1933, John Anderson (Gen. Foreman Anyox) to J. C. Brady (Dist. Eng. Prince Rupert), B.C. Ministry of Transportation and Highways, Terrace.

In the Terrace area, heavy rain, combined with a south wind, caused many small slides and downed telegraph lines. On the rail line between Woodcock-Kwinitsa, several slides and washouts occurred, interrupting the rail traffic. A four car train derailment occurred at the end of the bridge at Mile 36 west of Pacific. A wrecking train derailed 2 mi. (3.2 km) west of the first derailment. The high water levels on the lower Skeena River carried out several bridges and flooded the rail line in places. The train service was resumed on November 17 and the next day trains were running again both directions. The water in Kitsumkalum Lake reached very high levels. Heavy damage was caused and numerous bridges had to be replaced and grades built up. The Kitsequecla bridge No. 61 was undermined. The temporary repairs were undermined again during the November 17-24 storm event. In the Smithers district, warm rains removed the snow.

The rainfall at Anyox on November 9, 10, and 12 was the greatest on record. On November 10 and November 12, 4 in. (100 mm) over 4 in., respectively were recorded. In the hills a heavy snowfall occurred, causing high water. The townsite of Alice Arm flooded with up to 2 ft. (60 cm) of water, forcing the residents to move to higher ground. The northeast fork of the Kitsault River broke through onto the flats about 300 ft. (100 m) upstream from the previous year's break. The heaviest storm occurred on November 12. The wing dam constructed the year before was left high and dry. When the river broke through at previous year's location on November 12, it took out half of the dam. Bower's Ranch at the end of the bridge was under 4 ft. (1.2 m) of water. Other small farms on the flats, including Stevens' and Calfa's, were also flooded. Some small washouts occurred between Alliance Road and Stevens Ranch. The recommendation was to move the existing farmers out of the Kitsault Flats and to cancel the sale of more lands on the flats.

High water along the Naas (Nass) River washed away nearly half of the Indian cemetery at Greenville. Reed Staich, employee of the United Mining Co. of Stewart, drowned in the Bear River. The rowboat, which was attached to a cable, swamped while crossing the river.

November 14-25, 1933

Event type: Flooding.

Precipitation: Ocean Falls (178.1 mm/2 days), November 17-18, 1933; Prince Rupert (182.3 mm/7 days), November 17-23, 1933; Swanson Bay (501.5 mm/7 days), November 17-23, 1933; Falls River (271.1 mm/6 days), November 18-23, 1933; Terrace (157.3 mm/7 days), November 18-24, 1933; Namu (51.1 mm/1 day), November 19, 1933; Aiyansh (103.7 mm/3 days), November 20-22, 1932.

Source: *The Daily News*, November 18, 20, 21, 22, 23, 24 and 25, 1933; December 2, 1933; *The Omineca Herald*, November 15, 22 and 29, 1933; *The Terrace News*, November 22, 1933; *Evening Empire*, November 18, 22, 24 and 25, 1933; Environment Canada 1991; Letters, November 20 and 28, 1933, A. A. McLean (Acting Gen. Foreman) to J. C. Brady (Dist. Eng. Prince Rupert), B.C. Ministry of Transportation and Highways, Terrace.

Heavy rainfall and an east-south-east gale with an average velocity of 50-mph (80 km/h) and gusts of 70 mph (112.7 km/h) were reported along the coast. Heavy rain also occurred in Terrace, Rosswood, Alice Arm, and Anyox. Terrace reported a record rainfall of 5.85 in. (148.6 mm) for the period November 14-25. *1) The heaviest rainfall occurred on November 23 with 0.99 in. (25.1 mm).

In the Prince Rupert area a slide occurred on the hillside on 3rd Avenue at the back of Jones' Meat Market. The telephone line was downed for a distance of four poles and a small shed and lean-to were wrecked and carried off. Debris and old logs were reported drifting off the mouth of the Skeena River and elsewhere along the coast.

Overnight November 17-18, Prince Rupert experienced "the most severe storm of the year." Throughout the night an east-southeast gale raged with an average velocity of 50-mph (80 km/h) with gusts of 70 mph (112 km/h). Heavy rain accompanied the wind. In the 24 hours ending November 4 a.m. on November 18, Prince Rupert recorded 1.04 in. (26.4 mm), most of which fell during the night. Due to the highest tide of the year on November 18 at 2 p.m., the local docks were almost awash. Heavy rain was also reported from all interior and coastal points.

The rail line between Prince Rupert-Terrace experienced the "worst flood since 1917." At least 10 slides were reported and one end of the bridge at Amsbury went out. The tracks were flooded at several places between Mile 36-Prince Rupert.

On November 18, the rail line was cleared and some traffic resumed in both directions. The service was back to normal by November 20. During the previous week, slides and washouts on the lower Skeena had interrupted traffic. The last obstruction to be cleared was a washout just east of Ritchie station. Temporary bridging was expected to be completed later on November 18.

On the rail line between Terrace-Smithers the bridge 1 mi. (1.6 km) east of Woodcock went out. Between Andimaul-Kitwanga there were two washouts and some small slides elsewhere along the line. Both telegraph lines were down until the afternoon on November 24.

On November 22, a derailment occurred at Mile 43 at the portal of the tunnel just east of New Hazelton. A ditcher was knocked off a flatcar, killing fireman W.J. Smith and injuring engineer G.H. Mogden. Both men were from Smithers. They were returning from clearing a slide on the main line in the Bulkley Canyon. The westbound passenger train was delayed for seven hours. The rail line reopened on November 25 after a two-day closure.

On November 24, the Skeena River was reported to be at the June flood level. The Kispiox and Bulkley rivers reached high water levels. Two small 20-ft. (6 m) long bridges over the Kispiox River washed out and had to be replaced. A family at Mile 22 along the Kispiox River had to be evacuated because of the high water and some farm animals were lost. On November 25, the Bulkley River at Quick recorded a maximum daily discharge of 575 m³/s (Environment Canada 1991).

In the Kalum District, roads and bridges were damaged. The Kalum Lake Road sustained heavy damage. Glacier Creek had dammed up and flooded the road at Mile 14. The road between Mile 14-Mile 16 was almost impassable.

Kitsequecla bridge No. 61 was undermined again after temporary repairs had been made two weeks previous. The cost to replace Clear Creek bridge, which went out, was estimated at \$250; the replacement cost of Cedar River bridge was estimated at \$7,000-8,000. The Douglas Creek bridge No. 31 had to be rebuilt. Hall Creek bridge No. 173, with one end floating, was expected to go out with the next high water. The cutbank on the west side of Whiskey Creek was completely washed out. The road between Nash-Skeena Crossing was blocked. The cribbing at Porphyry Creek caved in. The filling was expected to take four to five days (A.A. McLean).

In the Smithers-Telkwa area, some slides occurred on the Aveling Coal Road. The Telkwa River changed its course, requiring another 150 ft. (45 m) of cribbing. At the Smithers bridge about 600 lineal ft. (180 m) of cribbing was required on the Bulkley Hill on the Telkwa side across the river.

*1) In November 1933, Terrace had an all-time record rainfall to date of 25.53 in. (648.5 mm) (*The Daily News*, December 2, 1933).

November 23-December 2, 1933

Event type: Flooding and snow avalanches.

Precipitation: Falls River (385.9 mm/9 days), November 23-December 1, 1933; Kitimat Mission (447.2 mm/10 days), November 23-December 2, 1933; Ocean Falls (145.3 mm/1 day), November 29, 1933; Swanson Bay (336.5 mm/3 days), November 29-December 1, 1933; Kitimat Mission (343.0 mm/5 days), November 29-December 2, 1933; Aiyansh (43.2 mm/1 day), November 30, 1933; Terrace (187.7 mm/2 days), November 30-December 1, 1933; Falls River (187.4 mm/2 days), November 30-December 1, 1933; Terrace (116.0 mm/1 day), December 1, 1933.

Source: *The Terrace News*, December 6, 1933; *The Omineca Herald*, November 29 and December 6, 1933; *The Daily News*, December 1 and 2, 1933; *Evening Empire*, November 28 and 30, December 1 and 2, 1933.

Heavy rain occurred all along the coast with unusual stormy weather on the Queen Charlotte Islands and snowstorms in Stewart and Anyox. The S.S. *Catala* reported experiencing squally weather all the way north. The winds were particularly strong on the west coast of the Queen Charlotte Islands. The vessel *Beatrice H* on her regular weekly trip had difficulty reaching the mining camps.

Prince Rupert reported a record rainfall of 25.53 in. (648.5 mm) for November; Terrace received 15 in. (381.0 mm) during that month.

The heavy rain caused flooding and property damage in the Terrace area. The Thornhill bridge on the Lakelse Road was flooded. A slide on the hill on Remo Road buried about half an acre of cultivated land on the Joe Cook Ranch. In Terrace, a plugged culvert on Lakelse Avenue caused the municipal reservoir to overflow and flood the street near the Public Works garage. The basement of the Philbert Hotel was flooded with 4 ft. (1.2 m) of water. On December 1, the telegraph lines east and west of Terrace and also the Anyox line went down, cutting the telegraphic communications. Lines were still down on December 2. A small culvert on the Kispiox road got plugged and flooded the road.

On the rail line between Prince Rupert-Terrace, an eastbound train from Prince Rupert was delayed due to slide conditions on the lower Skeena River. On December 1, snowslides were reported on the line at Kwinitsa. The rail traffic was reported back to normal on December 2.

December 18-20, 1933

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Vancouver Daily Province*, December 20, 1933.

Overnight December 18-19, an icejam on the Nechako River caused the river to overflow in a number of places. Near Prince George, the CNR rail yard was flooded with 2 ft. (60 cm) of water and sections of roadbed washed out. The heavy ice created a dam near the mouth of the Nechako River. A number of families living in what was known as the railway cache, between the railway yards and the river, were marooned. The water rose so rapidly that their escape was cut off. A woman was marooned on the upper floor of a farmhouse on the north bank of the Nechako

River after floodwaters completely surrounded the house. Alone at the time and though her cries for help could be heard across the river in central Fort George, she could not be located in the darkness.

On December 20, ice jammed at Engen in the canyon forcing water to break through and flooding low lying land and the home of Harry Worthington. This family escaped with great difficulty to the schoolhouse 0.75 mile (1.2 km) away. A number of sheep, pigs and large cattle drowned.

January 24-27, 1934

Event type: Rain-on-snow and icejam flooding.

Precipitation: Ocean Falls (393.0 mm/3 days), January 24-26, 1934; Swanson Bay (288.6 mm/3 days), January 24-26, 1934; Falls River (207.0 mm/4 days), January 24-27, 1934; Prince Rupert (219.2 mm/2 days), January 25-26, 1934; Aiyansh (96.7 mm/2 days), January 25-26, 1934; Terrace (116.6 mm/2 days), January 25-26, 1934; Kitimat Mission (168.9 mm/3 days), January 25-27, 1934; Terrace (77.5 mm/1 day), January 26, 1934.

Source: *The Daily News*, January 25, 26 and 27, 1934; *The Omineca Herald*, January 31, 1934; *The Terrace News*, January 31, 1934; *Evening Empire*, January 26, 27, 29 and 30, February 1, 1934; *The Interior News*, January 31, 1934.

Near Prince Rupert, a slide came down from Mount Oldfield near Fairview during the night of January 27. Thousands of tons of debris buried 30 cords of stacked wood.

Telegraphic communications and rail traffic between Prince Rupert-Terrace were interrupted by washouts, large slides, and damaged bridges. A mudslide blocked the rail line at North Pacific. After the slide had been cleared, a second slide came down at the same location. The Khyex River railroad bridge sustained minor damage by drifting ice and high water conditions. Between Pacific-Kwinitsa, eight to 10 snow and mudslides occurred, varying from 40-600 ft. (12-180 m) long and 5-25 ft. (1.5-7.5 m) deep. A rotary plow was dispatched to clear the line. Rail traffic was interrupted for a week. A washout occurred east of Smithers, but its exact location was unknown.

Just upstream from Terrace, big icejams in the Skeena River dammed the stream. The water was diverted to the south side of the river and almost completely washed away DL 374 Lot 107. Also a part of the old Copper City trail was washed away. On Kitselas Mountain, a large slide came down across the railway and frozen river.

Heavy rains and mild weather caused "one of the worst tie-ups on the railroad in the [Smithers] district during the past 15 years." Huge slides and washouts occurred at Kitwanga and the lower Skeena. For at least 10 days all trains from the west were cancelled. Serious washouts also occurred near Prince George.

During a continuous series of west gales with snow, rain, and sleet, the Queen Charlotte Islands experienced the "worst weather known for several years." The heavy rain and thaw combination caused floods and washouts that interrupted the traffic between Queen Charlotte City-Port Clements.

January 30-31, 1934

Event type: Ice jam flooding.

Source: *The Daily Colonist*, February 3, 1934; *The Cariboo Observer*, February 3, 1934.

At the end of January, ice jams caused the "worst winter flood in the history of Quesnel." Rain and mild weather caused an early thaw and break-up of river ice. On the afternoon of January 30, a large ice run came down the Fraser River and jammed about the mouth of the Quesnel River. Early next day, the river had completely jammed except for a small passage on the west side, and the water began to rise. About 6 p.m., the "auto camp," in which a large number of families were living, was flooded as was the south portion of Quesnel.

During the night of January 31, an ice jam occurred near Quesnel at the Forks, which backed up water in the Quesnel and Fraser rivers. Residents of houses bordering the banks of the two rivers both in Quesnel and West Quesnel had to leave their homes. Although during the spring runoff in 1894 there was more water on the flat on the west side and while ice jams are common, this one was the "worst in the memory of the old-timers."

Fraser River water levels rose to several feet above the high water mark, reaching to the windowsills of some houses along the river. The ice and trees were carried onto the front street at the lower end of town and against the piers of the Fraser River bridge to within 6 ft. (1.8 m) of the decking. On the west side, where a number of dwellings had been built the previous year, a larger area was flooded. About a dozen families hastily packed their belongings and moved across the bridge.

Quesnel Light and Power Co.'s plant was isolated for several hours. The basement of Ernest Sealy's cabin along the Quesnel River at the north portal of the Quesnel bridge was completely flooded. Water undermined its foundations and allowed the floor to settle. Sealy lost a number of personal belongings and five cords of his wood floated over the fence and down the river. Large chunks of ice piled on the banks uprooting trees. Under the Fraser River bridge, the ice piled up to only 6-8 ft. (1.8-2.4 m) from the spans on the west side. The water subsided almost as quickly as it had risen.

August 18, 1934

Event type: Flooding.

Precipitation: Stewart (54.1 mm/1 day), August 18, 1934.

Source: *The Stewart News*, August 24 and 31, September 7, 1934.

In Stewart, high water caused a drastic change in the course of the Bear River near the mouth. By August 24, approximately 100 ac. (40 ha) had already been washed out. The barn of Stewart Cartage and a number of other buildings were endangered. Provincial Public Works Road Foreman H. McDonald had two tractors and a crew of men hauling spruce trees in an effort to turn the current. At the time of starting this work, the railway grade above the trestle had been washed away. It would soon have permitted the whole river to come through at that point and sweep through 2nd Street. The Board of Trade made efforts to get necessary action before it was too late.

October 7-11, 1934

Event type: Flooding.

Precipitation: Terrace (83.8 mm/3 days), October 7-9, 1934; Swanson Bay (263.4 mm/4 days), October 7-10, 1934; Falls River (121.5 mm/2 days), October 8-9, 1934; Ocean Falls (203.7 mm/2 days), October 8-9, 1934; Kitimat Mission (208.2 mm/4 days), October 8-11, 1934; Bella Coola (126.7 mm/2 days), October 9-10, 1934. Namu (125.8 mm/2 days), October 10-11, 1934.

Source: *The Omineca Herald*, October 10 and 17, 1934; *The Terrace News*, October 10, 1934; *Vancouver Daily Province*, November 12 and 15, 1934; *The Daily News*, October 9, 10, 11 and 12, 1934; *Evening Empire*, October 9 and 12, 1934; *The Interior News*, October 10, 1934; *The Daily Alaska Empire*, October 11, 1934; *The Vancouver Sun*, October 12, 1934; *The Victoria Daily Times*, October 12, 1934; *The Vancouver Daily Province*, October 12 and 15, 1934; Kopas 1970 (p. 272); Tempest 1974.

The Terrace-Hazelton area experienced the “heaviest rainstorm in the district for a long time.” The Kitsequecla River bridge at Skeena Crossing was undermined and made unsafe for crossing. The Bulkley Valley experienced several days of heavy rain. The rains were described as “heavy and most protracted of the earliest arrivals here.” As a result, roads were in very bad shape.

Heavy rains throughout the interior caused severe flooding on the Bella Coola River. The rain started October 4, falling steadily until October 10. The large flood washed out many of the bridges and destroyed much of the road. Department of Public Works engineer Swan reported at the time that this was the “largest flood in 60 years.” (Tempest 1974) The flooding started on October 9. Soon the river changed course running down the main highway from Bella Coola to the Interior. *1)

Bella Coola was isolated after all bridges were demolished between Bella Coola-Hagensborg and the road washed out over a distance of 4 mi. (6.4 km). The flooding damaged Colony Hall, the community hall. The Bella Coola River diverted its course when it started flowing along the main highway, and several bridges were lost. Miles of open land were reported under water.

Hagensborg, where the river flooded an entire section of the valley, was hardest hit. Many residents of Hagensborg were evacuated when the town was isolated by the floodwaters. The communications were interrupted as a result of downed wires. In the inlet for over 10 mi. (16 km), most of the barns and roothouses were destroyed. Chickens and pigs were drowned and vegetable and hay crops destroyed by the floodwaters. The damage was estimated at \$50,000. At Hagensborg the pillars of the large suspension bridge were threatened. A number of families were isolated. In some houses the water was 3 ft. (90 cm) deep. Mail and supplies had to be taken to Hagensborg by backpacking. Three attempts to reach Hagensborg on three successive days failed. A fourth attempt to get through with canoe parties was accomplished. A police party managed to reach Hagensborg by canoe, according to a wire message from Const. Condon of Bella Coola.

Along the coast the heavy seas caused havoc. The fish packer *Delphinium* of the Royal Fish Co., on its way to Prince Rupert from Masset, was lashed by the storm. During the night of October 5-6, it ran aground on a reef on Whitesand Island off Dundas Island in the Hudson Bay Passage and broke up. The crew escaped to the Green Island lighthouse. The tender *Jedway*, belonging to Masset Packers, ran into trouble at Parry Passage, off Langara Island. The two-man crew of the *OK*, John Hazelton and partner, was rescued by the Mission launch *Northern Cross*. Before being rescued, both men had swum ashore and taken shelter for a couple of days in an old shack on Merrick Island, in the Arthur Passage in Greenville Channel. An Alaskan boat sank, drowning the crew of five. The *MS Dupoco II* of the Dupont Powder Company was torn loose from its moorings and washed ashore some 200 yd. (180 m) from the residence at Dupont. The vessel was towed by the *Yakobi* to Juneau, Alaska, for repairs.

*1) This was the latest in a long series of floods. In 1926, the provincial government moved all the inhabitants from the north to the south side where a new community was built for them.

January 30-February 2, 1935

Event type: Rain-on snow flooding.

Precipitation: Prince Rupert (47.2 mm/2 days), January 30-31, 1935; Falls River (249.5 mm/4 days), January 30-February 2, 1935; Terrace (145.1 mm/4 days), January 30-February 2, 1935.

Source: *The Interior News*, February 6, 1935; File 35-40-0, Letter, June 5, 1935, W. H. Cotton (Ass. Dist. Eng. Smithers) to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace.

Floodwaters took out the Fiddler Creek bridge, leaving only the cribs and approaches.

Around Smithers, several days of mild weather and heavy rain melted snow from the streets and mountainside.

October 21-26, 1935

Event type: Rain-on snow flooding and landslides.

Precipitation: Kitimat Mission (263.8 mm/5 days), October 21-25, 1935; Aiyansh (166.6 mm/4 days), October 22-25, 1935; Swanson Bay (646.2 mm/4 days), October 22-25, 1935; Ocean Falls (474.9 mm/4 days), October 22-25, 1935; Queen Charlotte City (202.2 mm/3 days), October 23-25, 1935; Masset (102.9 mm/3 days), October 23-25, 1935; Falls River (459.3 mm/4 days), October 23-26, 1935; Terrace (200.4 mm/3 days), October 24-26, 1935; Prince Rupert (112.8 mm/1 day), October 25, 1935.

Source: *The Daily News*, October 23, 25 and 28, November 5, 6 and 12, 1935; *Evening Empire*, October 25, 1935; *The Interior News*, October 30, November 6 and 13, 1935; *The Alaska Daily Empire*, October 26, 1935; *The Omineca Herald*, October 30 and November 6, 1935; *The Terrace News*, October 30, November 6, 1935; *The Interior News*, November 6 and 13, 1935; Fred Sharpe, pers. comm.; Lloyd Johnstone, pers. comm. September 1993; Environment Canada 1991; Annual Report 1935-36, Engineering District No. 7, April 23, 1936. B.C. Ministry of Transportation and Highways, Terrace; File 35-20-0, Letter, October 29, 1935, J. C. Brady (Dist. Eng. Prince Rupert) to Chief Eng., Victoria. B.C. Ministry of Transportation and Highways, Terrace; File 35-41-10, Letter, October 31, 1935, W. H. Cotton (Ass. Dist. Eng., Smithers) to J. C. Brady (Dist. Eng., Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace; File 35-40-6,1 Letter, December 6, 1935, W. H. Cotton to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; File 35-40-61 Letter, June 28, 1940 S. A. Cunliffe (Ass. Dist. Eng.,) to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Letter May 26, 1936, G. M. Beirnes to Public Works Eng., Victoria; McMullen et al. 1979.

The Prince Rupert area experienced an average wind of between 50-60 mph (80-96 km/h) for 24 hours, with lengthy gusts of 70 mph (112 km/h). This "most severe gale in years" caused heavy damage to the Prince Rupert waterfront. A slide occurred at Woodworth Lake at 8 p.m. on October 23. Three lengths of the water main between Woodworth-Shawatlan lakes were wiped out. Prince Rupert was without power for four hours. Near Inverness a large slide occurred. The school building at the Inverness Cannery, while in session, was narrowly missed by two debris slides (F. Sharpe, pers. comm.).

Between October 23-26, Terrace recorded 9 in. (228.6 mm) and Hazelton over 5 in. (127 mm) of rain. On October 25, Terrace received 4.44 in. (112.8 mm) of rain. The highway across the Copper River went out. A big slide and washout just east of Usk cut the link with Terrace. The Kalum Lake road was badly washed out for 2 mi. (3.2 km). The Skeena River at Hazelton came up 15 to 20 ft. (4.5 to 6 m) within 12 hours. The lower part of Hazelton was believed to be endangered.

The Bulkley River hit an all-time high for fall runoff. On October 26, the Bulkley River at Quick recorded a maximum daily discharge of 838 m³/s (Environment Canada 1991). The Smithers bridge was endangered. Dynamite had to be used to prevent logjams. The Telkwa River went on the rampage for several days. It cut an entirely new course near the confluence with the Bulkley River. The business section of Telkwa and the Coal Mine camp were flooded. The private bridge to the property of Asa Hanson and partners was washed away with two or three other bridges. The bridge crossing the Telkwa River just upstream from the confluence with Pine Creek washed out.

The rail line between Prince Rupert-Terrace sustained heavy damage. It was described as the "greatest and most costly interruption of its line in at least 17 years." All available equipment and approximately 200 men were working on repairing the line. Nine bridges went out of commission and the line was wrecked in two dozen places. Bridges across the Khyex and Shames Rivers were carried away. The Khyex railroad bridge went out as eight bents were washed away. Numerous slides and washouts occurred between Inverness-Bulkley Canyon. The line between Kwinitsa-Salvus was almost totally submerged. "Extensive slides" occurred near Ritchie. The rail traffic was halted on October 22 and was not expected to be back in service until November 11. On October 26, 6 in. (15.2 cm) of snow fell. After the water started receding on October 28, the damage to the railroad turned out to be heavier than expected. Long sections of track were lifted right off the grade and piled in the side ditches. Stockpiles of ties and emergency bridge timbers were carried away. During the height of the flood, the tracks were covered with water up to 6 ft. (1.8 m) for miles. At some points, particularly around Salvus, the track washed out. Elsewhere numerous slides covered the grade. On November 5, a mail and passenger train reached Terrace.

Lakelse Lake hit a new high water mark, causing heavy damage to cottage and boat owners. According to long-time resident and weather watcher Lloyd Johnstone, Lakelse Lake reached the highest water level this century -- 74.37 m, which is an all-time record, even higher than the 1978 mark (McMullen et al. 1979). *1) High water and debris seriously damaged the Dominion Hatchery located in a canyon at Lakelse Lake. The road to the hatchery washed out. As a result after having operated for about 20 years, the hatchery was closed down and the staff were moved elsewhere. Summerhouses at Lakelse Lake sustained extensive damage. Some houses floated away as far as 4 mi. (6.4 km). Granite Creek flooded its banks, inundating Lakelse Lodge, which was situated near the present location of Oli's Restaurant. The legs of the piano in the front room were sitting in 20 in. (50 cm) of water (L. Johnstone, pers. comm.). Bridges at Glacier Creek, Lean-to Creek, and on the east side of Kalum Lake washed out. The bridges over Cedar Creek, Trout Creek, Edgar Creek, Hall Creek, Rainbow Creek and Copper River Slough all went out. Near

Bulkley Canyon a mudslide occurred. In New Hazelton, Five Mile Creek flooded, inundating cellars and yards on 9th and 11th avenues. *2) Wires of the Government Telegraph Line came down in several locations. Some stores were running low on food staples.

The storm that dumped 9 in. (228.6 mm) of rain in 24 hours on Ocean Falls raised the water levels in the lake by 9 ft. (2.7 m).

On the Queen Charlotte Islands, most of the plank road between Port Clements-Tl-Ell (Tlell) was under water, raising the Kumdis bridge by 2 ft. (60 cm). On a stretch several miles long, the water flowed over the road in the low-lying areas. A landslide occurred at Lawn Hill.

The Department of Public Works reported damage to the following bridges: Pine Creek bridge, Aveling Coal Mine bridge on the Telkwa River, Goat Creek bridge, Kitsequecla bridge, Copper River Slough bridge, some small bridges at Kitwanga and Remo, and bridges across Douglas Creek, Hall Creek and Marroon Creek near Rosswood at the head of Kitsumkalum Road north of Terrace. Crews saved the Bulkley River bridges at Smithers and Hazelton, despite drift striking the lower parts of the bridges. The Hazelton Ferry No. 80 was damaged. The towers that were built in 1920 were reset in 1936. The Remo ferry broke its main cable. It cut from its moorings and was carried down river, reportedly hanging up on an island below Shames.

Roadbeds were damaged at Kitsequecla and at Glacier Creek. At Kitsequecla, a “gumbo” slide filled sections of road extending over 0.75 mi. (1.2 km). Over 1 mi. (1.6 km) of new road was required at Kitsequecla. The Kitsequecla bridge, a 60-ft. (18 m) King Truss with eight bays of trestles, went out. The complete bridge, including piers and abutments, was taken out by a debris jam. *3) The main channel changed to the south side. The bridge had just been rebuilt after a previous washout. The road below Skeena Crossing, which had recently been cleared, was badly damaged and made impassable by many slides. At least two bridges on Tee Creek at Kitwanga went out. Hannall near Usk sustained heavy damage resulting from washouts, and the Lowry Creek bridge washed out.

West of Usk Edgar Creek cut a new channel across the road, leaving the bridge dry. A big channel was cut in the Copper River Slough, discharging about half of the Copper River. The recently completed dam at its mouth was completely gone. Considerable damage occurred on the Lakelse Lake Road, especially towards the hot springs. The bridge to Lot 3993 at the island at Vanarsdol went out. The Kitsumkalum Road sustained considerable damage around Mile 14-16. Pontoon bridge and three or four bridges went out. All bridges around Remo suffered some damage.

North of Hazelton, the Telegraph Trail sustained damage between the First-Sixth Cabin, approximately 30-145 mi. (48-232 km) north of Hazelton. Six of the eight bridges went out. The repair cost was estimated at \$7,500-10,000.

Trout Creek changed its course and cut across the road, leaving the bridge dry. A long stretch of road slipped into Toboggan Creek. Several washouts occurred on the road between Smithers-Hazelton, closing the road for about two weeks. Most of the damage occurred in the Doughty area. The approaches to the bridge at Doughty washed away.

The Dolly Varden Railway trail, which had just been upgraded at a cost of \$7,000, sustained heavy damage. The cost to repair the damage was estimated at \$15,000. At Alice Arm, emergency repairs had to be made to the rock retaining wall, which protects the town streets, and suspension bridge.

*1) Lloyd Johnstone ranked the four highest water levels in Lakelse Lake during this century as follows (starting with the highest): 1935, 1978, 1992, and 1958. With the exception of the 1958 flood, these were all rain-on-snow events (L. Johnstone, pers. comm.).

*2) Five Mile Creek could not handle all the water. The railroad had diverted water from Mission Creek to Five Mile Creek to serve the water tower at the station.

*3) Native Indians of the Kitsequecla Village built a temporary bridge soon after the old one went out. In 1938, a concrete abutment and the bents for the pile trestle approach for the new Kitsequecla Bridge No. 61 were put in. Because of the lack of funding, the construction did not continue until the early 1940s.

November 5-8, 1935

Event type: Rain-on snow flooding.

Precipitation: Prince Rupert (138.7 mm/3 days), November 5-7, 1935; Terrace (52.6 mm/3 days), November 5-7, 1935; Aiyansh (34.5 mm/1 day), November 6, 1935; Swanson Bay (58.4 mm/1 day), November 7, 1935; Ocean Falls (129.3 mm/1 day), November 7, 1935; Falls River (96.3 mm/2 days), November 7-8, 1935; Namu (116.9 mm/2 days), November 7-8, 1935.

Source: *Evening Empire*, November 7, 8 and 9, 1935; *The Daily News*, November 7, 9 and 12, 1935; *The Terrace News*, November 13, 1935; *The Omineca Herald*, November 6, 1935; Dept. of Public Works Report of repairs caused by flood damage (Port Clements). B.C. Ministry of Transportation and Highways, Terrace; Dept. File, 3 PWM 1035 Quarterly Report April 1-December 1, 1935. Skeena Dist. B.C. Ministry of Transportation and Highways, Terrace; Letter, November 1, 1935, W. H. Cotton (Ass. Dist. Eng. Smithers) to J. C. Brady (Dist. Eng. Prince Rupert) Dept. File 5639, B.C. Ministry of Transportation and Highways, Terrace.

Exceptionally heavy rains and wind caused extensive damage in northern British Columbia. The area affected extended down the Telkwa, Bulkley, and Skeena rivers. Small tributary streams turned into raging torrents, bringing down many years' accumulation of drift. Damage also occurred along the Kitsault River near Alice Arm and on the Port Clements-Queen Charlotte City section of the Queen Charlotte Islands. Roads, bridges, and the rail line sustained heavy damage. The provincial government agreed to provide money for road and bridge repair by special warrant. Because of the cut in transportation links on November 6, shortages of certain food staples were reported from Terrace, Usk, and waypoints. Terrace and Usk were completely cut off for two weeks. On November 10, heavy rains were also reported from Anyox. A heavy snowfall in the lower Skeena Valley was reported.

On the rail line between Prince Rupert-Pacific, in addition to the regular section hands, 250 men worked to repair the damage. At Salvus bridge, crews worked in two shifts. The tracks between Salvus-Kwinitza were flooded with 1.5-7 ft. (0.5-2.1 m) of water. The Skeena River took the old course north of the roadbed. At Salvus, the platform and depot floated across the track and outbuildings floated 750 ft. (225 m) west of the depot. The section men used boats to escape when the water came up to the windows of their houses. Between Terrace-Vanarsdol, part of the right-of-way at Phillips Creek washed away, leaving the rails and ties suspended 40 ft. (12 m) in the air for a distance of 70 ft. (21 m). At Hardscrabble Creek, 6 mi. west of Pacific, both sides of the bank washed away: 30 ft. (10 m) on the east side and 50 ft. (15 m) on the west side. East of Pacific at Fiddler Creek, a 15-ft. (5 m) high right-of-way washed out over a distance of 200 ft. (60 m). A little further east, 300 ft. (90 m) of a 10 ft. (3 m) high grade were washed away. On November 9, the rail traffic resumed, after the line had been out since October 25. The first regular train since October 23 arrived at Prince Rupert on November 12.

The road between Skeena Crossing-Kitwanga was blocked and made impassable. This 2-mi. (3.2 km) section west of Kitsequecla had been cleared of slides earlier in the year. The shovel had to go back again the next year to clean it up. Roads and bridges in the Portland Canal-Stewart area sustained damage. Travel to the mining properties in the Salmon and Bear River sections was interrupted. The Virginia Creek bridge abutments had to be rebuilt. Extensive damage to the Dolly Varden Mine was expected, as heavy bridge timbers were seen floating in the Kitsault River.

Queen Charlotte City reported 2 in. (50.8 mm) of rain. The road between Queen Charlotte City-Port Clements sustained slight damage. There were a number of small slides and a small bridge near Skidegate washed out. Bridge No. 29 north of the Guss Ross Ranch and Bridge No. 30 at N. Schafer Ranch were replaced. The total cost for the bridge repairs, including the Kumdis bridge No. 55 and the small bridge in the centre of the Indian Mission, amounted to \$1,771.99. The temporary repairs of the bridge north of the wireless station cost \$225.00.

December 31, 1935-January 2, 1936

Event type: Flooding.

Precipitation: Namu (85.9 mm/2 days), December 31, 1935-January 1, 1936; Stewart (35.5 mm/3 days), December 31, 1935-January 2, 1936.

Source: *Vancouver Daily Province*, January 3, 1936; *The Daily Colonist*, January 3, 1936; *The Vancouver Sun*, January 3, 1936.

Flooding in the Alice Arm area of the Portland Canal District caused heavy damage and partially paralysed the mining industry in the area. The flood swept out bridges and tracks on the 16-mi. (25.6 km) Dolly Varden railway between Alice Arm-West Creek. Every bridge along the route was swept away and many miles of track washed out or twisted off the roadbed. The town of Alice Arm was saved when one of the mouths of the Kitsault River broke over the flats above the town and found a new outlet.

February 28-29, 1936

Event type: Non-fatal snow avalanche.

Precipitation: Aiyansh (132.1 mm/2 days), February 28-29, 1936; Namu (44.2 mm/2 days), February 28-29, 1936; Stewart (71.1 mm/2 days) February 28-29, 1936.

Source: *The Stewart News and Northern Miner*, March 6, 1936.

On March 1, part of a pack train near Stewart had a narrow escape when a slide came down on the Missouri Road. *1) When returning from the Big Missouri mine, four members of a Crawford Transfer pack train encountered a large slide blocking the road at Mile 13. Another slide came down at the same location, carrying away and burying five packhorses. Twenty-three men summoned from the Big Missouri, cleared the slide and located the horses. The animals were rescued but the harness was a complete loss.

*1) The practice of breaking a pack train into small strings was common on winter trails prone to slides. Its efficiency was proved in this case, as only one team was hit.

May 29-June 3, 1936

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Daily News*, May 30; June 1, 2, 3, 4, 5, 6, 8, 10 and 11, 1936; *Evening Empire*, May 30, June 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13 and 15, 1936; *The Omineca Herald*, June 3, 1936; *The Vancouver Daily Province*, June 2, 1936; *The Interior News*, June 3, 10 and 17, 1936; *The Omineca Herald and Terrace News*, June 3, 10 and 17, 1936; October 29, 1947; *Prince George Citizen*, May 18, 1939; *Terrace Omineca Herald*, June 3, 1964; *The Terrace Standard*, May 31, June 7, 1989; *The Daily Alaska Empire*, June 1, 2, 3, 5, 8, 9, 10 and 13, 1936; *The Vancouver Daily Province*, June 15, 1936; *The Herald*, May 4, 1972; Lloyd Johnstone, *In: Terrace Review*, Riverboat Days guide; Letter, June 9, 1936, W.H. Cotton (Ass. Dist. Eng. Smithers) to A. Dixon (Chief Eng. Victoria). B.C. Ministry of Transportation and Highways, Terrace; File G-20-01, Flood damage Range Dist. #9 Night letter, June 12, 1936, J.C. Brady (Dist. Eng. Prince Rupert) to Chief Eng. Victoria. B.C. Ministry of Transportation and Highways, Terrace; Letter, June 12, 1936, Carr (Road Foreman) to J.C. Brady: Damage from Floods - 1936 - Atlin District. B.C. Ministry of Transportation and Highways, Terrace; Letters, June 15, August 31, 1936, W.H. Cotton to J.C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Letter, June 19, 1936, Road Foreman at Aiyansh to Hugh McDonald (General Foreman Stewart). B.C. Ministry of Transportation and Highway, Terrace; Letters, June 17, 19, 27, 1936, M.J. Dougherty (Public Works Terrace) to J.C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Telegrams June 18 and 19, 1936, M.J. Dougherty to J.C. Brady. B.C. Ministry of Transportation and Highways, Terrace; File 27-40-0 Letter, July 7, 1936, F. Park (General Foreman Vanderhoof) to J.C. Brady. B.C. Ministry of Transportation and Highways, Terrace; File 35-41-10 Letter, July 13, 1936, W.H. Cotton to J.C. Brady: Estimated repair cost flood damage. B.C. Ministry of Transportation and Highways, Terrace; File 32-40-51, Letter May 10, 1939, S.A. Cunliffe (Ass. Dist. Eng.) to J.C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Department of Mines and Resources 1937; Environment Canada 1991; Meziadin Environmental Advisory Team 1975 (Vol. 3, Fig. 4-9); Asante 1972 (p. 47); Dr. A.S. Gottesfeld, pers. comm. June 1, 1994; Weber (ed.) 1986.

A sudden rise in temperatures caused snowmelt and flooding conditions province-wide and in the Yukon Territories and Alaska. The temperatures during the peak of the flood reached 90° F (32.2° C) in the shade and went as high as 95° F (35° C) during the last week of May. On June 1, the temperature in Smithers was 90° F (32.2° C) and 94° F (34.4° C) in Prince George. The Skeena, Columbia, and Thompson rivers reached the highest levels in 30 years. In the southern interior, the Fraser, Thompson and Columbia rivers flooded their banks.

According to the Native Indians, one would have to go back at least a hundred years to find a flood as bad as that in 1936 (F. Frank, letter to *The Herald*, May 4, 1972). The rising water of the Skeena River at Usk was 360,000 cfs (10,194 m³/s) (W.S.C. *In* Meziadin Environmental Advisory Team 1975). On June 3, *The Omineca Herald* reported, "All records for high water in the memory of men have been surpassed.... and Indians who have lived on the Skeena (River) all their lives, say never saw the like. The country of the Skeena and its tributaries will never look the same again... nearest [previous high water levels] ... in November 1917 and June 17, 1931 ... both those records are feet below the present level of the water...." In Terrace, the main course of the Skeena River shifted from the south side of Ferry Island to the north of it. The slough north of the island tripled in size to 300 yd. (275 m). On June 3, the Kitsumkalum River near Terrace recorded a maximum daily discharge of 883 m³/s, setting an all-time record (Environment Canada 1991). The Skeena River changed its course near Terrace and caused severe erosion (Gottesfeld, pers. comm.). Most of the pasture on the flats below the bench was washed away (Asante 1972). The lower part of the Frank Brothers farm at Kitsumkalum cut away 9 ac. (3.6 ha) of land. Floyd Frank described the situation as follows: "We lost about 12 ac. (4.8 ha) of land in about three days. The river was like something gone wild. Great waves, like rollers about 3 to 4 ft. (0.9-1.2 m) high, came down the river, carrying chunks of land, trees and lumber..." (F. Frank *In* Weber 1986). Other losses around Terrace included 6 ac. (2.4 ha) from the Alex Kerr farm, Sherwood's barn and several acres of his land, and "considerable land" from the W. Godwin property. Also the farm home belonging to Mr. and Mrs. John Loen was swept down the river. On Braun's Island, several farms were swept away and many horses and cattle were carried down the river. CNR electrician, William Reid, reported to have seen 23 houses, some of which from Usk, float down the Skeena River.

Usk and Remo were the most seriously stricken communities. Usk suffered more than anywhere else. The whole town was covered with drift and debris. A logjam at Kitselas Canyon backed up the water in the canyon. Usk was flooded by 6-10 ft. (1.8-3 m) of water. Several houses were entirely washed away and others floated off their foundations. The railway station was flooded and the water reached the second floor of Lee Bethurem's general store and post office. Only three buildings escaped more or less undamaged: the Riverside House, belonging to Perry Skinner, the John Williams residence, and Charlie Durham's old hotel and poolroom. Around June 5, Constable H.R. McKenay, together with another constable and a nurse, reached Usk with 700 lb. (300 kg) of provisions. A supply bureau was established at Usk. Around the same time Remo was reached.

Mike Frye described the flooding situation in Usk, "Early May 1936, three days of steady rain caused the Skeena River to flood its banks and flood the main valley. All the food from the local store owned by Jim Bethurem was hauled upstairs to the balcony. Above the store was a dance hall and at the far end was the balcony where the music played for the dances. The big store building was lifted off its foundations and settled at an angle with the back end down. The women and older men cooked and slept in the school. The livestock congregated on the higher ground about 1,500 ft. (450 m) from the landing at the schoolhouse. When the water rose crowding the cattle, these were shot. Most of the carcasses were lost in the fast muddy water. Only a few were butchered for food. When the rain finally stopped and the water receded, the deposited silt at the bottom of the hill was over a foot deep. The only food items

saved were the canned goods. Some food shortages occurred when the people started running out of flour, other cereals, sugar, coffee, and tea. Every man who could work was hired. The railway confiscated all the horses and anything that was needy.... It took well over a month of hard work for 20 men, eight teams of horses and all the equipment we could master.” (M. Frye In: The Terrace Standard). Will Christy remembers after the flood eating in the old hotel and looking at the high water mark just below the 8-ft. (2.4 m) high ceiling (W. Christy In: Weber 1986). There was nothing left of Remo. At Remo, the water rose over the 1920 mark. All the houses but one had gone, including the ferry house. The ferryman’s personal loss amounted to \$100, one violin, and nine volumes of the Harmsworth Encyclopedia. *1)

At the Kispiox Indian village, the river cut an entirely new channel through a group of houses, taking 20 buildings down the river. On June 1, the Bulkley River near Hazelton recorded a maximum daily discharge of 1,510 m³/s, an extreme for the period of record 1928-41 (Environment Canada 1991). At Hazelton, all the waterfront property was practically destroyed. *The Vancouver Daily Province* reported 33 houses washed away at Hazelton while more were being undermined by floodwaters. A 24- x 18-ft. (7.2 x 5.4 m) Indian house, two cabins, and the powerhouse belonging to the Kitanmax Power and Light Company were swept down river. On June 1-2, the Skeena River rose and cut into its bank at Hazelton. Hodder’s house went down the river and hit Hugh MacKay’s house. Hodder’s house disintegrated and started a big logjam. On the Hudson’s Bay Co. property, the last clump of trees went out and later that morning the old stone cellar collapsed. The lower section of Old Hazelton also sustained heavy damage. The ground floor of the Hazelton Hotel flooded and many residents had to be evacuated. The old Hazelton (Skeena Forks) Hudson’s Bay trading post store building, which was built in 1860, was undermined and collapsed. At the confluence of the Bulkley and Skeena rivers, the water was right up to the floor of the bridge. At Hopkins place near Cedarvale, 6 ft. (1.8 m) of sand was deposited. At Kitwanga, the water tank and pumphouse were carried away. On June 1, supplies were sent to the village from Hazelton. The village of Glenvowell was completely inundated.

The Skeena River cut entirely new channels in many places. From descriptions of damage at Remo, it was doubtful that the district would ever revive as a gardening area, at least for a long time. By nightfall on June 2, the Skeena River started to drop about 6 in. (15 cm). The Skeena and Bulkley Rivers at Hazelton dropped 4 ft. (1.2 m) on June 3. Though the warm weather continued, the Skeena River dropped another 10 ft. (3 m) at Hazelton on June 4.

On May 29, the westbound morning train got as far as Kitwanga but had to return to Smithers. The train service was reduced to two trains a week. The trains only ran as far as Smithers. From there a stub train ran as far as Hazelton. Plans for daily train service through the district to promote the tourist trade were put on hold. The railway agreed to take some 700 Native Indian cannery workers for practically the same fare as from Hazelton to Port Essington, all the way round via Jasper to Vancouver, up the coast by the steamers to Prince Rupert and then east to Port Essington by train. This meant a total distance of some 1,000 mi. (1,600 km) to get to a point about 100 mi. (160 km) from their homes. Without this arrangement the canneries would have faced a complete shut down. The rail line between Prince Rupert-Smithers was extensively damaged. Terrace old-timer Lloyd Johnstone recalls, “From the 29th of May until September the railway was washed out from Kitwanga to Kwinitsa. If you wanted to work, you worked on rebuilding the railway.” Native Indian cannery workers were transported from Kitwanga via Jasper Park to Vancouver by rail and brought to the Skeena River canneries by boat.

When the water levels went down enough, the damage was assessed and repairs started. Crews started at Mile 62, west of Salvus, putting in a new 700 to 800-ft. (210-240 m) bridge. A fully equipped work train with 25 men left for Kwinitsa. A second work and supply train left two days later. A major, 700 ft. (210 m) washout occurred 1.2 mi. (2 km) west of Salvus. Two additional repair crews of 20 men each were sent out from Terrace, one going to Usk, the other to Shames. On June 8, the track was cleared as far as Mile 63, about 1.5 mi. (2.4 km) west of Salvus. The repair work was also proceeding from Kitwanga. Six miles (10 km) of telephone and telegraph wire were swept away between Terrace-Kitwanga. A telegraph repair crew of 10 men arrived from Vancouver on June 10 to assist in restoring the communications. The CN Telegraph repair crews reached Terrace on June 12. By June 13, the telegraph service was restored, according to H.A. Meadows, local manager, much earlier than expected.

The damage was extensive: All across Remo Flat, the railway track was just hanging in the air; the gravel had all washed from underneath the track (W. Christy In: Weber 1986). The CNR waiting room at Remo and the pumphouse and several other buildings at Vanarsdol went out. The new railway station under construction at Pacific and the houses of the men along the tracks just west of Pacific were all flooded. At Vanarsdol, the railway depot was hanging over the river and the water tower was badly undercut. Half of its foundations were hanging over the river. Kitwanga was the scene of a big washout. The most serious trouble point was 2 mi. (3.2 km) west of Kitwanga.

On June 13, Cpl. H. Caybone and Game Warden E. Martin left Prince Rupert in a flat-bottomed boat for Terrace with supplies for isolated settlers. They would go as far as Kwinitsa where contact would be made with CNR employees. From Kwinitsa, a temporary freighting service would be established.

About 1-2 mi. (1.6-3.2 km) up the Bulkley River from Moricetown, a large logjam was reported. This would account for the very little driftwood coming down the Bulkley River.

On May 31, Quesnel experienced a power outage when floating debris cut the powerline just above the traffic bridge across the Fraser River. Between the morning of May 30 and the afternoon May 31, the river at Quesnel had risen 27 in. (67.5 cm), reaching 19.63 ft. On June 1, the Fraser River at Prince George rose to within 5 ft. (1.5 m) of the decking of the CNR rail bridge. According to CNR superintendent W.H. Cobey, it reached the highest recorded level since 1912. (1911?)

Overnight June 1-2, the waters of the converging Fraser and Nechako rivers rose 4 in. (10 cm) and were still rising at noon. Inbound trains were delayed. People in East Prince George were evacuating their homes. The westbound train into Prince George did not go beyond Dewey. On June 3, the Fraser River was 21 ft. (6.3 m) above its low water mark. Between June 3-5, it dropped 21 in. (53.3 cm) at Prince George. Near McBride, CNR lineman Andrew Ekren went missing and presumably drowned while restoring part of the line.

Flood damage in the Hazelton-Smithers area: Bulkley Bridge No. 51 at Hazelton slightly damaged by logs striking the span. *2) The water was actually running over the bridge deck while heavy drift was coming down. The water in the Skeena River got so high that it started backing up the Bulkley River. The south end of the Bulkley River bridge at Smithers washed out, lowering the bridge by about 2 ft. (60 cm). Both ends of the Driftwood Creek bridge No. 27 washed out. The bridge settled down after the end bents washed out. The pier at the east end of the Porphyry Creek bridge was undermined. The bridge settled down 3 ft. (90 cm), twisting it. The crib went out and a large portion of the road washed out and cracked. The Hazelton Ferry house washed away with all its contents. The ferryman's personal loss was estimated at \$50. The ferry tower on the Hazelton side moved 6 ft. (1.8 m) and got badly twisted. The riverbank on the Hazelton side cut in and changed considerably. The road on the opposite side was badly damaged. The ferry road from the town to the ferry was completely gone and piled up with drifts up to 20 ft. (6 m) high. The small bridge near the bridge went out and the road down the south side washed out in many places.

Flood damage Terrace-Kitwanga area: The Skeena suspension bridge No. 97 had the crib around its north end abutment partially washed away. At Kitsequecla, the temporary Indian bridge went out. The road just past the Kitsequecla village was completely gone for a distance of a mile (1.6 km). The north tower of the Kitwanga Ferry moved and the landings were damaged. The ferry house with all its contents washed away. Bob Burton, the ferryman, was in the house cooking breakfast when he felt the house shake. Thinking an earthquake caused it, he left the house. The building was then lifted off its foundations and floated down the Skeena River. Local resident Kathy Johnson remembered seeing the ferryman's house float by her father's place at Cedarvale. Smoke was still coming out of the chimney when the house passed by (Gottesfeld, pers. comm.). The ferryman's personal loss was \$20. The Cedarvale Slough bridge went out. The Cedarvale Ferry sustained only light damage. The ferry house lifted and floated amongst the trees. Pacific got flooded and lost the bridge across the slough behind the station and the old ferry buildings. The Usk Ferry cable between the anchor and the tower on the south side broke. A new cable was required. The total cost, including the salvaging of the old cable, was estimated at \$250.

A portion of the trestle approach on the south side of the Terrace main bridge was damaged and lost. Four of the timber spans and the approach of the bridge went out. Damage to the Terrace bridge was estimated at \$3,000, including the installation of a temporary catwalk. On the Remo road, on the south side of the Skeena River, six bridges were damaged. The access to the south bank of the Skeena River, including the Lakelse Valley was cut off. The Remo ferry lost its wind tower and basket tower on the south side and its north-end tail cable. The main tower on the south side was undermined and had to be moved back. The basket tower on the north side needed to be straightened. The riverbank washed in between 50-100 ft. (15 and 30 m). On the south side, about 400 ft. (120 m) of road along the bank was washed out. Both the Zimacord bridges No. 1 and No. 2 went out. The road from the Zimacord to the ferry was also gone. The Thornhill bridge on the Lakelse Road got slightly twisted. It needed straightening for a total distance of six spans. A small bridge at the Copper River ferry floated out of place. The powder house floated about 100 ft. (30 m) off its foundations. The cost to repair the north side of the Copper City Ferry bridge was estimated at \$500, and another \$500 to repair the road. The estimated cost to move the Copper River City bridge back 900 ft. (270 m) was \$750. The bridge to the Copper City ferry went out.

The Braun's Island bridge required two new spans and some piles replaced. The repair cost of Braun's Island bridge and approaches was estimated at \$2,000 and \$300 for road repair. The road from the Copper Ferry to Dobbies Crossing was wiped out. The south side riverbank just west of Skinners Store washed out over a distance of approximately 600 ft. (200 m). The cost estimate for road and bridge repair in the Skeena District as per June 13, 1936, was: roads, \$3,450; bridges, excluding the Driftwood bridge, \$15,755; and ferries, excluding the Remo Ferry, \$2,100. Total cost was \$21,305. The bridges included Remo, Terrace, Thornhill, Smithers, Canyon Creek, Porphyry Creek, Hazelton, Nine Mile, Kispiox, Seventeen Mile, Hankin, Mero Creek, Palletti (Kitwanga), Shandilla Creek, Meanskinisht (\$7,000), Fiddler Creek, Pacific, Usk Foot Bridge, Braun's Island, Bridges on Kitsumkalum Road, Hall Creek, and Driftwood.

Flood damage in the Atlin District: The Keystone bridge near Stewart across American Creek had a 100-ft. (30-m) stringer carried away. A 40-ft. (12 m) stringer on the Upper American Creek was badly weakened. Six small bridges on the Bear River Road needed renewal. Near Aiyansh, the Cranberry bridge and other small bridges were weakened and made unsafe. The Stikine Teslin bridge and the 2nd South Fork Stikine bridge needed repairs. The Alice Arm Illiance bridges were made unsafe for traffic. The total bridge repair cost was \$4,550. The Bear River Road near Stewart between American Creek-Mud Bay was under 2 ft. (60 cm) of water for a distance of over a mile. Most of its surfacing was carried away. Just beyond Glacier Creek, about half a mile was inundated and badly damaged. The Big Missouri Road required considerable ditching, culverts, and surface repairs. The Stikine caused flood damage in the Telegraph (Creek) townsite and washouts on the Telegraph (Creek) to Dease Lake Road. North Atlin sustained some general damage. Total cost for road repair \$5,500; overall cost, \$10,500.

Flood damage also occurred in the Bulkley Valley and the Lakes. The roads sustained only minor damage. The Pleasant Valley bridge No. 42 west of Houston on the Northern Trans-Provincial Highway (NTPH) had 100 ft. (30 m) of bank protection cribbing washed out, endangering the bridge during the next high water. The Kalthood bridge No. 463 on the NTPH 3 mi. (4.8 km) east of Topley had its cribs undermined. The Telkwa River bridge No. 101 was endangered after 250 ft. (75 m) of bank protection cribbing washed out.

The Stewart area experienced high water conditions as a result of heavy rain and a subsequent warm spell. The heat wave had temperatures of 75° F (23.9° C) on May 29, 84° F (28.9° C) on May 30, and in the 80s F (26.7°-32.2° C) for several days after that. The Bear River hit record heights, flooding the road from the other side of Muddy Gulch Hill to Mosquito Creek. The bank on the east end of 2nd Street got eroded. Logs and debris hanging up on the railway trestle had to be dynamited for several days. Glacier Creek overflowed its banks, flooding the road this side of the Dunwell Mill. Operations at the Dunwell and Welldun were temporarily ceased. Mining and milling resumed on June 9. The American Creek bridge was carried away. Bitter Creek was described as “a boiling mass of mud.” The Aiyansh district experienced “the worst flood catastrophe the district has ever known.” The water levels exceeded by 8 ft. (2.4 m) anything previously observed. The Nass River started rising on May 29, flooding the northern part of Greenville. The water reached a depth of 5 ft. (1.5 m) over the sidewalks. The sawmill and five houses got flooded. More serious damage may have been done at Aiyansh. The Nass River reached a higher level than the previous record flood of 1917.

Flood damage Aiyansh District: The bank mud sill on Gitzyon Creek bridge washed out letting a corner of the bridge down 1 ft. (30 cm). Three bridges on Tseax Flats floated up. Two of them were tied back into place. The third floated approximately 100 ft. (30 m) down the slough. The Slough bridge on the Aiyansh-Cranberry Trail settled out of place. Two small slides occurred 3 mi. (4.8 km) up the trail. The Cranberry bridge was damaged by drift striking the bridge. Three of the floor beams were knocked out, the stringers were shoved together and half of its decking was gone. The river flat trails were covered with debris. The River Flats were covered with a sticky silt layer 0.5 to 3 in. (1.25 to 7.5 cm) thick and all the potatoes were rotted.

Total of flood damages is estimated as follows. Omineca bridges, not including Aveling Coal Road, \$2,000; roads \$1,000. Skeena bridges, not including Kitsequecla, \$20,000, roads \$3,000; ferries, several thousand dollars and two ferryman’s houses gone. Prince Rupert, no damage. Atlin bridges, \$4,000, roads \$3,000, not including the Dolly Varden Railway.

The Stikine River reached unprecedented high water levels. The riverboat *Hazel B No. 2*, belonging to the Barrington Transportation Co., arrived at Wrangell, Alaska, eight days overdue, because of the high water conditions on the Stikine River. It was slightly damaged bumping a canyon wall several times while coming down the river. Capt. Sid Barrington reported the “highest floodwaters in his 20 years’ experience on the Stikine River.” He also reported to have seen many cabins of prospectors, trappers, and homesteaders that were swept away. Telegraph Creek was reported to have suffered heavy losses. All roads and bridges to Dease Lake washed out. The Stikine River swept away scores of riverbank warehouses and Indian smokehouses. The water was flowing 7 ft. (2.1 m) deep through the Hudson’s Bay warehouse at Telegraph Creek. The home of “Groundhog” Jackson at Grand Rapids was swept away, but the family escaped to a high bench. The wingdam at Barrington was also swept away.

The Taku and Tulsequah rivers flooded. The road into the “White Water-Taku Mines” White Water property washed out. The considerable damage done by the floodwaters caused problems getting supplies in.

According to government meteorologist Robert Carter, the Fraser River at Prince George crested at 21.8 ft. on June 3 at 8 p.m. The South Fort George gauge, which was set to a higher zero reading, peaked at 18.3 ft. (*Prince George Citizen*, May 18, 1939).

*1) In an unprecedented move, the three ferrymen at Remo, Hazelton, and Kitwanga were reimbursed for their personal losses. W.H. Cotton, the Assistant District Engineer in Smithers, noted, “These men had a very severe time during the flood and all did wonderful work, as evidenced by the fact that all ferries were saved....”

*2) In 1939, the bridge was limited to a gross load of 5 short tons and a speed of 15 mph.

October 4-6, 1936

Event type: Flooding.

Precipitation: Stewart (112.3 mm/2 days), October 4-5, 1936; Aiyansh (46.7 mm/1 day), October 5, 1936; Falls River (81.3 mm/1 day), October 6, 1936.

Source: *The Stewart News and Northern B.C. Miner*, October 16, 1936.

Near Stewart, nearly 4 in. (101.6 mm) of rain in 24 hours increased water pressure, completely demolishing the cofferdam at Long Lake. Management of the Big Missouri mine put on crews to rebuild the dam and the bridge at Silver Lake.

November 9-19, 1936

Event type: Rain-on snow flooding.

Precipitation: Stewart (204.7 mm/4 days), November 9-12, 1936; Swanson Bay (619.8 mm/10 days), November 9-18, 1936; Namu (226.2 mm/4 days), November 10-13, 1936; Queen Charlotte City (215.0 mm/9 days), November 10-18, 1936; Kitimat Mission (410.7 mm/10 days), November 10-19, 1936; Aiyansh (44.5 mm/1 day), November 11, 1936; Ocean Falls (305.1 mm/2 days), November 11-12, 1936; Falls River (362.3 mm/8 days), November 11-18, 1936; Terrace (82.1 mm/2 days), November 12-13, 1936; Prince Rupert (53.3 mm/2 days), November 12-13, 1936; Stewart (133.8 mm/4 days), November 15-18, 1936; Ocean Falls (223.3 mm/2 days), November 17-18, 1936; Bella Coola (182.4 mm/2 days), November 18-19, 1936.

Source: *Evening Empire*, November 12, 16 and 18, 1936; *The Daily Colonist*, November 14, 22 and 24, 1936; *The Terrace News*, November 26, 1936; *The Omineca Herald*, November 26, 1936; *The Daily News*, November 10, 12, 14, 16 and 18, 1936; *The Interior News*, November 18, 1936; *The Daily Alaska Empire*, November 11, 14, 16, 23, 24, 25, 27 and 28, 1936; *The New Outlook*, June 3, 1938; *The Stewart News and Northern B.C. Miner*, November 13 and 20, 1936; *The Informer*, November 20, 1976; *The Vancouver Sun*, November 23, 1936; *The Daily Province*, November 23, 1936; *The Coast Mountain Courier*, May 31, 1989; Kopas 1970 (p. 272); Tempest 1974; Letters, November 19, 1936, and no date, Ass. Dist. Eng. Smithers to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace; Letters, November 23 and December 4, 1936, Dist. Eng. Prince Rupert to Chief Eng. Victoria; B.C. Ministry of Transportation and Highways, Terrace; Telegram, November 10, 1936, W. H. Cotton to J. C. Brady; B.C. Ministry of Transportation and Highways, Terrace; File 35.41.0 Letter, December 2, 1936, W. H. Cotton to J. C. Brady, B.C. Ministry of Transportation and Highways, Terrace; Environment Canada 1991.

In November, early snows followed by a heavy warm rain brought about the “Armistice Day Flood.” Rail lines and roads sustained heavy damage. On November 13, after 2 to 3 days of excessive rain according to the Government Telegraphs, the Skeena River at Hazelton rose 4 ft. (1.2 m) overnight and another foot on November 14. On November 20, the Bulkley River at Quick recorded a maximum daily discharge of 807 m³/s (Environment Canada 1991). Though tributary streams caused all the flooding, no damage was expected from the Skeena River.

On the rail line between Prince Rupert-Hazelton, the train and telegraph services were interrupted. Eight bents of the Khyex River rail bridge were swept away. The bridge at Salvus had several bents washed out. The passengers from the westbound train were transferred to a stub train. Numerous slides occurred between Inverness-Bulkley Canyon. Near Pacific, railway bridges and new fill that were put in after the big 1935 flood were washed out. The area between Fiddler Creek and 3 mi. (4.8 km) west of Amsbury was hardest hit. At Fiddler Creek, the bridge embankment was washed out. Several small washouts were reported between Cedarvale-Vanarsdol. On November 12, the first regular passenger train since October 23 arrived at Prince Rupert. On November 15, the whole line was cleared and trains were running according to schedule on November 16.

In the Terrace area, roads were flooded and bridges washed out at Granite Creek and Eliza Creek. On Kalum Road, Lean-to and Glacier creeks flooded the road. The Copper River Ferry bridge was cut out on the east end and dropped down. The damage was estimated at \$200. The Copper River suspension bridge had its east-end centre bent trestle approach taken out by a logjam. The decking came down 3 ft. (90 cm) and was resting on logs. The repair cost for the Copper River suspension bridge was \$100. The cost to repair the approaches to Lean-to Creek was estimated at \$100. One mudsill of the Thornhill bridge No. 1 (Remo Road) moved slightly and became loose. One post of the stiffening bent on the 45-ft. (13.5 m) span of the Thornhill bridge No. 2 (Corlette Road) bridge went out. A logjam was threatening the bridge. The channel changed its course again, now running against the west pier. Rock was placed around the pier to protect it. Carr’s bridge No. 187 at Remo, a 42-ft. (12.6 m) long bridge over a dry slough, lifted off its sill at high water. The estimated cost of putting it back into place and repair of the approaches was \$250. *1)

On November 12, Smithers reported a record deluge. From intermittent showers on Armistice Day, the heavy downpour gradually developed into a deluge. The rain, which started on November 11, removed all traces of snow.

On November 20, high water and washouts occurred west of Hazelton. On November 23, rail service between Prince Rupert-Terrace was reported interrupted again, when a bridge at Salvus gave way. Repair crews were trying to get the train service to resume on November 23.

On November 23, the Telkwa River was reported to have washed out a highway bridge approach near Telkwa. (*The Daily Province*).

Near Alice Arm, flooding occurred on the Kitsault shore road, on the flats towards the Illiance River. The floodwaters took out all the bridges, restricting the road to foot traffic only. Because of a recent heavy snowfall, the government work on the Dolly Varden road ceased. After the snowfall it turned mild and started to rain.

In the Stewart area, south winds and a torrential rain closely followed a 15-in. (38.1 cm) snowfall. In Stewart, south winds combined with heavy snow and torrential rain to cause heavy damage. A record-breaking 16.56-in. (420.6 mm) of precipitation fell between November 1-18. Between November 1-7, 17 in. (43.2 cm) of snow fell, followed by 14.5 in. (368.3 mm) of rain between November 8-18. Stewart recorded 2.07 in. (52.6 mm) of rain on November 10, 3.22 in. (81.8 mm) on November 11, and 2.65 in. (67.3 mm) on November 17. Glacier Creek overflowed its bank, flooding the Bear River road both north and south of the creek.

Considerable damage was done to the road surface, washing out the road between Stewart-Dunwell. It took a crew of men several days to make the road passable. The road conditions up the Bear River beyond Dunwell were unknown. Side streams and the Bear River flooded the road in many places, all the way to American Creek. Between

Muddy Gulch and the terminal, the Bear River rose until, in many places, it was over the road to a depth of 3 ft. (90 cm).

A logjam formed on the road 2.5 mi. (4 km) downstream from American Creek. According to D.W. Kimball, water in American Creek was not as high as during the previous spring; the greater force of water seemed to come down the main Bear River. The heavy rains melted all the snow off the roads at the lower elevations, enabling cars to go to Premier and to the Half-way on the Big Missouri on bare ground. In Stewart, many basements flooded and some crossings were impassable. During the evening of November 11, some half dozen slides were reported on the Salmon River Road between the Premier mine and Stewart, by men walking in from the Big Missouri mine. These slides, consisting of snow, mud, and trees, greatly impeded travel for a few days. The slides on the Alaskan side of the Salmon River were expected to be repaired in four to five days. The wingdam sustained some minor damage. The government telegraph line went down, interrupting all communications with the Upper Salmon. The Northern B.C. Power Company experienced difficulties and swung onto the diesel plant. Motor transportation as far as the Premier mine was expected to be resumed by November 14. The exceptionally wet weather considerably delayed the shipment of ore that Sam Deschamps was taking out of his American Creek property.

In Prince Rupert, heavy gales were reported on November 12 and overnight November 17-18. Many trees were blown down, interrupting telegraph and other services. During the stormy weather on November 10-11, the *Princess Norah* was forced to return to Ketchikan. The ship arrived in Prince Rupert on November 16, one day late. On November 17, a boat was found overturned near Bella Coola. Two people were missing and feared dead. During the November 17-18 storm, the S.S. *Anyox* encountered difficulties. It was later found safe at Cape Cook.

The stormy weather over the Gulf of Alaska grounded three planes at Cordova and delayed shipping. The Coast Guard cutter *Morris* had to lay-to at Hoonah before crossing the Gulf for westward sections. On November 14, the *Princess Norah* was delayed for 12 hours by fog and bad weather. The *M.S. Estebeth* reported encountering a "mighty rough passage" and southwest gales along the coast of Chichagof Island and in Icy Straits. The *M.S. North Star* damaged its rudder and iced down in a northwest gale on November 14.

Ocean Falls reported heavy rain for about a week. The big dam was overflowing, even with all the outlets opened. Long-time Ocean Falls resident Erik Gustav Herman remembered the 75 in. (190.5 cm) snowfall: "You couldn't find the roads, or the railway or a fence." (E.G. Herman *In: The Informer*, November 20, 1976).

On November 21-22, heavy flooding in the Bella Coola area washed out five bridges, wrecked numerous culverts and inundated many miles of highway. Bella Coola, with a population of 800, was saved from flooding by dynamiting a bridge, just above the town. Other bridges were carried away and communication with Hagensborg, a town of 250 people, 10 mi. (16 km) east of Bella Coola, was cut.

The flood was described as "larger than the 1934 flood" (Tempest 1974). The Skimlix, Casperson and Canoe Pass bridges and two others unnamed washed away. The Sorenson bridge was badly damaged and another bridge was regarded unsafe. The Bella Coola River backed up and changed its course. The river rose 20 ft. (6 m) above its normal level. Floodwaters swept away the swining bridge that crossed the river from the "white" village on the south to the Native Indian village on the north side of the river.

The removal of the bridge also cut off the water supply to the Indain village. This was because the main from the water intake at the Chief's Ledge on the Tatsquam River was suspended under the swinging bridge (Kopas 1970).

Gillet, the Government Agent, and the Native Indians decided to move the whole village, including the Emmanuel Church across the river to higher ground. The church, which was 56 ft. (16.8 m) long and 28 ft. (8.4 m) wide with a 15-ft. (4.5 m) ceiling, was floated across in 1938. *2)

Juneau reported a record rainfall of 21.86 in. (555.2 mm) between November 1-28. Prompted by recent excessive rains on November 23, a landslide occurred on Mount Roberts near Juneau, Alaska, killing 15 people.. It wiped out two apartment houses, a lodging house, and a store. This was the second serious landslide in Juneau in 1936. Powerlines were cut and telephone and U.S. Signal Corps communications disrupted. The slide came down across South Franklin Street, crushing the Nickinovich and Peterson apartments and Gus Erickson's house. It also damaged the Matson apartment house and the Wahto boarding house. The mass of mud was 100 ft. (30 m) wide and 20 ft. (6 m) high. Around December 1, the ground on Mount Roberts gave indications of moving again. Mayor Goldstein ordered all houses in the area still occupied to be vacated.

*1) Most bridges in the Remo district were built on mudsills and floated off with each high water. All these bridges required pile driving.

*2) To avoid the cost of future flood damage, the provincial government decided in 1925 to abandon the white settler's townsite on the banks of the Necleetsconnoy River on the north side of the valley. It surveyed a piece of property on the south side of the Bella Coola River and offered to make an exchange of lots. In 1926, the non-Native settlers moved their townsite to the south side of the river. The Native Indian village with its community hall, church, and many homes, was situated on higher ground closer to the Bella Coola River. Since it had not been exposed to the freshets coming down the Necleetsconnoy River, it decided not to move.

February 23, 1937

Event type: Rockfall.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, February 23, 1937.

Late on February 22, a rock “about the size of a boxcar” caused a slide on the PGE line 7 mi. (11.2 km) south of Quesnel. Passengers were transferred around the slide, causing a six-hour delay. It was hoped to have the slide cleared on February 23.

Late June-early July 1937

Event type: Spring runoff flooding?

Precipitation: Not applicable.

Source: *Nechako Chronicle*, July 3, 1937; *The Prince George Citizen*, July 8, 1937.

At the end of June, rivers and lakes overflowed their banks and flooded low-lying areas in the Vanderhoof district. Floodwaters covered highways in many places. It was described as “one of the most serious floods taken place in this district for many years.” Floodwaters threatened business premises along 1st Street and Fraser Avenue along the south side of the railway tracks. The road between Vanderhoof-Prince George was flooded, halting traffic. The only way in and out of town was via the old West road.

Around July 7 (?), flood levels remained stationary. The ferryman at Fort Fraser, who had resided there for a quarter of a century, stated the water was within a few inches of “the greatest height he has known.”

January 20-26, 1938

Event type: Non-fatal snow avalanche.

Precipitation: Aiyansh (35.3 mm/1 day), January 20, 1938; Stewart (209.2 mm/7 days), January 20-26, 1938; Namu (85.1 mm/1 day), January 21, 1938; Namu (78.0 mm/1 day), January 24, 1938; Falls River (174.8 mm/2 days), January 24-25, 1938.

Source: *The Stewart News and Northern B.C. Miner*, January 28, 1938.

Near Stewart, snow was reported falling at about an inch (2.5 cm) an hour for several days. The snowfall totaled 6 ft. (1.8 m) in all, on top of the snow that was already on the ground. On January 26, the road between Stewart and the Crawford Co. dock was blocked by snow. Heavy snow sloughed off the upper side of the road, causing delays. Heavy slides came down on the road between Stewart-Hyder, Alaska.

On January 26, the government put a crew of men to work with shovels to clear the road. The 1.5-mi. (2.4 km) section of road between Eleven Mile and the Red Bridge, cut out of the steep mountainside, was completely filled in with snow. Many of the gullies disgorged heavy slides. At a point 0.5 mi. (800 m) on the Premier side of the Red Bridge, the V-plow driven by Jack Brooks was hit by a slide and completely buried. Fortunately a roof protected those on the plow, and Brooks managed to back the plow out.

February 16-18, 1939

Event type: Snow avalanches.

Precipitation: Prince Rupert (129.6 mm/2 days), February 16-17, 1939; Swanson Bay (186.2 mm/2 days), February 16-17, 1939; Falls River (164.3 mm/2 days), February 16-17, 1939; Smithers (58.4 mm/2 days), February 17-18, 1939; Namu (55.4 mm/1 day), February 19, 1939.

Source: *The Daily News*, February 17 and 18, 1939; *The Interior News*, February 22, 1939.

Heavy rain occurred in Prince Rupert and heavy wet snow in the lower Skeena area and west of Terrace. In a 24-hour period, 22 in. (55.9 cm) of snow was reported between Kwinitsa-Salvus. Downed telegraph lines cut the communications. On the afternoon of February 17, an engine and snowplow derailed. Just west of the derailment site was a snowslide 40 ft. (12 m) long and 15 ft. (4.5 m) deep. On February 18, snowslides were reported 5 mi. (8 km) east of Kwinitsa, interrupting the train traffic.

Smithers experienced the “heaviest snowstorm in 15 to 20 years.” The government experimental farm recorded 15 in. (38.1 cm) of snow. At other points close to Smithers, as much as 20 in. (50.8 cm) of snow fell.

Near Juneau, Alaska, a snowslide measuring a length of 150 ft. (45 m) and a depth of 12 ft. (3.6 m) came down on Thane Road on February 16. It took two days to remove the slide.

March 25, 1939

Event type: Ice jam flooding.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, March 25, 27, 28 and 29, 1939; *The Prince George Citizen*, March 30, 1939.

At the end of March, extreme mild weather throughout the central Interior caused a sudden breakup. The Fraser River opened up about 10 days earlier than usual. Warm temperatures and heavy rain in the mountains caused river ice to break up and ice jams to form. Quesnel recorded temperatures ranging above 60° F (15.6° C). High water conditions prevailed due to ice jams. Some loss of mining equipment was reported.

Early on March 25 following several days of rain and chinook winds, ice jams caused the Murray River to suddenly overflow its banks at East Pine, 27 mi. (43.2 km) west of Dawson Creek. Residents of the flooded area were

bewildered with the speed with which the flood occurred. Survivors described the flood as, “a great wall of ice that suddenly swept on the houses.”

Floodwaters swept away a house with eight occupants asleep. An estimated 25 people escaped and one family was marooned on the far side of the Murray River. On March 26, floodwaters covered 20-30 mi. (32-48 km) of low-lying land along the banks of the Pine and Murray rivers threatening the community of East Pine. Ice jams in the river were reported to be 60 to 70 ft. (18 to 21m) high. On March 27, floodwaters receded after taking a total of nine lives.

May 18-19, 1939

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Prince George Citizen*, May 18, 1939; *The Daily Colonist*, May 20, 1939.

Warmer weather during May brought a rapid rise in the Fraser River. Late on May 17, the water reached the 19-ft. mark at the CNR gauge on the steel bridge, a foot (30 cm) higher than the previous night. Although floodwaters had not yet threatened the CNR tracks, the flats in the east end of town were flooded over a wide area. The main highway on First Avenue was flooded at one location.

All the sloughs were filled to capacity and the Nechako and Fraser rivers were running over the normal banks. Summit Lake was reported to be a full 6 in. (15 cm) higher than any previous record. Crooked River was running so fast that the freighters were making relays.

Around May 19 near Prince George, the Fraser River backed up the Nechako River causing the lower floors of many homes on East-End flats to flood. Following heavy rain on May 18, a further rise was expected. On the morning of May 19, the river gauge stood at 19.7 ft. *1)

*1) During the record 1936 flood, the Fraser River at Prince George rose to 21.8 ft. The worst conditions occurred in June 1911 when the city flooded after the river rose to 25 ft. (*The Daily Colonist*, May 20, 1939).

December 1-5, 1939

Event type: Flooding.

Precipitation: Namu (205.5 mm/4 days), December 1-4, 1939; Falls River (245.4 mm/4 days), December 1-4, 1939; Prince Rupert (116.9 mm/4 days), December 1-4, 1939; Terrace (160.5 mm/4 days), December 2-5, 1939; Aiyansh (20.8 mm/1 day), December 3, 1939.

Source: *Evening Empire*, December 4, 6 and 7, 1939; *The Omineca Herald*, December 6, 1939; *The Terrace News*, December 6, 1939; *The Interior News*, December 6, 1939; Letter, April 20, 1940, C.H. Thomas to C. S. Leary (Min. of Public Works). B.C. Ministry of Transportation and Highways, Terrace; Letter, May 7, 1940 S. A. Cunliffe (Ass. Dist. Eng.) to District Eng. Prince Rupert. B.C. Ministry of Transportation and Highways, Terrace; File 32-20-100 Usk-Cedarvale Project, 4-A Weekly Rep. No. 10. B.C. Ministry of Transportation and Highways, Terrace.

On December 3 and 4, very heavy rain was reported in the Usk to Cedarvale area. In the Terrace area, flooding occurred in Remo, on the road east of the Terrace School and the Horse Shoe area west of Terrace. Some homes were completely isolated by the floodwaters. On the Lanfear Hill Road, a landslide measuring 200-300 ft. (60-90 m) long and 2-6 ft. (0.6-1.8 m) occurred. Water accumulating on the bench 50 ft. (15 m) above the road caused the slide. It covered a plowed field and an orchard belonging to C.H. Thomas. It also blocked a ditch, which was originally part of the Horse Shoe drainage scheme. S.A. Cunliffe, Assistant District Engineer, refused any responsibility: “The slide was an act of God and the fact that our road wound its way up the hillside is incidental.”

Heavy rains caused creeks along the Skeena River to flood. Telegraph lines were reported down and train traffic was interrupted for at least two days. On the rail line east of the Kalum River bridge, a series of washouts occurred. The area was badly cut by the 1936 flood when a gravel bank washed away. On December 5, rail traffic was interrupted by a serious mudslide along the lower Skeena River. The westbound train was held at Pacific. Regular service was restored on December 7.

October 17-20, 1940

Event type: Rain-on-snow flooding and rockslides.

Precipitation: Namu (250.4 mm/4 days), October 17-20, 1940; Prince Rupert (90.0 mm/4 days), October 17-20, 1940; Swanson Bay (412.5 mm/4 days), October 17-20, 1940; Kitimat Mission (205.8 mm/3 days), October 17-20, 1940; Aiyansh (54.1 mm/2 days), October 18-19, 1940; Falls River (124.2 mm/2 days), October 18-19, 1940; Bella Coola (187.8 mm/4 days), October 18-20, 1940; Swanson Bay (236.3 mm/3 days), October 18-20, 1940; Terrace (96.8 mm/2 days), October 19-20, 1940.

Source: *The Omineca Herald and Terrace News*, October 23 and 30, 1940; *Evening Empire*, October 19, 21 and 22, 1940; *The Daily News*, October 19, 22, 23, 24, 26 and 28, 1940; *The Interior News*, October 23 and 30, November 6 and 20; December 4, 1940; File 32-40-10 Letter, October 29, 1940, S. A. Cunliffe. B.C. Ministry of Transportation and Highways, Terrace (Ass. Dist. Eng. Smithers) to J. C. Brady (Dist. Eng. Prince Rupert) B.C. Ministry of Transportation and Highways, Terrace; File 32-0-53-4 Letter, November 5, 1940, Ass. Dist. Eng. Smithers to Chief

Eng. B.C. Ministry of Transportation and Highways, Terrace; File 32-20-100 Usk-Cedarvale Project, 4-A. Weekly Rep. No. 54. B.C. Ministry of Transportation and Highways, Terrace.

Between October 17-19, a “tremendous downpour” occurred. In Terrace, 5 in. (127.0 mm) of rain fell in three days, bringing the Skeena River to the spring flood level. The river rose more than 10 ft. (3 m). In the Terrace area, Glacier Creek washed out some of the road surface on the Kalum Road. The Williams Creek bridge sustained damage, closing the bridge to truck traffic. The rock fill at the south pier washed away. The water in Lakelse Lake came close to the high water mark. Two boats in the lake were damaged or sunk. Some telephone lines came down, interrupting communications for over 24 hours. The crib and the pier of the Ellsworth bridge at Kitwanga were washed away. At Whiskey Creek bridge, a crib scoured out and one end of the log stringers settled down 3 ft. (90 cm). Maroon Creek on the Kalum Lake Trail washed out. Near Kalum Lake, the road at Goat Creek and one end of the Goat Creek bridge washed out.

Construction work on the Usk to Cedarvale road also sustained damage. The false work for the bridge at Station 339 washed out. A number of slides occurred from Station 332 onwards. Half the roadbed between Station 336-337 was carried away by a slide. The heavy rains also sloughed the embankment shoulders.

The rail line experienced the “worst tie-up since 1936,” blocking the railroad east and west of Terrace until October 23. Rockslides occurred a few miles east of Terrace and a big rockslide came down at Ritchie. Near Dorreen, the Fiddler Creek bridge had part of the approach on the west side washed away. On October 19, a passenger train plunged off the flood-weakened bridge across Lorne Creek. The engine was virtually buried in the soft silt with the tender and freighter on top of it. The engineer, fireman, and two passengers were missing and presumed drowned. On November 1, the body of one of the passengers was found 16 mi. (25.6 km) below the scene of the accident. It was caught in the branches of a tree 5 ft. (1.5 m) above the ground, indicating the height of the river at this point at the time of the accident. On November 27, the body of the other passenger was found on a sand bar 1 mi. (1.6 km) below the Skeena River bridge. It was lodged about 4 ft. (1.2 m) above the river level and almost buried in the sand. On November 28, the engine was recovered but no more bodies were found. The fast water had probably swept them away.

At Bella Coola, a fishing boat sank and a bridge was swept away. On November 19, the seiner *Mildred G* of Metlakatla foundered near Deep Bay, 18 mi. (28.8 km) south of Prince Rupert. One man was drowned and the rest of the crew was rescued.

May 25-26, 1942

Event type: Spring runoff flooding.

Precipitation: Smithers (41.9 mm/2 days), May 25 and 26, 1942.

Source: *The Daily News*, May 27 and 28, 1942; *The Interior News*, May 27, 1942; *The Omineca Herald and Terrace News*, May 27, 1942; *Vancouver News-Herald*, May 27 and 28, 1942; *Prince George Citizen*, May 28, 1942; Environment Canada 1991; File 32-41-10 Telegrams, May 26, 27, 1942, S. A. Cunliffe (Ass. Dist. Eng.) to Chief Eng. Public Works Dept. Victoria. B.C. Ministry of Transportation and Highways, Terrace; Letter, May 28, 1942, S. A. Cunliffe to J. C. Brady (Dist. Eng. Prince Rupert) B.C. Ministry of Transportation and Highways, Terrace; File 32-40-51, Letters, June 10, 1942, April 9, 1943 S. A. Cunliffe to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Telegram, June 4, 1942, J. C. Brady (Dist. Eng. Prince Rupert) to Chief Eng. Dept. Public Works, Victoria. B.C. Ministry of Transportation and Highways, Terrace; Telegram, June 8, 1942. Hugh McDonald (Atlin Dist.) to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace.

On May 25 and 26 in the Terrace to Smithers area, very heavy warm rains occurred described as “torrential downpours.” After a gradual rise for two days, the Skeena and Bulkley rivers reached flood levels. On May 27, the Bulkley River at Quick recorded a maximum daily discharge of 691 m³/s (Environment Canada 1991). Several small creeks were reported to be on the rampage.

On the rail line, the bridge approaches of John Brown Creek near Moricetown were damaged. On May 26, the westbound train had to return to Smithers, delaying the train for 23 hours. The railway grade at Ritchie was reported damaged. In the same location in 1940, five lives were lost when a train derailed (see: October 17-20, 1940). Near Terrace, the fill of the north-end approach of the Glacier Creek bridge No. 44 washed out. The washout of the approach embankment was temporarily bridged for foot traffic. At Kitwanga, Ellsworth Bridge No. 248, a 70-ft. (21 m) hewn Queen Truss, at Kitwanga washed away. The Pallitti bridge No. 274 on the Northern Trans-Provincial Highway between Cedarvale-Kitwanga had its deck afloat. At the Kitwanga ferry, the cable of the tower under construction had to be cut in order to save it. On the Mannix contract, the roads on the Hardscrabble Flats east of Usk flooded. A large amount of drift timber piled up against the Terrace bridge. Drift was building at the old Indian bridge at Kitsequecla. On May 28 the bridge was ordered to be blown out.

Flooding closed the road between Smithers-Hazelton. Some settlement occurred on a small bridge on the Driftwood Creek Road. Glacier Creek, just east of Moricetown Station, flooded the road, cutting off the link with Hazelton. The Bulkley River bridge No. 51 at Hazelton was closed indefinitely to all traffic. Drift had tilted the northerly span. The water was still rising and bringing more drift. Blasting operations to remove the piled up drift proved to be ineffective. The first span moved downstream about 16 in. (40.6 cm). On the night of May 27, the

second pier and the span on the Hazelton side went out. *1) The ferry house at Hazelton was endangered and had to be lashed down with a cable.

The flood damage until May 31 was estimated as follows: bridges, \$319.65; roads \$184.10; ferries, \$91.85. Some additional cost was later incurred because not all damage was repaired. The cost to repair the flood damage at Mile 69 on the Telegraph Creek-Dease Lake road was \$200, for the Glacier Creek bridge No. 85 near Stewart was \$100, and for Ruby Road near Atlin was \$200.

Around May 28, the Fraser River near Prince George had been rising rapidly for the previous few days.

*1) The remains of the bridge were dismantled in early 1943.

November 10-13, 1942

Event type: Rain-on-snow and landslides.

Precipitation: Falls River (301.2 mm/4 days), November 10-13, 1942; Prince Rupert (147.1 mm/3 days), November 11-13, 1942; Prince Rupert (66.5 mm/1 day), November 11, 1942; Namu (48.3 mm/1 day), November 12, 1942.

Source: *Evening Empire*, November 11, 13 and 14, 1942; *The Daily News*, November 11, 12, 13 and 14, 1942; N.T.P.H. Construction Usk to Cedarvale Weekly Rep. No. 53. B.C. Ministry of Transportation and Highways, Terrace.

On November 9, 6 in. (15.2 cm) of snow followed by heavy rain on November 10-12 were reported in the Cedarvale - Usk area. Several slides occurred and considerable damage was done to the cuts on the Northern Trans-Provincial Highway construction project.

Winter 1942-1943

Event type: Icejam flooding?

Precipitation: Not applicable.

Source: Cohen 1992 (p. 72).

During the winter, ice took out part of the temporary bridge over the Peace River at Taylor Flats just south of Fort St. John (Cohen 1992).

Ca. 1942-1943

Event type: Landslide?

Precipitation: Not applicable.

Source: Dave Cruden, pers. comm. via Marten Geertsema, April 2, 2007.

Details: In 1942 or 1943, a train full of soldiers derailed near Blue River due to a landslide. A lot of the wounded ended up in the hospital in Edmonton, Alta. Because it happened during the war, the military probably kept it quiet.

January 6-12, 1943

Event type: Snow avalanche.

Precipitation: Aiyansh (61.2 mm/2 days), January 6-7, 1943; Ocean Falls (192.7 mm/2 days), January 6-7, 1943; Falls River (211.4 mm/3 days), January 6-8, 1943; Prince Rupert (125.7 mm/3 days), January 6-8, 1943; Prince Rupert (59.7 mm/1 day), January 12, 1943.

Source: Stethem and Schaerer 1980 (pp. 1-3).

On January 6, an avalanche came down the gully at MacLean Point, 85 km west of Terrace, blocking about 30 m of railway track. The slide did not reach the Tomlinson Construction Company camp. This construction camp was built on an avalanche track housing the workmen building the highway from Terrace to Prince Rupert.

February 10-13, 1943

Event type: Fatal snow avalanche.

Precipitation: Terrace (30.5 cm snow), February 10, 1943; Prince Rupert (109.8 mm/3 days), February 11-13, 1943; Aiyansh (48.5 mm/1 day), February 12, 1943; Falls River (69.9 mm/1 day), February 12, 1943; Terrace (73.9 mm/1 day), February 12, 1943.

Source: *The Daily News*, February 12, 15 and 17, 1943; *The Vancouver Daily Province*, February 12, 13 and 26, 1943; *Vancouver News-Herald*, February 13 and 16, 1943; *The Daily Colonist*, February 13 and 14, 1943; *The Interior News*, February 17 and 24, 1943; *The Vancouver Sun*, February 26, 1943; Stethem and Schaerer 1980 (p. 1-3); B.C. Ministry of Transportation and Highways 1980.

On February 12, a series of five avalanches hit the Tomlinson Construction Company camp at slide path MacLean Point, 84.5 km between Prince Rupert-Terrace. During the second week of February, a storm had raged in the area. Most of the precipitation fell as rain at the lower elevations. But on the night of February 10, snow was deposited on the camp.

One of the slides, 300 ft. (90 m) long and 4-6 ft. (1.2-1.8 m) wide (?) carried away the machinist's bunkhouse. Three men were killed and 12 others injured. *1) The first avalanche hit the camp housing about 200 construction workers at about 7:30-7:45 a.m., just as the men were preparing to leave for work. It swept away two small bunkhouses, the first aid shed and a 14-ton donkey locomotive. Had it struck an hour earlier, while the men were still in their bunkhouses, the toll might have been much higher.

Two larger bunkhouses were smashed later. Other buildings were carried away in four subsequent slides. (*The Daily Colonist*, February 14, 1943). The second slide destroyed the two remaining bunkhouses and a third one destroyed the office. The six buildings were all swept into the Skeena River. The slide also tied up the train traffic.

A father, who with his son was caught in the second slide, saw it coming towards them. "It looked like the whole camp was moving towards me. The next thing I was in the river." He later found his son nearly buried under snow and debris. One of the injured men said he heard "a rumble like a heavy wind."

On February 15, the body of one of the missing men was located. Late on February 15, the third victim was reported, but the body of third victim, 44-year old George Balderchak of Edgerton, Alta. was never found. Presumably the river carried it away.

*1) The coroner's jury investigating the death of the two men, in their verdict expressed the opinion "the Federal Government, through the engineers in charge, should prohibit construction of any camp in a dangerous location." The verdict also expressed the opinion that, "having been warned of the danger from slides at this point, the Tomlinson Construction Company should have selected a less dangerous site for their camp." A few days later the incident, the camp was rebuilt in a safer location at Telegraph Point, about a mile (1.6 km) west.

Late May-early June 1943

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Vancouver Daily Province*, June 2, 1943.

Late May-early June, the Fraser River was slowly rising despite continued cool weather. At the steel bridge east of Prince George, water levels rose 3 ft. (90 cm) during the previous week. Spring temperatures were 20 degrees F (degrees C) below average, leaving the bulk of the previous winter's still in the hills and retarding the annual runoff.

July 9-10, 1943

Event type: Flooding.

Precipitation: Not applicable.

Source: Coates 1992 (p. 146).

The spring thaw of 1943 ravaged the newly constructed Alaska Highway, washing away large sections and knocking out numerous bridges and culverts. The problems had been anticipated. Civilian workers set to work rebuilding the roadbed, culverts, and bridges. However, just as the work was nearing completion, on 9 and 10 July 1943, torrential rains hammered the south-central portions of the highway. Dozens of bridges were washed away in the two-day storm, setting back construction plans by many weeks.

One worker heard "boulders bumping their way down the small river that passed our camp" (Recollections of Duncan Bath). Huge mudslides, in July and again in August, further hampered reconstruction efforts. (Coates 1992).

October 14, 1943

Event type: Rockslide.

Precipitation: Not available.

Source: *The Omineca Herald and Terrace News*, October 20, 1943.

On October 14, a washout or slide occurred at Mile 86 near MacLean Point, at the same place where a slide took out a construction camp in the spring. The westbound train was held at Pacific for 16 hours.

February 11-13, 1945

Event type: Rockslide.

Precipitation: Prince Rupert (33.0 mm/2 days), February 11-12, 1945; Falls River (141.0 mm/3 days), February 11-13, 1945.

Source: *The Interior News*, February 15, 1945.

On February 12, a big rockslide came down west of Amsbury. The slide blocked the roadbed for a distance of 200 ft. (60 m). Hitting the railway in a cut, it piled up to a depth over 25 ft. (7.5 m). The slide consisted of boulders, some of which were reported "as big as boxcars." The schedule was expected to return to normal by February 17 or 18.

March 5, 1945

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Interior News*, March 8, 1945.

On March 5, another rockslide came down at Amsbury and covered the CNR line. The slide, 200 ft. (60 m) long and up to 30 ft. (9 m) deep, in a narrow cut was not expected to be cleared until March 17.

May 15-19, 1945

Event type: Spring runoff flooding.

Precipitation: Smithers A (15.7 mm/1 day), May 15, 1945; Smithers (22.6 mm/2 days), May 15-16, 1945.

Source: *The Interior News*, May 24, 1945; Environment Canada 1991.

Heavy rains causing high water levels held up rail traffic on the Smithers division. Passenger trains were delayed. The worst flooding conditions occurred east of Topley, where the Bulkley River overflowed the tracks and threatened to wash out a bridge.

On May 19, the Bulkley River near Houston recorded a maximum daily discharge of 156 m³/s (Environment Canada 1991).

May 26-31, 1945

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Prince George Citizen*, May 31, 1945; *The Vancouver Daily Province*, May 31, 1945.

Following a five-day heat wave with a peak at 84° F (28.9° C) near Prince George the water levels of the Nechako and Fraser rivers neared the flood stage. Rising at nearly 1 in. (2.5 cm) an hour, it caused flooding of lowlands east of Prince George. Around May 31, the Fraser River was rising faster than during the week preceding the disastrous 1936 floods. Minor washouts occurred on the rail line between Prince George-Smithers.

The spring of 1945 had been cool. In April in Prince George, the mean temperature was nearly 5 degrees Fahrenheit below normal, the lowest in 10 years. Water levels were at the lowest in 30 years and caused the ice to remain longer. The Fraser River opened up on April, fully a week later than usual. *1)

It was reported that the Bulkley and Telkwa rivers were over the banks until the low-lying snow would go. The Fraser and Nechako River watersheds were confronted with much snow at higher elevation.

*1) In 1911, 1920 and 1936, heavy winter snows, late spring, little April-May runoff, warm days and nights in late May and June, accompanied by heavy thunderstorms built up water levels to danger points. Weather conditions in 1945 were very similar to those in the 1936 flood year (*Prince George Citizen*, May 31, 1945).

June 18-20, 1945

Event type: Flooding.

Precipitation: Namu (101.9 mm/2 days), June 18-19, 1945; Falls River (73.7 mm/2 days), June 19-20, 1945; Bella Coola (60.0 mm/2days), June 19-20, 1945.

Source: *The Province*, June 21, 1945; *The Vancouver Sun*, February 20, 1946.

A constant heavy rainfall caused Snootshlee Creek and Bella Coola River to rise 8 ft. (2.4 m) above their normal levels. On June 21, hay fields and gardens in the Bella Coola Valley flooded. In Hagensborg, the schoolbus was unable to get through because of flooded roads. According to Bella Coola old-timers, this was the first time they remembered a flood occurring at this time of the year. *1)

*1) Over the winter of 1945-46, at a cost of approximately \$1,400 "Native Indian and white labourers" using bulldozers carved out a new riverbed through the forest and away from the village. By February 20, 1946, the work was almost completed. Within a week, a blast of dynamite charges would divert the river into its new channel. (*The Vancouver Sun*, February 20, 1946)

October 13-15, 1945

Event type: Flooding and landslides.

Precipitation: Falls River (192.6 mm/2 days), October 13-14, 1945; Kitimat Mission (171.2 mm/2 days), October 13-14, 1945; Terrace (92.0 mm/2 days), October 14-15, 1945; Terrace (63.8 mm/1 day), October 14, 1945.

Source: *The Omineca Herald and Terrace News*, October 17, 25, [24] and 31, 1945; *The Daily News*, October 13, 15, 16, 18 and 27, 1945; *The Evening Empire*, October 13, 15 and 16, 1945; *The Interior News*, October 18, 1945; *The Omineca Herald and Terrace News*, October 17 and 25 [24], 1945; *The Daily Alaska Empire*, October 13 and 15, 1945; Telegram, October 14, 1945, W. R. Workman to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; File 32-41-10, Letters October 18, November 26, 1945, March 28, 1946, W. R. Workman (Ass. Dist. Eng.) to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace; Telegram, October 22, 1945, Wilson to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Letters, October 15, 22, 1945, Hugh McDonald (General Foreman Stewart) to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace; File 2-40-80 Report, February 16, 1946, F. N. Good, P. Eng., Location of Bridge Replacement on Bitter Creek. B.C. Ministry of Transportation and Highways, Terrace.

On October 13, heavy rain and a gale averaging 34 mph (54.7 km/h) with around 9 p.m. gusts up to 42 mph (67.7 km/h) caused heavy damage. In the Prince Rupert area, the roof of the Valentin Dairy was blown off and the roof Malkin's warehouse on the waterfront was damaged. Many windows were blown in and several chimneys were damaged. The interior also received heavy rain. The heavy rains of the previous week brought rivers to flood levels. Hanson Co.'s boom at Nass broke around October 14, causing a heavy loss as some 2,000 poles went down the river. On the morning of October 14, the Skeena River rose to within the 1945-spring high water mark. Homes and property near Kalum Lake and Lakelse Lake were endangered by the high water. Pete Johnson's cabin at Kalum Lake and the Little, Haughland & Kerr mill at 17 Mile were flooded. On Lakelse Lake many rowboats broke away.

Train traffic and telegraph communications between Prince Rupert-Terrace were interrupted. East of Shames, a slide came down across the tracks and a section of track was flooded for some time. The slide, which did not affect the highway, was cleared on October 16. The slide near Amsbury measured a length of 1,000 ft. (300 m) and a depth of 12 ft. (3.6 m). The slide was described as "a grand mixture of huge rocks, dirt and many trees." The train traffic resumed on October 16.

The heavy rain on October 13-14 caused considerable damage on the Northern Trans-Provincial Highway between Amsbury-Kitwanga, especially in the Cedarvale section. At Amsbury, the creek gauged out a channel in the mountainside approximately 100 ft. (30 m) wide and 30 ft. (9 m) deep. The bridge was completely washed out, except for the crib abutments. On the east side of the bridge there were about 2,000⁺ ft.³ (56.6 m³) of boulders on the road. The slide measured a width of 250 ft. (75 m) and a depth of 15 ft. (4.5 m). The Amsbury slide section was expected to reopen on October 24. On the Pacific to Kitwanga section, two bridges were damaged and later reopened for light traffic. The Coyote Creek bridge had 8 ft. (2.4 m) of the approach on each side washed away. Driftwood and boulders had jammed between the pile bents, washing out the approach fills. The bridge was replaced on October 30.

The Boulder Creek bridge, the new trestle bridge east of Cedarvale, was undermined to a dangerous state for heavy traffic. The traffic was rerouted via the old bridge upstream. The bridge at Price Creek had a heavy pile-up of driftwood but did not sustain any damage. Lowrie No. 262 Bridge No. 2 near Usk and on the north side of the river washed out. Lorne Creek bridge No. 323 washed out on one end. The damage was estimated at \$10,000. The highway was reopened on October 27 after the Kitwanga to Terrace section of the highway was reopened for light traffic on October 22. The estimated cost only to open the roads damaged during the October 13-15 storm was \$2,195.

In the Stewart-Portland Canal area, the peak of the storm occurred on October 13. The storm was described as the "worst storm we have ever seen in the Portland Canal District." F.N. Good wrote in his report, "...this flood comes into the hundred year class and it is unlikely that such conditions will be experienced in the near future." The Bear and Salmon rivers flooded in many places. Bitter Creek went on the rampage, taking out the Bitter Creek bridge completely. The distance between the north and south bank increased to 200 ft. (60 m). A temporary crossing was put in across Bitter Creek. The estimated cost for a new bridge was \$5,000. The Stewart Cemetery was flooded and part of it covered with debris and large rocks up to 4 ft. (1.2 m) deep. A large washout occurred on the Bear-Naas (Nass) Trail between the end of the road and the first relief camp. The Power Company plant at Barney's Gulch was put out of commission. The flume was completely carried away by the same stream that covered the cemetery with the debris. The steel tower on the Prosperity Tram was carried downstream Marmot River for 4 mi. (6.4 km).

The Weather Bureau in Juneau, Alaska, recorded 3.3 in. (83.8 mm) of rain. *1) The Juneau airport reported 2.81 in. (71.4 mm) during the same period. Gale-force winds of 40 mph (64 km/h), with gusts of 50 mph (80 km/h), caused several craft to break their mooring lines within the Juneau Small Boat Harbour. The Alaska Game Commission's seaplane hangar was overturned when the mooring piles gave way. The troller *Bird*, owned by Peter Willis, was lost 2 mi. (3.2 km) southwest of Marmion Island on October 12.

*1) This was the second highest precipitation total for any 24-hour period since 1913 when 3.50 in. (88.9 mm) was recorded.

November 2-3, 1945

Event type: Rain-on-snow flooding.

Precipitation: Aiyansh (67.6 mm/1 day), November 2, 1945; Terrace (94.5 mm/1 day), November 2, 1945; Prince Rupert (69.1 mm/1 day), November 2, 1945; Kitimat Mission (72.6 mm/1 day), November 2, 1945; Smithers (50.8 mm/1 day), November 2, 1945; Smithers A (70.4 mm/2 days), November 2-3, 1945; Falls River (120.2 mm/2 days), November 2-3, 1945; Ocean Falls (163.1 mm/2 days), November 2-3, 1945.

Source: *The Omineca Herald and Terrace News*, November 7 and 21, December 5, 1945; *The Daily News*, November 3, 5, 6, 7, 8, 9, 13, 15, 16, 19, 21 and 26, December 3 and 12, 1945; *The Evening Empire*, November 3, 5, 7 and 9, 1945; *The Interior News*, November 8, 1945; *The Daily Alaska Empire*, November 5, 1945; File 32-20-99 Letter, November 19, 1945, Dist. Eng. Prince Rupert to Chief Eng. Victoria. B.C. Ministry of Transportation and Highways, Terrace; File 32-41-10 Letters, November 23, 26, 1945, W. R. Workman (Ass. Dist. Eng. Smithers) to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highway, Terrace; Telegram, November 5, 1945, J. C. Brady to Chief Eng. B.C. Ministry of Transportation and Highways, Terrace; Telegram, November 10, 1945, Chief Eng. to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; File 32.20.99 Northern Trans-Provincial Highway - General: Telegrams, November 20, 23, 1945, W. R. Workman (Ass. Dist. Eng.) to J. C. Brady. B.C.

Ministry of Transportation and Highways, Terrace; Letter, December 3, 1945, J. C. Brady to W. R. Workman. B.C. Ministry of Transportation and Highways, Terrace; Letter, December 11, 1945, Ass. Dist. Eng. Terrace to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Letter, December 17, 1945, J. C. Brady to A. L. Carruthers (Chief Eng.). B.C. Ministry of Transportation and Highways, Terrace; Letter, December 27, 1945, George Little & Son Ltd. to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Letter, February 16, 1946, W. R. Workman to J. C. Brady. B.C. Ministry of Transportation and Highways, Terrace; File 32-40-61 Letter, March 28, 1946, W. R. Workman (Ass. Dist. Eng. Smithers) to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace; File 32-40-57 Letter, June 15, 1946, W.R. Workman to J.C. Brady. B.C. Ministry of Transportation and Highways, Terrace; Letter, February 12, 1947, T.S. Mills (Chief Engineer Department of Mines and Resources, Ottawa) to J.C. Brady (District Engineer, Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace.

On November 2, Prince Rupert was hit by 50-60 mph (80-96 km) winds. The storm, which was described as "one of the wildest wind and rainstorms in history," cut all railway and communication links. The heavy rains came after several days of snowfall in the mountains. Intermittent power interruptions occurred as a result of damage to the local circuits.

An Indian family of four perished after getting caught in a fierce storm off Klemtu. On November 2, their submerged boat with two bodies was found at Poison Cove, some 90 mi. (144 km) south of Prince Rupert. The other two people were missing and presumed drowned.

Terrace received 3.7 in. (94.0 mm) of rain with heavier rain falling west of Terrace. It was described as the "heaviest short-period rainfall on record in the area west of Terrace." Logging roads in the Terrace district sustained heavy damage. Extensive slides and washouts occurred in the lower Skeena area. The headwaters of the Skeena and Bulkley rivers were not subject to the rain and thaw. If this had been the case, 1936 flood conditions could have occurred.

On the rail line between Prince Rupert-Pacific, over 30 slides (12 of which major ones) and washouts occurred, cutting the rail and wire lines. The 80-mi. (128 km) stretch of track between Pacific-Skeena was impassable. Two worktrains with Buildings and Bridges and extra gangs, pile driver, and dragline were dispatched from Smithers. The worst washout was just west of Kwinitza. An eastbound passenger train, an American Army Troop train with the last contingent of 141 returning soldiers, got caught between two rockslides at Salvus for two days. All the available equipment and some 250 men were set in to clear the tracks.

On November 3, a washout occurred at Mile 36.3 (Marble Creek?). The CNR alleged the washout was caused by the blocking of a stream channel under the highway bridge, approximately 800 ft. (240 m) upstream from the railway. Consequently the railway company submitted a claim in connection with the washout at Mile 36.3 (Mills). The movement of repair crews and equipment was delayed by the derailment of an auxiliary train. The ditcher, oil car, and caboose derailed near Kaien. During clearing operations a few miles west of Pacific, a large 40-ft. (12 m) crane went over the bank and ended up at the edge of the Skeena River. On November 23, the train service was back to normal, after an interruption of 10 days.

On the Northern Trans-Provincial Highway (NTPH) between Prince Rupert-Terrace, a rockslide occurred at Anscomb View near Rainbow Lake, 16 mi. (25.6 km) east of Prince Rupert. The slide, measuring a length of 200 ft. (60 m), was cleared on November 8. A smaller slide came down 4 mi. (6.4 km) further east. Washouts occurred at Tyee, with the worst one at the Tyee Hill. The heaviest damage occurred between Remo-Kwinitza, with six slides and the approaches to six bridges washed out. Between Remo-Shames, there were at least 12 washouts, some being 12-15 ft. (3.6-4.5 m) deep. At Kwinitza, a washout occurred east of the tunnel. Two smaller slides came down between Exstew-Salvus. A washout and a large debris slide measuring over 200 ft. (60 m) happened at Amsbury, at the same location as the one that occurred on October 13.

The Zymacord River bridge got washed out. In Remo, about 0.25 mi. (400 m) west of the Kitsumkalum bridge, a washout occurred, measuring a length of 300 ft. (90 m) and a depth of 10 ft. (3 m). The piling at the northeast end and both the approaches of the Shames River bridge washed away, tilting the bridge. The repairs were hampered by heavy snow. On December 5, the Public Works Department was still trying to reopen the highway. To repair the bridge at Shames, a pile driver was brought down from Smithers.

On December 12, however, the Public Works officials warned people not to be too hopeful about an early reopening of the highway between Terrace-Prince Rupert. The only major repairs left to be done were at the slide at Amsbury and the Shames River bridge. On November 25, the repair cost to date for Amsbury was \$1,130 and for Remo \$700, but the condition of the Shames bridge was still unknown. The cost just to open the road for Kwinitza was \$500, Shames \$700, Amsbury \$2,130, and Remo \$900, for a total cost of \$4,280. Because of the heavy snow, up to 7 ft. (2.1 m), the crews were not able to reach Shames River.

On December 3, a road crew under foreman E.P. Smith reached a point about 1.5 mi. (2.4 km) east of Salvus, and expected to reach Shames River by December 6 or 7. On December 21 the road was passable between Kwinitza and the Shames bridge. The rental of an U.S. Army Services D-4 Caterpillar tractor and labour for the period November 6 to December 8 amounted to \$1,267.43. On February 16, 1946, the road to Shames was opened. The bridge crew started working on it again on February 18. George Little's tractor was employed to remove the logjam under the bridge. On March 28, most of the repairs were completed, except for the rockfill around the piers and

placement of the river back in its original course. There was still a considerable amount of debris under the approach trestle.

On the N.T.P.H. between Terrace-Smithers, the Kitsequecla bridge No. 61 had three of its timber bents washed out. The riverbed scoured down 4-5 ft. (1.2-1.5 m). The highway washed out Toboggan Creek, Gull Creek, and a creek near Dorreen. Several rockslides occurred just east of Terrace and washouts between Hazelton-Usk. The western approach of the Copper River suspension bridge No. 168 washed out. A slide and washout occurred at Mile 26 and a slide at the Mannix rock cuts. Twist Creek washed out and a slide happened at Hells Bells Creek. Both the approaches of Coyote Creek were washed out. The culvert at Gull Creek washed out and at Whiskey Creek more scour occurred on the upstream banks. The construction of the bridge at Gull Creek depended on the opening of the road from Terrace so that the bridge crew could get across. The pile bent on the Price Creek bridge went out. At the Nash Gullies, washouts occurred in two of the three gullies. West of Toboggan Creek bridge No. 106, one half of the roadbed was washed out over a distance of 100 ft. (30 m).

The highway section between Terrace-South Hazelton reopened on November 26, after being closed for over three weeks. The South Hazelton to Smithers section had reopened on November 4 and Hazelton to Kitwanga on November 21.

Around Terrace, Lakelse Road, Kalum Road, and several minor side roads were damaged. The Williams Creek bridge No. 124 on Lakelse Road had its southern approach washed out. The Goat Creek bridge No. 223 on Kalum Road washed out. The centre pier on the Kitwancool bridge No. 57 settled at least 1 ft. (30 cm).

On the Lorne Creek Road, the eastern crib of Fiddler Creek bridge No. 37 scoured underneath. Lorne Creek bridge No. 323 washed out. On the Dean Road, Cherry Tree bridge No. 139 washed out. The Hodkin No. 1 bridge on the Hodkin Road had its east crib washed out, and a washout occurred on Owens Road. The Copper City Ferry lost its northern landing pontoon and the Usk Ferry lost a rowboat.

The cost to repair the damage caused during the November 2 event, only to open the roads, was estimated at \$8,840. The total repair cost for the flooding of October to December was, to December 17: roads, \$11,046.71; bridges, \$2,653.97; and ferries, \$262.42. The total was \$13,963.10. Heavy snowfalls during the first week of December caused considerable trouble opening the roads. On December 11, the Lakelse Road was practically closed.

In the Portland Canal District, the heavy damage to the roads and bridges was estimated at \$15,000. The 145-ft. (43.5 m) span bridge across Bitter Creek washed out. The Northern B.C. Power Company's plant was extensively damaged after being hit by a slide.

January 12-16, 1946

Event type: Snow avalanche.

Precipitation: Not applicable.

Source: *The Interior News*, January 17, 1946.

On January 12-13, heavy snow in the Terrace to Smithers area delayed the eastbound passenger train.

Around January 16, a large snowslide blocked the highway near Kwinitsa. This caused the highway through to Prince Rupert to be closed till spring. *1)

Unofficial reports estimated the slide at 600-1,200 ft. (180-360 m) long. Two Public Works engineers left for Terrace by car to determine the extent of the slide. They were unable to make the return trip, being forced to turn back and leave their car in Terrace. They had traveled only 27 mi. (43.2 km) behind a snowplow in nine hours. Since that time, heavy snowfalls added to the almost impossible task of opening the road between Hazelton-Terrace.

*1) The highway west of Terrace had been impassable due to the bridge being out at Amsbury following high water the previous fall. (*The Interior News*, January 17, 1946).

September 20-22, 1946

Event type: Severe storm.

Precipitation: Prince Rupert (116.7 mm/3 days), September 20-22, 1946; Falls River (184.6 mm/4 days), September 20-23, 1946; Aiyansh (35.3 mm/1 day), September 22, 1946; Kitimat Mission (70.1 mm/1 day), September 22, 1946.

Source: *The Evening Empire*, September 23, 1945; Telegram, September 23, 1946, J. C. Brady (Dist. Eng.) to Art Kennedy (Dept. of Public Works, Terrace). B.C. Ministry of Transportation and Highways, Terrace.

Gales along the north coast caused considerable damage. Fishing boats at Inverness and Port Simpson were set adrift. A Prince Rupert fisherman was swept overboard and drowned. A washout was reported on the highway at Salvus.

January 10, 1947

Event type: Rockfall.

Precipitation: Not applicable.

Source: *The Interior News*, January 15, 1947.

On January 10, a CNR Bridges and Buildings foreman was killed after he was thrown from his speeder when it struck a rock on the track near Pacific just west of Doreen.

January 15-19, 1947

Event type: Snow avalanches.

Precipitation: Ocean Falls (284.0 mm/3 days), January 15-17, 1947; Smithers A 134.7 mm/3 days), January 16-18, 1947; Bella Coola (170.6 mm/3 days), January 16-18, 1947; Aiyansh (126.8 mm/4 days), January 16-19, 1947; Falls River (147.6 mm/4 days), January 16-19, 1947; Smithers (57.9 mm/2 days), January 18-19, 1947.

Source: *The Advertiser*, February 5, 1947; *The Interior News*, January 22, 1947; November 1, 2006; Septer 1995 (p.26).

Between January 16-19, the rail service between Smithers-Prince Rupert was interrupted because of two slides near Kwinitsa. The first one came down during the night of January 16-17, 9 mi. (14.4 km) east of Kwinitsa. It was 200 ft. (60 m) long and 20 ft. (6 m) deep. On January 17, a westbound freight-extra train plowed into it, derailling the engine. A second slide, measuring a length of 300 ft. (90 m) and a depth of 20 ft. (6 m) came down approximately 5 mi. (8 km) east of the first one. A snow removal and wrecking crew was dispatched from Smithers and a rotary plow from Prince Rupert. Train traffic and telegraph and telephone communications were disrupted for over four days.

The heavy snowfall in the Exstew and Shames area forced a 16-men Public Works Department crew to shovel off by hand about seven highway bridges. It was feared that the weight of the snow, if not removed, might cause the collapse of the bridges. To move from bridge to bridge, the men had to snowshoe over the highway. The job was expected three days. Although the Public Works Department intended to make an attempt to clear the snow on the Terrace to Prince Rupert highway, it was believed there was little chance the highway would reopen until the snow would melt in spring. *1) Meanwhile CNR trains were running through a virtual trench of snow up to 6 ft. (1.8 m) high in places on either side of the track.

In the middle of January, Smithers reported a record snowfall of 105.5 cm (*The Interior News*, November 1, 2006).

In Bella Coola the schools were closed for three days. The roads were blocked for short periods of time. Three slides occurred on the old slide site between the town and the wharf. Along the road, 30-40 ft. (9-12 m) snow banks were reported.

*1) During the first years after the opening in 1944, it was considered that there was not sufficient traffic to warrant the expenditure to keep this highway open during the winter months. It was not until the winter of 1951-52, that the highway was kept open during the winter months (Septer 1995).

April 11-13, 1947

Event type: Flooding and mudslides.

Precipitation: Queen Charlotte City (73.7 mm/1 day), April 11, 1947; Prince Rupert (54.6 mm/1 day), April 11, 1947; Falls River (78.0 mm/1 day), April 12, 1947; Kitimat Mission (126.7 mm/2 days), April 12-13, 1947.

Source: *The Daily News*, April 12 and 14, 1947; *The Interior News*, April 16, 1947.

On April 11, a storm with rain and winds of 42 mph (67.6 km/h), described as "one of the liveliest of the season," was general all along the coast. Prince Rupert recorded 2.15 in. (54.6 mm) of rain in 24 hours. In Prince Rupert, the remains of the former exhibition building, nearly leveled by a storm in January, came down.

On April 13, warmer weather in the Bulkley Valley caused washouts on the rail line near Moricetown and in the Bulkley Canyon. The rail line between Smithers-New Hazelton was blocked by mudslides at several points. On April 13, a washout occurred at Doughty. Heavy rains caused the flooding of a culvert causing a considerable portion of the track to be undermined. A temporary bridge was built over the bad section of track, extending for about 70 ft. (21 m). In the worst spot the washout was about 20 ft. (6 m) deep.

May-June 1947

Event type: Spring runoff flooding.

Precipitation: Smithers A (39.7 mm/2 days), June 8-9, 1947.

Source: *The Interior News*, June 5, 1947; Environment Canada 1991; File 32-40-27. Driftwood Creek bridge Letter, June 13, 1947, D. T. Willis (Ass. Dist. Eng.) to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace.

In early June, water levels in the Skeena and Bulkley rivers rose to high water marks. Along the lower Skeena River, the highway and rail line were flooded in several places. Some road bridges near Kwinitsa and Shames were endangered, with water flowing over the decks. The approaches of some bridges along the lower Skeena River sustained minor damage. At the end of May, the Bulkley River at Telkwa came close to the flood point. On May 31, the Bulkley River at Quick and near Smithers recorded maximum daily discharges of 538 m³/s and 714 m³/s, respectively (Environment Canada 1991).

The water levels subsided in early June, the Skeena River near Kitwanga dropping 4 ft. (1.2 m). Previous heavy rains and snowmelt caused localised flooding. Near Smithers, the Driftwood Creek washed out a new channel at Harvey's on the east side of the present bridges. Driftwood No. 4 Ref. No. 29 bridge required a new abutment and one

extra span at an estimated cost of \$615.64. Driftwood No. 2 Ref. No. 27 bridge had the fill under and around the east approach washed away by floodwater. The costs were estimated at \$350.27.

October 8-15, 1947

Event type: Flooding.

Precipitation: Cape St. James (99.0 mm/4 days), October 8-11, 1947; Ocean Falls (201.1 mm/2 days), October 11-12, 1947; Prince Rupert (126.0 mm/4 days), October 11-14, 1947; Bella Coola (89.2 mm/2 days), October 12-13, 1947; Falls River (219.8 mm/4 days), October 12-15, 1947.

Source: *The Advertiser*, October 22, 1947; *The Daily News*, October 14, 1947.

Digby Island near Prince Rupert recorded 3.33 in. (84.6 mm) between October 11-13, and a southeast gale with gusts up to 38 mph (61.2 km/h).

The Bella Coola area experienced 36 hours of heavy rain with a southwest gale and a midnight high tide. Thorsen Creek flooded, weakening the supports under the bridge. In South Bentick Arm, the Osborne Logging Co. had a bridge washed away.

October 23-25, 1947

Event type: Severe wind storm.

Precipitation: Cape St. James (36.3 mm/1 day), October 23, 1947; Falls River (69.9 mm/1 day), October 24, 1947; Terrace (62.5 mm/1 day), October 24, 1947; Bella Coola (116.8 mm/2 days), October 24-25, 1947; Kitimat Mission (119.6 mm/2 days), October 24-25, 1947.

Source: *The Advertiser*, November 5, 1947; *The Omineca Herald and Terrace News*, October 29, 1947.

Namu experienced 85-mph (136.8 km/h) gales, causing heavy property damage. *1) A boat was reported to have sunk, drowning four people. Another boat just managed to get around the point into Burke Channel and get on the beach in a sinking condition. Andy Schooner reported that shingles were torn off the roofs and corrugated iron "twisted like tarpaper."

*1) Namu means "Whirlwind Bay" in the local Indian language.

November 1947

Event type: Rockslide.

Precipitation: Not applicable.

Source: Spooner et al. 1996; Evans (unpublished data).

In November a slide occurred in Mess Creek upstream of its confluence with the Stikine River. The landslide in highly fractured bedrock completely dammed Mess Creek. At Telegraph Creek, the creek bed was reported dry. (Evans (unpublished data). *1)

*1) Spooner et al. (1996) report oral accounts of the Stikine River flowing in the opposite direction for part of one day in the late summer of 1949, suggesting the Mess Creek landslide dam formed in November 1947 failed catastrophically in 1949 (Evans (unpublished data).

Late December 1947- January 15, 1948

Event type: Snow avalanche and mudslide.

Precipitation: Not applicable.

Source: *The Interior News*, January 1, 8 and 15, 1948; April 15, 1948.

Early January, snowslide came down between Terrace-Skeena City, 27 mi. (43.2 km) east of Prince Rupert.

Unusually heavy snow during the previous weeks kept Public Works crews busy especially near Terrace.

Around January 15, several feet of snow blocked the Skeena Highway between Amsbury-Kwinitsa. Due to the big task to keep this highway open, the road out of Prince Rupert and Terrace remained unplowed. *1)

Once the logging roads near Terrace would be cleared it was expected that an attempt would be made to open the highway. Windfalls along the highway east of Terrace, especially between Usk-Dorreene, created serious additional problems for road clearing crews.

Early January, a mud bank began to move slowly down onto the rail tracks near Walcott, a station on the CNR line between Telkwa-Houston. On January 7, an extra crew and a "ditcher" were sent to the scene. About 100 ft. (30 m) of high embankment was affected but trains were not delayed.

Early April, district highways engineer J.C. Brady announced that providing there were no new slides, the highway would be open towards the end of April. By April 15, Terrace-based snow removal equipment was working west of Shames through frozen snow up to 7-8 ft. (2.1-2.4 m) deep. Prince Rupert-based crews were working eastward from Skeena.

May 5, 1948

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Interior News*, May 7, 1948.

On May 5, a washout at Quick that blocked the Jasper to Prince Rupert rail line caused a considerable delay for the westbound train.

May 16-18, 1948

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Daily Colonist*, May 20, 1948.

On May 16, a flash flood washed out over Lower Rancheria River, between Watson Lake-Whitehorse, Y.T., closing the Alaska Highway. Eight sections of the 15-section span, 212-ft. (63.6 m) bridge were swept away in a flood during which the river rose over 10 ft. (3 m). An Army engineer expected to have the bridge rebuilt in about 10 days, hoping to reopen the highway by May 26.

Around May 17-18, the Fraser River inundated low-lying land at Giscome, 25 mi. (40 km) east of Prince George. This was the first reported flooding for the 1948 spring runoff. The Fraser River at Prince George rose 14 in. (35 cm) in 36 hours. At Willow River nearby, workmen built a log diversion to protect a bridge on the main highway.

May 25-June 10, 1948

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Daily News*, May 25, 26, 27, 28, 29, and 31, June 1, 2, 3, 4, 5, 7, 8, 9, 10 and 12, 1948; *The Interior News*, May 27; June 3, 10, 17, and 24; July 15, 1948; *The Province*, May 31, 1981; *Terrace Omineca Herald*, June 3, 1964; *Alaska Highway News*, May 27 and June 3, 1948; *The Daily Alaska Empire*, May 25, 26, 27, and 29, June 1, 2, 3, 4, 7, 8, 11, 12, 14 and 15, 1948; *The Daily Colonist*, July 8, 1948; *The Weekend Sun*, July 25, 1993; Environment Canada 1991; Hutchison 1950 (p. 319); Telegram, August 12, 1948, F. W. A. Mapleton (Telkwa Citizens Assn.) to Hon. E. Carson (Min. of Public Works). B.C. Ministry of Transportation and Highways, Terrace; File 32-21-37 Letter, July 6, 1948, W. E. Bottomley (Ass. Dist. Eng. Smithers) to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace File 35-41-10 Letter, May 30, 1949, W. E. Bottomley (Ass. Dist. Eng. Smithers) to H. W. Stevens (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace; Special Warrant No. 4 Flood Control & Relief - Expenditures to March 31, 1949. B.C. Ministry of Transportation and Highways, Terrace; File 2.30.0 Telegram, June 1, 1948, Hugh McDonald (Gen. Foreman Stewart) to J. C. Brady (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highway, Terrace; File 2.40.0 Telegram, June 11, 1948, J. C. Brady to Hugh McDonald. B.C. Ministry of Transportation and Highways, Terrace; File 2.30.0 Letter, April 27, 1949, R. H. Dunlop (Gen. Foreman Stewart) to J. W. Stevens (Dist. Eng. Prince Rupert). B.C. Ministry of Transportation and Highways, Terrace).

The 1948 spring runoff due to hot weather caused severe flood conditions in British Columbia, Washington, Oregon, Montana, Idaho, and elsewhere. On May 31, Premier Byron Johnson declared a state of emergency. Military authorities were given the power to conscript citizens and requisition transport. By June 2, some 9,000 people in British Columbia were homeless as a result of flooding. Four thousand Canadian soldiers were involved in the rescue operations. The Fraser River inundated parts of Quesnel and Prince George. The Skeena and Bulkley rivers caused the "worst flood since '36." (*The Interior News*, May 27, 1948).

Terrace was cut off from the outside world, after the highway and railroad links washed away. On May 25, the rail line between Hazelton-Prince Rupert was cut at Kitwanga, where 50 ft. (15 m) of roadbed washed out. At Kitwanga, an entirely new grade and track along a 1,200-ft. (360 m) long cutbank had to be built. The Northern Trans-Provincial Highway was also cut. The worst section was a 400-m stretch 1 mi. (1.6 km) west of Shames. At East Kwinitsa, just west of Little's sawmill, the road was flooded with more than a foot (30 cm) of water. A small bridge at East Kwinitsa was afloat and in a dangerous condition. On May 26, the CNR reported five more washouts: at Usk, Pacific, Ritchie, and two near Dorreen. At various points there was water across the tracks and logs and debris were knocking down telegraph poles.

The overall damage to the telegraph lines was worse than in 1936. In that year the flood hit only the Skeena River. In 1948, the flooding damage encompassed the Bulkley, Nechako, and Fraser rivers as well (*The Daily News*, May 31, 1948). About 1,000 ft. (300 m) of track washed out about 400 m west of Salvus. Just east of Terrace the Skeena River flooded the highway. District Engineer J.C. Brady ordered the highway closed. The residents of Braun's Island, about a dozen families, were evacuated. The residents of Remo, Usk, and Pacific prepared to evacuate. The Skeena River at Usk recorded a maximum daily discharge of 9,340 m³/s on May 26 (Environment Canada 1991). It rose to a record level of 207 ft. (*Terrace Omineca Herald*).

On May 27, the Skeena River, running 8 ft. (2.4 m) above normal, carried away a bridge and washed out 100 ft. (30 m) of railroad track at Salvus. On that day the Skeena River reached a higher level than that of the "big flood of 1936." The level of the lower Skeena rose to 12 ft. (3.6 m) above its normal high water mark. Compared to the 1936 flood, the rise was not as sudden and the grade and tracks were in better shape. At Salvus, floodwaters in the station house of section foreman E.G. Storey reached the ceiling of the first floor. On May 27, all communications between

Prince Rupert, Terrace, and interior points were cut. By then, flood conditions on the Bulkley River were the worst in many years. Cooler weather around June 1 made the Skeena River levels recede, only to rise again on June 8.

Floodwaters caused heavy damage to the rail line between Houston-Smithers. Two small washouts occurred near Barrett where 600 ft. (180 m) of track was under water. Washouts occurred between Kitwanga-Usk. The Skeena River cut through the railroad and highway embankments at Mile 43.3 near Shames, 20 mi. (32 km) west of Terrace. The washout was 450 ft. (135 m) long and 25 ft. (7.5 m) deep. Other washouts occurred just east of Walcott and just west of Quick, 30 ft. (9 m) and 90 ft. (27 m) long, respectively. Two washouts occurred at Tatlow, 65 ft. (19.5 m) and 30 ft. (9 m) long. At the site of these washouts, track was under water for 2,000 ft. (600 m) and 900 ft. (270 m), respectively. Another 800 ft. (240 m) of track was under water, without an apparent washout. On May 29, the Bulkley River near Houston reached record levels and the situation was described as "serious."

At Terrace, the Skeena exceeded the 1936 high water mark. Canadian Pacific Air Lines organised an emergency air service between Prince Rupert-Smithers using Canso amphibians stationed at Prince Rupert. Up to two flights were available, depending on the requirements of the situation. On May 30, the Bulkley River reached its peak. On that day the washout at Tatlow had grown to 300 yd. (270 m). The CNR maintained rail service from Jasper only as far as Houston. For a period of two weeks, passenger, mail, and express service were transported between Houston-Smithers by buses and trucks. From Smithers a stub train ran as far as Kitwanga. A special train took native cannery workers employed by Nelson Bros. Fisheries Ltd. and Canadian Fishing Co. at the canneries at the mouth of the Skeena from Kitwanga to Smithers. From there they were flown to Prince Rupert. *1)

Usk, a village of 108 people, sustained heavy damages. The former Bethurem general store, and the low lying homes of Joseph Bell, H.A. Butt, Thomas Pinchbeck, and others were flooded with 5.5 ft. (1.65 m) of water. The residents evacuated and were camped on higher ground above town. On Braun's Island, eight homes were washed out and the Craig family lost their barn.

On June 2 the residents of the villages of Glen Vowell, Kispiox and Telkwa were evacuated (*The Daily Colonist*). In Telkwa, the Bulkley River flooded the main street with 1.5 ft. (45 cm) of water. The Bulkley River overflowed its banks, cutting a new channel and forcing the river across the main highway 2 mi. (3.2 km) west of Telkwa. The road was flooded for five weeks. Flooding occurred near the town of Telkwa. Basements and the ground floors of some houses were flooded and several houses were isolated. Near Smithers, the Vetterli farm at the foot of Bulkley Hill suffered considerable damage. Crops were ruined and floodwaters dug deep holes. The Bulkley River at Quick recorded a maximum daily discharge of 895 m³/s on May 30 (Environment Canada 1991). On June 3, floodwaters on the Stikine were reported to have reached record heights. On that date the flood death toll in British Columbia rose to five. The income tax deadline was extended from May 31 to June 30.

By June 3, flood conditions in the Skeena and Bulkley valleys improved. By June 5, the CNR line was repaired as far west as Tatlow, 5 mi. (8 km) east of Smithers. On June 7, the wire service to Prince Rupert was restored. On June 8, the rail service was extended as far east as Salvus. Around June 10, the highway west from Smithers was open as far as Terrace. The railway fill was completed on June 18 and the highway fill on June 30. A new bridge with 14 bents of pile trestle was built at Mile 43.3, a mile (1.6 km) west of Shames. The superstructure of the Emmett Slough bridge No. 209 was renewed, and the bridges at Mile 58 and Mile 68 repaired. By June 10, the bridge at Emmett Slough near Usk still required replacement. At the Usk Ferry new towers were built and a new cable installed.

On June 12, the gap of interrupted rail service was reduced to 84 mi. (134.4 km). The two major washouts remaining to be cleared up were between Kitwanga-Woodcock and 1 mile (1.6 km) west of Shames. The former was the first major break on the line and measured a length of 1,200 ft. (360 m). The washout at Shames was 400 ft. (120 m) long and 25 ft. (7.5 m) deep. Here the repair work, employing 60 people, included the building of a new bridge. On June 22, the first eastbound train left Prince Rupert, the first one since May 21. The first westbound train from Jasper was due in Prince Rupert on June 23, the first one since May 22.

Summary of highway damage Houston to Smithers: *2)

The highway between Smithers-Telkwa flooded in three places. On the west side of Telkwa the road was flooded at Eddy Park. To avoid another flood at the foot of "Spud" Murphy Hill, traffic was re-routed over the Telkwa High Road. Near Smithers, at the foot of Bulkley Hill, water was flowing over the road.

Summary of highway damage Smithers to Terrace: Near the Smithers bridge, water cut across the field on the Smithers side. The new approach was washed out for about 250 yd. (225 m). The surface of the old road washed away for about 400 yd. (360 m). At Mosquito Flats, 36 mi. (57.6 km) west of Smithers, the road was washed out for about 200 ft. (60 m). The west end of the Shandilla Creek bridge washed out. The road just east of the Whiskey Creek bridge was flooded with 4 ft. (1.2 m) of water. On the road to Cedarvale ferry, the 68-ft. (20.4 m) King Truss bridge across the Skeena River channel at Meanskinisht washed out. The road between Smithers-Terrace was expected to be passable by June 6.

Summary of highway damage West of Pacific (The following are all in Railway Mileages): At Mile 45, some 60 ft. (180 m) of surface washed away. At Mile 50.1, the first bridge west of Exstew floated out. At Mile 54, the highway was covered with 1 ft. (30 cm) of silt and logs over a distance of 0.5 mi. (800 m). The bridge at Mile 58 floated off its piers and had to be rebuilt. At Mile 60, a washout, 50 ft. (15 m) wide and 4 ft. (1.2 m) deep occurred. Between Mile 60-63 the road surface was gone and the road washed out every 200-300 ft. (60-90 m) to a depth of 2-4

ft. (0.6-1.2 m). At Mile 62.5, washouts occurred 50 ft. (15 m) wide and 6 ft. (1.8 m) deep and 75 ft. (22.5 m) wide and 10 ft. (3 m) deep, respectively. Between Mile 66-68, the road surface was washed away. The bridge at Mile 68 floated and was raised about 2 ft. (60 cm) on the west end. At Mile 70.2, the bridge floated and was raised about a foot (30 cm). At Mile 70.8, the bridge floated and was 2 in. (5 cm) off the caps. Between Mile 68-71, the road surface was covered with silt and logs and washed off in stretches.

Summary of highway damage Terrace to Prince Rupert: At Remo, the road washed out over almost the full width for 60 ft. (18 m). A half-mile (800 m) east of Shames station the highway washed out over a width of 60 ft. (18 m) and a depth of 15 ft. (4.5 m). One mile (1.6 km) east of Shames station, some 2,000 ft. (600 m) of surface was lost. An average fill of about 2 ft. (60 cm) was required. At Mile 43.3, the Skeena River cut through the road. The new channel, 400 ft. (120 m) wide, 25 ft. (7.5 m) deep, and filled with fast running water, had to be bridged. From Mile 71 to Prince Rupert, a distance of about 44 mi. (70.4 km), the road was open and in fair condition. With the completion of a new bridge 1 mi. (1.6 km) west of Shames, the Northern Trans-Provincial Highway reopened on June 30. Major flooding and washouts closed the highway between May 25-June 10.

In the Portland Canal District, Bitter Creek, Bear River, and Salmon River rose abnormally after three days of extremely hot weather at the end of May, but no damage occurred. On June 11, the approaches and stringers of the Aiyansh bridge washed out. The Native Indians were prevented from hauling hay over the bridge until it was fixed. On June 14, the bridge across Gingit Creek at Phillips was made impassable. One guardrail and two stringers from the pier to the south abutment broke and one bent was turned over. As per April 1949 in Stewart, \$9,024.35 had been spent on the protection work for the Bear River encroaching on the townsite. An additional \$2,500 would be required to complete the job.

A late spring and the previous week's heat wave caused the "highest water ever recorded" on the Peace River. Herbie Taylor, "first white man on Taylor Flat and the oldest old-timer in Peace River" in his entire experience had not seen high water on the Peace like this year's.

The Peace River rose 2 ft. (60 cm) in 24 hours flowing 4-5 ft. (1.2-1.5 m) over the cofferdam. Floodwaters caused the loss of livestock. A dozen or more families were flooded out. Down from the bridge on the other side, Thomas Wilson's family was forced to leave their home. A washout occurred on Hudson's Hope road at the Halfway Bridge. Maximum temperatures recorded at Fort St James on May 20, 21, 24, 29 and 30, respectively, were 81.8° F (27.7° C), 84° F (28.9° C), 82.2° F (27.9° C), 83.2° F (28.4° C) and 84.5° F (29.2° C).

By June 5, the flood damage in Oregon, Washington, Idaho, and British Columbia was estimated at \$140 million. In the United States alone, floodwaters covered about 650 mi.² (1,683 km²). On June 14, the final toll was 41 known dead and at least 28 missing.

Province-wide, the flooding caused about \$20 million damage and left 2,400 families homeless. Some 15,000 ha of farmland were flooded. About 100 bridges washed out or were destroyed. Rail lines and highways cut off the Lower Mainland from the rest of Canada. Miraculously, nobody was killed but an unknown number of livestock drowned. (*The Weekend Sun*, July 25, 1993).

Early July, Lands and Forests Minister E.T. Kenney, who was appointed by the Cabinet to survey flood damage outside the Fraser Valley, gave a tentative analysis of flood costs outside the Fraser Valley for which the Province would bear the entire costs, including \$6,525 for the Skeena River Valley (*The Daily Colonist*, July 8, 1948). The total repair cost as per March 31, 1949 amounted to \$59,029.88, with \$40,816.49 for roads, \$13,158.82 for bridges, and \$5,054.57 for ferries.

*1) In 1936, the year of the previous big Skeena River flood, the Native Indian cannery workers were transported from Kitwanga via Jasper Park to Vancouver by rail and brought to the Skeena River canneries by boat.

*2) The road west of Houston to the bridge across the Bulkley River, being low-lying had been long a source of trouble. Following the 1948 flood and to avoid future disruption, Public Works built a long earth and gravel fill along the flat leading into Houston. (*The Interior News*, July 15, 1948).

August 22-24, 1948

Event type: Flooding.

Precipitation: Aiyansh (25.1 mm/1 day), August 22, 1948; Prince Rupert (137.2 mm/3 days), August 22-24, 1948; Falls River (99.1 mm/2 days), August 23-24, 1948.

Source: *The Daily News*, August 23-24, 1948.

In Prince Rupert, 3.75 in. (95.3 mm) of rain fell on August 23 in a 12-hour period. On August 24, the road between Terrace-Prince Rupert, particularly around Shames and Salvus, sustained damage.

December 13-14, 1948

Event type: Snow avalanche.

Precipitation: Not available.

Source: *The Interior News*, December 16, 1948

West of Terrace, unusually heavy snow caused an avalanche at the “well known slide area” just west of Kwinitsa. On the early afternoon of December 13, a 150-ft. (45 m) long slide came down. That night’s eastbound passenger train was held at Prince Rupert. It also delayed the arrival of the westbound train at Prince Rupert on December 14.

January 3-7, 1949

Event type: Snow avalanches and debris slides.

Precipitation: Falls River (171.7 mm/3 days), January 3-5, 1949; Bella Coola (85.1 mm/2 days), January 5-6, 1949.

Source: *The Interior News*, January 13, 1949; *The Daily News*, January 5, 6 and 7, 1949; *The Advertiser*, January 15, 1949.

Mild weather caused a series of slides near Kwinitsa. On January 5, three snow and debris slides came down within a distance of 800 ft. (240 m), 7 mi. (11.2 km) east of Kwinitsa. Two slides occurred near Mile 76, measuring lengths of 50 ft. (15 m) and 100 ft. (30 m), respectively. A rotary plow cleared the tracks on January 5. On January 6, a passenger train hit a series of slides 7 mi. (11.2 km) east of Kwinitsa. One slide was 600 ft. (180 m) long and 25 ft. (7.5 m) deep. On January 6, the train was delayed 20 hours and 4.5 hours on January 8. The slides also cut the telephone and telegraph communications. Damage to the landlines at Kwinitsa and further east was fairly widespread. Service was restored on January 7. Snow damage occurred between Woodcock-Burns Lake. Deep snow hampered the repair work.

Near Prince Rupert, the Skeena highway was blocked beyond the far end of Prudhomme Lake. The road between Terrace-Tyee had been blocked for some weeks. District engineer H.W. Stevens hoped to open the road over the divide again as far as Tyee.

On January 6-7, Smithers reported heavy wet snow. The Smithers airport recorded 8.5 in. (21.6 cm) of snow. Minor breaks in the telegraph and telephone lines were reported as far east as Burns Lake, a result of the heavy snowfall on January 6.

In the Bella Coola area, the violent storm on January 6 melted snow and made roads impassable.

February 1949

Event type: Snow avalanches.

Precipitation: Not applicable.

Source: *The Interior News*, February 10 and 24, 1949; March 3, 1949; *The Daily News*, February 22, 1949.

Early February “worst snow conditions in 35 years” tied up train service between Terrace-Prince Rupert. Continuous slides and drifting held up normal traffic for a month or more. In the 20-km Kwinitsa slide area, slides came down almost continuously since heavy snow fell early in the winter. Train service was restored and then suspended again for an indefinite period.

The sudden arrival of warm weather caused problems in the lower Skeena valley. Because of the hazards along the Terrace to Prince Rupert rail line only the bare essentials were accepted. With deteriorating conditions, an embargo on railway traffic was declared (*The Daily News*, February 22, 1949). At the end of February-early March, train service was restored. Conditions were far from normal. Small slides continued to come down between Kwinitsa-Salvus.

Early May 1949

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Interior News*, May 12, 1949.

During the second week of May, several days of warm weather caused rivers to rise. The Kitsequecla and Skeena rivers were reported to be “roaring torrents.” Residents of the lower Skeena feared a repetition of the previous year’s flood. At Telkwa, the Telkwa and Bulkley rivers rose “quite noticeably.” The old road at “Spud” Murphy Hill was reported under 2 ft. (60 cm) of water.

Late summer 1949

Event type: Landslide dam failure.

Precipitation: Not applicable.

Source: Spooner et al. 1996; Evans (unpublished data).

Spooner et al. (1996) report oral accounts of the Stikine River flowing in the opposite direction for part of one day in the late summer of 1949. The river was a deep brown colour and was choked with vegetation debris. These observations are somewhat sketchy but do suggest that the Mess Creek landslide dam formed in November 1947 failed catastrophically in 1949, releasing a large volume of water into the Stikine River, some of which traveled upstream. (Evans).

September 1949

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Interior News*, September 22, 1949.

Around the middle of September, a rockslide came down in a rock cut 2 mi. (3.2 km) east of Burns Lake. It occurred as a freight train was passing and resulted in the derailment of seven cars and the disruption of rail service. One car derailed which then piled up six others.

A few days later, when temporary tracks had been built around the slide and derailed cars, one car of a second freight train derailed, again disrupting traffic. On September 20, service was back to normal.

October 8-13, 1949

Event type: Rockslide.

Precipitation: Falls River (230.0 mm/5 days), October 8-12, 1949; Ocean Falls (434.2 mm/6 days), October 8-13, 1949; Prince Rupert (261.3 mm/7 days), October 8-14, 1949; Terrace (96.4 mm/7 days), October 8-14, 1949; Langara (50.8 mm/1 day), October 8, 1949; Falls River (177.7 mm/3 days), October 10-12, 1949; Stewart (119.9 mm/2 days), October 12-13, 1949; Sandspit A, (30.2 mm/1 day), October 13, 1949; Langara (51.6 mm/1 day), October 13, 1949.

Source: *The Daily News*, October 12, 13, 14, 15, 17, 19, 21 and 25, 1949; *Ocean Falls Reporter*, October 15, 1949; *The Daily Alaska Empire*, October 11, 12 and 13, 1949; MAST Ship Listing 1946-1983; Lewis and Moran 1985.

A gale, which started near the Aleutian Island Chain, swept into the Gulf of Alaska. The storm headed south to the Pacific Northwest. Winds of 50 mph (80 km/h) were recorded at the entrance of the Strait of Juan de Fuca. On October 10, a maximum wind of 76 kn. (128 km/h) was recorded. The number of MAST observations with wind over 48 kn. (89 km/h) was four (Lewis and Moran 1985). The gill-netter *Rowena* went missing in Hecate Strait on October 10. The air and sea search was halted on October 13 because of the high winds.

Near Prince Rupert, the water levels in the Shawatlan and Woodworth watersheds recorded "unprecedented" heights, not reached since the hydroplant and the city's waterworks were installed there in 1914. The levels of the lakes and streams were more than 6 ft. (1.8 m) above normal. A rockslide took out three lengths of the 45-in. (1.14 m) diameter water main, which supplies the water from Woodworth Lake to the Northern B.C. Power Co. Shawatlan hydro plant. The slide came down approximately 0.5 mi. (800 m) above the powerhouse, near the junction with North Fork Creek. Both the power and water supply to Prince Rupert were cut. *1) Schools and several industrial plants were closed because of the lack of water for their heating plants. An emergency line was hooked up to the Mount Oldfield storage reservoir at Roosevelt Park. The higher residential areas had their water supplied by tanker truck on October 15. The tentative repair date for the water line was October 26.

Overnight October 14-15, heavy rains caused the water levels in the Bella Coola River to rise 5 ft. (1.5 m).

Near Ocean Falls, heavy southeast storms and rains caused all rivers and lakes in the vicinity to rise to all-time highs. Pacific Mills had to open its dam gates. For the first time ever, all 13 gates were open while the water levels on the lake continued to rise. The current running under the bridge to the mill threatened to wash away the piling.

*1) The Prince Rupert 18-in. (45.7-cm) water main ran out of the 45-in. (1.14 m) main at the Shawatlan hydro plant.

December 13-15, 1949

Event type: Severe snowstorm.

Precipitation: Not applicable.

Source: *Prince George Citizen*, December 15, 1949.

In the middle of December 15, Prince George experienced the heaviest snowfall in 20 years. *1) Traffic in the city and district was paralysed. The snow started falling at 4 p.m. on December 13 and continued for 44 hours. On December 14, 11.5 in. (28.75 cm) were recorded in 24 hours. By 9 a.m. on December 15, an additional 9 in. (22.5 cm) had fallen. Summit Lake reported 26 in. (65 cm) of snow, blocking the Hart Highway and isolating residents.

*1) This was the heaviest snowfall since 1928 when 27.5 in. (68.75 cm) fell in one day. (*Prince George Citizen*, December 15, 1949).

December 22, 1949

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *Prince George Citizen*, December 22 and 29, 1949; February 2, and 16, 1950; *The Daily Colonist*, December 24, 1949.

Early on December 22, an icejam in the Nechako River caused flooding. The river had been watched during the previous weeks as ice started piling up in the Nechako River west of Lamb's Mill. The icejam was solid enough for a man to walk across the river. Overnight December 21-22, the river rose 4 ft. (1.2 m). At the confluence of the Nechako and Fraser rivers, 200 homes were threatened and 25 ac. (10 ha) of mill property was under water. Seven out of 11 district saw mills closed, leaving 300 workers idle. Property damage was estimated at \$75,000. (*The Daily Colonist*, December 24, 1949).

On the morning of December 22, City Engineer Charles East announced the city would immediately start using the emergency army power plant at Central Fort George. Floodwaters put four planer mills out of commission, leaving more than 100 men out of work. According to one mill operator, "these floods have been occurring for many years but it is only since the last major flood that the are affected has become the focal point for a major industry." Near British Columbia Spruce Mills Ltd., water was pouring across the Cache road.

Hardest hit of the big mill operators was Prince George Planing Mills Ltd., whose yard was flooded with 4 ft. (1.2 m) of water. Almost 1 million (bd.) ft. (28,300 m³) of lumber was afloat near the Prince George planing mills. On December 22, the flooding temporarily threw about 250 men out of work. One planer chain at the Prince George Planing Mills came loose from its moorings and canted half-floating "at a crazy angle." The Proppe Lumber Company mill was standing in 3 ft. (90 cm) of water, rapidly being frozen in. The engine house at this mill was in several feet of water. Damage was estimated at \$20,000. At Hales Ross Planing Mill, several employees were forced to vacate their bunkhouse. A few employees of other mills found their shacks flooded.

Operation at the Prince George Planing Mills was expected to resume in three weeks if all salvage and cleaning operations would go according to plan. Crews could not separate frozen planks even with crowbars. Proppe Lumber Company and Hans Roine Planer Mill expected to be running by January 1.

The December flooding of the Prince George planing mill district by the ice-blocked Nechako River caused more than half a million dollars damage. The direct damage to the planer mills and equipment was estimated at \$100,000. Loss of revenue to the district was estimated at \$500,000.

The flood event got much coverage in newspapers in Vancouver and across Canada. The local lumber operators expressed hope that the publicity given would focus the attention of the government departments on the "dilly-dallying," which had "characterised hitherto official reaction to suggestions for eliminating the flood menace." (*Prince George Citizen*, December 29, 1949). *1)

*1) Late January the Prince George Board of Trade urged provincial government and/or council of the city of Prince George action in alleviating flood threats. The necessary steps should be taken to correct the conditions. The work was to be carried out with or without the collaboration of CNR. More than a year previous, the Board of Trade had formed a committee consisting of W. Dobson, Bill Randy, Les Yates and Martin Cain to consider the possibility of removing the flood menace. Two different ways to preventing the floods were to either dyking of the river bank or dredging the Nechako River channel to prevent ice accumulating to an extent where it causes the water to back up into the industrial area.

On February 16, Mayor R.G. Garvin Dezell announced that he had received assurance that the provincial government would be putting up one-third of the cost of a flood control program, as well as supplying the necessary engineering facilities. The province would also urge the aid from CNR and the Dominion Government.

December 24-30, 1949

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Daily News*, December 28, 29 and 30, 1949; *The Interior News*, December 29, 1949.

Between December 24 at 7 a.m.-4 a.m. on December 25, Prince Rupert recorded 1.12 in. (28.5 mm) of precipitation. Snow, which began falling on Christmas Eve, turned into sleet and rain. In the lower Skeena Valley, the heavy wet snow was followed by sudden cold weather. It caused a complete breakdown in the telegraph service, radio network- and long distance service. Though the Skeena River highway was now blocked with snow, the rail service was maintained.

On December 29, colder weather moved into the southern part of the province. In the northern Interior, the weather continued cold with snow falling throughout the Cariboo and Prince George districts. On December 28, temperatures at Prince George and Dawson Creek dropped to -30° F (-34.4° C) and -42° F (-41.1° C), respectively. Between 4-10 p.m., temperatures in Prince Rupert dropped to 11° F (-11.7° C).

At the end of December, icejam flooding occurred on the Bulkley River east and west of Quick. The water backed up from a narrow canyon at Telkwa flooding some farms on low ground as far as Quick reportedly to a depth of 4-5 ft. (1.2-1.5 m). The river overflowed its banks, flooding the road at the Quick station and the Post Office and general store. After the bridge across the river, the only access to the small settlement, was surrounded by water, residents had to leave their homes. About 50 head of cattle, marooned on small islands, were hauled or driven to safer ground. Around December 30, though the river was still plugged with ice for a distance of 8 mi. (12.8 km) immediately below Quick, water levels had fallen 3 ft. (90 cm).

January 8-20, 1950

Event type: Severe coldsnap.

Precipitation: Not applicable.

Source: *The Daily News*, January 11, 12 and 20, 1950; *The Interior News*, January 12, 19 and 26, 1950.

Early January, a combination of an "Arctic Express," a mass of unusually cold air from Alaska and a "Pineapple Express," a series of warm, extremely wet storms hit the Pacific coast from British Columbia to California. Described as "one of the most severe storms of the past decade" hit the lower Skeena valley with winds of hurricane-

force. The storm with winds of 50-60 mph (80-96 km/h) lasted 36 hours, finally letting up on the morning of January 11. (*The Interior News*, January 12, 1950).

Heavy snow blocked the CNR rail line between Terrace-Prince Rupert. The last westbound train had arrived on January 6 and no trains had left Prince Rupert since January 8. The eastbound passenger train, which left Prince Rupert late on January 9, was trapped between two drifts at Kwinitsa. As soon as it could be extracted, it would be taken back to Prince Rupert. A westbound freight train with much needed meat and grocery supplies, of which Prince Rupert was running short, was held at Salvus.

High winds caused the dry snow to drift and hampered clearing operations east and west of Kwinitsa station, 47 mi. (75.2 km) east of Prince Rupert. A large drift 52 mi. (83.2 km) east of Prince Rupert measured up to 10 ft. (3 m) deep and a length of 600 ft. (180 m). Another one, 42 mi. (67.2 km) east of Prince Rupert, was 3-5 ft. (0.9-1.5 m) deep and 1,500 ft. (450 m) long.

On January 12, the rail line reopened. However, strong winds again drifted snow on the line before noon on that same day.

Overnight January 19-20, heavy snow drifting conditions developed again between Skeena-Exstew stations 33 mi. (52.8 km) and 70 mi. (112 km) east of Prince Rupert, respectively. The storm with snow and high winds started at 3 a.m. It delayed the regular passenger train when a heavy-duty wing plow, convoying it, got stuck in a snowdrift 8 mi. (12.8 km) east of Kwinitsa.

Early on January 20, a rotary plow managed to release the plow's caboose and water car but the plow remained stuck. Twenty-four men in an extra gang were trying to dig out the plow. The westbound passenger train was still held at Salvus and the scheduled eastbound train was held at Prince Rupert. A westbound freight train, bringing in supplies of coal which as a result of the heavy demand in the protracted cold snap were running short in Prince Rupert, was also held up.

A six-week continuous coldsnap between late December 1950-early February 1951 was described as the "longest coldspell in the history of the Bulkley Valley." In Smithers, temperatures had been below 0° F (-17.8° C) and since December 27 well below 0° F. (*The Interior News*, January 19, 1950).

June 14-18, 1950

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Omineca Herald*, June 16 and 23, 1950; *The Victoria Daily Times*, June 14 and 15, 1950; *The Daily Colonist*, June 15, 1950; *Vancouver Daily Province*, June 15, 1950; *The Interior News*, June 15 and 22, 1950, March 8, 1951; File 34-21-4 Letter, June 30, 1950, W. E. Bottomley (Dist. Eng. Smithers) to Div. Eng. Prince Rupert. B.C. Ministry of Transportation and Highways, Terrace; Environment Canada 1991.

Around the middle of June following several days of hot weather, the Skeena River flooded at Usk. On June 14, the Skeena River at Usk recorded a maximum daily discharge of 6,540 m³/s (Environment Canada 1991). The river backed up at the narrow canyon at Kitselas as far as the Usk flats. Approximately 100 residents at Usk were forced to leave their homes. The McRae store, close to the riverbank, flooded and suffered a considerable amount of damage. *1) The road in front of the Usk Hotel also flooded. Tents loaned by the Forestry Department were set up on the hill behind the town. Because of the amount of deadfalls coming down the river, the ferry service at Usk was temporarily discontinued. At Hazelton, men worked through the night erecting a dyke guarding the lower part of town. At Telkwa, some streets along the Bulkley River were also flooded. On June 18, the Bulkley River near Smithers recorded a maximum discharge of 702 m³/s (Environment Canada 1991).

On June 14, when Terrace recorded a temperature of 92°F (33.3°C), the Skeena River at the bridge at Terrace peaked at 203.40 ft. (Terrace Division of Columbia Cellulose). A Vancouver radio station erroneously reported that "Suburban" Terrace flooded, adding that, "several families had been evacuated from their homes." (*The Omineca Herald*) West of Terrace, some water was running underneath the roadbed of the rails for a distance of about 100 yd. (90 m). A CNR work train continued dumping rock at danger spots along the line.

Highway 16 west of Terrace was flooded at the usual low places and a small bridge at east Kwinitsa was reported to be floating. The longest stretch under water was about 0.75 mi. (1.2 km) long. Many other low spots were flooded with 1-3 ft. (30-90 cm) of water. Between Mile 33-34 west of Terrace on the Northern Trans-Provincial Highway, the road surfacing washed away. The Polymar Creek bridge No. 350 floated off its pilings. West of Salvus, the road was covered with 18 in. (45 cm) of water. Two bridges were floating, held in position by cables. At the Terrace bridge, some logjams had to be removed. Near Kwinitsa, riprap was washed away. The Usk and Copper River ferries were damaged. Old Hazelton required some river protection work. Assistant District Engineer Bill Bottomley reported sections of the highway between Cedarvale-Tyee flooded. For all official purposes, the highway was declared closed. The total cost of the flood damage was \$19,500.

With the arrival of cooler weather the rivers started to recede. On June 21, the highway west of Terrace was passable, but motorists were urged to use caution at the bridges near Kwinitsa. On June 23 the road reopened.

*1) The McRae store owned by "Scotty" McRae and operated by his son Billy was totally destroyed by a fire in March 1951 (*The Interior News*).

August 25-26, 1950

Event type: Severe wind storm.

Precipitation: Langara (71.7 mm/2 days), August 25-26, 1950; Falls River (39.6 mm/1 day), August 26, 1950; Prince Rupert (64.8 mm/1 day), August 26, 1950.

Source: *The Daily News*, August 28, 1950; *The Interior News*, August 31, 1950.

A rainstorm with winds of 60-70 mph (96.6-112.7 km/h) went through the Skeena Valley. The storm, which was described as “one of the worst storms known in the District,” was felt as far east as Burns Lake. Trees fell across the highway, railroad tracks and telephone lines. The highway 30 mi. (48 km) west of Terrace was blocked for a distance of 3 mi. (4.8 km).

In Prince Rupert, many basements flooded and the telephone service was interrupted. There were three major breaks in the line. The railway dispatcher’s telephone line also went out.

October 7-8, 1950

Event type: Severe storm.

Precipitation: Not applicable.

Source: *Prince Rupert Daily News*, October 10, 1950; *The British Columbian*, October 10, 1950.

On October 7-8, southeast gales, the third storm within a week with winds reaching 65 mph (104 km/h), hit the Queen Charlotte Islands. A Davis raft, valued at over \$1 million, was torn from its moorings at Alliford Bay and piled up on the shores of Queen Charlotte City. Barber’s float, used by fishermen and Queen Charlotte Airlines, parted and was scattered along the same shores. Several gillnet fishing vessels were badly damaged or lost. Attempts to tow to Queen Charlotte City the seiner *Scrub*, severely damaged in one of the earlier storms with the loss of two lives proved unsuccessful. Storms washed the vessel ashore at Sandspit where she broke up.

November 2-4, 1950

Event type: Flooding.

Precipitation: Aiyansh (38.9 mm/1 day), November 2, 1950; Namu (152.1 mm/2 days), November 2-3, 1950; Ocean Falls (293.1 mm/2 days), November 2-3, 1950; Falls River (64.8 mm/1 day), November 3, 1950; Bella Coola (180.3 mm/2 days), November 3-4, 1950.

Source: *Ocean Falls Reporter*, November 11, 1950; Environment Canada 1991.

Winds up to 50 mph (80 km/h) were reported from all across the Queen Charlotte Islands. In some places also fog and heavy rain occurred. The storms over the Queen Charlottes kept planes of Queen Charlotte Airlines grounded in Prince Rupert on November 2.

On November 4, the Bella Coola River near Hagensborg recorded a maximum daily discharge of 813 m³/s (Environment Canada 1991). The recent flood at the South Bentick Logging Camp washed out some of the logging bridges. Cartwright, Public Works Engineer, was called to Bella Coola to look over the damage caused by the rampaging Bella Coola River. The flood isolated Hagensborg and the rest of the valley from the townsite. The plans of the new bridge crossing to Salloompt had to be altered because of the rise of the river.

November 22-26, 1950

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *Nanaimo Free Press*, November 27, 1950; *The British Columbian*, November 28, 1950; *The Interior News*, November 30, 1950.

On November 22, drift ice started jamming the Bulkley River in a bend of the river at the east end of the bridge near Smithers. Ice started building up to some point between Smithers-Telkwa. The river’s surface was frozen in a canyon 4 mi. (6.4 km) south of the Bulkley bridge. Water started backing up into an old slough. On November 22 at 3 a.m., the K. Vetterli family was evacuated when the lower part of the farm flooded.

On November 26, the flood situation worsened. The river channel in the canyon near the airport, frozen across the top caused water to back up. An icejam 1 mi. (1.6 km) east of Smithers on the Bulkley River caused flooding of two farms with 3 ft. (90 cm) of water. The families of William Kidd and Carl Vetterli’s neighbouring 320-ac. (128 ha) farm were forced to vacate their farms. Floodwaters damaged 25 tons of potatoes and a large volume of timothy seed stored in a root cellar at the Vetterli farm.

Parts of the Northern Trans-Provincial Highway (Highway 16) were under 4-5 ft. (1.2-1.5 m) of water over an old part of the road. Water also covered a quarter-mile (400 m) section of the new highway, 0.5 mi. (800 m) from Smithers. By November 27, 10 in. (25 cm) of water was pouring across the main highway. School bus runs to Driftwood, Glentanna and Telkwa were temporary discontinued.

December 1-4, 1950

Icejam flooding.

Precipitation: Not applicable.

Source: *The Interior News*, December 7, 1950.

On December 1, cold weather caused icejams to form on the Skeena River near Terrace. “Authoritative sources” advised that the extensive ice jamming on the river were the worst since 1929. On December 1, 3 and 4, Smithers recorded temperatures of -20.8° , -19.2° and -21.7° F (-29.3° , -28.4° and -29.8° C), respectively.

March 23-26, 1951

Event type: Rockslide.

Precipitation: Falls River (98.3 mm/2 days), March 23-24, 1951; Prince Rupert (33.8 mm/2 days), March 24-25, 1951; Terrace (20.4 mm/2 days), March 25-26, 1951.

Source: *The Interior News*, March 29, 1951.

On March 26, a rockslide came down 5 mi. (8 km) west of Kwinitsa. The slide occurred just as a train was going by. It missed the engine but derailed the first two cars and overturned the rails. In addition to the bulldozers stationed at Kwinitsa, an extra crew was dispatched from Prince Rupert. It caused a nine-hour delay for the eastbound train out of Prince Rupert. An earlier slide at the same spot had taken out the wire services to Prince Rupert. Rail service was restored on March 27.

Severe storms of early March made attempts by the Public Works Department to have the highway between Prince Rupert-Terrace open for traffic impossible. A series of new slides interfered with the attempts to open up the snow-blocked road. One such slide at the tunnel near Kwinitsa blocked the highway to a depth of 12 ft. (3.6 m). It slid out on the river ice for a distance of 150 ft. (45 m). It was expected that slides would continue to block the highway for some time to come.

Spring 1951

Event type: Icejam flooding?

Source: *The Cariboo Observer*, April 24, 1952.

During the spring before the ice in the Quesnel River broke up, an ice jam developed, which extended well above the Fraser River bridge.

April 4-5, 1951

Event type: Spring runoff flooding.

Precipitation: Terrace (max. temp. 9.4° C, 13.9° C), April 4-5, 1951.

Source: *Omineca Herald*, April 6, 1951; *The Interior News*, April 5, 1951; Files, B.C. Ministry of Transportation and Highways, Terrace.

Around April 4-5, a major washout occurred at Dorreen, and the road was impassable at Copper River flats. Highway 16 between Usk-Terrace was closed. The highway was scheduled to reopen on April 7 at noon.

May 10-12, 1951

Event type: Spring runoff flooding.

Precipitation: Smithers (28.9 mm/2 days), May 10-11, 1951; Smithers A (17.2 mm/2 days), May 11-12, 1951.

Source: *The Interior News*, May 17, 1951; *The Daily Times*, May 15, 1951; Environment Canada 1991; Files, B.C. Ministry of Transportation and Highways, Terrace.

In the Bulkley Valley, steady rainfalls, together with warm weather, created flood conditions on the creeks flowing into the Bulkley River. The Bulkley River at Quick recorded a maximum daily discharge of $634 \text{ m}^3/\text{s}$ on May 13 (Environment Canada 1991). The worst situation occurred in the Forestdale-Houston area. Floodwaters threatened the new \$140,000 Houston Hotel and several houses were surrounded by water. Mile 16 of the highway was under 2-3 ft. (60-90 cm) of water and a number of homes were threatened with evacuation (*Daily Times*, May 15, 1951). Flooding occurred at Houston, when the Buck River (Creek) flooded the highway. On May 12, numerous small washouts occurred because the culverts were too small to handle the abnormal runoff. The most serious washout was at a point 2 mi. (3.2 km) west of Forestdale. The highway was open to light traffic only. On May 14, the eastbound way freight was cancelled because of impassable track. Other freight traffic was delayed for 36 hours. On the evening of May 14, the high water started receding.

June 4, 1951

Event type: Rockslide.

Precipitation: Not applicable; Terrace (max. temp. 26.1° C), June 3 and 4, 1951.

Source: *The Interior News*, June 7, 1951.

Early on June 4, a rockslide near Telegraph Point, 3 mi. (4.8 km) west of Kwinitsa, blocked the railway tracks. A 120-ft. (36 m) section of track was badly damaged and needed to be replaced, requiring drilling and blasting equipment.

Late summer-early fall 1951

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Daily Colonist*, February 7, 1953; *The Interior News*, April 16, 1953.

During the late summer-early fall, a 200,000-ton rockslide came down in the Babine River canyon. Water backing up behind the slide in the narrow gorge created a lake more than a mile (1.6 km) long. Elsewhere, it was reported to be 500,000 tons (*The Daily Colonist*, February 7, 1953). The slide, which tumbled down 400 ft. (120 m) of sheer canyon walls, presented many hazards and months of continuous labour to clear. *1) Work on the project began during the winter of 1951-52 with the construction of a \$90,000 road from Hazelton to the slide.

In the summer of 1952, the slide caused the death of thousands of sockeye salmon. To provide passage for the 1952 run of sockeye and coho salmon a narrow channel was blasted along the base of the slide.

*1) The cost of clearing to the Federal government, which was just under \$500,000, was completed by General Construction Co. Ltd. of Vancouver, B.C.

Early July 1951

Event type: Rain-on-snow?

Precipitation: Not applicable.

Source: Coates 1992 (p. 201).

During the summer of 1951 when skeleton highway crews were away from the maintenance camps, some 70 washouts occurred along the Alaska Highway from the south to the north ends of Kluane Lake. Brigadier-General H.W. Lowe, commander of the Northwest Highway System from 1951 to 1955, stated, "we experienced as bad a flash flood as ever recorded" in this stretch of about 60 miles. Every small bridge disappeared, streams changed their courses, and about 100 tourists were stranded between breaks in the road.

Marvin Armitage recalls that when he was working at Mile 245, the rains came "like clockwork" early in July. The rainfall combined with summer melt coursed off the mountainsides, washing out culverts and damaging the road. (Coates 1992).

October 26-28, 1951

Event type: Rain-on-snow flooding.

Precipitation: Aiyansh (89.4 mm/1 day), October 26, 1951; Langara (31.5 mm/1 day), October 26, 1951; Aiyansh (119.6 mm/2 days), October 26-27, 1951; Kemano (117.8 mm/2 days), October 26-27, 1951; Falls River (162.9 mm/2 days), October 26-27, 1951; Prince Rupert (140.4 mm/2 days), October 26-27, 1951; Smithers (80.5 mm/2 days), October 26-27, 1951; Smithers A (75.7 mm/2 days), October 26-27, 1951; Namu (49.0 mm/1 day), October 27, 1951; Terrace (119.1 mm/2 days), October 27-28, 1951.

Source: *The Daily News*, October 27, 29 and 30, 1951; *The Omineca Herald*, November 2, 1951; *The Interior News*, November 1, 1951; File 28-41-10 Letter, November 2, 1951, L. E. Smith (Div. Eng.) to N. M. McCallum (Chief Eng. Victoria). B.C. Ministry of Transportation and Highways, Terrace.

Prince Rupert experienced heavy rain with 4 in. (100 mm) in 24 hours and winds gusting at 40 mph (64.4 km/h). Stewart received 15 in. (37.5 cm) of snow. The telegraph and telephone lines were out until October 29. On that day two main sections of Prince Rupert were still without telephone service because of water in the cables.

The CNR rail line between Prince Rupert-Terrace was closed for several days, interrupting traffic for three days. Numerous small bridges and culverts were undermined. On the lower Skeena River, several washouts occurred near Amsbury and on a 6-mi. (9.6 km) stretch between Salvus-Kwinitsa. A large washout and slide occurred 3 mi. (4.8 km) east of Skeena. Near the Khyex River a large slide occurred. Several bridge approaches washed out and near Kwinitsa the line was out in three places.

The highway between Terrace-Prince Rupert was closed for several days. A logjam in Kloyah (Kloiya) Creek caused flooding in the Prudhomme Lake area. Washouts occurred near Kasiks River and Amsbury. Shoulder erosion occurred between Mile 34.9-30.0; at Mile 30.1, some 300 ft. (90 m) of shoulder washed out; and there were minor shoulder washouts between Mile 29.1-28.4 (the mileages are all from Prince Rupert). During the night of October 26, some streams east of Terrace went on the rampage, cutting the highway early on October 27.

In the Terrace area, risks of washouts occurred near Manson Creek and the Copper River Ferry. The Copper River bridge was endangered. The Copper River flooded the road between the two bridges with 1.5 ft. (45 cm) of water. The water levels in Lakelse Lake came up 4 ft. (1.2 m) during the 36-hour storm. The creeks flowing into the lake overflowed their banks, and some cabins in the lower area were surrounded by water. In Terrace, basements were flooded in the Lakelse Avenue/Apsley Street area. The water came down the hill behind the Canadian Cellulose camp. Drainage from part of Kalum Street flooded Terrace Building Supply on Greig Avenue. At Manson Creek, 11 mi. (17.6 km) east of Terrace, two washouts occurred.

On October 26-27, the government experimental station near Smithers recorded 3.17 in. (80.5 mm) of rain in two days. A torrential downpour brought rivers and creeks to the flood level. The Telkwa River, which was reported to have risen 6 ft. (1.8 m), threatened to flood the town's main thoroughfare. West of Houston, three small washouts just east of Walcott held up the passenger train for 20 hours on October 28.

December 8-10, 1951

Event type: Rain-on-snow flooding and landslides.

Precipitation: Stewart (113.3 mm/3 days), December 8-10, 1951; Aiyansh (67.0 mm/2 days), December 9-10, 1951; Prince Rupert (60.5 mm/1 day), December 10, 1951.

Source: *The Daily News*, December 11, 12, 13, 14, 15 and 17, 1951; *The Omineca Herald*, December 14, 1951; *The Interior News*, December 13 and 20, 1951.

A combination of rain and warm weather caused slides and washouts. Communication lines were cut, but temporary service was restored on December 11. The telegraph, long distance telephone, and radio network were interrupted. On December 12, the telegraph service to Prince Rupert was restored.

From December 1 on, Highway 16 between Prince Rupert-Terrace was closed. Some of the deep washouts were filled with snow from the slides. The highway was closed for at least four days. A total of three highway bridges went out. The flats along the highway near Exstew and Salvus were flooded with up to 2 ft. (60 cm) of slush. On the Prince Rupert section, at least six large slides occurred and numerous slides on the Terrace end. A 700-ft. (210 m) slide occurred at Mile 70, near the Little Kwinitza Tunnel, and a 15-ft. (4.5 m) wide slide between Skeena-Telegraph Point. The Delta Creek bridge washed out and the creek at the bottom of Amsbury Hill caused a bad washout. The bridge at Amsbury Hill was replaced. The bridge approach near the Little Kwinitza Tunnel washed out. On the Terrace end, the road was covered with trees and debris over a distance of several miles.

The last washed-out bridge at Delta Creek was expected to be repaired by December 14. On December 20, the highway was reported to be open, restricted to essential traffic only and limited to vehicles under 4,000 lb. (1,816 kg). District Engineer L.E. Smith advised the road to be "passable but should be used with the utmost care."

Many slides and washouts cut the rail line between Skeena-Salvus. The main damage occurred on a 15-mi. (24-km) stretch west of Kwinitza. Two bridges were plugged with debris and as a result had their approaches on both ends washed out. A slide 2 mi. (3.2 km) west of Kwinitza was 500 ft. (150 m) wide and consisted of snow, mud, and trees. The slide 9 mi. (14.4 km) west of Kwinitza covered the right-of-way to a depth of 4 ft. (1.2 m). The slide 2 mi. (3.2 km) east of Kwinitza covered the track for a distance of 1.5 mi. (2.4 km). Several other slides, one being 100 ft. (30 m) long, occurred. Water ran across the track in several locations, including 4 mi. (6.4 km) west of Kwinitza, where the roadbed washed out to a depth of 3 ft. (90 cm). Further west there were minor washouts and water across the tracks. There was also water on the track in several places between Shames-Amsbury. One slide measured a length of 250-300 ft. (75-90 m). On December 10, thirteen people got stranded. They stayed at the Kwinitza station and Gordon Little Lumber mill's cookhouse. On December 12 they were brought out to Terrace on a work train.

January 16, 1952

Event type: Snow avalanches.

Precipitation: Not available.

Source: *The Interior News*, January 17, 1952.

On January 16, "one of the worst storms ever recorded along the lower Skeena" blocked the rail line between Terrace-Prince Rupert. Shortly before midnight January 16, snowdrifts and slides piled up by 70-mph (112 km/h) winds tied up the railway.

April 11, 1952

Event type: Mudslide.

Precipitation: Not applicable.

Source: *The Cariboo Observer*, April 17, 1952.

On April 11, a big mudslide blocked the Deep Creek diversion south of Soda Creek, delaying traffic for hours. The northbound Greyhound bus arrived at Quesnel four hours late. Though the slide was cleared late on April 11, portions of the hill were still only wide enough for one-way traffic.

Slippery mud caused by spring break-up conditions delayed the start of construction of the Ahbau bridge, north of Quesnel.

April 15-21, 1952

Event type: Spring runoff flooding.

Precipitation: Sandspit (79.5 mm/1 day), April 15, 1952; Falls River (192.0 mm/2 days), April 15-16, 1952; Kemano (115.8 mm/2 days), April 15-16, 1952; Prince Rupert (123.4 mm/2 days), April 15-16, 1952; Terrace (68.6 mm/1 day), April 16, 1952; Terrace (136.4 mm/3 days), April 16-18, 1952.

Source: *The Daily News*, April 16 and 17, 1952; *The Omineca Herald*, April 18, 1952; *The Interior News*, April 17 and 24, 1952; *The Cariboo Observer*, April 24, 1952; *The Vancouver Province*, May 13, 1952.

Prince Rupert reported heavy rain and a gale with winds of 40 mph (64.4 km/h). Digby Island recorded 5.5 in. (139.7 mm) of rain in 72 hours or 4.5 in. (114.3 mm) in less than 48 hours. On April 15, Prince Rupert recorded the greatest rainfall in 24 hours with 79.5 mm. The city suffered light property damage and the telegraph line went out. Terrace recorded 2.6 in. (66.0 mm) of rain, for the 24-hour period of April 16-17, and 1.75 in. (44.5 mm) for 24 hours

on April 17-18. Sandspit airport reported the largest two-day storm on record with 94.0 mm of rain. *1) It also recorded the greatest rainfall in 24 hours with 79.5 mm on April 15.

In the lower areas north of Terrace, many basements were flooded. Williams Creek flooded the Lakelse Road. On Highway 16 several washouts and damage to the road occurred between Salvus-Kitwanga. The road was flooded at Prudhomme Lake and at Mile 67. Mudslides occurred at Kitwanga and east of Usk. Highway 16 between Endako-Lejac became impassable and was officially closed.

Damage on the lower Skeena River caused by heavy rain disrupted train schedules for three days. The railroad traffic was delayed by a washout at Mile 40. A washout 15 mi. (24 km) west of Terrace was cleared and washed out again. On April 17, a sinkhole developed a few miles west of Terrace, delaying the eastbound passenger train for 12 hours. The eastbound train was held at Kwinitsa. The Nechako and Bulkley subdivisions reported minor trouble, temporarily interrupting rail service on the Smithers division.

On April 19-20, torrential rains washed out the PGE trestle at Whiskey Creek, 13 mi. (20.8 km) north of Williams Lake. A 16-year-old boy who discovered the washout circled it and walked 2 mi. (3.2 km) down the track to warn the section foreman just in time to halt a train due to pass over the trestle two hours later. The flash flood in Whiskey Creek, caused by sudden thaw conditions, carried away about 200 ft. (60 m) of track and a "considerable portion" of fill.

On May 21, a plugged culvert in the PGE fill at Marguerite backed up water for an estimated 2 mi. (3.2 km) threatening the highway bridge which parallels the railway. Debris carried by down by runoff was believed to be the cause of plugging the culvert. Pumps were brought in to control the situation.

*1) In October 1978, a new record was set with 120.3 mm.

December 12-13, 1952

Event type: Debris slides

Precipitation: Not available.

Source: *The Interior News*, December 18, 1952.

Unseasonable rain caused washouts and slides between Terrace-Prince Rupert. On December 12 at 11:20 a.m., a washout 50 ft. (15 m) long and 3 ft. (90 cm) deep occurred 4 mi. (6.4 km) west of Kwinitsa. At 3 p.m., a 300-ft. (90 m) long and 3-ft. (90 cm) deep snow, tree and rockslide came down 1.5 mi (2.4 km) west of Kwinitsa. Another small rockslide occurred 2 mi. (3.2 km) east of Kwinitsa. A slide of snow, rock and trees, 200 ft. (60 m) long and 4 ft. (1.2 m) deep came down 7 mi. (11.2 km). Also a number of minor slides came down in the same area. On December 13 at 1 p.m., the rail line was passable.

February 1, 1953

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Vancouver Province*, February 6, 1953; *Victoria Daily Times*, February 7, 1953; *The Daily Colonist*, February 7, 1953; *The Interior News*, February 12, 1953.

On February 1, an estimated 25,000 tons of rock came down blocking the Babine River for the second time in less than two years. It came down the canyon in the same channel where in 1951a 500,000-ton slide blocked this vital salmon stream. The slide buried a bulldozer working there to clear a previous slide. No one was injured. When efforts were made to dig out the bulldozer, "further cascades" started and the crews were withdrawn for safety reasons. Work on the "Babine Project" was temporarily halted. *1)

*1) For 10 weeks crews had been working on clearing this section of the river to facilitate the 1953 sockeye salmon run. (*The Interior News*, February 12, 1953).

Summer 1953

Event type: Landslide.

Precipitation: Not applicable.

Source: *Terrace Omineca Herald*, June 24, 1954; *The Terrace Standard*, June 23, 1993; R.E. Wells, pers. comm. May 2, 1994. Former Resident Engineer CNR.

In the summer of 1953, during the construction of the Terrace-Kitimat railway, a landslide occurred near Alwyn Creek. The slide at Mile 6.6 buried construction equipment, including bulldozers, into the mud. When the slide occurred, construction of the bridge across Alwyn Creek and the bridge approach had begun. Later, the slide area was bulldozed over and the bridge construction proceeded. The bulldozed site was used as a fabrication area for all the bridge frames.

August 11, 1953

Event type: Landslide.

Precipitation: Terrace (0.0 mm/11 days), August 1-11, 1953.

Source: *The Omineca Herald*, August 21, 1953.

On August 11, a slide occurred on the Kalum Lake Road, about 5.5 mi. (8.8 km) north of Terrace. The slide, which wiped out a portion of the road under construction, left a gap 30 ft. (9 m) deep and over 120 ft. (36 m) wide. The road closure put 20 to 30 men employed in the logging industry temporarily out of work. By August 14, the road was passable. According to foreman Mathews, over 5,000 yd.³ (3,823 m³) of gravel was used to repair the road. (*The Omineca Herald*).

October 10-14, 1953

Event type: Flooding and debris slide.

Precipitation: Kitimat (98.3 mm/2 days), October 10-11, 1953; Prince Rupert (141.0 mm/1 day), October 11, 1953; Kemano (53.3 mm/1 day), October 11, 1954; Falls River (205.0 mm/5 days), October 10-14, 1953.

Source: *The Daily News*, October 13, 1953; *The Interior News*, October 21, 1953; Eero Karanka, pers. comm. February 21, 1994. Habitat Biologist Department of Fisheries and Oceans, Prince Rupert.

Prince Rupert experienced a record rainfall with 3.65 in. (92.7 mm) in six hours or 5.55 in. (141.0 mm) in 24 hours. Storm sewers overflowed and streets and basements were flooded.

According to Alcan data, the Kitimat River recorded a discharge of 45,000 cfs (1,274 m³/s) near the middle of the month. *1) It is not known whether this was a mean daily or an instantaneous discharge. If it was a mean daily discharge, it would have been the eleventh highest flow during the period of WSC stream gauge data (1964-1993) (Karanka, pers. comm.).

On October 16 at 4 p.m., a mud and rockslide came down at Telegraph Point, 44 mi. (70.4 km) east of Prince Rupert. To permit the flow of highway traffic without too much delay, bulldozers cleared the 15-ft. (4.5 m) deep debris into the Skeena River. Disrupted rail traffic necessitated the transfer of passengers. On October 17, the eastbound passenger train reached Smithers about eight hours late. By October 19, rail traffic was back to normal.

*1) From April 1953 to July 1954, Alcan operated private stream gauging stations on Moore Creek, Anderson Creek, and the Kitimat River (Karanka, pers. comm.).

October 25-27, 1953

Event type: Rain-on-snow flooding.

Precipitation: Kitimat Townsite (56.4 mm/2 days), November 25-26, 1953; Falls River (156.0 mm/3 days), October 25-27, 1953; Kitimat (65.8 mm/2 days), October 26-27, 1953; Terrace (64.5 mm/2 days) October 26-27, 1953.

Source: *The Omineca Herald*, October 30, November 6, 13, 1953; Eero Karanka, pers. comm. February 21, 1994. Habitat Biologist Department of Fisheries and Oceans, Prince Rupert.

Unusual heavy rains in the Terrace area caused creeks and lakes to overflow their banks. *1) According to an old-time resident, Lakelse Lake reached the "highest water level since 1936." In a number of summer homes the water was nearly up to the floor level. In Terrace, Greig Avenue flooded in front of the Credit Union Hall and in the vicinity of the Skeena Hotel. To drain the water, village maintenance workers dug a sump hole on the south side of Greig Avenue.

According to Alcan data, during a second freshet near the end of October, the Kitimat River recorded a discharge of 33,000 cfs (934 m³/s). Again, it is not known whether this was a mean daily or an instantaneous discharge (Karanka, pers. comm.).

On October 27, near Dorreen, a rockslide at a placer mine at Lorne Creek killed one miner. The victim's body, which was carried into Lorne Creek, was found about two weeks later.

*1) Terrace set an all-time rain record for October with 293.9 mm (*The Omineca Herald*).

January 30-February 3, 1954

Event type: Flooding.

Precipitation: Kemano (145.1 mm/3 days), January 30-February 1, 1954; Falls River (271.1 mm/4 days), January 30-February 2, 1954; Aiyansh (71.3 mm/2 days), January 31-February 1, 1954; Terrace (91.7 mm/4 days), January 31-February 2, 1954; Prince Rupert (64.5 mm/1day), February 1, 1954; Sandspit A (31.5 mm/1 day), February 2, 1954.

Source: *Terrace Omineca Herald*, February 4 and 11, 1954; *The Interior News*, February 4, 1954; Eero Karanka, pers. comm. February 21, 1994. Habitat Biologist Department of Fisheries and Oceans, Prince Rupert. Files. B.C. Ministry of Transportation and Highways, Terrace.

A sudden rise in temperature to 42° F (5.5° C) occurred with a steady heavy snowfall. The ice in the Skeena River broke up and a solid wall 15 ft. (4.5 m) high washed under the Skeena bridge at Terrace. The substructure of the new bridge escaped undamaged. This was the first time in its known history that the ice broke up in February.

The washouts and flooding in the Terrace area was not as serious as was at first feared. The highway east of Terrace was closed when Manson Creek washed out. The Department of Public Works issued road restrictions for heavy hauling on Lakelse Road, Kalum Road, and Highway 16 east. The Zymoetz River recorded peak flows with nine days of discharges exceeding 100 m³/s). On February 6, the river peaked at 365 m³/s. *1)

According to Alcan data, early February, the Kitimat River peaked at 48,000 cfs (1,329 m³/s). This puts it as the highest peak at that time of the year on the Kitimat River. It would rank it as the ninth highest flow during the period of WSC stream gauge data (1964-1993). The Alcan chart also recorded for February 5, 1954 a rainfall of 13.39 in. (345.2 mm) in a week. This would probably have been recorded at the Alcan Works AES Station named Kitimat. This station operated from 1951 till 1966 and was renamed Kitimat 2 in 1966 (Karanka, pers. comm.).

The Smithers area reported spring-like weather with temperatures in the high 40s °F (9° C) to 54° F (12.2° C) (unofficially) since January 30.

*1) A monthly mean flow of the Zymoetz River in February, 1954, at 103 m³/s exceeds the next highest January or February mean monthly flow by nearly 40 m³/s through 40 years of record (Karanka, pers. comm.).

May 15-22, 1954

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Alaska Highway News*, May 20, 1954; *Prince George Citizen*, May 17 and 20, 1954; *The Sun*, May 20, 1954.

On May 15 at 3:30 a.m., a washout 3 mi. (4.8 km) east of Isle Pierre, 29 mi. (46.4 km) west of Prince George, wrecked a westbound CNR passenger train. A sudden freshet caused a dam near a small lake 0.5 mi. (800 m) upstream broke and undermined the east approach of the 36-in. (90 cm) culvert. A locomotive and two baggage cars of the 11-car passenger train dropped into a deep hole left by a washed-out culvert. The engine, which buckled as it plunged through the weakened culvert, sending water against the culvert approaches was a total loss. A CNR fireman who was crushed and burned when pinned under a locomotive later died.

Old-timers of the Isle Pierre district where the accident happened believed the accident was caused when a beaver dam broke in a small lake, sending a wall of water cascading under the right-of-way.

On May 19, the Fraser River at Prince George recorded a reading of 23.21 ft. and 24.92 the next day (compared to 26.36 in 1948).

Heavy runoff caused a partial washout at Mile 589 on the Alaska Highway, necessitating temporary one-way traffic. At Mile 38 on the Beaton River access road, two culverts washed out and had to be replaced.

June 10, 1954

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Terrace Omineca Herald*, June 10 and 17, August 19, 1954; Environment Canada 1991.

High waters in the Skeena River caused severe bank erosion just west of Terrace. The river changed its course to the north bank upstream from the Frank Brothers dairy farm. *1) As a result, Ivan and Floyd Frank lost 5 ac. (2 ha) of their farmland. The riprap wall was swept away and chunks of land disappeared at over 1 ft. (30 cm) an hour. The CNR mainline west of the farm was almost put out of commission. In a combined effort between the Department of Public Works, the railway, and Columbia Construction Company, the riverbanks were reinforced. Three trains a day hauled rock on flat cars from Pacific. Rock was also hauled around the clock by a dozen trucks from the Public Works, cut at Copper River. Despite these efforts, the river washed out 350 ft. (105 m) of farmland and 15 ft. (4.5 m) of railway. The road to Little's Island washed out. The highway between Prince Rupert-Terrace was flooded in several places.

At high tide in the evening of June 9, 2 ft. (60 cm) of water and driftwood covered the highway around East Kwinitsa. As a precautionary measure, the Department of Public Works stationed a patrol car on the highway west of Terrace. On June 10, the Skeena River at Usk recorded a maximum instantaneous discharge of 5,970 m³/s and a maximum daily discharge of 5,920 m³/s (Environment Canada 1991).

*1) During the early 1900s when the Frank's farm was established, the river's main channel was on the south side. Floodwaters threatened the farm in 1936 and 1948. Between 1951-1954, the river appears to have been changing course. The Frank Brothers estimated having lost about 25 ac. (10 ha) of land since 1936 (*Terrace Omineca Herald*).

September 21-25, 1954

Event type: Flooding.

Precipitation: Ocean Falls (268.7 mm/4 days), September 21-24, 1954; Kitimat (125.2 mm/2 days), September 23-24, 1954; Kitimat Townsite (102.6 mm/2 days), September 23-24, 1954; Aiyansh (50.0 mm/2 days), September 23-24, 1954; Falls River (166.1 mm/3 days), September 23-25, 1954.

Source: *Kitimat Northern Sentinel*, September 30, 1954.

According to Alcan records, 7.74 in. (196.6 mm) of rain fell in the Kitimat area during the period September 21-26. On September 23 alone, 2.74 in. (69.6 mm) was recorded. The Kitimat River rose approximately 8 ft. (2.4 m) at its peak. Basements of the Johnson-Crooks houses (Nechako) area under construction were flooded as a result of the unfinished nature of the grade. The pouring of the concrete for the water intake was delayed. The Anderson Creek water intake, now serving the smelter, was blocked by debris.

October 11-16, 1954

Event type: Debris slide.

Precipitation: Kitimat Townsite (53.1 mm/1 day), October 11, 1954; Kitimat Townsite (75.7 mm/3 days), October 13-15, 1954; Namu (58.7 mm/1 day), October 14, 1954; Falls River (103.6 mm/3 days), October 14-16, 1954.

Source: *The Daily News*, October 18 and 19, 1954; *The Interior News*, October 21, 1954; *Kitimat Northern Sentinel*, October 21, 1954.

On October 16 at 4:00 p.m., a rock, mud, and debris slide occurred at Telegraph Point, 44 mi. (70.4 km) east of Prince Rupert, blocking the rail line and the highway. The slide measured a length of 150 ft. (45 m) and a depth of 15 ft. (4.5 m). The rock and mud was bulldozed into the Skeena River. At midnight on October 17, the highway was reopened to full traffic. The eastbound passenger train arrived at Smithers eight hours late. On October 19, rail traffic returned to normal.

On October 18, a steam shovel working at Mile 28 on the construction of the railway spur line between Terrace-Kitimat was hit by a slide. The accident claimed the lives of two construction workers. The crew was working on a section of the CNR grade between the Bannock Creek trestle and the Campbell-Bennett camp Four at the Big Wedeene River. The shovel moving south along the grade caused the rain-washed gravel to give way and overturned. The construction company encountered heavy blue clay in the area that earlier caused a delay in the grade construction.

January 19, 1955

Event type: Icejam flooding.

Precipitation: not applicable.

Source: *The Vancouver Province*, January 22, 1955.

In January following unusual mild temperatures, the Nechako River flooded low-lying areas twice within two weeks. On January 19, an icejam backed up the Nechako River from where it flows into the frozen Fraser River. It was feared that if the temperatures continued at the present 15-25° F (-9.4° to -3.9° C), the river was expected to back up beyond the city within a week. The Nechako River rose 8 ft. (2.4 m) within a week. *1)

After the powerhouse of Prince George Planing Mills flooded, operations were halted. To guard the water supply, city crews built an 800-ft. (240 m) dyke around the city's settling basin. After the river flooded the city water pumping station, the chlorination equipment was disconnected and removed. Residents were warned to boil their water.

*1) During a normal spring freshet, the Nechako River would usually not rise more than 5 ft. (1.5 m) (*The Vancouver Province*, January 22, 1955).

January 21-25, 1955

Event type: Snow avalanche.

Precipitation: Aiyansh (34.3 mm/1 day), January 21, 1955; Falls River (51.1 mm/1 day), January 22, 1955; Kitimat (43.2 mm/1 day), January 22, 1955; (max. temp. 6.1° C); Kitimat (32.0 mm/1 day), January 25, 1955; (max. temp. 9.4° C).

Source: *Kitimat Northern Sentinel*, January 27, February 3, 1955; Kendrick 1987; Jamieson and Geldsetzer 1996 (pp. 169-170); Adam Charneski, pers. comm. July 1991, Line Foreman Alcan, Kitimat.

On January 25 at noon, an airborne avalanche wiped out three transmission towers in Glacier Bowl on the south side of Kildala Pass between Kitimat-Kemano. *1) One of the towers was partially left in position. Destroyed were the towers 113L, 111R, and 112R; tower 113R was damaged. The right-hand sideline was wiped out but the left one was left relatively intact. *2) The power supply to the Kitimat smelter and townsite was cut, leaving the area without power. The telephone communications to Kemano were interrupted for three days. The production of aluminum was temporarily halted when the electrolyte in the pots froze. The town got power from the temporary diesel units, which had been installed during the construction of Kitimat. The tower on the uphill line had been swept clean away, but the conductors were undamaged. It was two days before a crew could get to the site, following a track plowed by a bulldozer. Using a helicopter, the conductors were pulled tight and then cut away from the cross arm. With the reduction in weight, the conductors floated above the snow. Nine days after the avalanche, power was restored to Kitimat. During the repair work, over 1 m of new snow fell. The conductors on the second line were broken in many places and tangled in the wreckage of the two destroyed towers. It took crews two weeks to put this line back into service. During the whole time, the men worked in the avalanche zone. By the time they finished, another 2 m of snow had fallen (Kendrick 1987).

*1) Any disturbance of a dry and powdery snow mantle on a steep slope can kick up small clouds of snow powder. This snow cloud, which may be only a few cubic metres in size, is heavier than air. Flowing downhill, it kicks up more snow powder. When speeding up, by a chain reaction, a huge cloud of airborne snow will billow down the mountain. It can reach speeds of 300 km/h, able to destroy almost anything in its path (Kendrick 1987).

*2) The transmission line had just been energised in August 1954. To avoid repeat failures in the pass, a cross rope suspension system was applied to eliminate the towers. In the summer of 1955, a unique protection was built by suspending the conductors in Glacier Bowl on 1,180-m long wire ropes spanning transversely across the bowl. The suspension eliminated towers on the ground in Glacier Bowl and kept the power conductors out of harm. (Jamieson and Geldsetzer 1996).

January 28-29, 1955

Event type: Icejam flooding.

Precipitation: not applicable.

Source: *The Vancouver Sun*, January 29, 1955; *The Vancouver Province*, February 1, 1955.

For the second time in two weeks, icejams caused the Nechako River to overflow its banks, spilling into low-lying areas. *1) The flow ice was riding against the solid ice in the Fraser River. On January 29, floodwaters and ice threatened the bridge linking Prince George with the John Hart Highway by straining the supports of this bridge across the Nechako River.

On January 28, the pumphouse flooded again, closing the planer mill, which after a six-day closure had been operating again for only two days. Water backing up threatened another flood. Six mills shut down. The damage was estimated "in the thousands of dollars." The loss of lumber from the lumberyard alone was estimated at \$8,000.

On January 31 with the return of cooler temperatures, though water levels dropped flood danger remained.

*1) According to municipal authorities, the only solution to solve the flooding problem, which occurs during mild temperature periods in winter, would be to dredge the Nechako River. Mayor Gordon Bryant made a request for dredging this year under the B.C. Rivers Protection Act. (*The Vancouver Province*, February 1, 1955).

April 6-8, 1955

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Cariboo Observer*, April 7 and 14, 1955; *The Vancouver Province*, April 12 and 13, 1955; April 30, 1965.

On April 6 in Quesnel, a flash flood caused by melting snow swept into a portion of the Junior-Senior School. Dammed up water on the northern playing field cascaded down the bank and into the lower class rooms and basement.

Late on April 7, "spring-softened mud" caused two mudslides to come down and block the PGE railway south and north of Quesnel. Damage to the rail line from a slide at "Mud Hill," 4 mi. (6.4 km) south of Quesnel was so extensive that it might be necessary to install a 50-ft. (15 m) bridge to span the break. A small creek, normally handled by a culvert, backed up and started a washout and mudslide that blocked several hundred feet of PGE track. Traffic on this section of the line was halted for almost a week.

A second slide immediately north of the Abhau bridge, "another periodic trouble spot," tore out the line 20 mi. (32 km) to the north, halting traffic between Quesnel-Prince George. This break was "considerably worse" than the break south of Quesnel and was expected to take at least a week to repair. Upon completion of the Mud Hill job, crews headed for the Abhau break.

June 25-28, 1955

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Daily Colonist*, June 28 and 29, 1955.

A storm starting early on June 25 caused rivers and streams to flood their banks for many miles. Five bridges on the Trans-Provincial Highway, including the one at Stone Creek washed out while others were dangerously weakened. The storm covered a very large area and forced a plane down at Bear Lake, 50 mi. (80 km) north of Prince George on the John Hart Highway.

On June 26, the flash floods knocked out several bridges in the Kootenay and Cariboo areas. The Cariboo Highway was flooded in the Cottonwood canyon area north of Quesnel. The village of Stone Creek was cut off in both north and south directions. According to old-timers, it was the "worst flood in 25 years."

Early on June 26, the roaring water awakened residents living close to the riverbanks and the movement of their home, one of which was carried downstream about 200 yd. (180 m). On June 26, the Stone Creek bridge 22 mi. (35.2 km) south of Prince George washed out. About 24 hours later, the PGE trestle over Stone Creek was left hanging without support at the northern end. The railway trestle, the footings of which were being undermined continually, was not expected to be repaired for weeks. The structure was feared to go out overnight June 28-29.

Quesnel became isolated leaving scores of travellers stranded there. The Sisters Creek bridge, 20 mi. (32 km) south of Quesnel, was damaged. The Sisters Creek bridge was unsafe for PGE traffic and the trestle foundations on a number of other PGE railway bridges were weakened. On June 28, Quesnel was isolated for the third straight day. The highway to Prince George was expected to reopen later that day. Lumber mills in the Quesnel area began closing and the plywood mill was expected to close on June 30.

October 5-14, 1955

Event type: Rockslides.

Precipitation: Kitimat (278.9 mm/8 days), October 5-12, 1955; Ocean Falls (184.8 mm/3 days), October 6-8, 1955; Namu (208.1 mm/4 days), October 6-9, 1955; Falls River (360.3 mm/8 days), October 6-13, 1955; Prince Rupert (82.5 mm/2 days), October 12-13, 1955; Ocean Falls (163.3 mm/2 days), October 13-14, 1955.

Source: *The Vancouver Province*, October 7, 1955; *Squamish Advance*, October 13, 1955; *Kitimat Northern Sentinel*, October 13, 1955; *Terrace Omineca Herald*, October 13, 1955.

A small slide occurred on the Terrace to Kitimat rail line. The 60-ft. (18-m) slide blocked the line near Lakelse Lake. On October 9, the Terrace-bound train was delayed for two hours. The line was expected to be reopened on October 14. In Terrace, the heavy rains hindered the work on the pipeline construction for the new water line from Deep Creek.

A gravel slide in the Sandhill buried the Kitimat Concrete belt loader. The Kitimat River rose to within 2 ft. (60 cm) of the road level near the Sandhill.

On the afternoon of October 6, a PGE speeder hit a rock and jumped the tracks at Stone Creek 23 mi. (36.8 km) south of Prince George. Two members of a PGE bridge and buildings crew were killed and two others injured. The speeder was flung sideways on the track and the two men killed were run over by it and the toolcar the speeder was towing.

November 15, 1955

Event type: Ice floe.

Precipitation: Not available.

Source: Ramsey 1962 (p. 250).

On November 15, a huge ice floe in the Fraser River near Prince George partially destroyed the false work on the PGE bridge under construction, causing \$10,000 damage.

February 15-19, 1956

Event type: Snow avalanches.

Precipitation: Aiyansh (38.1 mm/1 day), February 15, 1956; Prince Rupert (23.6 mm/1 day), February 16, 1956; Falls River (137.1 mm/4 days), February 16-19, 1956.

Source: *The Daily News*, February 16, 17, 18 and 21, 1956; January 31, 1961; B.C. Ministry of Public Works 1957 (p. N 35).

On February 15-16, the Prince Rupert area was hit by a blizzard with winds of 50 mph (80 km/h), followed by a rapid rise in temperature and rain. The winds caused snowdrifts up to 2 ft. (60 cm). *1) On February 16 and 17, power blackouts occurred in Prince Rupert as a result of heavy wet snow on the high-tension lines. The Prince Rupert to Kitimat passenger train was delayed by a snowslide at Kwinitisa. The slide came down on February 16, sometime between 1-9 a.m., and measured a length of 100 ft. (30 m) and a depth of 30 ft. (9 m). It was cleared at 5:30 p.m. on February 16.

The storm, described as "one of the worst snowstorms in the history of the Queen Charlotte Islands," caused the federal Public Works survey ship *Hilunga* to sink on February 16 after it ran aground near Cape St. James. The five-man crew of the 82-ft. (24.6 m) vessel, on a routine dredging inspection trip, took to the lifeboats. The gale hampered the search for the men, who were later found on Athlone Island.

In the middle of February, snow conditions closed Highway 16 between Prince Rupert-Terrace for six days (B.C. Ministry of Public Works 1957). It was closed late on February 15 because of a slide at "Hole in the Wall," 1 mi. (1.6 km) east of Salvus. Smaller slides occurred between Prince Rupert-Kwinitisa, and at Amsbury, 12 mi. (19.2 km) west of Terrace. Between February 15-19, 7 ft. (2.1 m) of snow fell at Salvus, 5 ft. (1.5 m) at the Summit, and 4 ft. (1.2 m) at the Rainbow Inn. High winds at Terrace caused continued drifting of snow, hampering the snow removal work. The highway was reopened on February 21.

*1) In February, Prince Rupert's record breaking snowfall totaled 28.9 in. (73.4 cm) (*The Daily News*, January 31, 1961).

March 6-7, 1956

Event type: Snow avalanches.

Precipitation: Terrace (26.4 cm snow/1 day), March 6, 1956.

Source: *The Daily News*, March 7, 1956.

A slide at "Hole-in-the-Wall," approximately 1 mi. (1.6 km) east of Salvus, closed Highway 16 again. During the afternoon on March 6, 2 ft. (60 cm) of fresh snow fell.

On March 7, CNR reported small slides on the rail line between Terrace-Prince Rupert at Mile 51.7 and a small slide, measuring 30 ft. x 10 ft. (9 x 3 m) at Mile 43.2. The slides closed the line for 6.5 hours.

July 12-14, 1956

Event type: Flooding.

Precipitation: Not available.

Source: *The Vancouver Herald*, July 16, 1956.

On July 12-13, sudden floods caused washouts of culverts and bridges along a 300-mi. (480 km) stretch of the Alaska Highway. The washouts left at least 20 crews from oil companies stranded in the Peace River area.

On July 14, about 500 tourists were stranded in Dawson Creek. Additional flood damage reported along the Alaska Highway would delay reopening of the highway till July 17.

October 4-6, 1956

Event type: Severe storm.

Precipitation: Kemano (45.2 mm/1 day), October 4, 1956; Aiyansh (62.5 mm/1 day), October 5, 1956; Sandspit A (30.5 mm/1 day), October 5, 1956; Prince Rupert (40.1 mm/1 day), October 5, 1956; Terrace (39.4 mm/1 day), October 5, 1956.

Source: *The Daily News*, October 6 and 9, 1956; B.C. Ministry of Public Works 1958 (p. J 39).

On October 5, heavy rain and a southeast gale with winds up to 60 mph (96.6 km/h) were reported from Prince Rupert. During six hours, 0.97 in. (24.6 mm) of rain fell. Basements were flooded and a garage on Atlin Avenue was damaged. The benches on the Court House lawn were "tossed around like cardboard." The heavy rains of September and October seriously hampered work on reconstruction and improvements on Highway 16 between Prince Rupert-Terrace (B.C. Ministry of Public Works 1958). Between Prince Rupert-Woodcock, 45 telephone poles went out. The CBC/CFPR Radio network connection, the CN telegraph, and the Prince Rupert Telephone Department were all interrupted. A freight train was derailed in the Kwinitsa tunnel, delaying the westbound passenger train.

On October 6, heavy snow and strong winds knocked out the wire communications between Terrace-Smithers. Many uprooted trees were across the tracks and wires.

November 2-4, 1956

Event type: Flooding and landslides.

Precipitation: Aiyansh (97.0 mm/2 days), November 2-3, 1956; Kemano (129.6 mm/2 days), November 2-3, 1956; Falls River (159.2 mm/2 days), November 2-3, 1956; Prince Rupert (182.9 mm/2 days), November 2-3, 1956; Terrace (168.2 mm/2 days), November 2-3, 1956; Kitimat (228.6 mm/2 days), November 2-3, 1956; Smithers (30.0 mm/1 day), November 3, 1956; Ocean Falls (201.6 mm/2 days), November 3-4, 1954; Namu (88.4 mm/1 day), November 4, 1956.

Source: *The Daily News*, November 3 and 5, 1956; *The Interior News*, November 8, 1956; *Terrace Omineca Herald*, November 8, 1956; *Kitimat Northern Sentinel*, November 6 and 16, 1956; Ann. Rep., Eng. Sec., Dep. Hwys. Prince Rupert Dist. 1956-57. B.C. Ministry of Transportation and Highways, Terrace.

A heavy rain and snowfall occurred in the Prince Rupert-Terrace-Kitimat area. Almost 6 in. (152.4 mm) of rain fell in Prince Rupert in 24 hours. Terrace recorded the heaviest rainfall ever in a 24-hour period with 93.0 mm.

Highway 16 between Prince Rupert-Terrace was closed to traffic for two days as a result of seven washouts. Flooding occurred at Prudhomme Lake where the road was covered with 3 ft. (90 cm) of water. The rail line between Prince Rupert-Terrace was cut in at least three places by a rockslide at Kwinitsa and other slides and washouts. Ten cars of a westbound freight train derailed near Port Essington, interrupting the train traffic for one day. The telegraph lines of CNR were cut in at least three places. The CBC radio signal, which is fed to the local booster station through the CN telegraph cable, was cut off. BC Tel reported 393 long distance telephone poles down. The telephone line between Prince Rupert-Burns Lake sustained heavy damage from the 8 in. (20 cm) of heavy wet snow. The snow downed over 150 poles. On a 7-mi. (11.2 km) stretch between Woodcock-Kitwanga alone, 30 poles came down.

In Prince Rupert a power failure occurred. It was caused by a mud and rockslide behind the city at Oldfield, which wiped out four power poles.

In Terrace the rail traffic was cut in all directions. The rail line to Kitimat was blocked for three days by a slide at Mile 52 and other slides and washouts. The telephone and power lines between Terrace and the airport were cut. Kitimat was completely cut off, stranding many people over the weekend. The Kitimat River flooded the road near the Beaver Pond and opposite the old Ball Park. A dragline was threatened to be washed into the Kitimat River. The municipal sewer outfall installation below the dike sustained extensive damage.

On November 3, nearly 18 in. (45.7 cm) of heavy wet snow fell in Smithers. The heavy snowfall that occurred in Smithers on November 3-4 did not extend east beyond Walcott, between Telkwa-Houston. On November 4, a number of telegraph poles were knocked down in the Smithers-Telkwa area under the weight of the heavy snow. Service was still out on November 7. The storm also disrupted some power services in the Smithers district. On November 3, some cars of a freight train derailed west of Houston at Barrett, delaying the westbound passenger train.

November 14, 1956

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Daily News*, November 15, 1956.

Around 5 p.m. on October 14, a rockslide knocked out 90 ft. (30 m) of main water pipe at Shawatlan Lake. City engineers did not locate the break until three hours later. The slide, which was halfway down Shawatlan Lake, about 0.75 mi. (1.2 km) from the Shawatlan pumping station, covered the pipeline with more than 20 ft. (6 m) of rock. It was expected it would take until November 19, before the five lengths of pipe would be replaced. On November 15, only half the city's water supply was reaching the city. Some higher residential levels of Prince Rupert were already without water. The reservoir, which the previous night was full with a capacity of 1,151,000 gal. (5,179,500 L) was now empty.

Acting Mayor Alderman Norman Bellis declared Prince Rupert in a state of emergency as far as its water supply was concerned. With the city reservoir at the top of Roosevelt Park Hill empty, this left a "good percentage" of the water pipes in the higher levels of the city dry. Bellis issued a desperate plea to all residents, especially those in the lower levels of town, to preserve water. Emergency pumps were drawing water downstream from the break but only half the city's day consumption.

Fall 1956

Event type: Landslide.

Precipitation: Not applicable.

Source: *The Daily Colonist*, May 4, 1975, pp. 12-13. Ron Burnham. Landslide.

During the fall (?), following heavy rain for more than one day, a landslide came down in the Yellowhead Pass near the British Columbia-Alberta border. Hundreds of tons of slide material covered two sets of railway tracks. The slide swept away a parked pick-up truck from a level spot beside the Mount Robson station and carried it downslope towards the Emperor station. The vegetation between the two sets of tracks was carried away. The Emperor station house was half full with muddy soup-like debris and the train tracks beside were buried. The slide had started at a waterfall on a steep slope above the Mount Robson station.

December 16-19, 1956

Event type: Rockslide and snow avalanches.

Precipitation: Aiyansh (50.5 mm/1 day), December 16, 1956; Terrace (110.3 mm/3 days), December 16-18, 1956; Ocean Falls (327.8 mm/4 days), December 16-19, 1956; Kitimat (284.2 mm/4 days), December 16-19, 1956; Bella Coola (126.5 mm/3 days), December 17-19, 1956; Falls River (155.5 mm/3 days), December 17-19, 1956; Kemano (61.0 mm/1 day), December 18, 1956.

Source: *The Omineca Herald*, December 20, 1956; *The Interior News*, December 20, 1956; *The Daily News*, December 17 and 18, 1956; *Kitimat Northern Sentinel*, December 18 and 21, 1956.

Prince Rupert experienced a gale with winds of 50 mph (80.5 km/h), gusting to 60 mph (96.6 km/h). Smithers reported heavy snow on December 14-15, bringing the season's total to 51.1 in. (129.8 cm). Terrace reported heavy snow with almost 2 ft. (60 cm) in 24 hours. During the week of December 13-20, 30.8 in. (78.2 cm) of snow and 1.74 in. (44.2 mm) of rain fell. Snowdrifts of 6-7 ft. (1.8-2.1 m) were reported. In Terrace schools were closed. The rail line was cut by a rockslide at Kwinitsa and slides elsewhere. Highway 16 was closed until December 20. Heavy snow east of Terrace blocked the road as far as Cedarvale.

On December 17, Kitimat recorded 20 in. (50.8 cm) of snow overnight. Almost 3 ft. (90 cm) of snow fell over the weekend. On December 21, the Kitimat smelter site reported 9.48 in. (240.8 mm) of rain for three days after the heavy snowfall on the weekend.

December 22-27, 1956

Event type: Flooding.

Precipitation: Kitimat (329.4 mm/5 days), December 22-26, 1956; Falls River (224.5 mm/4 days), December 23-26, 1956; Terrace (122.1 mm/4 days), December 23-26, 1956; Kemano (163.8 mm/4 days), December 23-26, 1956; Aiyansh (35.6 mm/1 day), December 24, 1956; Sandspit A (30.0 mm/1 day), December 24, 1956; Ocean Falls (414.2 mm/4 days), December 24-27, 1956; Namu (95.5 mm/2 days), December 25-26, 1956; Bella Coola (84.8 mm/2 days), December 25-26, 1956.

Source: *Kitimat Northern Sentinel*, December 28, 1956, January 4, 1957; *The Interior News*, January 3, 1957; Letter, May 30, 1957, W.S. Jackson. Hatchery Creek Flooding-Terrace; Northwest Hydraulic Consultants Ltd. 1987.

The Kitimat smelter site reported 8.84 in. (224.5 mm) of rain for the period December 24-26. The total precipitation at the site for December was 32.15 in. (816.6 mm); 8.67 ft. (2.6 m) of snow and 23.48 in. (596.4 mm) of rain. *1)

Hatchery Creek near Terrace flooded. It resulted in blockage of the entrance to the north channel and diversion of the main flow to the south channel (Jackson). A breakout through the left (south) bank in the vicinity of what is now 1st Avenue was prevented by bulldozing a dike. A "rock wall" was also built to prevent another breakthrough to the south (Northwest Hydraulic Consultants 1987).

*1) During December, the Smithers Experimental Farm reported a record 5.09 in. (129.3 mm) rain and snow, almost three times the 18-year average of 1.87 in. (47.5 mm). The highest previous December was in 1947 with 3.95 in. (100.3

mm). The highest month of precipitation was in May 1948 with 7.32 in. (185.9 mm) (*The Interior News*, January 3, 1957).

April 30, 1957

Event type: Landslide

Precipitation: Not applicable.

Source: *The Interior News*, May 2, 1957.

On April 30, a slide occurred on a side hill along the rail line 4 mi. (6.4 km) east of Moricetown. Fill saturated from spring runoff slid out from underneath the track. The roadbed slid downhill, leaving a gap approximately 40 ft. (12 m) long and 30 ft. (9 m) deep. The slide delayed the eastbound passenger train for 24 hours.

May 18-20, 1957

Event type: Spring runoff flooding.

Precipitation: Not available.

Source: *The Interior News*, May 23, 1957.

On May 18-19, heavy prolonged rain and melting of high-level snow caused flooding and washouts in the Smithers area. Washed out roads and bridges disrupted traffic on Highway 16 east and west of Smithers. District side roads also suffered with bridges and culverts reported out on the Smithers-Babine Lake Road and Driftwood Creek Road. Babine Road was closed to traffic. Near Perow, the approach to the Lund Creek bridge washed out on May 19. Following temporary repairs, traffic was able to get through. The bridge at Harvey Ranch on Driftwood Creek and the Chapman Lake bridge on Babine Road washed out.

On May 20, further damage resulted into further disruption of traffic. Highway 16 between Smithers-Prince Rupert washed out in at least 10 places, six of which between Terrace-Prince Rupert. Smaller cars were unable to get through to Terrace from Smithers due to washouts with up to 2.5 ft. (75 cm) of water flowing across the highway near Usk and Cedarvale.

For a time, the Bulkley and Telkwa rivers threatened to flood a road at Telkwa. The rainfall stopped on May 19. By the afternoon of May 20, the water level at Telkwa had dropped 6-8 ft. (1.8-2.4 m). Debris drifting down the Bulkley River threatened to take out the temporary piling for the new bridge at Telkwa. *1) Though the structure was damaged, little disruption was expected on further work on the bridge.

Around May 19, a 200-ft. (60 m) stretch of newly built rail line toppled into the Peace River near Taylor. Apparently undermined by high water, a 100 ac. (40 ha) area of land collapsed, destroying a section of grade and blocking the road for a distance of 1,000 ft. (300 m). According to construction officials, the line could not be fully restored until the ground would have settled.

*1) During the winter 1956-57, drifting ice had taken out the temporary structure. (*The Interior News*, May 23, 1957)

October 16, 1957

Event type: Severe scour.

Precipitation: Not applicable.

Source: *Prince George Citizen*, October 18, 1957; Kelsey 1958 (p. 86); Cohen 1992 (pp. 72-75).

In October 16, the north end of the Peace River bridge at Taylor Flats just south of Fort St. John collapsed. *1) The northern span of the multi-million dollar bridge tore from its moorings and crashed into the river. The centre portion of the collapsed span was badly warped out of shape. A sag in the 930-ft. centre span of the two-lane bridge aroused fears that it also could drop into the Peace River. Possible causes were given as a shift in the shale bed of the river or due to the intensive industrial traffic. The oil industry was one of those most acutely affected by the bridge's collapse.

Earlier in 1957, a water line, which was strung underneath the structure, ruptured sending high-pressure water into the river. This scoured out gravel once again from beneath the north abutment. *2)

*1) This bridge, completed in August 1943, was the longest bridge on the Alaska Highway, at 2,130 feet (639 m) costing approximately \$3.5 million. Because of the importance of the bridge, after the collapse the government of British Columbia rushed another, more substantial structure to completion in January 1960 (Cohen 1992).

*2) Early in 1948, it was discovered that scouring water undermined the north pier of the bridge making immediate repairs necessary (Cohen 1992).

November 2-4, 1957

Event type: Rockslides and snow avalanches.

Precipitation: Prince Rupert (93.2 mm/3 days), November 2-4, 1957.

Source: *Prince Rupert Daily News*, November 2 and 4, 1957; *Terrace Omineca Herald*, November 7, 1957; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

CNR reported rock and snowslides at Mile 28.7, 35.0, 45.0, and 50.0, and washouts in four locations. The rail line was closed for 28 hours.

November 21-24, 1957

Event type: Flooding and fatal snow avalanche.

Precipitation: Sandspit A (49.0 mm/2 days), November 21-22, 1957; Kemano (99.3 mm/2 days), November 21-22, 1957; Aiyansh (104.9 mm/2 days), November 21-22, 1957; Falls River (204.2 mm/2 days), November 21-22, 1957; Ocean Falls (192.0 mm/2 days), November 21-22, 1957; Prince Rupert (135.9 mm/2 days), November 21-22, 1957; Kitimat Townsite (125.7 mm/2 days), November 21-22, 1957; Langara (132.1 mm/3 days), November 21-23, 1957; Kitimat (215.1 mm/3 days), November 21-22, 24, 1957, Falls River (475.0 mm/9 days) November 21-29, 1957.

Source: *Prince Rupert Daily News*, November 22, 23, 25, 26, 27 and 30, December 2, 3, 4, 5, 9 and 10, 1957; *The Northern Sentinel*, November 22, 25, 26, 27 and 28, 1957; *The Sunday Sun*, November 23, 1957; Eisbacher and Clague 1981; Evans 1982; Clague 1984; Trenhaile 1998 (p. 83); Letter, October 3, 1958, H. J. Kelsall (Dist. Eng. Prince Rupert) to Research and Development Eng. Victoria. B.C. Ministry of Transportation and Highways, Terrace.

Prince Rupert recorded 3.96 in. (100.6 mm) of rain in 18 hours or 5 in. (127.0 mm) in 36 hours. *1) The storm was accompanied with gales up to 60 mph (96.6 km/h). Prince Rupert suffered heavy storm and rain damage. The long distance telephone, telegraph, and teletype wires to *The Daily News* all went out. The lines were cut in four places from 1-14 mi. (1.6-22.4 km) east of Prince Rupert.

On November 22 at noon, a slide on Mount Oldfield above Prince Rupert swept three houses into Oldfield Creek, killing seven people. The movement was rapid and lasted about 3-4 minutes. It was approximately 1,200 ft. (360 m) long and 600 ft. (180 m) wide with about 3 ft. (90 cm) of overburden over steeply sloping smooth rock. According to *The Daily News*, the slide measured approximately 300 ft. x 100 ft. (90 x 30 m). The debris completely covered a section of road and the remains of a number of houses in which the victims were trapped. There had been continuous heavy rain, with 4.25 in. (108.0 mm) immediately before the slide.

On November 23, *The Sunday Sun*, *The Colonist* and *The Times* all erroneously reported eight people killed by the slide. Subsequently, several authors (Eisbacher and Clague 1981; Evans 1982; Clague 1984 and Trenhaile 1998) have quoted this wrong number. The first two victims were found on December 2. On December 9, three victims were still unaccounted for. By December 10, the City of Prince Rupert had spent close to \$15,000 on the search. Financial aid was promised to help defray the costs of the search and rehabilitation of the disaster site.

Highway 16 between Prince Rupert-Terrace was closed for several days. Several washouts were reported. At Prudhomme Lake the road was flooded with 2-4 ft. (0.6-1.2 m) of water. Flooding occurred at Scree Creek and the Delta Creek bridge washed out.

Near Port Edward at the Watson Island pulp mill, a washout occurred on the rail line. This caused a westbound passenger train to derail near the terminal point of Pacific, 12 mi. (19.2 km) west of Terrace. The engine and two express cars left the tracks. Considerable damage was done to the equipment but there were no injuries.

During the period November 21-25, Kitimat reported over 6 in. (150 mm) of rain. High winds occurred in Kitimat Arm. At least 10 yachts and motorboats that were tied up to the floating pier were blown ashore or away. The wire and telephone service were disrupted, cutting the communications between Kitimat-Vancouver. Street runoff problems occurred and basements were flooded. The Nechako area sustained heavy flood damage. In the Shop Easy Food store a lot of food products were damaged. The small concrete bridge between Anderson-Moore, leading to the golf and yacht clubs, was damaged. The footings of the temporary pedestrian bridge in the Kildala area were loosened by the water, threatening to collapse the bridge.

*1) In November, Prince Rupert recorded 23 days with rain totaling 14.33 in. (364.0 mm), the highest since November 1953 when 15.66 in. (397.8 mm) of rain were recorded. (*Prince Rupert Daily News*, December 4, 1957).

December 2-8, 1957

Event type: Debris slides and snow avalanches.

Precipitation: Kitimat Townsite (13.0 mm/1 day)(max. temp. 10.0° C), December 2, 1957; Bella Coola (210.4 mm/7 days), December 2-7, 1957; Kemano (125.0 mm/3 days), December 5-7, 1957; Aiyansh (46.8 mm/2 days), December 6-7, 1957; Kemano (97.8 mm/1 day), December 7, 1957; Namu (109.7 mm/1 day), December 7, 1957; Ocean Falls (287.6 mm/2 days), December 7-8, 1957.

Source: *Prince Rupert Daily News*, December 9, 1957; *The Interior News*, December 12, 1957; *The Northern Sentinel*, October 30, 1958; Stethem and Schaerer 1980 (p. 21); Adam Charneski, pers. comm. July 1991, Line Foreman, Alcan, Kitimat; Ramsey 1971 (p. 161); Stethem and Schaerer 1980; Kendrick 1987.

The storm followed the November 21-24 rain-on-snow event. On December 2, Ocean Falls recorded 216 mm of rain in 24 hours. Near Ocean Falls, two large avalanches of mixed snow and mud crossed the Martin Valley road.

Slides cut highway and rail connections between Prince Rupert-Terrace. District engineer H.J. Kelsall reported four slides between Mile 49-50 and a fifth one approximately 35 mi. (56 km) east of Prince Rupert. Traffic was interrupted from midnight December 7 until 10 p.m. on December 9. The slides also delayed three trains. On

December 9, the telegraph lines between Terrace-Smithers came down, halting all telegram service. Because of a second break *The Daily News* teletype machine did not receive any wire.

On December 7, heavy wind and rain, following a week of heavy snow hit the Kitimat area. Shortly after midnight on December 7, a rock, mud and debris slide wiped out Tower 230 on the transmission line between Kitimat-Kemano in the mid-Kildala Valley, 27 mi. (43.2 km) from Kemano. *1) The power was interrupted for seven days. Some B.C. Power Commission diesel-electric power plants mounted on rail cars were brought in, keeping the town of Kitimat from being blacked out. Production at the Alcan smelter was halted as the electrolyte in the pots froze (Kendrick 1987). A ground patrol reached the trouble spot two days later as bad weather prevented helicopter patrols. One circuit was restored after five days on wooden poles. The second circuit was beyond repair and not back into service until July-August 1958.

Smithers reported heavy snow on December 6-7. With milder temperatures on December 8, it turned into rain.

On December 2, two large avalanches of mixed snow and mud crossed the Martin Valley Road near Ocean Falls (Stethem and Schaerer 1980). The two slides roared across the Martin Valley Road, isolating the subdivision about 1.5 mi. (2.4 km) from the townsite. Another hurled some 2,000 ft. (600 m) down the west side of Martin Valley across the Twin Lakes Road. Other slides could be heard coming from Mount Caro Marion. (Ramsey 1971).

*1) In 1958, Alcan spent approximately \$750,000 on an extensive program to reduce slide damage on the Kemano-Kitimat transmission line. At the Tower 230 area, about 9 mi. (14.4 km) from Kemano Beach, the transmission line was doubled on two sets of towers for 1.5 mi. (2.4 km) (*The Northern Sentinel*, October 30, 1958).

December 14, 1957

Event type: Landslides.

Precipitation: Ocean Falls (8.51 in. (216.2 mm)/1 day) December 14, 1957.

Source: Not available.

On December 14, Ocean Falls experienced very heavy wind and a record rainfall with a total of 8.51 in. (216.2 mm) in 24 hours. The rainfall was estimated at 0.5 in. (12.5 cm) an hour. Link Lake rose 4.17 ft. (1.25 m). There were several reports of people being blown off their feet. The men fighting the fast-rising waters of Link Lake by sand bagging splashboards on the dam, "had to hang on to the guard rails with one arm." When the wind gusted men striving to divert floodwaters around their Martin Valley homes "had to brace themselves with their shovels."

April 10-16, 1958

Event type: Landslide.

Precipitation: Not applicable.

Source: *Cariboo Observer*, April 17, 1958; Evans (unpublished data) (Case history 36).

Heavy rain in April caused a slump at westerly face of Red Bluff, at the south approach of Quesnel. The slump in glaciolacustrine silt destroyed three homes. *1) The cause of the massive slide was not immediately known. It was believed to have resulted from a combination of circumstances. One may be the fact that the hill had been logged off, making it more prone to water damage. Another may have been the directing of a drainage ditch into the back of the hill. Residents claimed that diverting water from Red Bluff Flat created a slough on top of the hill, which finally saturated the whole face of the cliff. The theory of the presence of hot springs deep within the hill was also advanced as a possible cause.

Starting April 10, a series of frost boils along the hill erupted into a landslide. Steadily the slide face expanded to the east face of the hill where the old road was located. Finally there was a front of 2,000 ft. (600 m) crawling and heaving down. The first house to be demolished was located on the hillside some 300 yd. (270 m) above the junction by the A.L. Patchett & Sons mill. For a week, its residents had watched with apprehension, as the hill behind their home appeared to be softening. An effort to move the house came too late. As the road below the house erupted and heaved, a wall of mud moved down to push the building off its foundations. In an effort to save the house, it was hoisted onto blocks late on April 11.

The next day it became apparent the house could not be saved. That same day, the slide face widened and the pressure increased. Department of Highways crews worked around the clock to open a one-way traffic lane around the slide area. There were frequent delays as light fill material was hauled in to stabilize the ground. The slide moved downward through January 12 and 13 into 14. On the morning of April 13, cabins at the foot of the hill occupied by Mr. and Mrs. Les Aiken and Mr. and Mrs. Leo Demas were evacuated as the ground started to heave. The buildings owned by C.L. Ellison tilted at "grotesque angles." Also threatened were the homes of Norman Zahara and still further up the hill the modern homes of Norman Palmer, Ed Knott and James Proudlove. The ground was trembling and heaving. The floors moved off level, and Proudlove's well collapsed.

By April 14, the roadway at the foot of the hill had heaved up 20 ft. (6 m). A hundred yards (90 m) further on, there was a hollow. Gaping cracks criss-crossed the old highway and in spots it had dropped more than 5 ft. (1.5 m). The new road, built originally to serve the Western Plywood plant and had later been converted into a portion of the main highway, was gone. Even as to where its original location had been was a matter of guesswork. Instead there

was a contorted track over which a bulldozer smoothed the way for traffic that gathered at either side of the break. Telephone lines and cables were a tangled mass, at some spots partially buried in the heaved-up ground. Power lines were stretched to a taut breaking point. Town Council declared the land immediately adjacent to the slide a disaster area. Residents were warned that they remained there at their own risk. For a time on April 14 and early April 15, the big refuse burner of the A.L. Patchett & Sons Ltd. mill was threatened. Slide debris that slowly oozed out over the flat area around the burner was being kept away by a bulldozer. However, at times it pushed to within 20 ft. (6 m) of the base of the burner.

By April 15, the land movement was noticeably less. By April 17, the movement had stopped. Crews were busy improving the road around Dragon Lake to allow traffic to be detoured that way and easing pressure on the hill. By the time the slide action had finished, the cabin and garage looked down on the highway that was once considered above the dwelling site. Early estimates placed the damage as high as \$300,000, including the cost of relocating power and telephone lines, emergency highway work and personal property damage.

*1) The area had long been a trouble spot and slides had frequently been experienced before but never at such a magnitude (*Cariboo Observer*).

October 1, 1958

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Citizen*, October 1, 1958; *The Vancouver Sun*, October 1, 1958.

On October 1, rocks came down onto the PGE line 30 mi. (48 km) north of Prince George, delaying Premier W.A.C. Bennett's north bound inaugural train for two hours. The train carrying Premier Bennett and members of his cabinet to Dawson Creek and Fort St. John for the opening of the northern extension. Another source put the location of the slide as 90 mi. (144 km) north of Prince George (*The Citizen*, October 1, 1958). Crews spend most of the day trying to clear the tracks. J.S. Broadbent, general manager of the PGE, said the slide was "a minor occurrence – it happens all the time." *1)

*1) He used much the same words in 1956, when Bennett's inaugural train was delayed for eight hours by rocks along Howe Sound during the opening of the southern extension between Squamish-Vancouver (*The Citizen*, October 1, 1958; *The Vancouver Sun*, October 1, 1958).

October 19, 1958

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Mathews 1965 (pp. 46-52).

On October 19, Strohn Lake suddenly drained. This was the first time a sudden draining of the lake at the head of the Bear River valley was recorded (Mathews 1965). *1)

*1) The lake drained again between October 26-28, 1959, and on October 6, 1960 (Mathews 1965).

October 27-November 2, 1958

Event type: Flooding.

Precipitation: Prince Rupert M. Circ (184.9 mm/7 days), October 27-November 2, 1958; Terrace (188.2 mm/7 days), October 27-November 2, 1958; Falls River (361.2 mm/7 days), October 27-November 2, 1958; Kitimat (329.0 mm/7 days), October 27-November 2, 1958; Kemano (123.2 mm/2 days), October 28-29, 1958; Sandspit A (90.1 mm/3 days), October 28-30, 1958.

Source: *Kitimat Kemano Ingot*, November 5, 1958; *The Northern Sentinel*, October 30, 1958; Northwest Hydraulic Consultants Ltd. 1987; B.C. Ministry of Transportation and Highways. Granite Creek Flooding, Lakelse Lake Area. B.C. Ministry of Transportation and Highways, Terrace; Lloyd Johnstone, pers. comm. September 1993.

The Kitimat River flooded the access roads under the bridge and the dike on the east side. The eroding river washed out some of the 13,000-V poles of the power line to the Service Centre. The road connecting the plant with the Service Centre was threatened. The Anderson Creek reached high water levels. The road on the Haisla Hill was closed. Runoff water washed through the gravel under the newly laid drainage flume. On November 29, the highway bridge at the end of the pavement washed out.

Lower Granite Creek piled up gravel and debris, blocking off the flow into the North Granite Creek. As a result, bank overflow occurred on the south side above this point, and the lower portion of the road from Highway 25 to the lake washed out. One car was lost in this road washout. The properties of the federal Department of Fisheries, Lot 4 and adjoining Lot 5, were greatly endangered and damaged. Lakelse Lake reached the highest water level since 1935, making it the fourth highest level this century (L. Johnstone, pers. comm.). According to local resident D.L.

Colter, the Ministry of Public Works blocked off the most northern channel of Hatchery Creek, which had been a major flood-relief channel (Northwest Hydraulic Consultants Ltd. 1987). *1)

*1) In 1956, the Department of Highways blocked off the overflow of Granite Creek to Hatchery Creek, in order for all flow of water in this area east of Highway 25 to go into one channel. This would make a large culvert or bridge at the point where Hatchery Creek formerly crossed Highway 25 unnecessary (Ministry of Transportation and Highways, Terrace). Much flood damage has occurred since the redirection of flow (Northwest Hydraulic Consultants Ltd. 1987).

November 30-December 1, 1958

Event type: Snow avalanche.

Precipitation: Kitimat Townsite (60.9 mm/2 days), November 30-December 1, 1958; Terrace A (38.6 mm/2 days), November 30-December 1, 1958.

Source: *The Northern Sentinel*, December 1, 1958.

A snow avalanche at Kwinitsa blocked Highway 16 between Terrace-Prince Rupert. The slide, measuring a length of 100 ft. (30 m), was reported at 4 a.m.

February 1-2, 1959

Event type: Snow avalanches.

Precipitation: Kitimat Townsite (16.3 mm/1 day), February 1, 1959; Prince Rupert (32.0 mm/2 days), February 1-2, 1959.

Source: *Prince Rupert Daily News*, February 2, 1959; *The Omineca Herald*, February 5, 1959; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

CNR reported two large snowslides near Mile 67.9, between Salvus-Kwinitsa. On February 1 at 8:30 p.m. a westbound freight train was hit by a slide. A second slide struck and derailed three cars. One car went into the Skeena River and two onto the highway. Heavy rainfall was reported in the area at the time. Besides the derailment at Mile 42.2, snowslides and washouts occurred between February 1-3. The largest slide came down at Mile 46.7, measuring a length of 100 ft. (30 m) and a depth of 20 ft. (6 m). The rail line was closed for 45 hours.

March 14-16, 1959

Event type: Flooding, debris slides and snow avalanches.

Precipitation: Falls River (231.3 mm/3 days), March 14-16, 1959; Kitimat Townsite (136.7 mm/3 days), March 14-16, 1959; Kitimat (206.3 mm/3 days), March 14-16, 1959; Prince Rupert (96.3 mm/2 days), March 15-16, 1959; Langara (66.3 mm/2 days), March 15-16, 1959; Kemano (46.7 mm/1 day), March 16, 1959.

Source: *The Northern Sentinel*, March 19, 1959; *Prince Rupert Daily News*, March 17, 18, 19, 20 and 23, 1959; *Terrace Omineca Herald*, March 19, 1959; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; Stethem and Schaerer 1980 (pp. 13-14); B.C. Ministry of Mines 1960 (pp. 231-232).

Prince Rupert recorded heavy rain, with 5.11 in. (129.8 mm) of rain in 72 hours. The telegraph, long distance telephone, teletype lines, and the CBC Radio link were all cut.

Highway 16 between Prince Rupert-Terrace was closed for three days. Near Prudhomme Lake, the highway was flooded with 1 ft. (30 cm) of water. Some slides occurred in the summit area near Tyee, and a large one between Salvus and the Kwinitsa tunnel. On March 20 the highway reopened, "usable at the public's own risk."

The rail line was closed for two days and nine hours. A large slide occurred at Mile 64.7. It measured 1,400 ft. (420 m) at the base, with a depth of 35-50 ft. (10.5-15 m). The Salvus railway tunnel was partially buried. A rock and snowslide occurred at Mile 39.9, blocking both ends of the tunnel. The slides west and east of the tunnel measured lengths of 1,800 ft. (540 m) and 300 ft. (90 m), respectively. The tracks were swept away and 12 telegraph poles were knocked out. Two section crews of 60 men and two extra gangs cleared the slide, with four bulldozers, a two-yard diesel shovel, and a turn-a-dozer. On March 20, the rail line was reopened for traffic "on slow orders." On March 21, an eastbound freight train hit a slide 32.4 mi. (51.8 km) west of Smithers and derailed, killing the engineer. The line was reopened on March 23.

At the Torbrit Silver Mines Limited Toric Mine near Alice Arm an avalanche came down. No injuries or damage was reported (B.C. Ministry of Mines 1960).

April 7, 1959

Event type: Fatal avalanche.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, April 9, 1959; *Stethem* and Schaerer 1980 (pp. 13-14); B.C. Ministry of Mines 1960 (pp. 231-232).

An avalanche at the Torbrit Silver Mines Limited Toric Mine near Alice Arm killed one miner. *1) The snow and rockslide broke through the snowshed striking a train and burying the switchman in the debris. A motorman on the engine pushing the cars escaped injury.

The avalanche, which came down 500 yd. (450 m) from the company's mill, covered 75 ft. (22.5 m) of track. It contained wet snow mixed with rock and appeared to be the result of high temperatures and snowmelt. The slide ran over a width of about 30 m and deposited debris to a maximum depth of 5 m in the snowshed. About 12 m of snowshed was destroyed. In March, a total snowfall of 3.6 m, accompanied by some rain, was reported at the mine site. Because of the heavy snow in the area, the site was very prone to slides.

*1) Previous avalanches occurred at the same site in March 1959 and another one, eight years earlier (Stethem and Schaerer 1980).

July 1959

Event type: Rockslide.

Precipitation: Not applicable.

Source: Evans et al. 1989; Evans (unpublished data) (Case History 9).

In July, a rock avalanche occurred at Pandemonium Creek in Tweedsmuir Provincial Park. The volume of the rock avalanche was estimated at 5 million m³ (Evans et al. 1989). It appears to have been transformed into a debris flow after energy losses involved in the run-up in Pandemonium Creek and swept down Pandemonium Creek at a velocity of between 21-38 m/s (Evans (unpublished data).

September 8-9, 1959

Event type: Mudslide.

Precipitation: Falls River (57.7 mm/1 day), September 8, 1959; Prince Rupert (66.8 mm/2 days), September 8-9, 1959.

Source: *Prince Rupert Daily News*, September 9, 1959; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

Digby Island near Prince Rupert recorded 2.63 in. (66.8 mm) of rain in 24 hours. Despite the heavy wind, no damage was reported. On the rail line between Terrace-Prince Rupert, a mudslide occurred at Mile 64.8, closing the line for three hours.

October 17-18, 1959

Event type: Debris slide.

Precipitation: Falls River (67.8 mm/2 days), October 17-18, 1959; Prince Rupert (64.0 mm/2 days), October 17-18, 1959; Terrace (28.2 mm/2 days), October 17-18, 1959.

Source: File 28-20-31 Letter, November 6, 1959 R. E. McKeown (Dist. Supt.; Prince Rupert) to J. A. Lonsbury (Safety Insurance Officer, Victoria) B.C. Ministry of Transportation and Highways, Terrace.

On October 19, a slide occurred about 0.5 mi. (800 m) west of Sunnyside. It knocked out all the communication lines and covered the rail line for several hours. According to R.E. McKeown, Highways Superintendent, it was a "direct result of our operations on the Port Edward-Cassiar Cannery Road Project No. 986."

October 26-28, 1959

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Mathews 1965 (pp. 46-52).

Between October 26-28, Strohn Lake, at the head of the Bear River valley, suddenly drained again. *1) (Mathews 1965).

*1) A sudden draining of Strohn Lake was recorded for the first time on October 19, 1958. On October 6, 1960, the lake drained again. (Mathews 1965).

October 30-November 1, 1959

Event type: Flooding and debris slide.

Precipitation: Falls River (128.3 mm/3 days), October 30-November 1, 1959; Ocean Falls (260.8 mm/3 days), October 30-November 1, 1959; Kitimat (131.3 mm/3 days), October 30-November 1, 1959; Langara (105.4 mm/2 days), October 31-November 1, 1959.

Source: *The Northern Sentinel*, November 5, 1959; *Terrace Omineca Herald*, November 5, 1959; *The Interior News*, November 5, 1959; *Ocean Falls Advertiser*, November 9, 1959; LAST Land Station Listing 1963-1983; Lewis and Moran, 1985; Letter, November 5, 1959, C. S. Shaw (Dist. Supt. Terrace) to R. G. Harvey (Reg. Eng. Prince George). B.C. Ministry of Transportation and Highways, Terrace.

Prince Rupert recorded 5 in. (127 mm) of rain and gale force winds with gusts of 50 mph (80 km/h). On October 31, a maximum wind of 50 kn. (92.5 km) was recorded. One station reported winds over 48 kn. (89 km/h) (Lewis and Moran 1985). The storm did considerable damage in the Prince Rupert-Terrace-Kitimat area. Telephone and telegraph communications were interrupted east, south, and west of Terrace. On November 1, the Granite Creek bridge on Highway 25 washed out, stranding over 100 cars for 34 hours. An 80-ft. (24 m) span Bailey bridge was

installed across Granite Creek. The overall cost to repair the washout at Granite Creek was \$2,187. Thornhill Creek overflowed, running over the road surface for a distance of 300 ft. (90 m). The road shoulders were severely scoured. Furlong Creek badly scoured the northern approach to the bridge.

In Terrace, the cover of the box drain crossing the Columbia Cellulose property collapsed in several places, causing the water to rush in an open stream to Lakelse and Greig Avenue. The Alcan power transmission line between the plant and the townsite was damaged.

Highway 16 east and west of Terrace and Highway 25 to Kitimat all had heavy washouts and trees across the road. Highway 16 had six large trees across the road and 30 to 40 trees across the highway 9 mi. (14.4 km) west of Terrace. On Highway 16 between Prince Rupert-Terrace, six slides occurred. The largest one was 35 mi. (56 km) west of Terrace.

Heavy rain on October 30-31 caused slides, creating havoc in Cousins Inlet near Ocean Falls. On October 31, a slide from a logged-off area above Wallace Bay completely demolished two summer camps belonging to Mr. and Mrs. I. Cairns and Mr. and Mrs. A.E. Corbin. Evidence was left of only one cabin. Part of one wall and the roof, lying on its side, was visible. The other building was buried in the mud and silt, or washed into the sea. The triangular-shaped slide practically matched the section that was logged off over 30 years previous. The mud and earth at the seashore was at least 30 ft. (9 m) deep. The two-log float, that was just out from the shore last summer, was partially buried and a complete loss. Several other cabins were threatened. The largest creek in the central area of Wallace Bay was jammed at the mouth, 70-100 ft. (21-30 m) into the salt water with trees, roots and stumps 3-6 ft. (0.9-1.8 m) across. The summer camp of Mr. and Mrs. E. Prosser of Thompson Bay was also obliterated indirectly by another slide or slides. It appeared at the mouth, with debris washed down from the valley beyond the building. This caused the creek, swollen by the food waters, to back up and move the house and contents into Cousins Inlet. Damage was estimated at approximately \$1,500-1,900.

Between October 31-November 1, the government experimental farm near Smithers recorded 1.53 in. (38.9 mm) of rain. High winds on November 1 damaged the Fall Fair grounds fence and lifted the old display booth section onto Highway 16. The road was closed until the debris was cleared.

November 30-December 5, 1959

Event type: Flooding and debris slides.

Precipitation: Kemano (98.0 mm/2 days), November 30-December 1, 1959; Sandspit A (121.1 mm/6 days), November 30-December 5, 1959; Ocean Falls (397.0 mm/6 days), November 30-December 5, 1959; Falls River (295.9 mm/4 days), December 2-5, 1959; Kitimat (249.4 mm/2 days), December 4-5, 1959; Kitimat Townsite (209.1 mm/2 days), December 4-5, 1959; Terrace (148.3 mm/2 days), December 4-5, 1959; Prince Rupert (112.8 mm/2 days), December 4-5, 1959; Langara (75.1 mm/2 days), December 4-5, 1959; Kemano (125.3 mm/2 days), December 4-5, 1959; Falls River (519.4 mm/10 days), December 4-13, 1959.

Source: *The Vancouver Sun*, December 7, 1959; *The Northern Sentinel*, December 10, 1959; *The Omineca Herald*, December 10, 1959; *Prince Rupert Daily News*, December 1, 5 and 7, 1959; *The Interior News*, December 10, 1959; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; File 28-20-31 No. 31 Port Edward - Cassiar Cannery Road. B.C. Ministry of Transportation and Highways, Terrace; Teletype, December 2, 1959 R. E. McKeown, Dist. Supt. to R. G. Harvey (Reg. Eng. Prince George). B.C. Ministry of Transportation and Highways, Terrace; Letter, December 10, 1959 Harvey Grier (Dist. Mgr. Terrace) to C. S. Shaw (Dist. Supt. Terrace). B.C. Ministry of Transportation and Highways, Terrace.

In the 48-hour period ending 4 a.m. on December 6, Prince Rupert recorded 4.44 in. (112.8 mm) and 60-mph (96.6 km/h) gusts. Terrace had 10 in. (254.0 mm) in 36 hours and Kitimat 5.5 in. (139.7 mm) in 24 hours or 8.5 in. (215.9 mm) in 72 hours. Heavy rain and gale force winds were reported throughout the area. More than 20 slides were reported on all roads leading into Terrace.

In Prince Rupert, winds caused property damage and many basements flooded. The winds were strong enough to scatter lumber in several yards and rip tarpaper from buildings under construction. At the Dominion Pool Hall, water rose to within a few inches of the underside of the billiard tables. Hays Creek threatened bridges in McClymont Park.

On December 2, a slide occurred on the rail line at Mile 80.3 (highway Mile 5.2) between the Sunnyside-Cassiar canneries. The shoulder of the road under construction broke away, covering the tracks to a depth of 6 to 7 ft. (1.8 to 2.1 m) over a distance of 60 ft. (18 m). Two subsequent slides happened, one of which derailed a freight train. Highways Superintendent R.E. McKeown admitted, "No doubt our operations contributed to some extent." Passenger train No. 196 was delayed at Mile 79.6 for three hours. A D-6 Cat and a 1-yd. shovel were used to clear the slide.

On December 4, a second slide came down east of the slide that happened on December 2. The rockslide at the Cassiar cannery derailed two engines and 12 loaded grain cars. On December 5, a mudslide occurred at Phelan, measuring a length of 500 ft. (150 m) and a depth of 50 ft. (15 m). It wrecked a worktrain, pushing CNR trucks, a water car and an equipment car 100 ft. (30 m) into the Skeena River. The telegraph and long distance telephone lines were knocked out. The rail line was closed for 32 hours (J. Mekechuck, pers. comm.).

In Kitimat, several road washouts occurred in town. The most serious washout occurred early on December 5, when the bank along Lahakas caved into the edge of the road. On December 5, the Kitimat River rose to near-flood

levels. Forty feet (12 m) of riverbank was eroded and a power pole was undermined. The Kildala subdivision was hit by a short power outage. Switching to the alternate line temporarily restored power. According to power company officials, this was by far the most the river has eroded in any storm. The southern transmission line between the smelter and the townsite was knocked out. Crews were working on clearing the Terrace to Kitimat road

Between December 5-7, because of slides and washouts Highway 16 and the rail line between Prince Rupert-Terrace were closed for 36 hours. Terrace was cut off east, west, and south by as many as 21 washouts. Cuts in Highway 16 measured widths of 100 ft. (30 m) and 30 ft. (9 m) and depths of 30 ft. (9 m) and 10 ft. (3 m), respectively. On Highway 16 east of Terrace, an extensive washout occurred at Hells Bells Creek. An abandoned pick-up truck ended undamaged, right side up at the bottom of a washout 10 ft. (3 m) deep and 25 ft. (7.5 m) wide. Earlier, its two occupants escaped unharmed when 35 mi. (56 km) east of Terrace, a narrow section of roadbed collapsed beneath the front wheels. The highway was still out on December 10. Flooding and many small slides occurred. At Prudhomme Lake there was 2 ft. (60 cm) of water on the highway.

Damage caused to Highway 16 required the relocation of a power pole. It necessitated an additional 10 ft. (3 m) of rock blasting of the north side of the road near the Indian Cemetery (H. Grier). On Highway 25, the southern approach to Furlong Creek bridge was undermined and flooded.

The Smithers area experienced heavy rain. Melting snow caused flooding in some low-lying areas and basements. Water levels in the Telkwa, Morice, and Bulkley rivers rose considerably. The highway bridge at Trout Creek, 14 mi. (22.4 km) west of Smithers, was damaged.

On December 4, a rock and snowslide occurred 8 mi. (12.8 km) north of Stewart. A mudslide hit two construction firm employees working on the Stewart-Cassiar road project. One of the men was killed.

December 25-26, 1959

Event type: Landslides and flooding.

Precipitation: Masset (76.2 mm/2 days), December 25-26, 1959; Sandspit A (55.6 mm/1 day), December 26, 1959; Falls River (77.2 mm/1 day), December 26, 1959; Kitimat (72.4 mm/1 day), December 26, 1959; Kitimat Townsite (62.5 mm/1 day), December 26, 1959.

Source: Telegram, R. E. McKeown (Dist. Supt. Prince Rupert) to R. G. Harvey (Reg. Eng. Prince George). B.C. Ministry of Transportation and Highways, Terrace.

On the Queen Charlotte Islands, the Port Clements to Masset road was closed by slides and washouts caused by the December 27 storm. L. Lilienweiss, Highways Foreman at Port Clements, reported a slide that occurred on the "toe hill (Tow Hill) road."

March 11-18, 1960

Event type: Snow avalanches.

Precipitation: Falls River (305.6 mm/7 days), March 12-18, 1960; Kitimat Townsite (368.9 mm/6 days), March 13-18, 1960; Langara (35.3 mm/1 day), March 16, 1960; Prince Rupert (91.7 mm/2 days), March 16-17, 1960.

Source: *The Northern Sentinel*, March 17, 1960; *Prince Rupert Daily News*, March 16, 1960.

In Kitimat, 4 in. (101.6 mm) of rain fell in 38 hours, followed by 12 in. (30.5 cm) of snow. Highway 16 and the rail line between Prince Rupert-Terrace were closed by a series of snowslides. On March 16, Highway 16 west of Terrace was hit by snowslides four times. One slide about 2 mi. (3.2 km) east of Kwinitsa measured a length of 100 ft. (30 m) and a depth of 20 ft. (6 m). During March 16-17, two more slides came down. Both the highway and rail line were reopened on March 17.

September 7, 1960

Event type: Fatal debris slide.

Precipitation: Not available.

Source: *The Citizen*, September 8, 1960; *The Vancouver Sun*, September 8, 1960.

On September 7 at 9:45 a.m., a landslide came down a steep ravine 18 mi. (28.8 km) west of McBride. The 10-ft. (3 m) high mud and debris slide killed three of the highway construction workers. The swiftly moving rubble broke two-thirds of the way up of the 125-ft. (37.5 m) ravine. Another man was injured while fifth man escaped. The slide was between 60-100 ft. (18-30 m) wide as it plunged down the steep slopes of the about 150-ft. (45 m) deep ravine. The debris was about 30 ft. (9 m) deep. The slide occurred in loose clay and carried stumps and trees but little rock.

The injured man was caught by the edge of the slide and was "rolled over a couple of times." The five-man crew was clearing bush for a highway roadbed when a section of the slope gave way. Other members of the crew, which numbered about 20, were working nearby. The men were working for Ben Ginter Construction Company of Prince George on the building of a new section of Highway 16.

The uninjured man later said, "There was only a split second warning when the slide started, and I just happened to jump the right way. One of the men who disappeared was right beside me." One body was recovered right after the slide came down. Because of the danger of another slide, recovery work of the bodies of a father and son by 40 men were halted at dusk on September 7.

October 5, 1960

Event type: Flooding.

Precipitation: Not available.

Source: *Victoria Daily Times*, October 8, 1960.

On October 5, the Bear River overflowed its banks, cutting away large sections of the Cassiar road near Stewart. Most of the road would have to be rebuilt. John Greer, superintendent of the Dawson, Wade and Emil Anderson construction company, reached Stewart after walking in from the Bear Pass construction camp. It also left a road construction camp housing 50 people at Snow Lake, 21 mi. (33.6 km) north of Stewart isolated.

October 6, 1960

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Mathews 1965 (pp. 46-52); Evans (unpublished data).

On October 6, Strohn Lake, at the head of the Bear River valley, suddenly drained, causing considerable flood damage to a road under construction from Stewart through Bear River Pass. *1) The volume of water released in the flood was estimated at 400 million ft.³ (11,320,000 m³) (Mathews 1965).

*1) A sudden draining of Strohn Lake was recorded for the first time on October 19, 1958. Between October 26-28, 1959, the lake drained again (Mathews 1965). Between 1961-1963, trenches were cut on several occasions across the ice and in surficial materials to lower the level of the lake and reduce the pressure on the ice dam. These measures, however, did not prevent significant jökulhlaups (approximate volume of 11.3 million m³) occurring in 1961 and 1962. (Mathews 1965; Evans (unpublished data).

October 13-16, 1960

Event type: Severe storm.

Precipitation: Smithers (62.2 mm/3 days), October 13-15, 1960; Falls River (81.8 mm/1 day), October 14, 1960; Aiyansh (50.8 mm/1 day), October 14, 1960; Langara (30.7 mm/1 day), October 14, 1960; Prince Rupert (65.8 mm/1 day), October 14, 1960; Ocean Falls (123.2 mm/1 day), October 14, 1960; Terrace (48.5 mm/1 day), October 14, 1960; Kitimat Townsite (113.1 mm/2 days), October 14-15, 1960; Kitimat (120.1 mm/2 days), October 14-15, 1960; Smithers A (66.4 mm/3 days), October 14-16, 1960.

Source: *Northern Sentinel*, October 20, 1960; *Prince Rupert Daily News*, October 17, 1960; *The Interior News*, October 20, 1960; Environment Canada 1991; MAST Ship Listing 1946-1983; Lewis and Moran 1985.

Prince Rupert reported a southeast gale with winds of 60 mph (96.6 km/h) gusting up to 70 mph (112.7 km/h). On October 14, the maximum wind recorded was 65 kn. (120 km/h). The number of MAST observations with winds over 48 kn. (89 km/h) was four (Lewis and Moran 1985). The storm caused a break in Prince Rupert's power supply. The F.E. Hunt Building on the waterfront between Babcock Fisheries and the Northern Fisherman's Cold Storage was blown down. The 42-year-old pioneer building collapsed and was totally wrecked.

Heavy rain over the weekend was reported from Kitimat. The Kitimat River came to near flood levels, taking stumps and whole trees downstream. On October 15, the Zymagotitz River recorded a maximum instantaneous discharge of 5,560 cfs (157 m³/s) (Environment Canada 1991).

On October 14-15, the government experimental farm near Smithers recorded over 2 in. (50 mm) of rain in 48 hours, making it a near record rainfall. Overnight 2 in. of rain fell in 12 hours. The rain followed high winds that reached 60 mph (96 km/h). The King Street drainage flume blocked, causing water to back up and overflow the ditch for a full block along Railway Avenue.

January 12-14, 1961

Event type: Landslide.

Precipitation: Falls River (125.2 mm/3 days), January 12-14, 1961; Ocean Falls (183.4 mm/2 days) January 13-14, 1961.

Source: *Ocean Falls Advertiser*, January 23, 1961.

On January 13 at 11:00 p.m., a slide blocked the road between Ocean Falls-Martin Valley. A log, approximately 2 ft. (60 cm) in diameter, slid down the mountainside on the highway at the entrance of the bridge. It fell against the guy line of a power pole, cutting electricity to Martin Valley. Ocean Falls was without power for 3.5 hours, after two lines shorted outside No. 5 Apartment. Heavy rain and gale force winds on January 13 caused very little damage at Ocean Falls and Martin Valley, compared to Vancouver Island and the Mainland. During the storm, all gates were open at the dam.

February 4-5, 1961

Event type: Flooding.

Precipitation: Falls River (131.8 mm/2 days), February 4-5, 1961; Terrace (121.4 mm/2 days), February 4-5, 1961; Kitimat Townsite (161.0 mm/2 days), February 4-5, 1961; Prince Rupert M. Circ (101.4 mm/2 days), February 4-5, 1961.

Source: *Terrace Omineca Herald*, February 9, 1961; *The Northern Sentinel*, February 9, 1961.

The Kitimat River flooded its banks, causing washouts in Kitimat on Haisla Boulevard at the overpass. The washout started above the roadway on the Haisla Hill, taking out part of the bank on the south side, west of the overpass. Municipal crews and equipment sandbagged the washout. The Kitimat River littered its banks with ice and debris.

On the airport road near Terrace, one pier on the northern approach of the Thornhill bridge was carried away. The Lakelse section of the highway had two near-washouts. Two culverts were put in.

October 1-4, 1961

Event type: Flooding.

Precipitation: Aiyansh (90.7 mm/3 days), October 1-3, 1961; Prince Rupert (123.4 mm/4 days), October 1-4, 1961; Stewart (240.8 mm/4 days), October 1-4, 1961; Kitimat Townsite (106.0 mm/2 days), October 2-3, 1961; Falls River (143.5 mm/2 days), October 2-3, 1961; Prince Rupert M. Circ (168.6 mm/4 days), October 2-5, 1961; Terrace (57.2 mm/2 days), October 3-4, 1961; Kitimat Townsite (49.5 mm/1 day) October 3, 1961.

Source: *Northern Sentinel*, October 5 and 12, 1961; *Prince Rupert Daily News*, October 4 and 5, 1961; *Terrace Omineca Herald*, October 5, 1961; *The Vancouver Sun*, October 4, 1961; *The Daily Colonist*, October 5 and 6, 1961; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; Meziadin Environment Advisory Team 1975 (Vol. 4 Appendix C1.1); B.C. Ministry of Public Works 1963 (p. J 104).

Stewart recorded 12 in. (304.8 mm) of rain in 48 hours, Kitimat 3.5 in. (88.9 mm) in 48 hours, and the Terrace airport 2.5 in. (63.5 mm) in 24 hours.

On October 3, floodwaters washed out the approaches to four bridges on Highway 16 west of Terrace and two bridges on Kalum Lake Road (B.C. Ministry of Public Works 1963). Highway 16 was closed to traffic for 24 hours, stranding dozens of travelers between Prince Rupert-Terrace. It was hoped to reopen the highway to one-way traffic on October 5.

The bridges at Scree Creek and Marble Creek, 8.9 mi. (14.2 km) and 7.1 mi. (11.4 km) west of Terrace, respectively, washed out. The bridge at Marble Creek had to be replaced. The bridges at Shames River and Delta Creek were undermined. On Highway 16 east of Terrace, the bridge at Boulder Creek, 6 mi. (9.6 km) east of Cedarvale, washed out. Traffic was detoured over the old bridge, which had a 10-ton load limit. On Kalum Road, the approaches at Glacier Creek washed out. On October 8, a rockslide occurred in the Nass Valley at Mile 46 on the Columbia Cellulose Road, stranding 25 motorists.

CNR reported three washouts at Mile 9.7, Mile 11.5, and Mile 12 on the rail line between Prince Rupert-Terrace. The line was closed for nine hours (J. Mekechuck, pers. comm.).

Stewart was isolated when the dam in the Bear River broke and flooded. The river broke its retaining walls and cut parts of the Stewart-Cassiar highway under construction. Stewart sustained heavy property damage and several residents had to be evacuated. Several airstrips were reported damaged. Several washouts occurred and two bridges were damaged.

October 10-14, 1961

Event type: Rain-on-snow flooding.

Precipitation: Stewart (436.6 mm/5 days), October 10-14, 1961; Aiyansh (46.7 mm/1 day), October 12, 1961; Kitimat Townsite (83.1 mm/1 day), October 12, 1961; Kitimat (103.9 mm/1 day), October 12, 1961; Kitimat (166.7 mm/3 days), October 12-14, 1961; Falls River (129.6 mm/3 days), October 12-14, 1961; Prince Rupert (42.7 mm/1 day), October 13, 1961; Langara (99.1 mm/2 days), October 13-14, 1961.

Source: *Northern Sentinel*, October 19 and November 2, 1961; *Prince Rupert Daily News*, October 16, 17, 18 and 19, 1961; December 18, 1961; *The Daily Colonist*, October 17, 1961 and September 23, 1962; *Terrace Omineca Herald*, October 19, 1961; *The Province*, October 17 and 18, 1961; *The Vancouver Sun*, October 17 and 18, 1961; *The Colonist*, October 18, 1961; *The Times*, November 25, 1961; *The Daily Alaska Empire*, October 13, 16 and 17, 1961; Meziadin Environmental Advisory Team 1975 (Vol. 3, part II p. 4.9); B.C. Ministry of Public Works 1963 (p. J 104); Water Survey of Canada; John Wright, pers. comm. Road and bridge foreman, Terrace.

Between October 10-14, 1961, Kitimat recorded 5.5 in. (139.7 mm) of rain in 96 hours. The storm, with heavy rain, warm temperatures, and freak winds, swept down from Atlin, causing flash floods.

On October 13, extreme high water again washed out three bridge approaches on Highway 16 west of Terrace and one bridge approach on Kalum Lake Road, closing the roads for seven hours. One-half mile (800 m) of roadway was destroyed on Kalum Lake Road, and numerous washouts occurred on many side roads. High water also caused four major washouts on Highway 16 east of Terrace, closing the road for 15 hours (B.C. Ministry of Public Works 1963).

The Nass River flooded, cutting off Greenville and Aiyansh. It was the largest recorded flood on the Nass River. On October 14, the river rose 11 ft. (3.3 m) during the afternoon and evening. The Nass River Water Survey of

Canada station near Aiyansh set a record peak stage of 32.22 ft., with a maximum discharge frequency of 1 in 63 years (Meziadin Environmental Advisory Team 1975). In some of the entrenched sections of the river, the water rose about 60 ft. (18 m) above the low water level. On October 15, the Nass River above Shumal Creek recorded a maximum daily discharge of 9,460 m³/s (Environment Canada 1991).

On October 16, flash floods ripped through the remote Native Indian fishing villages of Aiyansh and Greenville, leaving more than 100 residents homeless. The heavy rains, coupled with snow-melting warm winds, caused an estimated 20-ft. (6 m) surge in the Nass River. The nearby village of Canyon City, moved to higher ground after a serious flood in 1936, escaped flood damage. According to Jack McFarlane, district superintendent of Indian Affairs, who flew over the stricken area, debris from Aiyansh was scattered 2 mi. (3.2 km) downstream. He said 15% of the village of 500 was destroyed, and another 65% heavily damaged. Most of the village flooded with water up to 12 ft. (3.6 m). Fourteen homes were swept away and 17 others damaged. Two schools and two churches served as temporary accommodation for the about 100 homeless residents. Over 70 other buildings, including two schools and the Indian Health Services Station were badly damaged. *1) Floodwaters left more than 6 in. (15 cm) of silt in one of the schools.

In Greenville, 25 mi. (40 km) downstream from Aiyansh, three houses were lifted off their foundations. Sixty homes were flooded, but escaped destruction because they were built on pilings 3 ft. (90 cm) above the ground. At the crest of the flood, about two-thirds of Greenville was under water. In Greenville the school was closed. The school, which is on high ground, was used to house evacuated residents. The village wharf was swept away and the bridge to the sawmill washed out. Much of Greenville's winter supply of fish and meat was lost. The Greenville-Canyon City road was completely under water. According to R.C. Telford, manager for the Columbia Cellulose woods division, logging roads connecting Terrace with the villages washed out. The logging company ferried 2 tons of blankets and clothing, donated by the citizens of Terrace, across the Nass River to Aiyansh. L.S. Hewer, B.C. Commissioner for the Red Cross Society, arranged help in event of a food shortage among the flood victims of the Nass area.

The log drive on the Lower Nass River suffered heavy losses because a large amount of logs ended up in the ocean. At Stony Point, a Can Cel crane-shovel was flooded, sustaining \$40,000 damage. The bridge across Ginluklak Slough, west of Greenville on the south bank of the Nass River, floated off its pilings. The complete bridge, including stringers, ended up downstream near Kincolith. A large section of the bridge was towed back with a tug. Efforts to put it back into place failed after the water levels had receded. The bridge under construction across the Kiteen River, below the junction with the Cranberry River, washed away. Construction on the 180-ft. (54 m) long bridge, including approach work, had started at the end of September. Because the bridge was built using a skidrig piledriver, false work was required every 16 ft. (4.8 m) to support the sleigh. When the water levels rose, there was no room for drift. With the exception of a few pilings near the shore, everything was washed away. One of the stringers ended up on the porch of the new school at Aiyansh, which was built on an old river channel (J. Wright, pers. comm.). *2)

The Kitimat River rose 10.3 ft. (3.1 m) above its normal level to an elevation of 50.3 ft. (15.1 m). It changed course and cut through its banks 14 mi. (22.4 km) north of Kitimat. Highway 25 required 1,000 ft. (300 m) of road rebuilding and 3,000 ft. (900 m) of channel work. The road was closed for one day until a detour could be constructed. On October 14 and again on October 15, the Alcan power line to the Kitimat townsite was cut. The BC Hydro transmission line to Terrace was cut below Kildala. BC Hydro reported that the river came to within 25 ft. (7.5 m) of the transmission poles. Early on October 13, the approach to the northern dock was blocked when a gravel bank washed out. Gravel fill from the foundations of the British American Oil Company's warehouse washed out.

*1) The village of Aiyansh, partially devastated by the flood of October 1961, was again relocated. In a secret ballot, 102 residents voted for, and 3 against, relocation. A tentative site was selected on higher ground south of the river (John M. McFarlane, Indian Affairs Branch, Terrace). This third settlement of Aiyansh is called New Aiyansh.

*2) The original settlement of Old Aiyansh was built on a site approximately 3 mi. (4.8 km) away at the foot of a back channel parallel to the main river. After the 1917 flood it was moved to a new location. Some of the buildings were cut in sections and moved on rollers using manpower and horses. After moving them through an old back channel, which had to be cleared of brush, they were rebuilt on higher ground. Some of the buildings, including the school, were built on an old back channel (J. Wright, pers. comm.).

October 21-22, 1961

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Mathews 1965 (pp. 46-52).

Between October 21-22, Strohn Lake suddenly drained, again causing serious damage to the road. *1) The volume of water released in the flood was estimated at 400 million ft.³ (11,320,000 m³). It is not known whether the flood was triggered by the exceptionally heavy storm that dumped 11.97 in. (304.0 mm) on Stewart on October 12-13. The flood occurred eight days later during a cool, cloudy period. Destruction caused by the floods has been

concentrated on the Bear River Pass Road and on engineering structures at the Bear River Delta. Cost of reconstruction and remedial action had reached about \$150,000 by 1963 (Mathews 1965).

*1) About August 13, 1962, the lake broke out under the ice for the fifth known time (Mathews 1965).

October 29-31, 1961

Event type: Flooding and landslides.

Precipitation: Aiyansh (84.8 mm/2 days), October 29-30, 1961; Falls River (95.3 mm/1 day), October 30, 1961; Prince Rupert M. Circ (102.4 mm/1 day), October 30, 1961; Prince Rupert (72.2 mm/2 days), October 30-31, 1961; Stewart (152.4 mm/2 days), October 30-31, 1961; Prince Rupert (47.8 mm/1 day), October 31, 1961; Terrace (48.3 mm/1 day), October 31, 1961.

Source: *Prince Rupert Daily News*, October 31, November 1, 1961; *Terrace Omineca Herald*, November 1, 1961; MAST Ship Listing 1946-1983; Lewis and Moran 1985; Environment Canada 1991.

On October 29, the maximum wind was 55 kn. (102 km/h). The number of MAST observations of winds over 48 kn. (89 km/h) was two (Lewis and Moran 1985). The storm affected the rail, road, and telephone links. The telephone line between Terrace-Kitimat was cut. In the evening of October 31, Prince George was hit by winds gusting to 80 mph (128 km/h). A power pole was toppled in front of the Civic Centre, delaying the traffic.

Highway 16 was closed by slides and flooding. On October 30, west of Terrace, four bridges washed out. A slide measuring a length of 60 ft. (18 m) and a depth of 8 ft. (2.4 m) occurred near Kwinitsa. A bridge approach 12 mi. (19.2 km) west of Terrace washed out and further damage occurred. The highway was flooded near Prudhomme Lake.

On October 31, the Zymoetz River near Terrace recorded an instantaneous maximum discharge of 17,500 cfs (495.5 m³/s) (Environment Canada 1991). On Highway 16 east of Terrace, the bridge near Hazelton was damaged and a 6-ft. (1.8 m) culvert was swept from its moorings. Washouts occurred at points 10 and 12 mi. (16 km and 19.2 km) east of Terrace. In one location, 150 ft. (45 m) of a full width of highway washed away. The Terrace Ministry of Highways Road Superintendent Carl Shaw stated, "I have never seen so much water come down so fast in all my experience." He felt sure that 10 in. (250 mm) of rain had fallen in 48 hours (*Terrace Omineca Herald*).

On the rail line between Prince Rupert-Terrace, a 20 ft. (6 m) long washout occurred at Mile 10.2, 10.7, and three other places between Mile 12-13. On November 1, both the highway and rail line reopened. On November 1, crews were still working in the Kwinitsa slide area. On the rail line between Terrace-Kitimat, a mudslide occurred at Mile 25.9.

December 26-28, 1961

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: *The Daily Colonist*, December 29, 1961; *The Province*, December 2, 1965; Mathews 1965 (pp. 46-52); Mathews 1973 (pp. 99-110); Mathews and Clague 1993.

Summit Lake, north of Stewart, suddenly drained southward under the ice, creating a catastrophic flood in the Salmon River. The water forced its way south under Salmon Glacier for a distance of 8 mi. (12.8 km) into the Salmon River. From the time of the first surveys, around the turn of the century, Summit Lake had drained northward into the upper Bowser River. This lake, impounded by Salmon Glacier, is the largest self-draining, ice-dammed lake in Canada (Mathews and Clague 1953). In the many self-dumping lakes in northern British Columbia and Alaska, the dumping process usually occurs in summer at the height of the melting season.

Of this first jökulhlaup event from Summit Lake under Salmon Glacier near Stewart, in its 60 years of recorded history, only the flood of Salmon River below the glacier was witnessed. The Nine Mile bridge across the Salmon River had part of the bridge deck carried away. The steel-truss bridge that provided access to local mineral prospects in Alaska was written off. (Mathews and Clague 1993). The structure was finally destroyed in 1967 (Mathews 1973).

Though the river was reported to have been unusually muddy as early as December 22, eyewitness accounts indicate that the flood began about December 26. The river rose rapidly on December 27, cresting in the afternoon of December 28, at which time it was choked with icebergs. On the afternoon of December 29, the river subsided rapidly. By 4 p.m. that day the river was down almost to normal winter flow, though it remained muddy.

At the time of the flood, nobody observed the lake. A few days later, it was checked and found empty. At the time the draining started, the volume of the lake was estimated to have been 5-6 billion ft.³ (141-170 million m³), most of which was discharged in three days. The mean discharge during this period can be computed at somewhat more than 20,000 cfs (556.3 m³/s), with a peak discharge at perhaps twice as much.

The flooding caused heavy damage to roads, bridge, and protective works along the riverbanks and delays and inconvenience to mining activities upstream. The total cost could not be reliably appraised, but full restoration of all services may have exceeded \$200,000. Though Summit Lake itself was not observed during the flood, an aerial survey conducted a few days later found the lake to be empty except for scattered icebergs. One observer reported a tunnel entrance at the southwest corner of the lake, through which the water apparently had escaped (Mathews 1965).

*1)

Floodwaters cut the Stewart to Hyder highway. The border town of Hyder, situated on the tidal flats at the head of Portland Canal, was saved by 7 ft. (2.1 m) of snow on the ground. Though the floodwaters swept over a protective dyke, residents bulldozed the snow in temporary barriers that absorbed much of the water. The flooding was blamed on the excessive record snowfalls during November and December. Snowfalls at both Stewart and Hyder were measured at more than 18-ft. (5.4 m) with 50 ft. (15 m) being recorded at Premier. (*The Daily Colonist*, December 29, 1961). Floodwaters cut the road to Premier, closing operations at the Silbak Premier Mines.

*1) From the time of the earliest surveys, around 1900, until 1961 Summit Lake was effectively dammed on the south by Salmon Glacier (Mathews 1965).

January 23-February 2, 1962

Event type: Snow avalanches.

Precipitation: Prince Rupert (87.9 mm/2 days), January 23-24, 1962; Bella Coola (258.6 mm/5 days), January 23-24, 26-28, 1962; Falls River (333.0 mm/6 days), January 23-28, 1962; Ocean Falls (919.7 mm/11 days), January 23-February 2, 1962; Kemano (194.9 mm/3 days), January 26-28, 1962; Kitimat Townsite (149.6 mm/3 days), January 26-28, 1962; Aiyansh (167.1 mm/3 days), January 26-28, 1962; Prince Rupert M. Circ (283.9 mm/6 days), January 26-31, 1962; Sandspit A (32.0 mm/1 day), January 27, 1962; Langara (55.5 mm/2 days), January 29-30, 1962.

Source: *The Prince Rupert Daily News*, January 26, 29, 30 and 31, 1962; *Terrace Omineca Herald*, January 31, 1962; *The Vancouver Sun*, January 29, 1962; B.C. Ministry of Public Works 1963 (p. J 104); B.C. Ministry of Transportation and Highways 1980; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

At the end of January, the Terrace area experienced heavy snowfall and extreme thawing conditions. Slides occurred at Kwinitsa and 34 mi. west of Terrace. The Telegraph lines went out and Highway 16 and the rail line were closed. The Department of Highways worked 24-hour shifts. On January 26, 30 in. (76.2 cm) of snow fell overnight on Highway 16 west of Terrace. On January 27, two snowslides came down 40 mi. west of Terrace, closing both the highway and rail line to traffic for four days. When the slide was cleared away, nine large tractors continued clearing the snow from the highway, which was open only to single-lane traffic for over 65 mi. (104 km) (B.C. Ministry of Pubic Works 1963). January 26 was the beginning of a series of minor snowslides between Prince Rupert-Terrace. On January 26, the Shames River bridge was closed for repairs. Drift ice had struck the piling, damaging one bent. On January 27, a snow, mud, and rockslide, measuring a length of 1,000 ft. (300 m) and depth of 20 ft. (6 m), closed Highway 16. The highway was reopened for one-lane traffic on January 31.

CNR reported seven snowslides and a derailment at Mile 39.9. On January 29, two snowslides occurred at the tunnel at the slide path Tunnel, 64.0 km. (Mile 39.9). An eastbound freight train derailed when it hit a snowslide at the west end of the tunnel. The locomotive jumped the tracks onto the highway. A work train dispatched from Terrace was hit by a second slide, which extended over 1,000 ft. (300 m) and covered both ends of the tunnel. Two bulldozers were buried under 15 ft. (4.5 m) of snow. A locomotive and two bunk cars of the work train were swept into the Skeena River. An avalanche caught one member of the work crew. Two others were injured; one of whom was swept into the Skeena River. Locomotive engineer Arthur H. Staiger of Prince Rupert clung to an ice floe for 20 minutes before being rescued. Extensive damage was done to the snowplow, engine, and spreader. The line was closed for 40 hours. Over 30 in. (75 cm) of snow fell at Kwinitsa overnight January 26-27. The rail traffic was resumed on January 30.

February 4-7, 1962

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Province*, February 6, 1962; *The British Columbian*, February 6, 1963; *The Vancouver Sun*, February 5, 7 and 8, 1962; *The Citizen*, February 4 and 8, 1963.

Early February Quesnel was plagued by floods after unseasonably mild temperatures caused the Fraser River to break up prematurely and to form huge icejams. The previous week's warm temperatures of 45° F (7.2° C) caused the ice to move and pile up in a huge jam 2 mi. (3.2 km) south of town. Late on February 3, the ice-jammed Fraser River started rising and flooding low-lying areas in West Quesnel. It spilled its banks in low areas of western Quesnel. About 400 West Quesnel residents were evacuated. The icejam and subsequent flooding caused \$40,000 damage.

On February 4 at 3 a.m., firemen with boats evacuated about 35 people from a riverbank trailer court. River levels dropped and then rose again. Early on February 5, it was 15 ft. (4.5 m) above normal. The river level reached the sewer outlet, blocking sewage from the business area. *1) Highways crews already dynamited the 5-mi. (8 km) icejam when it threatened the Fraser River bridge connecting Quesnel and West Quesnel. According to Al Slater, district superintendent of highways, the distance from the top of the ice to the top of the bridge piers was only 10 ft. (3 m) while the normal distance is 25 ft. (7.5 m).

On February 5 at 2 a.m., when the river started rising again more than 100 people were forced to leave their homes in low-lying areas. Late on February 6, more than 500 people were ordered to leave their homes as a new icejam caused extensive flooding of low-lying areas. Mayor Alec Fraser declared the state of emergency. As water backed up from an icejam 14 mi. (22.4 km) south of Quesnel, the Fraser River rose 20 ft. (6 m) in seven hours.

On February 5, three men narrowly escaped when the huge icejam broke from under them as a mountain of ice was swept downstream by a 15-ft. (4.5 m) crest of water built up behind it. The explosives expert and two Department of Highways employees had gone on the frozen river in a second attempt to blast free the icejam that was threatening a bridge and sections of Quesnel. The men rode it down river on a big piece of ice and later managed to jump to shore. The river level dropped 15 ft. (4.5 m) in an hour, ending all threats of more serious flooding.

Earlier, a charge of 60 sticks of dynamite had been set off 2 mi. (3.2 km) downriver from the bridge linking Quesnel with west Quesnel. The explosion appeared to have no effect on the pile-up of ice that had backed up the river for more than 5 mi. (8 km). Preparations were made to set off a second and third charge.

By 1 a.m. on February 7, the river started dropping. As the jam slowly moved downstream, by 8 a.m. that day the river level was back to normal. According to Mayor Fraser, the 7-mi. (11.2 km) long, 500-ft. (150 m) wide and 30-ft. (9 m) high icejam caused an estimated damage to private homes and properties of \$35,000. It cost the municipality an additional \$5,000 to battle the flooding.

*1) The town's residential area was on septic tanks. (*The Vancouver Sun*, February 5, 1962).

February 28, 1962

Event type: Rockslide.

Precipitation: Prince Rupert (nil), February 22-28, 1962; Terrace (nil), February 22-28, 1962.

Source: J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

CNR reported a rockslide at Mile 73, measuring a length of 50 ft. (15 m) and a depth of 8 ft. (2.4 m). The line was closed for 15 hours.

May 24 and June 7, 1962

Event type: Clay flowslides.

Precipitation: Not applicable.

Source: *Northern Sentinel*, May 31, June 14, 1962; *Terrace Omineca Herald*, May 30, June 6 and 13, 1962; Clague 1984 (p. 60); Evans 1982.

Sensitive glaciomarine mud liquefied, caused two large mudflows at Lakelse Lake. *1) The more northerly of the two destroyed part of a provincial campsite and damaged the highway. The Lakelse Provincial Campsite had about 95% of its \$100,000 picnic grounds destroyed. Fortunately, the slide happened early in the season. Almost 1 mi. (1.6 km) of the old road and new highway construction was wiped out. The Lakelse Hotsprings, located 1.5 mi. (2.4 km) from the first and 4 mi. (6.4 km) from the second slide, remained undisturbed. The slide that occurred on May 24, about 13 mi. (20.8 km) south of Terrace, between Granite-Furlong Creeks, wiped out some 600 yd. (540 m) of highway. It moved over a distance of 1.5 mi. (2.4 km) and had large fissures 30 ft. (9 m) deep, 10-12 ft. (3-3.6 m) across. The movements occurred on very nearly level ground (Evans 1982). Vancouver-bound passengers were transported from Kitimat by boat and bus to the Terrace airport. They detoured by boat from a point on Lakelse Lake south of the slide area to Water Lily Bay Cabin landing, 2 mi. (3.2 km) further up the lake. From here a bus from Terrace met them. Starting June 2, CNR ran a special passenger service between Terrace-Kitimat. Because of the power outage, Terrace had to switch to local auxiliary sources. The road was reopened to traffic on May 29.

On June 7, the second slide came down wiping out almost a mile of the new Highway 25. Six BC Hydro powerpoles came down, causing a power outage in Terrace. Road building equipment was overturned and partially buried in the mud but there were no casualties. The operators of two pieces of heavy equipment belonging to Peter Kiewiet Ltd. working on the new highway escaped. The machines disappeared with the slide.

*1) There is evidence that one of these failures may have been related to the placement of a spoilbank about 365 m long and 3 m high (Evans 1982).

June 26-27, 1962

Event type: Spring runoff flooding.

Precipitation: not applicable.

Source: *The Vancouver Sun*, June 27 and 28, 1962; *The Interior News*, July 4, 1962.

Heavy 24-hour rain on June 26 caused Buck Creek to flood its banks. Floodwaters from the creek threatened a number of houses, and rail and highway bridges west of Houston. Several buildings and trailers were completely surrounded by water. Several families, including Borgenson's on 10th Street, had to temporarily vacate their homes. Hardest hit was the Christian Reformed Church and adjacent parsonage to which considerable damage resulted. As the creek washed out the bank to within a few feet of the new skating rink, the pumphouse of the rink swept away.

Debris buildups threatened the CNR railway bridge and a highway bridge for a while. Highway 16 was temporarily closed after the creek undermined the west approach of the bridge. Emergency repairs by the Highways Department saved the bridge from going out completely. Sandbagging helped preventing the shoulders of the highway to wash out.

The Morice and Telkwa rivers rose rapidly. Floodwaters came close to reaching Telkwa's Main Street, overflow Eddy Park and threaten a riverbank home. Some low-lying farmlands along the river were inundated. Driftwood Creek flooded and caused washing out two bridges and a section of the road near Harvey Ranch. The Federal Fisheries hatchery on the Nanika River was reported to have been threatened.

Early on June 27, Saul Creek spilled its banks, washing out Highway and the CNR line. The creek, which runs through Burns Lake, also flooded five homes and cutting off and closing three schools in Burns Lake. The flooding was caused by 4 in. (100 mm) of rain in 36 hours. Inadequate culverts under two roadways, a local road and Highway 16, backed up the fast flowing creek waters. Some village streets were covered with 6-18 in. (15-45 cm) of water. At the height of the flood, the creek was 25 ft. (7.5 m) deep in some places and up to 75 ft. (22.5 m) wide. *1) A temporary bridge was constructed across Highway 16. Another temporary bridge was erected across Highway 16 over a washout 16 mi. (25.6 km) east of Burns Lake at Tibbets Creek.

Though Saul Creek washed out a local road, it was dammed up by Highway 16. A section of Highway 16 was bulldozed out to allow the creek to run though and diverted its old bed past the elementary school. To permit the construction of a playground, the creek was originally diverted. The Burns Lake schools, the local secondary and a Catholic school, were expected to reopen on June 28. Because of the danger of Saul Creek undermining the building, the elementary school would stay closed.

While crews worked to repair a washout at Decker Lake, 6 mi. (9.6 km) west of Burns Lake, two CNR trains were delayed. Floodwaters washed out 15 ft. (4.5 m) of track at almost the same time as crews were repairing an earlier washout at Tintagel 6 mi. east of Burns Lake.

At Tintagel, two homes were swept from their foundations into a raging creek. Another home was flooded at Decker Lake. A number of sections of road along the 16-mi. (25.6 km) stretch between Tintagel-Decker Lake were also threatened.

*1) Saul Creek is usually 8-12 ft. (2.4-3.6 m) wide and 2-3 ft. (60-90 cm) deep. (*The Vancouver Sun*, June 27, 1962).

Ca. August 13, 1962

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Mathews 1965; Grove 1971; Evans (unpublished data).

Around August 13, Strohn Lake broke out under the ice for the fifth known time (Mathews 1965). *1)

*1) On July 23, 1967, Strohn Lake ceased to become an ice-dammed lake when the toe of the Bear Glacier melted through (Grove 1971), eliminating the jökulhlaup hazard in the Bear River valley until further glacier advance (Evans (unpublished data).

August 19-20, 1962

Event type: Debris slide.

Precipitation: Aiyansh (55.6 mm/1 day), August 19, 1962; Kemano (41.4 mm/1 day), August 19, 1962; Ocean Falls (141.7 mm/1 day), August 19, 1962; Falls River (131.2 mm/2 days), August 19-20, 1962; Prince Rupert (111.2 mm/2 days), August 19-20, 1962.

Source: *Prince Rupert Daily News*, August 20 and 21, 1962.

In Prince Rupert, 6.94 in. (176.3 mm) of rain fell in 96 hours. On August 20, a slide occurred near the North Pacific-Cassiar canneries, closing the road and rail line. One truck and two cars were buried by the slide, which narrowly missed a row of cannery houses. The slide was cleared the same day but washed out the next day. Wolf Creek rose 3-5 ft. (0.9-1.5 m) overnight, flooding a house across from the pulpmill.

September 16-17, 1962

Event type: Flooding.

Precipitation: Falls River (74.7 mm/1 day), September 16, 1962; Prince Rupert (95.5 mm/2 days), September 16-17, 1962.

Source: *Prince Rupert Daily News*, September 17, 1962.

Prince Rupert recorded 1.43 in. (36.3 mm) of rain in six hours or 4.7 in. (119.4 mm) in 48 hours. Highway 16 flooded in four places near the old city dump.

September 29-30, 1962

Event type: Rockslide.

Precipitation: Falls River (55.1 mm/1 day), September 29, 1962; Kitimat Townsite (51.8 mm/1 day), September 29, 1962; Terrace (47.5 mm/2 days), September 29-30, 1962; Kemano (98.3 mm/2 days), September 29-30, 1962; Ocean Falls (155.4 mm/2 days) September 29-30, 1962.

Source: J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

CNR reported a rockslide at Mile 13.9, which closed the rail line for 13.5 hours.

October 15-17, 1962

Event type: Flooding.

Precipitation: Aiyansh (86.1 mm/2 days), October 15-16, 1962; Falls River (111.6 mm/2 days), October 15-16, 1962; Kemano (74.5 mm/2 days), October 15-16, 1962; Kitimat (135.6 mm/3 days), October 15-17, 1962; Ocean Falls (158.2 mm/2 days), October 16-17, 1962.

Source: *Northern Sentinel*, October 18, 1962; Environment Canada 1991; Meziadin Environmental Advisory Team 1975 (Vol. 3, Fig. 4-9).

Kitimat recorded 3.73 in. (94.7 mm) of rain in 48 hours. The Kitimat River rose 10 ft. (3 m) in 36 hours. Radley Park had the two lower roads on either side of the bridge washed out, marooning a camper truck. The Kitimat dump road was closed, as there was 3 ft. (90 cm) of water across the bridge. On October 17, the Zymoetz River at Terrace recorded an estimated maximum daily discharge of 850 m³/s. On the same day the Exchamsiks River recorded a maximum instantaneous discharge of 23,100 cfs (854 m³/s) (Meziadin Environmental Advisory Team 1975). On Highway 16, washouts occurred at Delta Creek and Exstew River. The highway was closed for 2.5-7 hours.

November 18-19, 1962

Event type: Fatal snow avalanche.

Precipitation: Aiyansh (33.3 mm/1 day), November 18, 1962; Falls River (65.8 mm/1 day), November 18, 1962; Kemano (108.0 mm/1 day), November 18, 1962; Smithers (49.8 mm/2 days), November 18-19, 1962; Smithers A (58.2 mm/2 days), November 18-19, 1962.

Source: *The Interior News*, November 21, 1962.

Overnight November 18-19, the Smithers area experienced heavy snow. Heavy rain on November 18 preceded the snow. On the Hudson Bay's Glacier Gulch, a snowslide came down, killing a mining employee. It was reported that during the storm 4 ft. (1.2 m) of snow fell on the glacier. The victim's sleeping cabin was located near the south creek below the steep rockwall of the glacial cirque. The snow avalanche swept the sleeping camp and a pumphouse downhill, scattering debris for 1,000 ft. (300 m) down the slope of rock below the glacier. On November 18 at 6:30 p.m., the victim reported by radio a slide at the pump site.

On November 19, two members of a rescue team were hit and buried by another snow avalanche, but managed to extricate themselves. The victim's body was reported found on November 20 under 6-8 ft. (1.8-2.4 m) of snow.

February 2-8, 1963

Event type: Icejam flooding.

Precipitation: Kitimat (184.4 mm/5 days, incl. 106.7 cm snow/3 days), February 2-6, 1963; Tasu (45.0 mm/1 day), February 3, 1963; Kemano (159.3 mm/3 days), February 3-5, 1963; Kitimat Townsite (161.3 mm/3 days), February 3-5, 1963; Terrace (107.2 mm/4 days), February 3-6, 1963; Sandspit A (29.2 mm/1 day), February 4, 1963; Falls River (147.8 mm/2 days), February 4-5, 1963.

Source: *The Citizen*, February 4, 6 and 8 1963; *The British Columbian*, February 6, 1963; *Terrace Omineca Herald*, February 6, 1963; *Northern Sentinel*, February 7, 1963; *Cariboo Observer*, February 7, 1963.

About midnight on February 2, the rapidly rising Fraser River forced the evacuation of several house trailers in Quesnel. Town crews towed seven trailers parked in the Cariboo Log Cabin Camp at the edge of the river in West Quesnel to higher ground as the ice-swollen river rose approximately 9 ft. (2.7 m) since about February 1. On February 3, the Vancouver Piledriving and Contracting Co. Ltd, building the footings of the new PGE bridge, was forced to move equipment up the bank to higher ground. The ice was reported jammed for 15 mi. (24 km) downstream.

The icejam threatened the bridge across the river at Quesnel when tons of ice piled against its concrete superstructure. According to Al Slater, district superintendent of highways, the distance from the top of the ice to the top of the bridge piers at 10 a.m. on February 4 was 16 ft. (4.8 m) while the normal distance is 25 ft. (7.5 m). He said the river was frozen from Quesnel to just south of Soda Creek and for about a mile (1.6 km) north of town.

Between February 4-7, the Quesnel River rose more than 6 ft. (1.8 m), completely flooding the sandbar at its junction with the Fraser River. By February 7, the Fraser River was frozen for about 50 mi. (80 km) from 2 mi. (3.2 km) north of Quesnel to Soda Creek. At Quesnel, the river rose 6 ft. (1.8 m) in 8 hours. Early on February 8, for a short time the ice-jammed Fraser River threatened to flood Quesnel. At 3:30 a.m., the river was jammed solid at West Quesnel near the Fraser River bridge. One hour later, with the river running at an estimated speed of 2-4 mph (3.2-6.4 km/h), a clear channel was open. By noon, the river receded 20 ft. (6 m) from the west bank, dropping approximately 15 ft. (4.5 m). As the water fell back, it left huge blocks of ice up to 15 ft. thick. Immediately south of the bridge, tons of ice were piled on the west bank of the river.

Early February Kitimat recorded 27 in. (68.6 cm) of snow in 24 hours or 52 in. (132.1 cm) in 96 hours. Between the morning of February 3 and the night of February 4, more than 3 ft. (90 cm) of snow fell in Kitimat. The snowfall claimed two lives in Kitimat. Both victims suffered heart attacks while shoveling snow.

Terrace reported “one of the heaviest snowfalls ever experienced here,” bringing all traffic to a complete standstill. On February 5, the snow turned into heavy rain. Schools and some logging operations in the Terrace area were closed down. The Terrace “5 cent to \$1 Store” on Kalum Street had an 8-ft. (2.4 m) snowdrift. Power outages occurred because of the heavily laden power lines. The areas primarily affected were the Highway 16 east, the airport road, and parts of Keith Estate. The service was completely restored on February 6.

Between February 3-5, more than 5 ft. (1.5 m) of snow fell in the Pine Pass area, making it “one of the heaviest snowfalls ever recorded in the area.” According to Al Park, district superintendent of highways, the snowfall in the pass occasionally equals about half the February 3-4 fall of 59 in. (1.48 m) in a 24-hour period, but rarely had such a large amount fallen in such a short time. On February 5, a snowslide 400 ft. (120 m) long and several feet deep came down onto the highway through the Pine Pass.

March 31, 1963

Event type: Landslip.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, April 1, 1963.

On the afternoon of March 31, the tail end of a PGE freight train jumped the tracks and jumped into Williams Lake. Two trainmen escaped from a partially submerged maintenance car as fire broke out in the front section of the Vancouver bound train. Seventeen cars were derailed. The maintenance car and five boxcars toppled down a 20-ft. (6 m) sloping bank into Williams Lake. The derailment was apparently caused by a slip of the track’s shale foundation, which spread the rails.

July 21, 1963

Event type: Mudslide.

Precipitation: Not applicable.

Source: *The Province*, July 22, 1963.

Around July 21, a section of roadway, 100 mi. (160 km) north of Fort Nelson and just inside the Yukon Territory, gave way. The mudslide buried a truck with two men en route to a natural gas well. One was killed while the other was injured. Because the danger of further slides, at first the rescue team decided against digging the truck free.

December 28-31, 1963

Event type: Severe storm.

Precipitation: Tasu Sound (276.9 mm/4 days), December 28-31, 1963; Falls River (169.9 mm/2 days), December 29-30, 1963; Langara (54.4 mm/2 days), December 29-30, 1963; Kitimat (173.2 mm/3 days), December 29-31, 1963; Kemano (150.9 mm/3 days), December 29-31, 1963; Sandspit A (47.5 mm/2 days), December 30-31, 1963; Terrace (107.2 mm/2 days), December 30-31, 1963.

Source: *Prince Rupert daily News*, December 30, 1963; *Northern Sentinel*, January 2, 1964; *Terrace Omineca Herald*, January 2, 1964.

On December 28 and 29, Prince Rupert recorded 0.57 in. (14.5 mm) and 0.41 in. (10.4 mm) of rain, respectively. Digby Island reported strong winds up to 40 mph (64 km/h). On December 29 at 11:55 p.m., the 66,000-V transmission line serving Prince Rupert was cut near Falls River. A tree, which tumbled down a steep hill, broke two wires. Repairs were expected to be completed by December 31.

Terrace recorded 1.7 in. (43.2 mm) of rain in 14 hours or 5.45 in. (138.4 mm) in 38 hours, and winds gusting up to 60 mph (96.6 km/h). The bridge at Furlong Creek washed out, closing Highway 25. A slide knocked out Canadian National telegraph communications. Kitimat sustained heavy storm damage and several basements were flooded.

March 7, 1964

Event type: Snow avalanches.

Precipitation: Falls River (32.5 mm/1 day), March 7, 1964; Prince Rupert (30.7 mm/1 day), March 7, 1964; Prince Rupert M. Circ (47.2 mm/1 day), March 7, 1964.

Source: *Prince Rupert Daily News*, March 9, 1964; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On March 9, two snowslides came down at Mile 50.0 on the CNR line and Highway 16 between Terrace-Prince Rupert. CNR reported the slides as 100 ft. (30 m) long and 40 ft. (12 m) deep and 300 ft. (90 m) long and 40 ft. (12 m) deep, respectively. The rail line was closed for 11.5 hours. According to the *Prince Rupert Daily News*, the slides that covered the highway were 15 ft. (4.5 m) deep and 100 ft. (30 m) and 30 ft. (9 m) deep and 400 ft. (120 m) wide, respectively. The highway, which was blocked for several hours, was expected to open for traffic by mid afternoon.

March 21, 1964

Event type: Snow avalanche.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, April 1, 1963; *The Citizen*, March 23, 1964.

On March 21 at 4 a.m., a slide, the fifth this winter, came down in the Pine Pass, blocking the Hart Highway at Mile 149, 120 mi. (192 km) north of Prince George. Heavy tractors worked for 10 hours in a -23°F (-30.6°C) blizzard with winds of 25-35 mph (40-56 km/h) to open the slide. The slide, which measured a depth of 15 ft. (4.5 m) in places and blocked the highway for a distance of 600 ft. (180 m), was cleared on March 22 at 2 a.m. PGE reopened their tracks on March 23. *The Vancouver Sun* reported it as a 300-ft. (90 m) snowslide.

Till March 23, the Pine Pass had recorded 583 in. (14.575 m) of snow. Snowbanks along the highway were between 10-14 ft. (3-4.2 m) high.

March 27-29, 1964

Event type: Tsunami.

Precipitation: Not applicable.

Source: *Prince Rupert Daily News*, March 30, 1964; *The Vancouver Sun*, April 25, 1969; July 28, 1998; *Times Colonist*, January 27, 2000; Wigen and White 1964; Coulter and Migliaccio 1966; Thompson 1981; Hay 1983 (pp. 17-20).

On Good Friday March 27, a 9.2 Richter scale mega-thrust earthquake, the second largest of the 20th century, struck the Alaskan coast. At Anchorage, the damage generally involved larger buildings and structures like bridges. The quake triggered a large, about 75 million-m³, submarine slump near Valdez, Alaska. South of Anchorage, the ocean floor dropped causing a local tsunami that destroyed waterfront facilities and the fishing fleet (Coulter and Migliaccio 1966). Captain Merrill Stewart while aboard the 10,815-ton vessel *Chena* in Valdez harbour gave an eyewitness account of the earthquake, "The Valdez piers started to collapse right away. There was a tremendous noise. The ship was laying over to port. I had been in earthquakes before, but I knew right away that this was the worst one yet. The *Chena* rose about 30 feet (9 m) on an oncoming wave. The whole ship lifted and heeled to port about 50 degrees. Then it slammed down heavily on the spot where the docks had disintegrated moments before. I saw people running – with no place to run to. It was just ghastly. They were just engulfed by buildings, water, mud, and everything. The *Chena* dropped where the people had been. That was what kept me awake for days. There was no sight of them. The ship stayed there momentarily. Then there was an ungodly backroll to starboard. Then she came upright. Then we took another heavy roll to port." (Hay 1983).

At Seward, Alaska, the greatest damage was attributed to foundation collapses along the entire waterfront due to sliding and subsidence caused by successive sea level drawdowns. Near Kodiak City, Alaska a "bore" (a steep, fast moving, breaking wave) developed, travelling at over 60 km/h at a height of over 10 m. Though a crab boat rode the foaming crest of this wave and survived, the wave tore out docks and canneries in its path (Hay 1983).

The slide and concomitant tsunami were responsible for the loss of 30 lives, nearly 25% of all the casualties of the earthquake. A tsunami resulting from this earthquake also caused severe damage on the west coast of Vancouver Island and elsewhere. *1) It was historically the most destructive tsunami to hit British Columbia (Wigen and White 1964; Thompson 1981). The earthquake generated a series of sea waves that moved radially outward from the epicenter near the head of Prince William Sound. The main tsunami swept southward across the Pacific Ocean at a velocity of about 830 km/h, reaching Antarctica in only 16 hours. Within a few hours, the waves reached the outer coasts of the Queen Charlotte Islands and Vancouver Island.

Six hours after the quake, a tidal surge damaged marine installations and broke logbooms in Prince Rupert. The Department of Transport vessel *Yaloe* sank at her Digby Island moorings. The vessel being used to transport air service personnel between the city and Digby Island was to be raised on March 30.

In Metlakatla Pass and Casey Cove, 8-9 million ft.³ (226,400-254,700 m³) in transit to the Columbia Cellulose Company's Watson Island mill cut loose. At Metlakatla, a float and pierhead was torn out. At Fairview Bay, extensive damage occurred to the breakwater and part of the fishboat moorings. Pilings were ripped out at a float at the fishboat floats and 500 ft. (150 m) of breakwater went afloat. The high water also took out the dolphins. Pilings uprooted by the tidal wave bobbed at crazy angles. The submarine cable providing telephone service to Digby was put out of action. As a result of the cable damage, on March 30 communications with Digby were limited to radio via Sandspit. The Prince Rupert airport and homes on Digby Island were on emergency power.

At midnight, when Prince Rupert knew tidal waves could be expected from the earthquake, the water level was 16 ft. (4.8 m) above zero tide. One hour later, the tide reached a high of 26 ft. (7.8 m). It stayed at this level about 30 minutes while at 2:15 a.m. it had dropped 10 ft. (3 m). Then the flow reversed itself and at 3 a.m. a second wave reached its crest at 21 ft. (6.3 m) above low water.

At 12:30 a.m., residents of Haida and Masset on the Queen Charlotte Islands moved to higher ground 5 mi. (8 km) away at Deep Creek. There was, however, little damage from the tidal surge. The water rose about 5 ft. (1.5 m) above normal, as at Prince Rupert. Part of the wharf used by Regal Air Services was washed up.

Apparently the quake was not felt on the Queen Charlotte Islands. Though Prince Rupert did not feel the quake either, it was felt as near as Tyee and Kwinita on the Skeena River. At both places, houses shook. At Kwinita, a notorious slide area, residents at first thought more slides were on the way.

*1) Seismic sea waves comparable to those generated by the 1964 earthquake are rare. Of the 176 tsunamis recorded in the Pacific Ocean between 1900-1970, 35 caused damage near their sources, but only nine resulted in widespread destruction (Thompson 1981).

May 1, 1964

Event type: Rockslide.

Precipitation: Prince Rupert M. Circ (11.2 mm/1 day), May 1, 1964.

Source: *Prince Rupert Daily News*, May 4, 1964; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

A rockslide on Highway 16 at Mile 50 delayed the traffic for a few hours. CNR reported a rock and mudslide at Mile 50.2, measuring a length of 450 ft. (135 m) and a depth of 10 ft. (3 m). The rail line was closed for 12 hours.

May 29-June 3, 1964

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Province*, June 1, 1964; *Prince Rupert Daily News*, June 3, 4, 5 and 8, 1964; *Terrace Omineca Herald*, June 3 and 10, 1964; *The Interior News*, June 3 and 10, 1964; *The Daily Alaska Empire*, June 3, 4, 5 and 9, 1964; *The British Columbia Road Runner*, B.C. Ministry of Transportation and Highways, October 1964, Vol. 1 No. 4 p. 2; B.C. Ministry of Public Works 1966 (pp. C 104-105); Environment Canada 1991.

In the spring of 1964, unusually high snowpacks produced record high June through September volumes of runoff water. Late May-early June spring runoff caused extensive flooding in the Skeena Valley. Highway 16 west of Terrace was inundated with 3-8 ft. (0.9-2.4 m) of water for a distance of 12 mi. (19.2 km). The floodwaters filled a valley 5 mi. (8 km) wide (*The British Columbia Road Runner*). CNR poured rock fill along the Terrace-Prince Rupert right-of-way.

On June 3, the Skeena River started rising 3 in. (7.6 cm) an hour. It rose at least 13.5 ft. (4.1 m) to 204.65 ft. (61.4 m), nearing its 1948 flood level of 207 ft. (62.1 m). On June 3, Highway 16 and the CNR line between Terrace-Prince Rupert were closed. The Kitimat River came close to flooding.

On June 4, the rail line reopened but Highway 16 remained closed for five days. Because of the closure of Highway 16, an immediate and drastic decline occurred in the traffic on the Alaska State Ferry System, which uses Prince Rupert as the southern terminus of its marine highway system. At Kwinitisa the section between Mile 42-46 was completely flooded by up to 3.5 ft. (1.1 m) of water.

Residents of Remo, Usk, and Braun's Island were evacuated. The bridge on Gagnon Road was completely flooded. Stoney Creek bridge on the road between Hazelton-Kitwanga was washed out, isolating the Kitwanga area until a temporary crossing was installed to accommodate light traffic. The Skeena River ferry system was stopped by high water and swift current carrying debris downstream.

Flooding 3 mi. (4.8 km) east and 17 mi. (27.2 km) east and west of Terrace closed Highway 16. In the Cedarvale area, as much as 48 in. (1.2 m) of water was on the road. The southern approach of the bridge on Braun's Island had to be reinforced. The bridge 43 mi. (68.8 km) west of Terrace was on the verge of floating. Crews had to put ballast on the bridge and tie it down. Flooding closed the new Copper River Road.

Kitimat River came close to flooding. Logging operations slowed down or closed. The Columbia Cellulose Whitebottom operation closed down. The BC Tel tower at Kwinitisa had to be moved to higher ground. According to Don Chappion, District Manager BC Tel, on May 1 there was a peak snow level of 36 ft. (10.8 m) at 3,800 ft. (1,140 m) elevation. In 1963, the snow level for the same date and elevation was only 14 ft. (4.2 m).

The Between May 29-31, a combination of late secondary runoff and a warm front accompanied by heavy thunderstorms triggered extensive flooding comparable to that of 1948 between Topley-Houston. Two bridges were washed out and several damaged. Four large culverts were also washed out and many badly scoured (B.C. Ministry of Public Works 1966). The Houston Bridge No. 35 on Highway 16 required considerable repair on the substructure as a result of driftwood damages.

The late spring flood tore out three secondary bridges along Topley Road, 30 mi. (48 km) west of Burns Lake. Twelve persons stranded between two bridges were flown out by helicopter. A highways department official estimated it would take four to six days to rebuild two of the bridges. (*The Province*, June 1, 1964).

On May 31, the Topley Landing road was closed to traffic. Helicopters airlifted a number of people caught between washed-out bridges. A washed-out bridge at Canyon Creek closed burnt Cabin Road, between Telkwa-Babine Lake Road. A bridge on the T.F. & M. logging road up the Telkwa River washed out. Highway 16 reopened on May 31 after washouts near Topley, 17 mi. (27.2 km) east of Houston, had been repaired. CNR reported problems in the Smithers-Houston area. The old bridge across the Bulkley River, east of Houston and the CNR bridge across Buck (Creek) River were endangered. In the Burns Lake area, some smaller rivers caused flash-flood conditions.

On June 1-2, heavy rain was reported in Smithers. The Smithers Airport recorded 37.3 mm of rain over the two-day period. Three secondary roads were closed after the approaches of some small bridges washed out. The pump-house of the Smithers water system along the Bulkley River and a number of trailers at the Bulkley Bridge

Trailer Court were endangered. On June 3, the Bulkley River at Quick recorded a maximum daily discharge of 847 m³/s (Environment Canada 1991).

June 8-15, 1964

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Prince Rupert Daily News*, June 10, 11, 12 and 15, 1964; *Terrace Omineca Herald*, June 10, 1964; *The Interior News*, June 10 and 17, 1964; *The Daily News*, June 2, 1966; *The Vancouver Sun*, June 10 and 12, 1964; *Victoria Daily Times*, June 11, 1964; *The Daily Alaska Empire*, June 11, 12 and 14, 1964; *The Sun*, June 15, 1964; *The Province*, June 16, 1964; *The Citizen*, June 7, 1967; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; B.C. Ministry of Public Works 1966 (p. C 106); Environment Canada 1991; Letter, J. P. O'Toole (Dist. Supt. Terrace) to R. G. Harvey (Reg. Eng. Prince George). B.C. Ministry of Transportation and Highways, Terrace.

During the second week of June, a second rise in the water levels of the Skeena River was described as the "worst flood since 1948." On June 21, the Fraser River at Hope registered the third highest discharge on record (*The Citizen*, June 7, 1967).

On June 8, the Bulkley and Skeena rivers started rising. The levels had dropped during a short period of cooler weather following the heavy rain. On June 10, the Skeena River started rising again to the 14.5-ft. mark after it had dropped to 11.5 ft. on June 8. On June 11, the Skeena River at Usk recorded a maximum daily discharge of 7,480 m³/s (Environment Canada 1991). The Skeena River peaked at 15.5 ft. (4.65 m), flooding sections of highway 15 mi. (24 km) long (J.P. O'Toole *In: The Daily News*). Due to flooding east and west of Terrace, Highway 16 closed again. East of Terrace, on the stretch between Mile 40-74, 50% of the highway and 25% of the rail line were under water. Between Mile 45-51, the shoulders of the highway and bridges sustained heavy damage. At Polymar Creek, 45 mi. (72 km) east of Terrace, there was 2.5 ft. (0.75 m) of water on the road.

Between June 11-14, the rail line between Terrace-Prince Rupert was closed for three days and seven hours. Near Salvus, there was a washout at the Shames River and extensive damage. For three days, CP Air ran a DC-6B Air Shuttle between Prince Rupert-Terrace with three daily flights.

A total of 15 mi. (24 km) of the highway west of Terrace was flooded with 3 ft. (90 cm) of water (B.C. Ministry of Public Works 1966). It had been opened only briefly when the river receded with cooler weather. The flooding left 64 people, who on June 10 had arrived at Prince Rupert on the Alaska State Ferry stranded. Before closing it to traffic early on June 10, 25 cars most belonging to U.S. tourists were towed across two flooded sections of the highway.

Highway 16 east and west of Terrace was closed for more than a week. Floodwaters covered the road in two areas with more than 2.5 ft. (75 cm) of water. East of Prince Rupert, 200 ft. (60 m) of highway and railroad track were washed out 79 mi. (126.4 km). The section between 16-50 Mile (25.6-80 km) west of Terrace was inundated. Heavy flooding occurred at Kwinita, where the section between Mile 41-50 was almost completely inundated. Exceptionally high tides caused problems at Kwinita at tidewater on the Skeena River. Between Mile 41-47 west of Terrace, the highway was flooded with up to 3 ft. (90 cm) of water.

Near Terrace, the Skeena River flooded the area near the airport road. Some houses were surrounded by water. Only two suffered water damage from flooded basements. The residents of the low-lying Thornhill area were preparing for evacuation. On June 11, the Skeena River threatened Remo, the community of 25 families 6 mi. (9.6 km) east of Terrace. Protected by the high bed supporting the rail tracks alongside the river, the settlement is 6 ft. (1.8 m) below the waters of the flood-swollen river. The river began eroding the railbed and seeping through. CNR crews worked through the night, bringing in rail cars filled with rock and other fill to dump alongside the weakened railbed and saved the community from flooding. On the night of June 11, high waters forced the evacuation of three families from their flooded homes on the Skeena River's bank opposite Terrace.

On June 12, crews were trying to repair a 200-ft. (60 m) long washout 16 mi. (25.6 km) west of Terrace. Four Skeena River ferries were tied up because of driftwood in the river, which was up 14 ft. (4.2 m) from its winter low. The Kitwanga Ferry went out of service when the towers on both sides of the river collapsed.

East and west of Terrace, at least five other stretches of track and roadway alongside were flooded with up to 3 ft. (90 cm) of water. The highway near Cedarvale was flooded with 3.5 ft. (1.1 m) of water. At Whiskey Creek, 54 mi. (86.4 km) east of Terrace, there was 30 in. (75 cm) of water on the road.

Flood damage to the older short-span wooded bridges west of Terrace was considerable. The Skeena (West) District bridge crew was occupied from mid-June until Christmas replacing ballast walls on these bridges, as well as replacing many of the old wooden culverts.

The Columbia Cellulose Company experienced tie-ups in its operations near Terrace. The Nass River rose at a rate of 1.5 ft. (45 cm) a day. Residents of the Native Indian villages in the Nass River area also stood by for evacuations. At the height of the flood, some residents of Telkwa had to be evacuated.

The Fraser River also reached the flood danger level. Warm weather pushed the snowmelt line in the Prince George region up from 9,000-11,000 ft. (2,700-3,300 m). Near Prince George some 400 residents of "The Cache," an island at the confluence of the Nechako and the Fraser Rivers, were evacuated. Evacuation had started during the first

week of June. Prince George experienced trouble finding shelter for all the evacuees. Overnight June 11-12, the Fraser River dropped 0.1 ft. (3 cm). About 200 families of inundated Cottonwood Island remained in their homes.

Early on June 15, the Fraser River at Prince George dropped. A survey showed that there was little snow left in the watershed. According to H.I. Hunter, the director of snow surveys for the provincial water resources department, there was only 2 ft. (60 cm) of snow left at 6,000 ft. (1,800 m) level in the Moose Lake area of the river's headwaters. This was below the average early June level for the past years.

By June 16, the floodwaters in the Fraser, Nechako and Peace rivers dropped. The Fraser receded from some of the homes, which flooded in the Prince George area during the previous week.

According to BC Hydro's co-chairman Dr. Gordon Shrum, the 1964 flood on the Peace River was the "worst in history" and was causing concern for construction of the Portage Mountain hydro dam at Hudson's Hope. The river had reached 295,000 cfs (8,354 m³/s) well above the previous record of 267,000 cfs (7,561 m³/s) in 1922.

On June 11, the water level at the cofferdam that held back the Peace River from the dry riverbed where the dam was being constructed rose 1.5 ft. (45 cm). There was still 8.5 ft. (2.55 m) to go before the water would reach the top of the cofferdam. If it would become necessary, another 5 ft. (1.5 m) could quickly be added. Three tunnels diverted the river from the construction area. The capacity of the tunnels was 320,000 cfs (9,062 m³/s)

July 7-9, 1964

Event type: Flooding and rockslide.

Precipitation: Prince Rupert A (24.9 mm/1 day), July 7, 1964; Terrace (10.4 mm/1 day), July 9, 1964.

Source: *Terrace Omineca Herald*, July 15, 1964; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

In Terrace, just west of Eby Street, there was nearly 1 ft. (30 cm) of water on the highway.

On July 10, CNR reported a rockslide, measuring a length of 80 ft. (24 m) and a depth of 16 ft. (4.8 m) at Mile 1.7 near Seal Cove. The rail line was closed for 17.5 hours.

September 10-13, 1964

Event type: Landslide.

Precipitation: Terrace (104.7 mm/3 days), September 10-12, 1964; Tasu Sound (95.3 mm/2 days), September 12-13, 1964; Falls River (44.7 mm/1 day), September 13, 1964.

Source: *Terrace Omineca Herald*, September 16, 1964; B.C. Ministry of Public Works 1966 (p. C 105).

In Terrace, heavy rains delayed the paving of the western section of Highway 16 from Eby Street to the Kalum bridge.

During mid-September, Highway 16 was closed due to a large slide in the Bulkley Canyon section. (B.C. Ministry of Public Works 1966).

October 16-20, 1964

Event type: Flooding.

Precipitation: Terrace (59.7 mm/1 day), October 16, 1964; Tasu Sound (175.0 mm/3 days), October 17-19, 1964; Sandspit A (27.2 mm/1 day), October 18, 1964; Langara (43.2 mm/1 day), October 18, 1964; Aiyansh (111.5 mm/2 days), October 18-19, 1964; Prince Rupert (131.1 mm/2 days), October 19-20, 1964; Terrace (49.3 mm/1 day), October 20, 1964.

Source: *Prince Rupert Daily News*, October 19, 20 and 21, 1964; *Terrace Omineca Herald*, October 21, 1964; *The Interior News*, October 21 and 28, 1964; *The Vancouver Sun*, October 21, 1964; *Juneau Alaska Empire*, October 18, 1964; Meziadin Environmental Advisory Team 1975 (Vol. 3, Fig. 4-9).

A gale gusting up to 92 mph (170.5 km/h) caused damage in the Prince Rupert area. Westview Elementary School Section II had part of its asphalt/gravel roofing blown off. The stormy weather caused a delayed arrival at Prince Rupert of the Alaskan State Ferry *Taku*. The Japanese freighter *Kobe Maru* was driven aground in the Prince Rupert harbour.

On October 21, the Skeena River near Terrace rose 4 ft. (1.2 m). The North Kalum River flooded its banks near Beaver Flats, about 45 mi. (72 km) north of Terrace. The operations of the Columbia Cellulose Co. in the Nass area were halted. Approximately 60 workers were affected. Peak flows occurred on several streams. The Kispiox River near Hazelton recorded a mean daily discharge of 28,800 cfs (815 m³/s). The Zymoetz River near Terrace recorded a mean daily discharge of 37,000 cfs (1,047 m³/s) (Meziadin Environmental Advisory Team 1975).

In the Kispiox area, some low-lying farmland was under 12-15 ft. (3.6-4.5 m) of water. Two cabins and a small trailer washed into the river. It was described as the "worst fall flooding since 1936." On October 19, rain and warm winds melting snow caused flooding along the Kispiox River. In a very short period the Kispiox River and one of its tributaries, the Sweetin River, rose nearly 10 ft. (3 m). The Kispiox River near Hazelton recorded a mean daily discharge of 28,800 cfs (815 m³/s) (Meziadin Environmental Advisory Team 1975). A section of the Kispiox Road and farmlands about 20 mi. (32 km) north of Hazelton were inundated. The river covered the entire Jackson's Flat just north of 17 Mile bridge. The road at Love's ranch and oat fields near the house were flooded. A stranded car had only its top above water. Cattle were moved back from the river, but acres of good hay land and a silo were flooded. Telephone communications were knocked out and some residents had to leave their homes. Further north, where the

Sweetin River crosses the forestry road, the temporary forestry bridge under construction washed out. Heavy equipment on the other side was partly submerged. According to old-timers in the area, the Kispiox River had not been this high since 1936. On October 20 at about 8:00 a.m., water levels started to recede.

During the night of October 21, partial flooding was reported from two Native Indian villages on the Nass River. Heavy rains caused a sudden rise on the Nass River as it approached the 1961 flood level. The Aiyansh Indian village got flooded. The Senior Indian School was flooded and the teacherage trailer washed away. Animals and personal belongings were moved to higher ground.

January 11-13, 1965

Event type: Fatal snow and debris avalanche and snow avalanches.

Precipitation: Prince Rupert M. Circ (107.9 mm/3 days), January 11-13, 1965; Aiyansh (41.7 mm/1 day), January 13, 1965; Falls River (69.3 mm/1 day), January 13, 1965; Kitimat Townsite (54.4 mm/1 day), January 13, 1965; Ocean Falls (132.8 mm/1 day) January 13, 1965.

Source: *Prince Rupert Daily News*, January 11, 12, 15 and 18, 1965; *Terrace Omineca Herald*, January 13 and 20, 1965; *Victoria Daily Times*, January 14, 1965; *The Vancouver Sun*, January 14, 1965; *Ocean Falls Advertiser*, January 25, 1965; Ramsey 1971 pp. 163-182; Bulletins relating to the slide of January 13, 1965. PABC, MSS 217. Vol. 3; folder 2, Provincial Archives, Victoria, B.C.; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; B.C. Ministry of Public Works 1966 (p. C 106); B.C. Ministry of Transportation and Highways 1980; Stethem and Schaerer 1980 (pp. 19-21); Trenhaile 1998 (p. 84).

Between January 11-13, the rail line between Prince Rupert-Terrace was hit by a series of slides. On January 12, four slides came down at Mile 10.6, 43.6, 47.0, and 50.2, closing the line for 10.5 hours. On January 15, five snowslides came down at Mile 58.3, 57.5, 39.9, 52.7, and 57.0, closing the line for three days. Engineers described the slides as 10-20 ft. (3-6 m) deep and 200-300 ft. (60-90 m) long (J. Mekechuck, pers. comm.). Early on January 14, a rockslide derailed six cars of the freight train near Telegraph Point. The train with 13 crewmembers aboard was trapped between snowslides.

A heavy snowfall was reported at midnight on January 11 at Amsbury Bluffs, 8 mi. (12.8 km) west of Terrace. Highway 16 was closed for three days, blocked by 26 slides. Avalanches between Terrace-Prince Rupert trapped three vehicles and their drivers. Sixteen slides occurred between Mile 42-58. The largest was near Kwinitsa and measured a length of 200-300 ft. (60-90 m) and a depth of 10-20 ft. (3-6 m). A chartered Farwest bus carrying 31 Prince Rupert passengers to the Terrace airport was hit by a snowslide at Mile 55 on Highway 16. The bus was pushed off the road but there was no damage or injuries. The slide was 300 yd. (270 m) long and 7 ft. (2.1 m) deep. During the morning on January 12, the highway was reopened to one-lane traffic. It was closed again later that day because of more snow.

Three days of heavy rain caused snowslides between Terrace-Prince Rupert. The slides described as 10-20 ft. (3-6 m) deep and 200-300 ft. (60-90 m) long, came down within 10 minutes of each other. One brought rocks and trees with it. Six bulldozers were working at clearing the tracks and the highway. It was expected to reach the train sometime later that day.

On January 13, a mixed slush avalanche and channelised debris flow, triggered by heavy rainfall on an exceptionally thick cover of snow, killed seven people and injured five others in Ocean Falls. *1) The combination of a slush avalanche and debris flow started in the canyon at an elevation of 400-500 m. It cut a swath 100 yd. (90 m) wide through a residential section to the sea. The slide was the result of heavy snowfalls in early January, followed by high temperatures and heavy rain on January 13 (Stethem and Schaerer 1980). Between December 31-January 8, 136 cm of new snow was recorded at Ocean Falls. On January 13, extremely heavy rain fell on the townsite, dumping 133 mm in 24 hours. Three minor slides and a fourth followed the slide on January 14.

On January 13 at about 9:45 p.m., residents of the isolated coastal papermill town 470 km northwest of Vancouver heard a deep rumble that many took for the normal sounds of the mill. A 300-ft. (90 m) wide avalanche wiped out two duplex homes at 8:30 p.m.; the western end of the ground floor of The Willows apartments was flooded with slush and water. The Royal Canadian Mounted Police assisted in evacuating the tenants. Because of the increasing avalanche hazard the police also decided to close the road between the townsite and Martin Valley, a subdivision 1.5 km west of town. Around 9:30 p.m., the power and telephone communications were interrupted. At 10:00 p.m. the avalanche came down a gully from Mt. Caro Marion carrying trees, mud, and boulders. At the lower end of the gully it separated into three arms. Two of these followed watercourses on the alluvial fan. The arm on the westerly creek destroyed half a duplex house above Burma Road and knocked down the porch of a second duplex. It also destroyed the end rooms on a bunkhouse at the water's edge. The easterly arm completely destroyed another duplex above Burma Road, carrying the wreckage downhill and destroying the print shop and the Credit Union buildings below. Two adjacent buildings were also partially destroyed.

The avalanches tore out the wooden roadbed of Burma Road. On January 14, the Crown-Zellerbach Canada Ltd. papermill suspended its normal 24-hour operation to house evacuees and release more men for rescue operations. Early on January 14, the first body was recovered. The search continued for several days until the last two bodies were recovered on January 19. Residents in areas cut off by the slide were evacuated by boat. The Community Hall was set up as a refuge for evacuees. Control Centre was set up in the Townsite Office manned 24 hours daily. A radio

connection and emergency communication system was set up between the Fire Hall in Martin Valley and the Townsite Office. The Harbour Boom Crew set up ferry service to Martin Valley until January 20.

At Bella Bella, a fleet of seiners had been alerted and was standing by to come to assistance if required. The Department of Highways sent in heavy-duty equipment from Bella Bella and from Andy Widsten's Marine Services, for use during the excavating. The school reopened on January 18, after a two-day closure. While Martin Valley was without power and phone communication, transportation was maintained by boat. The road to Martin Valley reopened on January 19 and on January 20 telephone communication with Martin Valley was restored. The Credit Union building and the John Buchanan Printing and Photographic Shop were completely destroyed. All the records of the Credit Union, kept in fire proof file cabinets, were salvaged complete. By January 21, all residents had moved back to their homes.

*1) The older residents of Ocean Falls could not remember avalanches reaching the townsite before. The only large avalanches in memory were two of mixed snow and mud that crossed the Martin Valley road on December 2, 1957. (Stethem and Schaerer 1980).

February 12-18, 1965

Event type: Fatal avalanche.

Precipitation: Kitimat Townsite (98.0 mm/1 day), February 12, 1965; Stewart (152.4 mm/7 days), February 12-18, 1965; Aiyansh (83.6 mm/2 days), February 16-17, 1965; Falls River (155.7 mm/3 days), February 16-18, 1965; Kitimat (249.9 mm/3 days), February 16-18, 1965; Kitimat Townsite (114.5 mm/3 days), February 16-18, 1965; Prince Rupert M. Circ (143.0 mm/3 days), February 16-18, 1965; Tasu Sound (137.2 mm/2 days), February 17-18, 1965; Prince Rupert A (54.6 mm/1 day), February 18, 1965.

Source: *Victoria Daily Times*, February 18, 19 and 22, 1965; *Northern Sentinel*, February 18 and 25, 1965; *Prince Rupert Daily News*, February 18, 19, 22, 23, 24 and 25, 1965; *The Province*, February 22, 1965; Stethem and Schaerer 1979 (pp. 21-25); B.C. Ministry of Mines and Petroleum Resources 1966 (pp. 366-374); Skermer 1976 (pp. 5-8).

On February 18 at 10:16 a.m., an avalanche from the Leduc Glacier hit the camp of the Granduc Mining Co., 30 km northwest of Stewart near the Alaska border. *1) A similar slide occurred three years previously. The Granduc disaster was the largest of its kind to have occurred in Canada since the Rogers Pass disaster of 1910 (Stethem and Schaerer 1979).

The slide was triggered by the weight of the snow that had built up on the mountainside. It destroyed the southern portion of the camp and the buildings surrounding the portal. Between the camp and the portal all buildings, including a large powerhouse, a large workshop, and new and old dry buildings, were demolished. A total of 12 buildings were demolished. The property damage at Granduc was in excess of \$1 million (Skermer 1976).

For several days before the accident, a sub-arctic storm raged and an estimated 4.3 m of snow fell at the Granduc Mine. On February 13-14, a blizzard struck the camp, dropping more snow on the 12-18 ft. (3.6-4.8 m) that covered the area. According to Paul J. Zuest, president of Sentinel Construction Co., about the end of January the snow had started and it never stopped. "It just piled up. Then when it started to rain recently, the weight built up until it let go." On February 15, the freezing level suddenly started to rise, hitting the 7,000-ft. (2,100 m) level on February 17. On the day of the slide, it was at 6,000 ft. (1,800 m). On February 17 and 18, temperatures in the Smithers area, 100 mi. (160 km) southeast rose to an unusual high of 53 °F (11.7° C). Between February 16-18, Prince Rupert, 100 mi. south, recorded 4 in. (100 mm) of rain.

The search for survivors was greatly hampered by the mass of wreckage in the snow. Poor visibility, snow, fog, and wind also interfered with the rescue operations. One man was found half frozen but alive after being buried under snow for three days. During the operations, helicopter bombing at Granduc Mountain was carried out, probably the first time this control method was used. *2) Sixty-eight men were caught in the avalanche. The last body was recovered on June 18, leaving 26 dead and 20 injured. Some 110 men escaped unharmed and were airlifted to Vancouver.

Overnight February 18-19, two small snowslides on the CNR line near Red Pass Junction east of Prince George delayed trains.

*1) The previous summer the camp had been moved to this location. It was considered a safer site than the old one further up the glacier, 3 mi. (4.8 km) away. (*Victoria Daily Times*, February 19, 1965.

*2) Avalanche control was not applied here before the disaster, but a large-scale program was later introduced for the protection of the camps and access road (Stethem and Schaerer 1980).

Spring 1965

Event type: Spring runoff?

Precipitation: Not applicable.

Source: *The Citizen*, October 27, 1965.

During the spring, high water caused logjams to form against the PGE bridge across the Parsnip River, partially damaging the structure.

April 10, 1965

Event type: Mudslide.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, April 12, 1965; *Quesnel Cariboo Observer*, April 15, 1965.

On April 10 at 7 a.m., a mudslide near Quesnel blocked the PGE line. "Tons of water-loosened earth" oozed down over the PGE line 300 yd. (270 m) north of the Weldwood of Canada plant. "Massive earth breaks" occurred. Fir trees that were toppled in the slide were close to 30 in. (75 cm) in diameter. The tracks were submerged under mud more than 20 ft. (6 m) deep. By midnight on April 11, the 800 ft. (240 m) of track that had been ripped out had been replaced. Normal service resumed on April 12. The slide also cut the powerline to the Weldwood of Canada plant south of town.

April 23- May 2, 1965

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Quesnel Cariboo Observer*, April 29; May 6, 1965; *The Province*, April 29 and 30; May 1 and 3, 1965.

At the end of April, a sudden warm spell caused river levels to rise rapidly. Around April 24-25, temperatures in the 70s° F (21-26° C) brought sudden runoff of low level snow. Five-day flooding raised the level of Williams Lake to a record high. Its waters were eating away at the hastily built dikes around the village pump house. According to Village chairman Herb Gardner, it was the "worst flooding" he had seen in his 25-years in Williams Lake. Around April 29, some sections were without telephone service and radio station CKLW had been off the air for three days

Floodwaters from several creeks and streams threatened to contaminate the Williams Lake water supply. One section of the town's two-stage sewage lagoon closed after the swollen Williams Lake creek washed away a dike. Williams Lake, almost 6 ft. (1.8 m) higher than at the normal springtime breakup flooded several lakefront houses and washed out sections of the PGE roadbed. Trains were rerouted over alternate tracks.

Two creeks caused a major washout forcing the closure of Highway 97 between Williams Lake-Quesnel for 1.5 days. On April 30, the highway reopened but Highway 15 to Likely and the old Soda Creek Highway were still closed. About 3:30 p.m. on April 26, crews lost a two-day battle against the swollen waters of Deep Creek, an "old trouble spot" where the highway had been threatened several times previously. After a Bailey bridge was installed, traffic resumed about 10:30 p.m. on April 27. But north-south traffic had then been halted for 17 hours. After the initial break on Highway 97, about 15 mi. (24 km) north of Williams Lake, traffic was routed onto the old highway between Williams Lake-Soda Creek. This link was cut about 5 a.m. on April 27 when a heavy transport truck crashed through the old wooden bridge that crossed Deep Creek several miles west of the original highway break.

On April 28, Australian Creek was running wild and threatened the bridge on the old highway at the Yorston ranch. Considerable damage was done at the ranch feedlot as well. Highways crews maintained a 24-hour watch and dumped fill to protect both the old bridge and the large culverts that carry the creek under the new highway.

Late on April 28, Baker Creek caused bank erosion and slides near Quesnel. Since on April 24-25 riprap at the foot of the hill had been swept away, erosion continued. Along a 1-mi. (1.6 km) stretch, there were four separate damage areas, three of which occurred at sharp bends in the creekbed. Most serious was the big slide area near the north end of Hutchcroft Street. In the course of four days, more than 1 ac. (0.4 ha) of ground across a face 60 ft. (18 m) deep disappeared there, with 0.5 ac. (0.2 ha) being swept away on April 29 in a period of 12 hours. On that day, in a few hours the creek swept away more than 400 truckloads of fill. Serious erosion occurred at the high cutbank area near the corner of Hilborn Avenue and Hutchcroft Street where tons of silt were ripped out by the rampaging creek. Shortly before 5 a.m. on April 29, another huge section collapsed carrying with it a workshop and a children's playhouse on the Gordon McKay property. The McKay residence was also threatened of being undermined.

Early on April 29, debris lodged against the Baker Creek bridge caused floodwaters to deflect and erode the south bank of the creek. To provide clear passage trees on the east bank of the creek were dropped into the creek.

The continuing erosion threatened the sewer lines at that point and the No. 1 and No. 2 town well sites located some distance above the slide area. The slide also threatened BC Hydro and BC Telephone lines. Telephone crews had to move lines threatened by the heavy runoff. After one power pole was lost, temporary service had to be hooked up to several residences left without power. Civic crews were ordered into the Slaughterhouse Hill area with sandbags. House movers were attempting to haul several homes to firmer ground. At noon on April 29, the Baker Creek bridge was closed for almost two hours after a log jammed and the west approaches were swept away. It was later reopened after tons of rock and fill were dumped into the creek and the logjam cleared. Later a bulldozer was used to deepen the creek channel at the bridge site to eliminate the possibility of further jams. On May 5, repairs to the highway at the bridge approach were completed.

The creek continued to rise on April 30, threatening to "sweep away at least one block of homes." The creek had already washed away a garage and eroded large sections of its banks through the town. As all along the creek

banks were being undermined, Quesnel Mayor A.V. Fraser declared a local state of emergency covering the entire Baker Creek area. He ordered residents to stay out of flooded areas. He said, "...we may lose at least one block of homes, the street, sewers and the gas mains."

Near the Beaubien property on Lewis Drive, the creek cut to within a few feet of the road. To prevent further erosion, tons of rock was dumped. A couple of hundred yards downstream, the current swirled to the other side, raging into the bank again and threatening Hill Street at the Harper Avenue corner.

On May 1, the Baker Creek threatened to sweep away 25 homes. To reduce the danger to the Slaughterhouse Hill area, more than 100 workers cut a 1,000-ft. (300 m) canal at a bend in the creek. It provided a second channel for the swift moving water. On April 29, a shearboom was rigged to divert the creek from the slide area and that evening a heavy bulldozer was used to channel a portion of the flow through a hastily plowed canal across the L. L. Hill property on the west side of the creek. To halt the steady erosion, rock was dumped at the foot of the slide. On April 30, slippage halted when the level of Baker Creek dropped appreciably.

In assessing the damage caused by Baker Creek, concern was expressed about the state of the Tibbles Dam on Baker Creek 30 mi. (48 km) west of Quesnel. It was pointed out that the structure was deteriorating rapidly and might give way and create a further serious flood.

The heavy spring runoff resulted in flooding of some homes on the west side of Bouchie Lake. According to Don Dickie, whose basement flooded, the trouble began when the local staff of the highways department straightened the creekbed above the road but failed to install culverts to handle the increased flow of water. Around April 25-26, water began to undermine the two small culverts under the road near the Frank Dolman home on the west side of the lake. Early on April 27, the road and the culverts washed out. Trees washed into the creekbed and eroded the driveway into the Dolman property. Floodwaters threatened the Dolman home and ripped out a telephone pole adjacent to the house. Local Department of Highways superintendent George Harper said a larger culvert would be installed and the creekbed altered to reduce the flood hazard during the spring freshet season. He added that several other washouts kept his department busy two small bridges that had been swept away.

On May 6 at about 8 a.m., at the site of a recent mudslide two cars of a mile-long PGE northbound freight left the tracks near the Weldwood of Canada Co. plant. There were no injuries and traffic was expected to resume later that day.

The Quesnel River was also rising quickly, and the Fraser River was only 1 ft. (30 cm) away from flood level. George Harper, district highways superintendent, reported washouts on several major roads and said that some minor routes had been closed.

Crews were keeping a close watch on a dam and a highway fill at Australian, a station on the PGE about 20 mi. (32 km) south of Quesnel. *1) On May 1, Fraser said, "It's the highest it's ever been at this time of the year and if it does flood, the western section of the town will be hit. But we are hoping it will be cool and there will be a normal runoff from the mountains. He pointed out that if the area would get a sudden warm spell, snow on the high mountains might swell the Fraser River, which was about 1 ft. away from flood level.

On May 1-2, flood threats of Baker Creek and the Fraser River eased. The rampaging Baker Creek dropped 2 ft. (60 cm). At the same time, the Fraser River, which had crept within 1 ft. (30 cm) of the flood level, dropped 20 in. (50 cm).

*1) This section of highway, including a PGE trestle, washed away in 1955 (April 6-6, 1955?), leaving Quesnel isolated for several days. (*The Province*, April 30, 1965).

July 13, 1965

Event type: Rockslide.

Precipitation: Not applicable.

Source: J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

CNR reported a rockslide measuring a length of 160 ft. (48 m) and a depth of 20 ft. (6 m) at Mile 78.9. The rail line was closed for 10 hours.

October 15-22, 1965

Event type: Flooding.

Precipitation: Tasu Sound (406.5 mm/8 days), October 15-22, 1965; Terrace (59.7 mm/1 day), October 16, 1965; Bella Coola (183.1 mm/6 days), October 16-21, 1965; Ocean Falls (426.6 mm/6 days) October 16-21, 1965; Falls River (168.4 mm/3 days), October 18-20, 1965; Kitimat (219.6 mm/3 days), October 19-21, 1965; Kemano (182.1 mm/3 days), October 19-21, 1965; Sandspit A (70.6 mm/3 days), October 19-21, 1965; Prince Rupert M. Circ (187.2 mm/4 days), October 19-22, 1965; Terrace (49.3 mm/1 day) October 20, 1965; Aiyansh (85.4 mm/3 days), October 20-22, 1965.

Source: *Terrace Omineca Herald*, October 27, 1965; *Prince Rupert Daily News*, October 18, 19, 20, 21 and 22, 1965; *Northern Sentinel*, October 21 and 28, 1965; *The Province*, October 26, 1965; *The Citizen*, October 27 and 28, 1965; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; B.C. Ministry of Public Works 1967 (pp. C 105); Environment Canada 1991; Church 1983 (pp. 169-180).

Kitimat reported 10.7 in. (271.8 mm) of rain in seven days. The Kitimat River reached its highest level since 1958. On October 22, the Kitimat River recorded a maximum instantaneous discharge of 1,680 m³/s and an estimated maximum daily discharge of 1,100 m³/s (Environment Canada 1991). It overflowed its banks north of the bridge and swept through Radley Park, carrying off picnic tables. It also took out some sections of the sewer line further downstream. There were three washouts on the Kitimaat Village Road and a washout 8 mi. (12.8 km) north of Kitimat on Highway 25. The Crown Zellerbach logging roads had five washouts. The biggest was 16 mi. (25.6 km) north of town on the highway. A burst culvert spilling over on the adjacent logging road caused it.

Early on October 22, a 25-ft. (7.5 m) wide washout occurred on Highway 16, 3 mi. (4.8 km) east of Galloway Rapids bridge. On Highway 16, west of Terrace Hells Bells Bridge washed out (B.C. Ministry of Public Works 1967).

CNR reported five washouts near Mile 28.4. They were 10-12 ft. (3-3.6 m) wide and 2-3 ft. (60-90 cm) deep. The rail line was closed for 10 hours (J. Mekechuck, pers. comm.).

On October 21, a heavy rainstorm caused extensive damage and flooding in the Bella Coola Valley. On October 22, the Bella Coola River above Burnt Creek recorded a maximum daily discharge of 638 m³/s and a maximum instantaneous discharge of 776 m³/s. On the same day, the Bella Coola River near Hagensborg recorded a maximum daily discharge of 906 m³/s (Environment Canada 1991). The 1965 flood produced a major northward shift in the river (Church 1983). After a week of extreme rains, seven bridges and a section of road were washed out east of Bella Coola, isolating and flooding many communities. On October 22, the Kingcome River, swollen by torrential rains, flooded houses along the riverbank.

On October 21, high waters of the Parsnip River caused logs and debris to lodge against the PGE bridge across the Parsnip River. On October 22, the bridge 90 mi. (144 km) north of Prince George collapsed. A crane ordered one day prior to the collapse arrived too late to save the bridge. *1) Ray Dawson, PGE Prince George manager, said it would take about 10 days to restore the line.

*1) Erwin Hoppe, local chairman of the Brotherhood of Railroad Trainmen, Lodge 845, claimed the collapse could have been prevented if the PGE had taken precautionary measures. (*The Citizen*, October 27, 1965).

October 23-26, 1965

Event type: Flooding.

Precipitation: Not available.

Source: *The Province*, October 26, 1965; *The Vancouver Sun*, October 26, 1965.

Heavy rain on October 23-24 caused cuts in the PGE rail line and several highways in northern British Columbia.

On October 26, heavy rain cut the railroad bridge across the Parsnip River, 90 mi. (144 km) north of Prince George. Rail traffic on the PGE line between Prince George and the Peace River district was interrupted. Freight to and from Dawson Creek and Fort St. John was carried by truck.

November 27-29, 1965

Event type: Flooding.

Precipitation: Prince Rupert M. Circ (131.5 mm/3 days), November 27-29, 1965; Falls River (156.4 mm/2 days), November 28-29, 1965; Tasu Sound (311.4 mm/3 days), November 27-29, 1965; Sandspit A (29.7 mm/1 day), November 29, 1965.

Source: J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton.

On November 29, CNR reported three washouts at Mile 42.0, 42.1 and 45.4 and a small rockslide at Kaien.

December 1-2, 1965

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: *The Province*, November 30; December 1 and 2, 1965; *The Vancouver Sun*, April 9, 1966; Mathews 1973 (pp. 99-110).

Around November 30, an observer reported a tunnel entrance at the southwest corner of the lake through which the water apparently escaped, dropping quickly from 2,700 ft. (810 m) elevation to sea level and sweeping icebergs with it. Granduc general superintendent H.H. Waller stated that since early November the lake level had gradually dropped by a total of 55 ft. (16.5 m). However, with the total depth of the lake estimated at 180 ft. (54 m) it meant there was still a considerable amount of water left around November 30.

On December 1-2, heavy flood damage occurred near Stewart when Summit Lake discharged underneath the Salmon Glacier. Like in December 1961, a passage opened through the glacier. This second recorded jökulhlaup under Salmon Glacier near Stewart was first recognised on November 14 after the overflow from Summit Lake ceased. The lake had drained northward into the upper Bowser River for a 27-month period (about August 20, 1963 to November 14, 1965).

As the overflow was to be used for domestic purposes and milling of ore, Granduc Operating Company kept a weekly discharge record of the surface outlet during the summer and fall of 1965. Observations of the lake level

were continued until the flood culminated on December 1. During the last week of November, the flow of water from Summit Lake caused the level of the Salmon River to rise 7.5 ft. (2.25 m).

Six inches (15 cm) of water splashed across a gravel road used by Granduc Mines Ltd. to serve its operations. Floodwaters 3 ft. (90 cm) deep surged over 0.5 mi. (800 m) of road about 4 mi. (6.4 km) from Hyder. Though the flooded section is actually in Alaska, it is the only road accessing Granduc's mining camp.

The flood damaged the Salmon River road for about 1 km above Nine Mile, necessitating road relocation at a cost to Granduc Operating Company of \$250,000. In addition, another 2-km stretch of freshly completed road on the floodplain, costing \$275,000, was wiped out. *1) The Nine Mile bridge had part of its bridge deck carried away. The steel-truss bridge, which had been damaged and written off following the 1961 flood and its final destruction in 1967, represented no additional financial loss (Mathews 1973). Some 6 mi. (9.6 km) of the Stewart-Tide Lake road was destroyed or damaged.

According to L.J. Randall, president of Granduc Mines, flood damage to the newly constructed 32.5-mi. (52-km) road through Alaska to their Tide Lake camp totaled some \$750,000. Some 130 miners were briefly cut off. The company appealed to the provincial and federal governments for assistance on the cost of the Stewart-Tide Lake road. (*The Vancouver Sun*). Though with only 1 ft. (30 cm) of snow on the ground this time, Hyder escaped damage. *2) Residents at the mouth of the river were about to evacuate when the flood suddenly stopped.

Waller, who inspected the empty lakebed, reported a definite cavern or tunnel entrance at the south end of the lake. According to Dr. William H. Mathews, professor of Geology at the University of British Columbia, the immense weight pressure from the glacier would effectively seal the escape tunnel. Mathews commented that the unusual flood was unexplainable "by any of the current hypotheses for failure of ice dams (*The Province*, November 30, 1965).

* 1) Thanks to the relocation and some riverbank protection, the 1967 flood caused only a one-and-a-half-day interruption in traffic (Mathews 1973). In the many self-dumping lakes in northern British Columbia and Alaska, the dumping process usually occurs in summer at the height of the melting season (Mathews In: The Province, December 2, 1965)

*2) After the 1961 event, the Alaskan government had constructed a new 12-ft. (3.6 m) dyke, 4 ft. (1.2 m) higher than the original one (*The Province*, December 2, 1965)

January 7-8, 1966

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *Victoria Daily Times*, January 8, 1966; *The Quesnel Cariboo Observer*, January 13, 1966; *The Province*, May 1, 1974.

Early on January 7, ice in the Quesnel River started jamming forcing water to back up. High waters developed into a flood condition. On January 8, a big icejam on the Fraser River about 2 mi. (3.2 km) downstream from Quesnel brought the river levels up about 10 ft. (3 m). *1) Floodwaters of the two rivers, which join within the community, threatened Quesnel residents. According to Mayor Alex Fraser, the ice had reached the lower level of Front Street on the Fraser River. The Hume Sawmill Co., situated on the flat in the Quesnel River, was forced to suspend operations when the water flooded the lower portions of its dry kiln and planer installation. Between 12-15 men working at the mill were temporarily laid off. Cold weather caused the operation to freeze in. The PGE managed to pull two of three cars from the yard but a third was frozen in.

*1) In 1974, the Town of Quesnel and the provincial government agreed on a \$48,000-riverbank protection project at the confluence of the Quesnel and Fraser rivers. The project was scheduled to start on May 3, 1974. The town would pay 25% with the remainder paid by the provincial government. (*The Province*, May 1, 1974).

January 13-21, 1966

Event type: Flooding.

Precipitation: Prince Rupert M. Circ (106.6 mm/4 days), January 13-16, 1966; Prince Rupert M. Circ (82.2 mm/2 days), January 19-20, 1966; Bella Coola (24.4 mm/3 days), January 19-21, 1966; Terrace (30.8 cm snow/3 days), January 19-21, 1966; Kitimat Townsite (61.0 mm/1 day), January 20, 1966.

Source: *The Daily News*, January 12, 13, 18, 22, 23, 24 and 25, 1966.

On January 12, the first snowslide of the year blocked the highway near Kwinitsa. *1) The slide, which was 50 ft. (15 m) wide and 10 ft. (3 m) deep, closed the highway. After three hours it was made passable for one lane traffic and the rest of the slide was removed on January 13. On January 17, several small slides occurred on Highway 16 between Prince Rupert-Terrace. The worst spots were between Mile 8-Mile31 and at Mile 35. A snowfall of 16 in. (40.6 cm), turning into rain and 14 in. (35.6 cm) of snow at the Prince Rupert end, were reported. Highway 16 was open on January 18 with single lane traffic in several sections. Around January 24, Highway 16 east of Kwinitsa had a "considerable amount of water" on the road in several sections. On January 21 at 3 a.m., the BC Tel microwave tower at Zymoetz went out. On January 23, the temperatures rose.

On January 23, the Bella Coola River flooded its banks after several days of driving rain and record (high) temperatures. Snow melted up to the 10,000-ft. (3,000 m) level. In Bella Coola, more than 40 people had to evacuate to higher ground. On January 25, the evacuated residents returned to Bella Coola but the highway between Hagensborg-Bella Coola was still flooded. The Hagensborg telephone exchange was knocked out by the high water. Two bridges washed out and the town was surrounded by water up to 5 ft. (1.5 m) deep. A Department of Transport Sikorsky helicopter stood by to evacuate the residents if needed.

On the Queen Charlotte Islands, creeks along the island highway flooded. Also some roads near Sandspit were also reported flooded.

*1) For the first time, a semi-permanent winter crew from Terrace was stationed at Kwinitsa. This would enable them to work in both directions, thus saving time not having to come out from Terrace (*The Daily News*, January 13, 1966).

January 23-26, 1966

Event type: Severe snow storm.

Precipitation: Kitimat Townsite (55.9 cm snow/1 day), January 25, 1966; Terrace A (19.6 cm snow/2 days), January 25-26, 1966.

Source: *The Northern Sentinel*, January 27 and February 10, 1966.

Kitimat reported a three-day continuous snowstorm with winds gusting to 40 mph (64 km/h). According to records kept at the Kitimat Fire Hall, the storm that dumped 5 ft. (1.5 m) of fine dry snow, brought the winter's total snow to 198 in. (502.9 cm). *1)

*1) According to records kept by Alcan at the Kitimat Works, the total precipitation for January was 12.55 in. (318.8 mm): 103 in. (261.6 cm) of snow and 2.25 in. (57.2 mm) of rain (*The Northern Sentinel*, February 10, 1966).

February 8-10, 1966

Event type: Snow avalanches.

Precipitation: Prince Rupert (103.2 mm/3 days), February 8-10, 1966; Terrace (16.0 mm/3 days), February 8-10, 1966; Tasu Sound (63.8 mm/1 day), February 9, 1966.

Source: *The Northern Sentinel*, February 10 and 17, 1966; *The Daily News*, February 10 and 11, 1966.

Between February 1-10, 4 ft. (1.2 m) of snow fell on the Rainbow Summit east of Prince Rupert. Kitimat recorded 140 in. (3.56 m) of snow until February 11. Early February, Kitimat recorded almost 5 ft. (1.5 m) of snow in five days. According to records kept at the Kitimat Fire Hall, 59 in. (149.9 cm) of snow fell since February 1, bringing the winter's total snow to 302 in. (767.1 cm). This caused the heaviest snow load in the town's 12-year history. Around February 5-6, the Kitimat Fire Department tested the snowload on Kitimat roofs at 25 lb./ft.³ (407.1 kg/m³). In Kitimat, the roof of "Bravo's Welding Shop" collapsed, killing one man. The metal roof of the Quonset-type building collapsed, trapping three men inside. The building erected in 1959 was a total loss.

Highway 16 and the rail line between Prince Rupert-Terrace were blocked by slides and closed. The slide blocking both the highway and rail line at Mile 41 was 150 ft. (45 m) long and 20 ft. (6 m) deep. Another slide came down 35 mi. (56 km) west of Terrace. A series of smaller slides at Mile 31 west of Terrace only blocked the highway. On February 11, the small slush slides near Kwinitsa were cleared and the rail line reopened.

February 15-16, 1966

Event type: Flooding and snow avalanches.

Precipitation: Falls River (64.3 mm/2 days), February 15-16, 1966; Aiyansh (20.6 mm/1 day), February 16, 1966; Prince Rupert M. Circ (20.8 mm/1 day), February 16, 1966; Prince Rupert (43.2 mm/1 day), February 16, 1966.

Source: *The Daily News*, February 15, 16, 17 and 18, 1966; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On February 16, CNR reported washouts and snowslides at Mile 13.5, 14.0, 43.6, and 50.1. The rail line was closed for 13 hours.

February 19-21, 1966

Event type: Snow avalanches.

Precipitation: Falls River (97.8 mm/2 days), February 19-20, 1966; Prince Rupert M. Circ (75.9 mm/3 days), February 19-21, 1966.

Source: J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On February 21, CNR reported snowslides at Mile 40.7 and 43.8. The rail line was closed for 12 hours.

March 26-31, 1966

Event type: Flooding.

Precipitation: Falls River (82.6 mm/1 day), March 27, 1966; Stewart (67.5 mm/2 days), March 27-28, 1966; Tasu Sound (115.8 mm/1 day), March 28, 1966; Kitimat (167.4 mm/2 days), March 28-29, 1966; Kitimat Townsite (139.2

mm/2 days), March 28-29, 1966; Terrace (70.1 mm/2 days), March 28-29, 1966; Prince Rupert M. Circ (96.0 mm/2 days), March 28-29, 1966; Kitimat 2 (234.1 mm/4 days), March 28-31, 1966; Kemano (119.1 mm/2 days), March 29-30, 1966.

Source: *Northern Sentinel*, March 31, 1966; *The Daily News*, March 29 and 30, 1966; Mathews and Clague 1993.

Prince Rupert recorded 5.18 in. (131.6 mm) in three days and winds gusting up to 43 mph (69.2 km/h). Kitimat reported 6.49 in. (164.8 mm) between March 27-31. Minor washouts occurred in the Terrace area. Highway 16 was flooded with 2 ft. (60 cm) 28 mi. (44.8 km) west of Terrace, as a result of culverts being too small to handle the water. A small washout occurred between Kitimat-Kitimaat Village.

During the period March 26 to April 4, the hydrometric station on the Salmon River at Nine Mile, 9 km downstream of Salmon Glacier, recorded unusual high discharges. Though 50 mm of rain was recorded at Stewart on March 28, this seems inadequate to explain the high discharges during the following days. The highest mean daily discharge was 265 m³/s on March 29. This discharge is 17 times greater than the next highest March discharge at Nine Mile. It also exceeded by nearly 100%, the highest mean daily discharge recorded during the summer of 1966. A total of 0.045 km³ of water passed Nine Mile during this 10-day period, equivalent to approximately 18% of the volume of Summit Lake. This anomalous discharge is not yet fully explained. Two possible causes are a sequential failure of a cluster of water bodies within the Salmon Glacier, or a partial draining of Summit Lake (Mathews and Clague 1993).

April 8-12, 1966

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Interior News*, April 13, 1966, December 2, 1970; *The Daily News*, April 12, 15, 18, 22, 1966; *The Vancouver Sun*, April 9, 1966; *The British Columbia Road Runner*, B.C. Ministry of Transportation and Highways, June 1966 Vol. 3 No. 2, p. 2; Files M4-21-E34-0, M54-653-0 Smithers Bridge (Good Friday Damage). B.C. Ministry of Transportation and Highways, Terrace.

On Good Friday evening, an icejam blocked the Bulkley River between the bridge and Riverside Park. Ice was piled 15 ft. (4.5 m) above the river level, with some blocks as big as 10-ft. (3 m) square and 4 ft. (1.2 m) thick. It dammed up thousands of gallons of water, causing the river to flood behind it and to drop 8 ft. (2.4 m) below normal ahead of it. The backed-up waters overflowed their banks and flooded the flats surrounding the bridge area. The water levels rose more than 1 ft. (30 cm) in half an hour. A 290-ft. (87 m) section of the 22-year-old Bulkley River bridge on Highway 16, 1 mi. (1.6 km) east of Smithers, was taken out by break-up ice. *1) Riverside residents were evacuated. On the Smithers side, the Vetterli farm and Lubbers' Trailer Court were inundated.

On April 9, the Department of Highways reinforced the Canyon bridge on the Moricetown (Telkwa) Highroad. On April 10, some quicksand collapsed, splitting the village's sewer system. In an effort to break the icejam, engineers set off a series of dynamite explosions that caused flooding at the village's temporary water pumping station, leaving villagers without water. On April 10 and 11, the Department of Highways crews exploded several hundred pounds of dynamite in the icepack. Three quarters of the icejam was moved and the bridge site cleared. Nearly 300 ft. (90 m) of highway bridge and supporting pier were torn loose. A 40-mi. (64-km) gravel road detour was opened on April 8 for passenger cars and other light vehicles only. On April 11, the icepack moved, only to get stuck again 1 mi. (1.6 km) downstream. On the River Park section, over 0.5 mi. (800 m) of ice got stuck and caused the area to flood. A state of emergency was declared by Village Chairman Joe MacDonald to give the Council powers to cope with the water and sewer problems in the community. Work on the pumpsite at Riverside Park had to be discontinued.

On April 12, a channel broke through the icejam easing the problems of the waterworks crews when the water levels went down. Two small Smithers-based helicopters handled direct cross-river traffic. Detoured traffic on the Moricetown-Telkwa Highroad had to be cut down to a single-lane pilot relay system. Daytime traffic was limited to light vehicles; truck traffic was restricted to the hours between midnight-8:00 a.m. On April 13, approximately 8,000 lb. (3,632 kg) of dynamite were placed under the ice from a hovering helicopter. The blast, synchronised to go off every 15 minutes, consisted of 150-350 lb. (68-159 kg) each. A Bailey bridge put in to replace the lost bridge section was opened on April 21.

The ice was also holding back in a section of the Bulkley River in the Quick-Walcott area between Telkwa-Houston.

*1) Highway 16 was rerouted and a new permanent bridge was built, which was opened in August 1969. A new road was constructed to connect the Glentanna and Babine areas with the new highway. In December 1970, the temporary Bailey bridge was salvaged for future emergency use while the remainder of the old bridge was demolished and scrapped (*The Interior News*, December 2, 1970).

October 21-24, 1966

Event type: Flooding.

Precipitation: Falls River (165.9 mm/2 days), October 21-22, 1966; Ocean Falls (220.2 mm/3 days), October 21-23, 1966; Aiyansh (100.0 mm/2 days), October 22-23, 1966; Kildala (102.9 mm/2 days), October 22-23, 1966; Kitimat Townsite (145.8 mm/2 days), October 22-23, 1966; Kitimat 2 (175.3 mm/2 days), October 22-23, 1966; Prince Rupert

(143.0 mm/2 days), October 22-23, 1966; Aiyansh (100.0 mm/2 days), October 22-23, 1966; Smithers (37.8 mm/1 day), October 23, 1966; Smithers A (64.2 mm/2 days), October 23-24, 1966; Kemano (68.1 mm/1 day), October 24, 1966.

Source: *Northern Sentinel*, October 27, 1966; *The Daily News*, October 24, 25 and 26, 1966; *The Interior News*, October 26, 1966; *The Sun*, October 24, 1966; Letter, J.P. O'Toole (Dist. Supt. Terrace) to P.J. Carr (Reg. Maint. Eng. Prince George). B.C. Ministry of Transportation and Highways, Terrace File M 54-653-0, Flood damage Skeena East. B.C. Ministry of Transportation and Highways, Terrace; Environment Canada 1991; Meziadin Environmental Advisory Team 1975 (Vol. 3, Fig. 4-9); B.C. Ministry of Public Works 1968 (p. C 105); Ministry of Transportation and Highways. Granite Creek Flooding, Lakelse Lake Area. B.C. Ministry of Transportation and Highways, Terrace; Northwest Hydraulic Consultants Ltd. 1987.

Between October 22-23, Prince Rupert reported over 3 in. (76.2 mm) of rain. The Digby Island Marine Aeradio station recorded 2.70 in. (68.9 mm) on October 21 and 0.86 in. (21.9 mm) on October 22. On October 23, as a result of moisture in the cables the telephone service went out of service in Prince Rupert. The main problem was in cable No. 3 located towards the east end. On October 24, some 700 customers were still without service. About 400 telephones were still out of order on October 26. A few cellars were reported flooded. CHTK-TV experienced reception trouble because of ice building up on its 4,300-ft. (1,290 m) elevation Copper Mountain antenna.

At the Seco Electric construction site at Telegraph Point, two D-8 Cats and steel for the BC Hydro power towers were completely submerged. Water flowed over the Columbia Cellulose dam onto Highway 16.

Between October 22-23, Kitimat recorded about 6 in. (152.4 mm) of rain. On October 22, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 1,680 m³/s and a maximum daily discharge of 1,100 m³/s (Environment Canada 1991). It flooded the Service Centre, doing considerable damage to 12 businesses. According to George More, manager of the Gordon Hotel, the hotel and many of the businesses were flooded with 4 in. (10 cm) of water. Crown-Zellerbach Canada Ltd. suspended logging because of flooding of 2,000 ac. (800 ha) of its timber rights. Some basements in Kitimat were flooded. A secondary road into Kitimaat Village was damaged.

Flooding due to heavy rains occurred on October 22, causing considerable damage to the Kitimat Highway (B.C. Ministry of Public Works 1968). On Highway 25 at Williams Creek, 150 ft. (45 m) of pavement washed out. The bridge approaches of southern Williams Creek and Hatry (Hatchery) Creek were damaged. The wooden bridge over South Granite Creek on 1st Avenue partially washed away. The Highway Department removed this bridge and also the one over North Granite Creek. Both were replaced with two 6-ft. (1.8 m) diameter corrugated iron culverts. Instead of rock, gravel fill was used at both sites to bring up the road level. These culverts were able to handle medium creek flow, but in high flow both culverts washed out. Gravel fill, washed down with the flood, built up the creek bed, causing it to overflow much more than previously. During low water in the fall, the Highway Department bulldozed out most of the gravel and accumulated debris in the lower reaches of South and North Granite creeks. The high water flow in Granite Creek during this flood period also washed out 30 ft. (9 m) of the east lane of Highway 25 immediately south of Granite Creek bridge. A half-mile (800 m) stretch of highway was under 2 ft. (60 cm) of water. At Glacier Creek, erosion occurred around the culvert. Several roads in Terrace and Kitimat flooded.

Highway 16 between Terrace-Hazelton was closed. Extensive erosion occurred at the side hill fill west of Kitsequecla. Culvert sections were undermined and carried downslope. Further west of Kitsequecla, tension cracks developed on the shoulder of the highway, causing bank erosion. The Hells Bells bridge, 38 mi. (60.8 km) east of Terrace had its approach washed out. Erosion of the piling support caused the entire structure to collapse and be swept away. It was replaced temporarily by an 80-ft. (24 m) Bailey bridge. Repair cost of the flood damage in the Rosswood area, at the north end of Kalum Lake, was \$5,000.

On October 24, 4.18 in. (106.2 mm) of rain fell overnight in Ocean Falls. Currents from the six open dam gates, combined with gusts of wind, swung the *Northland Prince*, attempting to leave the harbour, over to the paper dock. On Twin Lakes Road, a 50-ft. (15 m) wide slide occurred. A tree uprooted by the wind came down on a power pole between Houses 1020-1022.

Heavy flooding occurred in the Smithers area. Nearly 2.5 in. (63.5 mm) of rain fell in 24 hours. Trout Creek, west of Smithers, had its cross bracing and pile bent damaged. The approach scoured out, and the east abutment of the new bridge fell into the stream channel. The approaches to the new bridge were also partially swept away. The old Highroad to Moricetown was used as a detour. On October 24, telephone service west of Trout Creek was temporarily cut off. Extensive bank erosion occurred adjacent to the Trout Creek store. At Toboggan Creek, debris at the culvert inlet caused a deep scour hole under the culvert discharge. In Telkwa, the Bulkley River flooded its banks alongside River Road. The Telkwa River crested well above the previous spring's flood stage. On the Kispiox River Road, two bridges were reported washed out.

Peak flows occurred on October 24. The Zymoetz River at OK Creek recorded a mean daily discharge of 44,000 cfs (1,245 m³/s), and an instantaneous discharge of 68,500 cfs (1,940 m³/s). The Little Wedeene River recorded an instantaneous discharge of 6,120 cfs (173 m³/s). The Kitsequecla River near Skeena Crossing recorded a mean daily discharge of 8,100 cfs (230 m³/s) and an instantaneous discharge of 21,300 cfs (603 m³/s) (Meziadin Environmental Advisory Team 1975).

November 12, 1966

Event type: Debris slide.

Precipitation: Not applicable.

Source: *The Province*, November 14, 1966; *The Quesnel Cariboo Observer*, November 17, 1966.

On November 11, a small mud and rockslide blocked part of the PGE track near Soda Creek, north of Williams Lake. About 150 ft. (45 m) of the northbound track were covered. Passengers were moved by bus between Williams Lake-Prince George.

November 23-25, 1966

Event type: Flooding.

Precipitation: Aiyansh (68.1 mm/2 days), November 23-24, 1966; Falls River (137.2 mm/3 days), November 23-25, 1966; Prince Rupert A (68.6 mm/1 day), November 24, 1966; Kemano (53.1 mm/1 day), November 25, 1966.

Source: *The Daily News*, November 24, 1966.

On November 24, Prince Rupert recorded 2.51 in. (63.8 mm) of rain in 24 hours ending 10:30 a.m., 1.5 in. (38.1 mm) of which fell after 4:30 a.m. Slight flooding occurred on roads near the Cassiar cannery and near the entrance of Prince Rupert.

January 30-February 5, 1967

Event type: Snow avalanches.

Precipitation: Kitimat Townsite (151.3 mm/5 days), January 30-February 3, 1967; Falls River (245.7 mm/6 days), January 31-February 5, 1967; Ocean Falls (168.4 mm/2days), February 1-2, 1967; Kitimat 2 (230.3 mm/5 days), February 1-5, 1967; Kemano (68.8 mm/2 days), February 3-4, 1967.

Source: *The Province*, February 3 and 6, 1967; *The Daily News*, February 6, 7, 8 and 9, 1967; *The Interior News*, February 8, 1967; B.C. Ministry of Transportation and Highways 1980.

On February 2, Highway 16 between Prince Rupert-Terrace was closed. Four slides occurred at 9 mi. (14.4 km) and 34 mi. (54.4 km) west of Terrace and two at Kwinitsa. Because of rain and mild temperatures more slides were expected. Later that night the road was still not cleared.

The rail traffic was delayed by two large slides near Usk, 25 mi. east of Terrace. On February 6, a westbound freight train hit a snowslide at slide path Tunnel at 64.0 km, 54 mi. (86.4 km) east of Prince Rupert, and derailed. The slide was 130 ft. (39 m) long and 25 ft. (7.5 m) deep. One engine and 13 wheat cars blocked the highway and a second engine went into the Skeena River. The rail line reopened after two days and the highway after three days.

June 5-6, 1967

Event type: Spring runoff flooding.

Source: *The Province*, June 6, 1967; *The Citizen*, June 6 and 7, 1967; Special Warrant #7 Flood control costs 1967-68.

In June, mountain snowpacks were similar to those in June 1964, which produced record high June to September volumes of runoff water and the third highest discharge on record, as measured at Hope.

On June 5, several homes in a residential area just north of the city were abandoned. According to the RCMP, the whole area on the North Nechako River a few miles above the Fraser containing about 85 homes was threatened. Early that day, the gauge under the old Fraser River bridge at Prince George reached 32.43 ft., rising to 32.68 ft., the highest point since 1964, on the morning of June 6. Water from the Fraser River backed up the Nechako River into the Island Cache, flooding a number of homes early on June 6. Two trailer courts on the banks of the Fraser River were flooded out as the river rose steadily. All the trailers were moved out of the Fraser River Trailer Court. A number of families left flooded homes in the Cache and the Island Cache school closed on June 5 and 6. By 9 a.m. on June 7, the Fraser River level had dropped to 30.85, or 1.58 ft. (47 cm) since the morning of June 6.

Although there were no reports of serious flooding anywhere further downstream on the Fraser River, some low-lying areas in Quesnel were covered.

Flood control costs for 1967-68 under Special Warrant #7 included:

Water Resources Service: West Quesnel: \$2,343.32. (Dyke extension under District Engineer, Prince George; work done by Town).

Department of Highways:

a) Dyke improvement: Prince George: \$15,000; Hirsch Creek-Kitimat Highway: \$15,000.

b) Stream clearing and river bank protection: Bella Coola River-Kleena Kleene River: \$2,594.70; Buck (Creek) River-Bulkley River: \$7,862.92; Highway 25 South-Terrace: \$17,994.80

c) General road repairs and washouts: Burns Lake area: \$4,866.81; Fort St. John area: \$46,857.68; Prince George: \$4,000.00; Quesnel area: \$9,466.16; Hazelton area: \$4,087.48

September 11-17, 1967

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Mathews 1973 (pp. 99-110); Mathews and Clague 1993.

This third recorded jökulhlaup event under Salmon Glacier near Stewart was first recognised on September 11. Summit Lake had been overflowing northward for less than 25 days (August 19-September 11). After allowance made for a substantial inflow into Summit Lake during a rainy period in early September, it seems clear that leakage was occurring through Salmon Glacier as early as September 1. The flood terminated on September 17 when the lake basin was nearly but not completely emptied (Mathews 1973). *1)

The steel-truss bridge across the Salmon River at Nine Mile was swept off its foundation, folded in half, and carried downstream several hundreds of metres. *2) There is no evidence that this jökulhlaup was any larger than the previous two, and the demise of the bridge may have resulted from the cumulative undermining of its piers. Alternately, perhaps the accumulation of alluvium downstream during the earlier floods raised the water level at the bridge and thus contributed to its destruction. A photograph taken the morning after the end of the jökulhlaup shows a large bar of cobbles and small boulders immediately downstream of the remnants of the Nine Mile bridge. This bar formed in the lee of the bridge during the ebbing stage of the jökulhlaup, showing that significant amounts of gravel can be transported in such events (Mathews and Clague 1993).

*1) After this jökulhlaup the lake no longer filled to overflowing but instead switched to a cycle of annual outbursts with the possible exceptions of 1969 and 1973 (Mathews and Clague 1993).

*2) Following the December 1961 jökulhlaup, the bridge was written off. It sustained further damage during the November, 1965 jökulhlaup.

September 20-24, 1967

Event type: Flooding.

Precipitation: Kildala (112.0 mm/3 days), September 20-22, 1967; Aiyansh (136.1 mm/4 days), September 20-23, 1967; Kitimat 2 (192.8 mm/4 days), September 20-23, 1967; Kitimat Townsite (155.4 mm/4 days), September 20-23, 1967; Prince Rupert M. Circ (222.4 mm/4 days), September 20-23, 1967; Falls River (222.6 mm/5 days), September 20-24, 1967; Tasu Sound (64.8 mm/1 day), September 22, 1967; Prince Rupert (145.4 mm/2 days), September 22-23, 1967; Aiyansh (109.2 mm/2 days), September 22-23, 1967; Langara (88.7 mm/3 days), September 22-24, 1967.

Source: *The Daily News*, September 25, 1967; *Northern Sentinel*, September 27, 1967; *Terrace Omineca Herald*, September 27, 1967; *The Vancouver Sun*, September 24, 1967; Environment Canada 1991; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

Between September 20-23, Prince Rupert reported 7.24 in. (183.9 mm) in four days. On September 23 alone, 3.48 in. (88.39 mm) of rain fell. Highway 16 between Prince Rupert-Terrace was flooded in several locations. Worst hit was a 2-mi. (3.2 km) section of highway between Diana Creek-Prudhomme Lake. At Taylor Lake and Prudhomme Lake, the highway was flooded with 2.5 ft. (0.75 m) of water. At Diana Creek, 15 mi. (24 km) east of Prince Rupert, the highway was flooded with 2 ft. (60 cm) of water. The highway was closed for seven hours. A small rockslide occurred at Amsbury Bluff, 8 mi. (12.8 km) west of Terrace. The Nass Valley road was closed as a result of a washed-out approach at Star Creek.

In Kitimat, the bridge across Goose Creek near the dump flooded. On September 23 the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 1,250 m³/s and a maximum daily discharge of 886 m³/s (Environment Canada 1991). The Kitimat River dike, just north of the Haisla bridge, was threatened. It had to be raised to a safe level.

CNR reported washouts at Mile 24.5 and 78.6. The rail line was closed for 10 hours. The rail traffic was delayed. Several small washouts occurred at Sockeye, Tyee, and the February 1967 derailment site.

December 1-2, 1967

Event type: Storm surge and tidal flooding.

Precipitation: Falls River (102.4 mm/2 days), December 1-2, 1967; Sandspit A (58.7 mm/2 days), December 1-2, 1967; Masset (79.8 mm/2 days), December 1-2, 1967; Prince Rupert M. Circ (27.4 mm/2 days), December 1-2, 1967.

Source: *The Daily News*, December 4, 1967; *Juneau Alaska Empire*, December 2, 1967; B.C. Ministry of Public Works 1969 (p. C 109); Lewis and Moran 1985 (p. 5.80, Storm No. 36); Mariners Weather Log, Vol. 12, No. 3, 1968. *1)

On December 1-2, winds gusting up to 60 mph (96.6 km/h) caused widespread damage and power outages in Prince Rupert. Portions of the highway between Galloway Rapids-Port Edward were covered by water. The wind whipped the high tides across the road. No damage was done to the road.

The maximum wind reported in this extremely deep and intense storm was 80 kn. (148 km/h) by a ship at 47.3°N, 138.3°W on December 1. There were three further ship reports of 70 kn. (130 km/h) or more and a total of 42 reports of storm force winds. The maximum land wind reported was 72 kn. (133 km/h) from Cape St. James and three other land stations reported storm force winds (Lewis and Moran 1985). The Canadian weathership *Quadra* was damaged during the hurricane force storm with winds gusting up to 100 mph (160.9 km/h). The ship had to return to Victoria. Weathership *Papa*, 980 mi. (1,568 km) northwest of Vancouver, reported 50-ft. (15 m) high waves. The Alaska State Ferry schedule was disrupted by heavy winds gusting to 50 mph (80 km/h) along the Alaska panhandle. Off Ketchikan, the southbound ferry *Taku* had to take shelter at Pennock Island and later at Ward Cove.

On the Queen Charlotte Islands the highway was devastated by the storm, which peaked on December 1 during the two hours around noon. The damage was caused by a combination of high tides, heavy rain, and winds up to 90 mph (132.0 km/h). The storm caused erosion of some 3 mi. (4.8 km) of road adjacent to the sea (B.C. Ministry of Public Works 1969). The highway between Skidegate-Tlell was strewn with fallen trees. At Dead Tree Point, waves carried on 24-ft. (7.2 m) tides pounded the highway flanks breaking up the pavement.

*1) The Mariners Weather Log (MWL) is a quarterly (bimonthly during the period 1957 -1981) publication of the U.S. Weather Bureau which provides information on weather over the world's oceans and the Great Lakes. The first issue was published in January 1957 (Lewis and Moran 1985).

December 22-26, 1967

Event type: Snow avalanches.

Precipitation: Kemano (48.3 mm/1 day), December 22, 1967; Kildala (44.2 mm/1 day), December 22, 1967; Terrace (57.4 cm (snow)/2 days), December 22-23, 1967; Prince Rupert M. Circ (70.8 mm/3 days), December 22-24, 1967; Langara (72.4 mm/2 days), December 25-26, 1967.

Source: *Terrace Omineca Herald*, January 3, 1968; *The Daily News*, December 27, 28 and 29, 1967; *The Northern Sentinel*, December 27, 1967; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On December 23-24, Terrace reported 28 in. (71.1 cm) of snow. The storm was a combination of heavy snow and warm temperatures. Prince Rupert reported maximum temperatures of 13.9^o C on December 26, 17.2^o C on December 27, and 13.1^o C on December 28.

Highway 16 between Prince Rupert-Terrace was closed. Since the night of December 26, the highway was blocked by four separate slides. Large slides occurred at Mile 35 and Mile 50, with a length of several hundred feet and a depth of 5 ft. (1.5 m). At the tunnel 44 mi. (70.4 km) west of Terrace, a small slide came down and there were numerous smaller slides at Amsbury Bluff. Winds up to 50 mph (80.5 km/h) caused snowdrifts 4-5 ft. (1.2-1.5 m) high.

CNR reported snowslides at Mile 42.4, 43.7, and 50.1. CN telecommunications were disrupted and the rail line was closed for 14 hours.

January 11-17, 1968

Event type: Snow slides.

Precipitation: Kemano (104.1 mm/1 day), January 11, 1968; Falls River (167.7 mm/2 days), January 11-12, 1968; Kildala (148.6 mm/3 days), January 11-13, 1968; Kitimat Townsite (211.9 mm/3 days), January 11, 13-14, 1968; Aiyansh (30.7 mm/1 day), January 12, 1968; Terrace (97.8 mm/2 days), January 12-13, 1968; Prince Rupert (101.1 mm/3 days), January 12-14, 1968; Terrace (56.9 mm/1 day), January 17, 1968.

Source: *The Province*, January 13, 1968; *Terrace Omineca Herald*, January 17, 1968; *The Daily News*, January 12, 15, 16, 18 and 19, February 1, 1968; *The Interior News*, January 17, 1968; Letter, January 10, 1989. J. Mekechuck (Geotechnical Engineer, CN Railway, Edmonton) to J.W. Schwab (B.C. Ministry of Forests, Smithers); J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta; B.C. Ministry of Transportation and Highways 1969 (p. C 109).

On January 11, Prince Rupert recorded 6.8 in. (17.3 cm) of snow. On January 12, the Queen Charlotte Islands reported 15 in. (38.1 cm) of snow, making it "one of the heaviest snowfalls in recent years." Between January 11-13, Terrace recorded 38 in. (96.5 cm) of snow and 2 in. (50.8 mm) of rain on January 14. It was described as the "worst snowfall in memory." On January 15, schools and many businesses were closed. On January 17, Prince Rupert reported 16 in. (40.6 cm) of snow followed by rain at night. *1)

Twenty-four inches (60 cm) of snow falling on January 12 forced the closure of Highway 16 between Prince Rupert-Terrace. On January 12, Highway 16 between Prince Rupert-Terrace and Highway 25 between Terrace-Kitimat were restricted to one-lane traffic only. Between Kwinitsa-Salvus, snowdrifts of 4-6-ft. (1.2-1.8 m) were reported. On January 13, 19 vehicles carrying approximately 30 persons were trapped by avalanches and heavy snowfall between Terrace-Prince Rupert. No damage or injuries were reported. On January 13-14, heavy snow, drifting, and slides blocked the highway. The highway was blocked for three days when 42 in. (106.7 cm) fell in a period of 24 hours, followed by rain (B.C. Ministry of Public Works 1969). The worst snowslide occurred 53 mi. (84.8 km) east of Prince Rupert. It was 200 ft. (60 m) long and 15 ft. (4.5 m) deep. The highway was reopened on January 15 for single-lane convoy traffic only. On that date, one RCMP-guided convoy was completed safely in each direction. On January 16, Highway 16 was reopened to traffic. On Highway 16 several small slides came down on January 17, creating hazardous driving conditions. On January 18, all slides were cleared, but single-lane traffic remained on several sections. The worst spots were between Mile 8-31 west of Terrace and Mile 35. Highway crews were keeping an eye on a huge pile of snow at Mile 51 near Kwinitsa. On January 19, Highway 16 was reported in good condition, despite 2 in. (5.1 cm) of fresh snow overnight.

On January 15, the rail line and the highway between Prince Rupert-Terrace were blocked by dozens of slides. The highway was blocked for three days, during which 42 in. (106.7 cm) of snow fell in a period of 24 hours, followed by rain. The worst snowslide occurred 53 mi. (84.8 km) east of Prince Rupert. It was 200 ft. (60 m) long and 15 ft. (4.5 m) deep. A large snowslide 300 ft. (90 m) long and 15 ft. (4.5 m) deep cut the rail line. On January 13, CNR

reported snowslides at Mile 14.3, 22.8, 34.5, 43.2, and 43.3. The rail line was closed for 12 hours. The line between Prince Rupert-Terrace reopened on January 16. East of Terrace the steel bridge near Usk washed out and collapsed. The timber and steel trestle at Mile 120.3, one mile (1.6 km) west of Usk, was severely damaged by an avalanche (J. Mekechuck, pers. comm. 1989). *2) The passenger train was held at Smithers and the passengers were airlifted to Prince Rupert.

In the Smithers area, power outages occurred when trees fell on the power line. On January 15, the area was hit by a brief storm with strong gusts and a downpour of rain.

*1) Digby Island near Prince Rupert recorded 28.8 in. (73.2 cm) of snow during January, the highest on record for more than 20 years. In addition 9.06 in. (230.1 mm) of rain were recorded.

*2) In 1973, the structure was hit by another avalanche. The steel girder spans were pushed into the Skeena River and could not be found. Twin large-diameter corrugated-metal pipes replaced it. (J. Mekechuck, pers. comm. 1989).

January 19-23, 1968

Event type: Flooding and snow avalanches.

Precipitation: Smithers (35.1 mm/2 days), January 19-20, 1968; Smithers A (27.4 mm/1 day), January 20, 1968; Falls River (102.1 mm/2 days), January 20-21, 1968; Ocean Falls (359.3 mm/4 days), January 20-23, 1968; Kitimat 2 (89.7 mm/2 days), January 21-22, 1968; Kitimat Townsite (69.3 mm/1 day), January 22, 1968; Aiyansh (34.8 mm/1 day), January 22, 1968; Kemano (59.9 mm/1 day), January 22, 1968; Kildala (68.8 mm/1 day), January 22, 1968; Bella Coola (107.1 mm/2 days), January 22-23, 1968.

Source: *The Daily News*, January 23, 1968; *The Interior News*, January 23, 1968; *Northern Sentinel*, January 24, 1968; Eero Karanka, pers. comm. February 21, 1994. Habitat Biologist, Department of Fisheries and Oceans, Prince Rupert; Church 1983 (pp. 169-180); Tempest 1974; Environment Canada 1991.

On January 20, Kitimat reported 21 in. (53.3 cm) of snow. Highway 16 was closed by a slide at Mile 51, halfway between Prince Rupert-Terrace. A sharp rise in temperatures on January 22 caused minor flooding on Highway 16 between Prince Rupert-Terrace. On January 23, the highway was reported in fair condition, with crews standing by for possible flooding and washouts in several sections. Some power and telephone interruptions occurred. A power failure occurred at the Zymoetz microwave site, 35 mi. (56 km) east of Terrace. Crews had difficulty reaching the site because of snowdrifts and slides. Helicopters were grounded by freezing rain.

Heavy rain and warm temperatures caused a major flood on the Bella Coola River. It resulted from a frontal rainstorm with unusually high freezing levels for January. The Port Hardy freezing level began to rise during the night of January 18-19, culminating at over 3,400 m on the afternoon of January 22. A cumulative total of 186 cm of snow had fallen at Bella Coola prior to the rainstorm. This would suggest a 50- to 80-cm snowpack on the valley bottom (Karanka, pers. comm.).

From January 11-18, the stations of Bella Coola and Bella Coola Hydro recorded 5.44 and 7.17 in. (138.2 and 182.1 mm), respectively. Daily maximum temperatures rose to 40° F (4.4° C) and minimums above 32° F (0° C). Between January 19-23, 6.20 and 9.32 in. (157.5 and 236.7 mm) of rain was recorded at the two stations, respectively. The Bella Coola two-day rainfall did not have a significant return period, but the Bella Coola BC Hydro two-day rainfall was the third highest in 25 years of record. Chinook conditions prevailed on the Chilcotin Plateau, possibly including the Atnarko Basin (Karanka, pers. comm.). On January 23, temperatures rose to 48° F (8.9° C) and a minimum of 37° F (2.8° C). The high temperatures probably raised the freezing level to the 5,000-ft. (1,500-m) level in the lower part of the Bella Coola valley. *1) Emergency flood control measures for an expenditure of \$250,000 were carried out. On January 23, the Bella Coola River above Burnt Bridge Creek recorded a maximum instantaneous discharge of 828 m³/s and a maximum daily discharge of 703 m³/s. Both values are extreme highs for the period of record (Environment Canada 1991). Beginning around noon on January 22, the river rose 11 ft. (3.3 m) in just over a day, peaking just before 6 p.m. on January 23. The river stayed high for about 12 hours and then began to fall at a rate of 3 ft. (90 cm) per day until ice conditions set in on January 26 (Tempest 1974).

The Nusatsum River near Hagensborg recorded a maximum instantaneous discharge of 182 m³/s on January 22 and a maximum daily discharge of 86.9 m³/s on January 23. On January 23, the Salloompt River near Hagensborg recorded a maximum instantaneous discharge of 142 m³/s and a maximum daily discharge of 118 m³/s. *2) It was the second highest peakflow recorded on the Salloompt River. (The highest flow was on December 16, 1980, with a peakflow 1.7 times higher than on January 23, 1968 (Karanka, pers. comm.). On January 24, the Bella Coola River near Hagensborg recorded an estimated maximum daily discharge of 963 m³/s. This was an extreme high for the period of record (Environment Canada 1991).

In the Bulkley Valley, a 14-in. (35.6 cm) snowfall caused a power outage on January 20. Warm temperatures and rain followed the heavy snowfall on January 22. The 0.43 in. (10.9 mm) of rain combined with the 15.8 in. (40.1 cm) of snow brought the week's total precipitation to 2.01 in. (51.1 mm).

*1) As the greatest floods on the Bella Coola River generally occur in October and November, this flood was apparently the first to have happened so late in the winter.

*2) From river-level surveys taken at the time and an estimated discharge at Hagensborg, the flood in 1934 was slightly less in magnitude than the 1968 flood. Field surveys of historical flood marks indicate that the 1936 flood was higher than the 1968 flood by about a foot (30 cm) (Tempest 1974).

April 7-8, 1968

Event type: Mudslide.

Precipitation: Falls River (113.3 mm/2 days), April 7-8, 1968; Tasu Sound (148.3 mm/2 days), April 7-8, 1968; Prince Rupert M. Circ (150.8 mm/2 days), April 7-8, 1968; Kildala (43.4 mm/1 day), April 8, 1968; Kitimat Townsite (34.8 mm/1 day), April 8, 1968.

Source: *The Daily News*, April 8, 1968; *Northern Sentinel*, April 10, 1968.

On April 6-7, Prince Rupert recorded 1.05 in. (26.7 mm) of rain. On April 9-10, Highway 25 was blocked by a mudslide 12 mi. (19.2 km) north of Kitimat, 0.5 mi. (800 m) south of the Kitimat River bridge. It measured a width of 50 yd. (45 m) and a depth of 4 ft. (1.2 m).

April 9-10, 1968

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Interior News*, April 17, 1968; *Terrace Herald*, April 17, 1964; Dr. A.S. Gottesfeld, pers. comm. May 30, 1994; J.C. Gillespie, pers. comm. June 14, 1994; W. Smith, pers. comm. August 4, 1994.

On April 9, a serious pile-up of ice against the bridge piers threatened the Bulkley River bridge at Telkwa. Efforts by the Highways Department to break up the icejam by blasting failed. The ice eventually washed out after the river backed up.

During the spring of 1968 a series of icejams occurred on the Morice River. The ice started breaking up way upriver, rather than further downstream. Major icejams occurred near Houston at Owen Flats and at the confluence with the Bulkley River. At Owen Flats, floodwaters reached the edge of the road, but did no damage (Smith, pers. comm. August 4, 1994). At the confluence of the Morice and Bulkley rivers, the ice was pushed up above the high-water line. Buildings of an old sawmill on the flats had only their roofs showing. The ice was backed up to the current bridge site. (Gillespie, pers. comm.). The icejam caused the river to back up and inundate the floodplain. Large iceflows were caught 2 m. up in the poplar trees (Gottesfeld, pers. comm. May 30, 1994).

On April 9 at 11:40 p.m., a 4-ft. (1.2 m) wall of mud and rocks flowed across Highway 25, about 15 mi. (24 km) north of Kitimat. The slide hit the right (hand) side of a car broadside. It pushed the car towards the riverbank, ripping a wheel from the car. The road, which was covered for 50 yd. (45 m) with 4 ft. of debris, was cleared by 6:30 a.m. on April 10.

April 27-28, 1968

Event type: Mudslide.

Precipitation: Kildala (53.1 mm/1 day), April 27, 1968; Falls River (92.4 mm/2 days), April 27-28, 1968; Kitimat 2 (83.3 mm/2 days), April 27-28, 1968.

Source: *Northern Sentinel*, May 1, 1968.

Another mudslide occurred at the same site the April 9-10 mudslide came down. Highway 25 was closed intermittently for clearing.

May 20-23, 1968

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Daily News*, May 22 and 23, 1968; *The Interior News*, May 22, 1968; *The Vancouver Sun*, May 22 and 23, 1968; *The Province*, May 22 and 23, 1968; Environment Canada 1991; B.C. Ministry of Public Works 1970 (p. C 120).

Warm weather with temperatures in the high 70⁰s F (ca. 26⁰ C), coupled with two days of warm rain brought rivers in the Bulkley Valley to the flood level. On May 20-21, the Bulkley, Telkwa, and Buck rivers went on the rampage. The Bulkley River was at its highest level since 1964. On May 21, the Bulkley River at Quick and the Skeena River at Glen Vowell recorded maximum daily discharges of 861 m³/s and 2,700 m³/s, respectively (Environment Canada 1991). On May 20, floods threatened four families in Houston. Late on May 20 the approaches to Buck River washed out. The Buck River, fed by a heavy snowpack in an area denuded by a forest fire in 1961, was at its highest level in several years. The four families, who sustained about \$5,000-6,000 property damage, were evacuated. In Houston, a general store suffered extensive stock damage to stored winter goods. Traffic across the temporary Bailey bridge, just east of Houston, was halted for a while on May 20 as the approaches were threatened. On May 23, Buck River was reported to have dropped about 2 in. (5 cm) in the past 24 hours. Water was still 6-8 in. (15-20 cm) deep on some of the secondary roads. Logging operations were affected when a bridge on the Owen Lake Road south of Houston washed out. In Telkwa, the highway at Eddy Park was under several inches of water. The

Smithers Landing Road to Babine Lake was closed to heavy trucks because of a washout near Doris Lake. Across the Bulkley River from Smithers, the Bill Kidd farm was flooded. On the Kispiox Road also a washout occurred.

The Cedarvale ferry was out of service due to high water. The Skeena River also flooded its banks. On Highway 16 between Terrace-Prince Rupert, minor flooding was reported near Remo and an area 42 mi. (67.2 km) west of Terrace. On May 22, the Skeena River at Usk recorded a maximum instantaneous discharge of 5,720 m³/s. (Environment Canada 1991). The CNR moved passengers by bus past high water on its line between Prince George-Prince Rupert.

November 13-20, 1968

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: *The Daily News*, November 13, 14, 15, 16, 19 and 20, 1968; Mathews 1973 (pp. 99-110).

Flooding occurred on the Salmon River near Hyder, Alaska. On November 13, Summit Lake broke through under a glacier. The water of the lake, which is situated near the mining operations of Granduc Company, poured into the Salmon River, threatening to flood Hyder. During the night of November 19-20, this fourth recorded jökulhlaup from Summit Lake reached its climax. During this flood the lake level was well below that of the previous three recorded outburst floods. Peak flow at the end of the flood was reported to be substantially lower than that of the earlier events. Damage in the 1968 flood was minor (Mathews 1973). Alaska Department of Highways crews reinforced the protection dam with gravel. *1) On November 15, the river came up about 4 ft. (1.2 m) and was expected to peak at 12-14 ft. (3.6-4.2 m). At Mile 7, 200-ft. (60 m) of gravel highway leading to the Granduc Mine washed out. On November 19, the Salmon River completely washed out the road to the Granduc Mine.

*1) Gravel washed down into the river built up the riverbanks higher than the ground Hyder is built on. In 1962, the U.S. Army Engineering Department built a dam of rocks to protect the town.

December 4-7, 1968

Event type: Snow avalanches.

Precipitation: Sandspit A (43.7 mm/1 day), December 4, 1968; Tasu Sound (29.7 mm/1 day), December 5, 1968;

Terrace (65.5mm/1 day =49.8 cm snow), December 6, 1968; Prince Rupert (41.1 mm/1 day), December 6, 1968.

Source: *Terrace Omineca Herald*, December 11, 1968; *The Daily News*, December 9, 1968; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On December 6-7, Terrace reported 31 in. (78.7 cm) of snow. On December 6 alone, 20 in. (50.8 cm) fell. On that same day, 48 in. (121.9 cm) of snow was reported from Salvus and Kwinitsa. CP Air Northern Service was disrupted and delayed during the weekend.

Highway 16 was blocked for short periods. Snowslides came down at Mile 35, 43, and 50. On December 9, it was reported that the highway between Terrace-Prince Rupert had over 5 ft. (1.5 m) of snow since December 5. Power outages occurred in Remo, the Kalum Lake Road area, and Thornhill. Worst hit was Remo, which was without power for 28 hours. CN telecommunications from Terrace to Prince Rupert, Kitimat, and Smithers were interrupted.

CN reported snowslides at Mile 43.6 and 50.1. The rail line was closed for 12 hours. Some small slides occurred on December 7-8. A freight train got stuck behind a slide at Mile 50 near Kwinitsa.

December 27-29, 1968

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Citizen*, December 30, 1968; January 16, 1970; *The Vancouver Sun*, January 16, 1970.

On December 27 and again on December 29, the Nechako River caused two flood waves near Prince George when icejams backed up the river. Temperatures on those dates were -34° F (-36.7° C) and -32° F (-35.6° C), respectively.

The first flooding started around 10:35 p.m. on December 27 when an iceflow on the Nechako River jammed at the confluence with the Fraser River. Floodwaters affected at least 25 houses for several days. On December 28, when the river level reached 21 ft., about 150 people were forced from their homes on Cottonwood Island. This was the third time in seven years the area flooded. *1) During this flooding the water level rose to 23.3 ft. (*The Vancouver Sun*, January 16, 1970).

On December 29, most of the north side of River Road, all of the area between River Road and the Nechako River resembled "an icefield."

*1) About four years earlier, Resources minister and local MLA Ray Williston had offered Cottonwood Island residents property of equal value outside of Prince George in return for their present home sites. Very few people took

the offer as most residents considered it would cost more to move their homes than the buildings themselves were worth. (*The Citizen*, December 30, 1968). According to Jim Ormerod, Chairman of the Cottonwood Improvement District, the immediate solution to the flooding problem would involve dredging the Nechako River at the confluence of the Fraser River. He noted that he once counted nine federal and provincial agencies that would have to come to an agreement before the Nechako River could be dredged.

January 30-February 2, 1969

Event type: Severe weather.

Precipitation: Kildala (34.0 mm/1 day), January 30, 1969; Falls River (218.4 mm/4 days), January 30-February 2, 1969; Prince Rupert M. Circ (55.6 cm (snow)/4 days), January 30-February 2, 1969; Terrace (37.6 cm (snow) /3 days), January 31-February 2, 1969.

Source: *The Daily News*, January 31; February 3, 4, 6, 12 and 13, 1969; Lewis and Moran 1985 (p. 5.100, Storm No. 46).

On January 30, a 6-in. (15 cm) snowfall in Prince Rupert and winds gusting to 40 mph. (64 km/h) created blizzard conditions and drifting snow. The (highways) crew foreman reported 22 in. (55 cm) of snow on January 26, making a total of 38 in. (95 cm) on the Rainbow Summit since January 24. Digby Island recorded 10.3 in. (26.2 cm) and Prince Rupert over 12 in. (30.5 cm) of snow. In Prince Rupert, the traffic was paralysed and motorists were urged to leave their vehicles at home. The Prince Rupert airport was closed for several days. Passengers were bussed to and from Terrace.

The maximum wind reported was 83 kn. (154 km/h) from Cape St. James on January 31. The lighthouse on Green Island reported 70-kn. (130 km/h) winds on January 31 (Lewis and Moran 1985). In Prince Rupert, three boats sank, one at the new floats: a gillnetter, and a small troller at the Co-op, and another small vessel at Cow Bay.

Frozen water pipelines left Prince Rupert and Port Edwards without water. The 18-in. (45 cm) Nelson Brothers' pipeline through which Prince Rupert normally got its water was blocked, except for a 6-in. (15 cm) aperture. Nelson Brothers own pipeline was clogged by 400 yd. (360 m) of solid ice. On January 31, the Columbia Cellulose Watson Island plant's 6-in. pipeline supplied the village of Port Edward with water. *1)

In Prince Rupert, the snow hampered switching in the CNR yard. Snow pile-ups threatened some older buildings. Telephone communications went out when at Seal Cove ice formed in underground cables entering buildings and cracking them as they expanded. The apartments along Evergreen Drive were without service after January 31. On February 2, 22 in. (55.9 cm) of snow fell on the (Rainbow) Summit, for a total of 38 in. (96.5 cm) since January 31.

The Department of Highways was working three shifts to keep Highway 16 between Prince Rupert-Terrace open. On February 6, 10, and 12, slides came down at Amsbury Bluff, 12 mi. (19.2 km) west of Terrace. These slides occurred all in the same spot. Several small slides were reported on February 12.

*1) Columbia Cellulose built the pipeline between Watson Island-Port Edward when they established their plant on the island. This was the first time the line was being used because of ice problems in the village. (*The Daily News*, January 31, 1969).

April 15-18, 1969

Event type: Rockslide.

Precipitation: Tasu Sound (88.4 mm/1 day), April 15, 1969; Prince Rupert M. Circ (67.9 mm/3 days) April 16-18, 1969.

Source: *The Daily News*, April 21, 1969.

Overnight April 18-19, a rockslide 4 mi. (6.4 km) east of Terrace blocked the rail line. Two diesel locomotives and 11 cars of a 49-car eastbound train were derailed after tearing up 500 ft. (150 m) of track when the eastbound train struck a rock described as "the size of a very large table." Auxiliaries from Prince Rupert and Prince George and about 50 men worked non-stop at clearing the track. Busses transported train passengers. According to trainmaster Floyd Jessup, "the slide was the worst one since February 1967; that was the last big one we had." Rail service was restored by noon on April 21.

September 17, 1969

Event type: Clay flowslide-Subaqueous slide?

Precipitation: Not applicable.

Source: *The Sunday Sun*, September 20, 1969; C.T. Penney (General Manager British Columbia Molybdenum Limited), Preliminary Report Destruction of No. 2 Trailer Park, 1969; Campbell and Skermer 1979.

On September 17, shortly after 2 p.m., a ground movement occurred at the new trailer park site at the B.C. Molybdenum mine. It destroyed eight mobile homes, all unoccupied at the time. There were no injuries, but personal effects of five occupants were lost or extensively damaged by salt water. According to a company spokesman, the trailers were salvaged and the damage was slight (*The Sunday Sun*, September 20, 1969).

The slide took place in a small bay just below Picnic Point. It took out a piece of land about 300 ft. (90 m) wide and about 600 ft. (180 m) long measured back from the shoreline. The volume of material displaced by the slide was between 250,000-500,000 yd.³ (190,000-380,000 m³). The area dropped approximately 20 ft. (6 m) as the underlying blue clay slid into the sea. The soft sensitive marine clay was found in the backscarp, overlain by about 7-8 ft. (2.1-2.4 m) of coarse sand containing shells.

In all probability the slide was caused by overloading this soft clay under the weight of gravel fill brought into the area (Campbell and Skermer 1979). A D-8 Caterpillar used in pushing the gravel over a septic tank disappeared and was never found. It was believed to have been covered in mud or carried further out into deep water. Prompt action by the operator saved four people from very serious injury or death. According to calculations based on the initial survey of the slide area approximately 132,000 yd.³ (100,000 m³) of material slid into the sea, not including 30,000 yd.³ (23,000 m³) of gravel fill. According to a diver brought in to examine the offshore slide areas, the slide was started by tidal water and river currents undercutting the clay at the drop-off into deep water (C.T. Penney 1969).

November 26-December 2, 1969

Event type: Flooding and mudslides.

Precipitation: Kildala (184.2 mm/4 days), November 26-29, 1969; Tasu Sound (531.3 mm/6 days), November 26-December 1, 1969; Falls River (214.9 mm/3 days), November 27-29, 1969; Terrace (129.3 mm/3 days), November 28-30, 1969; Prince Rupert (259.7 mm/6 days), November 27-December 2, 1969; Kitimat 2 (267.2 mm/6 days), November 27-December 2, 1969; Falls River (324.4 mm/6 days), November 27-December 2, 1969; Kitimat 2 (188.4 mm/3 days), November 28-30, 1969; Prince Rupert M. Circ (189.9 mm/3 days), November 27-29, 1969; Tasu Sound (101.6 mm/1 day), December 1, 1969.

Source: *Terrace Omineca Herald*, December 3, 1969; *Northern Sentinel*, December 3 and 10, 1969; *The Daily News*, November 29, December 1, 1969; Environment Canada 1991; Ministry of Transportation and Highways. Granite Creek Flooding, Lakelse Lake Area. B.C. Ministry of Transportation and Highways, Terrace; Northwest Hydraulic Consultants Ltd. 1987.

Record high temperatures and heavy rain caused flooding, mudslides, and hazardous driving conditions in the Terrace area. Temperatures in Terrace averaged 40.3°F (4.6°C) compared with a normal expected high of 31°F (-0.5°C). Terrace reported 5.09 in. (129.3 mm) and Kitimat 6.7 in. (170.2 mm) of rain over the weekend. Prince Rupert and Kitimat set rain records for the month of November, with 20.86 in. (529.8 mm) and 32.86 in. (834.6 mm), respectively. According to George Blakey, the Terrace weather office had a record rainfall of 13.43 in. (342.9 mm) for November. In Terrace, the drainage system was plugged, flooding the Emerson and Park municipal parking lot and the basement of the E.T. Kenney School.

On Highway 16 east of Terrace, minor mudslides occurred. A rockslide and some mudslides blocked the section of highway under construction 20 mi. (32 km) east of Prince Rupert. The rockslide, which was 75 ft. (22.5 m) long and quite deep, occurred 2 mi. (3.2 km) east of Rainbow Lake Lodge. On the Cannery Road near Port Edward a small slide occurred.

In the Terrace area, Highway 25 was flooded at Williams Creek. On November 30 the Lakelse Lake road was closed because of a washout at the southern approach of Williams Creek. A major flood occurred on Granite Creek, with most of the flow going down South Granite Creek. The flow was described as "a raging torrent." Observations at the time showed negligible increase in flows in North Granite and Salmon creeks. A huge amount of gravel and debris ended up in South Granite Creek. Heavy damage occurred on lots 4 and 5, and to a lesser extent on lots 1, 2, 3 and 6. When the flow subsided, the Highways Department partially bulldozed the lower portions of South Granite Creek. The creek bottom level was left several feet above normal creek bottom level from the wooden bridge at First Avenue to the lake, a distance of about 300 yd. (270 m). The construction of a dike by a bulldozer saved the trailer park and part of the Lakelse Road (Northwest Hydraulic Consultants 1987). The Columbia Cellulose road was flooded at Beaver Flats. The Twin River Timber, Skoglund Logging, Crown Zellerbach, and other small logging operations closed down on December 1, because of unserviceable logging roads.

In the Kitimat area, the Kitimat River rose to the near-flood level. On November 30, the Crown Zellerbach bridge over the Kitimat River was torn out. The Kitimat River below Hirsch Creek on November 30, recorded a maximum instantaneous discharge of 1,540 m³/s and a maximum daily discharge of 1,300 m³/s (Environment Canada 1991). Minor scour occurred on the Kitimaat Village road.

January 15-20, 1970

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Citizen*, January 16 and 19, 1970; *The Vancouver Sun*, January 16, 17, 19 and 20, 1970; *Province*, January 17 and 21, 1970.

On January 15, temperatures of -34°F (-36.7°C) caused a sudden formation of ice on the Nechako River and the river levels to rise later that day at a steady 2 in. (5 cm) an hour. The river packed with slush ice caused the water to back up and flood. The Nechako River rose rapidly, at one point 8 in. (20 cm) within 15 minutes. The rising waters caused backflow as the fast flowing Nechako River was running into an ice-jammed Fraser River. On the night

of January 15, about 120 island residents, 37 families, left their homes on Island Cache when the river rose to within 4 in. (10 cm) of the top of the dike. They returned the next day only forced to leave again on the night of January 16.

Overnight January 15-16, temperatures in Prince George plunged to -42°F (-41.1°C). *1) That night an estimated 100 people were evacuated from Cottonwood Island, threatened by flooding. Early on January 16, the river leveled off at 18 ft., 3 ft. (90 cm) short of the annual flood level. But temperatures dipped to 40 degrees below zero overnight and the river again froze over. On January 16, about 120 people were forced to leave their homes on Island Cache again after an icejam backed up the water in the Nechako River.

Around January 17-18, the river level fluctuated widely as water backed up in the Nechako from its confluence with the frozen-over river. From a peak of 20 ft., 8 in. early on January 16, the water level fell 8 ft. (2.4 m) in five hours. Early evening on January 17, the level rose to 20 ft., 6 in. but then hovered around 19 ft.

On January 17, the Nechako River finally spilled its banks, forcing more residents evacuated. Two homes flooded to a depth of 2 ft. (60 cm). On January 17-18, the river rose to 19 ft. (5.7 m), leaving the 21-ft. (6.3 m) dike around low-lying Cottonwood Island with only 2 ft. (60 cm) of clearance, and considerable seepage occurred. *2)

On January 18 temperatures dropped to -34°F , a record for that date. At 6 p.m. that day, the Nechako River level held at 19 ft., 2 ft. (60 cm) below the top of a dike along the island's north side. On the night of January 19, some 100 people were evacuated and another 100 the next day when more flooding was feared.

On January 20, several families returned to their homes on Cottonwood Island after floodwaters on the Nechako River receded.

*1) The record low temperature at the time stood at -55°F (48.3°C) set on January 3, 1950 (*The Citizen*, January 19, 1970).

*2) The flood threat was the fourth in eight years to hit the island, home of about 750 residents just outside Prince George city limits (*The Citizen*, January 19, 1970). During the December 1968-January 1969 flooding, the Nechako reached 23.3 ft. (*The Vancouver Sun*, January 16, 1970). The freezing is an "annual event," and caused serious flooding in 1968. "The community floods just about every year," said an RCMP spokesman. "There's no danger to life or anything. The people just take a holiday and live in town until the waters go down." (*The Vancouver Sun*, January 17, 1970).

February 3, 1970

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, February 4, 1970; *Peace River Block News*, February 4, 1970.

On February 3, warm weather, coupled with an icejam caused a sharp increase in the level of the Peace River at Taylor. An icejam below Clayburst caused the Peace River to back up for 22 mi. (35.2 km). Residents of South Taylor, 40 mi. (64 km) northwest of Dawson Creek, reported an 18-ft. (5.4 m) rise in the Peace River. According to Homer Good, district superintendent for the ministry of highways at Fort St. John, the real rise had been closer to only 5 ft. (1.5 m). Overnight February 3-4, the river dropped 2 ft. (60 cm) from its crest but not before it had damaged Peace Island Park in this unorganised territory on the south bank of the Peace. The drop reduced the flood threat to the community.

John Jackman, a South Taylor hotel operator and president of the Taylor Chamber of Commerce, stated that a rise of another 5 ft. (1.5 m) would flood the flatland area. Concerned were 150 residents and 110 pupils in an elementary school 250 yd. (225 m) from the riverbank. According to school principal David Holmes, the river appeared to have risen 14 ft. (4.2 m) in his area and on February 3 was about 2.5 ft. (75 cm) from overflowing. The sudden rise was attributed to a massive icejam stretching 20 mi. (32 km) downstream to the Alberta border.

On February 4, snowdrifts 3-4 ft. (0.9-1.2 m) high blocked many roads, trapping local residents. The hardest hit districts were Fellers Heights, Rolla, Progress and Kilkerran. Winds were blowing at 30 mph (48 km/h) with gusts to 50 mph (80 km/h).

July 18, 1970

Event type: Rockslide.

Precipitation: Prince Rupert (30.2 mm/1 day), July 18, 1970.

Source: *The Daily News*, July 20, 1970; *Terrace Omineca Herald*, July 22, 1970; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On July 19, CNR reported a rockslide on the highway and rail line near Telegraph Point. Four days of heavy rain were reported in the area before the slide occurred. The line was closed for nine hours. On July 20, an eastbound passenger train derailed at Haysport, injuring 20 people. Four cars derailed; a fifth went over the embankment and 20 yd. (18 m) of tracks were torn up.

August 1, 1970

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Gilbert 1972.

On August 1, Summit Lake started draining after it reached a maximum level of 821.7 m above sea level, only 4.3 m below the level when full. The maximum observed discharge determined from the rate of volume change in the lake occurred on August 8 at 4 p.m. Sometime between 6-8 a.m. on August 9, a maximum discharge of approximately 2,600 m³/s may have occurred (Gilbert 1972).

January 6-7, 1971

Event type: Debris slides and snow avalanches.

Precipitation: Falls River (55.1 mm/1 day), January 6, 1971; Prince Rupert M. Circ (54.6 mm/1 day), January 6, 1971; Prince Rupert (80.8 mm/2 days), January 6-7, 1971.

Source: *The Daily News*, January 7, 1971; *Terrace Omineca Herald*, January 11, 1971; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

Terrace recorded 2.05 in. (52.1 mm) of rain in three days. A mild spell with heavy rain occurred in the Skeena Valley.

Highway 16 between Prince Rupert-Terrace was closed for 21 hours. Seven or eight large snow and debris slides and more than a dozen smaller ones came down between 20-45 mi. (32-72 km) west of Terrace.

CNR reported a series of snowslides in the Skeena Subdivision between Terrace-Prince Rupert. Freight trains were interrupted but passenger service was not affected.

January 10, 1971

Event type: Fatal snow avalanche.

Precipitation: Not available.

Source: Williams 1975.

On January 10, an avalanche near Juneau, Alaska killed a climber. The slide, which was witnessed by several people, was released near the 2,700-ft. (810 m) elevation. A search proved to be futile as the debris was 40-50 ft. (12-15 m) deep. The victim's body was not found until the following summer when it was uncovered by a bear near the 400-ft. (120 m) elevation. The fatal avalanche was the fourth to run down the Behrends Avenue path on Mt. Juneau that day. All four were large avalanches, which threw up billowing dust clouds. The cause of this remarkable avalanche activity was a local wind phenomenon known as the Taku wind. *1) At the time of the accident, snow depths on the mountain ranged from 2-12 ft. (0.6-3.6 m) (Williams 1975).

*1) The Taku wind is a cold northeast katabatic wind, which blows off the inland glaciers and is accelerated to incredible speeds. Wind speeds over the ridge tops above Juneau are estimated at more than 200 mph (320 km/h) (Williams 1975).

January 17-18, 1971

Event type: Flooding and snow avalanches.

Precipitation: Bella Coola (86.4 mm/1 day), January 15, 1971; Kitimat Townsite (211.6 mm/4 days), January 15-18, 1971; Prince Rupert M. Circ (46.5 mm/1 day), January 17, 1971; Kildala (42.4 mm/1 day), January 17, 1971; Tasu Sound (98.3 mm/1 day), January 17, 1971; Falls River (84.4 mm/2 days), January 17-18, 1971; Sandspit A (43.4 mm/2 days), January 17-18, 1971; Terrace (101.1 mm incl. 70.4 cm snow/2 days), January 17-18, 1971

Source: *The Terrace Omineca Herald*, January 18, 1971; *The Daily News*, January 17, 18, 19 and 21, 1971; *The Northern Sentinel*, January 20, 1971; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On January 17, Terrace recorded 35 in. (88.9 cm) of snow followed by 1.5 in. (38.1 mm) of rain. The temperatures dropped 43° F (26 degrees C) from 43° F (6° C) to -4° F (-20° C) within 18 hours. The Terrace airport closed due to icy landing conditions, stranding 60 passengers in Prince Rupert. Schools in Terrace and Kitimat closed for two days.

Highway 16 between Prince Rupert-Terrace was closed for 15 hours. Two small snowslides came down and the highway on the Prince Rupert side was described as "pure ice." The Greyhound bus got stuck at the bottom of the Rainbow Summit, 15 mi. (24 km) east of Prince Rupert. It was delayed for 15 hours. Highway 16 was scheduled to reopen to all traffic on January 18 at 10 a.m.

Between January 14-19, Kitimat recorded 31.7 in. (80.5 cm) of snow, bringing the winter's total to 137.5 in. (349.3 cm). Eighteen hours of heavy rain caused flooding at the corner of Columbus at the junction to the trailer courts and some flooded basements. The rain falling on packed snow also caused hazardous driving conditions. Power outages occurred in the City centre and Nechako areas.

On January 18, CNR reported heavy rains between Prince Rupert-Smithers. On the Prince Rupert-Terrace section, water was reported on the tracks in seven places between Mile 39.9-51.7. The main track was impassable for about five hours.

January 20-23, 1971

Event type: Snow avalanches.

Precipitation: Prince Rupert M. Circ (76.4 mm/4 days), January 20-23, 1971.

Source: *The Daily News*, January 25, 1971; Files, B.C. Ministry of Transportation and Highways, Terrace; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On January 23-24, Prince Rupert recorded 13.2 in. (33.5 cm) of snow with 9.5 in. (24.1 cm) on January 23. Snowslides closed both the rail line and Highway 16 between Prince Rupert-Terrace. Near Rainbow Lake, snow and slides blocked Highway 16. Many motorists, including five visiting curling rinks in town for the woman's district curling playdowns, were stranded. Crews worked non-stop to clear the streets. The Ministry of Transport and Highways reported the highway open for one-lane traffic on January 25 at 5 p.m.

On January 24, CNR reported heavy snow between Terrace-Prince Rupert. The rail line was blocked in several locations between Skeena-Salvus. Train No. 10 hit a large slide at Mile 46.7 and broke in two. The rail line was closed for 28 hours.

March 6-9, 1971

Event type: Snow avalanches.

Precipitation: Falls River (136.7 mm/3 days), March 6-8, 1971; Terrace (65.7 mm/3 days incl. 70.3 cm snow), March 6-8, 1971; Prince Rupert M. Circ (20.6 mm/1 day), March 9, 1971.

Source: *The Daily News*, March 9, 1971; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On March 9, a large snowslide blocked Highway 16 and the rail line in the Little Tunnel area, 41 mi. (65.6 km) west of Terrace. No casualties were reported. The highway was closed for six hours because of the slide at Mile 41. On March 9, CNR reported a snowslide 150 ft. (45 m) long and 20 ft. (6 m) deep at Mile 41.2, closing the rail line for seven hours.

March 31-April 4, 1971

Event type: Debris slide and snow avalanches.

Precipitation: Falls River (152.4 mm/ 4 days), March 31-April 3, 1971; Tasu Sound (314.5 mm/5 days), March 31-April 4, 1971; Prince Rupert (50.8 mm/1 day), April 1, 1971; Prince Rupert M. Circ (67.0 mm/2 days), April 3-4, 1971; Kildala (39.9 mm/1 day), April 4, 1971.

Source: *The Daily News*, April 5, 1971; *Terrace Omineca Herald*, April 5, 1971; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

Highway 16 was blocked for two hours by a debris slide 17 mi. (27.2 km) east of Prince Rupert. On April 2 at 7:00 p.m., a snow and debris slide came down at Mile 50.2 near Telegraph Point. It blocked the highway and the rail line and was described by a CNR spokesman as, "one of the biggest in this area for some time." The highway was reopened on April 3 in the afternoon.

On April 2, CNR reported snowslides at Mile 39.9 and Mile 50.1. The latter measured a length of 600 ft. (180 m) and a depth of 30 ft. (9 m). It closed the rail line for 20 hours. On April 10, a smaller snowslide came down at Mile 50.1, measuring a length of 150 ft. (45 m) and a depth of 10 ft. (3 m). It closed the line for 5.5 hours.

July 11-12, 1971

Event type: Flooding.

Precipitation: Not available.

Source: *Victoria Daily Times*, July 14, 1971; *Terrace-Kitimat Daily Herald*, July 14, 1971.

On July 11, heavy rain in the Peace River country caused a section of track on the PGE line near Chetwynd to wash out. The line was blocked for approximately 30 hours. On the morning of July 12, Dawson Creek rose to a high level. Both ends of the rotary bridge from the parking lot to the artificial lake flooded.

November 17-20, 1971

Event type: Flooding, debris slides and snow avalanches.

Precipitation: Falls River (88.7 mm/2 days), November 17-18, 1971; Prince Rupert M. Circ (79.3 mm/2 days), November 17-18, 1971; Prince Rupert (69.8 mm/2 days), November 18-19, 1971; Terrace (54.1 mm/2 days), November 18-19, 1971; Kildala (117.4 mm/3 days), November 18-20, 1971; Ocean Falls (265.9 mm/3 days), October 18-20, 1971.

Source: *The Daily Herald*, November 18 and 22, 1971; *The Daily News*, November 18 and 19, 1971; *The Vancouver Sun*, November 19, 1971; *The Province*, November 20, 1971; *Victoria Times*, November 20, 1971; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

Overnight November 18-19, heavy rain and unusually warm temperatures caused many mud and snowslides and washouts between 28-44 mi. (44.8-70.4 km) on Highway 16 between Prince Rupert-Terrace. A small bridge west of Terrace was washed out. At Diana Creek, 16 mi. (25.6 km) east of Prince Rupert, the highway was flooded. Late on November 18, it took out a 100-ft. (30 m) section of highway. Later on November 19, the road was expected to be restored.

On November 18, CNR reported 10 rock and snowslides at Mile 39.9, 44.4, 46.0, 44.1, 50.9, 43.7, 45.2, 57.3, and 55.9. The rail line was closed for four days and 10 hours. The largest slide, 20 ft. (6 m) deep and 300 ft. (90 m)

long, which occurred 44 mi. (70.4 km) west of Terrace, blocked both the highway and rail line. Two smaller slides came down about one mile (1.6 km) on either side of the large one. Train service was expected to resume late on November 20 or on November 21.

The storm intensity between Prince Rupert-Terrace was much greater than at these weather-reporting stations. The precipitation was estimated at 6 in. (150 mm) for the 24-hour period on November 18. Between Mile 7-54 previous to November 18, there was about 12 in. (30.5 cm) of snow on the ground up to the 400-ft. (120 m) level. The 2,000-8,500 ft. (600-2,550 m) level had an estimated 4-10 ft. (1.2-3 m) of snow.

On the Kitimat subdivision between Terrace-Kitimat, a 10-car derailment occurred 3.7 mi. (5.9 km) east of Terrace. There were no injuries.

December 15-19, 1971

Event type: Snow avalanches.

Precipitation: Prince Rupert M. Circ (63.3 mm/2 days), December 18-19, 1971.

Source: *The Daily Herald*, December 17, 1971; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; B.C. Ministry of Transportation and Highways 1980.

On December 15, Terrace reported 5 in. (12.7 cm) of snow. On December 16, snowslides came down at Mile 43.6 and 43.7. At slide path Split at 69.9 km, the westbound extra train No. 9072 hit a snowslide on December 16. Two diesel units and 12 cars derailed. The two units and most of the cars remained upright. Eleven cars were blocking the highway at Mile 43.6. On December 19, CNR reported several slides at Mile 50.0 and a small slide at Mile 47.0. The rail line was closed for 15.5 hours.

January 5, 1972

Event type: Non-fatal snow avalanche.

Precipitation: Not applicable.

Source: Williams and Armstrong 1984 (p. 1).

On January 5, an avalanche hit a bus at Mile 11 on the Hyder-Tide Lake highway. The bus struck was the third of three buses carrying dayshift workers to the Granduc Tide Lake Mine. The vehicle was pushed off the road, toppled on to its side and slid 40 ft. (12 m) down the embankment. Four passengers were injured. Meanwhile an avalanche on the road ahead trapped the first two busses. All stranded passengers were transferred to the Stewart hospital where they were examined and released. The road was reopened several days later and mining activities continued (Williams and Armstrong 1984).

January 13-17, 1972

Event type: Snow avalanches.

Precipitation: Tasu Sound (154.7 mm/2 days), January 13-14, 1972; Prince Rupert M. Circ (176.3 mm/3 days), January 13-15, 1972; Falls River (230.2 mm/5 days), January 13-17, 1972; Prince Rupert M. Circ (106.2 mm/1 day), January 14, 1972; Tasu Sound (112.5 mm/1 day), January 14, 1972; Kemano (99.1 mm/2 days), January 14-15, 1972; Kildala (74.4 mm/2 days), January 14-15, 1972; Bella Coola (89.1 mm/2 days), January 14-15, 1972; Prince Rupert (101.4 mm/2 days), January 14-15, 1972; Kitimat 2 (146.6 mm/2 days), January 14-15, 1972; Kitimat Townsite (89.4 mm/2 days), January 14-15, 1972; Terrace (66.8 mm/2 days), January 14-15, 1972; Ocean Falls (230.7 mm/2 days), January 14-15, 1972.

Source: *The Daily News*, January 17, 19, 20, 24, 26 and 27; February 4, 8, 17, 25 and 29, 1972; *The Daily Herald*, January 31, February 4 and 9, 1972; *The Northern Sentinel*, January 19, 1972; *The Vancouver Sun*, January 17, 1972; J. Mekechuck, pers. comm. 1989. CN Railway Edmonton, Alta.; B.C. Ministry of Transportation and Highways 1980.

In January, Highway 16 Prince Rupert-Terrace was closed for nearly two weeks by snowslides. It had been blocked since January 15. It reopened to two-way traffic on January 30. Starting January 26, two convoys a day traveled the route. Several slides came down between Mile 35-Mile 50. The largest slide was 1 mi. (1.6 km) long and 15 ft. (4.5 m) deep. The clearing of the slide at Mile 43 had to be halted because of a second slide coming down. Soon after being reopened, the highway was closed again. On January 28, the first plane since January 16 landed on the Terrace airport.

Between February 2-4, 21 slides came down on a 20-mi. (32-km) stretch of highway. On February 4, more slides threatened Highway 16 and the rail line. Overnight February 7-8, slides came down near Mile 35, 43, and 51, closing the highway. On February 8, the road opened for one-lane traffic only. One train was hit by a slide, but no injuries were reported.

On February 9, the Terrace area reported 15 in. (38 cm) of snow in a 24-hour period. Early on February 15, a new slide, 600 ft. (180 m) long and 20 ft. (6 m) deep came down at Mile 50.4, closing down the highway and rail line. The Greyhound morning bus was cancelled.

The rail line between Prince Rupert-Terrace was closed for 12 days. The tracks were hit by a series of 20 slides, but apparently did not suffer any damage. On January 14, an eastbound snowplow with two diesel units got struck at Mile 50.3. Later some snowslides buried it. It was pulled free on January 18. A snowplow consisting of three units, caboose, and snowplow bunk derailed at Shames because of heavy snow. A snowslide came down at slide

path Big Tunnel at 80.0 km (Mile 50). On January 14, a passenger train got stopped near Exstew at Mile 51 as a result of slides at Mile 51.5. The 24 passengers were stranded for 24 hours. On January 15, a Department of Transport Sikorsky helicopter flew them out. The train returned to Prince Rupert on January 16 after snowplows reached it and its 14 crewmembers. On January 20, it took three bulldozers one day to clear the slide. A CNR spokesman stated that the main method in clearing the rail line had been with rented bulldozers. At one point, 12 machines had been employed by CNR alone.

On February 17 the rail line was open, but subject to cancellation. Highway 16 was also open, in passable but poor condition. During the week of February 21-25, a series of small snowslides came down over a distance of 8 mi. (12.8 km). On February 25, crews completed clearing the slide near Mile 50. Starting February 25, the Department of Highways assembled convoy traffic twice daily. Traffic was reported back to normal on February 29.

January 27, 1972

Event type: Severe storm.

Precipitation: Not applicable

Source: Langara lighthouse tide gauge system book.

On January 27, a severe storm struck Langara Island. Winds blew steadily from the west at 85 mph. (136 km/h). The Langara lighthouse station sustained severe damage. The doors on the east side of the lighthouse engine room were blown in. Salt spray came over the helicopter landing site, 150 ft. (45 m) above sea level. Salt also got into the cisterns in the houses, contaminating the drinking water. The same storm severely damaged the lighthouse wharf landing site. Though unconfirmed, the storm might have finished the already damaged submarine sensor link.

February 18-19, 1972

Event type: Snow avalanches.

Precipitation: Kildala (99.6 mm/1 day), February 18, 1972; Kemano (89.7 mm/1 day), February 18, 1972; Kitimat Townsite (112.3 mm/1 day), February 18, 1972; Terrace (107.9 mm/2 days = 109.2 cm snow), February 18-19, 1972; Falls River (114.1 mm/2 days), February 18-19, 1972; Sandspit A (31.8 mm/1 day), February 19, 1972; Tasu Sound (56.6 mm/1 day), February 19, 1972.

Source: *The Daily Herald*, February 15 and 23, 1972; *The Daily News*, February 18, 21, 22, 23 and 25, 1972; *The Daily Colonist*, February 20, 1972; *The Province*, February 21, 1972; *The Northern Sentinel*, February 23, 1972; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; B.C. Ministry of Public Works 1973 (p. C 130).

Between February 12-noon on February 14, Terrace recorded 15 in. (38.1 cm) of snow. The total snowfall until noon on February 14 was 207 in. (5.26 m). The record snowfall for the winter 1970-71 totaled 211 in. (5.36 m). A few days later the record was broken after "the Blizzard of the Decade" dumped 42 in. (1.07 m) of snow on Terrace over the weekend. It brought the year's total until February 19 to 255.3-in. (6.48 m). *1) Terrace reported 75 in. (187.5 cm) of snow on the ground. The Terrace-Kitimat airport and many roads were closed.

Kitimat recorded 44.2 in. (1.12 m) of snow in 24 hours. It brought Kitimat to a virtual stand still. Hundreds of cars were stranded and abandoned between the town and the Eurocan and Alcan plants at the afternoon shift changes. The roof of the B.C. Mechanical Building collapsed under the snow.

On February 19, a gale with gusts up to 70 mph (112.7 km/h) caused property damage in Prince Rupert. The area worst hit was the Jamaica Avenue section.

Highway 16 between Prince Rupert-Terrace was closed. Two major and several small slides came down on the 8-mi. (12.8 km) stretch west of Kwinitsa, blocking Highway 16 and the CNR rail line. Overnight February 19-20 snowslides 10 mi. (16 km) west of Terrace trapped a Canadian Coachways bus with 22 passengers. A westbound bus from Prince George was stranded 5 mi. (8 km) east of Terrace for a time. The highway was reopened to one-lane traffic on February 23. Until February 27, it was open to convoy traffic only.

CNR reported several snowslides, closing the line for six hours. The rail line was cleared on February 21.

*1) The Department of Highways Maintenance Camp at Salvus, 36 mi. (57.6 km) west of Terrace, reported (unofficially) a record snowfall for the winter of 1971-1972 of 600 in. (1.5 m).

March 7-8, 1972

Event type: Snow avalanches.

Precipitation: Kildala (58.4 mm/2 days), March 7-8, 1972; Prince Rupert M. Circ (129.1 mm/2 days), March 7-8, 1972.

Source: *The Province*, March 9, 10 and 18 1972; *The Daily News*, March 9, 10 and 13, 1972; Asante 1972 (p. 188). J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; B.C. Ministry of Transportation and Highways 1980.

A 36-in. (90 cm) snowfall in 48 hours caused the closure of Highway 36 and the CNR line between Terrace-Prince Rupert. At Kwinitsa, three slides blocked the highway and the rail line. According to a CNR spokesman, a 200-ft. (60 m) slide came down at 3:20 p.m. on March 8.

Late on March 8, as temperatures rose, slides started coming down again on Highway 16 between Terrace-Prince Rupert. A series of snowslides came down between Mile 35-50. The Department of Highways posted an indefinite closure of highway travel. Two vehicles were reported trapped by two different slides on the west side of

the slide area. Both drivers walked into Kwinitsa, where they received assistance. On March 12, another slide came down at Mile 34, blocking the highway and partially blocking the rail line. The highway and rail line were reopened later that day. On March 13, the highway and rail connections between Terrace-Prince Rupert were reported to be restored.

On March 8, CNR reported several slides between Mile 43.5-51.5. The larger slides were at: Mile 43.6, 300 ft. (90 m) long, 15 ft. (4.5 m) deep; Mile 50.1, 300 ft. (90 m) long, 35 ft. (10.5 m) deep; Mile 51.5, 200 ft. (60 m) long, 30 ft. (9 m) deep. On March 8, one or more CNR vehicles were hit and avalanches buried nine CNR personnel. Ministry of Transportation and Highways personnel rescued them. On March 11, a large slide came down at Mile 50.1. It measured a length of 600 ft. (180 m) and a depth of 20 ft. (6 m). The rail line was closed twice, once for 57 hours and once for 11 hours.

March 15-19, 1972

Event type: Snow avalanches.

Precipitation: Ocean Falls (112.8 mm/1 day), March 15, 1972; Prince Rupert M. Circ (83.7 mm/5 days), March 15-19, 1972; Tasu Sound (51.6 mm/1 day), March 18, 1972.

Source: *The Daily News*, March 16 and 17, 1972; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On March 16, two more minor snowslides came down, one being at Mile 47. The slides, which measured 30 ft. (9 m) in depth, closed the highway and rail line, both of which were reopened on March 17. On that day, a small slide came down but did not affect traffic. On March 17, Highway 16 reopened. Up until March 17, the highway had been closed 20 times during the winter.

On March 19, CNR reported slides at Mile 39.9 and 51.7. The rail line was closed for 12 hours.

*1) During the winter 1971-1972, the highway between Terrace-Prince Rupert was closed 22 times, from periods of a few hours to one closure of 12 days (B.C. Ministry of Public Works 1973). Terrace recorded a total snowfall of 303 in. (7.7 m) (Asante 1972).

April 18-20, 1972

Event type: Snow avalanches.

Precipitation: Falls River (70.4 mm/1 day), April 18, 1972; Kitimat Townsite (71.6 mm/1 day), April 18, 1972; Prince Rupert (30.2 mm/1 day), April 18, 1972.

Source: J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On April 19 and 20, CNR reported slides at Mile 50.1. The slides occurred at the same location and both measured a length of 200 ft. (60 m). They had depths of 25 ft. (7.5 m) and 30 ft. (9 m), respectively. The rail line was closed for 12 and 22 hours.

May 15, 1972

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Interior News*, May 29, 1996.

On May 15, hot weather caused snowmelt and runoff. The Bulkley River overflowed its banks and flooded basements in Smithers.

May 31-June 2, 1972

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, May 31, 1972; *The Daily News*, May 31, June 1 and 2, 1972; *The Herald*, June 1 and 6, 1972; *The Interior News*, June 7, 1972.

Overnight May 30-31, the Skeena River at Terrace rose 18 in. (45 cm) or 2 ft. (60 cm) in 24 hours. During the previous 24 hours it already had risen 3 ft. (90 cm). The melting of the heavy snowpack caused the river to flood. On May 30, Highway 16 between Prince Rupert-Terrace closed for two days. Some sections of the highway had 1.5 ft. (45 cm) of water on the road. The Skeena River flooded at Mile 43 and between Mile 41-46 west of Terrace. Some residents of Remo were evacuated when the area flooded. At Usk, the ferry service was suspended for over a week because of the high river levels. Except for minor problems at Usk, no flooding occurred east of Terrace. On June 2, the very high water on the Skeena River and high tides restricted the rail traffic between Terrace-Prince Rupert to daylight movements at low tide only.

At the end of May, floodwaters of the Bulkley River came very close to washing out Highway 16 at Eddy Park in Telkwa. On May 31, water lapped at the edge of the highway for a day. The Bulkley River at Telkwa peaked around May 31. The Bulkley River flooded its banks at Telkwa. The street in front of the Telkwa Hotel and Eddy Park were under water. The street leading off the highway at Eddy Park was under water for three days.

On May 31, the Fraser River at Prince George reached 29.8 ft., about 2 ft. (60 cm) under the flood level of 32 ft. On June 2, the Fraser River at Prince George recorded an early peak of 31.75 ft. The scale of the June 1972 runoff can be

measured by the fact the height in the Thompson River system actually exceeded the 1948 level. At Prince George the Fraser River peaked just under the 1948 peak. The closure of the spillways on the Kenny Dam and the curtailed flow from the Bridge River system are believed to have made the difference.

June 12-16, 1972

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, June 13, 14 and 15, 1972; *The Daily News*, June 14, 15 and 16, 1972; *The Herald*, June 13, 1972; *The Province*, January 6, 1973; McMullen et al. 1979; Environment Canada 1991; Meziadin Environmental Advisory Team 1975 (Vol. 3, Fig. 4-9).

During the first two weeks of June, a significantly high spring runoff caused widespread flooding. At Prince George, the Fraser River peaked just under the 1948 peak. *1) During the last major flood here, in 1972, water levels peaked at 10.44 m.

Highway 16 east and west of Terrace closed for several days. West of Terrace, most of the section between Mile 44-46 was under up to 3 ft. (90 cm) of water. Residents of Braun's Island, Remo, Cedarvale, Usk, and some low-lying areas such as Thornhill were evacuated. Between Terrace-Prince Rupert, two wooden bridges lifted with the floodwater. The highway reopened on June 16, under pilotage between Mile 41-47.

The ferry docked at Hazelton was swept away. In Hazelton, the Skeena River eroded its banks and two of three dykes were lost, leaving the village with less flood protection at any time since 1948 when flood protection work was started. *1) (*The Province*, January 6, 1973)

On June 12, the Skeena River at Glen Vowell recorded a maximum daily discharge of 206,000 cfs (5,833 m³/s) (Meziadin Environmental Advisory Team 1975). On the same day, the Skeena River at Usk recorded a maximum daily discharge of 7,790 m³/s and a maximum instantaneous discharge of 286,000 cfs (8,100 m³/s), being a maximum recorded flow (McMullen et al. 1979). On June 13, the Bulkley River at Quick recorded a maximum daily discharge of 957 m³/s (Environment Canada 1991).

On June 14, the very high water on the Skeena River and high tides restricted the rail traffic between Terrace-Prince Rupert to daylight movements at low tide only.

The Houston bridge washed out, making a 70-mi. (112 km) detour necessary. High water washed out the foundations of the Walcott footbridge west of Houston.

Between June 10-early June 13, Prince George recorded a total of 2.47 in. (62.7 mm) of rain. The Fraser River at Prince George rose steadily at a rate of 0.5 in. (1.25 cm) an hour. On June 13 at 8 a.m., it stood at 32.52 ft., the highest since the freshet began. There was "considerable" flooding on Cottonwood Island, a partially-dyked island at the junction of the Fraser and Nechako rivers. Some of the island's residents were evacuated. Overnight June 13-14, the Fraser River rose more than 1 ft. (30 cm). At 8 a.m., the river reached 33.63 ft., only 0.4 ft. (12 cm) under the 34-ft. peak reached in the record flood year of 1948. On June 13, a total of 243 people were evacuated from Cottonwood Island. Most of the low-lying land there was under 2-6 ft. (0.6-1.8 m) of water, and 46 homes had been flooded. At South Fort George, just downstream from Prince George, an undetermined number of residents in a trailer court near the river were evacuated on June 13 as about 1 ft. of water spilled over the banks. On June 14 at midnight, the Fraser River at Prince George reached a high of 34.22 ft., holding at that level. (*The Vancouver Sun*, June 15, 1972). On June 16 with cooler weather, the Fraser River at Prince George was expected to begin falling soon from an early peak on June 2.

In McBride, five families were evacuated from the undyked Mountainview area near town. On June 12, schools in McBride were closed because of the flood threat.

On June 13 north of Prince George, Highway 97 closed after the Pine River washed out the road near Pine Pass. On June 14, after crews built a detour around the washout the highway reopened. At Peace River, the Peace River crested on June 14 at 6 p.m. after having forced 60 families out of their homes. One business firm was also evacuated.

*1) Flood stage at South Fort George is at 9.4 m.

*2) In December, Hazelton mayor Perry York warned that one-third of the homes in the village of 347 persons could be lost in spring floods unless flood protection estimated at \$22,700 would be carried out. (*The Province*, January 6, 1973).

Early July 1972

Event type: Flooding.

Precipitation: Not applicable.

Source: *Reader's Digest* 1976 (p. 358).

After eight days of rain in early July, world's most northern polje, a part of the North Nahanni Karst, was transformed into a lake *1)

*1) A polje is a depression without outlets. The North Nahanni Karst is an eroded limestone formation extending for 31 mi. (49.6 km) and up to 7 mi. (11.2 km) wide. (*Reader's Digest* 1976).

September 14-15, 1972

Event type: Debris slide.

Precipitation: Prince Rupert M. Circ (51.8 mm/1 day), September 14, 1972; Falls River (64.0 mm/2 days), September 14-15, 1972.

Source: *The Daily News*, September 15, 1972.

Overnight September 14-15, heavy rains caused a rock and mudslide near Port Edward. The slide, which was approximately 75 ft. (22.5 m) long, came down on the highway at 8 Mile near Inverness. Part of the highway was closed. By 10 a.m., one lane was open to traffic.

September 27, 1972

Event type: Debris slides.

Source: *The Citizen*, September 29; October 2 and 3, 1972; *The Vancouver Sun*, September 30, 1972; *The Province*, September 30, 1972; *Victoria Times*, October 4, 1972.

On September 29, two slides temporarily blocked the Bear River, 240 mi. (384 km) northwest of Prince George. A hillside 3 mi. (4.8 km) above the mouth of the Bear River where it enters the Sustut River northeast of Hazelton fell into the river in area considered unstable. The slides were triggered along the river by roadbed construction of the BC Rail extension line to Dease Lake. They left silt deposits and debris on spring (Chinook) spawning areas. Tons of earth blocked the 70-foot (21 m) wide river, clogging the salmon and steelhead spawning beds for nearly 1 mi. (1.6 km).

Harry Kruisselbrink, Secretary-Treasurer of Smithers' SPEC (Society Promoting Environmental Conservation), who flew over the slide area said that three-quarters of the river was blocked. "There are more potential slides in a stretch of about 0.75 mi. (1.2 km). One of the is downstream about 0.5 mi. (800 m) from the slide in what is known as site two, an area long suspected by the fish and wildlife department and fisheries department" (*The Citizen*, October 2, 1972).

A Fish and Wildlife Branch official said that the railway knew of the dangers of laying track on such unstable clay banks. Not only did the silt shift into the spawning beds but much of the silt drifted downstream, affecting the river right up to its mouth. He speculated that the spawning area would be spoiled for at least a year (*The Citizen*, September 29, 1972).

According to Morley Pinsent, regional fisheries biologist for the Fish and Wildlife Branch, he had gone to the Bear River construction site twice to warn the BCR about the slide danger. But railway officials had "insisted on doing things the easy way." Pinsent considered the Bear River, a tributary of the Skeena River, an extremely important steelhead spawning ground and also a very important salmon spawning ground. Pinsent said that the BCR also took the easy way at Takla Lake by going so near the lakefront.

Dick Phillips, former president of the B.C. Wildlife Federation and an outspoken critic of the location of the BC Rail extension, stated that such an accident could have been avoided. The railway could have been set back in most places far from Takla Lake, Bear Lake and the river, and that the railway could have bypassed the area that collapsed (*The Citizen*, September 29, 1972). *1)

*1) This was the first time a charge was laid against a provincial corporation under the amendment to the Fisheries Act allowing such charges against government corporations.

October 23-24, 1972

Event type: Landslides.

Precipitation: Tasu Sound (82.0 mm/1 day), October 23, 1972; Falls River (107.0 mm/2 days), October 23-24, 1972; Kildala (70.6 mm/2 days), October 23-24, 1972; Kitimat 2 (108.0 mm/2 days), October 23-24, 1972; Prince Rupert M. Circ (145.8 mm/2 days), October 23-24, 1972; Prince Rupert (105.8 mm/1 day), October 24, 1972; Langara (62.2 mm/1 day), October 24, 1972.

Source: *The Daily News*, October 24, 25 and 26, 1972; *The Herald*, October 25, 1972; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On October 23, Prince Rupert recorded 2.16 in. (54.9 mm) of rain in 16 hours or 2.89 in. (73.4 mm) in 24 hours. The Terrace airport reported 1.25 in. (31.8 mm) in 23 hours. Highway 16 between Prince Rupert-Terrace was closed until October 26 by a massive slide and two smaller slides. The Port Edward Cannery road was closed from North Pacific south until October 26, the result of mud and water on the road. In Prince Rupert, basements flooded and downtown stores sustained damage. In Terrace, Kalum Street was closed to traffic after a landslide carried away the roadbed at the Kalum Street Hill.

On November 24, CNR reported heavy rains. Several washouts and two slides occurred at Mile 80.5 and 81.6. Debris slides blocked the line east and west of Terrace. The rail line was closed for 90 hours.

November 10, 1972

Event type: Severe scour?

Precipitation: Not available.

Source: *The Vancouver Sun*, November 20 and 30, 1972; January 5, 1973; *Fort Nelson News*, November 15, 1972; *The Province*, August 10, 1973.

On November 10, a bridge abutment at Blueberry River on the PGE Fort Nelson Extension, about 53 mi. (84.8 km) north of Fort St. John collapsed after the foundation for the bridge shifted. *1) The entire bridge foundation had to be rebuilt before the south end of the structure could be anchored. December 15 was the likely date before traffic would resume. Though the lost rail link affected the its economy of the entire Fort Nelson area, hardest hit were those that were using the railway for shipping. All traffic between the two points had to be routed along the Alaska Highway.

Rail service was interrupted for about three months (*The Province*, August 10, 1973). It was earlier estimated the span would be repaired before Christmas but cold weather hampered the construction. Engineers blamed the collapse on poor footing for the main supporting pillars. They recommended that the new bridge foundations be located closer to each bank. *2) Early January, it was announced that the rail line would remain closed until January 24.

*1) Only in September 1972 Premier W.A.C. Bennett had officially opened this rail line between Prince George-Fort Nelson. At the time, the premier's official train derailed near Williams Lake en route home from the ceremonies, injuring four railway employees. (*The Vancouver Sun*, November 20, 1972).

*2) The new span was 135ft. (40.5 m) longer than the old one.

November 29-30, 1972

Event type: Debris slide and snow avalanche.

Precipitation: Falls River (82.3 mm/1 day), November 28, 1972; Kildala (47.5 mm/1 day), November 29, 1972; Kitimat 2 (77.7 mm/1 day), November 29, 1972; Prince Rupert (88.6 mm/2 days), November 29-30, 1972; Tasu Sound (175.3 mm/2 days), November 29-30, 1972.

Source: *The Daily News*, November 30, December 1, 1972; *The Vancouver Sun*, November 30, 1972; *The Herald*, November 30 and December 6, 1972; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On November 30 at 2:30 a.m., a snowslide came down at Mile 45. A mudslide came down at Mile 56. Slides at Mile 45 and Mile 56 caused by heavy rain closed highway 16 between Prince Rupert-Terrace for 12 hours. The highway was expected to reopen later on November 30.

CNR reported ballast washouts at three locations and a debris slide at Mile 57.5. The slide was 75 ft. (22.5 m) long and 4 ft. (1.2 m) deep. The rail line was closed for 10 hours. There were minor delays at the "soft spots" near Kwinitsa.

In the Smithers area, 18 in. (45.7 cm) of snow was reported. Telecommunication links to Prince Rupert, including telex and all systems using high wires, were cut.

December 28, 1972-January 1, 1973

Event type: Snow avalanche.

Precipitation: Tasu Sound (227.9 mm/4 days), December 28-31, 1972 Prince Rupert (58.7 mm/1 day), December 31, 1972; Falls River (85.1 mm/1 day), December 31, 1973; Kemano (44.5 mm/1 day), December 31, 1973; Kildala (73.2 mm/1 day), December 31, 1973; Sandspit A (29.1 mm/1 day), December 31, 1973; Terrace (43.6 mm/2 days), December 31, 1972 - January 1, 1973.

Source: J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On January 1, CNR reported a snowslide at Mile 43.6, measuring a length of 200 ft. (60 m) and a depth of 25 ft. (7.5 m). The rail line was closed for five hours.

January 17-23, 1973

Event type: Flooding and snow avalanches.

Precipitation: Falls River (352.1 mm/6 days), January 17-22, 1973; Prince Rupert M. Circ (280.4 mm/6 days), January 17-22, 1973; Prince Rupert (224.0 mm/7 days), January 17-23, 1973; Tasu Sound (225.0 mm/4 days), January 19-22, 1973; Kildala (210.8 mm/4 days), January 19-22, 1973; Terrace (148.8 mm/4 days), January 20-23, 1973; Kemano (176.0 mm/3 days), January 21-23, 1973; Kitimat 2 (291.6 mm/3 days), January 21-23, 1973.

Source: *The Daily News*, January 22, 23 and 24, July 12, 1973; *The Province*, January 23, 1973; *Northern Sentinel*, January 24, 1973; *The Herald*, January 24, 1973; Jamieson and Geldsetzer 1996 (pp. 169-170); J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.; A. Charneski, pers. comm. July 1991, Line Foreman Alcan, Kitimat.

Around January 23, Terrace experienced flood problems due to high water levels. Between 75-140 houses were affected, ranging from flooded basements to very serious flood damage. Runoff water was flowing into the sanitary sewage system, backing up the sewers. A Civil Defense official came to town to assess the damages. One of the findings was that Terrace would need a proper underground drainage system, rather than the ditch system used at the time.

Highway 16 between Prince Rupert-Terrace was closed by a slide 43 mi. (68.8 km) west of Terrace. The slide was 40 ft. (12 m) long and 20 ft. (6 m) deep. Severe flooding occurred 28 mi. (44.8 km) west of Terrace.

Power outages occurred in Prince Rupert, Port Simpson, Terrace, and Kitimat. In Kitimat, a 40-minute power outage and flooding occurred. Early on January 22, a hydro transmission tower, 10.5 mi. (16.8 km) from Kemano at an altitude of 2,300 ft. (690 m) near the Kildala Pass was knocked down by an avalanche. The slab-type avalanche, with a depth of 3-4 m, wiped out the aluminum tower 105L. The rebuilding of the tower was completed by July 1, 1973. The repairs were completed three weeks ahead of schedule. The line between Kemano-Kitimat had been operating on one circuit since January. *1)

On January 21, CNR reported five snowslides at Mile 43.6, 43.7, and 50.1. The rail line was closed for 23 hours.

Stewart reported 23.8 in. (60.5 cm) of snow. Schools were closed on January 23-24.

*1) Subsequently, the legs of towers 105L and 105R were protected by placing strong steel breakers in front of them. (Jamieson and Geldsetzer 1996).

March 14, 1973

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: Stethem and Schaerer 1979 (pp. 26-28).

On March 14, a snow avalanche on Nine Mile Mountain near Hazelton buried and killed one member of a party of six snowmobilers. The passage of two of the snowmobiles probably caused the large dry snow avalanche, which contained both a slab and a broken cornice. Prior to the avalanche, several days of freeze-thaw had been experienced at Nine Mile Mountain. The slope in question was fairly short and the survivors described it as not being particularly steep. Wind during the winter had scoured the ridge and deposited the snow on the avalanche snow. The majority of the latter, both chunky and fine in texture, was deposited at the slope transition.

The ski of the victim's machine was located about 1.5 m below the surface. It took 40 minutes to uncover the victim. He was found face up, blue and not breathing, underneath the overturned snowmobile 2.2-3 m below the snow surface. Removing him from the hole was very difficult because the snow had set like cement.

May 26, 1973

Event type: Clay slump.

Precipitation: Not available.

Source: *The Province*, May 28, 1973; B.C. Ministry of Energy, Mines and Petroleum Resources 1993.

On May 26 west of Fort St. John, a clay slump dammed the Peace River some 20 mi. (32 km) upstream from Fort St. John for about 12 hours. On May 27, a lake began to form after the embankment collapsed and blocked the Peace River. The water rose 30-40 ft. (9-12 m) creating a lake 20 mi. (32 km) long before starting to make channels through the slide on the afternoon of May 27. No houses were endangered in the sparsely populated region.

At one point on May 27, the family-owned 10,000-ac. (4,000 ha) Tomkins Ranch, on the north bank of the Peace River with the ranch house directly across the river from the slide, was threatened. Rancher Bill Tomkins said he was concerned about 200 ac. (80 ha.) of bottomland and considered asking officials to "turn off" the Peace River's safety valve at the W.A.C. Bennett Dam, 35 mi. (56 km) upstream from the slide.

By nightfall, it was estimated that 50% of the water was getting through. The danger of the dam bursting and flooding areas downstream passed at that time. A combination of factors probably averted a more serious disaster. The heavy, deep clay soil of the region, ideal for grain, contains few rocks. After ending up in the middle of the Peace River, it quickly turned into mud allowing to quickly forming new channels. Also, before the completion of the W.A.C. Bennett Dam, the flow of the Peace River at runoff time would have been much higher. Now with BC Hydro's generators in operation, allows for an even, lower flow.

The Attachie Slide involved over 24 million m³ of sediment. According to an RCMP officer at nearby Hudson's Hope, the slide "looked a lot like the Hope Slide (on the Hope-Princeton highway)." He said it took away a 2,000-ft. (600 m) slice of the riverbank at the junction of the Peace and Halfway rivers. The force of the slide hurled trees across the river, a distance of about 500 yd. (450 m).

July 7, 1973

Event type: Severe erosion.

Precipitation: Not available.

Source: *The Vancouver Sun*, July 7 and 10, 1973 and June 14, 1974; *The Province*, August 7 and 10, 1973.

Around July 7, a combination of heavy rain and soft ground caused a washout on the BC Rail mainline 58 mi. (92.8 km) south of Fort Nelson. Repairs of the 250-ft. (75 m) section of track laid over earth fill were hampered by continuous rain. Rail traffic was temporarily halted and repairs were not expected to be completed for two weeks.

The Fort Nelson area suffered a crippling blow to its economy when the BC Rail line was cut by the washout. On July 9, Fort Nelson Forest Products was forced to lay off their 40-man nightshift. It was not until October before the bridge across Fontas River could be replaced. During that period, no lumber shipments could be made by rail. (*The Vancouver Sun*, June 14, 1974). Regional Board member Bob Angus said that the Fort Nelson Forest

Industries lumber mill, which employed about 250 people, might be forced to close. Barge service down the Nelson River and the mining industry also suffered due to the rail break.

On August 3, rail service between Fort St. John-Fort Nelson was scheduled to resume after Fontas River washed out the line in July. However, the opening date was further delayed to the first week of October. Rain and mushy muskeg terrain hampered the repair work.

September 25-26, 1973

Event type: Flooding.

Precipitation: Falls River (51.8 mm/1 day), September 25, 1973; Sewell Inlet (58.2 mm/1 day), September 25, 1973; Tasu Sound (49.8 mm/1 day), September 25, 1973; Kemano (91.7 mm/2 days), September 25-26, 1973; Kildala (81.5 mm/2 days), September 25-26, 1973; Bella Coola (103.1 mm/2 days) September 25-26, 1973.

Source: Environment Canada 1991; Church 1983 (pp. 169-180); Church 1988 (p. 226).

On September 27, the Bella Coola River above Brunt Creek recorded a maximum instantaneous discharge of 682 m³/s and a maximum daily discharge of 541 m³/s (Environment Canada 1991). During this flood in the Bella Coola River, major destabilization occurred in the Big Bend reach. Upstream from Tastsquan Creek fan, the “big bend” near Bella Coola village was cut off when sediment filled the former channel, which had persisted for nearly a century (Church 1983; Church 1988).

January 14-21, 1974

Event type: Fatal snow avalanche.

Precipitation: Kildala (281.2 mm/8 days), January 14-21, 1974; Kitimat Townsite (320.1 mm/8 days), January 14-21, 1974; Kemano (175.2 mm/3 days), January 16-18, 1974; Falls River (191.7 mm/6 days), January 16-21, 1974; Sewell Inlet (79.2 mm/1 day), January 17, 1974; Terrace (99.1 mm/1 day), January 17, 1974; Kitimat Townsite (96.5 mm/1 day), January 17, 1974; Prince Rupert M. Circ (35.1 mm/1 day), January 17, 1974.

Source: *The Daily News*, January 22 and 23, 1974, September 9, 1981; *The Northern Sentinel*, January 24, 1974; *The Herald*, January 23, 1974; *The Vancouver Sun*, January 22 and 31, 1974; March 21, 1974; *The Province*, January 26, 1974; *Terrace Standard*, February 17, 1999; January 21, 2004; *Times Colonist*, January 26, 2003; File 49-20-0 Letter, January 29, 1974, D.D. Godfrey (Reg. Hwy. Eng.) to R. G. Harvey (Ass. Dept. Min., Victoria). B.C. Ministry of Transportation and Highways, Terrace; Phillips 1990 (p. 33); B.C. Ministry of Transportation and Highways 1980; Godfrey et al. 1974; Stethem and Schaerer 1979 (pp. 89-93).

On January 17, 118.1 cm of snow fell in 24 hours at Lakelse Lake near Terrace, setting the Canadian record for the greatest snowfall in one day (Phillips 1990). *1) Terrace reported 99.1 cm of snow on January 17 and 40 cm of snow on January 22. The Terrace airport recorded 237 cm of snow in 11 days. Before January 14, 172 in. (4.37 m) of snow fell. The heavy snowfall was followed by a sharp rise in temperature. During the week before to the storm, the temperatures were very low, rising to 0° C during the storm.

On January 22, a “dry” avalanche came down 28 mi. (45 km) west of Terrace. It wiped out a service station and motel-restaurant complex North Route along Highway 16. The service station had been built in 1964. It was located in the run-out zone of large avalanches that would probably occur once in about 15 years (Stethem and Schaerer 1979). According to a National Research Council report, tree growth patterns and broken wood in the area demonstrated that avalanches had reached the highway through two narrow gaps before the café was built. The North Route buildings stood directly in the path that dry, rapidly moving avalanches would be expected to take. “Unfortunately, the hazard was not recognised when the service center was built,” the report states. “And later, when avalanches did come close, the warning went unheeded.” (*Terrace Standard*, January 21, 2004). Several vehicles were also buried. Seven people were killed. *2)

The snow mass was estimated at 400 ft. (120 m) long, 100 ft. (30 m) wide, and 30 ft. (9 m) deep. The avalanche traveled 500-600 ft. (150-180 m) down and 1,000-1,500 ft. (300-450 m) across. D.D. Godfrey, Highways Department regional engineer for Burnaby, estimated the speed at which it traveled to be over 100 mph (160 km/h). The estimated speed of the avalanche when it hit the buildings was 108 km/h (Stethem and Schaerer 1979).

The avalanche snow ranged from 1-8 m in depth and was strewn with housing debris and trees up to 0.5 m in diameter. The average depth was 1 m, but the snow in the area surrounding the buildings was up to 8 m deep. The avalanche ran out on the ice of the Skeena River, with the tip of the deposit 250 m past the service centre. On several trees between the railroad and the river, snow was plastered on the north side of the tree trunks up to 30 ft. (9 m) above the tracks. Snowfalls at the accident site are usually greater than those at the Terrace airport. At the North Route site, the snowfall was probably greater by one third (Stethem and Schaerer 1979).

Earlier that morning, a Canada Post mail truck driver and only survivor, heard “a bunch of noise rattling outside.” He was told not to worry as “it’s way up in the hills.” Just after 8 a.m., the slide hit. “I heard it – just like a cannon shot,” he said. It pushed him through the wall of the coffee shop and 50 ft. (15 m) beyond.

During the rescue operations, a smaller slide occurred about a mile (1.6 km) from the disaster site. At 2:45 p.m., almost seven hours later the first body was found under 3.6 m of snow. Zobel was the second victim found, and he would be the only survivor. It was nearly 20 hours after the slide hit that the last bodies were found. The only other survivor was a husky. The dog was under a building and crawled out a couple of days later.

The coroner's inquiry found that logging carried out by the service station owner was a contributing factor to the slide. He had logged off an area above his property on Highway 16. Warmer temperatures loosened the heavy snowpack on the mountain above the highway triggering a fast moving powder snowslide. (*The Vancouver Sun*, March 21, 1974).

Highway 16 between Prince Rupert-Terrace was closed for 12 days. Major slides occurred at 25 locations. At Mile 35, a slide knocked down the telegraph line and at least six other slides came down.

Between January 14-18, Kitimat recorded 246.2 cm of snow. This made it the second greatest snowfall in five consecutive days, just short of the Canadian record held by Pointe-des-Monts, Que., which recorded 248.9 cm of snow between March 16-20, 1885 (Phillips 1990). According to John Cruikshank of the Fire Department, Kitimat recorded a total of 149.2 in. (3.78 m) of snow between January 11-22. The Terrace airport had 93.4 in. (2.37 m) of snow.

On January 22, the roof of the Ocean Falls High School collapsed. There were no injuries because the accident happened 1.5 hours before school started. The building had only been open since September 1972. The collapse was caused by heavy rain on top of 16 in. (40.6 cm) of snow on the flat-roofed structure.

An avalanche at Boathouse Hill blocked the highway linking the Bella Coola townsite with the local docks (Godfrey et al. 1974).

*1) On February 11, 1999, this record was broken when Tahtsa Lake recorded the greatest single-day snowfall of 145 cm. (*Times Colonist*, January 26, 2003). On the same day, Terrace set a new one-day snowfall record with 113.1 cm. (*Terrace Standard*, February 17, 1999). The total snowfall for the Terrace airport for January 1974 was a new record for the month.

*2) Following the fatal avalanche, the provincial government engaged freelance avalanche consultant Roger Tremblay of Stewart to set up a new system of snow control along the highway between Prince Rupert-Terrace. The Highway 16 program would be followed by the establishment of a group to study snow conditions over the province as a whole. (*The Vancouver Sun*, January 31, 1974).

February 17, 1974

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: *The Province*, February 18, 1974.

On February 17, an avalanche on Mica Mountain close to the Alberta border, 7 mi. (11.2 km) west of Valemount killed one man and seriously injured two others. The avalanche was caused by the upper layer of snow fracturing at the top of the mountain. Mild weather and wind conditions had led to the layering in the snow. The 0.5-mi. wide slide thundered 3,000 ft. (900 m) down the mountain. Geoffrey B. Taylor, 44, of Montreal was buried under 3 ft. (90 cm) snow and suffocated. With the aid of avalanche radios, the victim was found in a maximum of 20 minutes.

Four other skiers were treated for minor injuries. The injured skiers were on the edge of the avalanche and were hurt when thrown against trees by the slide. All the skiers injured belonged to a party of 40 skiing in groups of 10 under an experienced guide. The groups were skiing at different levels on the 3,000-ft. ski run. The heli-skiers were a party mainly from Germany and eastern Canada and the U.S., organised by Canadian Mountain Holidays. They were skiing with the help of two helicopters, which carried the injured to the hospital. One helicopter almost got swept away. It had just taken off from the bottom of the ski run when the avalanche came down.

March 6-8, 1974

Event type: Snow avalanche.

Precipitation: Not applicable.

Source: *The Province*, March 9 and 13, 1974.

On March 8, a snowslide blocked about 200 ft. (60 m) of Highway 16 at Telegraph Point, approximately 50 mi. (80 km) west of Terrace. During the previous days, snow had been falling heavy in the area. The highway was expected to reopen early on March 9. This was the first snowslide to come down onto Highway 16 since the provincial government had set up a new system of snow control along the highway between Prince Rupert-Terrace in January.

*1)

*1) Daily patrols and weather reports were being used to check possible snowslide sites along the highway. It was one of the recommendations in the first report from Roger Tremblay to Highways Minister Graham Lea. (*The Province*, March 13, 1974).

June 13-25, 1974

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Victoria Times*, June 19, 1974; *The Vancouver Sun*, June 14 and 19, 1974; *The Province*, June 18, 1974; *The Kelowna Courier*, June 22, 1974; *The Province*, June 24, 1974.

On June 13, about 1,500 ft. (450 m) of rail grade slipped downhill 12 mi. (19.2 km) south of Fort St. John. The landslide also dragged along a 125-ton \$450,000 locomotive. The massive landslide came down about 0.5 mi. (800 m) east of the bridge across the Peace River. The four-man crew on the engine-and-caboose switching train escaped injury in the derailment. Debris from the hillside spilled into the river.

The BC Rail link to the northern Peace River region was expected to be closed for two weeks but by nightfall the gap kept widening. Railway officials later noted that it might take 2.5 months to rebuild the track along Peace River Hill some 400 ft. (120 m) above the river level. The problem facing the railway was how and where to relocate the line, which made a long switchback curve to the top of the hill 800 ft. (240 m) above the gorge. According to businessmen in Fort St. John, the cut in the line would cripple lumber and sulphur shipments to the south.

On June 18, the Fraser River at Prince George reached 29.26 ft. (8.8 m), 5 ft. (1.5 m) below its 1972 peak level. On June 19, small amounts of seepage were reported from Prince George. Though warm air continued to cover the southern part of the province, temperatures in the Prince George area dropped about 10 degrees F.

On June 19, water levels reached 29.29 ft. (8.79 m) at South Fort George. This was only slightly above the previous day's level of 29.25 ft. (8.78 m). On June 21, the Fraser River at Prince George continued to drop slightly down to 28.77 ft. Though it was expected to reach 32 ft. (9.6 m) by June 22-23 on June 23, it was only up to 29.06 ft. The river was expected to peak around June 24 or 25 but it levelled without reaching an extremely high mark.

July 15-18, 1974

Event type: Spring runoff flooding.

Precipitation: Dease Lake (34.5 mm/1 day), July 16, 1974.

Source: *The Vancouver Sun*, July 19, 23 and 24, 1974; Coates 1992 (pp. 252-56).

In the middle of July, torrential rain and late melting snow caused floods and washouts in northwest and northern British Columbia. There had been exceptionally heavy snowfalls the previous winter. The following summer was cool, and mountain snowmelt slow. Warm weather arrived in early July, to be followed by exceptionally heavy rainfall starting on July 15.

The Alaska Highway experienced some of the worst flooding in its history. Within a matter of hours, dozens of miles of the highway had been rendered impassable. The storm continued, interrupting telecommunications and stranding hundreds of travellers. Of the people stranded in the washed-out sections, 50 were at Summit Lake, 50 at Toad River Lodge, others at isolated sites, and the largest group, 175 trapped at Muncho Lake. The Provincial Emergency Planning Group, assisted by the Royal Canadian Mounted Police, flew food and other supplies (as well as a social worker and a public health nurse to the group at Muncho Lake) to the stranded travellers.

The Muncho Lake area was turned into an island, as the raging water cut off the highway at both ends and brought the level of the lake to unheard of levels. Miles of the highway simply disappeared; at Muncho Lake, Trout River, and elsewhere in the district. In total, 130 miles of the highway were rendered impassable. The Racing River bridge, its foundations eaten away by the raging waters, lost one of its approach spans. To complicate matters further, the Stewart-Cassiar Road, an alternate road access to the outside, washed out in the same storm, stranding the entire Northwest and adding to the urgent need to reopen the Alaska Highway.

On July 18, the provincial government chartered a plane to fly about 2,600 lbs. (1,180 kg) of food into Muncho Lake. Here at a lodge, 150 mi. (240 km) northwest of Nelson, about 150 tourists were stuck. Some food was flown by helicopter to some 50 other tourists stranded at lodges and campsites between Muncho Lake-Racing River, about 40 mi. (64 km) south. Here, a 40-ft. (12 m) span bridge was cut by floodwaters. There were also six quarter-mile (400 m) washouts on a 30-mi. (48 km) stretch north of Muncho Lake. At Mile 479, about 1,000 yd. (900 m) of the Alaska Highway washed out. An estimated 340 telephone poles went down along the highway north of Fort Nelson.

At Fort Nelson and Watson Lake, the ends of the washed out sections, large communities of stranded highway travellers congregated. To the north the road was not closed until Trout River, more than 150 miles (240 km) to the south of Watson Lake, was filled to capacity. For a day or two, travellers continued south, filling up the campgrounds and other highway accommodations. On July 17, a roadblock was set up south of Watson Lake to prevent additional travellers from continuing down the highway.

On July 20, the Stewart-Cassiar Road reopened, thus siphoning off some of the huge mob then gathered in Watson Lake. On July 22, the stranded travellers from Muncho Lake passed through Watson Lake. Two days after the first caravan arrived, the first vehicles from Watson Lake were allowed to leave. The task of restoring the Alaska Highway to its normal standard was enormous. Equipment and crews from the maintenance contractors on the southern highway, and from the Yukon Territorial Government's highway operations, were diverted en masse to the washouts.

About 2,000 residents of the Cassiar area were isolated by a series of washouts on the Stewart-Watson Lake highway. The highway south of Cassiar towards Stewart and Terrace was impassable from July 17 on. Washouts occurred at Troutline Creek, 13 mi. (20.8 km) from Cassiar, at Pine Tree Lake, between there and Dease Lake, and at Sawmill Point at the north end of Dease Lake. On July 18, the Blue River washed out a 40-ft. (12 m) section of the road approach to a bridge about 70 mi. (112 km) north of Cassiar.

Construction of a new tramline and primary concentrate plant at the Cassiar Asbestos Corp. mine was delayed, because steel supplies needed for the project were held up at Dawson Creek. The problems were compounded by an earlier series of washouts that closed down the Alaska Highway north of Fort Nelson. Helicopters were used to ferry people trapped in Cassiar to Watson Lake and to distribute food to tourists stranded along a 40-mi. (64 km) stretch of the Alaska Highway.

By July 26, only 11 days after the rains started, the Alaska Highway was open to two-way traffic. Reconstruction work continued: several bridges, including the one across racing River, had to be rebuilt. *1)

*1) Most of the work was completed by freeze-up in 1974, leaving only a limited amount of resurfacing and bridgework for the following year. The entire operation cost the Canadian government more than \$1.3 million (Coates 1992).

September 29-October 2, 1974

Event type: Debris slides.

Precipitation: Hartley Bay (126.7 mm/1 day), September 29, 1974; Tasu Sound (97.1 mm/2 days), September 29-30, 1974; Sewell Inlet (166.4 mm/3 days), September 29-October 1, 1974; Kitimat Townsite (84.1 mm/2 days), September 30-October 1, 1974; Falls River (111.6 mm/2 days), September 30-October 1, 1974; Kildala (86.4 mm/3 days), September 30-October 2, 1974; Nass Camp (47.2 mm/1 day), October 1, 1974; Aiyansh (48.0 mm/1 day), October 1, 1974; Terrace (55.6 mm/2 days), October 1-2, 1974.

Source: *Northern Sentinel*, October 3, 1974; Meziadin Environmental Advisory Team 1975 (Vol. 4 Appendix C 1.1); Schwab 1983.

In the two-day period between September 30-October 1, the Terrace airport recorded 2.77 in. (70.4 mm) of rain, Rosswood had 1.89 in. (48.0 mm), and Aiyansh 2.99 in. (75.95 mm) of rain (Meziadin Environmental Advisory Team 1975). In Kitimat, a 50-55 mph (80.5-88.5 km/h) gale caused heavy property damage and an 8 to 10-hour power cut. Telephone service to Kitimaat Village was interrupted.

On the Queen Charlotte Islands, widespread slope failures occurred, many in the Rennell Sound area. The weather station in the QC Timber camp at Rennell Sound recorded 215 mm of rain in four days. *1)

*1) Rennell Sound weather station Camp Shields Bay, Atmospheric and Environmental Service Canada operated from September 1974 through November 1975. The station was located 10 km from the Gospel Point station. The camp location generally experiences higher rainfall during storms than the Gospel Point station (Schwab 1983).

October 5-9, 1974

Event type: Flooding and debris slides.

Precipitation: Hartley Bay (357.4 mm/3 days), October 5-7, 1974; Nass Camp (151.3 mm/4 days), October 5-8, 1974; Falls River (256.5 mm/4 days), October 5-8, 1974; Prince Rupert (306.1 mm/5 days), October 5-9, 1974; Kemano (42.4 mm/1 day), October 6, 1974; Kildala (74.7 mm/2 days), October 6-7, 1974; Kitimat 2 (127.7 mm/3 days), October 6-8, 1974; Sewell Inlet (407.9 mm/3 days), October 6-8, 1974; Tasu Sound (335.9 mm/3 days), October 6-8, 1974; Aiyansh (103.9 mm/2 days), October 7-8, 1974; Nass Camp (115.3 mm/2 days), October 7-8, 1974; Sandspit A (87.3 mm/3 days), October 7-9, 1974; Masset (90.4 mm/3 days), October 7-9, 1974; Langara (45.0 mm/1 day), October 8, 1974.

Source: *The Daily News*, October 7, 8, 9, 10 and 11, 1974; *The Sentinel*, October 9 and 16, 1974; *Northern Sentinel*, October 10, 1974; *The Province*, October 12, 1974; Meziadin Environmental Advisory Team 1975 (Vol. 4 Appendix C 1); B.C. Ministry of Transportation and Highways 1976 (p. B 127); Environment Canada 1991.

Between October 1-10, Prince Rupert recorded 15 in. (381 mm) of rain. On October 8-9, Prince Rupert recorded 5.35 in. (135.9 mm) of rain in 24 hours. As the freezing level in the mountain basins of the Skeena and Nass rivers was down at 2,500 ft. (750 m), a heavy snowpack was forming (Meziadin Environmental Advisory Team 1975).

High river levels and several washouts in the Bell-Irving area closed Cassiar Highway 37 from Kitwanga to Bob Quinn Lake. Bridges in the Nass River valley flooded or washed out. Numerous washouts and slides closed the Stewart-Meziadin road. Bitter Creek bridge was damaged and had to be reconstructed. Minor flooding occurred in Kitsault and Alice Arm. At Alice Arm, 60 mi. (96 km) northeast of Prince Rupert, several houses and many unoccupied shacks were washed away. The Nass Road was reported washed out in two locations.

Prolonged periods of torrential rain caused severe mud and rock slides at both levels of the Bear Pass. On October 5-6, the road closed and again on the night of October 7 and the morning of October 8. Water cascading down the rockface and across the Stewart-Hyder, Alaska road brought down rocks early on October 8, restricting traffic.

Stewart suffered flooding after two culverts at Rainey Creek and one on Victoria Street near the Bank of Montreal could not handle the volume of water running off. According to Mayor McLeod, "never in the last 40 years had so much rain fallen in so short a time."

Around Terrace, the Twin Rivers Timber road north of Kitsumkalum Lake was closed. Nass Camp flooded and the entire Nass area was without power. A mudslide took out a transmission tower at the south end of Lava Lake. There was flooding and road grade erosion along the South Seaskinnish Creek near Nass Camp. Numerous grade washouts occurred in the Nass Valley as far north as Meziadin Lake. Wooden bridges across Alice Creek, Little Cedar

River, Hadenschild Creek, and Lean-to Creek washed out or were damaged. Major over-road flow occurred at Star Creek, Nelson River, the Beaver Flats area (Upper Kitsumkalum River), and Hadenschild Creek.

Floods caused by the heavy rain isolated Native Indian villages and logging camps along the Nass River. On October 9, the Nass River above Shumal Creek recorded an estimated maximum instantaneous discharge of 8,920 m³/s and a maximum daily discharge of 7,670 m³/s. The instantaneous discharge was an all-time high for the period of record (Environment Canada 1991). The Nass River flooded homes in the Nisga'a village of Greenville. New Aiyansh, another Nisga'a village, was isolated for several days by road closures. *1) Flooding and washouts also isolated the Twin River Timber Ltd. base of Nass Camp.

High flows occurred on most of the rivers along the Tseaux and Kitsumkalum River valleys. The Skeena River at Usk set a new discharge record for the month of October. The instantaneous peak flow at Usk on October 10 was 209,000 cfs (5,929 m³/s), and the maximum daily discharge was 5,640 m³/s (Environment Canada 1991). The ferry at Usk was suspended because of the high river levels.

On the Queen Charlotte Islands, widespread slope failures occurred, many in the Rennell Sound area. Between October 6-8, the weather station, QC Timber camp, at Rennell Sound, recorded 473.7 mm. On October 9, Crown Forest Products reported a slide blocking a road near Sandspit and several other slides occurring in the Sandspit area. The area received 20.3 mm of rain in the previous 24 hours and a total of 119.4 mm during the previous 10 days. On the same date, the Department of Fisheries and Oceans reported a slide at Sachs Creek.

*1) The Nisga'a population numbers about 6,000. About 2,500 of these live in the Nisga'a villages of Gingolx (Kincolith), Lakalzap (Greenville); Gitwinksihlkw (Canyon City) and Gitlakdamiks (New Aiyansh). The rest live elsewhere in Canada.

October 13-16, 1974

Event type: Flooding and debris slides.

Precipitation: Hartley Bay (273.5 mm/2 days), October 13-14, 1974; Nass Camp (73.2 mm/1 day), October 14, 1974; Sewell Inlet (134.6 mm/1 day), October 14, 1974; Prince Rupert M. Circ (102.9 mm/1 day), October 14, 1974; Tasu Sound (114.8 mm/1 day), October 14, 1974; Terrace (98.8 mm/2 days), October 14-15, 1974; Prince Rupert (117.1 mm/2 days), October 14-15, 1974; Kemano (151.1 mm/2 days), October 14-15, 1974; Kildala (154.7 mm/2 days), October 14-15, 1974; Kitimat 2 (174.7 mm/2 days), October 14-15, 1974; Cape St. James (95.5 mm/2 days), October 14-15, 1974; Aiyansh (82.0 mm/2 days), October 14-15, 1974; Ocean Falls (221.0 mm/2days), October 14-15, 1974; Terrace (71.1 mm/1 day), October 15, 1974; Bella Coola (118.4 mm/2 days) October 15-16, 1974

Source: *The Herald*, October 16, 1974; *The Daily News*, October 15, 16, 17 and 18, 1974; *The Vancouver Sun*, October 16, 1974; *Northern Sentinel*, October 17, 1974; *The Province*, October 25, 1974; *The Vancouver Sun*, October 16 and 17, 1974; *Alaska Highway News*, October 16, 1974; *South East Alaska Empire*, October 16, 1974; Meziadin Environmental Advisory Team 1975 (Vol. 4 Appendix C 1.1); Environment Canada 1991; John A. McDonald, Fisheries Officer. November 4, 1974. Report of effects of flooding of streams in the Butedale sub-district on October 15th and 16th, 1974. McMullen et al. 1979; Eurocan Pulp and Paper Co. Ltd., Annual Report, 1974, TFL 41, Kitimat; Brent Smith, pers. comm. Skeena Cellulose, Terrace; Bill Hough, pers. comm. December 1991, Pacific Northern Gas Ltd., Vancouver; D. Finlay. DIOD. October 17, 1996. Alice Arm Wing Dam historical summary.

Between October 13-15, Prince Rupert recorded 4.33 in. (110 mm) of rain. *1) On October 14-15, the Terrace airport recorded 3.23 in. (82.0 mm) of rain in 24 hours, setting a record for October. Precipitation measured in the 24-hour period starting 6 p.m. on October 14 at the Kitimat Fire Hall, amounted to 4.52 in. (114.8 mm). In the Nass and Skeena River valleys, the freezing level rose to 12,000 ft. (3,600 m), melting the heavy snowpack that formed during early October (Meziadin Environmental Advisory Team 1975). Combined with the record rainfall on October 14-15, this caused major flooding on most of the rivers in the area. The Skeena River basin was located mainly outside the region of intense precipitation.

Heavy flooding occurred in Terrace, particularly in the Horse Shoe area below the bench. Logjams in the Zymacord River caused severe flooding in New Remo. The peak flows for Hirsch Creek near the mouth and Zymagotitz (Zymacord) River near Terrace were maximum-recorded flows (McMullen et al. 1979). The Kalum Lake Road was closed by a washout at Mile 14. A temporary bridge had to be installed. The Nass road was closed earlier in the week, by several washouts. On the old Lakelse Road, the approach to the wooden bridge at Williams Creek was washed out. The Cedarvale ferry did not operate because of the high water. Logging operations in the area were closed.

Highway traffic both east and west of Terrace was interrupted. On Highway 16, a large washout occurred 32 mi. (51.2 km) west of Hazelton. Flooding and mudslides closed Highway 16 between Prince Rupert-Terrace. Between Mile 8-13, a number of major culverts were plugged. A mudslide came down 60 mi. (96.6 km) east of Prince Rupert. The mudslide at Kwinitsa pushed a section of the road and part of the adjoining railway embankment into the Skeena River. Highway 16 was closed until October 17. Near Port Edward, a mudslide occurred between Cassiar-Sunnyside. The road was closed, isolating three canneries.

Terrace reported more than 10 in. (250 mm) of rain during the first 20 days of October, bringing the Skeena River 3-5 ft. (0.9-1.5 m) above its normal level since October 7. The high water delayed the \$4.5 million highway

bridge construction project near Terrace. One unfinished pier in the centre of the river was continually hit by debris, causing the support poles to tilt. Rebuilding the whole pier could delay the project by six weeks. The new bridge with 16 piers crossing Dudley Little Main and Dudley Little West channels was to replace the old curved one-lane wooden bridge.

Two slides along the Skeena River and washouts at Mile 43 and 10 mi. (16 km) west of Terrace cut the CNR line and Highway 16 between Prince Rupert-Terrace. The rail traffic was interrupted until October 17. Another closure of the CNR line occurred about 30 mi. (48 km) east of Terrace and was expected to be repaired by 6 p.m. on October 16. Washouts also closed down the road between Kitimat-Kitimaat Village and the ones between Terrace-Stewart and Stewart via Meziadin Lake.

The exceptionally heavy rain caused mudslides, cutting BC Hydro's main transmission line about 60 mi. (96 km) east of Prince Rupert. A mudslide and a washed-out power pole cut the main power line to Prince Rupert at Mile 51. Power in Prince Rupert was out for five-and-a-half hours. There were also power outages in Terrace and Kitimat and major transmission problems between Terrace-Prince Rupert.

The Kitimat River level rose 13.6 ft. (4.08 m), causing the "worst flooding since 1966." On October 15, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 2,020 m³/s and a maximum daily discharge of 1,650 m³/s (Environment Canada 1991). North of the Kitimat bridge, the north arm of the main dike collapsed for over 200 ft. (60 m). Dykes erected since the 1966 flood prevented flooding of the Service Centre. Major gravel movement took place near the Service Centre bridge. Several loads of shot rock were dumped to protect the Municipal sewage treatment facilities. Radley Park was completely under water. The bridge near the Minette Bay Marina was taken out. The road into the Kitimaat village was impassable as the bridge just before the village was flooded. Extensive damage occurred, especially at Hirsch Park. In the Kildala section of Kitimat, basements were flooded. Roads, including the road to the Alcan Smelter site, were flooded. The Alcan water intake on the Kitimat River crested at 49 ft. (14.7 m) as compared to 50 ft. (15 m) in 1966. Flooding and bank erosion occurred along the river. Heavy gravel movements took place and on many smaller tributaries of the Kitimat River erosion and silting were severe. The silt load was extremely heavy, with visibility down to a "fraction of an inch." At many points in the river logjams formed. The most dramatic changes occurred on the steeper gradient tributaries, such as Moore and Anderson creeks. Flooding and bank erosion took place, on many smaller tributaries of the Kitimat River and erosion and silting were severe. Logs and debris from a logjam that broke loose above the falls on Anderson Creek lodged against the bridge on the Alcan Road. After water started backing up over the road, heavy equipment lifted out the debris. Water backing up from the Kitimat River caused the bridge over Goose Creek on the Eurocan Main Line to float out.

Similar incidents occurred at a number of other points along the logging road network in the Kitimat Valley. At the height of the flood, back pressure on the diffuser outlet of the Eurocan Pulp and Paper Company effluent treatment ponds brought the water level in the outlet chamber to within a few inches of the pond level. An estimated 5 ft. (1.5 m) of gravel built up over the diffuser, causing the installation to fail to function properly. Gravel deposited behind the rock groyne on the opposite side of the river completely cut off the flow into the side channel. After the channel became filled with gravel, sand and silt, most of the seepage into the oxbow was cut off, adversely affecting its rearing capacity. The major logjam near the Crown Zellerbach (CZ) bridge increased in size, diverting more of the flow to the west side of the river. The build-up of logjams and gravel bars upstream of the third and fourth CZ bridges (from the highway) diverted nearly the entire Kitimat River. This left little water under the main bridge. Between the CZ bridge and the 17 Mile bridge many bars changed, drying and/or silting up a number of spawning channels. In several places on the west side of the river severe erosion occurred. On the upper ends of islands and along both sides of the river new logjams formed. Upstream of the 17 Mile bridge, major bank erosion took place and many new logjams formed up to the limits of tree growth.

On Hirsch Creek, gravelbars changed and several logjams formed. Judging by the large amount of debris in the lower reaches, major changes must have taken place above the canyon. Severe scouring and erosion took place along Nalabila Creek. A massive logjam formed on Branch 20, approximately 150 yd. (135 m) downstream of the bridge. The jam, which was at least 150 yd. (135 m) long, effectively blocked the stream to salmon migration. It forced the stream to spread out along the length of the dam and to meander through the timber with no definite channels. Much of the stream channel between the Branch 20 bridge and the logjam built up to a higher level than the surrounding area. It was contained in its present course only by a low "dyke" of silt and small debris deposited during the flood. It was believed that the stream left the channel and meandered off through the timber. The lower reaches of Humphrey's Creek downstream of the highway showed considerable siltation. A large logjam built up about 300 yd. (270 m) below the canyon. Due to the nature of this stream, the changes were not as apparent as in Nalabila Creek. Road access to Chist Creek was blocked.

Many minor slumps and slides throughout the logged-off areas accumulatively contributed large quantities of silt to the stream. Small jams and some localised erosion silting occurred in Cecil and Deception creeks. In the Wedeene River some small jams formed and some bank erosion took place. Locally, some severe scouring and silting took place. At the chronic problem areas along the Wedeene Main Line, sloughing of silt and clay was considerable, adding to the overall silt load of the river. A large mudslide on a tributary of Dahl Creek contributed large quantities of silt to Dahl Creek, and to some extent to the Little Wedeene River.

Damage to the Kemano River system was at least as severe as that on the Kitimat River. Major changes occurred in both the main stem and on the lower reaches of the tributaries. Approximately 0.5 mi. (800 m) downstream from the Eurocan camp, the bank of the Kemano River was cut back about 50 ft. (15 m). The river took out about 100 yd. (90 m) of the main haul road. The changes caused in the current pattern resulted in changes to bars and channels downstream. At the confluence of the Kemano River and Cariboo Creek, about 1.5 mi. (2.4 km) upstream from the Kemano Townsite, a major channel change occurred. An estimated 10 ac. (4 ha) of timber scheduled to be logged in 1975, was taken out. On the lower reaches of Cariboo Creek, floodwaters spread out over a large area, causing serious erosion. The vegetation, which was completely removed, was carried down into the Kemano River. About 0.5 mi. (800 m) of the access road to the Alcan transmission line washed out. Considerable erosion occurred near the town of Kemano along the Kemano River adjacent to the golf course. An important spawning area was lost when the portion of Horetzky Creek moved back into an old channel. It left the spawning channel immediately behind the golf course dry and silted up. From the lower end of the canyon to its confluence with the Kemano River, Seekwyakin Creek radically changed its course. It took out two sections of the main haul road when the stream shifted into two old beds, leaving no water under the main bridge. Major gravel movement took place, leaving most of the former spawning area dry. Though less obvious, changes above the first canyon were considerable. The lower portion of Wachwas (Creek) was heavily impacted. The many trees that came down the creek formed jams near the mouth of the creek. The bridge that was installed the previous year across one arm for access to a recreation area washed out. At this point, the bank was cut back at least 20 ft. (6 m). Localised scouring occurred on Weewanie Creek. Minor changes in the stream course took place at about the 5-mile point where the creek spreads out into two or three channels.

The town of Stewart was isolated. The area recorded more than 9 in. (228.6 mm) of rain during the previous week. Mayor Jon Spires described the situation as the "worst in the past 40 years." Highway 37A, Stewart to Meziadin, was closed by a washout at Bear Glacier. The Nass River rose to record heights. The WSC station near Aiyansh recorded a peak stage of 31.34 ft. At Moore Creek, about 9 km. downstream from the confluence with the Meziadin River, the water level rose 45 ft. (13.5 m) above spring low water level and flooded the highway. About 7 km downstream from the confluence with the Bell-Irving River, just upstream from a 60-ft. (18 m) wide canyon, driftwood was deposited at an estimated elevation of 85 ft. (25.5 m) above the low water level. The road grade and culverts on the east side of Lava Lake sustained extensive damage. About 0.5 mi. (800 m) north of Lava Lake, Crater Creek flowed on the surface, causing minor erosion along part of the road grade. This was the third and most extreme flood in October. The Kitimat River, Hirsch Creek, Zymagotitz River, and the Zymoetz River all reached record peak flows. On the coastal streams below Usk and in the Kitimat basin, new maximum annual discharges were reported (Meziadin Environmental Advisory Team 1975). The instantaneous peakflows on October 15 were: Zymoetz River above O.K. Creek, 104,000 cfs (2,940 m³/s); Zymagotitz River 19,400 cfs (540 m³/s); Exchamsiks River, 25,800 cfs (731 m³/s); Kitimat River below Hirsch Creek, 71,400 cfs (2,021 m³/s); Hirsch Creek 28,500 cfs (549 m³/s), Little Wedeene River below Bowbyes Creek, 7,550 cfs (214 m³/s); Kemano River above Tailrace, 31,400 cfs (889 m³/s). On October 18, the Bella Coola River above Burnt Bridge Creek recorded a maximum instantaneous discharge of 453 m³/s and a maximum daily discharge of 408 m³/s (Environment Canada 1991).

Logging roads in the Terrace area sustained heavy damage. A section of the Copper Main haul road between the Clore River-Limonite Creek along the Zymoetz River was badly damaged with large washouts. *2) Skeena Cellulose reported a cost of \$400,000 to repair its road between the Clore-Kitnayakwa. This included the replacement of a bridge and major reconstruction of 10 km of road. The Copper Main between Kitnayakwa-Limonite Creek was left unrepaired and not reconstructed to date. Another \$30,000 was spent to repair the road between the highway and the Clore. Eurocan reported a total damage of \$203,031. Of this amount, a total of \$162,063 was spent on the Kemano roads in CP 2. The river scoured large sections of road. Bridges at Mile 8.3 (bridge No. 1), Mile 12, Mile 16.3 (Branch 150 bridge), Mile 17 (Branch 160 bridge), and Mile 22.75 (bridge No. 7) all sustained damage. In CP 1, Goose Creek bridge had to be rebuilt at a cost of \$2,624. Damage to the Pacific Northern Gas pipeline in the Copper River system totaled approximately \$4 million (B. Hough, pers. comm.).

On the Queen Charlotte Islands, widespread slope failures occurred, many in the Rennell Sound area. Between October 13-14 the weather station in the QC Timber camp at Rennell Sound recorded 192.8 mm of rain. On October 15, Crown Forests Products reported a slide at Deena. Sandspit received 19 mm of rain in the previous 24 hours and a total of 140.5 mm over the previous 10 days.

Early on October 15 till noon, 40-50 mph (64-80 km/h) winds with gusts up to 70 mph (112 km/h) from a southwest direction hit Fort St. John. The winds ripped off the shingles and insulation on the curling rink's rooftop causing an estimated \$6,000 damage. BC Telephone Company reported problems and BC Hydro had a couple of lines torn down by fallen trees. Several store windows and TV aerials were also damaged. *3)

In October, Alice Arm experienced severe flooding and was classified as a disaster area. The actual repair cost of 700 linear ft. (210 m) of the existing wingdam and removal of debris from the channel of the Kitsault River was \$26,400. (D. Finlay).

*1) In the first 15 days of October, Prince Rupert recorded 20 in. (500 mm) of rain. The average for the whole month of October was 16 in. (400 mm) (*The Vancouver Sun*, October 16, 1974).

*2) Addendum 1 of TFL #1 provided for the reimbursement of the reconstruction costs through stumpage offset. Before issuance of this addendum, the Copper Main haul road was reclassified from private road to Copper River Forest Road.

*3) In January 1963 in Fort St. John, southwest winds reached a top 60 mph (96 km/h) and an excess of 70 mph (112 km/h) was recorded in 1965 (*Alaska Highway News*, October 16, 1974).

October 17, 1974

Event type: Subaqueous slide and tsunami.

Precipitation: Not available.

Source: *Northern Sentinel*, October 24, 1974; Murty 1979 (p. 7777).

On October 17 at 11:15 p.m., a submarine slide occurred in Kitimat Inlet. *1) It generated a water wave of 2.8 m (Murty 1979). The sudden tide or wave amounting to nearly 20 ft. (6 m) by witness account was attributed to a landslide either under the sea or from a hill or mountainside. It caused damage including the sinking of several small boats, upturned canoes and larger boats.

Tibor Baldauf rode out the series of waves. "We went down a good 8 ft. (2.4 m)," he said adding that his boat rode up 8 ft. afterwards. Waves then came in at one, one-and-a-half or two- minute intervals, taking just as long to go out. By the second wave, the boat hit bottom again. Baldauf stuck his head out of the hatch. His vessel's mast and trolling poles, including his antenna were ripped off the boat, apparently by becoming caught by the dock pilings. The mast almost struck him as it went over. By the time he could get out of the cabin, the spring lines holding the boat had snapped. Two heavy chain plates embedded in the craft's cement hull were ripped out. George Grant's 35-ft. (10.5 m) gillnetter, moored stern-to-stern to Baldauf's cement boat, was bashed in by the waves, resulting in \$3,000-4,000 damage.

A fourth wave, sounding like "rushing water," swept the boat towards shore, only to become entangled on a pile by a floating mass of ropes, mast antenna, stabilizers and trolling poles. By hitting the ropes with an axe Baldauf was able to free the boat, which was then picked up and flung a second time towards shore. The waves were gradually reduced after the major surges. Baldauf was then able to make it out into the channel into clear water.

At the Rivtow Straits dock across the channel, a piling was knocked into the Rivtow office, which was at water level. The office roof caved in when the dolphin and pilings broke off. One barge pulled a cleat with eight lugs off the Northland dock. Mike Stephens at Rivtow estimated the wave was 6-8 ft. (2-2.4 m) high. Other witnesses claimed subsequent ones up to 15 ft. (4.5 m)

At Kitimaat Village, marks near the top of pilings to where the tide had risen indicated a height of close to 20 ft. (6 m), from the near low tide. Sam Robinson noted that had the wave occurred during high tide, water would have been swept over the village road.

*1) Kitimat Inlet has a history of landslides. Several slides occurred during the period 1952-68 and several in 1971 (Murty 1979).

October 25-27, 1974

Event type: Landslide.

Precipitation: Prince Rupert (5.08 in./129.0 mm/2 days), October 25-26, 1974.

Source: *The Vancouver Sun*, October 27, 1974; *The Province*, October 28, 1974.

During the 48-hour period ending 11 a.m. on October 27, Prince Rupert recorded 5.08 in. (129.0 mm) of rain, 3.6 in. (91.4 mm) of which fell in the second 24 hours.

On November 26 at 9:25, a landslide on Mount Hays, 3 mi. (4.8 km) west of Prince Rupert pulled down two telex lines. A mudslide 11 mi. (17.6 km) east of Prince Rupert knocked out the BC Hydro line and the line connecting the substation. A number of basements were flooded after the power outage shut down sump pumps.

January 2, 1975

Event type: Snow and debris avalanche.

Precipitation: Not available

Source: *The Vancouver Sun*, January 3, 1977.

On January 2 just before 6 p.m., a massive mud and snowslide came down a steep hillside cut on a 1,000 ft. (300 m) mountain along Highway 16 about 23 mi. (36.8 km) east of Prince Rupert. The slide, loosened by heavy rains and high winds during the previous week, covered a 100-ft. (30 m) stretch of road to a depth of up to 20 ft. (6 m). Winds had reached up to 70 mph (112 km/h) and about 4-5 in. (100-125 mm) of rain had fallen in the area.

According to the highways department spokesman, it was "an unusually large slide," consisting of a thick mixture of mud, snow, rocks and large trees. Though crews managed to clear one lane for traffic by 9:30 p.m., normal traffic would not be restored before late on January 3.

January 11-12, 1975

Event type: Snow avalanche.

Precipitation: Stewart (82.6 mm/1 day), January 12, 1975.

Source: *The Vancouver Sun*, January 13, 1975; *The Sentinel*, January 15, 1975.

On January 12 at 10 p.m., a snowslide came down onto Highway 16, 10 mi. (16 km) east of Kwinitsa, 7 mi. (11.2 km) west of the location where an avalanche killed seven people a year earlier. Though the slide was not a very big one, the road was not reopened until highway crews made sure there were no other slides further west.

Winter storms with coastal gales and whiteout conditions hit Stewart. Continuous snow on January 11-12 added 40-50 in. (1.02-1.27 m) of snow to the approximate 172 in. (4.37 m) on the ground. Because of the extremely high snowslide potential in the area across the Bear River and at the foot of Mount Rainey, snowmobilers were advised not to use that eastern end of town. The heavy build-up of snow was to be bombed as soon as flying conditions would permit.

February 14-23, 1975

Event type: Snow avalanches.

Precipitation: Stewart A (155.8 mm/5 days), February 14-18, 1975; Sewell Inlet (517.2 mm/8 days), February 14-21, 1975; Hartley Bay (133.1 mm/2 days), February 17-18, 1975; Prince Rupert M. Circ (149.9 mm/6 days), February 17-22, 1975; Falls River (252.8 mm/5 days), February 18-22, 1975; Tasu Sound (357.5 mm/5 days), February 18-22, 1975; Kemano (64.8 mm/1 day), February 21, 1975; Kitimat Townsite (102.1 mm/2 days), February 21-22, 1975; Kildala (116.8 mm/2 days), February 21-22, 1975; Sandspit A (61.5 mm/2 days), February 21-22, 1975; Terrace (59.9 mm/1 day), February 22, 1975.

Source: *The Daily News*, February 18, 19, 20, 24 and 25, 1975; B.C. Ministry of Transportation and Highways 1982.

On February 21-23 in Prince Rupert, winds gusting to 70 mph (112.7 km/h) caused severe damage. Windows were smashed, signs demolished, and trees downed. The "Col. Saunders" bucket came down and one totem pole on the Hospital Lookout snapped off and split lengthwise. Digby Island registered gusts of 73 mph (117.5 km/h) on February 21. On the afternoon of February 21, the Prince Rupert Elementary School had the corner of the roof blown off. Some 230 students were sent home. A section of the roof of the Prince Rupert Senior Secondary School Gymnasium was damaged, causing water damage. The Prince Rupert telephone service experienced cable trouble, affecting about 20 lines.

On February 18, an avalanche at Mile 52.8 closed Highway 16 between Prince Rupert-Terrace. On February 18, the Avalanche Control fired a total of 14 shots at Mile 4.8, 43.57 [?], 47, and 50. The highway reopened on February 19. An additional 10 in. (25.4 cm) of fresh snow on February 20 caused an avalanche hazard.

Highway 37 to Stewart was closed on February 18 by two slides at the Bear Pass. On February 18 in the Bear Pass at slide path Lindsay's at 38.6 km, a freight truck that was stopped by an avalanche deposit was hit by a second slide. It was partially buried as it was backing away from the first deposit. The truck was pushed off the road and damaged. The driver was able to free himself from the wreckage. Because of the extreme avalanche hazard, the road remained closed. On February 24, the road to Stewart reported 60 in. (1.52 m) of fresh snow and the road to Meziadin, 36 in. (91.4 cm). On February 25, Highway 37 to Meziadin was open with a number of one-lane sections.

April 15-16, 1975

Event type: Snow avalanche and mudslide.

Precipitation: Not applicable.

Source: *The Herald*, April 16, 1975; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

On April 15, Highway 16 between Prince Rupert-Terrace was closed for most of the day, by a slide at Mile 52. The slide measured a length of 200 ft. (60 m) and a depth of 30 ft. (9 m).

CNR reported a mudslide in the Bulkley subdivision at Mile 43 west of Smithers.

April 27-28, 1975

Event type: Subaqueous slide and tsunami.

Precipitation: Not applicable.

Source: *Northern Sentinel*, May 1, 1975; *The Vancouver Sun*, May 1, 1975; Campbell and Skermer 1975; Murty 1979 (p. 7777); Clague 1989 (p. 82).

On April 27 at 10:00 a.m., a large submarine landslide involving at least 10 million m³ of material occurred in the Moon Bay area near the head of Kitimat Arm. The slide took place approximately 53 minutes after the occurrence of low tide and caused a local tsunami. *1) Following the slide at least two (and possibly three) water waves were generated and propagated into the connecting bays and channels. The largest wave was estimated to be 8.2 m in range (4.6-m crest plus 3.6 m trough). The whole water disturbance lasted about 1 hour.

In Bish Creek and Clio Bay, which are about 8 km from the site of the slide, at least one wave was observed. Some damage occurred in Bish Creek, and the range at Clio Bay was estimated to be about 6.7 m (Murty 1979). Shore installations at Kitimat suffered about \$600,000 damage (Campbell and Skermer 1975; Clague 1989). According to

federal tidal surveyor Bob Brown, had the wave struck at high tide, it would be very possible there would have been considerable damage to housing at Kitamaat Village.

The 20-ft. (6 m) wave and a lengthy ocean turbulence, which followed, left a large warehouse and a pollution control shed hanging precariously over the edge of the dock and would have to be replaced. The Northland *Kemano IV*, a 145-ft. (43.5 m) covered barge was torn loose from its moorings and swept onto tidal flats, but was not damaged. Hardest hit was the dock owned by Northland Navigation Co. A 225 x 40 to 60-ft. (67.5 m x 12-18 m) section of dock was wiped right into the sea. According to Northland manager Don Murray, a quarter million dollars was a conservative damage estimate.

Murray felt the wave was caused by an undersea hillslide, possibly in the area where Rivtow Straits was dredging in Half Moon Bay. Here, the previous fall Rivtow had started work on a tug tie-up facility. An estimated \$75,000 damage was done as the area was gutted of roadwork and a bulkhead. Rivtow manager Capt. Tim Stangroom reported "everything gone" from the installation. The Rivtow office barge sustained little damage after being torn from its moorings at the Northland dock. At the Eurocan Pulp and Paper Co. dock, the estimated damage was close to \$200,000 to dolphins (pilings) and logbooms. Comptroller Herb Smart said 25 dolphins had been broken off by the wave.

Gillnetters belonging to Allan Williams and Dan Paul were sunk and a packer owned by Walter Wilson sustained an undetermined amount of damage. Lines from two new boats became wrapped around dolphins but *Island Point* packer was swept to shore and back by the rush of water.

Chief Tom Robinson reported damage to harbour breakwater and considerable destruction of canoes and small boats. He believed the wave and ocean disturbance were the result of man-made conditions, because "we've been here hundreds of years and there is nothing; now, all of a sudden, there are these two occurrences." He speculated the wave and the one in October 1974 might have been caused by silt build-ups from Eurocan.

Robinson estimated the damage at Kitamaat Village at between \$50,000-100,000. Provincial officials estimated the former figure as low. Eighty percent of the damage done at the village was caused by floating logs "going 20-25 mph (32-40 km/h) hitting canoes, boats and floats." Federal fisheries officer John Macdonald ascertained the height of the wave at Kitamaat Village at approximately 20 ft. (6 m).

Reports differed on how the wave and subsequent waves came in. Albert Walker noted that in the 1974 tsunami one of the waves was bigger than the others. This time, the waves were so close together that "they were just boiling, it was continuous."

Later, 10 mi. (16 km) down the channel, Marshall Grykuliak noticed what at first appeared to be a rip tide near Costi Island. The sea was dead calm when a small, 6-in. (15 cm) curl of water passed beneath his boat coming from the direction of Kitimat.

Stangroom came down to the Kitamaat Village float when the second wave hit. He estimated the first two waves at 12-15 ft. (3.6-4.5 m). A fourth he felt was so huge that it looked like it would break any minute. He looked toward Eurocan and the whole of the booming grounds were dry "with a surf like on the west coast of Vancouver Island." The incoming water "just boiled over the bank, ripped loose logbooms and dolphins and took them out to sea." The first wave had already taken out part of the Northland dock with the second one getting the Eurocan booming grounds. "There was 12-15 ft. of boiling, swelling, surging water right at mouth of Eurocan. The dolphins there are 20 ft. (6 m) out of the water, and I don't remember seeing them behind the water."

On April 28, a second ocean disturbance occurred when an acre (0.4 ha) of land fell into the sea at half Moon Bay, north of the Northland dock. It happened between 10 a.m.-5 p.m. without any pronounced ocean disturbances.

*1) There is considerable evidence to show that submarine slides predominantly occur associated with the low tide (Murty 1979). The provincial government engaged Golder, Brawner & Associates Ltd. to conduct a soil analysis of (Half) Moon Bay. (*The Vancouver Sun*, May 1, 1975).

July 26-27, 1975

Event type: Flooding and mudslide.

Precipitation: Not available.

Source: *The Province*, July 2 and 3, 1975; Coates 1992 (pp. 256-57).

On July 26 and 27, washouts forced the closure of the Rocky Mountain section of the Alaska Highway. Following heavy rain on July 26-27, a section of the Alaska Highway closed after it washed out in about 14 places and three bridges were knocked out. Climatically, it was a replay of the previous year, another summer of exceptionally heavy rain, when a series of washouts stranded hundreds of travellers in the same area. The rapidity and severity of the runoff, this year, caused greatest damage to bridges and proportionally less to the road surface. *1) For at least six days, the Stewart-Cassiar highway was the only road link between British Columbia and the Yukon.

At Mile 32 between Dawson Creek-Fort St. John, travel was also restricted to one-lane after a mudslide covered the road. About 800 people were stranded in Fort Nelson and 80 were trapped between downed bridges along the 355-mi. (568 km) stretch of highway between Watson Lake-Fort Nelson. By July 3, there was still the possibility that some people might be trapped between Mile 410-437, including the stretch where the Racing River bridge was still out.

The bridge repairs took the longest. Bridges at MacDonald Creek, Racing River, and Toad River were severely damaged, ensuring travel delays and considerable cost in bringing the highway back into service. Work started on the Racing River bridge on July 5 but was not finished until July 14. Still the washouts did not have the same crippling effect as the previous year's. Most travellers were able to return to Watson Lake or Fort Nelson, where they waited for work to be completed. As well, the Stewart-Cassiar Road remained open, providing travellers with a viable route in and out of the territory.

By July 3, the highway reopened from Mile 410 south to Fort Nelson and was open between Mile 437 to Watson Lake "on emergency basis". Emergency repairs were still being made to portions of the highway. When the Alaska Highway reopened, initially to cars and small trucks, on July 8, the convoy south from Watson Lake comprised of only 40 vehicles. The expedition from Fort Nelson, escorted by RCMP cruisers, included 310 cars and vans, 303 campers, 120 towed trailers, 93 motor homes, and a few other vehicles. Repair work was not completed by winter freeze-up, and some of the bridgework continued through the winter. By May 1976, the highway was back to its pre-flood condition.

*1) The 1975 flooding proved to be expensive: more than \$2 million. (Coates 1992).

October 30-November 4, 1975

Event type: Debris slides.

Precipitation: Tasu Sound (159.0 mm/3 days), October 30-November 1, 1975; Sewell Inlet (289.8 mm/4 days), October 30-November 2, 1975; Falls River (200.2 mm/4 days), October 30-November 2, 1975; Hartley Bay (227.9 mm/4 days), October 30-November 2, 1975; Kildala (151.6 mm/4 days), October 30-November 2, 1975; Kemano (177.4 mm/4 days), October 30-November 2, 1975; Falls River (200.2 mm/4 days), October 30-November 2, 1975; Prince Rupert M. Circ (173.0 mm/4 days), October 30-November 2, 1975; Kitimat Townsite (56.6 mm/1 day), October 30, 1975; Ocean Falls (301.4 mm/4 days), November 1-4, 1975.

Source: *The Daily News*, October 29 and 30, November 1, 2 and 3, 1975; *The Herald*, October 29, November 5, 1975; J. Mekechuck, pers. comm. 1989. CN Railway, Edmonton, Alta.

CNR reported debris slides near Sockeye and Port Edward.

On the Queen Charlotte Islands on November 2, the Department of Fisheries and Oceans reported a large slope failure on Louise Island. Sewell Inlet recorded 52.3 mm of rain on November 2 and a total of 320.0 mm during the previous 10 days.

November 10-14, 1975

Event type: Debris slides.

Precipitation: Sewell Inlet (151.9 mm/2 days), November 10-11, 1975; Tasu Sound (174.8 mm/2 days), November 10-11, 1975; Falls River (141.2 mm/2 days), November 10-11, 1975; Cape St. James (41.9 mm/1 day), November 11, 1975; Kemano (162.5 mm/2 days), November 11-12, 1975; Kildala (115.6 mm/2 days), November 11-12, 1975; Kitimat Townsite (115.1 mm/2 days) November 11-12, 1975; Terrace (145.5 mm/3 days), November 11-12, 1975; Bella Coola (184.1 mm/2 days), November 11-13, 1975; Sandspit (109.8 mm/5 days), November 11-15, 1975; Bella Coola (114.0 mm/1 day), November 12, 1975; Smithers A (37.8 mm/2 days), November 12-13, 1975; Ocean Falls (220.3 mm/2 days), November 12-13, 1975; Hartley Bay (108.7 mm/2 days), November 13-14, 1975.

Source: *The Daily News*, November 13, 1975; *The Interior News*, November 26, 1975.

Between October 5-7 and October 11 and 13, storms with high intensity rainfall occurred on the Queen Charlotte Islands. Late on November 13, the frontal wave of a storm that originated over the East China Sea on November 6 deteriorated as it struck the Coast Mountains. On November 12, in the Bear Pass area near Stewart, 100 cm of snow fell in 24 hours.

Between November 10-13, Terrace reported 93.3 cm of mixed rain and snow. Highway 16 between Prince Rupert-Terrace was closed by a snow and debris slide 12 mi. (19.2 km) west of Terrace. Around midnight November 12-13, a slide came down 16 mi. (25.6 km) west of Terrace, closing Highway 16. The "landslide" dumped over 25 ft. (7.5 m) of mud, rock, and snow on the highway. It took crews most of the day to clear a single lane for traffic. On November 12, a heavy snowfall was reported in the Smithers area. According to Smithers BC Hydro director LaMarre, four hydro poles were knocked down by trees and approximately a dozen conductors knocked out by the storm.

MacMillan-Bloedel reported slides at Macktush Creek. On November 17, the Department of Fisheries and Oceans reported that a slide had occurred at Sachs Creek. During the previous 10 days, Sandspit received 134.1 mm of rain.

March 11, 1976

Event type: Non-fatal snow avalanche.

Precipitation: Not applicable.

Source: Williams and Armstrong 1984 (p. 120).

On March 11, a snow avalanche buried one member of a line crew for Ketchikan Public Utilities working on a mountainside near Ketchikan, Alaska. Dirk Richardson, the victim, was totally buried for 90 minutes. Using his hard

hat as a scoop, he managed to reach the surface. The sole newspaper account, listing the depth of burial as 20 ft. (6 m) is without doubt an exaggeration. A reasonable guess would put the victim's head at 5-6 ft. (1.5-1.8 m) below the surface (Williams and Armstrong 1984).

April 9, 1976

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Interior News*, April 14, 1976.

On April 9, spring runoff caused flooding near Smithers. Backyards on King Street were flooded with 6 in. (15 cm) of water. The double culverts at the top of "Suicide Corner," the S-curve on Highway 16 east of the Northern Training Centre, could not handle the spring runoff. A water course, 5 in. (12.5 cm) deep and 50 ft. (15 m) long, flowed across the highway at the bottom of the hill. Only some shoulder damage occurred. *1)

*1) It was the second year in a row that this spot flooded. To end the problem, the Highways Department considered installing a culvert.

April 30-May 14, 1976

Event type: Spring runoff flooding.

Source: *The Interior News*, May 5 and 19, 1976; *The Vancouver Sun*, May 7, 1976; *The Province*, May 13 and 14, 1976.

Near Smithers, record breaking temperatures and spring runoff caused small creeks to overflow their banks. On April 30, Bigelow Creek flooded the parking area and storage yard of Smithers Concrete Products. On May 5, high water levels caused a washout on the CNR line 12 mi. (19.2 km) east of Endako. After a nine-day disruption service was restored on May 14.

Heavy rain, frost-free nights and a large snow pack in the Nechako drainage area caused a heavy runoff. On May 6, the Nechako River rose 5 ft. (1.5 m). Overnight May 6-7, the level remained steady. Though the river was some 5 ft. (1.5 m) above normal, it was still 2 ft. (60 cm) below flood level. Roads in the district washed out, cutting off some local residents.

Overnight May 12-13, The Fraser River at Prince George rose 3 in. (7.5 cm) bringing it above the 30-ft. flood warning level. Though it was still rising, the level was still more than 4 ft. (1.2 m) below the record levels set in 1972.

On May 12, in Vanderhoof and Burns Lake floodwaters were receding. Late on May 11, the Nechako River in Vanderhoof dropped about 3 in. (7.5 cm). In some low-lying areas, a few houses had flooded basements with water inching into yards and moving up city streets.

On May 14, with a surge of cooler weather threats of serious flooding in central British Columbia lessened. Water levels on the McGregor, Bowron and Salmon rivers were all dropping.

August 25, 1976

Event type: Mudslide.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, August 25, 1976.

On August 21, a 0.25-mi. (400 m) long mudslide along 95-Mile Road blocked a dead-end road at the Halfway River, 13 mi. (20.8 km) west of the Alaska Highway and 45 mi. (72 km) northwest of Fort St. John. Rainfall totaling more than 40 mm during the previous week loosened over 1 million yd.³ (764,600 m³) of mud. A total of 75 people, including 25 families on the Halfway Indian Reserve and two ranch families, were isolated. The highways department repaired an abandoned oil drilling road to by-pass the slide. The continuous rain played havoc with local transportation in the Peace River area with its many dirt roads.

September 2-4, 1976

Event type: Debris slide.

Precipitation: Hartley Bay (128.5 mm/2 days), September 2-3, 1976; Prince Rupert M. Circ (68.3 mm/3 days), September 2-4, 1976; Terrace (15.2 mm/1 day), September 3, 1976.

Source: *The Daily News*, September 14, 1976; File M 51-653-186122 Galloway Rapids. B.C. Ministry of Transportation and Highways, Terrace.

Around September 5, a debris slide occurred on Highway 16, 1,500 ft. (450 m) east of the Galloway Rapids bridge. The slide was still being cleared on September 10.

October 25-28, 1976

Event type: Debris slides.

Precipitation: Sewell Inlet (230.1 mm/2 days), October 25-26, 1976; Falls River (164.9 mm/2 days), October 25-26, 1976; Prince Rupert (153.7 mm/3 days), October 25-27, 1976; Tasu Sound (281.1 mm/5 days), October 25-29, 1976; Kildala (117.1 mm/1 day), October 25-29, 1976; Nass Camp (75.2 mm/1 day), October 26, 1976; Cape St. James (44.7 mm/1 day), October 26, 1976; Prince Rupert M. Circ (31.3 mm/1 day), October 26, 1976; Terrace (94.2 mm/2 days),

October 26-27, 1976; Stewart A (112.7 mm/2 days), October 26-27, 1976; Kemano (158.5 mm/2 days), October 26-27, 1976; Hartley Bay (162.0 mm/3 days), October 26-28, 1976; Ocean Falls (192.0 mm/2 days), October 27-28, 1976.
Source: *The Herald*, October 27, November 3, 1976; *The Daily News*, October 27, 1976.

Prince Rupert reported 110 mm of rain in 24 hours with 46-mph (74.0 km/h) winds. Two power transmission lines were damaged by slides, causing a 24-hour power blackout in Prince Rupert. A mudslide near Oliver Lake took out three power poles. The slide also stripped part of the hillside from the top of the mountain to across the road 1,500 ft. (450 m) below. The October 29 issue of *The Daily News* shows a photograph of the slide at Oliver Lake.

In Prince Rupert, the Senior Highschool sustained \$5,000 damage. Its basement boiler room was submerged under 4 ft. (1.2 m) of water. The Kindergarten room in the King Edward Elementary School was flooded. The Seal Cove School lost two furnaces as a result of water damage. Basements in homes were flooded because of poor drainage and backed-up runoff ditches. The Mountain View trailer court was flooded with water at "mid calf height." The road along the lower areas of the town was under water. On Conrad Street, a small slide occurred in Mrs. Bond's yard. Approximately 60 ft. (18 m) of yard, including a reinforced rock and concrete wall, slid down to the street below.

In Port Edward, a slide cut off the electric power and the main water supply. Parts of Port Edward were without power on October 26. On October 27, a slide came down just before the Cassiar Cannery, cutting off power to some 50 people. Falls River reported 447.0 mm in the 10 days between October 25-November 3 (Environment Canada 1991). In Terrace, Spring Creek flooded near Dutch Valley. The water rose above the footbridge just below the logjam.

November 1-3, 1976

Event type: Flooding and debris slides.

Precipitation: Hartley Bay (101.1 mm/2 days), November 1-2, 1976; Tasu Sound (234.2 mm/3 days), November 1-3, 1976; Sewell Inlet (261.4 mm/3 days), November 1-3, 1976; Falls River (117.1 mm/2 days), November 2-3, 1976; Prince Rupert M. Circ (129.0 mm/2 days), November 2-3, 1976; Terrace (36.0 mm/2 days), November 2-3, 1976; Stewart A (153.9 mm/2 days), November 2-3, 1976; Sandspit A (42.2 mm/1 day), November 3, 1976; Prince Rupert (69.9 mm/1 day), November 3, 1976.

Source: *The Daily News*, November 3, 4 and 5, 1976; *The Sentinel*, November 12, 1976.

In Prince Rupert, a heavy rainstorm with over 4 in. (101.6 mm) in 24 hours caused severe erosion and flood damage. The recently completed Comox Mobile Home Park was flooded with up to 1 ft. (30 cm) of water. An area covering about 5,000 ft.² (465 m²), including at least three trailer pads, was under water. On November 3, two debris slides came down on the Port Edward Cannery Road. One slide happened at Phelan and the second one just north of the old Inverness Cannery Road.

On November 2, an eastbound freight train hit a rockslide 1 mi. (1.6 km) west of Usk. Ten cars derailed and one of the three engines went into the Skeena River. There were no injuries.

The Stewart-Meziadin road was closed by extensive flood damage. The bridges across the Hanna and Tintina creeks were restricted to 50% weight load. In Stewart, the downtown area was flooded with 1 ft. (30 cm) of water. Many residents had their basements flooded with up to 4 ft. (1.2 m) of water; others had their property completely inundated.

Between November 1-3, slides occurred in the Rennell Sound area. The weather station at Gospel Point recorded 197.6 mm of rain in three days. On November 3, MacMillan Bloedel reported about 10 slides at Dinan Bay. The weather station at Sewall Masset Inlet recorded 17.8 mm of rain in the previous 24 hours and a total of 138.7 mm during the previous 10 days. On November 3, Crown Forest Products reported a slide near Sandspit. During the previous 24 hours, Sandspit had recorded 42.2 mm of rain and a total of 141.7 mm during the previous 10 days.

December 1976

Event type: Slide potential.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, December 4 and 16, 1976.

On December 3, BC Hydro chairman Robert Bonner reported that an enormous slide, 80 % bigger than the Downie slide on the Columbia River, was creeping into the reservoir behind the W.A.C. Bennett Dam. BC Hydro engineers noted that "safety cannot be guaranteed." According to Larry Peterson of Fort St. John, spokesman for the Peace Valley Environmental Association and speaking for concerned Peace River farmers, the Brantham Ridge slide, located above a failure zone 20 mi. (32 km) upstream from the dam, contains an estimated 1.8 billion cubic yards (1.38 billion m³) of material. *1)

Peterson said that the situation was particularly critical in view of BC Hydro's intention to divert the McGregor River from the Fraser drainage system to flow north into 410,000-ac. (164,000 ha) Williston Lake. The McGregor diversion would put 20% more water in the reservoir and add to the pressure on the slide area. *2)

A report by the hydro-electric design division, dated July, 1974, said that the monitoring of the unstable Brantham Ridge area showed the slide, which extends for 4 mi. (6.4 km) along the shore of Williston Lake, had moved 2 ft. (60 cm) closer to the reservoir since 1968.

According to the report, it is probable that any slide would be limited to a “single, intact unit containing about 50 million yd.³ (38.2 million m³) of rock. “It can be seen that a slide of 50 million yd.³ (38,230,000 m³) from the central section of the slide would not fully obstruct the reservoir. There are a number of factors that indicate that the landslide has a long history of movement. Soil slumps have occurred along the shoreline during the last few years where the terraces have been undercut by wave action.”

The report noted cracks in sandstone rocks, which in two cases “had toppled trees, which were still green at the time of observation.” It concluded that the slide is very ancient and recent measurements reveal “that a slow apparent downhill movement is taking place.” The report recommended that the survey program be expanded to cover more of the slide. This recommendation was accepted giving the slide 11 instead of five markers. Since 1973, the original markers on the slide had shown much smaller movement.

A second report dated May 1975 and based on 1974 survey work, states that the slide movement has slowed down since the reservoir filled. But the report quotes Victor Dolmage as suggesting that monitoring of the slide “should continue, since the problem of land and rockslides occurring on the shorelines of large reservoirs is becoming more and more important.”

On December 15, BC Hydro released a press statement from an October, 1974 report by its consulting geologist, Dolmage. Having reviewed the results of geological mapping, Dolmage concluded there was “high improbability of a recurrence of a landslide at this locality and virtually no chance of its causing any damage to the Bennett hydro-electric station.” He continued, “Since the main mass of slide debris has moved (in geological times) down a steep to a flatter slope, much of the propelling force has been dissipated and the chances of repeated sliding reduced accordingly. A slide, no matter how large, moving slowly down such a gentle slope into the deep, wide Williston Lake is not likely to generate a wave large enough to reach, let alone damage, the Bennett complex.”

BC Hydro stated in its press release that the slide was first mapped in 1950 and was studied by Hydro consultants before the filling of the Williston reservoir in 1967. BC Hydro later said that the massive 5.5-mi.² (14.25 km²) slide, virtually a mountainside, did not pose danger to people living below the dam.

*1) The Downie slide, the toe of which would be in the reservoir of a new dam approved for construction above Revelstoke, contains an estimated 1 billion yd.³ (0.76 billion m³), about 60 times the 1965 Hope slide (*The Vancouver Sun*, December 4, 1976).

*2) Extensive studies were done on three large slides that fringe the reservoir on the Mica Dam on the Columbia River. The Downie slide was the major concern in considering the new dam to be built between the Mica Dam-Revelstoke (*The Vancouver Sun*, December 4, 1976).

January 16-18, 1977

Event type: Rockslide and flooding.

Precipitation: Hartley Bay (104.6 mm/1 day), January 16, 1977; Sewell Inlet (106.9 mm/1 day), January 16, 1977; Kildala (86.4 mm/1 day), January 16, 1977; Tasu Sound (73.7 mm/1 day), January 16, 1977; Salvus Camp (70.6 mm/1 day), January 16, 1977; Ocean Falls (105.4 mm/1 day), January 16, 1977; Stewart A (107.7 mm/1 day), January 16, 1977; Kemano (114.0 mm/2 days), January 16-17, 1977; Terrace (76.0 mm/2 days), January 16-17, 1977; Bella Coola (98.0 mm/2 days), January 16-17, 1977; Kitimat Townsite (107.2 mm/2 days), January 16-17, 1977; Falls River (179.4 mm/3 days), January 16-18, 1977.

Source: *The Herald*, January 19, 1977; *The Daily News*, January 17, 1977; *The Informer*, January 22, 1977.

On January 16, a rockslide blocked Highway 16, 20 mi. (32 km) east of Prince Rupert. One large boulder had to be blasted off the highway, which was expected to be cleared on January 17.

In Terrace, minor flood damage was reported. In Ocean Falls, the Shanghai Inn was flooded. The whole place was under several inches of water. It was caused by a plugged drain near the back entrance.

October 21-24, 1977

Event type: Debris slides and flooding.

Precipitation: Hartley Bay (121.7 mm/1 day), October 21, 1977; Sewell Inlet (106.4 mm/1 day), October 21, 1977; Falls River (128.0 mm/2 day), October 21-22, 1977; Terrace (77.7 mm/2 days), October 21-22, 1977; Kitimat Townsite (102.9 mm/2 days), October 21-22, 1977; Kemano (209.5 mm/4 days), October 21-24, 1977; Sandspit A (92.9 mm/4 days), October 21-24, 1977; Kildala (155.0 mm/4 days), October 21-24, 1977; Bella Coola (93.4 mm/2 days), October 21-22, 1977; Ocean Falls (190.0 mm/2 days), October 22-23, 1977; Tasu Sound (88.9 mm/1 day), October 24, 1977.

Source: *The Herald*, October 21 and 24, 1977; *The Daily News*, November 2, 1977, (October 21-24, 1977: Not available); *The Informer*, October 29, 1977; Lewis and Moran 1985 (p. 5.202, Storm No. 97).

For the month of October, Digby Island reported 20 days of winds 25 mph (40.2 km/h) or higher, with gusts reaching 55 mph (88.5 km/h) on November 22 at midnight. This windy weather was caused by three extremely deep and intensive lows passing through the area during October (Lewis and Moran 1985). The total precipitation was

355.0 mm of rain. Only four days had no rain. The caption of a photograph in *The Herald* reads: “Heavy weekend rains overflowed many a creek.”

On October 22-23 in Ocean Falls, heavy rains flooded telephone cables, putting the entire system out of order for 24 hours. A large manhole near the BC Tel office filled with over 10 ft. (3 m) of water, shorting out a 3,200 (pair) wire cable. Communications with the “outside” were interrupted. The fire alarm system to Martin Valley was also put out of order.

Between October 21-26, a slide occurred at Rennell Sound. The area received 244 mm of rain in six days. MacMillan Bloedel reported a slide at Dinan Bay and a slide on Louise Island.

November 1977

October 29-November 1, 1978

Event type: Flooding and debris slides.

Precipitation: Kitimat 2 (392.7 mm/4 days), October 29-November 1, 1978; Prince Rupert M. Circ (226.0 mm/4 days), October 29-November 1, 1978; Masset (75.5 mm/3 days), October 30-November 1, 1978; Sewell Inlet (422.2 mm/3 days), October 30-November 1, 1978; Tasu Sound (170.4 mm/3 days), October 30-November 1, 1978; Kitimat Townsite (257.9 mm/3 days), October 30-November 1, 1978; Kitimat 2 (369.4 mm/3 days), October 30-November 1, 1978; Aiyansh (177.4 mm/3 days), October 30-November 1, 1978; Falls River (338.0 mm/3 days), October 30-November 1, 1978; Salvus (151.3 mm/3 days), October 30-November 1, 1978; Salvus Camp (156.3 mm/3 days), October 30-November 1, 1978; Kildala (230.1 mm/3 days), October 30-November 1, 1978; Hartley Bay (331.5 mm/3 days), October 30-November 1, 1978; Kemano (184.4 mm/2 days), October 31-November 1, 1978; Sandspit A (120.3 mm/2 days), October 31-November 1, 1978; Stewart A (232.3 mm/5 days), October 30-November 3, 1978; Bella Coola (101.2 mm/2 days), October 31-November 1, 1978; Prince Rupert (102.1 mm/2 days), October 31-November 1, 1978; Terrace (203.9 mm/2 days), October 31-November 1, 1978; Ocean Falls (196.8 mm/3 days), October 31-November 2, 1978.

Source: *Northern Sentinel*, November 2, 1978; *Southeast Alaska Empire*, November 3 and 7, 1978; *Terrace-Kitimat Daily Herald*, November 1, 2, 3, 6 and 7, 1978; *The Thunder Bird*, (Bella Coola) November 14, 1978; *The Daily News*, November 2, 3, 6, 7 and 8, 1978; February 28, 1995; *The Interior News*, November 8, 1978; December 7, 1978; *Daily Colonist*, March 21 and 22, 1979; *The Vancouver Sun*, October 31, 1978; *The Province*, November 16, 1979; *Terrace Standard*, October 7?, 1992; McMullen et al. 1979; Johnson 1984; Environment Canada 1991; Schaefer 1979^a; Schaefer 1979^b; Scanlon and Taylor 1979; Lewis and Moran 1985 (p. 5.218, Storm No. 105); Mariners Weather Log, Vol. 23, No. 2, 1979; B.C. Ministry of Forests, Queen Charlotte City; Schwab 1983; B.C. Ministry of Transportation and Highways 1980 (p. 303); European Pulp & Paper Co. Ltd., Annual Report 1978, TFL 41, Kitimat; Brent Smith, pers. comm. Skeena Cellulose, Terrace; T. Wardrop (B.C. Forest Service, Terrace). Damage Assessment Copper River Forest Road, Clore River Operational Road; T. Wardrop, pers. comm. December 1991. B.C. Ministry of Forests, 100 Mile House; Letter D.G. MacKinnon (Can. Cellulose Co. Ltd. Twin River Woodlands Div., Terrace) to B.C. Min. For., Engineering Div. Smithers; Bill Hough, pers. comm. December, 1991. Pacific Northern Gas Ltd., Vancouver; Northwest Hydraulic Consultants Ltd. 1987.

On October 31, Terrace recorded 114.8 mm of rain in 24 hours, setting an all time record any time of the year, with 70-80 km/h winds. On November 1, another 89.1 mm of rain fell in a 24-hour period. The storm appears to have centered around the Terrace-Kitimat area. It originated in a trough of another “low” which was dissipating over Siberia. Before the storm there was little accumulation of snow below the 1,000 m elevation. The storm approached across the Bering Sea and probably reached the height of its influence on October 30. The maximum wind reported was 68 kn. (126 km/h) by a ship coded “GSUE” close to the front at 45.9°N, 154.5°W on October 29. Ships reporting to station “WBH-129 Kodiak” were calling in winds up to 70 kn. (130 km/h) and gusts to 90 kn. (166 km/h) (Lewis and Moran 1985).

The bulk of the storm’s rainfall resulted from the passage of two frontal waves under a strong southwestern flow of warm moist air aloft. Sandspit airport recorded the largest two-day storm with 120.3 mm. An estimate of the frequency of the multi-day event based on 30 years of records from Sandspit airport is between 75-95 years (Schaefer, 1979a). Sewell Inlet recorded a total rainfall of 879.3 mm for the month of October, and 1,132.2 mm for the period October 1-November 5.

The Atmospheric Environment Service concluded that snow melt did not likely play an important role in this event (Schaefer 1979b). Snowmelt at higher elevations, however, is believed to have contributed to this event. According to the weather specialist at the Terrace airport Harry Earle, the flooding was triggered by heavy rain and high freezing levels resulting in snowmelt in the mountains. (*Terrace Standard*, October 7?, 1992).

Flows on the coastal streams peaked on November 1. The instantaneous maximum daily discharges were: Zymagotitz River 18,700 cfs (530 m³/s), Exchamsiks River 30,500 cfs (863 m³/s), Kitimat River 99,900 cfs (3,000 m³/s), Hirsch Creek 23,500 cfs (681 m³/s), Little Wedeene River 13,500 cfs (382 m³/s), Zymoetz River (on November 2) 111,000 cfs (3,140 m³/s) (Environment Canada 1991). Both the Zymagotitz and the Zymoetz Rivers overflowed their banks on November 2. The Bulkley River at Quick recorded a maximum daily discharge of 547 m³/s on November 2. The estimated maximum daily discharge for the Skeena River at Usk was 3,949 m³/s on November 3

(Environment Canada 1991). It rose 12 ft. (3.6 m) in 40 hours and was barely below the flood level at Terrace. Flows on the Nanika and Morice rivers were not near their historical extremes.

Highway 16 between Prince Rupert-Terrace experienced flooding along Taylor, Diana, and Prudhomme lakes. Much of the low-lying boglands on both sides of the highway were flooded. Highway 16 east of Terrace was closed. There were 44 washouts between Terrace-Hazelton and three bridges, Chindemash, Legate, and Little Oliver creeks went out.

The areas around Lakelse Lake and Remo were worst hit. The water level in Lakelse Lake rose within three days from a normal 71.5-m elevation to peak at 74 m on late November 1. *1) Approximately 60% of the dwellings and cottages on the lake, including almost all lakefront lots on the east shore were flooded. Large quantities of forest debris were carried into Lakelse Lake. The material, combined with floating debris such as fences, lumber, and firewood, was blown by high winds to further damage flooded homes. Much debris finally ended up at the north end of the lake along the shore of the Provincial Park. The cost of disposal of driftwood debris, removal of blowdowns and general cleanup of Lots 682, 3391, 3980, 3981, 4489, and 5133 was estimated at \$32,000. Flooding occurred in Thornhill (Woodland Heights), Kitamaat Village, Terrace, and Kitimat. Highway 25 between Terrace-Kitimat was closed. Williams Creek washed out and in places the highway was under 6-7 ft. (1.8-2.1 m) of water. Old Lakelse Road was closed by washouts at Hatchery Creek near Oli's Place. The stream channel of Furlong Creek, a small tributary of Lakelse Lake, migrated on its alluvial fan surface to wash out a private road access below the Kitimat-Terrace highway. The cost of channel restoration work was estimated at \$2,000. Granite (Hatchery) Creek, another creek flowing into Lakelse Lake, broke out of its channel in two places because of log jamming and sedimentation, combined with stream erosion processes. The migrated flows caused extensive erosion damage to existing roads and flooding of several houses. Debris and sediment were deposited over a wide area. Along Hatchery Creek, heavy erosion occurred along the entire length of the channel between Highway 25 and Lakelse Lake. Most damage took place along the course of the south channel. A major breakout occurred to the south, where flood flows extensively damaged roads and property (McMullen et al. 1979). Large amounts of debris and sediment were deposited along the channel and carried into the lake and the 1st Avenue bridge was washed out. On Williams Creek, about a dozen logjams occurred. The cost of removal of these was estimated at \$18,000. Two areas along Williams Creek adjacent to the old, now washed-out, Terrace Road Bridge suffered severe erosion. The cost of the required bank restoration and bank protection was estimated at \$10,000. Schulbuckhand Creek and several smaller streams near the Hot Springs Hotel on the northeast side of Lakelse Lake flooded due to inadequate channel capacity and blocked culverts. The cost of stream cleaning work was estimated at about \$11,000. The peak flow that occurred on Hatchery Creek late on November 1 was estimated at 200 m³/s. The flooding was considered severe, probably a 50- to 100-year event (Northwest Hydraulic Consultants 1987). A logjam in Hirsch Creek occurred on the inside bend, on the edge of the Provincial Park, downstream of the Highway 25 bridge. The cost of removal of the jam was estimated at \$3,000. Hirsch Creek peaked on November 1 at 23,500 cfs (665 m³/s). *2) Along Kleanza Creek, 15 km northeast of Terrace, erosion of existing bank protection occurred along approximately 100 m of stream at the Provincial Park. The cost to restore the riprap was estimated at \$3,000.

The Kitsumkalum River and other tributaries fed large quantities of forest and logging debris into Kitsumkalum Lake. High winds occurred while the lake level was up, resulting in large accumulations of debris being deposited on the north and east shores of the lake. Tributaries to the Kitsumkalum River experienced significant log jamming and stream migration on their alluvial fans. One cabin was destroyed and several bridges washed out. Fish spawning and rearing channels also sustained damage. According to Environment Canada, the debris should be removed and the streams returned to their former courses in order to improve fish migration and spawning areas. The cost of such restoration work in Clear Creek, Goat Creek, Glacier Creek, and Lean-To Creek was estimated by a federal Fisheries Officer at \$25,000. Clear Creek changed its course about 600 m above the highway due to erosion and log jamming. It resulted in the destruction of a cabin and a road washout.

On November 1 the Zymagotitz, locally known as the Zymacord River, hit 18,700 cfs (530 m³/s). It normally flows at 573 cfs (16.3 m³/s) in November. On November 2, the Skeena River had swollen to 150,000 cfs (4,248 m³/s), while its usual November rate is 19,500 cfs (555 m³/s) (Scanlon and Taylor 1979). Near Terrace, high water levels in the Skeena River aggravated erosion upstream of a reach previously rip-rapped. A large back eddy was eroding material from the high bank at the old Frank Brothers Dairy Farm (Lot 365). To protect the bank over a reach of about 300 m, extending upstream from the existing riprap protecting the CNR track, an estimated \$110,000 would be required. The Zymagotitz (Zymacord) River flooded the service roads to New Remo up to 1 m in depth. About 30 residences sustained damage and residents were evacuated. A large logjam developed on a sharp bend above the developed area. In Dutch Valley, north of Terrace, shallow flooding occurred due to overbank flows from the Kitsumkalum River on November 1 and 2. Flooding also occurred from Spring Creek due to backwater from the river. Erosion and landsliding of a high bank upstream of the valley took place.

The Zymoetz (Copper) River recorded a maximum instantaneous flow of 111,000 cfs (3,143 m³/s) late on November 1. Extensive erosion damage occurred to an existing training dyke maintained by the Ministry of Highways. Further upstream where the Zymoetz valley widens into the Skeena floodplain, a private airstrip and farmland suffered erosion damage, overbank flooding, and debris deposition. Major washouts occurred on the Copper River Forest Road situated along the Zymoetz River.

In Kitimat, both Radley and Hirsch Creek parks were under water. On November 1, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 3,000 m³/s and a maximum daily discharge of 2,410 m³/s, setting extreme records (Environment Canada 1991). In the Kildala section, especially the Lillooet and Nass Streets, many basements were flooded with 4 ft. (1.2 m) of water. The main powerline to the Alcan smelter was threatened.

On October 30, a mudslide coming down in the Prince George BC Rail yard 3 km north of Prince George killed two PGE employees who were repairing a clogged drainpipe. One man was buried alive and the second died of a heart attack while attempting to rescue the other.

On November 2 at the Prince Rupert waterfront, a near flooding situation occurred because of a 22-ft. (6.6 m) high tide combined with heavy rain and wind. Hays Creek came nearly up to the road level. At the old dry-dock site, Cow bridge nearly flooded. Four major mudslides occurred on the Port Edward Arterial Highway.

The railways were affected the most by the flooding. The rail line between Smithers-Terrace was closed. About 50 CNR workers in Smithers were temporarily laid off. Extensive damage occurred between Kitwanga-Kitselas. There were more than 25 washouts on a 53-mi. (84.8 km) stretch, with the worst damage at a point 103 mi. (164.8 km) west of Smithers. There were two major washouts at Mile 113.2. Washouts also occurred on the Kitimat Subdivision between Terrace-Kitimat. On October 31, the Bulkley subdivision between Smithers-Terrace was closed for 12 hours. A passenger train derailed after hitting a rockslide. There were no injuries and the passengers were transported by bus. On November 1, the high water, slides, and washouts started causing major problems on all three subdivisions linking Terrace. Part of a work train plunged into the Skeena River. On November 2, the remaining two parts of the train, the engine unit and caboose, went into the river. The train carried two crewmembers: an engine man and a conductor. The search for the bodies had to be abandoned, as the river was too high and moving too fast. Only a few days later when the river went down did divers recover the bodies of Frances William Watson and Kenneth Scott Bateman from the partially submerged locomotive. A new roadbed was put in and new track was laid at Mile 121, the site of the accident. Work crews, made up of about 100 men, worked around the clock to repair the washed-out sections between Terrace-Hazelton. From both directions crews worked towards the big washout at Mile 103.7, where rock fill had to be used. The washout 73 mi. (116.9 km) west of Smithers was repaired on November 3. The bridge span at Mile 113.8 was out of alignment, considerably slowing down the repairs. Freight and grain shipments were rerouted to Vancouver. Aqua Barges, operated by the Washington Tug and Barge Co. between Prince Rupert-Whittier, Alaska, were used on the Vancouver-Prince Rupert and Vancouver-Whittier runs until the line reopened. Canadian National used the Aqua Train between Vancouver-Prince Rupert with priorities on shipments of chemicals and fuel. Most of these were destined for Alcan in Kitimat and various lumber companies. CNR also used space on Eurocan and Cancel rail barges.

The Prince Rupert to Terrace and Terrace to Kitimat subdivisions were both reopened on November 4. On the Bulkley Subdivision between Smithers-Terrace, which was hit worst, traffic resumed on December 3. However, the line was not fully restored for months. The opening of the line was just the first phase of rebuilding. Bank protection and reinforcing along with stream restraining was to follow. According to Alec Rennie of CNR's Edmonton office, complete reconstruction would not be completed until August 1979.

The gas pipeline of Pacific Northern Gas Ltd. (PNG) broke in the Telkwa Pass about 26 mi. (41.6 km) upriver from the Copper River bridge on Highway 16. According to John Low, PNG Sales and Service Manager in Terrace, over 6,000 ft. (1,800 m) of gas pipeline in five spots were actually floating in the river after floodwaters had changed the river's course. Temporary repairs were made by replacing the 10-in. (25 cm) pipe with a 2-in. (5 cm) one. As the 2-in. connection was not adequate to provide full service, a switchover to 4 or 6-in. (10 or 15 cm) pipe was necessary. While efforts were underway to restore service, however, a second break, 12 mi. (19.2 km) east of the first one, was discovered and later repaired. A major section of the pipeline had to be repaired and moved away from the Copper River. Total damage to the PNG pipelines in the Copper River and Skeena River systems totaled approximately \$6 million. It was the most expensive flood event in the company's history (Bill Hough, pers. comm.). The BC Tel cable car used to access its facility up the Copper River was carried away. Telephone service and power were interrupted in Kitimat, Kitimaat Village, and Terrace.

Roads along the Nass River washed out. In Greenville, a small tributary to the Nass River jumped its bank, causing damage to a gymnasium and cemetery. Rosswood and Cedarvale were without road access. At Rosswood, a torrent of water ripped across the highway, taking out a bridge and sweeping away a new home. The house was moved some 150 ft. (45 m) off its foundations. Greenville was isolated for more than a week. It took 10 days to make the final road repairs. On November 2, the Greenville water supply was hit by a mudslide, making the water muddy and reducing the pressure. The road at Kaseaden Camp, 12 mi. (19.2 km) north of Greenville was washed out. Helicopter relief flights to outlying communities were grounded by poor visibility. Because of the closure of Highway 16, the mail destined for Alaska was returned to Seattle. From there it was sent on the Alaska State Ferry.

On November 1, the Kitsault River flooded Alice Arm to a depth of 1.5 m. As only four cabins were inhabited at the time, property damage was limited. A combination of scour and overtopping breached the low training wall in two places, 15 and 30 m in length, respectively. High water on November 2-3 washed out some of the Alice Arm wingdam. The cost of repair work was \$46,075. The 1978 flooding report dated January 1979 completed by B. McMullen mentions the damage at Alice Arm.

Highway 37 between Kitwanga-Cranberry Junction was closed because of two large washouts between Cranberry Junction-Deltaic Creek and along the Stewart-Meziadin Highway 37A. Near Kitwanga, an access road serving two residences on Lot 3123 was flooded and washed out by the Kitwanga River. Erosion also caused loss of land downstream of this area on Lot 1320. The cost of a total of 450 m of bank protection was estimated at \$38,500. The road leading to Stewart washed out, isolating the community. Apart from flooded basements, no major damage occurred in Stewart. The road to Stewart was still closed on November 8.

Near Telkwa, minor flooding occurred in the lower Coal Mine Road area. The Telkwa River took out the abutment of a logging road some 20 mi. (32 km) along Coal Mine Road. At the confluence of the Telkwa and Bulkley rivers, high water aggravated erosion on the north bank of the Bulkley River opposite the confluence and also further downstream at Big Eddy Park. A preliminary cost estimate to provide dyking and broken rock riprap bank protection from the vicinity of the fire hall to Big Eddy Park was \$195,000.

Though some damage occurred in the Bella Coola area, the highway system sustained little damage. Some channel cleaning was carried out for the Ministry of Environment. The riprap protecting the Bella Coola airport eroded at two locations for a total distance of about 70 m. The estimated cost to reconstruct the riprap to a stable slope was \$11,000. The Bella Coola Wilderness Airline float plane terminal on the south bank of the Bella Coola River sustained damage. The docks washed away and the docking area was infilled with river gravel. The estimated repair cost was \$7,000. Near Firvale, 31 km east of Bella Coola, about 15 m off the end of the rock groyne eroded and a logjam partially blocked the relief channel. The cost of restorative work was estimated at \$11,000 and improvement work at an additional \$20,500. At Burnt Bridge Creek, about 37 km east of Bella Coola, a dike and bank protection (constructed after the 1968 flood to plug and overflow channel) eroded. As a result, water flowed down the channel and along the highway. The estimated cost of restoring the training dike to protect the highway and the farm was \$6,000. An additional \$6,000 was later required to restore the bank protection to the pre-flood condition. About 180 m of existing bank protection along Nooklikonnik Creek, 12 km east of Bella Coola, eroded at various locations upstream of the highway bridge. Additional gravel was sedimented in the stream channel. Restorative work of stream cleaning and bank protection repair was estimated at \$19,000 and improvement work at an additional \$39,000. Debris accumulation and channel accretion in the Salloompt River, 15 km east of Bella Coola, caused the river to change course along a 450-m reach through the Hayden and Meyer properties. The Meyer property suffered extensive flooding, with the water rising up to the main floor level at the house, about 1 m deep. The cost of cleaning the stream was estimated at \$21,500. An alternative dyking proposal to provide more comprehensive flood protection was estimated to cost an additional \$102,500. Along Thorsen Creek, 4 km east of Bella Coola, about 250 m of existing bank protection at various locations eroded and gravel deposition in the channel increased. The estimated cost of restoring the bank protection to a stable slope and removal of the newly deposited gravel was \$28,000. An additional \$55,000 was later required for gravel removal to improve a 1,040 m reach of the creek.

On November 2, the Kispiox River near Hazelton recorded a maximum instantaneous discharge of 702 m³/s and a maximum daily discharge of 595 m³/s. Both of these are extremes for the period of record (Environment Canada 1991). On the Kispiox River, existing erosion conditions on the outside of river meanders increased noticeably, threatening cultivated fields, homesites, and a campsite. The cost of providing riprap at 11 sites, totaling 3,250 m in length, was estimated at \$280,000.

Logging roads in the Terrace area sustained heavy damage. Skeena Cellulose reported a cost of about \$500,000 to repair the road system between the Clore-Kitnayakwa. It involved a major reconstruction of 10 km of the Copper River Forest road. In addition some \$300,000 was spent on repair of the roads below the Clore. Repairs included a major washout at the Clore junction, road at Kelly Creek, and at Kilometre 15 and Kilometre 3. Cost claims for the reconstruction of the section 48.85-49.35 km near the Kitnayakwa junction totaled \$125,328.49. An additional \$1,266.06 was spent on the temporary repairs to the Kitnayakwa bridge. Eurocan reported to have spent a total of \$33,171 on the repair of its roads in TFL 41. The repair included the removal of mudslides at 12.8 and 20 km on the Wedeene Main, at 2.4 km and 5.0 km on the W. 200, and small slides between 1.6-6.4 km on the W. 1300 Road. An additional \$15,500 was planned for repair work on the Br. 200 W and Chist Main Line to be completed in 1979. Damage to roads and bridges on the Copper River Forest Road and Clore River Operational Road were estimated at \$1,294,500 and \$62,300, respectively. The latter was based on information supplied by CanCel.

The storm also caused extensive environmental damage in the form of landslides, erosion, and washouts on the Queen Charlotte Islands. At Sachs Creek, both ends of the bridge were washed out and the bridge suffered a split piling. Hands (Haans) Creek had side wash along the wing wall. Gore Creek on 2nd Avenue had its 42-in. (106 cm) diameter culvert washed out. Lawn Hill lost about 60 ft. (18 m) of shoulder. About one-third of the road width washed out. At Deep Creek, two 48-in. (1.2 m) diameter culverts were exposed for about 15 ft. (4.5 m). The roadway at the Skidegate Mission bridge was undermined. At Miller Creek, the roadway at the abutment washed out for 30 ft. (9 m) longitudinally. The stream changed course, requiring a wing wall and 600 ft. (180 m) of channelisation upstream. Sea erosion occurred on the Toe (Tow) Hill Road where the shoulder eroded 2 ft. (60 cm) wide for 200 ft. (60 m). Near Skidegate, some 1,000 ft. (300 m) of roadway required riprapping.

Between October 29-November 1, the storm caused an estimated 1,000 slope failures all through the Queen Charlotte Islands (B.C. Ministry of Forests). In the Rennell Sound area, many new slope failures occurred. *3) The area received 284 mm of rain in three days. The weather station at Gospel Point recorded 277.6 mm of rain in three

days. *4) In the Rennell Sound area, two distinct 12-hour periods of intense rainfall (120 mm and 110 mm) were recorded. Maximum average hourly wind speeds were reached during periods of heaviest rainfall. Some 264 mass movements were recorded: 126 in clearcuts, 113 in forested terrain, and 25 from roads. The area distributed by debris avalanches was 64 ha or 0.4% of the steep land area (Schwab 1983). Many slides were reported in the areas of Sewell Inlet, Tangell Peninsula, and Dana Passage and on Talunkwan and Lyell islands. On Talunkwan Island, 14 new failures occurred on the south side and 17 new failures on the north side. On Lyell Island, six new failures occurred in logged area (B.C. Ministry of Forests).

A B.C. Forest Service draft working paper completed in February 1979 stated that logging on steep hills causes slides and massive soil erosion. This directly contradicted official statements by the B.C. Forest Service that the danger of slides in the area was minimal. The report stated that 71 slides had occurred in logged zones near Rennell Sound since February 1978. The average area of each slide was 840 m². One slide wiped out a 73,566-m² section, temporarily damming a stream. (*Daily Colonist*, March 21 and 22, 1979)

*1) The highest lake level known was 74.37 m in 1935; the Ministry of Environment's recommended flood construction level is 74.98 m (246 ft.) (McMullen et al. 1979).

* 2) The highest instantaneous discharge on record with 28,500 cfs (807 m³/s) occurred on October 15, 1974 (McMullen et al. 1979).

*3) On the west coast of Graham Island in the Rennell Sound area, a number of slides occurred in QC Timber's Cutting Permit (CP) 144. In January 1979, the federal Department of Fisheries ordered QC Timber to stop logging. Two months later when logging was resumed, fisheries officers arrested loggers working in CP 144. Over the next several months charges were laid and dropped and QC Timber was found not guilty. In the fall of 1979, after a series of heavy storms, more landslides occurred. The many slides that occurred on the Queen Charlotte Islands eventually initiated a multi-year program to study the problem of landslides related to logging practices. The program set up jointly by the B.C. Ministry of Environment, the B.C. Ministry of Forests, and the Canada Department of Fisheries and Oceans, was dubbed the Fish/Forest Interaction Program (FFIP) (Johnson 1984).

*4) The Gospel Point climatological station, Air Studies Branch, B.C. Ministry of Environment, was established on May 4, 1976. It is situated 12 m above sea level on a gentle west-facing slope (Schwab 1983).

November 4-7, 1978

Event type: Flooding.

Precipitation: Sewell Inlet (163.1 mm/2 days), November 4-5, 1978; Hartley Bay (168.4 mm/2 days), November 4-5, 1978; Kemano (114.1 mm/2 days), November 4-5, 1978; Tasu Sound (194.3 mm/2 days), November 4-5, 1978; Kitimat 2 (206.6 mm/3 days), November 4-6, 1978; Prince Rupert M. Circ (207.7 mm/3 days), November 4-6, 1978; Kitimat Townsite (110.0 mm/1 day), November 5, 1978; Kildala (132.8 mm/2 days), November 5-6, 1978; Prince Rupert (102.2 mm/2 days), November 5-6, 1978; Langara (80.1 mm/2 days), November 5-6, 1978; Terrace (76.8 mm/2 days), November 5-6, 1978; Stewart A (66.8 mm/2 days), November 5-6, 1978; Salvus Camp (146.8 mm/2 days), November 5-6, 1978; Ocean Falls (261.8 mm/3 days), November 5-7, 1978; Bella Coola (119.2 mm/3 days), November 5-7, 1978.

Source: *Northern Sentinel*, November 9, 1978; *Southeast Alaska Empire*, November 7, 1978; *Daily Colonist*, March 2, 1979; B.C. Ministry of Transportation, Communications and Highways 1980 (p. 301); Files, B.C. Ministry of Transportation and Highways, Terrace.

On November 6, Terrace reported 55.8 mm of mixed rain and snow. In total Terrace had 12 in. (315 mm) of rain in one week. Several areas were flooded a second time in a week. The Lakelse Lake and Old Remo were the areas worst hit with flooding. Heavy damage was done to the spawning streams flowing into the Skeena River. Hardest hit were the pink and chum salmon. Dozens of houses were standing in the lake in some 6 ft. (1.8 m) of water. On Highway 16 west of Terrace, Andesite Creek sustained minor shoulder washouts on November 6.

The local economy was severely disrupted by the flooding and loss of communication links. Many businesses cut back their operations or shut down altogether. Though logging operations shut down, the sawmills were able to continue shipping lumber. However because of the shortage of natural gas, the lumber could not be dried and had to be shipped green. With the cut rail connection east of Terrace, the lumber had to be sent by sea from Prince Rupert. Given the lower price for green rather than dried lumber and the higher costs for the alternative shipping route, the companies lost an estimated half million dollars (Scanlon and Taylor 1979).

In a special meeting of the provincial cabinet, Terrace-Kitimat region was declared a disaster area. Federal and provincial aid was made available. On November 7, more than 150 men and 100 pieces of equipment were mobilised to repair the flood damage. Skeena MLA Cyril Shelford estimated the repair costs to highways at \$15 million. A total of 19 major bridges had been destroyed in the district. The estimated damage to the four Skeena bridges alone was \$1.5 million. Highway crews from Cloverdale, Langford, and Courtenay were brought in with pipe, culvert material, and Bailey bridges. The regular ferry to Prince Rupert was commandeered and loaded with supplies.

A special camp was rented, fitted, reroofed, equipped, and put in shape at Kitwanga. Crews up to 250 men and 100 pieces of equipment were working on “one of the largest highway reconstruction projects in the province’s history.” Given the combined efforts of Bridge, Road and Construction crews from all Regions, Highway 16 was closed for only nine days (B.C. Ministry of Transportation, Communications and Highways 1980).

Summary of highway damage Highway 16 east of Terrace: Shandilla Creek sustained minor upstream shoulder damage. Price Creek had a destroyed culvert and a washout 150 ft. (45 m) long and 20 ft. (6 m) deep. Opposite Woodcock, water and gravel was on the road. Opposite Wilson Creek was a washout 300 ft. (90 m) long and 20 ft. (6 m) deep, affecting both lanes, and a washout 100 ft. (30 m) long over both lanes. On Lot 2351 was a washout 200 ft. (60 m) long and 100 ft. (30 m) deep over both lanes. The westbound shoulder was out on Lot 221. Lot 2355C had the upstream shoulders eroded around the abutments. At Flint Creek, trees blocked the upstream end of an approximately 15-ft. (4.5 m) diameter culvert. The shoulders at both ends of the culvert were washed out. At Klooitch Canyon there were two trees across the highway at the south end of the canyon. Lot 4770 and block “B” had small slides over the eastbound lane. On Lot 4766, the westbound lane washed out for a distance of 100 ft. (30 m). Lot 910 had shoulder washouts and debris on the road. Opposite the Chis-in-Kaht Indian Reserve, the westbound shoulder was gone for 400 ft. (120 m), and had a 20-ft. (6 m) drop at the end of the pavement. At Devils Elbow, the westbound shoulder washed out for a distance of 300 ft. (90 m) and had debris on the road. At (Big) Oliver Creek, the retaining wall at the west end was undermined, and had a rockslide 0.5 mi. (800 m) north of there. At Little Oliver Creek, the east span section of the bridge collapsed, requiring a 60 ft.-(18 m) Bailey bridge. On Lot 6635, the westbound shoulder washed out for approximately 30 ft. (9 m). At Legate Creek the bridge was skewed on the piers with the east span down, and the fill around the west abutment was gone. On Lot 4490, the eastbound lane washed out for 100 ft. (30 m). Opposite Carpenter Creek, the westbound lane washed out for 100 ft. (30 m). St. Croix Creek had a 150-ft. (45-m) washout after the 12-ft. (3.6 m) diameter culvert washed out. At Tumbling Creek, the eastbound lane was gone for 100 ft. (30 m) and had the upstream half of the culvert flattened. On the Chindemash Creek bridge, two of the three spans were down and had a washout of approximately 200 ft. (60 m). At Noble Five Creek, the ditch on the eastbound side filled with gravel for 200 ft. (60 m).

Summary of highway damage Highway 16 west of Terrace: The Zymacord River washed out one shoulder for 300 ft. (90 m). Andesite Creek lost 600 ft. (180 m) of shouldering. The creek re-channeled, and sustained minor shoulder washouts on November 6. The Polymar Creek bridge sustained severe structural damage and the deck floated free of the piles. At Mile 43, a drainage ditch was required. At Mile 46, 200 ft. (60 m) of shoulder washed out. The Slickenside Creek bridge required minor repairs.

Summary of destroyed bridges Terrace District: Lean-to-Creek No. 73, Glacier Creek No. 74, Camp Creek, Douglas Creek No. 83, Clear Creek No. 84, Wawelth (Wathl) Creek No. 90, Hatchery Creek No. 11, Williams Creek No. 101, Chindemash Creek No. 2170, Legate Creek No. 370, Little Oliver Creek No. 1135,

Summary of destroyed bridges Smithers District: Wilson Creek No. 125, Sedan Creek No. 160, Kitwanga River No. 376, Stoney Creek No. 268, 15 Mile bridge No. 174, 18 Mile Creek, Cranberry 1 bridge, Derrick Creek, Taylor Creek No. 115, Fiddler Creek No. 37.

Cost of damage due to flooding (summary of subtotals):

Highway District #51 (Prince Rupert) :	\$ 319,023.00
Highway District #52 (Terrace):	\$ 3,922,496.00
Highway District #54 (Smithers):	\$ 1,997,509.00

Total:	\$ 6,239,028.00
--------	-----------------

According to Transportation minister Alex Fraser, the damage caused by the flooding in the Kitimat-Terrace region totaled over \$50 million. The provincial and federal governments shared the damage to private property and highways, estimated at \$15-20 million. The remaining \$30-35 million included damage to BC Hydro and CNR property and pipelines. The provincial government ended up paying approximately \$8-10 million. (*Daily Colonist*, March 2, 1979).

By December 1, a total of 520 claims for compensation for damage to personal effects and property as a result of the flooding in the Terrace-Kitimat area, declared as a disaster area, had been filed with the provincial government. A team of 16 independent adjusters handled about 750 claims to be covered by the federal-provincial emergency assistance program. The final bill for the area’s “worst flood ever” would probably hit \$50 million.

By the time train service was resumed on December 3, the cost of rebuilding the rail line till that date was around \$2.5 million. It was expected another \$2.5 million would be spent before the line would be in its original condition. (*The Interior News*, December 6, 1978).

R.E. Neale, head of PEP, said that fixing homes, small businesses and highways would cost at least \$12 million. Repair work on washouts along the CNR line and BC Hydro powerlines and the natural gas pipeline of Pacific Northern Gas would cost another \$35 million.

The government originally refused to pay for damage to cottages and second homes around Lakelse Lake, one of the worst hit areas. Only after a string of protest that included a letter-writing campaign, the government decided in March 1979 to pay 50 cents for every dollar of damage done to second homes and recreational equipment.

January 23, 1979

Event type: Snow avalanches.

Precipitation: Not applicable.

Source: *Terrace-Kitimat Daily Herald*, January 24, 1979; *Victoria Times*, January 24, 1974.

Around January 23, two avalanches blocked Highway 16 about halfway between Terrace-Prince Rupert. The slides that came down after recent heavy snowfalls followed by mild weather and rain closed the road for up to two days. On January 23 at 1:15 a.m., an avalanche closed Highway 16 about 43 mi. (68.8 km) west of Terrace after 30 ft. (9 m) of snow fell onto 150 ft. (45 m) of highway. By noon, the highway was cleared to single-lane traffic. During the previous two and a half weeks, 12 minor avalanches had closed the highway for approximately 30 minutes.

February 10-13, 1979

Event type: Snow avalanches.

Precipitation: Not available.

Source: *Victoria Times*, February 12, 1979; *The Citizen*, February 13, 1979.

On February 10, heavy snow, recent warm temperatures and rain caused avalanches in the Interior. Late on February 11, the Pine Pass section of Highway 97 reopened to single-lane traffic.

Around February 13, blizzards and snow slides blocked the highway in the Pine Pass and Highway 16 between Terrace-Prince Rupert.

April 1979

Event type: Landslide.

Precipitation: Not applicable.

Source: *Alaska*, July 1979; Evans 1986; Clague and Evans 1994 (p. 8); S. Johnson, pers. comm. October 1996; Geertsema 1998.

A landslide near Yeth Creek, 50 km east of Tulsequah Lake, dammed Inklin River, one of the main tributaries of the Taku River just south of Juneau, Alaska. The dam, located about 70 mi. (112 km) upstream from the mouth of the Taku River, formed by quaternary sediments created a lake 12 km long raising the water level by about 20 m. (Clague and Evans 1994; Geertsema 1998). Water later cut a chute through the dam. The slide impounded the river just upstream of a rock canyon, blocking the steelhead and Chinook salmon run for about a month (S. Johnson, pers. comm.). *1)

Upstream of the slide, a “characteristic bathtub ring” of shrubby vegetation with dead trees, long since fallen, contrasted against coniferous forest, is still evident today (Geertsema 1998).

The dam caused by the slide was about 65 ft. (19.5 m) high and the lake forming behind it was as much as 0.5 mi. (800 m) wide (*Alaska*, July 1979). The dimensions of the slide are about 400 m long by 250-300 m wide, giving an area of about 11 ha. The slide involved an estimated 2-3 million m³ of material. The distance from the crown of the headscarp to the tip of the spoil is about 700 m and about 850 m of the slide spoil is exposed along the river.

* 1) According to Alaska Department of Fish & Game biologist Paul Kissner, an estimated 50% of the Taku River king () salmon and up to 90% of the Taku River red salmon normally spawn in the dam-blocked river reaches of the Inklin River (*Alaska*, July 1979).

June 30-July 2, 1979

Event type: Flooding.

Precipitation: Not available.

Source: *Victoria Times*, July 3, 1979; *Alaska Highway Daily News*, July 6, 1979.

On June 30-July 1, Fort St. John experienced heavy rainfall, causing flooding and washouts, including on 106th Avenue between 94th-96th streets.

On July 2, a 225-km section of the Alaska Highway was closed after rain washed out two bridge approaches. RCMP stopped traffic near Fort Nelson at mile 308. The highway was expected to reopen in about three days. More than 1,000 stranded travelers were waiting in Fort Nelson when the road reopened at noon on July 6.

August 13, 1979

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: *Victoria Times*, August 7, 1979; Clarke and Waldron 1984 (pp. 502-504).

Around August 6, a lake building behind Flood Creek Glacier was reported threatening to release some 100,000 ft.³/min. (m³/min.). According to Jim Scott of the B.C. Provincial Emergency Program, the Stikine River valley, “being 8 km wide, the large volume (of water) will not cause the flooding we expected.” (*Victoria Times*, August 7, 1979).

On August 13, Flood Lake, a glacier-dammed lake in the Stikine River basin, released approximately 150 million m³ of water beneath Flood Glacier. The resulting flood was routed through the Stikine River, yielding a

maximum discharge rate of 1,200 m³/s at the gauging station at Wrangell, Alaska, 90 km downstream from the glacier dam. Glacial outburst floods from Flood Lake are routed through Flood River 4 km downstream from the drainage tunnel in the ice dam. Analysis of the discharge records of the U.S. Geological Survey Stikine River station near Wrangell showed an estimated total water volume of 149.3 million m³ for this flood (Clarke and Waldron 1984).

November 14, 1979

Event type: Mudslide.

Precipitation: Not available.

Source: *The Citizen*, November 16 and 20, 1979; *The Province*, November 16, 1979.

On the night of November 14, a mudslide in the Prince George BC Rail yard derailed a boxcar and seven butane-filled tanker cars. More than 0.5 m of mud covered about 45 m of track, blocking the BC Rail line between Prince George and the Northwood pulpmills. The mud also pushed away a small bridge the company stored in the area. Rain unexpectedly fast increased the thawing of the ground. On November 16, a BC Rail spokesman said that there was more mud on the tracks than first estimated. Traffic was expected to resume on the afternoon of November 17. The slide, which was cleared by November 16 only affected rail traffic between Fort St. John-Prince George.

This most recent slide came down in a mudslide-prone area. *1) The mud is about 15 m away from the track. About 20 stories high, it is too loose to hold foundations. According to BCR spokesman Hugh Armstrong, it had been a "trouble spot for many, many years." The company kept a dragline, a "cable-and-bucket-affair, in there to keep rid of the mud." BC Rail president M.C. Norris expressed concern about the repeated derailments between Prince George and the Northwood pulpmills. Though there had been other derailments caused by mudslides in the past, Norris said it was an isolated problem because of the topography.

*1) The previous year a mudslide in the same area killed two men. Immediately after the accident, the whole area was cleaned out and completely cleaned out since. (*The Province*, November 16, 1979).

November 19-21, 1979

Event type: Debris slides.

Precipitation: Kildala (79.4 mm/3 days), November 19-21, 1979; Tasu Sound (146.8 mm/3 days), November 19-21, 1979; Falls River (210.8 mm/3 days), November 19-21, 1979; Sewell Inlet (207.7 mm/3 days), November 19-21, 1979; Prince Rupert M. Circ (146.4 mm/3 days), November 19-21, 1979; Prince Rupert (100.4 mm/2 days), November 20-21, 1979; Sandspit A (81.6 mm/2 days), November 20-21, 1979; Terrace (79.4 mm/2 days) November 20-21, 1979; Kitimat 2 (113.8 mm/2 days) November 20-21, 1979; Cape St. James (98.9 mm/2 days), November 20-21, 1979.

Source: *The Daily Colonist*, November 27 and December 1, 1979; *The Vancouver Sun*, December 3 and 4, 1979; *Victoria Times*, February 7 and 13, 1980; B.C. Ministry of Forests, Queen Charlotte City.

Between November 19-21, slope failures occurred in Cutting Permits CP 144 and CP 145 in the Rennell Sound area on the Queen Charlotte Islands. The nearby weather station Penthouse recorded 159.8 mm of rain in three days.

During heavy rains on November 20-22, 13 slides occurred; three of which caused extensive damage to Riley Creek. Eight more were reported in the area on November 26 (?).

On November 24-25 and 27, landslides occurred in a logged-over valley in a cutting permit operated by QC Timber Ltd. The slides threatened a major salmon-spawning stream. Three of the slides were considered major, measuring up to 60 m across exposing bedrock in crevasses up to 15 m deep. A wall of mud crossed a logging access road and moved into slash and standing timber near Riley Creek, a major pink salmon stream. *1)

According to Don Smuin, the environment ministry's regional director for the Skeena area, the provincial environment ministry's objections early the previous spring to the permit granted by the forests ministry were ignored. Newly appointed Environment Minister Stephen Rogers called it a "disgraceful accident," adding if anybody goofed, it was the forests ministry, not the forest company" (*The Vancouver Sun*, December 4, 1979).

The differences between the two provincial ministries flared into the open after 13 landslides, three of them termed significant, occurred the previous week in the logged-over valley that was the scene the previous March of a bitter dispute between forestry officials and the federal fisheries department (*The Vancouver Sun*, December 4, 1979). (see: October 29-November 1, 1978 event).

Forestry minister Tom Waterland, said that the problem in Rennell Sound is that the cross ditch was built in an area where there is a natural piping effect and that the extra water "greased it (the slope) right out, and away she went" (*Victoria Times*, February 13, 1980). *2)

The conflict between the forest ministry and the federal fisheries department over continued logging at this site led to the arrest of 15 loggers. (*The Vancouver Sun*, December 3, 1979). Charges under the Fisheries Act (with endangering a fish habitat by increasing the risk of sedimentation in spawning areas) against the 15 loggers and an official of QC Timber Ltd. were dropped after Premier Bill Bennett wired a strong protest to then Fisheries minister Romeo LeBlanc.

*1) Riley Creek, along with Bonanza and Gregory creeks, account for 25% of pink salmon stocks in the Rennell Sound area (Smuin, In: The Vancouver Sun, December 4, 1979).

*2) On February 12, 1980, Waterland announced that logging on steep slopes on the Queen Charlotte Islands would be prohibited until techniques would be developed to prevent further mudslides. (*Victoria Times*, February 13, 1980). (see: October 29-November 1, 1978 event).

December 25-27, 1979

Event type: Flooding and debris slides.

Precipitation: Kildala (120.0 mm/2 days), December 25-26, 1979; Sewell Inlet (300.4 mm/3 days), December 25-27, 1979; Terrace (151.4 mm/3 days), December 25-27, 1979; Kitimat 2 (285.0 mm/3 days), December 25-27, 1979; Kemano (63.4 mm/1 day), December 26, 1979; Terrace (94.9 mm/1 day), December 26, 1979; Tasu Sound (83.3 mm/2 days), December 26-27, 1979; Sandspit A (51.6 mm/2 days), December 26-27, 1979; Stewart A (84.0 mm/2 days), December 26-27, 1979.

Source: *Terrace-Kitimat Daily Herald*, December 27, 1979; *Northern Sentinel*, December 27, 1979; Environment Canada 1991.

In Kitimat, spot floods occurred in the Columbia and Kuldo Boulevard areas and the River Lodge parking lot. On December 27, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 1,230 m³/s and a maximum daily discharge of 794 m³/s (Environment Canada 1991).

Old Lakelse Road was closed by three separate washouts. The Bailey bridge on 1st Avenue near Oli's Place washed out. The west end corner of the bridge dropped 4 ft. (1.2 m).

Heavy rain and snow closed Highway 37 north of Meziadin.

In the Rennell Sound area on the Queen Charlotte Islands, the debris slide on Cutting Permits CP 144 and CP 145 enlarged. The weather station at Gospel Point recorded 225.4 mm of rain in four days.

1980

Event type: Landslide.

Precipitation: Not applicable.

Source: S. Johnson, pers. comm. October 1996; Geertsema 1998.

In 1980, a slide occurred on the west bank of the lower Sheslay River. (S. Johnson, pers. comm.). The Sharktooth slide penetrated approximately 800 m into the hill slope, covering an area of about 40 ha, crown to tip spoil. It involved 3-4 million m³ of mud. Triggered by aggressive bank erosion at the outside of a hairpin bend, the slide was likely retrogressive. Materials exposed in the scarp include glaciolacustrine mud, till and volcanic and shaly bedrock near the headscarp.

The slide, which appears in an area with previous slide history, pushed the Sheslay River to the opposite side of the valley. Slide debris may have impounded the river for a short duration.

July 1980

Event type: Fatal debris slide.

Precipitation: Not applicable.

Source: *Terrace-Kitimat Daily Herald*, July 4, 1980.

In July, a debris avalanche in the Beaver Valley near Terrace killed an equipment operator. The vibration of a caterpillar tractor set off the accident.

With only 10.4 mm of precipitation, Terrace reported the driest month of June since 1957. *1) During the month, there were only five days with measurable rain, half the normal of 11.

*1) The previous record was set in June 1958 with 16.8 mm of rain (*Terrace-Kitimat Daily Herald*, July 4, 1980).

September 3-5, 1980

Event type: Flooding.

Precipitation: Hartley Bay (129.1 mm/2 days), September 3-4, 1980; Kildala (79.2 mm/2 days), September 3-4, 1980; Sewell Inlet (72.3 mm/1 day), September 4, 1980; Tasu Sound (70.3 mm/1 day), September 4, 1980; Bella Coola (149.4 mm/2 days), September 4-5, 1980; Kemano (39.6 mm/1 day), September 5, 1980.

Source: *The Tribune*, September 9, 1980; B.C. Ministry of Transportation and Highways 1982 (p. 338).

Around September 6-7 following a week of heavy rain, Willis Bridge over Snootshlee Creek near Bella Coola on the Chilcotin-Bella Coola Highway 20 washed out. Continuous rain during the previous 24 hours was estimated at 6 in. (150 mm). As a temporary replacement, a 100-ft. (30 m) Bailey span was installed by noon on September 9. According to the police, "only two locals had water problems at their homes."

December 7-15, 1980

Event type: Flooding and snow avalanches.

Precipitation: Nass Camp (38.6 mm/1 day), December 7, 1980; Stewart A (163.7 mm/5 days), December 7-11, 1980; Falls River (265.6 mm/6 days), December 7-12, 1980; Salvus Camp (209.0 mm/4 days), December 7-10, 1980; Falls River (190.8 mm/3 days), December 8-10, 1980; Ocean Falls (251.0 mm/2 days), December 9-10, 1980; Bella Coola (320.4 mm/7 days), December 9-15, 1980; Prince Rupert (184.1 mm/3 days), December 8-10, 1980; Kitimat 2 (424.4 mm/8 days), December 8-15, 1980; Tasu Sound (173.4 mm/5 days), December 10-14, 1980; Sewell Inlet (258.9 mm/5 days), December 10-14, 1980; Hartley Bay (511.8 mm/6 days), December 10-15, 1980; Pallant Creek (176.8 mm/5 days), December 10-14, 1980; Ocean Falls (363.4 mm/3 days), December 13-15, 1980; Kemano (93.1 mm/2 days), November 14-15, 1980.

Source: *Terrace-Kitimat Daily Herald*, December 17, 1980; *Northern Sentinel*, December 11 and 18, 1980; *The Province*, December 18 and 19, 1980; January 7, 1981; *Times Colonist*, December 15 and 17, 1980; B.C. Ministry of Transportation and Highways 1982 (p. 339); Environment Canada 1988; Environment Canada 1991.

In mid-December a heavy snowfall of over 1,000 (100 cm?) cm occurred in a 24-hour period near Stewart. It resulted in avalanches releasing and covering about 2 km of highway in the Bear Pass area. Single-lane traffic was restored after a 10-hour closure. (B.C. Ministry of Transportation and Highways, Terrace, 1982)

The Bella Coola area was hit with severe flooding caused by a combination of heavy rains and unseasonably warm temperatures melting snowcaps off mountains on either side of the valley. Late on December 9, the area's only airstrip, 21 km east of Bella Coola at Hagensborg, was submerged.

Preliminary estimates put the damage at up to \$5 million. According to Highways minister Alex Fraser, this included about \$1 million damage to watercourses, and "\$500,000 or better" to the highway system. Damage to homes was estimated at up to \$3 million. The damage estimate for repair and bank protection work was estimated at \$500,000. Environment minister Stephen Rogers promised financial aid to residents affected by flooding. Two nearby logging camps sustained an additional estimated damage of \$1 million. *1)

On December 9, the Bella Coola River broke its banks, carving out new channels in several locations. Over 60 families had to leave their homes in the low-lying subdivisions east of Bella Coola. Thirty homes sustained flood damage and one house was swept away. Elsewhere it was reported that more than 40 families were evacuated and 46 homes flooded, 10 of which severely.

Highway 20, the only highway link to the remote community, sustained an estimated \$1 million and was closed. Three bridges were closed and a fourth was teetering. The Bella Coola airport, closed due to mass flooding, reopened on December 17.

The Nusatsum River flooded the rock dyke that was built in September 1980 and wiped out a house. The river cut a new channel through the Satterwhite home to a depth of about 2 m. The dyke had been built after a previous flood submerged the main floor of the house.

On December 16, the Bella Coola River above Burnt Bridge Creek recorded a maximum instantaneous discharge of 725 m³/s and a maximum daily discharge of 701 m³/s. On the same day the Salloompt River near Hagensborg recorded a maximum instantaneous discharge of 241 m³/s and a maximum daily discharge of 141 m³/s, both these being extremes for the period of record (Environment Canada 1991). With colder temperatures on December 17, water levels receded dramatically. Though still beyond its banks, the Bella Coola River was expected to be in its original channel on December 18.

For Isabel Edwards, 75, who had lived in the Bella Coola River valley for 48 years, this was just another in a long series of floods. *2) Her house, built in 1910, miraculously escaped damage. But floodwaters took out her driveway, all the topsoil of the just plowed hayfield, and left her with a debris-covered lawn.

Two logging camps near Owikeno Lake, 145 km south of Bella Coola, were wiped out when the lake level in the lake rose 6 m. On December 16, Owikeno Lake at Rivers Inlet recorded a maximum instantaneous water level of 5.074 m and an estimated maximum daily water level of 4.870 m (Environment Canada 1988). The Owikeno Indian Reserve, a community of 55 inhabitants was threatened. One family was evacuated.

According to preliminary findings, the December 1980 flooding caused a loss of at least 50% of the salmon in the Kitimat River. (*The Province*, January 7, 1981).

*1) The provincial government agreed to provide \$2 million for homes damaged by the flooding and \$1 million to repair watercourses and \$500,000 to repair Highway 20. Cabinet also earmarked \$500,000 to cover flood damage elsewhere in the province.

*2) The previous peak flood had occurred in 1968.

December 16-17, 1980

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Citizen*, December 17, 18 and 19, 1980; *The Province*, December 18, 1980; *Times Colonist*, December 19, 1980.

On December 17, a 5-km long icejam in the Fraser River near Penny, about 90 km east of Prince George, backed up the water and caused flooding. Ice flows plugged sloughs and creeks and began to build up on gravel banks. The flooding started during early morning with the river rising 30 cm an hour.

A heavy snowfall of more than 5 ft. (1.5 m) earlier in December followed by thaw and three days of rain melted the ice and then it froze again. At least two families were evacuated. According to Barry Akehurst, regional director of the Provincial Emergency Program, the water was rising at a rate of 0.5 m an hour. The ice floe was about 3-4 mi. (4.8-6.4 km) long.

The low-lying area around Penny was covered with ice “as far as the eye can see.” The river appeared to be solid for miles. On December 18, though the water level in the river went down about 5 in. (12.5 cm), was about 12-14 ft. (3.6-4.2 m) above normal. It was approaching the 1936 flood level, which was “the worst anyone could remember.”

On December 19, the icejam was 6 km long and blocked the river both up and downstream of Penny. Fifteen cars parked on the south side of the river were flooded to their windshields and several boats were lost to river ice.

More flooding was reported west of Penny near Aleza Lake. Icejams also cut a road near the community of Upper Fraser. Floodwaters washed away materials and tools at a bridge construction site behind the Northwood Pulp and Timber Ltd. behind its mill near Prince George. *1) Here, floodwaters went over the mark left by the spring freshet. The cofferdam for the bridge’s third pier was also damaged and was covered with muddy water.

Worst damage done by the abnormal winter thaw occurred on December 16 on the Herrick River about 100 km east of Prince George. A tributary of the McGregor River went up 1.5 m, washing away parts of a bridge being built and dumping a crane into the water.

*1) The bridge is to be used to cut the hauling distance from the logging areas to the mill, bypassing routes that now take through city streets. About 16 km and almost an hour’s travelling will be saved (*Times Colonist*, December 19, 1980).

December 23-27, 1980

Event type: Rain-on-snow flooding?

Precipitation: Not available.

Source: B.E. MacFayden. Rivers Subsection, Water Mgt. Branch. Southwest British Columbia. December 1980
Flooding Squamish to D’Arcy Area.

Between December 25-27, southwestern British Columbia experienced mild temperatures and moderate to high rainfall on most areas below 5,000 ft. (1,500 m). This caused very rapid snowmelt and high runoff. Overtopping of river and creek banks caused extensive damage to property. The degree of damage prompted the Province of British Columbia to extend aid under the PEP program to those within an area described as follows, “A line extending east from the northern tip of Vancouver Island following the 51st parallel to its junction with 120 degrees West longitude then south to the 49th parallel then to Vancouver Island and including the Bella Coola Valley.”

Just before south western British Columbia was hit by a severe storm, Bella Coola experienced what the federal government called a “separate event and not shareable.” The first \$350,000 of the Bella Coola restoration was done under O.I.C. 2827 and the balance under O.I.C. 2861, which was later transferred by PEP to O.I.C. 2827. Total expenditure for Bella Coola: \$726,208.77 (expenditure excluding above component of O.I.C. 2861: \$376, 215.66; and \$349,993.11.

September 28, 1981

Event type: Fatal mudslide.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, September 29, 1981.

On September 28, a mudslide killed a 25-year old man working on the new BC Rail line near the Tumbler Ridge coal site. The victim was working across a creek and upslope from a cliff face that broke away. The slide rolled across the creek and continued about 30 m up the slope. The body was found under a metre of mud about 5 m from where he had been working.

January 5-12, 1982

Event type: Snow (fatal) avalanches.

Precipitation: Nass Camp (230.4 mm/4 days), January 5-8, 1982; Salvus Camp (174.0 mm/4 days), January 5-8, 1982; Tasu Sound (128.1 mm/2 days), January 6-7, 1982; Aiyansh (191.0 mm/3 days), January 6-8, 1982; Prince Rupert (152.6 mm/3 days), January 6-8, 1982; Ocean Falls (240.4 mm/3 days), January 6-8, 1982; Bella Coola (101.6 mm/1 day), January 7, 1982; Prince Rupert M. Circ (355.0 mm/7 days), January 6-12, 1982; Langara (76.0 mm/2 days), January 7-8, 1982; Smithers A (43.4 mm/2 days), January 7-8, 1982; Hartley Bay (243.2 mm/3 days), January 7-9, 1982; Terrace (98.8 mm/3 days), January 7-9, 1982.

Source: *The Daily News*, January 8, 11, 12, 13, 14, 15 and 19, 1982; *Northern Sentinel*, January 6, 7 and 13, 1982; *Daily Herald*, January 11, 1982; *The Interior News*, January 13, 1982; *The Province*, January 13, 1983; February 26, 1982; *The Vancouver Sun*, January 15, 1982; Schaefer 1983 (pp. 21-22).

Between January 5-10, the Kitimat-Terrace area recorded 140 cm of snow and winds gusting up to 100 km/h. On January 12, another 10 cm of snow brought the total snowfall in Terrace to more than 150 cm in less than a week.

Prince Rupert was without power for 12 hours as the power the transmission lines between Terrace-Prince Rupert went out. The Terrace airport was closed on January 7-8. In Terrace, the schools and banks were closed on January 8.

The local storm caused more than \$2 million damage. Hardest hit were B.C. Timber, BC Hydro, the Highway Department, and CNR. During the power interruption, B.C. Timber lost an estimated \$120,000 a day in lost production. BC Hydro estimated the cost to run the emergency generators at a minimum of \$350,000. The cost to repair the break in the main power line between Terrace-Prince Rupert was estimated at \$100,000. According to Terrace District Highways Manager Bill Stanley, it would cost the Highways Department some \$300,000 to repair the storm damage. Besides the life of one of its employees, the storm cost CNR about \$150,000. The rail closure cost the grain elevators about \$50,000. Two grain ships anchored in the harbour, at a cost of \$5,000 each a day, had to wait for more grain to come in.

Overnight January 10-11, Prince Rupert was hit by a power blackout. For more than a week the city was on emergency power generated by two back-up generators. The gas-powered twin generators, located near Port Edward, used 10 million ft.³ (283,000 m³) of gas a day, costing BC Hydro some \$1,500 an hour. The B.C. Timber Watson Island pulpmill had its own source of electrical power, which was insufficient for full production. On January 10, a conductor on the 287-Kv powerline from Terrace was torn loose by the severe storm conditions on the Skeena River. Freezing rain on January 11 caused the line to break completely. A 2,900-ft. (870 m) span of line went down in an inaccessible ravine near Tyee. The site was only accessible by helicopter. Because of the weight of the ice, BC Hydro was forced to bring in a helicopter with a 4,500 lb. (2,025 kg) lift capacity from Chetwynd. The transmission line that carries the power to Prince Rupert from the Falls River generating station, which crosses the Skeena River above Tyee, went down in numerous places. Several of the transmission towers were damaged. The dangling wires became frozen in the drifting river ice and pulled some of the tower's steel cross arms out of shape.

Highway 16 between Prince Rupert-Terrace was closed for more than a week during the middle of January. Snowdrifts of 3-4 m hampered traffic on Highway 16 east and west of Terrace. The road was blocked by 24 snowslides, including two major avalanches at Mile 40.9 and 43.5.

On January 14, several new slides came down in the Mile 40 area. Two convoys of trucks and private vehicles were the only non-emergency traffic to use the highway. During the highway closure, Trans Provincial Airlines operated a special once-a-day flight between Prince Rupert-Terrace using a DC-3 aircraft.

Both Highway 16 and Highway 37 were reported open again on January 15. After a week closure Highway 16 opened on January 15. Vehicles continued to be escorted along sections where crews were still working removing the remains of the slides. Only two convoys of traffic escorted by highway crews were allowed to travel between Terrace-Prince Rupert. During the previous week, more than 150 cm of snow had fallen in the area.

The rail line between Prince Rupert-Terrace was closed by snowslides. On January 7, a CNR Cat was buried. The operator escaped injury. A CNR snowplow derailed at slide path Rockface at 69.6 km (Mile 43.5). Fifty metres of track were damaged. On January 9, at slide path Long Slough at 81.6 km, a CNR worktrain was caught and partially buried. The VIA Rail passenger service was temporarily terminated at Smithers.

On January 12 just before 4 p.m. 70 km west of Terrace, another slide came down at the same location as the January 7 avalanche. The slide occurred as provincial highway and railway workers were digging out equipment buried by the earlier slide. The slide that covered 60 m of track and Highway 16 buried and killed a 53-year old CNR section man. The victim was one of about 28 CNR employees working at the site of a derailed snowplow at Mile 43.5. Four vehicles and four other CNR employees were also caught in the 1-m deep slide. Highways crews reached three men caught in the slide within an hour. Two of the survivors were trapped in a railway caboose and a third was found outside in the snow. The fourth man was not uncovered until half an hour later. The victim had been buried in the snow under a truck for 38 minutes before he was found.

During the coroner's inquest Mike Zylicz, Ministry of Highways district avalanche technician said that during the day of the fatal slide the avalanche hazard had increased rapidly. Rising temperatures and rain added to the risk. Mark Ruelle, a Workers' Compensation Board (WCB) industrial safety officer testified that he was in the area when the slide happened. While patrolling the highway with Zylicz, he ordered two independent contractors out of the avalanche area because of the deteriorating conditions. Ruelle explained that the WCB does have jurisdiction over independent employers working on CNR property but does not have control over the CNR itself. Zylicz said that he was getting along fine with the local CNR men in Terrace but added: "They are under continual pressure to keep the line open..." (*The Vancouver Sun*, February 25, 1982). *1)

Between January 7-10, Smithers recorded 87.8 cm of snow. The bulk of this fell on January 7-8, with 42.8 and 27.6 cm, respectively. The snow followed a sharp rise in temperatures. (On January 5, Smithers had reported a temperature of -37° C). Schools and some major businesses and employers shut down during the afternoons of January 7 and 8. The deep snow forced wildlife down from the mountains to the cleared roads in search of food. Logging operations in the area were temporarily shut down.

Highway 37A between Meziadin-Stewart was closed due to a snowslide near Bear River. In a four-day period, 230 cm of fresh snow fell in the Nass Valley. Helicopter access was required until ground transportation links could be restored (Schaefer 1983). The Nass Valley Road was open to emergency traffic only, isolating the Nass Valley communities. Greenville was without power for five days. On January 10, repair crews reached the settlement from New Aiyansh by snow cat.

*1) The Terrace coroner's jury recommended CNR to revamp its avalanche safety program. It also urged the railway company and the highways department to work more closely in controlling avalanches. (*The Vancouver Province*, February 26, 1982). The inquest probed into log-standing friction between the CNR and two provincial government agencies – the WCB and the highways ministry. The jury learned that a CNR employee turned down three times an offer of avalanche equipment from the ministry. The last offer was rejected only 15 minutes before the fatal avalanche occurred. A ministry employee did not warn the trainmen of the avalanche hazard because his advice had been ignored in the past. The WCB has no authority over the operation of the federal-controlled CNR. (*The Vancouver Sun*, February 25, 1982).

January 23-31, 1982

Event type: Snow avalanches.

Precipitation: Tasu Sound (150.3 mm/4 days), January 28-31, 1982; Prince Rupert M. Circ (115.6 mm/4 days) January 28-31, 1982.

Source: *The Daily News*, January 25 and 26, 1982; February 1 and 2, 1982.

On the afternoon of January 23, because of new snow avalanches in the Terrace area and blizzard conditions near Prince Rupert, Highway 16 was closed again. Snow sloughing (small slides) and drifting snow made the road impassable. Only two slides, at points 50 and 60 km west of Terrace, were considered major. On the afternoon of January 25, Highway 16 was reopened after being closed for two nearly days.

For most of January 29 and 30, Highway 16 was closed again to be reopened on January 31. On January 29, a snow avalanche covered 10 m of roadway. On February 1, the highway was closed for a fourth time when snow avalanches started coming down about midway between Terrace-Prince Rupert. It was reopened early on February 2. The rail line was also cut, but reopened on February 1.

February 15-18, 1982

Event type: Snow avalanche.

Precipitation: Prince Rupert M. Circ (113.3 mm/4 days) February 15-18, 1982; Terrace (55.6 cm snow/3 days) February 16-18, 1982; Sewell Inlet (43.8 mm/1 day), February 17, 1982; Tasu Sound (43.0 mm/1 day), February 17, 1982.

Source: *The Daily News*, February 16, 17 and 18, 1982.

On February 16-17, Prince Rupert recorded more than 50 cm of snow, followed by rain. Highway 16 between Prince Rupert-Terrace closed again and remained closed on February 18 when another small slide came down. The road to Port Edward remained passable. After reopening, the highway was closed again on February 24 by a snow avalanche. *1)

*1) During the winter 1981-1982, the hazardous conditions resulted in a total of 41 road closures on Highway 16 (B.C. Ministry of Transportation and Highways).

July 13-14, 1982

Event type: Flash flood.

Precipitation: Prince George (29.2 mm/24 hours), July 13-14, 1982.

Source: *The Citizen*, July 14, 15 and 21, 1982; *The Peace River Block Daily News*, July 22 and 28, 1982.

On July 13-14, freak storms dumped about 30 cm of rain in 36 hours in the Chetwynd area. According to weatherman Earl Zilkie, the rain was caused by a typical summer storm with thunderclaps layered in heavy cloud, accompanied by lightning and heavy rain.

The torrential rains washed out culverts and damaged bridges, forcing rail line and highway closures. The extremely heavy rains cut trenches 5 m deep and up to 50 m long. Near Chetwynd, Falling Creek went on a rampage. Stan Glapysz, highways manager in Dawson Creek, put the damage figure at \$200,000.

The Heritage Highway to Tumbler Ridge was expected to reopen on July 21. Work on the Heritage Highway and the Sukunka Highway from Chetwynd to the coalfield was returning to normal. On July 14, the heavy rain caused a washout along East Austin Road near Dawson Road. About 100 m of roadside ditch were washed out to a depth of about 3 m. City Public Works crews were expecting to have the ditch filled later on July 15.

The BC Rail line between Chetwynd-Lemoray was shut down till July 18. The damage was estimated at several hundred thousand dollars. *1)

*1) The damage was not as bad as in 1973 when the rail line was closed for 16 days. (*The Citizen*, July 21, 1982).

July 31-August 2, 1982

Event type: Flooding.

Precipitation: Dawson Creek (85.6 mm/3 days), July 31-August 2, 1982.

Source: *The Peace River Block Daily News*, August 3, 1982.

Between July 31-August 2, Dawson Creek received a record rainfall of 85.6 mm in three days. This amount by far surpassed the total precipitation for the entire months of July and August 1981.

A number of washouts occurred on the Chetwynd-Tumbler Ridge and Dawson Creek-Tumbler Ridge highways. Though narrowed somewhat in certain sections, both highways remained open. The Boundary-Tumbler Ridge link closed due to a minor culvert washout at mile 42. This was expected to be repaired by 3 p.m. on August 3.

The rains were so severe that some of the better grain crops in the South Peace "lodged" or went down said Field Crops Specialist Jack Dobb of the provincial Ministry of Agriculture and Food. Particularly hard hit was the hay crop. The rain delayed the fescue harvest. After the previous year's drought, this hay was already in short supply. The rain also leached nutrients out of the hay, resulting in substantially lower quality feed.

September 23-26, 1983

Event type: Flooding and debris slides.

Precipitation: Hartley Bay (120.4 mm/2 days), September 23-24, 1983; Sewell Inlet (235.7 mm/3 days), September 23-25, 1983; Pallant Creek (184.4 mm/3 days), September 23-25, 1983; Falls River (205.0 mm/2 days), September 24-25, 1983; Prince Rupert (229.8 mm/2 days), September 24-25, 1983; Terrace (51.8 mm/2 days), September 24-25, 1983; Kitimat 2 (152.0 mm/2 days), September 24-25, 1983; Stewart A (96.8 mm/2 days), September 24-25, 1983; Tasu Sound (261.0 mm/2 days), September 24-25, 1983; Kildala (88.2 mm/2 days), September 24-25, 1983; Sandspit A (67.6 mm/2 days), September 24-25, 1983; Nass Camp (88.8 mm/2 days), September 24-25, 1983; Falls River (205.0 mm/2 days), September 24-25, 1983; Kemano (35.0 mm/1 day), September 25, 1983; Langara (56.8 mm/1 day), September 25, 1983.

Source: *The Daily Herald*, September 26 and 27, 1983; *Northern Sentinel*, September 29, 1983; *The Daily News*, September 26, 1983; Environment Canada 1991; B.C. Ministry of Forests, Queen Charlotte City.

Between September 23-25, Digby Island recorded 343.7 mm (13.53 in.) of rain in 58 hours. Prince Rupert had 270 mm (10.63 in.): 54.2 mm on September 24, 139.2 mm on September 25, and 76.2 mm on September 26. The three-day rainstorm caused damage on the Queen Charlotte Islands, Prince Rupert, and past Terrace. In Prince Rupert, Hays Creek flooded Patullo Park. City crews, concerned about possible flooding of the swimming pool, kept a close watch on the dike behind the Civic Centre. Basements were flooded throughout the city, with the Eagle subdivision being worst hit. In Prince Rupert, several homes flooded by water coursing under Highway 16. One basement had 4 ft. (1.2 m) of water. The Department of Highways spent several days cleaning up the results of the region-wide damage, estimated in the thousands of dollars. In the Port Edward area, a mudslide near the Cassiar Cannery closed the highway for seven hours. A small rockslide came down some 15 km west of Terrace, closing one lane of Highway 16 for a short time. Some 40 mi. (64 km) east of Terrace, a rockslide came down. CNR reported some water lapping over the tracks near Tyee.

In the Terrace area, B.C. Timber's West Kalum Road was closed until September 27. Some sections were flooded and one bridge was washed out. B.C. Timber's Twin River Woodlands Division shut down. Roads were flooded at Star Creek and Nelson River.

On September 26, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 1,700 m³/s and a maximum daily discharge of 931 m³/s (Environment Canada 1991). The Minette Bay Road into Kitimaat Village was closed for half an hour. A road culvert was plugged and the road and some shoulders washed out. Some other minor washouts and rockslides occurred.

On the Queen Charlotte Islands, minor flooding occurred on Highway 16. Some sections had 2-3 ft. (60-90 cm) of water on the road. At least 14 slides were reported in the Sewell Inlet area (B.C. Ministry of Forests). The weather station at Sewell Inlet recorded 263.8 mm of rain in four days.

November 1983

Event type: Landslide.

Precipitation: Not available.

Source: Bruce Easton, pers. comm. April 19, 1994. CN Rail Prince George.

Around the end of November, the hillside near the bridge across Bannock Creek on the rail line between Terrace-Kitimat collapsed. The south slope slid towards the creek. A new abutment was put in and additional bracing piles were driven in. The piles were recapped and bracing put in between the piles. The creek, which was undermining the toe, was straightened out (Bruce Easton, pers. comm.).

January 21-27, 1984

Event type: Debris slides.

Precipitation: Falls River (248.4 mm/6 days), January 21-26, 1984; Tasu Sound (281.2 mm/6 days), January 21-26, 1984; Sewell Inlet (514.2 mm/6 days), January 21-26, 1984; Prince Rupert M. Circ (237.3 mm/6 days), January 21-25, 1984; Bella Coola (298.0 mm/7 days), January 21-27, 1984; Ocean Falls (604.2 mm/7 days), January 21-27, 1984; Falls River (265.7 mm/7 days), January 21-27, 1984; Salvus Camp (172.8 mm/5 days), January 22-26, 1984; Kitimat 2 (137.4 mm/3 days), January 24-26, 1984; Pallant Creek (245.2 mm/3 days), January 24-26, 1984; Sandspit A (40.1

mm/2 days), January 25-26, 1984; Sewell Inlet (336.4 mm/2 days), January 25-26, 1984; Sandspit A (39.5 mm/1 day), January 26, 1984; Kemano (35.0 mm/1 day), January 27, 1984.

Source: *The Daily News*, January 27, 1984; Letter, February 27, 1984, J.W. Schwab (B.C. Ministry of Forests) to District Office, Queen Charlotte City; B.C. Ministry of Forests, Queen Charlotte City; Fish/Forest Interaction Program (FFIP).

On January 26 a mudslide came down onto Cannery Road near Port Edward. The slide was cleared on January 27. Both lanes were open for traffic within six hours.

Snow avalanches blocked highway 37A between Stewart-Meziadin. It was still reported closed on January 27.

The severe storm, lasting approximately 20 hours, was centered over Sewell Inlet on the Queen Charlotte Islands. An estimated 500 slope failures occurred during the storm (B.C. Ministry of Forests). The largest mass movement occurred above Mathers Lake on Louise Island. The debris slide was over 800 m long, possibly incorporating up to 50,000 m³ of debris. The creeks that were most heavily impacted were Thorsen, Deena, and Bonanza creeks. Slides were reported in the Sewell Inlet area and Thorsen Creek (B.C. Ministry of Forests, Western Forest Products). Debris torrents and debris avalanches occurred in the Deena, King, and Bonanza creeks (FFIP). The weather stations at Sewall Masset Inlet and Gospel Point recorded 47.4 and 92.0 mm of rain in two days, respectively. Near Rennell Sound on clearcut areas along Bonanza Creek, about 13 large slope failures occurred (FFIP).

February 13, 1984

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: *The Sun*, February 13, 1984.

On February 11, an avalanche in the Red Fern Lake area, about 185 km south of Fort Nelson swept down a five-man snowmobiler party. An 18-year old Fort St. John man and a 20-year old man from Taylor were killed. The victims were buried in deep snow. Three others escaped because they were behind a knoll. The avalanche came down without any warning. The bodies were not recovered until the next day.

October 6-10, 1984

Event type: Glacial outburst flood.

Precipitation: Sandspit A (32.6 mm/1 day), October 6, 1984; Sewell Inlet (84.6 mm/1 day), October 6, 1984; Bella Coola (78.2 mm/2 days), October 6-7, 1984; Tasu Sound (178.0 mm/5 days), October 6-10, 1984.

Source: Jones et al. 1985; Environment Canada 1991.

This major Thanksgiving Day storm created large floods in the watersheds on the east side of Coast Mountains between the Squamish River to the south and the Dean River to the north (Jones et al. 1985). On October 8, the Bella Coola River above Burnt Bridge Creek recorded a maximum instantaneous discharge of 389 m³/s and a maximum daily discharge of 369 m³/s (Environment Canada 1991).

On October 20, Ape Lake, 50 km southeast of Bella Coola, drained in less than 24 hours beneath the snout of Fyles Glacier. *1) The two distinct peak discharges were probably in the range of 985-1,500 m³/s. The sudden release of about 45.8 million m³ of water formerly stored in the lake created an unusually large flood on the Noeick River. The flood caused extensive erosion, transport, and deposition of sediment stored on and adjacent to the floodplain of the Noeick River. The flood destroyed more than 200,000 newly planted trees and some merchantable timber was lost. Two bridges across the Noeick River were damaged and more than 1 km of a newly constructed forestry access road and several kilometres of spur road were destroyed. The flooding also affected the productivity of the local fisheries on the Noeick River downstream from the lake. Debris from the flood covered South Bentick Arm, affecting access by water for several days. Immediately upstream from Purgatory Lake, floodwaters undercut the high lateral moraine formed by Purgatory Glacier. Up to 3 m of sediment was deposited upstream from the lake, while immediately downstream the river scoured and greatly enlarged its channel. Prior to the draining of Ape Lake, the area was subject to two major storms. Between September 16-17, Bella Coola recorded 82.9 mm of rain. During the second storm, which was widespread and caused large floods throughout southwest British Columbia, Bella Coola reported 102 mm of rain.

*1) Ape Lake appears to have been stable for several centuries until gradually changing ice conditions led to the sudden draining of the lake (Jones et al. 1985).

November 21-22, 1984

Event type: Debris slides.

Precipitation: Hartley Bay (53.2 mm/1 day), November 21, 1984; Sewell Inlet (125.0 mm/1 day), November 21, 1984; Pallant Creek (130.0 mm/1 day), November 21, 1984; Prince Rupert M. Circ (66.9 mm/2 days), November 21-22, 1984; Prince Rupert A (57.3 mm/2 days), November 21-22, 1984; Kitimat 2 (134.1 mm/2 days), November 21-22, 1984; Kitimat Townsite (97.8 mm/2 days), November 21-22, 1984; Falls River (129.6 mm/2 days), November 21-22,

1984; Kemano (98.0 mm/2 days), November 21-22, 1984; Kildala (108.2 mm/2 days), November 21-22, 1984; Sandspit A (37.2 mm/1 day), November 22, 1984; Terrace (82.6 mm/1 day), November 22, 1984.

Source: *The Daily News*, November 22, 1984; *Times Colonist*, November 23, 1984; *The Vancouver Sun*, May 30, 1985; File M51-651-18212-25.00, Cannery Road Stability Investigations. B.C. Ministry of Transportation and Highways, Terrace; Al Cowan, pers. comm. Dept. of Fisheries and Oceans, Queen Charlotte City.

Overnight November 21-22, Prince Rupert recorded 42 mm of rain and winds of 60-110 km/h. The storm with gusts up to 105 km/h caused power outages in Port Edward and Port Simpson and Metlakatla. In Prince Rupert, powerlines were knocked down, signs were torn off buildings, and at the Prince Rupert Yacht Club's wharves were torn away. The transmitter of local radio station CHTK on Digby Island went off the air. A partially completed garage was blown off its foundations. A shed from a rental outfit was badly damaged and blown onto the first ramp of the fisherman's Co-op dock. The stormy weather forced the cancellation of the Rivtow Straits Ltd. barge to the Queen Charlotte Islands. According to George Blakey, supervisor at the Terrace weather station, a storm this size happens once every four years.

Near Port Edward on the Cannery Road, approximately 200 m south of the Cannery Road fill failure, a debris slide occurred. It measured a length of 20 m, a width of 6 m, and a depth of 3 m. The debris extended upslope of the road to the downhill side of the road fill, blocking the road traffic. Muddy water was ponded from the ditch to the guardrail. The debris was cleared by a front-end loader.

South of Rosswood, a section of the new Kalum Lake road split, one lane sliding into the lake. *1) The section of highway, locally known as the "Stanley slide," was built on an unstable slope. According to Bill Allen, the Ministry of Highways senior information officer in Victoria, the slide was caused by "exceptionally heavy rains in October and November" before the road had stabilised. Dan Doyle, Regional Director for Highways, estimated the repair cost at \$300,000 (*The Vancouver Sun*, May 30, 1985).

On the Queen Charlotte Islands in the upper headwaters of Landric Creek, eight debris avalanches occurred. The slides, all in the 500-1,000 yd.³ (382-765 m³) size class, are described in detail by Doug Swanson in a confidential report commissioned by the Department of Fisheries and Oceans.

*1) Two days after the new 52-km, \$11 million road was officially opened, sections along a 2-km stretch had begun to develop cracks (B. Holden In: *The Vancouver Sun*, May 30, 1985).

December 23-28, 1984

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Interior News*, January 2, 1985; *The Daily News*, December 27 and 28, 1984; Dr. A.S. Gottesfeld, pers. comm. June 1, 1994.

An icejam on the Bulkley River near Quick, between Smithers-Houston, caused flooding near the Quick bridge. On December 23, the water started rising near the Dave Gillespie residence, the lowest spot on the floodplain near the bridge. The 63-year-old Quick bridge itself was not endangered. Though one abutment is situated in the middle of the river, the structure is buttressed by piles driven into the river bottom bedrock. By Christmas Eve the water reached a depth of 2 m. According to Larry Garinger, field engineer with the Water Management Branch, anchor ice had formed on the bottom of the river. *1) Due to a long cold spell most of the channel was occupied by ice frozen to the bottom. Though the discharge was low, overbank flow occurred. Floating ice damaged and removed small fruit trees with diameters to about 6 cm on the floodplain near the bridge (Gottesfeld, pers. comm.). The ice stretched for about 12 km south from the Telkwa bridge. Ten families living on the floodplain adjacent to the bridge were evacuated on Christmas Day. When the flooding subsided, seven families returned to their homes. The waters rose and receded several times.

On December 27, the situation was more threatening than before. The water rose to a depth of more than 2 ft. (60 cm) in 10-15 minutes where Quick Road crosses the railroad tracks. The Bulkley River cut a new channel, flowing directly under the Buchfink residence. On December 28, after a major shift in the icejam occurred, the families had to leave their homes a second time. On December 30, the evacuation order was lifted and most residents returned to their homes. The icejam later broke up by itself.

* 1) Anchor ice is a common occurrence in the Yukon and Saskatchewan in spring but relatively rare in British Columbia (*The Interior News*, January 2, 1985).

February 17-23, 1985

Event type: Snow (fatal) avalanches.

Precipitation: Kemano (41.1 mm/1 day), February 17, 1985; Sewell Inlet (132.7 mm/2 days), February 17-18, 1985; Kitimat 2 (150.0 mm/2 days), February 17-18, 1985; Ocean Falls (176.8 mm/2 days), February 17-18, 1985; Falls River (165.0 mm/4 days), February 17-20, 1985; Prince Rupert M. Circ (106.2 mm/1 day), February 20, 1985; Bella Coola (84.2 mm/2 days), February 22-23, 1985.

Source: *Northern Sentinel*, February 21, 1985; *The Interior News*, February 27, 1985; Jamieson and Geldsetzer 1996 (p. 109; pp. 169-170); B.C. Ministry of Transportation and Highways 1980; Adam Charneski, pers. comm. July 1991, Line Foreman Alcan, Kitimat.

At slide path Rockface, 69.6 km west of Terrace on February 18, a CNR train ran into a slide deposit at 50 mph (80 km/h). The lights on the engine were broken and the train uncoupled.

An avalanche wiped out a transmission tower between Kemano-Kitimat near the Kildala Pass, 24 km from Kemano on the south side of the Hanging Valley. *1) The slab type avalanche occurred at a steep 60% slope at the 6,000 ft. (1,800 m) level. It jumped a ridge and spilled over and the windblast created by the massive snow flow knocked down the aluminum tower 124L. Pieces of the tower were carried away over a maximum horizontal distance of 950 ft. (285 m). The windblast also caused minor damage to steel members of adjacent towers 123R and 124R at an elevation of 740 m and knocked down trees on the uphill side of these towers (A. Charneski, pers. comm.). The single circuit on the right was able to maintain the delivery of power. *2)

In the five days prior to the avalanche, about 200 mm of precipitation had fallen in the area. This and previous snowfalls probably an approximately 190-cm deep unstable snowpack in the avalanche path. The avalanche starting zone, at 1,700 m, was on a northeast-facing slope with a 39° incline and lee to the prevailing storm wind. After running down an open 31° slope, the avalanche was deflected by a 50-m high ridge. It then moved over 400 m on gentle incline between 0-10° along the opposite valley side, towards the powerline.

Models of avalanche dynamics and the runout distance of the avalanche led to the conclusion that the avalanche speed at tower 124L was approximately 24 m/s (86.4 km/h). The avalanche snow was dry and probably had a deep powder component. The age of broken trees in the avalanche path suggested that an avalanche of similar magnitude had not occurred for close to 100 years. (Peter Schaerer in; Jamieson and Geldsetzer 1996).

On February 22 at midnight, an avalanche on Onion Mountain near Smithers killed a snowmobiler. At just after midnight, it was snowing heavily. A number of snowmobilers were taking turns running up of one of its slopes. The victim, a 29-year old man, started up the slope and was traveling at high speed when hit by the avalanche. The slide was about 350 m wide and ran 400 m. Neither the victim nor his snowmobile were buried in the avalanche. But when the other members of the group found him, he had died of massive trauma. (Jamieson and Geldsetzer 1996).

*1) For a distance of 15 km over Kildala Pass, the transmission line is split into two single, parallel circuits. The line on the right side (identified by R) is carried on steel lattice towers, and the line on the left (L) on towers built with aluminum tubing. The transmission line has a history of destructive avalanches. By January 26, 1955, avalanches had already destroyed three towers in Glacier Bowl at the south side of Kildala Pass on the line completed only the previous year. (Jamieson and Geldsetzer 1996).

*2) In the following years, earth and steel deflectors were built at other exposed towers. On January 22, 1973, an avalanche destroyed tower 105L. Subsequently, placing strong steel breakers in front of them protected the legs of towers 105L and 105R. On December 27, 1992, tower 113R near the top of Kildala Pass was damaged. (Jamieson and Geldsetzer 1996).

March 1985

Event type: Landslide potential.

Precipitation: Not applicable.

Source: *Times Colonist*, March 12, 1985.

In March, Dinosaur Lake on the Peace River was closed to the public until further notice for all recreation and sport fishing. This followed a study on the movement of a landslide, which developed on the north-shore of the reservoir near the town of Hudson's Hope. The slide had moved 5 m in the last four years. It was feared that if it would move rapidly into the water it could create waves in excess of 4 m. Depending on how fast the slide would move, the lake could be closed for up to five years.

September 3-4, 1985

Event type: Flooding.

Precipitation: Prince Rupert M. Circ (57.4 mm/1 day), September 3, 1985; Prince Rupert A (52.2 mm/1 day), September 4, 1985.

Source: *The Daily News*, September 12, 1985.

Unusually heavy rains washed out the forms for the construction of the new Wolf Creek dam near Port Edward. Forms for the 5-m high and 13-m wide concrete dam had been set up and crews were ready to pour the concrete when the washout occurred. The forms lifted up and drifted against a tractor. Stikine Construction company lost about 62 man-hours as a result of the incident. Work on the project resumed on September 12.

September 19-20, 1985

Event type: Debris slides.

Precipitation: Sewell Inlet (121.0 mm/1 day), September 19, 1985; Falls River (72.0 mm/1 day), September 19, 1985; Kildala (55.0 mm/1 day), September 19, 1985; Nass Camp (30.8 mm/1 day), September 19, 1985; Prince Rupert M. Circ (100.0 mm/1 day), September 19, 1985; Langara (53.6 mm/2 days), September 19-20, 1985; Prince Rupert (82.3 mm/2 days), September 19-20, 1985.

Source: *The Daily News*, September 20, 1985.

High winds and rain caused trouble for fishing vessels on the North Coast. The fishing boat *Pacific Breeze* ran aground in Tana Bay on the west coast of the Queen Charlotte Islands. The lone occupant was rescued. The *Ruthy J*, a 42-ft. (12.6 m) American boat, was towed into Prince Rupert.

On the Queen Charlotte Islands, many debris avalanches and debris torrents occurred near Bonanza Creek and Tartu Inlet. The Tartu Inlet area, on the west coast of the Queen Charlotte Islands, experienced heavy rain. The watchman of a logging camp at Tartu Inlet estimated the rainfall at 7 in. (175 mm) in 12 hours. Three separate torrents, originating on the hillside above the camp located on the flats, hit the facilities. The logdump and sort and fuel storage were pushed into the inlet. A bunkhouse trailer was hit and carried downslope. There were no injuries. The watchman spent the night in a boat on the water.

October 9-17, 1985

Event type: Flooding.

Precipitation: Ocean Falls (558.9 mm/8 days), October 9-16, 1985; Sewell Inlet (253.2 mm/5 days), October 12-16, 1985; Bella Coola (158.8 mm/5 days), October 12-16, 1985; Hartley Bay (218.0 mm/4 days), October 14-17, 1985; Kemano (160.2 mm/4 days), October 14-17, 1985; Sandspit A (34.0 mm/1 day), October 15, 1985; Kildala (98.2 mm/3 days), October 15-17, 1985; Kitimat 2 (164.1 mm/3 days), October 15-17, 1985.

Source: *Northern Sentinel*, October 17 and 18, 1985; *Coast Mountain Courier*, October 23, 1985.

Between October 8-16, Bella Coola recorded 6.18 in. (156.9 mm) of rain, and gale force winds up to 76 kn. (140 km/h) at Cathedral Point, Kwatna Bay in Burke Channel. On October 15, 1.6 in. (40.8 mm) of rain fell. Rivers and side streams reached near record levels. The Thorsen Creek bridge was closed for one day by water and debris on the bridge.

Kitimat reported gales with gusts up to 138 km/h. On October 15, the gillnetter *Lucky Rock* and another gillnetter sank in Hecate Strait. The occupants of both boats were rescued.

March 29, 1986

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, March 31, 1986.

On March 29, an avalanche on the Cariboo Mountain trail about 50 km south of Valemount killed four snowmobilers, all of Drayton Valley, about 110 km west of Edmonton, Alta. The victims were part of 11 riding snowmobiles along a popular alpine ridge when the avalanche, estimated more than 1 km wide, swept over them. The avalanche missed the five riders in the rear of the group.

Lyda Sedgbeer, another snowmobiler who was in Valemount to participate in a weekend snowmobile rally, said conditions were too hazardous to be in the backcountry. Heavy rains on March 28-29 made conditions unsafe. Both the big British Columbia mountaineering clubs cancelled all their weekend outings because of avalanche danger.

Avalanche expert Frank Baumann, a former heli-skiing operator, blamed the four deaths on the lack of communication between the avalanche professionals and the general public. After a snowslide in the East Kootenay had killed two skiers the previous month, he had predicted "there will be more deaths." Baumann said a 24-hour avalanche information phone, such as the ones operating in Alberta and Washington State, would help keep recreationalists informed about the hazards.

The depth of the avalanche ranged up to 10 m, hampering recovery operations. One man was pulled out uninjured. A 23-year old woman was found alive after she was buried for more than an hour. Two bodies were recovered before darkness stopped searchers. The risk of avalanches in the area was extremely high. Using three police dogs, the other two bodies were recovered the next day.

Spring 1986

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: Nesbitt-Porter 1986.

During the spring, an ice jam on the Dore River caused damage in the Mackie area.

May 26-29, 1986

Event type: Mudslide and flash flood.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, May 30; June 2 and 5, 1986; *The Prince George Citizen*, June 1 and 16, 1990; *Robson Valley Courier*, June 4 and 11, 1986; Nesbitt-Porter 1986. B.G. Wilson. 1986. East Central British Columbia. O.I.C. 1106 May 1986 Summary of restoration works and costs B.G. Wilson. McBride – As constructed summary June-September. November 1986.

At the end of May, a mudslide near McBride cut off about 100 people. Continuing warm weather melting mountain snowpacks quickly caused a threat of creeks in the McBride area to overflow their banks. Prior to that, cool, unsettled weather during the early spring resulted in less than normal melting of the mountain snowpack. McBride village administrator Ron Brown said that a close watch was still being kept on a 240-km stretch of the upper Fraser River between Purden Lake-Valemount.

Starting during the evening of May 26, and continuing for several days, high temperatures caused snow slides and rapid snowmelt runoff. It resulted in flow surges, debris flows and damage along many McBride area creeks. Following high water for a week, a surge of water through the Dore River caused extensive property damage on Mountain View Road and along Dore Road.

On May 26-27, during a sudden warming trend, a series of avalanches exacerbated snowmelt runoff flows in a number of Fraser River tributaries in the McBride area. Avalanches typically would plug these creeks, which have steep gradients and watersheds ranging in elevation between 760 m and the permanent glacier level of 2,300 m. Once a sufficient head of water would have developed upstream, it would breach, resulting in a debris torrent moving down onto the Fraser River floodplain. Surge levels of up to 9 m above normal water level were observed.

On May 26 around 9 p.m., a “wall of water” swept down the Dore River, flooding several basements, overturning vehicles and submerging Highway 16. Hardest hit were the residences of Bob Learie, Bob Elliott and Myrtle Mackie along the Dore River Road, and those of Bill Hayes and Terry St. Jean across the river. Learie’s and Elliott’s basements were flooded and all suffered damage to their wells and yards. On Mountain View Road, the mudslide hit the Powell residence. It knocked down the garage, tore off a balcony, flooded the basement, overturned a vehicle and washed another vehicle down into their yard.

The flood was caused by a rupture of an ice dam/huge avalanche in the headwaters of the south fork of the river. The slab avalanche started within a few hundred metre of the mountaintop. Gene Runtz, Woodlands Manager for Zeidler Forest Products, who surveyed the river by helicopter, said that the river was “blocked with 50 ft. (15 m) of ice.” At least three avalanches blocked the south fork of the river. The largest ice dam furthest up the river gave way causing material and water from all the slides to wash down the river.

During the flash flood, floodwaters were estimated 4 ft. (1.2 m) on the road near the Dore River bridge. After about an hour, the water receded. A total of 74 people were evacuated the first night. Next day, with the inclusion of people who were flown out from beyond a washout on Mountain View Road, the total rose to 94.

The most dramatic incidents included the destruction of one private home, tumbling of a D8 Cat down Bevier Creek channel and a car being swept of Highway 16, at the Dore River. The only injury was to an equipment operator working on rebuilding Mountain View Road, who was hit by a second mudslide about 3 p.m. on May 27. Nearby resident Peter Lindelauf described it as, “A fourteen foot wall of water, mud and rock tumbling the Cat like a matchbox down the creek.” The 40-ton crawler was tossed 150 ft. (45 m) down the stream. Damage to the Cat was estimated at \$50,000. The bulldozer operator attempting to restore the channel after the initial slug of water narrowly escaped serious injury or death when trapped in his machine which rolled down the creek channel by a subsequent surge. This second slide caused additional damage to the Powell residence. Exterior walls collapsed and the main floor was filled with mud.

An aerial survey of the creek on May 27 showed that there was still a danger of more slides. Of the 10 chutes feeding the stream, mud had come down from only one of these. That same afternoon, three other chutes had slumped together hundreds of metres. Six more looked ready to come down any time. Because of the continuing danger, work on Mountain View Road was halted, keeping about 100 people stranded. Only four families comprising 19 people accepted the offer of evacuation. Rising water levels prompted the road closure, which was opened again on May 30.

The flood also stranded men and equipment of the Triple C Logging Company up the Dore River. Two bridges were washed out and the road was cut away in several spots. Zeidler Forest Industries estimated reconstruction cost to be at least \$250,000. The reconstruction estimate depended on the co-operation of the ministries of Fisheries, Environment and Forestry.

On May 28, a high water alert for residents of the Robson Valley continued but there were no recurrences of the flooding that forced the evacuation of McBride. The Fraser River caused flooding on Mountain View Road. On May 28, PEP coordinator Tim Mitchell announced that the danger area increased to include all creeks between Purden Lake-Valemount. On the night of May 28, Chris D’Alessandro evacuated his home on Nevin Creek. In Dunster, several families lost their water supplies through flooding. On the evening of May 29, the RCMP evacuated residents along Spittle Creek and Packsaddle Creek in Valemount.

In addition to creek restoration, estimated to cost \$88,300, a further \$134,700 expenditure on new bank protection was necessary if future losses were to be prevented (Nesbitt-Porter 1986).

Centurion Creek, located within the boundaries of Chetwynd flooded its banks. It appeared that a very sudden and large volume came downstream. This surge of water flushed the creek channel taking out everything in its path. There was evidence of much overland flow, especially on the Brockman property, Lot 1809 downstream from the Legion. Besides erosion, the Brockmans lost their water supply and had their basement flooded. There is some

speculation and evidence to suggest that the plugging up of the two 8-ft. (2.4 m) culverts under the BCR line may have aggravated the situation on this creek. The BCR later replaced these two culverts with an identical pair.

Floodwaters on Nevin (King) Creek, Holliday (Baker) Creek and two other small creeks near Tete Jeune threatened the highway. The Blue River was reported to be at its highest level in recorded history. The Fraser River threatened flooding low-lying areas. On May 29, a small washout occurred on the Holmes River.

Early on May 29, the road (Mountain View Road?) was reopened. Traffic was allowed through for several hours while a close watch was kept on a large mass of material on the slopes above the road that was expected to fall at any time. To avoid recurrence, a 2-m culvert was placed into Bevier Creek. *1) Flood-related mudslides in the area caused more than \$1 million worth of damage. (*The Prince George Citizen*, June 16, 1990) *2)

In the flood and debris flow event in east central British Columbia the following watercourses were affected at a total estimated restoration cost of \$214,000. (Nesbitt-Porter 1986):

West Twin Creek: erosion of the left bank, immediately upstream of the recently improved CNR bridge threatened to sever access to the Paul Hulka and Landon Rich properties; McKale River: Log jams and gravel deposition downstream from the road bridge caused development of a previously very minor right bank distributary with the result that grazing and tree planted areas were being flooded and eroded; Tumbledick Creek: right bank diversion of this very minor creek along a cleared waterline route threatened flooding of one home.

Bevier Creek: A series of snowslide generated debris flows caused very severe damage to the highway and to two properties bordering the creek below the road; On the Powell property, a debris flow destroyed the poorly situated house and caused extensive damage to the property. The intake of a house on the Runtz property on the left bank, opposite of Powell's house, was destroyed. The house, though undamaged, was left more vulnerable to future flood damage. The downstream creek channel was totally infilled and buried under about 1.5 m of gravel and debris.

Dore River: Three snow slides caused the most extensive damage occurred along this river. Blocking the main channel to a depth of up to 15 m they were believed to have failed in succession, releasing a large slug of accumulated water and snow. This, in turn, picked up and deposited gravel and wood debris along its about 15-km long passage to the Fraser River. It caused extensive damage to training berms, riprap and natural banks as well as water intake and heating system damage. Debris was deposited across flooded areas and the main channel was infilled in places. In the Mackie area, the main channel became partially blocked by a logjam that formed on the upstream end of a tree-covered island. Debris-laden flood surges swept across the Learie, Mackie, and other properties. Only the Learie home suffered direct damage. Combined with the damage done by the ice jam earlier in the year, left the residents concerned. Though the bank erosion in the Mackie area was limited to the downstream end of this reach, the potential for future erosion of the two properties had greatly increased. At the Elliott property left bank erosion removed the downstream remainder of a gravel training berm. The Arnenson property suffered riprap loss and bank erosion. The water intakes for the River Bend Trailer park, serving 31 people in 14 homes, were rendered unserviceable and were exposed when the left bank riprap was totally eliminated and significant erosion resulted. In the Dorval Mobile Home Park in the Melko Subdivision, the right bank wells and a pumphouse, which served 18 mobile homes and four others, were threatened by extensive upstream erosion. Prior to the flood, a berm that at one time provided protection for the area had almost totally collapsed, exposing these wells. On the Shawara property, the loss of right bank riprap resulted in the destruction of a single property water intake and other erosion damage. The Bonneville property below the railway bridge flooded as a combined result of bedload deposition in the channel and damage/loss of a gravel berm along the right bank. Windrowed land clearing debris along the right bank was swept away allowing the erosion of a large cultivated field. On June 13, two logjams caused the stream to overflow the right bank of the Bonneville property. The stream flowed in the area marked for rechanneling before the freshet. On that day, the right bank was eroding at about 0.5 ft. (15 cm) a day. It was feared that high water could result in the Dore River to reroute its channel through the Bonneville property.

Castle (Cottonwood) Creek: a debris slide temporarily blocked the creek and also severed the access road; Nevin Creek: snow and debris slides blocked the main stem creek channel resulting in four or more surges as these constrictions washed out releasing impounded water. A dozen or more logjams remained in the channel but posed little threat; Holliday Creek: bank erosion occurred at the highway junction; Horsey Creek: erosion of a very high bank well downstream from the highway crossing continued. Mike Lorenz, the owner, attributed it to work done by the Ministry of Highways and Transportation in 1972; Wardman Creek: an emergency berm constructed on May 26 and washed out on May 27 in the forested area upstream from the cleared field and farmyard was reported to have prevented overbank flow damage to other properties to the north of the creek; Eustis (Big) Creek: debris deposition and bed scour on the Vern Davis property indicated that a major slug of water or debris flow must have passed down this channel. Damage to the Davis property consisted of the loss of the water intake and erosion/deposition along the channel. The water supply for the Stoner property was also disrupted. Extensive debris deposition was reported on the downstream Tony Bosio property. An 8-ft. (2.4 m) culvert on Packsaddle Creek plugged threatening several homes immediately downstream of the bridge. On May 30, after removing the debris, the water level in Packsaddle Creek dropped several feet.

On May 30, the Fraser River near McBride was measured running at 1,400 m³/s, about 1 m below the recorded high water level in 1972. On May 31, the Fraser River at Prince George reached 9.14 m, 2 cm below the flood warning level. Flooding occurred near Prince George. Some residents of Farrell Street in South Fort George experienced flooded basements with water up to 1 ft. (30 cm) deep. *3)

Between June 18-September 16, designated areas of creeks in the McBride and area creeks involved were cleared of flood-deposited materials and gravel berms and riprap bank sections were re-established to provide similar to pre-flood protection for a total cost of 247,650. (B.G. Wilson. November 1986).

*1) On June 11, 1990, a debris and rockslide blocked this 2-m culvert. (*The Prince George Citizen*, June 16, 1990).

*2) On June 4, it was announced that Cabinet approved \$1.5 million relief for McBride that was hit by mudslides (*The Vancouver Sun*, June 5, 1986).

*3) The flood-related problems in Prince George are caused by water collecting in the lower Patricia Boulevard area between Fourth-Second avenues. There are two sewer line valves in the area. In anticipation of flooding, the City of Prince George seals the sewage manholes. Floodwaters will spread right over them and not mix with the sewage (*The Prince George Citizen*, June 1, 1990).

June 14-16, 1986

Event type: Flooding.

Precipitation: Nass Camp (41.0 mm/1 day), June 14, 1986; Quick (52.6 mm/1 day), June 14, 1986; Smithers A (70.0 mm/3 days), June 14-16, 1986; Houston (49.8 mm/1 day), June 15, 1986.

Source: *The Interior News*, June 18, 1986; *Houston Today*, June 25, 1986; Environment Canada 1991; Sewa Tehera, pers. comm. April 1993. Field Engineer, Structures, B.C. Ministry of Forests, Smithers; H.H. Nesbitt-Porter. Ministry of Environment. Memorandum. June 25, 1986. June 1986 Flooding-Smithers area; Ministry of Environment. Memorandum. August 21, 1986. June 14/15 flooding in Smithers. File 55.4630.

On June 14-15, heavy rain occurred in the Houston -Moricetown area. *1) In the five days between June 15-19, Houston recorded 73.9 mm of rain. Heavy precipitation on the evening of June 14, continuing through to mid-day June 15, resulted in accelerated snowmelt. It caused flood flows in many local watercourses, including the Bulkley and Telkwa rivers. Floodwaters were reported to have risen more than 25 ft. (7.5 m) above normal level before receding. Further heavy rain on June 16 sustained these high flows.

The "Father's Day Storm" caused extensive damage. Highway 16 and the rail line between Moricetown-Telkwa sustained heavy damage. The Provincial Emergency Program evacuated eight people from five families at Moricetown. Smithers was without water service when the water intakes on the river clogged. In the Town of Smithers, the Beaver Islands Estates, on the east bank of the Bulkley River in section 31, Tp. 4, was inundated. As the houses in the area appeared to have been reasonably flood-proofed, the only reported damage consisted of flooded gardens and property access problems.

Near Moricetown, a washout occurred when a culvert on the rail line plugged. A large culvert washed right out, sticking into the air. The CNR had replaced the Corya Creek trestle crossing of a left bank overflow channel with a small 1200-mm culvert and a 10-ft. (3 m) diameter multi-plate cattle underpass. The latter washed out and was deposited some distance downstream. Further downstream, a 10-ft. diameter highway underpass was undamaged although the road fill was overtopped.

On June 15, about 50 volunteers helped sandbag the Bulkley River near Eddy Park on the west side of Telkwa. The riprapped riverbank near the Village of Telkwa water intake and the Village and Fire Hall suffered damage as a result of high water levels and high velocities of the Bulkley River.

On June 15, the Bulkley River at Quick recorded a maximum daily discharge of 721 m³/s. On the same day, the Telkwa River below Tsai Creek recorded a maximum instantaneous discharge of 132 m³/s and a maximum daily discharge of 120 m³/s (Environment Canada 1991). The Telkwa River eroded riprap at the foot of Elm Street in Telkwa. Flood flow necessitated the emergency placement of some 200 loads of riprap to stabilize the right bank at the upstream end of the existing bank protection ("Bartlett area"). Further upstream, a recently constructed cut-off dyke probably prevented damage to area houses, and was itself undamaged.

Damage to the highway and road system occurred along Driftwood Creek (Bulkley River tributary), Coalmine Road (Telkwa River) and Tenas and Goathorn Creek (tributaries to Telkwa River). The Goathorn Creek bridge on the Telkwa Coalmine Road was destroyed beyond repair. The bridge across Tenas Creek was also damaged. A Bailey bridge was put in downstream from the point where Tenas Creek flows into Goathorn Creek.

On June 15, Foss bridge in the Driftwood Canyon washed away, leaving several families stranded. A Bailey bridge later replaced the bridge. One family in the Upper Driftwood was evacuated by helicopter on June 15. Very high floodwaters and logjams on Driftwood Creek caused considerable erosion adjacent to the Fred Seychuk residence. The creek channel moved to within 2 m of the building, posing a threat to the house in future high flows. Approximately 100 m of streambank was left unprotected and actively eroding.

In the Driftwood area, additional damage included the destruction of unauthorised irrigation and domestic water systems on the Jim Shorter property; older front portion of a house on the Mike Rosger property was now very close to the creek bank; immediately upstream of the Lester property, and old, reportedly inadequate, timber bridge washed out and was deposited, along with other debris, on the Lester property. Floodwaters completely surrounded the

log home, which was undamaged but the yard and garden suffered severely. Downstream from Lister's, damage to the Fred Coles property was limited to fencing and loss of land.

A considerable quantity of wood debris blocked the Canyon Creek channel immediately upstream of the Babine Lake Road crossing. It resulted in gravel deposition, lateral relocation of the channel towards the left bank (Schwegler property) farm buildings and overbank flow, which threatened the farmhouse and downstream hayfield. Of major concern to the owner was the loss of burial of his industrial-domestic water intake-pump system adjacent to the farmyard.

Downstream from the highway crossing of Canyon Creek a cut-off channel developed, which resulted the isolation or destruction of at least eight domestic water intake-pump systems. A further four or more might suffer water quality problems as the water table drops and groundwater being of poor quality in this area.

Unusually severe localised damage, mostly to water supply intakes, left a number of properties and one dairy farm without proper water supplies. Based on a very cursory assessment, the estimated repair costs were: water supply system: \$28,000; channel restoration: \$1,000; riprap/erosion control: \$17,000 and property cleanup \$1,000 for a total of \$47,500. (Nesbitt-Porter).

Several bridge approaches on Forest Service roads (FSR) were washed out, causing at least \$24,000 damage. On the Telkwa FSR, the Cumming and Jonas bridges sustained \$1,500 damage each. On the Houston-Walcott FSR total damage to the Dockerill and Emerson bridges totaled \$5,000. On the Blunt Creek FSR, damage to the Blunt Creek bridge was about \$11,000. Two or three bridges on the McDonell FSR, were damaged for a total of \$5,000 (S. Tehara, pers. comm.). At 19 km on the Morice River FSR, a large section of road collapsed, closing the road for several days. The "massive" slide was still active on June 25. According to B.C. Forest Service Morice District Manager Arnold Amonson, the whole hillside was moving. Crews were working to drain the hill of water and to rebuild the slumped road.

*1) A record 55 mm of rain in 24 hours broke the June 24-hour record of 29 mm. This intensity, even without snowmelt, will produce fall-winter period floods. (Ministry of Environment).

October 1-5, 1986

Event type: Debris slide.

Precipitation: Prince Rupert M. Circ (182.8 mm/5 days), October 1-5, 1986; Kildala (32.6 mm/1 day), October 2, 1986; Prince Rupert (257.1 mm/4 days), October 2-5, 1986; Hartley Bay (172.8 mm/3 days), October 3-5, 1986; Falls River (63.4 mm/1 day), October 4, 1986; Nass Camp (69.6 mm/2 days), October 4-5, 1986; Stewart A (96.2 mm/2 days), October 4-5, 1986.

Source: File M51-651-705180, Debris Flow Hwy. 37A (Airphoto BC 5425 No. 018). B.C. Ministry of Transportation and Highways, Terrace

On October 5, a debris slide came down on Highway 37A between Meziadin-Stewart. The debris flow, consisting of cobbles, boulders, and saturated tills, was about 100 m wide. It started running in the evening and at 11:30 p.m. the road was officially closed. In the 24-36 hours before the slide, Stewart recorded approximately 125 mm of rain.

October 26-28, 1986

Event type: Flooding.

Precipitation: Kitimat Townsite (73.0 mm/2 days), October 26-27, 1986; Kitimat 2 (115.4 mm/3 days), October 26-28, 1986; Prince Rupert M. Circ (64.4 mm/3 days), October 26-28, 1986; Terrace A (37.6 mm/2 days), October 27-28, 1986.

Source: Environment Canada 1991; Bruce Easton, pers. comm. April 19, 1994. CN Rail Prince George.

The south abutment of the two-truss steel railroad bridge across the Wedeene River washed out. The bridge tipped in and settled under an angle, necessitating a 2-6 in. (5-15 cm) concrete wedge (Easton, pers. comm.).

On October 28, the Little Wedeene River below Bowbyes Creek and the Kitimat River below Hirsch Creek recorded maximum instantaneous discharges of 170 and 712 m³/s, respectively. On the same day, these rivers recorded maximum daily discharges of 90.6 and 575 m³/s, respectively (Environment Canada 1991).

July 26-August 3, 1987

Event type: Flooding.

Precipitation: Chetwynd (197.6 mm/ month of July); (51.0 mm/12 hours), July 26, 1987; (30.0 mm), subsequent July precipitation; (63.6 mm/24 hours), August 1, 1987.

Source: *The Pioneer*, August 4 and 11, 1987; *Chetwynd Echo*, August 4 and 11, 1987; *The Vancouver Sun*, September 14, 1987; Nesbitt-Porter 1987; File 55.5020 Chetwynd and South Taylor Flooding-1st August.

Between July 31-August 1, following weeks of unseasonably heavy and prolonged wet weather in northeastern British Columbia, intense rainfall resulted in extensive flood damage to watercourses and property. On July 26, Chetwynd recorded 51 mm of rain in a 12-hour period. It was followed by a light continuous rain, which added another 30 mm. Then on August 1, 63.6 mm fell in a 24-hour period on saturated soils and creeks with higher than normal levels.

On the evening of July 28, Dokie and the Wildmare area were hit by heavy rain and marble-size hailstones. The hailstones accumulated in some ditches nearly 1 ft. (30 cm) deep. Corn crops, wheat fields and greenhouses were ruined throughout the area. Many berry bushes and trees were totally stripped of their just ripening fruit and leaves.

Between early August 1-4, Chetwynd recorded more than 2 in. (50 mm) of rain. More than 6 in. (150 mm) of rain fell during a weeklong period. On July 31-August 1, Chetwynd was hit by flooding causing an estimated \$500,000 damage. *1) Hardest hit was the area around the post office. Damages in the Chetwynd district were estimated at \$680,000. *2) Several businesses flooded, roads washed out, bridges collapsed and many residences suffered minor to severe damage.

Commotion Creek overflowed its banks, affecting three culverts and stalling traffic on Highway 97, 15 mi. (24 km) west of Chetwynd. Most damage occurred in the vicinity of the District of Chetwynd but also in areas as far east as Pouce Coupe and as far north as the Fontas River. Initial restoration cost was estimated at \$733,000. (Province of British Columbia, File P87-7).

Flooding problems occurred in the Chetwynd-Moberly Lake area (including creeks crossing Highway 97 further east); near the Villages of Pouce Coupe and Taylor; at the Halfway River Indian Band Lands and at the Indian communities of Kahntah and Fontas and along the Fontas River southeast of Fort Nelson.

Preliminary indications were that most of the damage was sustained as a result of wood and gravel debris blockages of culverts and stream channels, and not because these facilities were otherwise inadequate.

Numerous Dokie residences suffered damage from two flooding creeks. At least one house lost its foundations and tipped over. Following the announcement that Highway 97 would reopen on August 1 at 4 p.m., a mile-long traffic jam occurred at Dokie. Flooding streams re-routed themselves, washing out fences and driveways. A washed out culvert at Hillview Access Road, 1 mi. (1.6 km) west of Chetwynd left several families cut off.

On the evening of July 28, the Dokie and Wildmare areas west of Chetwynd was hit by heavy rain and "marble-size" hailstones. In one ditch, hailstones accumulated nearly 1 ft. (30 cm) deep. Leaves were torn off trees and shrubs. This summer hailstorm ruined corn crops, wheat fields, gardens and greenhouses. Many berry bushes were totally stripped of their just ripening fruit. Property owners in Dokie were hit by the flooding of two creeks. Numerous residences suffered damages and at least one house lost its foundations and tipped over.

Starting about 9 a.m. on August 1, Commotion Creek overflowed its banks and eventually stalled traffic on Highway 97, 15 mi. (24 km) west of Chetwynd. The highway was finally closed after the bridge at Dokie, about 6 mi. (9.6 km) west of Chetwynd washed on the afternoon of August 1. Other flooding streams closed Highway 29 north towards Hudson's Hope and south towards Tumbler Ridge.

On the night of August 1 and the morning of August 2, heavy rain caused flooding and an estimated \$680,000 of damage in Chetwynd. Not since the early 1970s had the town of 2,500 been hit so hard by rain and subsequent flooding. Runoff water severely affected culvert and bridges. Gravel washed out from the bases of several, including Windrem and Centurion Creek bridges. Large trees and other floating debris plugged near the Post Office, destroying the road pavement. When the creek re-routed severe flooding occurred to several buildings on the South Access Road.

Hardest hit was the area near the Post Office, where a culvert in Windrem Creek was too small to handle the volume of water, and the Kal Tire/Red Rooster area where the BC Rail tracks prevented the water from escaping. The Northern Lights College and the BC Rail line also flooded.

On the access boulevard and around the Red Rooster store small lakes formed. The Legion Subdivision was nearly flooded when Centurion Creek flooded and destroyed the footbridge. When the creek found a new route, severe flooding occurred to several buildings on the South Access Road. The sanitation sewer trunk line with aerial pipes crossing Centurion Creek washed out. It was replaced by an inverted siphon system with pipes placed under the creek.

Near Northern Metallic and Kal Tire, floodwaters severely damaged the pavement. At the old Windrem Creek dam near the Chetwynd Public Campground waterfalls were formed. Some families at Hillview Road were isolated after floodwaters washed out the culvert. The sanitation sewer trunk line, with aerial pipes crossing Centurion Creek, washed out. It was replaced with an inverted siphon system, where the pipes are placed under the creek.

The cages along the bridge by Dixied Lee, and the industrial subdivision where the culvert was also too small to handle the extreme flow, would have to be replaced by larger ones. A beaver dam backed up water into one of the town's trailer parks, but once the dam broke, the water went down in 40 minutes.

At about 9 a.m. on August 2, serious highway flooding started at the Commotion Creek turnoff on Highway 97.

Bisset bridge, west of Chetwynd on Highway 97 washed away and the road was closed briefly. On August 3, Dokie bridge washed out, causing traffic to line up for miles before a temporary bridge could be put in. On August 1, the 36-in.culvert at Fernando Creek was partially submerged and there was evidence that it was plugged with debris.

Watercourses impacted included: Boulder Creek; Commotion Creek; Stone Creek; Bissett Creek; Wildmare Creek; Fernando Creek; Unnamed Creek; Windrem Creek; Widmark Creek; Centurion Creek; Medicine Woman Creek; Le Bleu Creek; Pingel Creek; 8-Mile Creek; Halfway River; Townsend Creek; Prespatou Creek and Rolla Creek, Tremblay Creek and Meikle Creek.

Deposition of Boulder Creek bedload in the Pine River, at their confluence immediately upstream from a secondary road crossing plugged the channel of the Pine River to an average depth of about 3.5 m. Being plugged from the left bank to mid channel, the flow was diverted towards the eroding right bank. It endangered a cabin, the highway bridge and to a lesser extent, a nearby house. Estimated cost to remove 4,500 m³ of gravel was \$22,000.

At Commotion Creek, significant damage was confined to the vicinity of three Highway 97 culverts. At Stone Creek, MOH completed the clean-up work, including the restoration of the private driveway to Paula John's mobile home. Bissett Creek suffered very severe damage as a direct consequence of log jam formation throughout an approximately 700-m reach upstream from the Highway 97 crossing. Here, properties on both banks were directly endangered; those on the left bank, including a small subdivision or mobile home park, from erosion and the one on the right bank (Embree's house and small mill) from overbank flow, surface scour and deposition. A small house belonging to the Martensons was balanced precariously on the left bank and was uninhabitable. Downstream from the highway, much of the creek is bound by Provincial Park Reserve where restoration is not believed to be necessary. Estimated cost to burn logs or restore channel upstream was \$18,000.

On the right bank of Wildmare Creek upstream from Highway 97, rapid erosion posed a potential threat to the Jim Schillings home and, further upstream, massive log jams resulted in channel relocation and posed a direct threat to both the Schillings' home and to a mobile home, contractor's yard and storage building. Estimated cost to restore channel and riprap the Schillings home \$40,000. Downstream from Highway 97, the channel of Wildmare Creek infilling occurred adjacent to the Sangha home, resulting in extensive right overbank flow and bedload deposition. Estimated cost for channel restoration \$5,000. Unnamed Creek west of Chetwynd, a small creek culvert under Campbell Road, infilled both sides of the road culvert and downstream of the McLaughlin house.

In the Chetwynd District, Windrem Creek caused the majority of the flood-related problems within the Municipality. Upstream of the Ski Lodge/Rod and Gun Club, significant erosion of the channel's right bank took place in the cleared land used for shooting ranges. Estimated cost for 650 m³ riprap was \$16,000; Adjacent to the lodge, right bank erosion area adjacent to the main buildings and from which, as a precautionary measure, a mobile home was removed, required 330 m³ riprap estimated at \$8,000. The access road to the lodge and gun club washed out partially after the creek slightly changed channels. At the Municipal Campsite immediately downstream from the old Windrem Creek dam the left bank eroded. Estimated cost on the North Access Road Crossing, repairs to the bridge support structure, gabion basket approach and downstream wingwalls, replacement of two footbridges and minor channel restorations was \$60,000. 50th Street crossing and BC Railway crossing washed out.

Restoration cost of Widmark Creek was \$45,000. (KLM Engineering Ltd.). An 11.5-m high culvert on Centurion crossing the BC Railway line Dawson Creek failed. A 96-in. multi-plate culvert and two 48-in. dia. culverts replaced the previous three 48-in. dia. culverts. Downstream, at the Highway 97 crossing, two footbridges were swept away and a sewer crossing was destroyed, while, further downstream, evacuations were necessary. The estimated cost of restoration was \$67,000 (KLM Engineering Ltd.);

In the Moberly Lake area north of Chetwynd: Medicine Woman Creek: extensive damage to private properties resulted when the Highway 29 pipe-arch culvert plugged with debris, diverting floodwater east along the highway before it passed through local drainage culverts under the highway. Camp Sagatawa was but one of the nine or more downstream properties to suffer damage. Le Bleu Creek: problems in this area resulted from extremely high runoff rather than debris blockages. Overbank flow caused damage at the Lobergs property. Further upstream, the Anderson property suffered extensive flood damage from overbank flow.

In the Pouce Coupe area: estimated cost bedload deposition leading to left bank erosion Millsap property \$18,000. Regional District Park right bank erosion protection totally destroyed throughout its former 110-m length downstream from the Highway 2 bridge crossing. Estimated riprap replacement cost \$30,000.

Near Taylor, Pingle Creek was the most seriously damaged of all the areas visited. Upstream from the Highway 97 bridge, much of the original channel throughout the first 1,300 m upstream from the highway was completely infilled with silty-sand, balls of clay and massive quantities of wood debris. Estimated cost to re-excavate the channel and riprap left bank for 150 m was \$44,000. 8-Mile (Tower) Creek: overbank flow was reported to have caused crop damage. Flooding at the confluence of the Kahntah and Fontas rivers resulted in some property damage. A huge log jam at the BC Railway crossing is believed to have been responsible for upstream flooding which damaged two houses in the Fontas Indian Community-Fort Nelson I.B. In case of the old house, floodwater was 2+ m above the floor level and in the new house it was 1.2 m deep. Band members reported additional logjams further downstream. They attributed them to material moved from upstream of the bridge by BC Railway. Halfway River: Indian and Northern Affairs reported a total loss of riprap protecting the community water intake, and a change in the main channel which is directing the flow at the intake. Rain and high water were both reportedly continuous through to at least August 13; Townsend Creek (tributary to Halfway River): the timber bridge crossing to this Christian Community (Shilo Ranch) washed away, which was not an infrequent occurrence. On Prespatou Creek a problem was reported, possibly a debris jam. Rolla Creek: crop damage was reported as a result of a creek blockage.

All BC Rail traffic halted after floodwaters covered the tracks with debris. In several locations, foundations washed out up to 10 ft. (3 m) under the track. Floodwaters washed out the bridge over Bissett Creek, making Highway 97 impassable. Bissett Creek suffered very severe damage due to the formation of a logjam throughout an approximately 700-m reach upstream from the Highway 97 crossing. Properties on both banks were directly endangered. Those on the left bank, including a small subdivision or mobile home park, from erosion and the one on the right bank (Embree's house and a small mill) from overbank flow, surface scour and deposition.

After the bridge at Dokie, about 6 mi. (9.6 km) west of Chetwynd washed out on the afternoon of August 1, the highway was later closed to all traffic. Other flooding creeks caused the closure of Highway 29 North toward Hudson's Hope

and Highway 29 South to Tumbler Ridge. The road closures affected hundreds of southbound vehicles. A number of stranded motorists were evacuated by helicopter from isolated areas.

On the morning of August 1, just before the lakeside road washed out, the Moberly Lake provincial campground at was evacuated. When flooding rivers caused Moberly Lake to rise rapidly, 50 people were evacuated from Camp Sagatawa and five camping units. Waves up to 3 ft. (90 cm) high were forced over its shore. Five people were evacuated by boat from the south side of the lake. Camp Sagatawa was inundated by a 3-ft. (90 cm) stream, which became 30 ft. (9 m) wide. Near Camp Sagatawa, Highway 97 was threatened. Near Sagatawa, an 8-ft. (2.4 m) culvert at Medicine Woman Creek became plugged. Near Moberly, Le Bleu Creek washed out the approach to the bridge by Ken's Place.

The gravel road between Highway 29 and the park washed out in four places, including the Martin Creek bridge, and was not expected to be repaired within two or three weeks. After both approaches to the Martin Creek bridge washed out, about 20 Sukunka River campers were cut off from Highway 29. On August 2, 19 people were evacuated by helicopter: 14 campers staying at the Sukunka Falls Provincial Park and five hikers at Kinuseo Falls. A local resident rescued a two-year old child from a camper hung up on the edge of a collapsed bridge.

*1) According to Mayor Charlie Lasser, an increase in the number of settling ponds along the creek which passes through Chetwynd would remedy the problem of accumulated gravel during the flood (*Chetwynd Echo*, August 11, 1987).

*2) The provincial government approved \$6 million in assistance for victims of the July flooding in Chetwynd, Dawson Creek, Fort St. John, Fort Nelson and Tumbler Ridge. The money was to compensate residents and businesses and cover repair to roads, bridges and creeks (*The Vancouver Sun*, September 14, 1987). On September 10, 1988, Order in Council 1797 was approved in response to the extensive damage that occurred in the northeast of British Columbia, ordered relief to an amount not to exceed \$6 million under the Flood Relief Act.

September 17-21, 1987

Event type: Rain-on-snow flooding.

Precipitation: Hartley Bay (294.6 mm/2 days), September 19-20, 1987; Kemano (165.0 mm/2 days), September 19-20, 1987; Kildala (195.7 mm/2 days), September 19-20, 1987; Langara (105.4 mm/3 days), September 17-19, 1987; Bella Coola (52.2 mm/1 day), September 19, 1987; Kitimat Townsite (201.1 mm/2 days), September 19-20, 1987; Kitimat 2 (225.8 mm/2 days), September 19-20, 1987; Prince Rupert M. Circ (170.2 mm/3 days), September 19-21, 1987; Prince Rupert (142.0 mm/3 days), September 19-21, 1987; Terrace (162.6 mm/3 days), September 19-21, 1987; Falls River (203.0 mm/3 days), September 19-21, 1987; Nass Camp (59.4 mm/1 day), September 20, 1987; Terrace (100.4 mm/1 day), September 20, 1987.

Source: *The Daily News*, September 21, 1987; *Northern Sentinel*, September 24, 1987; *Terrace Review*, September 23, 1987; *The Interior News*, September 30, 1987; Environment Canada 1991; Brent Smith, pers. comm. Skeena Cellulose, Terrace.

On September 20, Terrace recorded 100.4 mm of rain in 24 hours. The heavy rain caused snowmelt at higher elevations. Highway 16 between Prince Rupert-Terrace had water pooling along the railroad track for a distance of 8 km. Highway 16 between Terrace-Hazelton was closed by a washout at Whiskey Creek, 14 km west of the Kitwanga junction. The site of the washout had 3 ft. (90 cm) of water on the road. Heavy rains caused gravel and debris to plug the culvert. The creek bed rose 16-20 ft. (4.8-6 m) when thousands of yards of debris were deposited, forcing the highway to flood. Some \$50,000 was spent to clear the culvert. The highway reopened late on September 21. Minor problems were also reported from other locations. Flooding at Williams Creek closed highway 37 between Terrace-Kitimat. *1) The traffic was rerouted via the old Lakelse Road. The rail line between Terrace-Kitimat was out of service for three to four weeks.

On September 21, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 2,170 m³/s and a maximum daily discharge of 1,530 m³/s (Environment Canada 1991). The Kitimat River changed its course and damaged the foundations of the Kitimat River bridge.

Skeena Cellulose reported about \$60,000 damage to its logging roads. Major washouts occurred between Kilometres 45-47 on the road between the Clore-Kitnayakwa. Replacement of culverts on the Kleanza road cost some \$20,000 (B. Smith, pers. comm.).

The PNG pipeline between Kitimat/Terrace-Prince Rupert was cut by severe erosion in the Copper River Valley.

*1) The highway between Terrace-Kitimat was originally known as Highway 25. It was later renumbered Highway 37 to link Kitimat up with the existing Highway 37 between Kitwanga and the Yukon border. Thus, Kitimat was made the southern point of this north-south highway link.

July 1988

Event type: Debris slides.

Precipitation: Not available.

Source: Coates 1992 (p. 257); Evans and Clague 1989; Trenhaile 1998..

In July, heavy rainfall caused widespread landsliding over a large area of the northern Cordillera. The heavy rainfall resulted in numerous debris flows and related sediment-water flow processes that severed the Alaska Highway in three areas: Muncho Lake, B.C., Rancheria and Kluane, Y.T. The events paralysed travel in the region for several days (Evans and Clague 1989; Trenhaile 1998).

A major portion of the highway along the west shore of Kluane Lake was buried under a mountain slide. It took many days to dig the muck off the road surface and to stabilise the hillside sufficiently to protect against further slides. Traffic again piled up at both ends of the blockage, although many escaped by driving around by way of Dawson City, the Top of the World Highway, and Richardson Highway in Alaska to Teslin Junction on the Alaska Highway (Coates 1992).

In the vicinity of Muncho Lake, debris flows originating in the steep watersheds of the Sentinel Range of the Rocky Mountains severed the highway at six locations. At Kluane Lake, debris flows and debris avalanches severed the highway in numerous places. At one location, near the Slims River, a debris flow covered over 500 m of highway. The direct cost of restoring the Alaska Highway was in the order of \$1.8 Million in 1988 dollars (Evans and Clague 1989). *1)

*1) These events point out the vulnerability of transportation facilities in mountainous terrain where the location of routes necessarily involves the traversing of active geomorphic surfaces.

August 1, 1988

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Eero Karanka, pers. comm. February 21, 1994. Habitat Biologist, Department of Fisheries and Oceans, Prince Rupert.

On August 1, the lower lake on the Tulsequah Glacier drained (Karanka, pers. comm.). *1)

*1) There are two lakes on Tulsequah Glacier that drain by jökulhlaup; the one described by Marcus (1960) and another lake further up the glacier. The latter should not be confused with Upper Lake Tulsequah described by Marcus (1960) (Karanka, pers. comm.).

September 16, 1988

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Eero Karanka, pers. comm. February 21, 1994. Habitat Biologist, Department of Fisheries and Oceans, Prince Rupert.

On September 16, the upper lake of the Tulsequah Glacier drained (Karanka, pers. comm.). *1)

*1) Based on WSC data, other drainings may have occurred on August 17, 1989, July 19 and August 20, 1990. The drainings are detectable in the WSC data only since 1988, when the gauging station was moved from upstream to downstream of the Tulsequah River junction (Karanka, pers. comm.).

September 26-29, 1988

Event type: Flooding.

Precipitation: Hartley Bay (357.2 mm/3 days), September 26-28, 1988; Prince Rupert (75.0 mm/1 day), September 27, 1988; Pallant Creek (234.6 mm/2 days), September 27-28, 1988; Prince Rupert M. Circ (121.4 mm/2 days), September 27-28, 1988; Falls River (180.2 mm/2 days), September 27-28, 1988; Kemano (114.4 mm/2 days), September 27-28, 1988; Kildala (172.9 mm/2 days), September 27-28, 1988; Kitimat 2 (204.2 mm/2 days), September 27-28, 1988; Kitimat Townsite (180.5 mm/2 days), September 27-28, 1988; Bella Coola (149.8 mm/2 days), September 27-28, 1988; Sewell Inlet (222.2 mm/2 days), September 27-28, 1988; Sandspit A (36.6 mm/1 day), September 28, 1988; Nass Camp (62.4 mm/1 day), September 28, 1988; Terrace (106.6 mm/1 day), September 28, 1988; Smithers A (59.4 mm/2 days), September 28-29, 1988.

Source: *The Daily News*, September 29, October 21, 1988; *Northern Sentinel*, September 29, 1988; *The Coast Mountain Courier*, October 5, November 30, 1988; *The Terrace Standard*, October 5 and 19, November 2, 1988; *The Interior News*, October 5, 1988; *The Province*, October 21, 1988; Environment Canada 1991; Initial Report by Ministry of Environment –Rivers Section File P88-6, Task 890895; Eurocan Pulp & Paper Co. Ltd., Annual Report 1988 T.F.L. 41, Kitimat; Brent Smith, pers. comm. Skeena Cellulose, Terrace; Memorandum, October 4, 1988, Archie MacDonald (Skeena Cellulose, Terrace) to Ted Wilson (B.C. Min. For., Terrace); Pacific Northern Gas, Terrace) Repair Costs for Copper River; Letter, October 31, 1988, Ted Wilson (Engineering Assistant B.C. Min. For., Terrace) to Dean Moneray (Manager, Coastal Sector Provincial Emergency Program) Vancouver. Damage Report for September 29-30, 1988.

On August 29 following heavy rains, severe flooding occurred in a number of watersheds in northwestern British Columbia. A two-day storm hit Terrace and Kitimat, with winds gusting up to 100 km/h. Kitimat reported 5.5 in. (139.7 mm) of rain in 24 hours and Terrace reported 4 in. (101.6 mm) on September 28. The storm brought heavy

winds to Terrace, Kitimat, and Burns Lake. The storm damage in the Terrace area was estimated to amount to \$800,000. *1)

On September 29, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 2,710 m³/s and a maximum daily discharge of 1,300 m³/s (Environment Canada 1991). Kitimat suffered flooding, as sewers backed up and flooded basements. The intersection of Columbia Street and Yukon Street had up to 2 ft. (60 cm) of water on the road because of an overloaded drainage system. Hirsch Creek Park sustained severe erosion and in the Cable Car area roads were undermined. The access and power to Kitimaat Village were cut. The Village road washed out 2 mi. (3.2 km) past Minette Bay and a section of road at Minette Bay washed away. The bridge across Wathl Creek went out, the third time this happened since 1965. It was swept down the creek into Douglas Channel. The village was cut off for more than four days until the Ministry of Highways installed a Bailey bridge. The Alcan water cooling system was damaged, causing delays in the smelter production line. The Anderson Creek pumphouse flooded with 4 ft. (1.2 m) of water. Anderson Creek changed course, flooding the Alcan road with up to 3 ft. (90 cm) of water. The road at the Alcan Tour building was blocked by a mudslide.

Prince Rupert experienced power interruptions in several areas of the city. Portions of Port Edward were without power for up to 10 hours. North of Prince Rupert, two large debris slides occurred at Silver Creek.

In the Terrace area, some power interruptions occurred. The Kalum Lake Road was closed, cutting off the residents of Rosswood. The bridge at Clear Creek washed out and the Camp Creek bridge was eroded and damaged. Flooding at New Remo left the Zymacord River much closer to the training berm. Williams Creek and adjacent creeks but there was no readily apparent damage to structures or private property. Hirsch Creek flooded and damaged gabion basket bank protection within District of Kitimat park area. In the Dutch Valley area west of Terrace, erosion of high bank was evident that might lead to future flooding problems.

Logging roads in the Terrace area sustained heavy damage. Skeena Cellulose (SCI) reported to have spent some \$250,000 on repairing flood damage on the Copper River Forest Service road between the Clore-Kitnayakwa. Numerous washouts occurred between 41-48 km. In addition, some \$70,000 was spent on the road below the Clore River where almost every culvert had to be replaced. Replacement of culverts on the Kleanza road totaled some \$50,000 (B. Smith, pers. comm.). SCI estimated the cost of emergency repairs, including for the Nass Mainline from 50 km to Nass Camp and west to Greenville bridge, to be \$19,700. Flood damage to its south unit (including the Copper, Kleanza, Zymacord, Williams, Chindemash and St. Croix rivers was estimated at \$261,000). Estimates for their north unit (including at Mainline 73 km, Br. 5000, Br. 4600, 4 km, and various other locations) totaled \$74,500 (A. MacDonald). Eurocan reported a repair cost of \$160,000. An additional \$11,318.65 was claimed under Section 88 of the Forest Act. The total cost included \$69,000 for the replacement of culverts and \$83,000 for bridge repair and gravel.

Flooding occurred on the Lakelse White Bottom road in the usual area: the Forest Service campsite, west of the Lakelse River bridge, km 17 on the Lakelse Main. In the Lower Kitimat Valley, the north approach of the temporary bridge at Cecil Creek went out. On the Main line at 76 km, several washouts occurred at bridges just north of Kitimat. The new bridge at Hunter Creek in the Upper Kitimat Valley plugged up. The creek diverted down the new grade for over 500 m, totally destroying the grade. On the West Kalum, logjams in the Nelson and Beaver rivers caused extensive flooding. About 1 m of new material was deposited on the grade. Several people were stranded temporarily. The south sill and approach of Tumbling Creek were slightly undermined. On the Nass FSR damage occurred at the Kiteen River on the north approach of Ginniltkin Creek went out. Major culverts on the Kleanza FSR failed at km 4, 6, 14, 19, and 20, causing total washouts. Numerous minor culverts plugged up, flooding the road. On the Copper River FSR in many locations, flooding and shoulder erosion occurred and riprap was lost. At km 24, the east approach of Simpson Creek washed out. The shoulder of the east bridge approach of Matson Creek went out. The substructure of the Clore River bridge at 41 km was damaged. At 50 km, both approaches of the Kitnayakwa River went out.

Storm damage to Forest Service roads (FSR) in the Prince Rupert Forest Region totaled \$333,000. Major damage occurred on the Telkwa FSR where the bridge approach at Jonas Creek and 300 m of rock armouring washed out (\$39,000); Kleanza FSR (\$46,000); Copper FSR (\$171,000 total, including armour washout at km 30: \$18,000, and rip-rap repairs at km 42, 45.5, 46 and 48: \$62,000); Upper Kitimat FSR, where at km 28 Hunter Creek changed channel and washed out the road (\$25,000).

Pacific Northern Gas reported \$521,945 damage to its pipeline along the Copper River. Major damage occurred at MP 247.5 (km 39.8) where the floating pipeline required relocation for 0.5 km. At MP 244.2 (km 46), the washed-out river crossing needed 200 m of rock dike and fill.

Highway 16 between Kitwanga-Telkwa sustained minor damage, mainly from plugged culverts. Smithers reported over 60 mm of rain during the night of September 28-29. Some creeks in the area overflowed and caused damage to roads, rail lines and telephone and hydro lines. West of Smithers, flooding occurred in the Slack and Nielsen roads area, where roads washed out and basements flooded. Biggs Creek at the end of Nielsen Road flooded, dumping gravel on driveways in the neighbourhood. Mud, rock, and debris plugged culverts along Nielsen and Slack roads. Some residents had their driveways washed away. Power outages occurred because of downed trees. Lines to the Ski Hill road and the transmitters on Mt. Harry Davis near Houston were out. Most of the damage occurred on the south

side of the Bulkley River. Near Telkwa, Goathorn Creek had most of its approach washed away. Approximately 400 ft. (120 m) of Coalmine Road near the beginning of the logging road washed away.

The extensive bedload movement in the Kitimat, Copper, and Zymacord rivers caused heavy damage to the salmon spawning grounds. The flood impact on the salmon reproduction had yet to be determined.

On September 29, the Bella Coola River above Burnt Bridge Creek recorded a maximum instantaneous discharge of 681 m³/s and a maximum daily discharge of 526 m³/s. On the same day, the Salloompt River near Hagensborg recorded similar readings of 170 m³/s and 78.1 m³/s, respectively (Environment Canada 1991). Near Bella Coola, a portion of the main road into Salloompt was closed by flooding, stranding residents on one side. The schools shut down and some families in the Salloompt area were evacuated. High water threatened one residence, formerly Ounpuu's Lean-To cafe. *2)

The northwest B.C. flooding covered the following watercourses: in Bella Coola area: Nusatsum River; Thorsen Creek; in the Kitimat-Terrace area: Granite Creek; Shames River; and in the Smithers area: Haddow Creek; McKinnon Creek; Simpson Creek, Biggs Creek; Telkwa River; Glacier Gulch Creek; Furlong Creek; and the Mount Layton Hot Springs Waddy Project for a total program expenditure of \$160,460.99 (shareable) and \$121,791.06 (Non-shareable). The initial report by the Ministry of Environment included:

Bella Coola area: Nusatsum River tributary upstream of highway: loss of riprap: \$2,000; Nusatsum River at Douglas Road North: apparent loss of 50 m of berm and riprap: \$34,000; and Thorsen Creek: gravel removal and repairs to separation berm downstream of highway bridge: \$10,000. The damage to riprap adjacent to the highway between Firvale-Burnt Bridge (\$37,000) was not included, nor were extensions totaling \$120,000. The impending problem area on right bank of Bella Coola upstream of Salloompt River was estimated to cost in excess of \$140,000 for riprap and dyke not justifiable under PEP.

Kitimat-Terrace: Site 4, Granite Creek-Lakelse Lake area: work on eight locations mainly replacing riprap, and downstream of 1st Ave. bridge excavation of flood-deposited gravel for a total cost of \$203,000; Site 5, Shames River: \$25,000. Flooding at New Remo left the Zymacord River much closer to the training berm. Williams Creek and adjacent creeks flooded but there was no readily apparent damage to structures or private property. Hirsh Creek flooded and damaged gabion basket bank protection within the District of Kitimat park area.

*1) On October 20, 1988, Order-in-Council 1957 was approved in response to the extensive damage that occurred in the northern region of British Columbia, ordered relief to an amount not to exceed \$3 million under the Flood Relief Act. The provincial government made \$3 million flood aid available for victims of flooding in Terrace, Kitimat, Hazelton, Smithers, and surrounding areas between September 27-29. Portions of the assistance were to go to the repair of roads, bridges, and creeks. Small businesses and municipalities were also eligible for assistance. (*The Province*, October 21, 1988)

*2) A flood control lobby was formed as a direct result of the flooding. There were major concerns over potential future flood damage in the Salloompt and Hagensborg areas.

October 20-22, 1988

Event type: Flooding and mudslide.

Precipitation: Nass Camp (52.6 mm/1 day), October 20, 1988; Kildala (59.8 mm/1 day), October 20, 1988; Prince Rupert M. Circ (105.9 mm/1 day), October 20, 1988; Pallant Creek (157.6 mm/2 days), October 20-21, 1988; Sandspit A (46.4 mm/2 days), October 20-21, 1988; Hartley Bay (154.4 mm/2 days), October 20-21, 1988; Kemano (73.4 mm/2 days), October 20-21, 1988; Falls River (182.4 mm/3 days), October 20-22, 1988; Prince Rupert M. Circ (174.2 mm/3 days), October 20-22, 1988; Prince Rupert (111.2 mm/3 days), October 20-22, 1988; Kitimat 2 (167.8 mm/3 days), October 20-22, 1988; Sewell Inlet (44.4 mm/1 day), October 21, 1988; Terrace (59.0 mm/1 day), October 21, 1988.

Source: *The Daily News*, October 21, 1988; *The Terrace Standard*, October 26, 1988.

Prince Rupert reported 73.4 mm of rain in 24 hours and winds of 45 km/h with gusts up to 70 km/h. The Kitimat-Terrace area recorded over 100 mm of rain and winds gusting up to 100 km/h. In Terrace, a small mudslide occurred at the Skeena View hill. Plugged drains caused minor flooding.

On Highway 16 between Prince Rupert-Terrace, the Skeena River caused flooding conditions between the Tyee overpass and the Khyex River bridge.

On the Queen Charlotte Islands, the power was interrupted for several hours.

January 23-29, 1989

Event type: Snow (fatal) avalanches.

Precipitation: Kitimat Townsite (149.4 mm/5 days), January 23-27, 1989; Kitimat 2 (298.0 mm/6 days), January 23-28, 1989; Stewart A (179.8 mm/3 days), January 24-26, 1989; Prince Rupert M. Circ (178.8 mm/4 days), January 24-27, 1989; Nass Camp (169.0 mm/4 days), January 24-27, 1989; Pallant Creek (170.1 mm/3 days), January 25-27, 1989; Kildala (109.5 mm/3 days), January 25-27, 1989; Falls River (152.8 mm/2 days), January 26-27, 1989; Sandspit A (33.4 mm/1 day), January 28, 1989; Bella Coola (134.8 mm/2 days), January 28-29, 1989.

Source: *Northern Sentinel*, February 2, 1989; *The Coast Mountain Courier*, February 8, 1989; *The Daily News*, January 24, 25, 26, 27 and 30, 1989; *The Province*, January 28 and 29, 1989; Jamieson and Geldsetzer 1996 (pp. 171-173); File 859.13 Letter, February 7, 1989, *Ingot*, August 9, 1991; W.E. Southgate (Contract Supervisor Skeena Cellulose, Terrace) to Pacific Northern Gas Ltd. Terrace.

On January 25, an avalanche hit a transmission tower on the main line between Prince Rupert-Terrace and ripped it off its foundations. The Prince Rupert area was served by local generating facilities. On January 26, winds of 40 km/h and gusts up to 55 km/h caused a power outage in the India-Frederick Street area of Prince Rupert. The BC Ferries terminal sustained some damage, delaying the ferries to the Queen Charlotte Islands and Port Hardy. The metal and wooden canopy of the “Dairy Queen” on McBride Street was ripped off by the wind.

An avalanche 80 km east of Prince Rupert blocked and closed Highway 16 and the rail line. The slide, which was 300 m long and 18 m deep, hit a truck. There were no injuries. On January 28, a 40-m long avalanche 82 km west of Terrace blocked the highway and rail line. Highway 16 was closed for 11 hours. On January 29, Highway 16 between Prince Rupert-Terrace was closed intermittently for avalanche control.

The Terrace-Kitimat area reported winds gusting up to over 60 km/h and causing power outages. Residents in the Old Lakelse Road area were without power for six hours. The power in Usk and Kincolith was interrupted by heavy snow dropping trees on the transmission lines.

In January, an avalanche very nearly damaged two transmission line towers in the Kildala Pass. The towers, 113R, a steel tower, and 114L are part of Alcan’s powerline from Kemano to Kitimat (*Ingot*, August 9, 1991).

A small debris slide came down at 31 km on the Copper Road. Skeena Cellulose cleared the slide, which covered the ditch line of the gas pipeline.

Highway 37A between Meziadin Junction-Stewart was open for daylight-only convoy traffic. Highway 37A had over 25 avalanches. Stewart was cut off for over three days. Highway 37 between Meziadin Junction-Bob Quinn was closed by massive snowslides. The biggest slide occurred in the Ningunsaw Pass, approximately 150 km south of Dease Lake. It blocked a stretch of highway three city blocks long. In an interview with *The Daily News*, Jon Buckle, Regional Highways Director, called it the “worst avalanche we have ever seen.” The avalanche broke mature forest, depositing up to 15 m of snow and trees on Highway 37 (Jamieson and Geldsetzer 1996).

On January 28, avalanches at Telegraph Creek, 60 km southwest of Dease Lake, struck a house, killing an 80-year old woman. Another house was demolished and two more were swept off their foundations. On the night of January 24, a heavy storm hit northern British Columbia. One site reported 61cm of snow in a 12-hour period, followed by 140 mm of rain. In low-lying areas such as Telegraph Creek, a mixture of rain and snow fell. On the night of January 27 as the storm continued, the temperature in Telegraph Creek dropped to only 1⁰ C and rose to 3⁰ C on January 28.

Fearing avalanches from the slope directly above, most people in the east part of town had left their homes but the victim had declined to leave her house. Around 2 p.m., two back-to-back avalanches swept down the slope, removing most of the snow and hitting the four houses. The occupied house was demolished. Much of it was pulled 30 m off its foundation and to the edge of the Stikine River. Two other houses were pushed off their foundations as well. The fourth house was partly buried (Jamieson and Geldsetzer 1996).

In the Bella Coola area, a snowslide on Red Hill closed the road for one-and-a-half hours. An avalanche blocked the Fletcher Challenge road in Talchako. An avalanche on Highway 20 between the townsite and the wharf blocked the road for four hours. The heavy wind caused power outages all through the Bella Coola valley.

March 25, 1989

Event type: Fatal icefall.

Precipitation: Not applicable.

Source: *The Daily News*, March 27, 1989; February 24, 1995; *Terrace Standard*, April 5, 1989.

On March 25 at 9:30 a.m., a piece of falling ice instantly killed the driver of a pick-up truck travelling on Highway 16 at Carwash Rock 50 km west of Terrace. *1) The 32-year old man died of massive head injuries. His common-law wife suffered minor injuries. The highway was closed to traffic for about four hours until highways crews were able to clear the ice. Controlled blasts were used to knock the rest of the ice down from the cliff.

*1) Due to the limited availability of space and high environmental impact, reconstruction of the section of highway around Carwash Rock is difficult and costly (*The Daily News*, February 24, 1995).

May 8, 1989

Event type: Non-fatal rock fall.

Precipitation: Not applicable.

Source: *Terrace Review*, November 1, 1898.

On March 8 at 2:30 p.m., a large rock crashed down onto the front of a Ministry of Highways truck passing Glacier Lake between Meziadin-Stewart. The rock, estimated to be at least 6 ft. (1.8 m) across, destroyed all the vehicle’s steering and breaking capability. Out of control, the truck traveled a full 620 ft. (186 m) before coming to rest. In the last 100 ft. (30 m), the vehicle traversed 40 ft. (12 m) of the right shoulder, flew 30 ft. (9 m) through the air

before impacting the embankment. It then proceeded another 30 ft. up the embankment before rolling over on the passenger side in a boulder-filled ditch. Both occupants were wearing seatbelts and escaped serious injuries.

November 7-9, 1989

Event type: Flooding and debris slides.

Precipitation: Falls River (49.8 mm/1 day), November 7, 1989; Hartley Bay (108.2 mm/2 days), November 7-8, 1989; Kildala (63.5 mm/2 days), November 7-8, 1989; Kemano (68.6 mm/2 days), November 7-8, 1989; Pallant Creek (85.4 mm/2 days), November 7-8, 1989; Bella Coola (68.2 mm/2 days), November 8-9, 1989.

Source: *The Vancouver Sun*, November 10 and 13, 1989; *The Province*, November 12, 1989; *Terrace Review*, November 15, 1989; Memo T. Wilson (Fisheries Officer Department of Fisheries and Oceans, Central Coast) to District Supervisor, Prince Rupert; Eero Karanka, pers. comm. February 21, 1994. Habitat Biologist, Department of Fisheries and Oceans, Prince Rupert; Nesbitt-Porter 1989 (p. 15).

On November 7 and 8, torrential rains and near gale force winds occurred throughout southwestern British Columbia. The extremely heavy rainfall resulted in localised flooding in many areas. In the Bella Coola valley, the flooding was limited to the tributaries of the Bella Coola River. Flooding on the Salloompt River caused damage to two homes. (Nesbitt-Porter 1989).

Flooding of Wannock River forced the evacuation of the tiny Rivers Inlet Indian village of Oweekeno. The flooding originated from swollen creeks behind the village, rather than an actual overflow of the Wannock River. On November 7, a Comox-based Canadian Forces Labrador helicopter rescued 15 women and children. They were flown to Port Hardy where provincial emergency services housed them in a hotel. Late on November 9, flooding at Oweekeno had subsided, and there was no apparent danger to the 35 residents that remained behind. Other women and children remained at Rivers Inlet with most of the village men and 12 employees from a nearby logging camp.

Oweekeno Village also suffered severe damage during a debris flow event on the morning of November 9. It started with a major landslide in the headwaters of the creek passing through the village. *1) The flow covered the upper part of the fan above the village with large boulders and timber, destroying stands of mature forest. It deposited large amounts of debris, sand, silt and gravel in a fan 600 yds. (540 m) wide through the village and into the Wannock River. The watertank and one house north of the forestry road were destroyed by rapidly moving debris. Heavy floodwaters charged with finer debris and timber passed through the village and damaged several houses. The storm caused three large debris avalanches and numerous minor ones in the immediate vicinity of Oweekeno Village. Within the 12-km² area representing the lower slopes of drainages immediately adjacent to the community, 18 large slope failures occurred on unlogged terrain. The local intensity of slope failures was as high as seven events per km². The largest debris avalanche triggered the debris flow that hit the community. It was 200 m wide, 420 m long, covered 42,000 m², and had a volume of 30,000 m³ (Hungr and Smith 1990). The storm may have had a return period of 40 years or more for the Rivers Inlet area. This debris avalanche-debris slide was among the largest of similar events observed in the area, and its return period was probably considerably longer than 40 years (Hungr and Smith 1990).

The water level in Owikeno Lake reached approximately 14 ft. (4.2 m). *2) The numerous slides along the shore from the second narrows to the head of the lake caused heavy silting of the water. Turbidity and water colour indicated that all beach spawning might have been unsuccessful. An estimated 40,000 Chinook eggs were lost. At Shotbolt Bay, a debris torrent destroyed the Shotbolt Hatchery facility. Of the 350,000 fry being reared, all but 50,000 were lost. The Kilbella River bridge above the logjam at 9 mile was destroyed. The logjam itself opened up, giving access to the upper river. Numerous small slides and flooding of the river washed out the Chuckwalla Main Line at several locations. Three major debris torrents entering from the east side of the river deposited large amounts of organic debris into the river. This severely impacted the fishery resource. A large 300-ft. (90 m) wide slide near the estuary of McNair Creek blocked the stream with debris, stumps and broken trees. The creek appeared heavily scoured, and another slide may have come down further upstream. A 250-ft. (75 m) wide and 20-ft. (6 m) deep slide near the lower Nekite River came down and blocked the road. The bridge above the Nekite spawning channel was destroyed. The main stem of the river overflowing the intake heavily silted the top one-quarter of the Nekite spawning channel. Near the mouth of Smokehouse Creek a slide occurred.

The severe storm knocked out large sections of BC Hydro powerline in the Nass valley. Power to several locations along the Nass and Bulkley valleys was restored after a few hours. The BC Hydro powerline between the Nass Valley-Kincolith at the mouth of the Nass River was damaged. The about 400 residents of the remote Native Indian village were left without power for several days. *3) Along a 20-km corridor, falling trees and mudslides downed 31 powerline spans and six hydro poles. Due to weather conditions, helicopters were unable to reach Kincolith, which can only be reached by water or air. Kincolith residents, left without power from November 7 until the afternoon of November 12, lost much of their reserves of frozen fish and game. Fifteen linemen with three helicopters were involved in repairing the damage estimated at \$45,000.

Around November 10, a Stewart logging truck driver was killed near Meziadin when his vehicle drove into a rockslide (*Terrace Review*, November 15, 1989).

*1) In early 1990, several houses from the most exposed central part of the fan were relocated and temporary ("primary") dikes were constructed to provide interim protection to the community (Hung and Smith 1990). To protect the village, retaining walls were later built at a cost reported to be around \$1,000,000 (Karanka, pers. comm.)

*2) Extreme lake levels in the past have exceeded 20 ft. (6 m).

*3) This line, which is one of the highest maintenance lines in British Columbia, was installed 10 years earlier at a cost of \$600,000. In the previous year, BC Hydro spent more than \$300,000 on repairs (*The Vancouver Province*).

November 15-18, 1989

Event type: Flooding, icejam flooding and debris slides.

Precipitation: Hartley Bay (353.6 mm/4 days), November 15-18, 1989; Prince Rupert (115.2 mm/4 days), November 15-18, 1989; Prince Rupert M. Circ (140.2 mm/4 days), November 15-18, 1989; Nass Camp (52.6 mm/1 day), November 17, 1989; Falls River (184.0 mm/3 days), November 17-19, 1989; Kemano (100.0 mm/3 days), November 17-19, 1989; Kildala (99.9 mm/3 days), November 17-19, 1989; Terrace (55.4 mm/2 days), November 17-18, 1989; Kitimat Townsite (94.6 mm/2 days), November 17-18, 1989; Bella Coola (83.6 mm/2 days), November 17-18, 1989; Smithers (38.7 mm/1 day), November 18, 1989.

Source: *The Daily News*, November 20, 1989; *Northern Sentinel*, January 17, 1990; *The Terrace Standard*, November 22, 1989; Environment Canada 1991.

Mudslides 50 km west of Terrace closed Highway 16 between Prince Rupert-Terrace for six hours. Ice blocked Pollywog Creek, causing the water to overflow. The highway was covered with 1.5 ft. (45 cm) of water and mud.

On November 19 on Highway 37, 30 km south of Terrace, 150 ft. (45 m) of highway collapsed. The damage was estimated at \$20,000. On November 21, the highway was reopened with one-lane traffic on the damaged section. Water in the Kitimat River reached exceptionally high levels. On November 18, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 1,949 m³/s and a maximum daily discharge of 1,020 m³/s (Environment Canada 1991). It changed course at the east bank below the Haisla bridge. The river relocation caused the removal of gravel, exposing the municipal water infiltration galleries. The municipal water turned muddy but was considered safe to drink.

Terrace experienced the first major snowfall of the winter. The snowfall put an end to the construction work on the Shames Mountain Ski Hill access road. According to Dave St. Thomas, the Ministry of Highways official in charge of the project, the base for 1.25 km of the 4.5-km road was completed before the snow made further work impossible.

On the west coast of the Queen Charlotte Islands, new debris slides occurred in CP 144 and elsewhere in the Rennell Sound area. This area was severely hit by slides during the October 31-November 1, 1978, storm and again in 1979.

November 26-December 4, 1989

Event type: Flooding and debris slides.

Precipitation: Pallant Creek (259.8 mm/4 days), November 26-29, 1989; Prince Rupert M. Circ (469.2 mm/9 days), November 26-December 4, 1989; Kemano (52.0 mm/1 day), November 27, 1989; Kildala (52.5 mm/1 day), November 27, 1989; Sandspit A (87.4 mm/3 days), November 27-29, 1989; Prince Rupert (198.1 mm/6 days), November 27-December 2, 1989; Kitimat Townsite (273.8 mm/7 days), November 27-December 3, 1989; Terrace (205.7 mm/7 days), November 27-December 3, 1989; Falls River (373.0 mm/7 days), November 27-December 3, 1989; Hartley Bay (272.7 mm/6 days), November 28-December 3, 1989; Kemano (98.0 mm/2 days), December 1-2, 1989; Kildala (102.8 mm/2 days), December 1-2, 1989; Pallant Creek (194.8 mm/4 days), December 1-4, 1989.

Source: *Northern Sentinel*, December 6, 1989; *The Daily News*, December 4, 1989; *The Terrace Standard*, December 6, 1989; *Terrace Review*, November 29, December 6, 1989; File M 52-651-091310 Hwy. 16. B.C. Ministry of Transportation and Highways, Terrace.

Overnight November 27-28, Terrace recorded its second heaviest 24-hour rainfall in its recorded history with 91.9 mm. *1) According to John How, Terrace airport weather specialist, Terrace had a total rainfall of 234.2 mm for November.

In Terrace, debris-clogged storm drains caused flooding on Greig Avenue between Atwood-Kalum. The storm sewer near the Park Avenue pumping station was plugged with debris. It caused a 2 ft. (60 cm) deep ditch parallel to Park Avenue, with water flowing down city streets to Greig Avenue. The Terrace Hotel was hardest hit. Services in the electrical room were under more than a metre of water. The basement storage rooms sustained some damage. The Iron Works gymnasium was flooded with 2 in. (5 cm) of water. The front office of the *Terrace Review* had 9 in. (22.9 cm) of water on the floor. In the 4600 block (of Greig Avenue?), clogged storm drains forced Howe Creek to overflow its banks. Some homes had up to 2 m of water in their basements. Elsewhere in Terrace, plugged storm drains caused minor damage.

The heavy rains caused two slides on Highway 16 at km 125, about 1 mi. (1.6 km) east of the Shames River bridge. On December 3, a 40-m long and 4-m deep slide came down, reaching the centre of the highway. It restricted the traffic to one lane only for 12 hours. On December 4 at 5:20 a.m., a second slide came down at the same location, closing the highway for nearly four hours and resulting in a short period of one-lane traffic. The progressive, rotational style soil slope failure covered the entire road surface. The volume of loose material was about 6,300 m³. Both rotational failures were triggered by heavy rainfall in the preceding two days.

*1) The all-time record was set in November 1956 with 93.0 mm. The 30-year average for November is 131.8 mm, while the all-time record for rain in November was set in 1969 with 342.9 mm (J. Howe In: The Terrace Review, November 29, 1989).

May 5, 1990

Event type: Dump spreading failure.

Precipitation: Not applicable.

Source: Evans (unpublished data) (Case History 91).

On May 5, a dump spreading failure at Quintette blocked the Murray River.

May 31- June 7, 1990

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Prince George Citizen*, June 1, 2, 4, 7, 1990; *Terrace Review*, June 6, 1990; Environment Canada 1991; Ministry of Environment, Lands and Parks files.

During the early part of June, four large areas (Okanagan, Kelowna and Kamloops areas, Prince George, including Williams Lake and Dawson Creek) experienced flooding.

Overnight May 31-June 1, Paddlewheel Park flooded. Water here had risen about 3-4 ft. (0.9-1.2 m) during the previous week. The river had risen enough to make the campground nearby the Indian reservation unusable. Both Cottonwood Island Park and Paddlewheel Park were completely under water.

The City of Prince George sealed the sewage manholes in the Farrell Street area. *1) One Farrell Street resident saw the floodwater in her basement rise about 9 in. (22.5 cm) in six hours. At 7:30 a.m. on June 2, water almost reached the basement windows. A number of Farrell Road residents evacuated their homes. According to Berta Nolin, a Farrell Road resident who remained in her home, the flooding was the "worst she has seen it in the 10 years she has lived alongside the river." In those 10 years, the unfinished basement had been flooded "two or three times, but this is by far the worst."

On June 1 after rising 70 cm in 24 hours, the Fraser River at Prince George reached flood stage with the gauge at South Fort George reading 9.4 m. The rainy weather caused the rapid snowmelt in the Upper Fraser River basin. *2) Les Holroyd, spokesman for Alcan, stated that if necessary the company was prepared to hold back flows in the Nechako River from the Skins Lake spillway.

On June 1, there were already 250,000 sandbags stockpiled in Prince George. On June 2, a flood emergency office opened in the Government Agent's office. Several residents in the Foreman Flats were advised to prepare for evacuation. The Highways Department closed off one loop of the road at Foreman Flats to traffic. The Upper Fraser River Road at Hansard Bridge was closed off and barricaded and also the Marguerite ferry closed.

On June 2 at 4 p.m., the river peaked at 9.91 m, flooding parks and basements and forcing about a dozen families out of their homes. *3) On the morning of June 4, the gauge at South Fort George showed the water level there down to 9.32 m. According to Glen Davidson, Ministry of Environment head of engineering in the region, snowpack readings taken in the Upper Fraser basin around June 3 showed it 7% above normal for this date.

On June 3, Prince George was hit by flooding. About a dozen families left their homes on Farrell, Hazelton, and the Inlander streets as well as Landsdowne and Pulp Mill roads as water filled their basements and came close to covering some outbuildings.

Flood conditions hampered the area's logging and tree planting operations. Forest Service roads (FSR) in the Anzak and Carp Lake areas were closed. North Fraser FSR was closed at 17 km and 57 km; Bowron FSR at 12 km; McGregor-Sande FSR at 9 km; McGregor-Logan FSR at 57 km; Carp FSR at 13.78 km; (The Carp Provincial Park Road remained open); McGregor-Gleason FSR at 3.5 km and the Chuchinka-Colbourne FSR at 51 km.

Early on June 7, the Fraser River was down to 8.13 m, more than a metre below flood stage. On Farrell Street, the worst-hit part of South Fort George, evacuated residents returned to their homes. Some homes still had up to a foot of water in their basements.

The flooding Fraser River damaged the Harris home in the Foreman Flats area near Prince George. The Foreman Flats area, on the east side of the Fraser River upstream from the Yellowhead Bridge, was hard hit by the flood, but only one family there was evacuated. In Foreman Flats, a stretch of Foreman Road was flooded cutting access to six homes. One residence was totally flooded. Because of their location, they were unable to get insurance but were hoping to get some government compensation for their losses.

Floodwaters filled the basement to a depth of 4.5-5 ft. and destroyed the personal property stored in the basement and elsewhere on the property to a value of \$19,568.61. The residence itself was damaged requiring repairs valued at \$31,278.61.

Harris, not satisfied with PEP compensation took the case to court. The subject property was flooded in 1948 and 1972, but no one observed or recorded any high water marks on that property and even as late as 1979 when the building permit was issued, the Regional District had no relevant data on file as to historic flood levels. A witness noted that during the construction of the footings of the residence in 1979 this neighbour had told Harris that during the 1972 flood she and another woman had canoed across the site he was building on and perhaps he should choose another location. Harris had refused the help by a search and rescue crew to sandbag his home, which probably would have totally eliminated his losses in the basement. Harris was offered the cost of moving the house and agricultural building and incidental. It did not include the cost of a replacement lot, since the purchase of the land was not a consequence owner's acts or omissions. On the evidence tendered, this head totaled \$51,600.

The Skeena River flooded part of Usk, Old Remo, and the Esker overpass construction site on Highway 16 west of Terrace. Near Old Remo, there was about 1 ft. (30 cm) of water on the road. On June 2, the Skeena River at Usk recorded a maximum instantaneous discharge of 5,980 m³/s and a maximum daily discharge of 5,840 m³/s (Environment Canada 1991). Flooding at the overpass construction site was only prevented when workers used fill from the overpass approach to raise the level of the detour. Some flooding occurred also on the Greenville road.

*1) There are two sewer line valves in the lower Patricia Boulevard area between Fourth-Second avenues. In anticipation of flooding, the City of Prince George seals the sewage manholes. Floodwaters will spread right over them and not mix with the sewage (*The Prince George Citizen*, June 1, 1990).

*2) Normally at this time of the year, the river rises only 20-30 cm a day. Rivers, like the Willow River, which would have peaked by this date, were still rising. Spring snowpack conditions were similar to those in 1972, the year of the last major flood in Prince George. The most recent snow survey taken in the Upper Fraser River basin on May 15 showed a snowpack 32% above normal. Prince George and the Central Interior also experienced an unusually wet spring. May was the seventh wettest since 1921 with 67.8 mm of rain recorded. The normal amount of rain for the month is 47.3 mm. During April, usually dry with an average of 17.4 mm, 51.5 mm fell. On April 24 alone, 25.5 mm was recorded (*The Prince George Citizen*, June 1 and 2, 1990).

*3) Flood stage at South Fort George is at 9.4 m. During the last major flood here, in 1972, water levels peaked at 10.44 m.

June 9-12, 1990

Event type: Spring runoff flooding and debris slide.

Precipitation: Prince George (45.2 mm), midnight on June 9-June 12, 1990; Dawson Creek A (106 mm), evening of June 10 to about 5 p.m. on June 12, 1990.

Source: *The Prince George Citizen*, June 12, 13, 14 and 16, 1990; *The Vancouver Sun*, June 13 and 14, 1990; Ministry of Environment, Lands and Parks. Attachment No. 3. The summary of sites damaged by the June 1990 flood; O.I.C. 919, Task No. 910077.

On the night of June 11, Highway 97 washed out in the Stoner area, about 35 km south of Prince George. Rain-swollen Stone Creek washed out about 100 m of the road. The creek was five times and more its normal width of 8 m. Between 2-4 a.m. on June 12, the rising waters of the creek washed out about 100 m of Highway 97's southern approach to the bridge and four houses. At 10 p.m. on June 12, the highway reopened to two-way traffic. By June 13, the highway was again open to traffic. Upstream from Highway 97, Stone Creek swept away homes, vehicles, the community well and 100 m of Highway 97.

Floodwaters lifted a \$109,000-home from its foundations and floated down Stone Creek to the Fraser River. Besides the four-year old house, the Enders family also lost a 2,400 ft.² (220.8 m²) garage, about 8 ac. (3.2 ha) and their dog. The rising waters had given enough warning. Their fence started to disappear around 7:30 p.m. on June 11. "The land just washed away," Suzanne Enders said. When the fence went, they had lost 100 ft. (30 m) of property. "Trees went just crashing. It was incredible." By 4:30 a.m. on June 12, the house went. "It was just like a movie. The house lifted from the foundations; we could see inside. It bobbed down the creek." After rounding a curve, the house hit a logjam and disintegrated before the owner's eyes. "We can't even find a piece of it today."

Two or three other smaller houses also washed away. The basement of a large cabin washed out, leaving the hulk to be condemned. Another home, a log house high on a hill overlooking Stone Creek, was endangered. Three metres of bank had been cut from underneath it, leaving the basement insulation exposed. Land used to extend about 12 m from the edge of the house lined with rows of large cottonwood and spruce trees. Jim Ridley had one house and a trailer carried away from the south side of the creek. Two of his other houses were swept more than 10 m down the creek before getting hung up on a trailer. Ridley also lost 4 ac. (1.6 ha) of his land, two trucks and four cars. He put his loss at \$100,000.

The cost for bank protection of Stone Creek for log home immediately downstream of the highway was \$73,178.49. Upstream, the cost of placing riprap at the base of a slope to protect a house was \$4,422.87. The cost to remove channel deposition of Wilson property on Bissett Creek was \$10,738.04. (Ministry of Environment, Lands and Parks files).

At Hixon Creek riprap was required to armour the creek bend to protect property owners and highway yard. Along Hixon and Naver creeks, riprap had to be repaired to protect the Magnussen home and access to several others. (Ministry of Environment, Lands and Parks files).

By June 13, the Fraser River started another rapid rise. At 8 a.m. the gauge at South Fort George reached 9.36 m. Around 11 a.m., it rose slightly to 9.37 m. The river was expected to crest sometime later on June 13 or early on June 14. Gauge readings at McBride showed the river level had started dropping.

By June 13, a number of FSRs remained closed, including Bowron at km 54; Willow at km 30; McGregor-Cargill at km 25; Chuchinka at km 22, and Walker at km 21.

At about 10:30 p.m. on June 11, a van carrying eight tree planters employed by Evergreen Forest Service plunged off a partly washed out bridge on the Willow-Cale FSR, a remote forestry road about 150 km southeast of Prince George. The van drove onto the wooden bridge over George Creek. Because of darkness and rain, the driver probably failed to see that the far end had been washed out. Four survivors were airlifted to hospital in Prince George.

A helicopter-aided search on June 12 failed to locate four missing occupants carried away by the floodwaters. Heavy rain, rugged terrain and dense bush hampered searchers. Access to the area was restricted due to road washouts. RCMP announced that the search of the creek until the water level would subside. An unconfirmed report indicated the van was found early on June 13. That same day, one body was located in a logjam. On June 15, the official search for the three missing tree planters was called off. Police believed their remains had been swept further downstream and that they would continue the search after water levels would recede.

The heavy rainfall caused flash flooding and erosion damage in the Dawson Creek area. (East Pine bridge-north to the Peace River and south to Tumbler Ridge). Around June 12, parts of downtown Dawson Creek experienced "thigh-high" water. On June 13, floodwaters subsided.

The Dawson Creek area flooding was caused by heavy rain whereas the other areas experienced damage due to a combination of snowmelt and rain. The total cost of channel restoration, log clearing and repair work was estimated to be \$2,575,980. A further \$883,080 was needed for enhancement work. (O.I.C. 919 Task No. 910077) Dates of flooding occurred between May 28-June 30.

On the evening of June 12, the sudden melt caused Bevier Creek to overflow its banks about 5 km north of McBride. The creek caused a slide described as a "wall of mud, boulders and snow." At noon on June 14, a second and third slide came down. According to PEP co-ordinator Bob Kelly, "Someone timed the last slide coming down and it took only four minutes from the top of Monroe Mountain to hit the bottom of the highway."

The slides severed dozens of families from town and cut their power lines. Highway maintenance crews had temporarily cleared the road earlier that morning. At noon, it was covered with another "wall of mud and boulders as big as cars shaking down." In addition, the slide effectively blocked the creek. A 2-m. culvert put in after the 1986 slide was demolished by the first fall of boulders. *1) It was reported on June 16 that dozens of homes were still without power.

*1) At the end of May 1986, flood-related mudslides in the same area caused more than \$1 million worth of damage.

June 15-20, 1990

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Province*, June 20, 1990; *The Vancouver Sun*, June 21, 1990; Ministry of Environment, Lands and Parks files.

Around the middle of June, the Skeena River spilled its banks, causing the evacuation of between 50-100 people in the Old Remo area.

Around June 19-20, residents of Old Remo returned to their homes after flooding caused minor damage to 30 homes during the previous week. In Terrace, a dozen homes on Skeena Street remained surrounded by sandbags.

June 28, 1990

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Clague and Evans 1992; Clague and Evans 1994 (p. 15).

On June 28, Tats Lake in the St. Elias Mountains drained. The moraine dam failure caused a flood and debris flow. The outburst volume was estimated at 4,000 m³ (Clague and Evans 1994).

September 27-October 3, 1990

Event type: Debris slides.

Precipitation: Pallant Creek (161.4 mm/4 days), September 27-30, 1990; Sandspit A (33.0 mm/1 day), October 1, 1990; Bella Coola (93.6 mm/3 days), October 1-3, 1990.

Source: J.W. Schwab, pers. comm. 1990. B.C. Ministry of Forests, Smithers.

On October 2, 26 landslides occurred on Lyell Island on the Queen Charlotte Islands (Schwab, pers. comm.).

November 11-12, 1990

Event type: Flooding.

Precipitation: Kemano (66.0 mm/1 day), November 11, 1990; Kildala (67.5 mm/1 day), November 11, 1990; Hartley Bay (114.6 mm/1 day), November 11, 1990; Falls River (67.8 mm/1 day), November 11, 1990; Terrace (71.4 mm/1 day incl. 26.2 cm snow), November 11, 1990; Pallant Creek (70.9 mm/2 days), November 11-12, 1990; Bella Coola (84.0 mm/2 days), November 11-12, 1990; Kitimat Townsite (103.0 mm/2 days), November 11-12, 1990; Prince Rupert (50.0 mm/1 day), November 12, 1990.

Source: *Northern Sentinel*, November 14, 1990; *Terrace Review*, November 14, 1990.

Overnight December 12, more than 2 ft. (60 cm) of snow fell in Terrace. No reference to damage was found.

The Kitimat River flooded the work done on the water intakes in August, causing the municipal water to turn murky. According to District Director of Engineering Tim Gleig, the water will remain discoloured until the backfill material consolidates.

November 28-December 8, 1990

Event type: Storm surge and tidal flooding.

Precipitation: Bella Coola (126.0 mm/2 days), November 28-29, 1990; Nass Camp (152.0 mm/5 days), December 2-6, 1990; Prince Rupert M. Circ (346.9 mm/6 days), December 2-7, 1990; Pallant Creek (273.8 mm/6 days), December 2-7, 1990; Kitimat Townsite (287.2 mm/6 days), December 2-7, 1990; Terrace (102.6 mm/1 day), December 3, 1990; Bella Coola (77.4 mm/2 days), December 3-4, 1990; Falls River (232.8 mm/4 days), December 3-6, 1990; Hartley Bay (323.4 mm/4 days), December 3-6, 1990; Prince Rupert (218.0 mm/5 days), December 3-7, 1990; Kildala (249.6 mm/5 days), December 4-8, 1990; Stewart A (210.6 mm/3 days), December 5-7, 1990; Sandspit A (88.9 mm/2 days), December 6-7, 1990; Terrace (111.6 mm/1 day), December 7, 1990.

Source: *Terrace Review*, December 5 and 12, 1990; *The Terrace Standard*, December 12, 1990; *Prince Rupert This Week*, December 9 and 16, 1990; *The Daily News*, December 4 and 10, 1990; *The Vancouver Sun*, December 3 and 4, 1990; Environment Canada 1991; Provincial Emergency Program. *PEP Talk*, Vol. 2, No. 1, Spring 1991.

In the 24 hours ending 10 p.m. on December 2, Terrace received 88 cm of snow (*The Vancouver Sun*, December 4, 1990). Between the afternoon of December 2 and the morning of December 4, Terrace recorded 39.6 in. (100.6 cm) of snow and 20 mm of rain. On December 3, 32.6 in. (82.8 cm) of snow fell, setting a new 24-hour record for December. *1) In total, Terrace recorded 147.8 mm of rain in a week. An estimated 78 cm of melting snow added approximately 78 mm of water to this total. The snow clearing cost Terrace some \$30,000, exhausting the city's snow-clearing budget.

On December 7 and 8, the communities of Terrace, Kitimat, James Flats, Hazelton, Stewart, Greenville, and Queen Charlotte City all endured flooding. Terrace suffered only minor problems caused by groundwater retained by frozen snow. Short sections of Keith Avenue on both sides of Kenney Street were flooded with 8-12 in. (20-25 cm) of water. In the 4600 block of Straume Avenue and on Mountainvista Crescent, some basements flooded. At Lindsay's, some flooding occurred when a Howe Creek culvert near Kalum Drive filled to capacity. Five families required temporary relocation because of flooding in the Copperstone Estates. Residents living on the west side of Lakelse Lake were cut off for a day when Beam Station Road near the airport was closed on December 7. At Lakelse Lake, flooding and a 4-ft. (1.2 m) deep washout about 0.5 km south of Lakelse Lake Lodge Road closed First Avenue. The water level in Lakelse Lake flooded some summer cabins and threatened some permanent homes. Old Lakelse Road suffered washouts, reducing traffic to one lane. On Kalum Lake Drive, one house was flooded by inadequate ground drainage.

On December 3, the rail line east of Terrace and Highway 16 east and west were closed by slides. Slides occurred 16 and 83 km west and 25 km east of Terrace. According to Mike Zylicz of North Coast Road Maintenance, every available piece of equipment, 18 graders and several trucks were on the job. Highway 16 West was closed from 11:00 a.m. on December 3 until 10:00 a.m. on December 4. Highway 16 East reopened on December 4 at 5:00 a.m. The Shames Mountain Road experienced some erosion problems and, during the late afternoon of December 7, an avalanche closed the road for about four hours.

Highway 37 north of Meziadin was closed at times. Highway 37A between Meziadin-Stewart was closed for four hours by a small slide at Bear Pass. On December 7, a slide came down on the highway to Rosswood, 17 km north of Terrace. The traffic was restricted to one lane. Due to the instability of the road base, the highway was closed from 11 p.m. on December 7 until 10 a.m. on December 8.

On Highway 37 between Terrace-Kitimat, temporary flooding near the entrance of Water Lily Bay undermined one lane. Another section just south of the Kitimat River bridge was endangered. The swollen Kitimat River was eroding the shoulder of the road. On December 7, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 1,340 m³/s and a maximum daily discharge of 1,090 m³/s (Environment Canada

1991). According to John Newhouse, Ministry of Highways District Manager, two days of hauling riprap saved the highway. The road between New Aiyansh-Greenville was closed by a slide and flooding of the Nass River.

In Prince Rupert, the highest predicted tide in a decade occurred on December 3. The 24.2-ft. (7.4 m) tide caused some localised flooding near the former Kwinitsa station, and Hays Slough nearly overflowed its banks. The currently unoccupied quarters of Sea Sport were flooded. *2) On the night of December 7, three people were rescued from a lifeboat by an U.S. Coast Guard Sikorsky helicopter. The crew had abandoned ship after their boat took on water in high seas about 150 km south of Prince Rupert. The 135-ft. (40 m) antique luxury yacht *Norsal* ran into trouble 30 mi. (48 km) west of Trutch Island during a storm. Winds in the area were recorded at 70 kn. (132 km/h).

On December 3 in Prince George, high winds knocked over a tree, killing a 53-year old man who was operating a snowplough on his property. (*The Vancouver Sun*, December 3, 1990).

*1) The previous record was set on December 12, 1978, with 19.9 in. (50.6 cm) of snow. All-time records were set on January 17, 1974, with 40.6 in. (103.1 cm) and on February 18, 1972, with 40.3 in. (102.4 cm).

*2) The previous high tide of 24.6 ft. (7.56 m) in November 1977 caused extensive flooding at the Prince Rupert harbour side. On December 30, 1963, a record high tide of 26.1 ft. (8.56 m) was recorded.

October 6-14, 1991

Event type: Flooding and landslides.

Precipitation: Falls River (213.8 mm/2 days), October 8-9, 1991; Kemano (144.0 mm/2 days), October 8-9, 1991; Kildala (144.1 mm/2 days), October 8-9, 1991; Kitimat Townsite (151.2 mm/2 days), October 8-9, 1991; Sandspit A (54.2 mm/2 days), October 8-9, 1991; Bella Coola (63.6 mm/2 days), October 8-9, 1991; Nass Camp (142.0 mm/3 days), October 8-10, 1991; Hartley Bay (724.0 mm/7 days), October 8-14, 1991; Prince Rupert (361.5 mm/7 days), October 8-14, 1991; Terrace (235.7 mm/7 days), October 8-14, 1991; Smithers (95.3 mm/2 days), October 9-10, 1991.

Source: *Northern Sentinel*, October 16, 1991; *Terrace Review*, October 9 and 16, 1991; *The Vancouver Sun*, October 16, 1991; *The Terrace Standard*, October 16, 1991; *The Interior News*, October 16 and 23, November 6, 1991; *The Daily News*, October 9, 10, 11, 15, 16, 17 and 23, 1991; *Prince Rupert This Week*, October 13 and 20, 1991; *British Columbia Report*, October 28, 1991; Environment Canada 1991; Sigma Engineering Ltd. Zymoetz erosion study. E 5724 Ministry of Transportation and Highways, Kitselas Board Council, March 1992; Provincial Emergency Program. *PEP Talk*, Vol. 2, No. 4, Winter 1991; Brent Smith, pers. comm. Skeena Cellulose, Terrace; Letter, October 23, 1991, Pacific Inland Resources, Smithers, Flood Damage Repair Estimate Telkwa FSR; Letter, October 28, 1991, D. Keating (Skeena Sawmills, Terrace) to Don Varner (B.C. Min. For., Terrace) Estimate Flood Damage; Letter, October 22, 1991, G. Adolph (District Manager B.C. Ministry of Forests, Prince Rupert) to Vern Strain (Operations Manager B.C. Ministry of Forests, Smithers), Flood and Damage Reports, Terrace-Nass and Smithers Area; Dennis Towriss, pers. comm. Pacific Northern Gas, Terrace; Frank Maximchuk, pers. comm. B.C. Ministry of Transportation and Highways, Terrace, Thornhill Creek Slide.

Heavy rain and a major street construction project in Prince Rupert were blamed for the flooding of the 24 Video outlet and other businesses on 3rd Avenue West. Worst hit was Parker's Ladies Wear. In Prince Rupert, a ramp fell off the Cow Bay floats just south of the Prince Rupert Yacht and Rowing Club. According to wharf manager Robert Small, a combination of low tides and high winds tore the ramp loose from the float. On October 11, merchandise in the basement was floating in 2 ft. (60 cm) of water. Several debris slides occurred near Port Simpson. On Indian Reserve 2 (Port Simpson) a slide wiped out a powerline. Two slides occurred adjacent to Steamer Passage, spilling considerable debris into the water. A hand logger was observed trying to recover what he could.

During the second week of October, the Terrace area experienced a record rainfall. According to the Terrace Weather Office, 242.4 mm (9.54 in) of rain fell between October 6-14, far more than the annual average for October. The Kitimat Weather Station reported 221.2 mm of rain between 5 a.m. on October 8-9p.m. on October 10, setting a possible record for a 48-hour time period.

Near Terrace, some erosion occurred around and under the Deep Creek dam, causing the Terrace water supply to run dry. Water was drawn from Spring Creek until the damage was repaired. Flooding forced several families near Terrace to evacuate their homes. In the Dutch Valley area just outside of Terrace, 15 people were evacuated by road when a nearby river overflowed its banks and threatened residential areas. At least one house in the Dutch Valley was flooded and sandbags were used in the area to prevent further damage. Food and shelter was supplied to 27 families from outlying communities who were stranded in Terrace by Emergency Social Service volunteers. In Terrace, three businesses *The Terrace Review*, the Neighbourhood Market, and the Video Stop on Lakelse Avenue sustained flood damage. *1)

On Highway 16 east of Terrace, the bridges over the Copper River and St. Croix Creek were threatened by erosion. The rising Skeena River backed up side rivers, causing flooding in the smaller communities near Terrace. On October 15, the Skeena River at Usk recorded a maximum instantaneous discharge of 5,530 m³/s and a maximum daily discharge of 5,310 m³/s (Environment Canada 1991). For a time the rising water threatened to flood homes at Lakelse Lake. On October 15, Burdick Creek near Kitwanga ran out of the channel under the old bridge. It cut a new channel

across the Kitwanga backroad, closing the road for over a week. One vehicle drove off the end and got buried halfway in the mud.

Highway 37 between Terrace-Kitimat was closed for about 24 hours by flooding and shoulder washouts. Two kilometres south of the Kitimat River bridge, a one-lane section of 150 m of highway disappeared into the river. The Kitimat River moved to the east, hitting a portion of highway where the embankment had not been riprapped. Tim Gleig, the District of Kitimat director of engineering services, stated that the Kitimat River rose more than 17 ft. (5.1 m) in just over 30 hours by high tide in the afternoon on October 10. On October 10, the Kitimat River below Hirsch Creek recorded a maximum instantaneous discharge of 3,030 m³/s and a maximum daily discharge of 2,500 m³/s. *2) By October 11, the river levels tapered off. Ministry of Highways district manager John Newhouse estimated the damage to Highway 37 south to Kitimat at \$200,000. On October 10, a section of highway near the Lakelse Lake picnic area was closed. Williams Creek flooded into Blackwater Creek. At Blackwater Creek, the culverts could not handle the water, resulting in heavy erosion damage to the gravel road shoulders. On the Kitimaat Village road, only minor shoulder erosions occurred. Near Kitimat, Hirsch Creek Park had water running through and the picnic area in Radley Park was under about 4 ft. (1.2 m) of water. The access road to the sewage treatment outfall was washed out. In localised areas of Kitimat, sewer backups and some problems with surface drainage occurred.

Damage to Forest Service Roads (FSR) in the Prince Rupert Forest Region caused by the storm totaled \$1,274,000. On the Copper River FSR, extensive damage occurred between Matson Creek-Clore River, causing an estimated \$715,000 damage. Major washouts at km 13 and at Hunter Creek, on the Upper Kitimat FSR totaled \$220,000 damage. On the Nass-Kinskuch/Kwinatahl, damage to a bridge was estimated at \$100,000. On the Nass FSR, the estimated cost was \$52,000. Repairs included re-channeling and replacing riprap at km 2 and the Ginmiltkun bridge. Major damage also occurred on the Telkwa FSR, totaling \$115,000. Repairs included replacement of 300 m of road at 6.0 km, replacement of 2,000 m³ of riprap at 12 km, reconstruction of 2,000 m of road at 21 km, and replacement of riprap at Jonas and Cumming creeks.

Pacific Northern Gas reported damage to the gas pipeline along the Copper River. Near Tauw Lake in the Telkwa Pass, a massive rockslide damaged the line, causing some \$65,000 damage. At Middle Lake a slide blocked the road. From Middle Lake west, the line filled up with water for 4 mi. (6.4 km). At the junction of Limonite Creek and Copper River, the line was exposed for 200 ft. (60 m). Limonite Creek, which had moved its channel over, had to be re-channelled for 900 ft. (270 m) at a cost of \$30,000. Cost to replace some river crossing armouring at MP 244 near Summit Lake was estimated at \$160,000. At the mouth of the Clore, 300 ft. (90 m) of the line on the west side was exposed. To completely rebuild this section was expected to cost \$500,000. Minor damage occurred at 28 km and 15 km on the Copper River Road. Damage to the road at 28 km was estimated at \$10,000 (D. Towriss, pers. comm.). On October 10, the Zymoetz River recorded a maximum daily discharge of 1,050 m³/s, which is approximately a 35-year return period flood (Sigma Engineering p. 6).

Record rainfall also caused drainage problems throughout the Nass Valley. Approximately 360 mm of rain fell in seven days, equaling the monthly average for the region. The flooding in the Nass Valley was described as the "worst since October 1961" (*British Columbia Report*). *3) In some areas the roads were under more than 1 m of water. Because of flooding along Kitsumkalum and Lava Lake, the road north of Terrace from Dover Road to Greenville was closed. The Nisga'a Highway was flooded at Lava Lake. The Ministry of Forests confirmed that extensive damage was done to the road north of Nass Camp, isolating nearly 3,000 Nass Valley residents in Nass Camp, Greenville, Canyon City, and New Aiyansh. Fresh food was airlifted to the trapped residents by helicopter through the Provincial Emergency Program (PEP). In the largest airlift in PEP's history, nearly \$25,000 worth of groceries was airlifted. A total of 14 flights were made, during which mail and ballots for the provincial election were also delivered. Ministry of Highways officials reported that more than 80% of a 22-km road to Greenville was completely under water. Many washouts occurred, bridge structures were damaged, and other bridges had their approaches washed out. The Ministry of Highways district manager estimated damages to the roads in the Nass Valley to be approximately \$500,000. On October 23, the road to Greenville was reported open to traffic. The more than 800 residents of Greenville had been isolated since October 9. A contractor working into the night saved a major bridge over the Cedar River. At one point the level of the Cedar River rose 3 ft. (90 cm) in 15 minutes.

In Stewart, the rain fell at an average of 6 mm an hour, totaling 376.6 mm for the duration of the storm. Many basements were flooded, but extensive sandbagging efforts avoided major damage.

The heavy rain also caused damage in the Smithers-Telkwa area. The weather station at the Smithers airport recorded 95.3 mm of rain for November 9 and 10. The Telkwa River flooded its banks and carried down trees and other debris. At the confluence with the Bulkley River, standing waves up to 1 m were seen. Flood damage to the Telkwa FSR was estimated at \$114,200. A Telkwa family was stranded at their Cottonwoods Flats home for five days after floodwaters washed out their driveway, creating an island. A dike built parallel to the property eight years previous caused the water to back up and then to flood. In order to avoid future problems, officials have indicated that an old river channel will be opened to divert the overflow. Other creeks in the Smithers area impacted by high water levels were Toboggan, Casson, Simpson, Canyon, and Big creeks. Toboggan Creek at the fish hatchery was in imminent danger of flooding. The high water did permanent damage to fish spawning grounds near the Toboggan Creek Fish Hatchery and threatened to flood ponds holding salmon fry. According to hatchery manager Mike O'Neill, that summer's wild spawn along creeks was wiped out by the floods, which were worse than the ones in 1988.

On October 15, the Kispiox River near Hazelton recorded a maximum daily discharge of 977 m³/s, breaking the previous all-time high for the period of record of 595 m³/s on November 2 (Environment Canada 1991). Residents of the Kispiox Valley along Poplar Park Road were stranded for nearly 24 hours after the road flooded. Others had to leave their homes and many suffered property damage in fields and hay sheds. No other bridges in the upper Kispiox sustained serious damage. The grounds of the Kispiox Valley Community Association were flooded. Bleachers were damaged, picnic tables washed away, and fences were knocked over.

On the evening of October 18, a slide occurred below the Old Lakelse Road, approximately 300 m north of the Thornhill Bridge. It was caused by excess water in the subsurface, saturating the clay. The slide, which was about 25 m long at the road and tapered to 20 m at the toe, displaced approximately 1,000 m³ of material. The slide material dammed up Thornhill Creek, resulting in the flooding of some residential property. A fresh water pipe running under the shoulder of the road was exposed and pulled apart at one joint.

In the Kispiox Valley near Hazelton heavy damage to fish eggs was reported. Floodwaters in the Nass River may have wiped out more than half of the salmon eggs already laid that year. The main species affected were pink, chum, and sockeye salmon, spawning in August and September. (Les Jantz, Dept. of Fisheries and Oceans *In: Prince Rupert Today*).

*1) A solution to avoid the flooding on Greig Avenue would be to reroute the storm sewer at Atwood and Greig avenues to an open ditch near the CNR tracks.

*2) Both are all-time high values for the period of record, beating the previous highs of 3,000 and 2,410 m³/s, respectively, on November 1, 1978 (Environment Canada 1991).

*3) According to Lakalzap band administrator Wallace Clark, the Nass River levels were higher than during the record flood in 1961. The Nisga'a Tribal Council continued to press demands for an audit of logging practices in the Nass Valley to see how clearcut logging had contributed to the flooding.

October-November 1991

Event type: Flooding.

Precipitation: Not available.

Source: Ministry of Environment Lands and Parks File 35000-30 Spring Creek.

In October, during a high runoff condition, staff from PEP and MELP removed the Charron log driveway bridge over Spring Creek in Dutch Valley to prevent a debris jam. To provide continued access to the Charron property, two 6-ft. (1,800 mm) temporary culverts were installed. During subsequent high water in November 1991, these temporary culverts were damaged. They were then replaced by three 6-ft. (1,800 mm) and one 4-ft. (1,200 mm) single lengths.

The installed culverts did not perform satisfactorily, both from a hydraulics and public safety point of view. A new (rail car) bridge, estimated at \$40,000, later replaced the culverts. The four culverts were a barrier to the natural movement of bedload downstream, hindered the passage of fish at low flows and eliminated a portion of viable spawning and rearing habitat.

November 10-15, 1991

Event type: Flooding and debris slide.

Precipitation: Nass Camp (30.6 mm/1 day), November 10, 1991; Hartley Bay (207.8 mm/3 days), November 10-12, 1991; Falls River (263.0 mm/5 days), November 10-14, 1991; Kildala (202.4 mm/6 days), November 10-15, 1991; Kitimat Townsite (208.8 mm/6 days), November 10-15, 1991; Kemano (68.0 mm/1 day), November 14, 1991; Bella Coola (69.3 mm/1 day), November 15, 1991; Terrace (87.2 mm/1 day), November 15, 1991; Sandspit A (58.0 mm/2 days), November 15-16, 1991.

Source: *The Terrace Standard*, November 20, December 4, 1991; *Terrace Review*, November 20, 1991; *Prince Rupert This Week*, November 24, 1991; *The Daily News*, November 15, 1991; *The Observer*, January 9 and 16, 1992; Letter, November 26, 1991, B.G. Hirczy (Operations Engineer Ministry of Forests) to Ms. K.A. McDougall (Manager Provincial Emergency Program); Frank Maximchuk (Ministry of Transportation and Highways, Terrace) Fieldnotes Slides South End-Old Skeena Bridge, and Tow Hill Road.

A storm with winds of 75-90 mph (112.5-144 km/h) hit the Prince Rupert area. The flight station at Digby Island recorded 37 mm of rain in 12 hours. Many powerlines were blown down and service was still out on the morning of November 15. The power cuts occurred in Port Edward, Ridley Island, Oona River, Kitkatla, Kincolith, and some isolated areas in Prince Rupert. The power outage caused the Skeena Cellulose mill to shut down. Several catch basins plugged up. Campers were blown over and some boats had their hatches blown off. Damage occurred to cars, windows, siding, and roofs. At the Yacht Club, three fingers were broken off the main float. A power cable was pulled from its housing, leaving boats without electricity. At the Fairview floats the dock anchors dragged. The Coast Guard Cutter Point Henry and the fishing vessel Langwood rescued the American seine boat Gayle.

Heavy rain was reported in the Terrace area. Between November 14, 4 p.m.- November 15, 4 p.m., a total of 97.4 mm of rain fell. *1) Flooding occurred in Terrace in the 4500 block of Lazelle Avenue, after gravel had plugged the Park Avenue sewer inlet. A similar problem occurred in the 4600 block of Lakelse Avenue. The Terrace Video Stop was flooded again after flooding on October 13, 1991 due to a plugged storm drain. The store had 7 in. (17.8 cm) of water at the door, and half the store was under 1 in. (2.5 cm) of water. Flooding also occurred at the Terrace Inn and the *Terrace Review* newspaper office. Following 24 hours of heavy rains in the Terrace area, a slide occurred at the south end of the old Skeena bridge. The circular slump, about 25 m wide, was caused by the failure of liquefied saturated silts dropping 30 m down an embankment. It pulled away from a 3-in. (7.5-cm) Pacific Northern Gas pipeline and damaged the lights and signal conduits.

Heavy rain in the Terrace area caused further damage to Forest Service roads (FSR) already weakened by the October 8-14 flood. The damage estimates were as follows: Grease Trail FSR, \$40,000 for bridge repair and replacement of seven culverts; Lakelse FSR \$25,000 for the rebuilding of a bridge approach and replacements of 10 culverts; West Kalum FSR \$40,000 for the replacement of a culvert and 100 m of road; and Thunderbird FSR \$2,500 for the repair of a washout at 6 km.

During the night of November 15-16, a slide occurred on the Tow Hill Road On the Queen Charlotte Islands. The slide, which measured a width of 25 m and a height of 5 m on the road, moved an estimated volume of maximum 1,300 m³. In the immediate area of Tow Hill, numerous slides have occurred during the past 25 years. For long-term safety, a realignment of the road away from the toe of the hill is recommended (F. Maximchuk, pers. comm.). On January 9, 1992, the Tow Hill road was reported still closed. Extremely high tides coupled with high water levels contributed to erosion around the road and bridge. High water levels on the road made raising sections of the road by a metre or more necessary.

*1) The old record for November was set in 1956 with 93 mm. The Terrace-Kitimat airport weather office recorded a total of 320 mm of rainfall for November. The rainfall was nearly 2.5 times the November average, just 22 mm short of the 1969 record. Total precipitation including snow was 374 mm; the same number for 1969 was 354 mm. (*The Terrace Standard*).

November 1991?

Event type: Debris slide.

Precipitation: Not available.

Source: *The Daily News*, February 28, 1995.

Around November?, a landslide occurred in Miller Creek on the Queen Charlotte Islands. Seven charges under the Fisheries Act were laid against Fletcher Challenge Canada Ltd. and Crown Forest Industries Ltd. and former Fletcher employee John Kay. These were for “carrying out work resulting in the destruction of fish habitat and depositing harmful materials, such as wood, rock and earth, into a water frequented by fish.” Each charge carried a maximum penalty of \$300,000. *1)

*1) The Sierra Legal Defence Fund laid initial charges but in January 1994, the Crown took over the case. On February 20, 1995, the charges were stayed in Queen Charlotte provincial court because it was not possible to prove logging practices caused the Miller Creek landslide” (*The Daily News*, February 28, 1995).

November 27, 1991

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: Jamieson and Geldsetzer 1996 (pp. 149-151).

On November 27, three avalanches came down Twin Falls near Smithers, killing one ice-climber and injuring four others. At about 5 p.m., a small avalanche came down the chute. Twenty minutes later, a second, size 1, avalanche occurred, which carried down four members of a group of seven ice-climbers. A bulge in the ice above them protected two climbers at the upper station. After the avalanche stopped, one member ended up on the surface, two were partially buried right side up and the fourth was partially buried, head down, with his feet sticking out. The snow was very dense and it took 15 minutes to dig out the latter. As the victim had no vital signs, CPR was initiated. After 15 minutes of CPR, a third avalanche came down.

1992

Event type: Slope failure.

Precipitation: Not available.

Source: B.C. Ministry of Energy, Mines and Petroleum Resources 1993.

In 1992, a house near Williams Lake received considerable damage from undercutting of a slope.

1992

Event type: Slope failure.

Precipitation: Not applicable.

Source: *The Terrace Standard*, March 2, 1994; March 3, 1995.

In 1992 in Terrace, a landslide undermined the sidewalk and a section of Lanfear Road, the feeder road to the central Bench area. Erosion is gradually narrowing the road and rebuilding was estimated at more than \$2 million. According to city director engineer Stew Christensen, the existing road could last another 5 or ten years even. "But it could slide off the hill next week." The problem is caused by a series of clay lenses that make it almost impossible to predict stability. *1)

After the incident, the hill was closed to pedestrians and a 20-km/h speed limit put in place. Although the city of Terrace had been talking about possible realignment of the road even before the slide, successive capital budgets had given priority to other projects.

Before a final decision could be made on a new route for the road, a comprehensive geotechnical study of the hill would have to be carried out. *2) City council would have to decide soon whether to allow a proposed subdivision at the top of the hill. All options involved going lower down the hill, rather than going further west and cutting harder into the bank. Cutting into the bank could threaten lots at the top of the hill causing land to slide.

*1) A similar problem was encountered in Prince George during the construction of the road up Cranbrook Hill to the University of Northern B.C. campus. The road there began sliding and construction cost eventually came in \$16 million over budget (*The Terrace Standard*, March 3, 1995).

*2) In March 1994, Terrace city council approved spending up to \$30,000 on a design study for Lanfear Hill (*The Terrace Standard*, March 2, 1994).

January 3, 1992

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: *The Terrace Standard*, January 8, 1992; Jamieson and Geldsetzer 1996 (pp. 116-119).

On January 3 around 3 p.m., a massive snow avalanche on Thornhill Mountain in the Copper Mountain range area just southeast of Terrace killed two snowmobilers, who with six others were riding on the north slopes of the mountain. Though searchers were called in immediately, the victims were not found until 11 p.m. with the aid of the Terrace RCMP police dog Echo. Due to strong winds and whiteout conditions, the bodies were not recovered until the next day. (*The Terrace Standard*, January 8, 1992). The 400-m wide slab failed on a layer of graupel and partly decomposed particles. The crown varied in thickness from 60-135 cm and averaged 115 cm. The size 3 avalanche resulted in a 1.3 m deep deposit, 125 m wide and 200 m long.

The members of the group were each trying to ride as far up the slope, which reached 38°, as possible (high-marking). Two avalanche deposits, one to two days old, were visible on slopes adjacent to the high-marking slope. At 3:15 p.m., two riders were making their last climb of the day. One was 75 m ahead and started his descent when the slope released as a large slab avalanche. The two snowmobilers were pushed off their machines and briefly visible on the surface of the avalanche. When the avalanche stopped, they could not be seen anymore. The slope had been repeatedly high-marked before it released. Presumably, the victims triggered the slope from an isolated weakness or an area where the slab was thinner than average.

Using small trees for probes, the five surviving riders and additional snowmobilers started searching for the two missing ones. They used the sticks to probe an area about 14 m wide one recovered machine that had been barely visible in the deposit. The accident party initially probed in the right area for the second victim, near his snowmobile. However, their improvised probes only penetrated only 35 cm, only half the depth where he was found. The chances of recovering both victims alive would have been much better had the snowmobilers been equipped with transceivers, shovels and probes.

A storm with 70 to 80-km/h winds made snowmobiling, part of which was along a ridge, slow and difficult. The first searchers from Terrace did not arrive until 7:30 p.m. A search dog that arrived at 10 p.m. found the second machine. Twenty-five minutes later, over seven hours after the avalanche, the first body was located under 70 cm of snow within 2 m of the first machine. An hour later, the dog found the second body under 80 cm of snow 37 m uphill from his machine at the side of the deposit. Both had asphyxiated.

The weather in the Skeena Mountains had been warmer and wetter than average. In December, almost three times the normal precipitation fell. Between December 22-January 3, 125 mm of precipitation fell at the Terrace airport, 1,100 m below the slopes of Thornhill Mountain. During the same period, moderate or strong winds from the south had loaded north-facing slopes. On January 3, strong southwest winds had continued to load the slope.

It was the first ever fatal snowmobiling accident here. Both men were members of the Skeena Valley Snowmobilers' Club and were described as experienced snowmobilers. Ron Niesner, the club's secretary, said the size of the slide shocked even the avalanche technicians. "The thing was astronomical; it was just massive." (*The Terrace Standard*, January 8, 1992).

Winter 1992

Event type: Dam failure.

Precipitation: Not applicable.

Source: *British Columbia Report*, May 11, 1992.

During one of the winter storms, the dam in Deep Creek, one of Terrace's two principal sources of water, gave way. The small 30-year old structure washed out under the pressure of the water that had built up in a pond on the Deep Creek water system, 4 mi. (6.4 km) north of Terrace. *1)

The water this system provides is mainly from the snowpack. Following an extremely mild and extremely wet winter, the snowpack was very small. *2) When the dam let go, even this amount of water was lost. To augment its water supply, Terrace was forced to drill a number of wells.

*1) The Deep Creek system's watershed is a relatively small area. Only about 4,000 ft. (1,200 m) above sea level, it is not high enough for snow to remain on its slopes during summer.

*2) In November, December and January, Terrace had its highest recorded rainfall.

June 2-10, 1992

Event type: Debris slide.

Precipitation: Not available.

Source: *The Times*, June 16, 1992; Donna Creek Technical Investigative Team 1992; Evans (unpublished data).

On June 2 between 12 noon-2 p.m., a slide occurred in the Donna Creek area. Approximately 10-20 ha or 0.5 million m³ of materials moved into Donna Creek and proceeded down the Manson River into the Manson Reach and finally into Williston Lake. The slide took out a bridge and caused a considerable amount of damage in the immediate area but also in the creek, river and lake. (*The Times*, June 16, 1992).

Between June 2-10, catastrophic seepage erosion occurred in the Donna Creek watershed, 75 km northwest of Mackenzie in the Omineca Mountains. It occurred within a forested sandy gravel fluvio-glacial terrace and culminated in a gradual process of seepage erosion in the gully initiated in 1990. Between 1990 and the 1992 event, a total of 423,000 m³ was removed from the gully. The dominant texture of the terrace is fine sand. Subsurface pipes developed in eroding faces leading to collapse.

Debris flows transported the saturated materials away from the actively eroding face in 2 m-deep surges to the Donna Creek valley. Erosion of the valley continued until June 10. Rapid melt of an above average snowpack was a triggering factor for the 1992 event. In addition, forestry road construction upslope of the site had expanded the natural catchment area by almost 10 times and concentrated runoff into the failure location (Donna Creek Technical Investigative Team 1992). The flows destroyed about 3 km of Donna Creek. A forestry road bridge was washed out and large volumes of sediment were deposited in the lower 4 km of the creek. According to Brian Blackman of Fish and Wildlife and the Williston Compensation Program. "There is close to 40 km of (Manson) river that has been affected by the slide." One project was set for the release of 200,000 Kokanee into the river (*The Times*, June 16, 1992).

A multi disciplinary review team looked at the cause of the slide and made recommendations to the clean up of the damage and restabilising the area and look at long-term solutions to avoid reoccurrence. It had not been determined yet whether Fletcher Challenge's nearby logging road had any effect on the slide.

Late September 1992

Event type: Flooding and debris slide

Precipitation: Kitimat 2 (143.3 mm/2 days), September 21-22, 1992; Kildala (146.6 mm/2 days), September 21-22, 1992; Kitimat 2 (62.7 mm/1 day), September 27, 1992; Nass Camp (60.4 mm/2 days), September 27-28, 1992; Stewart A (107.8 mm/2 days), September 27-28, 1992; Terrace A (180.6 mm/2 days) September 27-28, 1992; Prince Rupert M. Circ. (142.9 mm/2 days), September 27-28, 1992; Smithers (121.2 mm/30 days), September 1992.

Source: *The Stewart Signal*, October 2, 1992; *The Interior News*, October 7, 1992; *Terrace Standard*, October 7, 1992; *Alcan in British Columbia*, Vol. 5, No. 5, November 1992; B.C. Forest Service Investigative Team P.R.F.R. Investigation into the September 29, 1992 landslide Windfall Mainline near Meziadin Lake, Kalum F.D. November 1992; Evans (unpublished data).

On September 28, Terrace recorded more a month's rainfall in a single day. In the 24-hour period starting on the evening of September 28, 124 mm of rain was recorded, breaking a record set in 1978. It was also the most rainfall for any 24-hour period since weather records were kept at the Terrace airport. Although it rained also hard in Kitimat, no record was broken here.

According to weather specialist Harry Earle, unlike the 1978 flooding that was triggered by heavy rain and high freezing levels resulting in snowmelt in the mountains, during this rain event most of the higher elevation snow had melted two weeks earlier. (*Terrace Standard*, October 7, 1992).

For a time, the highway between Terrace-Kitimat was closed. Flooding in two places along the Skeena River prompted CNR to halt train traffic between Terrace-Prince Rupert. The road to the Nass Valley was under water. Near Terrace, flooding occurred in Dutch Valley and at Lakelse Lake. *1)

Late in September, a combination of earlier high mountain snowfall, followed by two major rainstorms brought over 350 mm of rain to the Kemano Valley over five days. The Kemano River changed course by several hundred metres and washed out the transmission line access road in several areas north of the Kemano townsite. One leg of Alcan's Tower No. 9 in Kemano buckled under pressure of water, floating logs and other debris when the Kemano River flooded in Kemano. Prompt action by repair crews saved the tower and the powerline to Kitimat. Repair crews with heavy equipment had to rebuild the road between Kemano and the tower before linemen could start stabilize the tower, which was supported by only three of its four legs. Later, most of the structural support steel was replaced and the footing of the damaged leg reworked in order for all four legs to support the 18,000 kg mass above them. A rock ring was constructed around the tower and the access road re-established. As the Kemano River was expected to continue to flow near the transmission towers for some time, rock barriers were also built around Towers No. 8, 7 and 6. The Kildala and Kitimat rivers also flooded. The Kildala River changed course and significantly eroded two tower bases. A local contractor in the area, engaged in logging operations, was employed to build self-contained ring protection.

The 12-km Kemano Beach Road, connecting the townsite and the dock, also washed out. During the Kemano River flood, this road suffered major damage. Canadian Helicopters stationed a machine from their Terrace base in Kemano to ferry passengers and supplies over the washed out section and to provide for emergency daytime evacuation. To ensure temporary service, a section of the road was temporarily diverted and built up.

On September 29, a landslide came down on the Windfall Mainline near Meziadin. The slide removed 75 m of road, cutting a 900-m swath and removed 14 ha of mature timber. It cut the access to Orenda's main logging operation within the chart area. The road was in active use at the time of the failure, and trucks and other equipment were isolated behind the failure for almost two weeks. As the failure terminated in a swamp system, it did not directly impact Class 1 (anadromous) fish habitat. The bedrock slide that triggered the debris avalanche was caused by a 10-year rain-on-snow event.

The slide sequence was initiated by a rock mass 50-70 m wide, up to 20 m deep, and 120 m long, which slid on a bedding plane dipping at an angle of 32° toward the valley. The disintegrating rockslide slid onto the steep slope below, which was mantled by a cover of glacial till. Following heavy rains and rapid snowmelt, the till-covered slope was very wet at the time and failed due to the undrained loading imparted by the rock mass.

The process initiated a debris avalanche, which cut a swath extending downslope for a distance of 900 m, widening to 200 m in width. Large "pick-up truck-size" boulders were transported in the avalanche mass to the valley floor. The initial failure block has a volume of approximately 100,000 m³. An estimated total volume of material transported in the landslide was in the order of 130,000-160,000 m³. (Evans (unpublished data).

Excessive rainfall and heavy snows near Stewart caused a washout on the road to Salmon Glacier about 0.5 mi. (800 m) up past the mine. Repairs were expected completed by October 2.

Smithers recorded 121.2 mm of rain in September, making it the wettest September since the weather station at the airport started keeping records in 1942. *3)

*1) In an effort to reducing flooding in the area, Lakelse Lake residents renewed their demands for the dredging of portions of Lakelse River. Lakelse Community Association president Sandy Sandhals called for the removal of a gravel bar that forms the delta near the mouth of the river of Herman Creek. The Westside Residents Association, the lake's other group, set a similar request to DFO (*Terrace Standard*). Lakelse Lake residents contended that flooding problems could be eased by removing the gravel bar that forms the delta near the mouth of Herman Creek, just downstream of the lake outflow. Flooding on some scale seemed to be an annual event now. They suggested that by widening and deepening the outflow, the flooding of lakeside homes might be entirely eliminated. With residents becoming increasingly concerned, the Department of Fisheries and Oceans (DFO) and the provincial fisheries branch "strenuously objected" to any dredging of the river. A January 1988 environment ministry report disagreed the dredging might eliminate flooding. The report concludes that while the delta controlled the outflow, the removal of 30,000 m³ would only have reduced high water flows during the last destructive flood of 1978 by only 25 cm. That flood had left many lakeside homes under more than 2 m of water (*Terrace Standard*, October 7, 1992).

*2) The previous record was set in September 1958, when 111.3 mm of rain was recorded. The long-term rainfall for Smithers for September is 50 mm (*The Interior News*).

December 23-24, 1992

Event type: Snow and debris avalanches.

Precipitation: Prince Rupert M. Circ. (50.2 mm/1 day), December 22, 1992; Terrace (47.2 mm/1 day), December 23, 1992; Kitimat 2 (44.6 mm/1 day), December 23, 1992; Stewart A (66.2 mm/2 days), December 23-24, 1992.

Source: Frank Maximchuk (Ministry of Transportation and Highways, Terrace) pers. comm.

A warm front that brought about 2.5 in. (63.5 mm) of rain to Prince Rupert caused between 200-300 snow avalanches between Prince Rupert-Exchamsiks. Some of the snow avalanches turned into debris flows. Approximately 20

slides hit the railroad tracks and six to seven hit the highway. Highway 16 between Prince Rupert-Terrace was closed for approximately 20 hours, from 8 a.m. on December 23 till 3 a.m. on December 24. From a helicopter Frank Maximchuk observed a snow avalanche, a couple of hundred feet wide come down west of Kwinitsa (Maximchuk, pers. comm.).

December 23-29, 1992

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *Vancouver Sun*, December 28, 29, 1992; *The Province*, December 28, 29, 1992; *The Interior News*, January 6, 1993; Jamieson and Geldsetzer 1996 (p. 176).

Late December a massive ice jam in the Bulkley River near Smithers caused the waters to rise to dangerous levels. *1) The jam started forming down river near the Canyon Creek confluence. Current streamflow was $70 \text{ m}^3/\text{s}$. On Christmas Day, the river had backed upstream to the Dohler Flats area at the end of Rosenthal Road causing water over the banks. Pack ice backed up quickly upstream, preventing a high icedam that would have caused flooding in the Kidd Road subdivision. The river breached its banks in the 22nd Ave. and Columbia area of the Ebenezer subdivision. The damage was apparently confined to some basement flooding from rising groundwater levels.

Christmas Day was the most threatening with the river rising as much as 2 m in half-an hour. Careening ice blocks moved across the lowest-lying areas. Approximately 50 residents were advised to evacuate. On Boxing Day, the risk of flooding was so severe in the Dohler Flats area that the Ministry of Environment recommended the approximately 20 families living in the area to move into hotels in Smithers. However, the residents choose to stay to look after their properties.

On December 27, the dam stabilised and none of the 50 homes in the area had been flooded, but Provincial Emergency Program workers warned residents to prepare to evacuate. The extremely cold weather with temperatures of -30°C caused the ice pack to thicken, but also lessen the chance of flooding. One resident estimated the ice flow about 2-3 mi. (3.2-4.8 km) long, and the water level 3 m above normal. On December 28 the water rose 5 ft. (1.5 m) overnight, but later dropped. Cooler weather stabilised the ice jam, which was now about 8 km long.

The sudden cold weather prevented serious icejam flooding near Smithers in the low-lying Kidd and Ebenezer subdivision just opposite the town and Dohler Flats on the west bank of the river below Smithers. On December 27 and 30, Smithers recorded temperatures of -22°C and -35°C , respectively. *2) The near-record December cold and an upriver icejam off the end of Donaldson Road combined to avoid large-scale flooding.

On December 28, the dam was just over 4 km long and not showing any signs of weakening. The event started on December 23 when the weather warmed up to zero and started to rain. The water level rose and ice patches along the riverbanks broke off and started floating downstream. When the weather turned cold again the dam started to form at a narrowing where a pile of boulders caught the floating ice. Water was also rising at the other end of town. Officials had considered blasting the dam on Christmas Day, but believed the ice was too soft and therefore unsafe for workers to walk on to set up an explosive device.

On December 27, an avalanche hit the powerline near its highest point along the route between Kemano-Kitimat. One tower was totally destroyed, downing about 1 km of powerline. Due to the inhospitable weather and terrain it took 43 days to reconstruct the tower and restore power to the line. Fortunately, a parallel line was undamaged and was able to provide power for the interim. The cost of repairing the damage came to over \$1 million.

A hard, storm-snow slab fractured 1,000 m wide. Both the west and east aspects of Glacier Creek Bowl avalanched and ran about 1,000 m down the 40° incline, not stopping until they reached 10° terrain. The avalanches were size 3 and 4, respectively.

Prior to December 18, a cold, clear period had produced a weak layer of facets up to 4 cm thick sitting on 50 cm of multi-layered ice crusts. Between December 18-26, up to 250 cm of storm snow accumulated on top of the weak layer formed into a stiff slab of pencil hardness. On December 27, an Arctic front moved in and dropped the temperature to -22°C . A strong northeast wind transported even more snow onto the unstable snowpack. (Jamieson and Geldsetzer 1996).

*1) Freeze-up jamming and lowland flooding are not uncommon on northern rivers. The Bulkley River, however, usually flows freely through the Telkwa and Smithers areas (Reid White, head of engineering, Water Management Branch, Skeena Region, In: *The Interior News*, January 6, 1993).

*2) The latter tied the all time low set in 1984. In January 1938, Smithers experienced the coldest day on record with -43.9°C (*The Interior News*, January 6, 1993).

Late January 1993

Event type: Debris slide.

Precipitation: Nass Camp (49.2 mm/2days), January 28-29, 1993; Prince Rupert M. Circ. (132.1 mm/1 day), January 29, 1993; Kitimat 2 (45.2 mm/1 day), January 29, 1993.

Source: Frank Maximchuk (Ministry of Transportation and Highways, Terrace) pers. comm.

Late January on the Tow Hill Road a small slide came down on the northeast backside of Tow Hill. The slide, with a volume of approximately $600\text{--}1,000 \text{ m}^3$, occurred in extremely saturated clay. It was a flow rather than a block slide (Maximchuk, pers. comm.).

Early June 1993

Event type: Spring runoff flooding.

Precipitation: Smithers (126.8 mm/30 days), June 1993.

Source: *Terrace Review*, June 6, 1993; *The Interior News*, July 7, 1993.

Early June some flooding occurred in the Terrace area. According to Mike Zylicz, North Coast Road Maintenance manager, flooding was a real concern in some areas. Part of Usk flooded but the situation was not nearly as serious as that in Prince George and the Fraser Valley. There was 1 ft. (30 cm) of water on the road near Old Remo. The Greenville Road was flooded but this was considered more an annual than an emergency event. Flooding at the Esker overpass construction site on Highway 16 west of Terrace was only prevented when workers used fill from the overpass approach to raise the level of the detour there.

Smithers recorded the wettest June on record. A total of 126.8 mm of rain fell, breaking the previous record of 113.5 mm set in 1946. *1) During the wet periods, just after June 1 and around June 22, logging operations and road building in the Kispiox Forest District were shut down.

*1) The average rainfall for Smithers for June is 42 mm (*The Interior News*).

September 6-7, 1993

Event type: Glacial outburst flood.

Precipitation: Not applicable.

Source: Eero Karanka, pers. comm. Dept. of Fisheries and Oceans, Prince Rupert, B.C.; D. Diana, pers. comm. Skeena Sawmills, Terrace, B.C.

During the late afternoon or early evening of September 6, in the Kitimat Range an ice dam break and subsequent rapid draining of a lake beneath the glacial ice occurred. Close to the source, sediment was deposited over banks and in backchannels.

On the morning of September 7, a sediment slug or a wall of mud was observed moving down the Kitimat River. The event was apparently first noticed around 10 a.m. by a field crew at km 17 of the Kitimat Main (River km 53). Around 2 p.m., the discharge reached the 8 km bridge at MacKay Creek (River km 43.3) and the Highway 37 bridge (River km 38.3 km) around 3 p.m. Dino Diana, Skeena Sawmills field operations supervisor, also estimated the plume covered a distance of 15 km. At its junction with the Kitimat River he reported seeing muddy backwaters, and signs of flooding in the trees, including a "blackish ooze."

When first noticed the sediment slug had traveled some 25 km. The rate of movement of the front of the plume down the Kitimat River between the time it was first spotted and the time it arrived at the mouth was estimated at 2.5 km/h. If the plume was 15 km long and moved at the same speed since its arrival in the Kitimat River, it took six hours to form, beginning in the late afternoon or early evening on September 6. (Karanka, pers. comm.).

The source was determined from a glacier within the Kitimat Range. According to Dr. J.J. Clague, since small glaciers tend to be more fractured from their surface to their base, they may be more susceptible to in-glacier ponding. If the drainage channels become temporarily plugged water can build up in the fractures and then release when sufficient hydraulic pressure builds up.

On September 8 at 11 a.m. a large sediment plume was evident at the mouth of the Kitimat River (E. Karanka, pers. comm.). The Fish Hatchery at Kitimat reported that the water was dirty, but diluted by the time the plume reached Kitimat.

November 1-2, 1993

Event type: Landslides and flooding.

Precipitation: Prince Rupert A (115.4 mm/2 days), November 1-2, 1993; Prince Rupert M. Circ. (126.1 mm/2 days), October 31-November 2, 1993; Terrace A (93.2 mm/2 days), November 1-2, 1993; Kildala (58.1 mm/1 day), November 2, 1993.

Source: *Prince Rupert This Week*, November 7, 1993; *The Daily News*, January 19, 1994.

Two days of torrential rains accompanied by strong winds caused two slides near Prince Rupert. The largest one came down at 12:30 p.m. on November 1, on Wantage Road ca. 100 m past the Mount Hays gondola chalet. An empty World War II vintage concrete building helped channel the flow of mud and trees into a ravine behind the old city dumpsite. The slide, which funneled down near the disused BC Tel dynamite shack, caused the closure of Wantage Road past the city yards. It narrowly missed the BC Hydro powerlines along the road. A smaller slide came down on November 2, from the middle of the cut on the gondola path and into the trees, causing no damage to the road.

A geotechnical report released on January 17, 1994, recommended to reduce risk to the public, the Mount Hays access road remained closed till the site could be further studied. The report from the geotechnical engineering firm Golder and Associates of Vancouver advised there was risk of further slides in the area. The engineer conducting the survey had been prevented from fully assessing the slopes because of high water levels shortly after the slide occurred.

November 2, flooding occurred in the Terrace area.

November 18-20, 1993

Event type: Fatal debris slide.

Precipitation: Kitimat 2 (66.4 mm/1 day), November 18, 1993; Prince Rupert M. Circ. (166.9 mm/2 days), November 18-19, 1993; Stewart A (81.8 mm/2 days), November 18-19, 1993; Terrace A (37.8 mm/1 day), November 19, 1993; Hartley Bay (221.8 mm/36 hrs.), November 19-20; Kildala (107.2 mm/36 hrs.), November 19-20; Kitimat Townsite (108.2 mm/36 hrs.), November 19-20.

Source: Files Ministry of Forest, North Coast Forest District.

On November 19 at approximately 2:15 p.m., a debris avalanche buried and killed a Tsibass Construction Ltd. buckerman. The failure traveled approximately 80 m depositing mud and debris on the road. It started without warning and moved very rapidly down covering the worker. Efforts to rescue the victim were unsuccessful. The accident occurred in Blk. 4, CP410 of TO 236 on the eastern shore of Allan Reach near Shearwater Point approximately 70 km southwest of Kitimat.

The relatively small slide, which was about 10 m wide, 75 m long and 0.5 m deep moved approximately 350 m³ of material. Based on preliminary findings the slide occurred as a result of a combination of heavy rains, steep terrain and destabilised soils resulting from harvesting activities. Heavy rain was reported on the day of the event. Hartley Bay, located approximately 45 km due west of Shearwater Point, recorded 144 mm on November 19.

Late December 1993

Event type: Clay flowslide.

Precipitation: Not applicable.

Source: *The Terrace Standard*, April 27, 1994; September 28, 1994; File 17275-20 Mink Creek, Memorandum, April 21, 1994, J.W. Schwab, Research Geomorphologist, B.C. Ministry of Forests, Smithers. Geertsema. 1995; Geertsema, pers. comm. November 21, 2003.

Around late December, a landslide near Lakelse Lake came down and partially dammed Mink Creek. It left a 25-ft. (7.5 m) drop off at the top of the slope covering the shallow valley floor with a soup of clay, gravel and silts. The 23-ha earthflow in sensitive glaciomarine sediments involved 1.4 million m³ of material. The landslide crater is located less than 10 km from the sites of two other large earthflows that occurred at Lakelse Lake in May and June 1962.

This major slide came within 1 km of the Mink Creek trestle on the Terrace to Kitimat rail line. The failure occupying an area of 32 ha. occurred on terrain gently sloping at 10% toward Mink Creek. Approximately 500,000-600,000 m³ of material moved downslope. The creek was plugged with an estimated 240,000 m³ of water saturated sensitive clay and debris covering a length of 1,200 m of stream channel (north and south forks). Aerial photos taken by Skeena Cellulose showed a discoloration of Lakelse Lake caused by the surge of sediment into the lake.

The remainder of the creek carried heavy sediment laden water to the junction with Lakelse River. The mud formed a dam and created two ponds. The largest pond, on the north fork of Mink Creek, extended back for a distance of 900 m to the railroad trestle. The pond on the south fork extended back 400 m. The total area impacted by the slide, including the run-out into the creek was 43 ha. (Geertsema, pers. comm.).

February 10-13, 1994

Event type: Non-fatal snow slides.

Precipitation: Not applicable.

Source: Jamieson and Geldsetzer 1996 (p. 176).

On February 12, an avalanche near Kildala Pass trapped six people in an emergency shelter for several days. On February 10, two crews of six were flown by helicopter to Kildala Pass to restore a powerline tower. As the first crew left, the weather deteriorated. The other six people were forced to stay behind, finding refuge in the small emergency shelter at the base of the damaged tower, which was exposed to avalanches from Glacier Creek Bowl. *1)

Overnight February 10-11, an estimated 100 cm of new snow fell. At noon, there was a light to moderate wind and the barometric pressure was falling steadily. The men, preparing to stay for an indefinite period, spent then entire day shoring up the shack with double 2 x 12 pillars.

During the night of February 11-12, an avalanche hit and damaged the shack and dumped 2 m of snow on the roof. An estimated 50-75 cm of new snow fell; the wind was moderate from the southwest and the pressure bottomed at 828 mb.

At 10 a.m, another large avalanche shook the shelter. The two men shoveling snow outside escaped. The snow/air turbulence the men heard and felt inside indicated that a fairly major avalanche had passed by.

Overnight February 12-13, an additional estimated 20-30 cm of snow fell. The wind was light from the southwest and zero visibility. Later that day, a helicopter was able to airlift the men out. The remains of a fracture line estimated 2 m deep was observed between the towers on the pass.

*1) Because of this incident, the shelter at camp 12 is no longer used for overnight stays in the winter. All work is done with a helicopter on hand and in fair weather.

May 22, 1994

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: *Northern Sentinel*, May 25, 1994; *The Terrace Standard*, May 25, 1994.

On May 22, a small snow avalanche killed a member of a ski-mountaineering group. The accident occurred near Europa Lake, 125 km south of Kitimat. The victim, 31-year old Randy Stoltmann of West Vancouver, was swept over a 360-m cliff. Stoltmann, a well-known environmentalist, and his four companions were on a 21-day ski-mountaineering holiday from Mussel Inlet to Cornwall Point in the Gardener Canal near Kemano.

September 5-6, 1994

Event type: Non-fatal landslide.

Precipitation: Scotia River (47.0 mm/ 2 days), September 5-6, 1994.

Source: Tony W. Wideski, Operations Manager, North Coast Forest District. Operations Division Early warning: Roadside slump in Alder Creek, North Coast Forest District; File 17275.01 Letter September 26, 1994, J.W. Schwab, Research Geomorphologist, to Tony Wideski.

On September 6 at approximately 10:00 a.m., a roadside slump near the Alder Creek Forest Service Road partially buried a worker. The victim, who was hand cleaning a ditch below a 2 m high cutbank, was knocked unconscious and was not found for approximately one hour. He was subsequently evacuated to Prince Rupert Regional Hospital where his condition was reported as stable. The incident occurred on an upper spur: Stn. 1+458.8 within Timber Sale Licence A43277. The slump, which was 13 m long, 8 m wide and 3 m deep displaced about 312 m³ of material and was caused by a combination of factors. High rainfall during the previous days had saturated the soils while the uphill side of the road was destabilised from recent road building activities.

September 22, 1994

Event type: Flooding and mudslide.

Precipitation: Not available.

Source: *The Interior News*, September 28, 1994.

In the Meziadin-Iskut area, heavy rains accompanied by unusually warm temperatures caused swollen rivers and creeks, washed out roads, minor mudslides and clogged culverts. On September 22, a flash flood knocked out Burrage Bridge between Bob Quinn-Iskut and closed traffic on Highway 37 for several days. One end of the 110-ft (33 m) steel girder bridge collapsed when the Burrage River washed out an approach. The span fell about 15 ft. (4.5 m). An emergency Bailey bridge trucked in from Terrace was expected to be in place on September 26. On Highway 37A to Stewart in the Bear Pass, the top of a large steel culvert collapsed. A temporary Bailey bridge was installed. While repairs were carried out, traffic was reduced to single-lane only.

September 28, 1994

Event type: Fatal debris slide.

Precipitation: Not applicable.

Source: *The Terrace Standard*, October 5, 1994.

A section of road under construction at Kiseadin Creek near Greenville gave way. A D-8 Cat employed building a road on a steep slope plunged 1,500 ft (450 m). A heavy equipment operator was killed. The victim was trapped and pinned inside the machine. Helicopters tried to extricate the Cat. Using every piece of available equipment, it still took more than 24 hours to recover the body. Heavy rainfalls were reported in the area prior to the accident.

November 3, 1994

Event type: Subaqueous slide and tsunami.

Precipitation: Not applicable.

Source: Cornforth and Lowell 1996; Kulikov et al. 1996; Evans (unpublished data).

On November 3, a submarine slide occurred at the head of Taiya Inlet at Skagway, Alaska, about 20 km from the British Columbia border. (Cornforth and Lowell 1996; Kulikov et al. 1996). *1) Major renovations were being undertaken at a dock on the east side of the harbour. The work involved pile driving and the storage of riprap on the dock.

At 6:47 p.m., an extremely low tide (-1.3 m) occurred. At 7:10 p.m., the entire south end of the 260-m long dock slid into the water, killing a worker on the dock. The total time taken for the total loss of ground was estimated at approximately 15-20 seconds. (Cornforth and Lowell 1996). The slide generated a 3.7-m high wave that moved across the harbour, causing significant damage to the nearby public boat harbour and to the terminal of the Alaska State Ferry, 280 m from the dock.

Three days prior to the failure, signs of distress in the form of cracking and pile movement had been noted. The replacement value of the railway dock was estimated at \$15-20 million. (Kulikov et al. 1996).

*1) A similar submarine slide had taken place at the dock in 1966. (Kulikov et al. 1996).

November 22, 1994

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Terrace Standard*, November 30, 1994.

On November 22, a rockslide came down onto Highway 16 between Terrace-Prince Rupert. A huge slab of rock broke off above the highway and shattered into pieces when it hit the road. It hit the tail end of a passing logging truck, causing to spill its load over the highway. There were no injuries to the driver. Dynamite was used to clear the highway, which was closed for approximately six hours.

December 19, 1994

Event type: Flooding.

Precipitation: Prince Rupert (42.2 mm/1 day), December 19, 1994.

Source: *The Daily News*, December 20, 1994.

In Prince Rupert, days of steady rains (incl. 42.2 mm on December 19) caused flooding of a couple of Third Avenue businesses. Clogged drains at the back of the Bargain Shop caused extensive flooding. The store lacks a back alley and proper drainage, causing the water to build up and then running underneath into the store's crawl space. On the morning of December 20, the situation was under control with one pump extracting 450 L of water per hour. Tinker Realty, another business on Third Avenue, also sustained water damage on December 19 when water came off the cliff behind the building.

January 1995

Event type: Severe storm.

Precipitation: Not applicable.

Source: *The Interior News*, January 15 and 29, 1995; *Houston Today*, January 29, 1995; *Lakes District News*, January 1995.

In early January, heavy snowfall caused many roofs of commercial buildings and barns in the Bulkley Valley to collapse. In the Smithers area, there were at least 12 collapses, all farm buildings and other structures built without permits or inspections. Snow core samples taken by Richard Wainwright, building inspector for the Regional District of Bulkley-Nechako, showed a snow load of 45 lb./in.². As of January 21, unshoveled roofs in Houston had about 2 ft. (60 cm) of snow at a weight of about 31 lbs./in.². *1)

In Smithers, the entire roof of The Peak billiards and espresso came down. The 50 x 90 ft. (15 x 27 m) building, constructed in June 1979, was worth about \$250,000. For years it operated as an auto parts store before the Peak opened the previous April. A sidewall collapsed, crushing a couple of vehicles and narrowly missing the next door building. The wall on the other side was pushing dangerously against the Legion building, forcing the evacuation of occupants.

On January 7, snowloads also collapsed the roof of the downtown Smithers Bi-Rite Furniture warehouse. Bi-Rite's main building also suffered snow-load damage. On January 11, the landmark Storie barn collapsed from the weight of the snow on its roof. Built in the mid 1920s by the Fagerlet family, it was used store hay and house cattle and horses.

In Quick, a 1.5-year old hay barn slumped over. The 60 x 80-ft. (18 x 24 m) building was used to store hay, a tractor and some equipment. In Houston, one barn and the old BC Hydro building at 11th Street collapsed. In the rural Burns Lake area, at least eight Quonsets, arch-shaped corrugated steel structures, and four other buildings including the 1947-vintage gas station at Grassy Plains collapsed.

*1) Prior to 1993, in Smithers and Houston buildings were designed to withstand minimums of about 30 lb./in.² and 35 lb./in.², respectively. Beginning in 1993, the Canadian Building Code set the limit at 46 lb./in.², a 50% increase. (*Lakes District News*).

May 14, 1995

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Houston Today*, May 24, 1995.

On the evening of May 14, Buck Creek came close to washing out a section of Houston's dyking system. Near the end of Haftner Road, off Riverbank Drive, a sharp corner of the dike was half washed out. Thanks to the call from a concerned resident, works crews managed to shore up the dike before Buck Creek could break through. Had crews been informed any later, the dike at this point might have burst, flooding nearby residences.

May 27, 1995

Event type: Dam burst flooding.

Precipitation: Not applicable.

Source: *Quesnel-Cariboo Observer*, May 31 and June 7, 1995; Ministry of Environment, Lands and Parks. files.

On May 27 at around 8 a.m., a 6-m high earth-filled irrigation dam about 45 km east of Quesnel failed. *1) It caused approximately \$500,000 to the road system and other property damage. The sudden release of the storage killed 48 head of cattle, destroyed 1.5 km of a public road, damaged between 100-200 ac. (40-80 ha) of hayfield. According to the *Quesnel-Cariboo Observer*, the Buchanan's ranch lost 17 cows and 10 calves. Besides killing the cattle, it rendered half of the 600 ac. (240 ha.) Buchanan Ranch useless. The slide dumped thousands of tons of gravel and debris into the Quesnel River, about 300 ft. (90 m) below the ranch. Ironically, a day prior to the dam burst, a deal to sell the ranch fell through. Part of the reason for the failed real estate transaction were problems cited with the dam.

The dam was on a sloping hillside about 1,000 ft. (300 m) above the ranch, and 2 km south. It held back a 12 to 15-ac. (4.8-6 ha) body of water, 20 ft. (6 m) deep. The torrent cut a quarter-mile (400 m) swath down towards the Quesnel River. Some 700,000 m³ of material into the river, turning it dark for 45 km.

About a 40-ft. (12 m) section of Hydraulic Road disappeared into an instant 25-ft. (7.5 m) deep ravine. A 20-ft. (6 m) piece of the roadway holding the lake blew away. According to district highways manager Grant Lachmuth, it would take up to two weeks and up to \$250,000 to stabilize Hydraulic Road. Some 2 km of the road had to be reconstructed. Road damage was later estimated at less than \$200,000.

The torrent peaked at about 8:15. The roar from the mountainside was deafening, "like a squadron of jets flying in a low-altitude mission." A wall of water, trees and debris headed directly towards the ranch. Three occupants of the ranch narrowly escaped "river as wide as the Fraser." The force of the cascading river created its own wind.

Fifteen minutes later, the flow was beginning to back off and by 9 a.m. it was reduced to a trickle. Much of the ranch's northern pasture turned into a series of ravines. In some places, these gorges dropped 300 ft. (90 m) deep, measuring more than 100 ft. (30 m) across.

For a week prior to the burst, the Buchanans had experienced trouble with their irrigation dam. Just days earlier, a diver had been hired to take a look and repair a faulty gate valve at the dam. He reported that water was running under the 16-in. (40 cm) culvert. Material was deposited around the culvert and the valve was repaired. At that point, the culvert was considered working properly.

Garth Wakelam, the region's dam inspector, suspected the failure of culvert, which either became corroded or somehow separated, as the cause. Despite an extensive search of the area, including the Quesnel River, the culvert was never found. The Buchanans, who were not insured for such an occurrence, may receive some funding from the provincial emergency program.

*1) The dam, one of the approximately 500 licenced in the Cariboo-Chilcotin-Bella Coola region, had been constructed in 1962. In 1992 when last inspected, there were several improvements recommended. But the dam itself was declared a "C" hazard, the lowest category. No follow-up inspection had taken place. The Ministry of Environment, Lands and Parks intended to use the Buchanan flood as part of a video to help other dam owners understand the damage that can occur. (*Quesnel-Cariboo Observer*, June 7, 1995).

July 13, 1995

Event type: Debris slide.

Precipitation: Not applicable.

Source: Letter July 27, 1995, J.W. Schwab, Research Geomorphologist PRFR to G. Rawlings, Operations Manager PRFR, File A16841, Mt. Elwin Main (Kumealon Inlet Operations, International Forest Products).

A slope failure occurred at Moore Cove, off Greenville Channel south of Prince Rupert. The failure occurred at the end of a newly constructed grade (Sta. 0+143 Mt. Elwin Main). It measured 15 x 43 m entraining a volume of approximately 420-450 m³. The debris flow initiated in an old headwall of a previous slope failure. It entered a steep gulley and traveled an additional 90 m downstream. Much of the organic debris from the failure remained in temporary storage within a steep channel.

Rainfall was not considered a factor in triggering the debris flow. Weather records for the Prince Rupert area indicate that no rainfall of significance occurred on the days or even weeks preceding the event.

January 1 and 6-15, 1996

Event type: Rain-on-snow flooding and debris slide.

Precipitation: Terrace A (48.2 mm/1 day), January 1, 1996; Terrace A (145.8 mm/7 days), January 6-12, 1996.

Source: *The Terrace Standard*, January 10, 1996; *The Daily News*, January 15, 1996; *Lakes District News*, January 17, 1996; *British Columbia Report*, January 29, 1996; Len Barak, Ministry of Environment Lands and Parks, pers. comm.; CBC newscasts, January 11 and 12, 1996.

Early January, two rain and/or snow events took place in the Terrace area. Unseasonable warm weather with rain and a melting snowpack caused flooding and avalanches. Heavy rain occurred in north coastal British Columbia with heavy snow in the Stewart area.

On January 1, the Terrace airport recorded 48.2 mm precipitation, which included 33.2 cm of snow. For three or four hours, the snow came down at a rate of 4 cm per hour. (*The Terrace Standard*, January 10, 1996). On January 10, the Shames Mountain ski hill recorded over 100 cm of snow in 24 hours. Because of the avalanche danger, the Ministry of Transportation and Highways closed the road to the ski hill for two days. Between January 7-13, about 2 m of snow fell on Stewart. For four days starting January 10, snowdrifts up to 4 m deep and 100 m long covered the highway at Bear Pass, 25 km. east of town. This prompted the Ministry of Highways to close Highway 37A, the only land route in and out of town, for four days. *1) Highway crews feared that, even if they cleared the route, avalanches might cover the road again. Due to a high avalanche danger, Highway 37 was closed between Bell II-Bob Quinn. During the snowfall, the local airstrip was closed as well.

On January 13, a washout 15 mi. (24 km) east of Terrace put the rail track out of commission for about 24 hours. Train traffic was interrupted and VIA Rail passengers were bussed between Smithers-Prince Rupert on January 13 and 14. The slide was the first traffic interruption on the British Columbia north line for several years (*The Daily News*, January 15, 1996).

During January 12-13, two debris flows from unlogged gulley systems hit the Shannon Mainline, located a short distance up the Skeena from Terrace. On January 12, Terrace airport 15.8 mm of rain melted the 29-cm snowpack. Given that the preceding four days were warm and wet, it is reasonable to assume that the snowpack had at least 30% water equivalent. Thus the minimum total water on January 12 was 15.8 mm plus 87 mm = 102.8 mm, or a return period of approximately 20 years. The maximum water content for the snowpack could have been 39%, recorded on December 30, 1992 at the Terrace airport. Thus the maximum total water on January 12 could have been 15.8 mm plus 113.1 mm = 128.9 mm or a return period of approaching 100 years. (Len Barak, pers. comm.).

In the Francois Lake-Ootsa Lake area, unusually heavy snow combined with poor design in some cases caused the roofs of at least seven buildings to collapse. Between January 13-14, five structures (hay barns), one shop and one of undetermined nature came down. Building inspector Wainwright came close to issue a snow advisory, which he did do when about 20 roofs collapsed in February and March 1994. On that occasion, however, mild temperatures and heavy rain had swept through the area.

Bella Coola recorded some 200 mm of rain in 36 hours. On January 11 and 12, schools were closed due to a possible flooding threat. Provincial Emergency officials issued a flood alert, warning Bella Coola residents to be ready to move to higher ground.

*1) The last time Stewart residents faced a four-day road blockage was in 1989. Mayor Andy Burton suggested that the ministry boost funding to keep the highway open, or install fixed gun mounts for mortars to clear snow from mountainsides (*British Columbia Report*, January 29, 1996).

1996

Event type: Dam burst flooding.

Precipitation: Not applicable.

Source: Letter December 3, 1996 to Helmut Hemmel Ministry of Environment, Lands and Parks file D620198/Frame Creek Dam 6000437.

Sometime in 1996, a dam failure occurred on Frame Creek. During the construction, earthfills were likely too great for the compaction equipment. Tracked equipment like bulldozers, though they are heavy, their weight is dispersed upon its track, resulting in less than optimum compaction. Evidence also suggested that the slopes of the dam were too great for soil conditions.

Upon reservoir filling, beaver activity plugged the inlet of the spillway raising water levels. High watermark suggests freeboard was dramatically reduced and threatened overtopping. Saturation of the downstream slope occurred and it began to slough. The 20-cm outlet sluice was opened to drain the reservoir, which took three to four weeks. The saturated upstream slope failed and sloughed into the reservoir, damaging the gates and possibly the intake.

Mid February 1996

Event type: Flooding.

Precipitation: Not available.

Source: *The Terrace Standard*, February 21, 1996.

During mid-February, heavy rains on top of frozen ground caused flooding near Terrace. A portion of the road near the cemetery and part of the graveyard flooded. According to Steve Scott, head of the parks and recreation department for Terrace, flooding at the cemetery is not a common problem. *1)

*1) Since the soil is quite sandy there and the graveyard is located far from any sewer line, no additional drainage was included in the cemetery (*The Terrace Standard*, February 21, 1996).

April 9-13, 1996

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: *The Interior News*, April 17, 1996; January 14, 1998; *Houston Today*, April 17, 1996.

Around April 10, ice jams occurred on the Telkwa River and Buck Creek. A huge break-up icejam created a bottleneck on the Bulkley River, forcing the water over the riverbanks into some homes and yards. The jam began forming around April 9 when upstream chunks of ice drifted into old river ice. Late on April 10 the rising water threatened major flooding for a couple of days. At one point, the ice pack extended about 5 km, from the Donaldson Road area to beyond the Telkwa bridge.

In Telkwa, "a handful" of residents and one business were directly affected by the flooding and three or four families were evacuated. On the afternoon of April 11, Jerry and Nancy Clausen were evacuated from their home in the low-lying area near Eddy Park. John Sproule's residence suffered the most severe damage. His fully camperised school bus was covered and broadsided. It floated around and jammed against a fence. Next door, staff at Bulkley Valley Farm Supply scrambled to move lumber and other merchandise from the store's riverfront storage. The icejam threatened the Overstall residence beside Eddy Park.

Long-time residents said it was the highest they had ever seen the river rise. Isabel Paulsen, who moved to the village in 1947, noted they had seen high water before but "never seen anything like this." After the waters went down, Bernice Sparks, who had lived by the river for 28 years, was left with a yard covered with mini-icebergs and piles of river silt.

According to Bill Elsner, the village's volunteer emergency co-ordinator, the water backed up about 12 ft. (3.6 m) in about 90 seconds, flooding Highway 16. Early predictions were for the jam to last up to a week. The most critical period was on the late afternoon of April 12 when there was every chance the river would spill over its banks. But sometime around 9 p.m. on April 12, the ice shifted and the river broke through, moving the jam downstream.

According to Ministry of Environment water branch hydrologist Paul Marquis, the jam was just too large to dynamite or bring machinery in for. The jam finally broke on the afternoon of April 13.

The jam at Buck Creek near Houston was not as serious as Telkwa's. By April 12, the ice had melted away.

May 17, 1996

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: *The Vancouver Sun*, May 24, 1996; Jamieson and Geldsetzer 1996 (pp. 164-166).

On May 17 at about 12:30 p.m., an avalanche down the slope of Mount Cerberus in the Monarch Icefields about 70 km from Bella Coola killed four skiers. Six members of the B.C. Mountaineering Club were on a 21-day expedition to the Monarch Icefields. Before setting off to reach the summit of Mount Cerberus, the group had dug a pit to evaluate the snowpack stability.

One member decided to turn around at the base of the steep (35-45°) west face of Mount Cerberus and skied back towards their camp. During the ascent the group stopped. One of the survivors considered the risk to high and descended and began building a windbreak for a group lunch shelter. Watching the progress of the other three. At approximately 12:45, after reaching the uppermost visible crevasse and in the process of passing it, an avalanche released. The three climbers who were quite close to each other were likely swept off the cliff (200-300 m) over the icefall and down to the basin below.

The party member that had turned around earlier was returning to meet the others due to poor visibility on the ski route back to camp. The avalanche released as she continued up to meet the person building the windbreak. She turned around and tried to run away but was knocked down by the wind and spray.

As all the group members were wearing transceivers, the two survivors located all three victims in approximately 20 minutes. The first victim was uncovered in about one minute, having been partially buried with part of his pack showing. The second recovery was five minutes later and the last was within 20 minutes. The two buried climbers were both under about 1 m of snow. None exhibited pulse, pupil response or any other sign of life.

Having determined that there was nothing further they could do for their friends, they left the bodies partially buried. One of the victim's transceivers was left on "transmit." The two survivors returned to their camp and prepared for the three-day ski out via Talchako, Hanlen Falls and Atnarko to their truck.

The avalanche was a size 2.5 dry slab, which released on a 37° glaciated slope at 3,100 m just above the uppermost crevasse on the west aspect of Mount Cerberus. Dimensions of the initial slab release in the storm were 30

cm deep by 60 m wide. The deeper slab 50 m downslope was from 40 cm to 1.5 m deep and 90 m wide, stepping into the older snow layer, possibly along the climbers' steps.

The sun burning down on the slope was thought to be the cause of the avalanche. Early May had been very cool with significant snowfall and unusually low freezing levels. The weather during the four days prior to May 17 was unstable, stormy and cool. Daily new snow averaged 4-6 cm and temperatures were -3 to -10°.

On May 23, search and rescue personnel from Whistler and Pemberton flew to the site by helicopter. After a stability evaluation, the bodies were located and recovered from under light amounts of new snow. At 12:30, 15 minutes after the bodies were recovered, another avalanche occurred under the same conditions.

Late May 1996

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Lakes District News*, May 29, 1996; *Houston Today*, May 29, 1996; *The Terrace Standard*, May 29, 1996.

At the end of May, following a prolonged period of below normal temperatures coupled with higher than normal snowpacks, many British Columbia river basins had the potential to high runoffs and possible flooding over the next weeks. The most recent snow surveys showed snowpacks above normal in much of the interior. Since this survey, some areas received additional snow accumulations, most unusual at this time of the year.

The Bulkley River basin was one of the areas of concern. Due to spring runoff Buck Creek was approaching or at capacity. The Skeena River (near Terrace) was only somewhat above normal. On May 27, it measured a flow of 3,000 m³/s, up from the 2,500 m³/s norm.

June 10, 1996

Event type: Debris slide.

Precipitation: Not applicable.

Source: Individual Erosion Event Report Form June 17, 1996 by Rob Cuthbert, Engineering Specialist.

Around June 10, a debris slide occurred in the Chambers Creek area. It happened on a steep slope of mature timber on thin soils over bedrock. Gravity and soil moisture most likely helped make the slope unstable. The slide in CP50, Blk. C1B, Forest Licence FLA-16820 measured approximately 40 m x 430 m.

June 14, 1996

Event type: Sinkholes.

Precipitation: Not applicable.

Source: *Peace River Block Daily News*, January 15, 1997; *Canadian Press*, June 6, 1997.

During the summer, two sinkholes were found in the W.A.C. Bennett Dam. *1) On June 14, a tourist noticed the first one, about 40 m deep, in a road across the bridge. Drilling tests showed the sinkhole was caused by a 110-m long pipe about 15 cm in diameter that had been left in the dam when the construction was completed in 1967. In September, a smaller sinkhole was discovered surrounding a second survey pipe embedded in the dam. The discovery of the two holes in June and September caused alarm. It was feared that the dam might breach and spill the contents of the 1,120-mi.² (2,900 km²) Williston Lake Reservoir, the largest in North America.

Hand compaction of material around the benchmark pipes during the construction of the dam was believed to be the cause of the two sinkholes. According to BC Hydro spokesman Dave Read, also the 30-ft. (9 m) areas around the sinkholes were not firm as could be and silt in the core of the dam had been moving. The sinkholes were refilled and the road across the dam rebuilt. To stiffen up the core of the dam the holes were filled by compaction grouting. Work for each hole was expected to cost about \$7 million (*Peace River Block Daily News*, January 15, 1997).

In May, the level of Williston Lake behind the dam dropped significantly, causing dust storms in some shoreline areas. By June, the reservoir started to refill. B.C. Hydro officials expected the lake to reach its normal level in September.

*1) The huge earth dam in northeastern British Columbia contains 57 Million m³ of fill, mostly compacted till. A cross-section of the dam resembles a giant triangle, 800 m at the base, 12 m across the top and 185 m high. The dam, completed in 1967, is 13 m above the level of Williston Lake, which stretches about 100 km west behind it. It provides about one third of British Columbia's hydroelectric needs (*Canadian Press*, June 6, 1997). The sinkholes are columns of loose material 8 ft. (2.4 m) across and about 100-120 ft. (30-36 m) deep. It is basically a round elevator shaft that is not at the specified density (*Peace River Block Daily News*, January 15, 1997).

November 7-9, 1996

Event type: Severe storm.

Precipitation: Smithers A (75 cm snow/2 days), November 7-9, 1996.

Source: *The Interior News*, November 13, 1996.

Between late afternoon on November 7 and the afternoon of November 9, the Bulkley Valley recorded about 48 hours of continuous snow. The storm paralysed the valley, leaving roads and driveways clogged, knocking out

powerlines and causing cancelled air flights. Many long-time valley residents said they couldn't recall "as big a dump of snow so early."

During the storm, between 2,000-3,000 customers lost power for different lengths of time, some for more than a day. The Kispiox Valley experienced the longest outages. Parts of Smithers lost power but the longest outages were in the rural areas, including Driftwood, Kidd Road, Seymour Lake, and Kroeker Road. To the east, the Quick-Walcott area was out as well. Other areas affected included Kitwanga, Kitwancool, Kispiox Valley, the Carnaby saw mill and Moricetown.

November 20-27, 1996

Event type: Icejam flooding.

Precipitation: Not available.

Source: *Prince George Citizen*, November 25, 26, 28 and 29, 1996; *Alcan in BC*, December 1996 (p. 9); Geonorth Engineering Ltd. 1998. Nechako River bank erosion study. Miworth and Prince George, B.C.; Ministry of Environment, Lands and Parks files. Fax December 4, 1996, Glen Davidson to Neil Hamilton.

In November, a combination of higher than average flow and a sudden cold snap led to ice jamming in the Lower Nechako River. *1) It resulted in severe flooding and localised bank erosion in Prince George. Wet weather conditions in the second half of 1996 and an early coldsnap in the central Interior caused flooding in low-lying areas of Vanderhoof and Prince George. Several homes and businesses located on the floodplain of the Nechako River were affected when the river rose abruptly due to ice blockages.

It began a week after Alcan had concluded a program of higher than normal water releases from the Nechako reservoir to create storage space for the 1997 spring runoff. Alcan's plans to shut off the fall release from its Nechako Reservoir on November 8 were extended to November 15. On that date, flows were reduced from 8,000 cfs (226.5 m³) to 2,000 cfs (56.6 m³). On November 15, the Nechako River's flow through Prince George was estimated at 14,700 cfs (416.3 m³) and on November 23, more than a week after the reduction at the spillway, the flow through the city was estimated at a little under 10,700 cfs (303.0 m³). As of November 23, 70 per cent of the reduced release from the spillway had already been registered in the Nechako River at Prince George. *2)

On November 19, temperatures in the region plummeted to -30° C for a five-day period. This early and sustained cold snap caused ice to form quickly on the river, restricting the passage of flows and causing the river to overtop its banks at some points. Wet weather conditions over the second half of 1996 and an early cold snap in the Central Interior resulted in flooding low-lying areas in Vanderhoof and Prince in November. When the river rose abruptly due to ice blockages, several homes and businesses located on the flood plain along the Nechako were affected.

On November 20, a series of ice jams began forming on the river, which resulted in flooding near Vanderhoof and Prince George over the following few weeks. Prior to this "freeze up" jam, the majority of the river was ice-free. The sudden cold weather caused the rapid generation of large amount of frazil ice, which accumulated and formed a series of jams. The small jams collapsed and reformed into several large jams that resulted in flooding. Prior to the event, large quantities of water - 8,000 cfs (m³) - were being spilled from the Skins Lake spillway, which were subsequently reduced to 2,000 cfs (m³). On November 15. Since it takes several weeks for flow changes to reach Prince George, it was believed that though the flows were declining, they were still higher than normal. Between November 21-23, the Nechako River at Vanderhoof rose 8 ft. (2.4 m), causing some basements in Vanderhoof to flood. Unusually high river levels also engulfed irrigation pumps, each worth about \$40-50,000.

Early on November 24, the rise in the water level due to the ice buildup touched the underside of the deck of the Cameron Bridge. At about 1 a.m., the RCMP considered closing it and advised a charter bus company to move their equipment. Warmer temperatures during the day allowed for a channel of freely flowing water to form in the middle of the ice and the river level declined by about 2.5 ft. (75 cm). On the afternoon of November 24, even though the water level had declined 3 ft. (90 cm), the boat launch between Cottonwood Island and the Spruce City Wildlife Association hatchery was mostly flooded. The fish hatchery with 65,000 Chinook salmon fingerlings was threatened. The Riverside Trail leading west from Cottonwood Island Park was flooded past the Rotary Park. Water ponded on the north side of the river by The Pas Lumber mill. By mid afternoon on November 24, the highest blocks of ice reached a level with the Prince George Pulp Mill Road.

On November 25 between noon-2 p.m., the Nechako River rose as much as 7 ft. (2.1 m). Then the river's advance slowed, rising only another 2 in. (5 cm) during the next hour. By mid-afternoon, floodwaters were just 2 ft. (60 cm) in elevation from inundating the basements of Morning Place.

By nightfall on November 25, icejams seemed to be located in three key areas in the district. The lead edge of one against the Fraser River ice with its upper edge just above Morning Place; a minor icejam between Vanderhoof-Prince George and a third one located just above Vanderhoof.

On November 26, the river seemed to recede but early on November 27 it rose again due to a massive ice jam behind the Foothills Bridge. Rising to higher levels than before, floodwaters reached windows and sliding glass doors on Morning Place. Between midnight-1:30 a.m. on November 27, the water levels rose 5 ft. (1.5 m). At 4 a.m. at Morning Place, the water was higher than on the afternoon on November 26, its previous high point. During the early afternoon of November 27, temperatures rose to 4° C.

On November 27 at 11 p.m., the river rose quickly, flooding River Road and closing it from the Cameron Street Bridge to Foley Crescent. According to an employee of Papason Trucking Ltd., it “came suddenly like a wave around 11 p.m.” The ice jam just above the Foothills Bridge broke allowing the water to drain to the next ice jam at the confluence of the Nechako and Fraser rivers. The water backing up behind this ice jam, which caused the flooding in the Cameron Street Bridge area, slowly drained. The dam break above Foothills Bridge also lowered the water level at Morning Place where homes near the river’s edge had been flooded. While it caused flooding problems closer to downtown, it removed the threat of further flooding at the upscale neighbourhood on the west side of the North Nechako Road. Though the riverbanks reappeared, massive blocks of ice, some as thick as 10 ft. (3 m) continued to hug the riverbanks.

On the morning of November 28, the icejam extended more than 5 km, from about 1 km west of the Foothills Bridge to the Spruce City Wildlife Association hatchery on River Road. The rising water was up to the backs of the houses on Prince George Pulp Mill Road. River road was closed after flooding from just east of the Cameron Street Bridge to Foley Crescent. Parking lots and storage on both sides of the road were flooded and Cottonwood Island was half under water. The flooding caused Pacific Western Brewery to shut down regular production the first time in 27 years. When the brewery’s loading area flooded, BC Rail sent in tractors to pull out all trailer units threatened by the floodwaters. Nearby Cedars Christian School was closed for the day. Water had covered driveways and was lapping against units of the Del Haven condominium project closest to the riverbank. West of Wilson Park was under water, and its industrial fuel tanks were floating downstream among the blocks of ice.

The massive icejam on the Nechako River moved downstream from outlying western Prince George neighbourhoods, causing significant flooding of low-lying residential and industrial areas. Floodwaters more than 1 m deep forced the closure of the underpass on North Nechako Road and most off-ramps from the Hart Highway were closed. By 7:30 a.m., morning commuters heading into town were backed up to the Mohawk service station. On November 28 at 3 a.m., the river had crested and by 2 p.m. that day, the water had receded by a foot (30 cm).

By November 30, the only remaining road closure was the North Nechako Road under the John Hart underpass, which was expected to reopen around December 1.

On December 5, Environment Minister Paul Ramsay announced that his ministry would review the circumstances that led to the flooding.

*1) According to a local old-timer, it was the first time he had seen this type of winter flooding since 1953 (*Prince George Citizen*, November 29, 1996). Though there had not been any for some years, the Nechako River has a long history of damaging ice jams. This ice jam was not the highest on record but it appeared to be one of the largest in recent years.

*2) It takes about 10 days to two weeks for a reduced flow from the reservoir to be registered at Vanderhoof and Prince George (*Prince George Citizen*, November 26, 1996). Between the Skins Lake Spillway-Prince George, three significant rivers (the Nautley, Stuart and Chilako) provide inflow into the Nechako River. Following one of the longest winters in recent years, Prince George had the fourth wettest summer on record. Despite earlier increased releases, runoff into the Nechako Reservoir in June and July was still 15-17% over the long-term average. In August, the reservoir was 25% too high in view of runoffs anticipated during the next spring (*Prince George Citizen*, November 28, 1996).

January 27-29, 1997

Event type: Ice jam flooding.

Precipitation: Not applicable.

Source: *Peace River Block Daily News*, January 30, 1997; Ministry of Environment, Lands and Parks files; Flood Report Summary, January 31, 1997.

Late on January 27, ice build up in the Peace River about 5 km downstream from Taylor caused the level of the Peace River to rise behind it. To alleviate the potential flooding of properties along the river in South Taylor, BC Hydro cut back the outflow from the W.A.C. Bennett Dam about 5,000 cfs (141.6 m³/s). BC Hydro spokesman Dennis Hunter noted, “I don’t think it will get any worse than it did last year.”

As of the morning of January 29, there were no reports of shoreline homes in danger of flooding. In response to warm weather patterns the ice jam south of Taylor and potential flooding receded. The ice front slowly made its way down the Peace River. By January 30, it was situated at the Taylor Bridge. The ice jam later receded 2.5 km downstream of Highway 97 bridge. The water level at South Taylor dropped 1.5 m.

Early March 1997

Event type: Debris slides.

Precipitation: Not available.

Source: *Quesnel Cariboo Observer*, March 16, 1997.

Early March, a logjam and a series of slides in Baker Creek threatened Quesnel with possible flooding. *1) No problems were anticipated if snowmelt would start around April 15. But in case of a cool spring with snow not starting to melt until April 25th, flood problems might be anticipated. *2)

In the meantime, city council mandated that no building permits be issued within 100 m of Baker Creek unless a geotechnical study had been conducted.

*1) Baker Creek usually crests sometime around June 21-22 (*Quesnel Cariboo Observer*, March 16, 1997).

*2) Quesnel almost lost a bridge a “couple of years” previous when a lot of debris came down Baker Creek (*Quesnel Cariboo Observer*, March 16, 1997).

March 29-April 16, 1997

Event type: Debris slides.

Precipitation: Not applicable.

Source: *Quesnel Cariboo Observer*, April 2, 6, 9, 13 and 16, 1997; *The Daily Courier*, April 16, 1997; Ministry of Environment, Lands and Parks files; Memos April 8, 1997. Herb Langin to Jon O’Riordan and April 9, 1997. Neil Hamilton to Peter Woods. Re: Slides in Cariboo Region.

During late March-early April, several landslides were reported in the Fraser and Quesnel Rivers, causing considerable mass wasting in the area. On the morning of March 29, on West Fraser Road a mobile home was evacuated. Influenced by weather and runoff, the ground around the home started to shift pushing the trailer to the edge of an embankment overlooking the Fraser River. The trailer was tied up for the night. On March 31, the trailer was moved closer towards West Fraser Road on the same property. A second trailer at the same location had a fault line running under its foundation and though threatened, was not yet affected by the ground shift. *1)

In early April, Quesnel city council passed a variance permit to allow the endangered McKone residence on Twan Street to be moved away to safety from a crumbling Baker Creek cliff. The home was later moved further onto their lot.

Around April 5-6, about 100 ft. (30 m) of the south side of Durrell Road about 1 mi. (1.6 km) up from Highway 97 gave way. Spring conditions caused the road to slide down the embankment, reducing the road to one lane. Residents were forced to make a 5-mi (8 km) detour via Dale Lake Road.

Les Townsend of Argo Road Maintenance called the site a historic area of instability. At the time, Argo was monitoring 10 active slide locations. “Quesnel is probably the landslide capital of North America,” Townsend observed. *2) “A wet summer last year and a quick spring runoff this year, it’s the worst I’ve seen it in five years.” At the slide site, the roadway material was constantly moving and the pavement continued to crack in either direction.

According to Geotech engineer Nick Polysou, the slope the trailer was located on had been moving over a period of many years. He added that the slope, left by the Fraser River when it cut down through the ground, would continue to move back. Polysou also found evidence of an older slide area above the road. This was either an older slide or a small slump of slope below the trailer, which happened shortly after the road was cut.

Around April 7-8, a helicopter pilot and Ministry of Forests staff flying the area noted four slides occurred on the Fraser River. A large slide at Moose Heights, just upstream of Quesnel 7-km north-northwest from the Quesnel airport, did block the Fraser River for a short time. At 2:30 p.m. on April 8?, the slide was still very active. According to the pilot’s report, it was blocking about a third of the channel then. Water ponded 1-2 m before breaching. The water was below the high water mark at all times.

The Quesnel River slide, just above Big Canyon about 10 km upstream from Cariboo Pulp and Paper in Quesnel, completely blocked the river for some time, possibly more than once. The river ponded for a couple of metres of elevation before breaching. The slide was breached at 2:00 p.m. on April 8 when last seen by the pilot. The breach was small and lots of slide activity was still occurring. At its maximum, the blockage ponded water 2-3 m. Even on April 9 after breaching, this ponding was still 1-2 m deep.

On April 9 at the time of inspection, both sites were still active. Small slides and falling trees were observed. The slides posed no hazard to the nearest public infrastructures, like bridges at Quesnel. The slide on the Quesnel River had a major impact on the river water and would continue to do so for some time. There was neither downstream threat nor immediate concern of water quality. The City of Quesnel gets its domestic water from deep wells and it was too early in the year for private irrigation systems to be operating. The pulp mills in Quesnel handle theirs with filter systems.

Around April 11, 11 more landslides were noted in the Quesnel area during the previous 48 hours. Though they were most active and continued to move, none impacted watercourses in the area. The other slides did not block the Fraser River but were dumping “plenty of soil,” causing the river to run very dirty downstream. As not too many trees were involved no logjams were formed. The slides disrupted or closed roads and affected some homes. On April 11, all roads except a small side road south of Quesnel were open.

On April 16 at 4:45 p.m., shifting soil snapped a gas line and caused an explosion in West Quesnel that killed five people and injured 20 others. Shock waves were felt throughout the city. The explosion leveled and destroyed two

businesses at the corner of Abbott and Anderson Drives. The front of one building was blown across the street and the other walls were blown out. One car across the street was flipped. Investigations from the fire commissioner's office found that the cracked pipe allowed a small amount of gas seepage, saturating the ground. The gas traveled along the natural gas line and got inside the building through a crack.

*1) The homes, which had been established two years earlier, were located on an eroding slope above an access road overlooking the Fraser River. The trailers were part of a 40-year old, six-lot subdivision in an area not deemed sensitive and hazardous as outlined by the Quesnel Official Community Plan (*Quesnel Cariboo Observer*, April 2, 1997).

*2) Before the last ice age, an inland lake covered the area. Resulting residual water pockets and subsurface running water played havoc with surface construction (*Quesnel Cariboo Observer*, April 9, 1997).

May 13-19, 1997

Event type: Spring runoff flooding.

Precipitation:

Source: *The Province*, May 15 and 20, 1997; *Times Colonist*, May 16, 1997; *The Vancouver Sun*, May 20, 1997; *The Interior News*, May 14, 21 and 28, 1997; January 14, 1998; Ministry of Environment files; PEP Emergency Coordination Centre Flood Sitrep, May 19, 1997; Letter Ebenezer Flats Resident's Association July 21, 1997 to The Board of the Regional District of Bulkley-Nechako; Letter Len Barak, Deputy Dyke Inspector.

In the middle of May, a hot spell caused snow to melt at higher elevations and flooding. Unusually warm temperatures that melted snow faster than normal caused the heavy runoff. After floodwaters went over its tracks at several locations around Houston, CN Rail closed its northern main line.

On May 13, water levels on the Bulkley River jumped 30 cm. CN Rail closed all rail traffic through the town of Houston. On the evening of May 13, the Bulkley River rose threateningly high at the overpass west of town. The river was rising at about 1 in. (2.5 cm) an hour. Construction started on a dike in an attempt to keep the Bulkley River from flooding the town. A dike, 2.5-km long and 2.5 m high was holding back 500 ac. (200 ha) of water at least 2 m deep.

By the evening of May 14, Buck Creek was also rising rapidly and Henry Creek was flooding the bottom of East Valley Road, surrounding nearby homes. A number of residents left their homes. On May 14, Houston high school students were excused from classes to fill sandbags. Some 150,000 sandbags had been used, with more on the way. At about 11 a.m., the gas main in town broke and four blocks had to be temporarily evacuated. At 5 p.m., the new dike finally tied in with the existing one. The river was threatening to top another dike and had to be reinforced.

On May 16, a second dike was started on East Valley Road. By evening, the railway bridge east of Houston, now 6 in. (15 cm) under water was acting like a dam, pushing water back into the dike. CN Rail agreed to have large culverts placed east of the bridge, allowing water to escape. A series of culverts installed by CN Rail through the rail bed to the east of its bridge behind Riverside Gardens relieved some of the water pressure on the East Valley Road dyke. On May 17, Attorney General Ujjal Dosanjh toured the area. Near Houston, 21 families evacuated their homes. By early May 19, the Bulkley River at Houston was down 15 cm from its highest point and dropping. The cost of this emergency was estimated at more than \$2.5 million.

Floodwaters threatened several low-lying spots in Smithers and Telkwa. The village of Telkwa had some dikes in place at the end of Cottonwood and Elm streets. At Eddy Park, a sandbag dike had been place at the end of April. Other locations threatened by flooding included Quick Station and the Walcott area.

Near Smithers, areas flooded were three successive river terraces on the right bank (downstream direction) of the Bulkley River from the Smithers bridge downstream to the confluence with Canyon Creek. The opposite bank is highly unstable in places where a house has been condemned unsafe due to the mass wasting and erosion of its landmass adjacent to the river. The most acute flooding situation was on Ebenezer Flats, where more than 200 volunteers built a 400-m sandbag dike. *1)

Early on May 16, the Bulkley River breached its banks adjacent to Columbia Road, flowing into low-lying yards and over roads. In the Columbia Street area, 12 ft. (3.6 m) or more of river shore was lost. This flood also washed away a large portion of the top end of Beaver Island, which acts as a protective mechanism from the river. On May 17, floodwaters working its way around the dike threatened residents on Kidd Road. Volunteers, forest fire and highway maintenance crews managed to put up another dike at Kidd Road.

The four other potential areas of flood concern in Smithers, the Fall Fair Grounds, Riverside Park, areas around the bottom of Main Street and the sewage treatment plant on Dohler Flats were being watched. The town also kept 10,000 unfilled sandbags at hand. Around May 17, three families temporarily moved out of their 22nd Avenue homes. Cooler weather on May 18-19 caused the Bulkley River's water levels to drop.

In Old Hazelton, the Gitanmax First Nations Community asked for provincial assistance of the 'Ksan Historic Indian village and museum. The First Nations village of Glen Vowell also requested sandbags and assistance. Near Terrace, serious bank erosion occurred in the Mark Road area. The Thornhill area was threatened. A number of homes on Kitselas Road were temporarily cut off.

On May 18, the Fraser River caused minor flooding in the city of Prince George. Because of the increased water table levels some small businesses at 2nd and 3rd Avenue were affected by ground water seepage. Local authorities blocked access to Paddlewheel Park in South Fort George. Damage at Prince George was estimated at \$1 million. At Stoner, a slide on Highway 97 South, and no immediate detour available, threatened to sever the highway. The required berm and drain work was estimated in excess of \$100,000.

On May 19, water levels in the Fraser River at Prince George were slowly dropping, but the Nechako River was rising. The Nechako and Stuart River systems continued to rise, though at a slower rate. Fraser Lake continued to rise to record highs and Burns Lake also continued to rise. High winds continued to erode Colleymount Road, threatening at least one residence. Francois Lake continued to rise causing concern about Nadina River to wash out a MoTH road used as an important industrial artery. At Fort Babine, a rising Babine River at Babine Lake threatened a large salmonoid enhancement project with 500,000 salmon fry. So far, 350,000-400,000 fry had been lost. The Salmon River, though dropping, threatened 3-5 homes.

The Mud River damaged bridges and road accesses to four different ranches. On the Telachuk Road, 30 mi. (48 km) west of Prince George, road access was damaged and 3-5 homes reported flood damage. Near Fort St. James, Stewart(?) Lake was rising slowly causing minor local flooding.

In Shelly, 20 km. east of Prince George, the flooding Fraser River caused the evacuation of nine families. At Foreman Flats, 10 km west of Prince George, floodwaters threatened 3-4 homes. Sandbagging had started here on the afternoon of May 17.

On May 22, the side tributaries in the Central/Northeast Region remained high. The Chilako/Mud River had dropped on May 21 but the Nechako continued to rise slowly. The Nautaley River, a tributary into the Nechako River upstream of Vanderhoof was still quite high. The Fraser River at South Fort George (near Prince George city centre) started dropping slowly on May 21.

Pre-freshet food protection projects and cost in the Northwest included: New Remo: bank repairs and raising dyke along the Zymagotitz River (\$13,000); Telkwa: removal of logjam to modify river flows, due to high river levels unable to complete (\$20,000); Lakelse: Granite Creek dyke repairs and riprap restoration (\$30,000)

*1) The Ebenezer Flats area is located approximately 7 km from downtown Smithers, on the east side of the Bulkley River. The area is accessed via Lower Viewmont Road. Local roads include Columbia Street and 22nd Ave. The area is predominantly rural residential acreages of between 1-10 ac. in size and includes small intensive farms. Ebenezer Canadian Reformed School is also located in the neighbourhood with an enrolment of approximately 130 students and 10-15 staff and volunteers. The most recent flooding in the area occurred during the spring of 1976, June 17, 1986 and in 1993 a Christmas Day ice jam flood. Following the flooding that took place in mid May, the residents of Ebenezer Flats organised as a resident's association. They agreed immediate attention was required in order to ensure permanent flood protection in the event of future flooding

Early July 1997

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: Ministry of Environment files; Geonorth Engineering Ltd.1998. Nechako River bank erosion study. Miworth and Prince George, B.C.

During the spring freshet of 1997, river and lake levels in many regions were the highest they had been in 25 years. The following damage occurred and restoration cost: Lakelse: aggradation (\$60,000); Dutch Valley: erosion and aggradation (\$40,000); Telkwa (\$10,000); Bulkley River: aggradation (\$2,500); Sowchea Creek: log jam (\$1,000); Nechako River: erosion (\$10,000); Pingle Creek: erosion (\$40,000);

British Columbia's Disaster Financial Assistance Program provided assistance to victims who sustained damage caused by the May 1 to June 27, 1997 flooding in the regional districts of Fraser Fort George, Kitimat-Stikine and Bulkley-Nechako.

During May and June, subsequent high flows on the Lower Nechako River caused severe bank erosion at Miworth and Prince George, beyond any experienced in recent years. *1) The high flows during May and June, including 17 days when the flow exceeded 1,000 m³/s and a further 72 days when it exceeded 800 m³/s, caused continuous toe erosion and sloughing of the slope at Island Drive and Bergman Road. The erosion of the Nechako River continued "at an alarming rate." By mid July, much of the Nechako River Park and Trail System in the City of Prince George was still under water. Though the assessment was not complete, the estimated cost to repair several bridges and paved portions of the trail that were damaged was between \$50,000-75,000.

A study by Geonorth Engineering Ltd. found that homes on Aspen Lane to be at risk in the event of one or two reoccurrence similar to the icejam of November 1996. They recommended the riverbank at this location to be revetted. As the homeowners most at risk along Island Park Drive did have space in which to relocate, this action was less expensive than revetting the river.

Pingle Creek near Fort St. John eroded a section of bank downstream of Highway 97 and threatened several homes. Estimated cost for bank protection was \$50,000.

Early in July, high water on the Goat River washed out 1km of Highway 16 between McBride-Prince George. Some private roads also washed out.

On July 6, a debris torrent on Leona Creek affected one home, Highway 16, several water licences and some agricultural properties

*1) Since the construction of the Kenny Dam by Alcan Smelters and Chemical Ltd. (Alcan) the Nechako River has been partially regulated with Nautley and Stuart River systems providing the bulk of the unregulated discharge. As a result of the reduced flow, there has been comparatively little bank erosion in the Miworth-Prince George area (Geonorth Engineering 1998).

Early January 1998

Event type: Ice jam flooding.

Precipitation: Not applicable.

Source: *The Interior News*, January 14, 1998; Ministry of Environment, Lands and Parks. Information Bulletin SK002-98/99. January 9, 1998.

In early January, several localised incidents of flooding and overland iceflows were reported in the Bulkley Valley. Extreme cold temperatures caused significant amounts of ice to form in local waterways. Property damage was minimal. The provincial environment ministry was closely watching a 20-km icejam in the Bulkley River downstream from Houston. Temperatures dipping to around -30°C the previous week caused the ice build-up. On January 12, the Bulkley River east of Smithers to Quick was full of shifting pack ice. In Telkwa, ice was threatening to choke the river by the Douglas Motel. *1)

*1) Historically, the Quick, Telkwa and Ebenezer Flats areas have been prone to flooding because of narrow or shallow river channels.

January 29-31, 1998

Event type: Mudslide.

Precipitation: Not applicable.

Source: Frank Maximchuk, pers. comm. February 3, 1998.

On January 29, a mudslide 15 ft. (4.5 m) deep and 150 ft. (45 m) long came down onto Highway 16, 3 km south of Masset. Residents were without power and telephone service for two days. The highway was closed for two to three days.

According to Frank Maximchuk, who did a detailed study of the slide, the size of it was much smaller, with a maximum height of 3.5-4 m and a width of 30 m, replacing some 2,200-2,400 m³. The debris consisted mainly of sand and some trees and was certainly not a mudslide. It occurred in an 8-10 m wide gully on which north wall a rectangular chunk of sand 25 m high and 2 m thick slumped. Though precipitation may have been part of the cause, the event was probably wind induced. During the proceeding days, there was no significant precipitation, but for several days of winds up to 90 km/h. were recorded. Apparently it had been an ongoing event, just waiting to happen given the right circumstances. Tension cracks about one year old were observed (Maximchuk, pers. comm.).

May 27-28, 1998

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Terrace Standard*, June 3, 1998; Ministry of Environment files.

At the end of May, the Skeena River was rising and flooding some property near Robin Road, just west of Terrace. About half of the 100-ac. (40 ha) Bercello property was under water. In some areas the water was quite deep, as a current had formed in some areas over the fields. On May 28, the main residence was threatened with floodwater being 15 ft. (4.5 m) away. Water was washing over one section of a road being fixed at the time. The roadway being affected was the Old Remo and Robin Road Six or seven nearby homes were threatened, two of which seriously.

Flooding was reported from the Nass Valley between Terrace-New Aiyansh. Flooding overnight May 27-28 at Beaver Flats cut off access to Lachkalsap Reserve (Greenville). By May 29, the flooding had worsened. Between 7-8 km of road into Greenville flooded. *1)

*1) Residents demanded significant action to end the annual flooding of the road when runoff swells the Nass River. According to regional highways director Dirk Nyland, the solution would cost perhaps \$10 million. He noted, "There's no temporary fix in the meantime. We just can't raise the road; we would have to move it over and that would mean moving all the power poles. As well, the road runs along coho (salmon) habitat requiring extra care and expense when doing any kind of road construction." (*The Terrace Standard*, June 3, 1998).

October 6, 1998

Event type: Tsunami.

Precipitation: Not available.

Source: Schwab 1999.

On the morning of October 6, a large underwater landslide occurred at Troitsa Lake, on the edge of the coastal mountains west of Tweedsmuir Park. The tsunami happened off a steep slope of a fan delta. The visible portion of the landslide measured 60 x 400 m along the edge of the fan delta surface. This visible face is the head scarp and upper slump block of a large landslide that extends down the steep face of the delta to depth in Troitsa Lake. During the event, an estimated 3 million m³ of materials moved.

A 1.5-m high displacement wave hit the opposite side of the lake, 1 km away. Groups of large trees matted together were rafted by the wave up to 1 km across the lake. A 2-m high backwash wave crashed back over the head scarp carrying debris up to 150 m inland over the delta surface.

The north end of Troitsa Lake, 10 km from the landslide, experienced an initial sharp swell about 60 cm in height; not an abnormally large storm-size wave. Seconds later, water was sucked from bays and shallows, leaving boats and debris stranded. About 10 minutes later, with a tremendous roar a large 1.5 to 2-m high wave returned. It tore sunken logs and debris from the bay floor and hurled the debris onto the beach and up into the forest surrounding the bay. Boats and floating wharves were ripped from their moorings and smashed into the shore carrying debris 20 m over the beach.

A logjam at the head of Troitsa River was dislodged and sent down the river. Though the water subsided, the lake remained unsettled. Many progressively smaller waves pulsed back and forth throughout the day. Following the tsunami the lake was not dirty.

January 7, 1999

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: *The Terrace Standard*, January 13, 1999.

On January 7 around 1:30 p.m., an avalanche killed two employees of the Ministry of Transportation and Highways. The Terrace-based avalanche technicians had been testing slopes near Bob Quinn Lake and Highway 3, north of Meziadin Junction. Having finished heli-bombing a potential avalanche site, the two men had decided to ski a slope they were testing when the avalanche hit. Their bodies were found on January 8.

February 11-12, 1999

Event type: Severe storm.

Precipitation: Not available.

Source: *Terrace Standard*, February 17, 1999; *Times Colonist*, January 26, 2003.

On February 11, Taitsa Lake recorded Canada's greatest single-day snowfall of 145 cm. The Terrace-Kitimat area reported a record snowfall. In the 24-hour period ending February 12 at 7 a.m., 127 cm of snow fell; 123 cm of which in a 10-hour period. *1) On February 11, Terrace reported Canada's ever one-day snowfall record with 113.1 cm, breaking the previous one of 99.1 cm set on January 17, 1974. On that same day, Lakelse Lake recorded 127.1 cm of snow, breaking the previous national record of 118.1 cm set in 1974.

It was the second big snowstorm in two weeks. Overnight February 11-12, more than 50 cm, bringing the winter's total to over 500 cm. Between February 1-11 alone, Terrace recorded 182 cm of snow. The continuous snow was coming down at 12 in. (30 cm) an hour. The Terrace airport recorded over 110 cm at by about 5 p.m. The snow was falling at a rate of 12 cm an hour.

There was so much snow on the runway that the Terrace airport closed first time in history and remained closed the following day. Airport manager Darryl Laurent said it was the first time in his 15 years of work at the airport that it had to close. Businesses and the Skeena Cellulose mill shut down. Schools in Terrace and Kitimat also closed.

Overnight February 11-12, rain falling on the heavy snow put unusual weights on area roofs. On February 12, heavy snow loads brought down the roof of Kalum Tire's service garage in Terrace. Highway 37 between Kitimat-Terrace and Highway 16 between Prince Rupert-Terrace were closed. Due to poor visibility, snowplows had trouble clearing the snow quickly. Due to an avalanche in the Bear Pass, Highway 37A near Stewart also closed. The highway to Kitimat reopened at 11 p.m. on February 11 and the highway to Prince Rupert at 9 p.m. on February 12.

*1) This snowfall broke the all-time Canadian record set in 1974 (*Times Colonist*, January 26, 2003).

May 22-23, 1999

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Prince George Citizen*, May 26, 1999.

Warm temperatures on May 22-23 caused the Fraser River at Prince George to rise a metre to 7.6 m. *1) Though Prince George was still at low risk for floods, Quesnel and areas closer to the Lower Mainland remained at a high risk. Snowpacks in Quesnel were higher than normal and Barkerville still had 6 ft. (1.8 m) of snow. Quesnel used provincial funds to construct one dike and started construction on another.

*1) Floodlevel at Prince George is at 9.6 m (*Prince George Citizen*, May 26, 1999).

June 1999

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *The Province*, June 20, 1999; *The Globe and Mail*, June 21, 1999; *Quesnel Cariboo Observer*, June 13 and 30, 1999; *The Terrace Standard*, June 19, 2002; Ministry of Environment files.

In June during the spring runoff, flooding occurred in the Terrace and Remo areas. In Terrace, Jutta Smeltzer's Queensway home was surrounded by water. Skeena River floodwaters covered the backyard and spilled roughly 200 m in front of her home. A makeshift wall of sandbags saved the home from water damage. Near Remo, Brent Rogers and Dieter Bahr lost their potato crop to floodwaters.

With unseasonably cool weather the danger of serious flooding in Quesnel lessened, but the snow levels in the Quesnel and Fraser River watersheds remained above normal. Public Works crews completed armouring the south bank of the Quesnel River and the construction of a dike along the west bank of the Fraser River. In order to alleviate public concerns, Public Works crews started to landscape the residential side of the West Quesnel dike.

Fast rising waters of the Quesnel River undermined the foundations of a landmark historical building known as the Tong House in Quesnelle Forks. *1) On June 27, the building was threatened of washing downstream. During a daylight operation on June 27 the wood structure was separated from its concrete foundations and moved to safety. Two other historical buildings located in Quesnelle Forks remained at the risk of washing away.

Flooding also closed several roads. South of Valemount, Highway 5 North was reduced to single-lane, alternating traffic.

On June 16, the culvert crossing on Highway 5 became blocked, causing buildup of water which washed out the foundation of the Nifac (Ministry of Forests firefighting camp) pumphouse 9 km north of Valemount. Total restoration cost was \$3,317. On June 17, flooding near Valemount derailed a 70-car eastbound CN Rail freight train. The cars and a locomotive were knocked off the tracks. Late on June 19, the line reopened. On June 19, a section of the Yellowhead Highway, about 45 km south of Valemount washed out by heavy rains and runoff from a nearby creek.

On June 16-17, heavy runoff caused debris and creek bedload to block a culvert at km 5.2 Mountain View Forest Service Road, causing a road washout. Total restoration cost was \$8,998.10.

On June 25, a debris flow at Goslin(g) Creek near Tete Jaune caused some erosion to a private access road to Highway 16 East.

*1) The more than 100-year old 6 x 8-m building is the most significant structure in the ghost town of Quesnelle Forks. It is believed to have served as a social meeting place for the 3,000 Chinese men who inhabited the town during the Cariboo gold rush (*Quesnel Cariboo Observer*, June 30, 1999).

September 11, 1999

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Terrace Standard*, June 19, 2002; Cruden and Lu 1992; Schwab et al. 2003.

On September 11 at 3 a.m., a massive rockslide came down in the Telkwa Pass about 50 km from Terrace, severing the Pacific Natural Gas (PNG) main pipeline. The slide path through mature forest covered an area 1,200 m long and up to 400 m wide. Trees were blown over by the resultant air blast along the sides and front margin.

Landslide debris dammed Limonite Creek, creating a lake that filled within a few days. According to Jim Schwab, research geomorphologist for the Prince Rupert Forest Region, there is a long history of landslides in the area. *1)

The Howson rock avalanche originated as a topple of about 0.9 million m³ from a bedrock ridge at 1,923 m a.s.l. The rock toppled and slid on a 48° slope for 150 m on to glacial ice. The rock avalanche expanded to cover the glacier to a width of 300 m spreading out on a 10° slope. Rubble hurtled over the ice along an ever-increasing slope gradient, dropping into Limonite Creek valley over a slope of close to 40°. Maximum velocity was probably reached as the avalanche dropped into the valley. At about 500 m below the drop, uprooted and snapped trees were observed. Velocity estimates necessary to uproot and snap trees are in the order of 18-30 m/s, as discussed by Cruden and Lu (1992). Travel through the forest was along a slope gradient of 22° and deposition occurred on slopes of 5-10°. The rock avalanche travelled a distance of 2.7 km, dropping 1,300 m in elevation. *2) A few large boulders, some up to 10 m in diameter, were strewn along the landslide path. The Howson rock avalanche appears to have involved an estimated 1.5 x 10⁶ m³ of material.

During the months of May to September, precipitation for the nearby Terrace airport was two times normal. At the time of the slide, conditions were generally clear and cool with freezing temperatures at the higher elevations in Howson Range.

* 1) On June 8, 2002, a similar slide would occur in the Copper River area (*The Terrace Standard*, June 19, 2002).

*2) Slope gradient and distance estimates as presented are derived from 1:20,000 TRIM topographic maps (Schwab et al. 2003).

Late December 2000

Event type: Ice jam flooding.

Precipitation: Not applicable.

Source: Ministry of Environment, Lands and Parks file 035050-30/2000. Ice jam Bulkley River.

At the end of December, an ice jam in the Bulkley River caused flooding near Smithers. Between Raymond Road and Gidding's Field, the river was completely covered with debris. The water level at the CN Rail line at Tatlow came to within 0.3-0.5 m of the tracks while adjacent fields were flooded. At Dohler Flats, the icejam remained unchanged.

June 10-13, 2001

Event type: Flooding.

Precipitation: Not available.

Source: Ministry of Environment files; Message June 13, Bruce McGonigal to Eva Boehringer; Ministry of Transportation. Issue Alert. Peace River North. June 14, 2001.

During the second week of June, extreme precipitation caused many rivers in the Peace River area to overflow their banks. Flooding caused significant damage to at least three roads in the area: Cypress Road, 65 km northwest of Fort St. John; Farrell Creek and Upper Halfway Road between Fort St John-Hudson's Hope.

Two major washouts of about 200-300 m in length, one at each bridge, made Cypress Road impassable. *1) At the Cypress Creek bridge, the end fills were completely gone. Repairs were estimated at \$250-300,000. According to one local resident, this was the "worst flooding to have occurred here since 1965."

On the Upper Halfway Road, another substantial washout of 500-1,000 m in length obliterated the road and its right-of-way. Water flows at the Halfway River bridge were high and the approaches appeared to be holding. Repairs were estimated at \$500-600,000. Repairs to a major culvert failure on Farrell Creek Road were estimated at \$400-600,000.

On Highway 29, ten downpipes were demolished. Repairs were estimated at \$200,000. There were two new slides on Highway 29 at the Halfway and three more three more at Cache Creek hill with an estimated repair cost of \$1 million. Many other significant washouts occurred along this route. As the water table changed, more slides were anticipated over the coming weeks. Significant damage was done to private roads, driveways, oil and gas facilities and roads.

Around June 13 near Smithers, two or three blocked culverts caused substantial flooding on the last 2 km on Driftwood Road. A piece of road washed out around 3 km from the gate.

*1) The Cypress Creek Road is 44 km long, with three bridges and has a number of short side roads attached to it. While the first 22 km and the first bridge remained intact, about 12 families were left isolated beyond this point. (Ministry of Transportation). There are no alternate routes for Cypress, Upper Halfway or Farrell Creek roads.

Late December 2001-early January 2002

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: Monty Miedrich, January 8, 2001. Updated Bulkley River ice-jam flood response team. December 22 (2001) update.

At the end of December, icejams on the Bulkley River caused flood concern in the Telkwa-Smithers area from Tatlow to Dohler Flats. On December 21, CN Rail removed ice from around their tracks at location 9 km on Tatlow Road and was closely monitoring the situation on December 22. On that day, the river appeared more stable. At Dohler Flats, the water levels were down 30 cm compared to the previous day. However, water levels in the Raymond Road-9 km on Tatlow area were still high. At the Tatlow icejam location, the water was only 30-60 cm below the CN Rail tracks.

April 13-14, 2002

Event type: Flooding.

Precipitation: Not available.

Source: *The Prince George Citizen*, April 15 and 17, 2002; CBC newscasts April 14, 15 and 16, 2002.

Around April 13-14, Prince George reported 10 cm of snow mixed with rain. The unusually heavy snow and rain created havoc outside Prince George city limits. In two days, the area had received 32 mm of precipitation, more than the average for the entire month of April. Early on April 14, a new weather system added to the flooding which had already begun in the rural areas. During the previous 24 hours, at least two homes, both on Johnson Road near the Prince George airport flooded. A couple of minor mudslides were reported in the region. During the late night of April

14, a mud, rock and debris slide came down that covered a 35-m section of the Trans-Canada Highway up to a depth of 3-4 m.

Several roads, including Shelley Road South and Graves Road near the Blackburn area were affected by floodwaters. A 15-m deep washout occurred near Prince George and the main road to the airport flooded. Floodwaters caused Graves Road to collapse, creating a hole "some 10 m deep."

South Shelley Road suffered most damage. Floodwaters eroded a section on the south side of Highway 16, creating a massive chasm in the road about 15 m deep and 7-10 m wide. Damage to the road, which was closed, was estimated at \$75,000. In the Pineview area, high water flowed across some roads. Also hard hit were the Old Cariboo Highway and Johnson Road. A stretch along Johnson Road from the Old Cariboo Highway to Sintich Road was closed. A portion of the Old Cariboo Highway between Johnson Road-Highway 16 was reduced to single-lane traffic.

The inclement weather also caused power outages in the College Heights, North Nechako, Giscome and Willow River areas. On the morning of April 14, two circuits went out in Chief lake and Beaverly. All outlying areas in Blackburn, west of town and off the Hart Highway were plowed. City street crew foreman Terry Arndt noted, "I don't think.... ever plowed snow on the 14th of April." *1)

*1) On April 24, 1985, Prince George reported a record snowfall of 14 cm while in 1984 it snowed as late as May 31 in Prince George (*The Prince George Citizen*, April 15, 2002).

May 23, 2002

Event type: Flooding.

Precipitation: Not available.

Source: *Times Colonist*, May 23, 2002.

On May 23, heavy rains caused rivers and creeks to jump their banks in the Houston-Smithers area. The Bulkley River rose 75 cm over 24 hours. Excavators in front of bridges were pulling logjams and debris to prevent damage. In the District of Houston, floodwaters were right up to the doorsteps of some places, forcing four residents to evacuate their homes. Protective dykes built after the last serious flood in 1997 were holding and helped to reduce the impact of the water.

Water also covered a section of Highway 16 east of Houston. Two CNR bridges were threatened and farmers moved animals to higher ground. In Smithers and Telkwa, sandbagging continued in low-lying areas as water levels rose.

June 8, 2002

Event type: Rockslide.

Precipitation: Not applicable.

Source: *The Terrace Standard*, June 19, 2002; Schwab et al. 2003.

On June 8 between 0:15-1:30 a.m., melting ice caused a massive landslide into the Copper River. The river was temporarily blocked twice; once by the original debris and also by smaller landslides that occurred all day on June 8. Water Survey of Canada station 08EF005 situated 3 km downstream recorded the blocking of the river. The slide at 15.5 km up the Copper River Forest Road severed this main logging road and also the Pacific Natural Gas (PNG) pipeline. The major landslide cut a 4,000-ft. (1,200 m) section of the PNG 10-in. (25 cm) main pipeline. A temporary 4-in. (10 cm) gas line was strung across the slide area. By June 12, PNG had completed the first phase of their temporary repairs and were providing full service to all their customers. An intense fire at the break could be seen along Highway 16 near the bridge crossing of the Zymoetz River. At 10:15 a.m., PNG personnel observed overtopping of the dam and a smaller debris flow.

A 200-m section of the road was covered in mud and debris to a depth of around 10 ft. (3 m). According to Forest Service acting operations manager Dave Bewick, the road would be out of action for several weeks. It would take time for the slide debris to dry out to the point it could be excavated and for engineers to determine what repairs could be made. "It could be August ... or even a bit later," Bewick said.

The blockage of the road barred access for both recreational users and loggers. K'shian Construction had some equipment stranded upstream of the slide. Although normally road maintenance is the responsibility of the forest company licensee, Bewick noted that a slide of this magnitude was "an extraordinary situation" that likely called for special treatment.

According to Jim Schwab, this high alpine landslide will not be the last in the area. *1) Warm weather and heavy rain makes the highly fractured rock more unstable. Approximately a 1.4 million- m³ slab of rock, "the size of a sky scraper," broke off at the 4,500-ft. (1,350 m) level. As it rolled down the valley, the high alpine landslide gathered huge amounts of rocks, mud, trees and other debris.

It was estimated that the pile of debris that hit the bottom was "the size of a city block six storeys high," and included boulders the size of houses. "It's one of the bigger landslides that have occurred in the last 20 years," Schwab said. He said that about 2-3 million m³ of large rocks and small forest debris entered the Copper River and created a small lake upstream.

The avalanche debris flow traveled a distance of 4.3 km. The drop in elevation from the headscarp to the river was 1,255 m. The total volume entrained, transported and deposited through various zones approached 1.6

million m³. About 30% of the total volume was contained within the dam on the Zymoetz River. Preliminary velocity calculations provided estimates of 18-26 m/s along the debris flow. At one location, mud splatter was observed to have reached 13 m above the trim line, a total distance of about 33 m above the base of the stream channel.

Debris exploded onto the Zymoetz (Copper) floodplain, extending across the river a distance of 250 m, to a depth of 10-12 m. An estimated 0.5 million m³ of debris, some rocks up to 7 m in diameter, dammed the river. Water was backed up on the floodplain 1.5 km. An unknown volume of debris was transported down river. Within 30-45 minutes, the dam was overtopped. During high flows of June and July, the river cut a 5 x 60-m channel through the dam (Schwab et al.).

Jim Culp, a local fishing guide who has helped the Department of Fisheries and Oceans do an annual count of Chinook salmon in the river since the 1970s, said the pool extended upstream for about 1.5 km and contained juvenile fish and adult salmon and steelhead. According to Steve Jennings, fisheries biologist with local firm Triton Environmental Consultants, it was very difficult to determine long term impacts on the fish stocks. The river later breached the pile of debris. "It's fortunate that the river was at high flow because it is moving things along."

The days prior to the landslide were cool with snow falling at higher elevations. In June, local snow packs were about 200% of normal. This was reflected in above normal temperature in the preceding months. On May 15, the Tsai Creek snow pillow station situated at 1,360 m a.s.l. in the Telkwa River watershed west of Smithers recorded a snow water equivalent of 1909 mm (Schwab et al.).

*1) The Copper River landslide is very similar to the one that occurred in 1999 in the Telkwa Pass, about 50 km from Terrace. That slide also severed the PNG pipeline. Of the four similar rock avalanches in the previous four years in British Columbia, two have been occurred in the Copper River area.

June 12-18, 2002

Event type: Spring runoff flooding.

Precipitation: Not applicable.

Source: *Times Colonist*, June 18 and 19, 2002; *The Terrace Standard*, June 19 and 26, 2002; *The Vancouver Sun*, June 20, 2002.

A combination of hot weather and rain caused the Skeena, Bulkley, Nechako and Fraser rivers, already running high from the summer melt of a snowpack that had not as large in 55 years, to rise. Between June 13-15, the Skeena River near Terrace rose more than 64 cm. On June 16, the river at Usk reached 11.44 m, exceeding the 1999 flood level. Between June 12-18, as the Skeena River spilled over its banks the provincial government opened its regional emergency response centre in Terrace.

Around June 16, some Old Remo residents fled their homes. That afternoon several homes in the area were surrounded by water. In Terrace, some Skeena Street and Queensway Drive residents were building sandbag walls to keep out the water. About a dozen people left their homes in the Old Remo area. Water flooded streets and surrounded some homes in that area for several days.

In Terrace, floodwaters ate away the riverbank of Rich McDaniel's Skeena Street home. On Queensway Drive, generators ran around the clock pumping water from a trailer park on the 1900 block into the Skeena River.

On June 19 in Prince George, the upper Fraser River passed the 9.4-m mark. In south Fort George, the river breached its bank. The river level there was expected to peak at 9.8 m on June 20 and begin to decline.

At Smithers and Terrace, at least 40 people evacuated 13 homes in anticipation of rising water levels. On June 20, the Skeena and Bulkley rivers were still very high but receding.

Rain around June 18-19 in the Peace basin raised some rivers to near the top of their banks. Although some localised flooding occurred, it was not to damaging levels.

Ca. June 22-24, 2002

Event type: Rockslide.

Precipitation: Not applicable.

Source: Schwab et al. 2003.

Sometime between June 22-24, a rock avalanche occurred on Harold Price. A forestry crew doing helicopter reconnaissance in the area first observed it on the morning of June 24. It was raining hard at the time and high water flow was observed in the streams. Local snow depths at the time were still around 150-200% of normal for June. Following the rise to above normal temperatures there was a high discharge in local streams. Prior to the landslide, temperatures appear to have cooled. During June 22-23, rainsqualls were observed in the vicinity of Harold Price valley.

The rock avalanche originated at 1,723 m a.s.l. on the lip of a southwest-facing cirque occupied by a rock glacier. *1) The total displaced volume was about 1.6 million m³. Volume from the upper displacement zone was estimated at 0.7 million m³ across a scarp face of 175 m wide by 30 m deep. In addition, an 8-ha area of rubble within the basin exhibited post slide tension cracks and showed downward and lateral displacement. The volume of the displaced rock and ice that remained in the basin was estimated in the order of 2 million m³. The rock avalanche dropped 300 m onto the open valley expanding to a width of about 360 m while moving at a rapid speed across a basal till surface.

At 1.3 km, the landslide transformed into a debris flow transporting mainly forest debris. At 2.2 km, debris entered an incised stream and carried down a further 1.8 km to Harold Price Creek. Debris jammed over a 150-m stretch of the creek and resulted in re-routing the stream. A debris flood carried logs an additional 3.5 km downstream to a sharp corner, leaving a debris pile inundation about 100 m onto the floodplain. Of the initial landslide only a minor amount of rock and debris appear to have been transported to Harold Price Creek. The main constituents of the channelised debris flow entering the creek were trees and forest debris. The distance traveled by the rock avalanche-debris flow was 4 km to Harold Price Creek with an elevation drop of 700 m, an overall slope gradient of 10°. Slope gradient in the depletion zone was about 34°, dropping to 17° in the middle zone and 7° in the zone of the channelised debris flow.

*1) A deep till blanket covers the Harold Price valley below 1,450 m (Schwab et al. 2003).

September 2002

Event type: Mudslides and dam burst flooding.

Precipitation: Not available.

Source: *The Daily News*, September 18 and 19, 2002; *Dolphin*, January 2003.

Late on September 18, in Prince Rupert flooding threatened the Mountainview Trailer Park. Floodwaters up to 3 ft. (90 cm) deep were lapping at the front doors. Slides hit roads and power was cut for varying periods up to six hours to about a quarter of the city. The power was off throughout Port Simpson, in most of Digby Island and half of Metlakatla. On September 18 at 7 a.m., Port Simpson lost power for more than a day.

Near Oliver Lake, an “impressive” mudslide came down. Another slide came down near Mountainview Trailer Park. On Mount Hays, a transmission tower went out and slides on Wantage Road just past the city yard took out two BC Hydro distribution lines. Wantage Road was closed off and a search was activated for a reported overdue vehicle.

In September, heavy rain caused a beaver dam above the Prince Rupert ferry terminal to break. The road approaching the terminal was flooded. At the same time the dam broke, a slide knocked out the fibre optics cable and interrupted power and the computerised system for more than five hours. Luckily, no sailings were scheduled at the time and service was uninterrupted.

December 12, 2002

Event type: Debris slide.

Precipitation: Not available.

Source: *The Vancouver Sun*, December 17, 2002; CBC newscast December 16, 2002.

On December 12, a landslide wiped out two poles of powerline into the First Nations reserve community of Kitkatla. Due to storms and high winds, hydro repair crews were unable to fly in by helicopter. Temporary repairs were estimated not completed before December 17. *1) On the morning of December 16, two helicopters with repair crews had landed at the slide area and began laying emergency cables. Bad weather, however, forced the eight-person crew to fly back to Prince Rupert at 11:30 a.m. The storm, which started pounding the north coast on December 12, produced fierce winds reaching up to 70 km/h on December 16.

*1) Power outages are an annual problem in the isolated community of 500 about 75 km south of Prince Rupert. This was the fourth time this year the power had been out in Kitkatla (*The Vancouver Sun*, December 17, 2002).

December 28, 2002

Event type: Fatal snow avalanche.

Precipitation: Not applicable.

Source: CBC newscast December 29, 2002.

On the afternoon of December 28, two Alberta snowmobilers got caught in an avalanche south of Valemount. One of the victims was killed.

October 25-27, 2003

Event type: Flooding.

Precipitation: Not available.

Source: *The Province*, October 29, 2003; *The Daily News*, October 31, 2003; Ministry of Environment files; CBC newscasts October 27-28, 2003.

On October 26, flooding was reported from Greenville in the Nass Valley. Several days of heavy rain caused washed out roads and cut communication lines in northwestern British Columbia. On October 25, the Nisga'a communities of Kincolith and Greenville lost power due to a break in the line. Due to fog, BC Hydro crews were unable to reach the break on October 26. Power was restored to the two communities on October 28.

On October 26, road to Kincolith just completed this year, washed out at No Name Creek, 35 km west of New Aiyansh, cutting off Kincolith and Greenville. A bridge was washed out and hard to be replaced. Tentative reopening date for the road was November 5. The fishing vessel *Ocean Virtue* brought in supplies. A Prince Rupert-

based RCMP helicopter was standing by for medical emergencies. Greenville also reported minor flooding. In the low-lying areas, some basements were flooded.

Washouts closed the back road between Kitwanga-Cedarvale. Near Terrace, about 30 families in the low-lying areas of Dutch Valley were threatened with flooding. On October 27, the back road between Kitwanga-Cedarvale reopened. Highway crews repaired about 450 m of washed out road to the Nass Valley communities.

By October 28, flood danger receded. Provincial emergency officials did not have to evacuate homes in any of the flood-affected areas.

November 28, 2003

Event type: Clay flowslide.

Precipitation: Not available.

Source: *The Province*, November 30, 2003; Lebuis et al. 1983; Viberg 1983; Cruden and Varnes 1996; Hungr et al. 2001; Schwab et al. 2004

On the evening of November 27 at about 12:30 a.m., a clay flowslide (classification of Hungr et al. 2001) came down on the Khyex River, 35 km east of Prince Rupert. *1) The slide severed about 350 m of the Pacific Northern Gas natural gas pipeline and heat source to that city and Port Edward. The 200-m wide slide, triggered by the snowstorm, rolled some 300 m down the valley, blocking the river. Initial fears the diverted river could cut Highway 16, the only road link between Prince Rupert-Terrace were allayed by November 29.

The low gradient extremely rapid, liquefaction earthflow (classification of Cruden and Varnes 1996) caused displaced material to flow up and down the river for a distance of 10 km. The slide, located 6.8 km upstream from the confluence with the Skeena River, was characterised by a steep main scarp 45 m high by 345 m wide that consists of glaciomarine sediments mantled by rubbly colluvium. It covered an area of 32 ha, of which 13 ha in the zone of depletion. About 4.7 million m³ of material was displaced. The estimated retrogression from the riverbank, back to bedrock of the valley wall, was about 480 m.

The landslide occurred in uplifted glaciomarine sediments along an outside river bend. Pre-landslide bank height was between 5-10 m. The landslide area was logged in December 1959. In 1968, the natural gas pipeline was installed mid-way through the present zone of depletion. The most likely trigger appears to have been bank erosion, considered the most common trigger of retrogressive flow slides (Lebuis et al. 1983; Viberg 1983). The role logging played in bank disturbance and in any increase in bank erosion is likely minimal (Schwab et al. 2004).

With temperatures descending towards freezing point, an emergency social services centre was set up in the Charles Hay Secondary School. The 14,600 local residents were urged to cut back on gas usage as the reserve tank was quickly depleted. About 4,000 homes in Prince Rupert and Port Edward were left without natural gas service for 10 days. The estimated cost for the city of Prince Rupert alone in emergency food and shelter over the 10-day period was about \$300,000. A temporary gas line placed over the landslide to restore service cost in excess of \$1,000,000. The cost for a permanent repair to the line may have exceeded \$5 million. Repairs were not completed by the summer of 2004.

*1) Roads, railways, pipelines and utilities are located in British Columbia's north coast valleys on glaciomarine sediments, which are common in river valleys. Consequently flowslides pose a high risk to infrastructure within these valleys flanked by the sensitive glaciomarine sediments. Over the previous four decades, four other large clay flowslides occurred in this general area. See events of May 24 and June 7, 1962 (Lakelse Lake), September 17, 1969 (Kitsault) and late December 1993 (Mink Creek) (Septer and Schwab 1995; Schwab et al. 2004).

December 24, 2003

Event type: Storm surge and flooding.

Precipitation: Not available.

Source: *The Observer*, January 1 and 8, 2004; June 10, 2004; CBC newscasts December 29 and 30, 2003.

On December 24, 100-kmh wind, huge Pacific waves and heavy rain hit the Queen Charlotte Islands. Long-time residents called the storm "the worst in half a century." Water and debris on the road closed Highway 16 between Skidegate-Tlell. The waves carried away sections of asphalt and riprap. In Tlell, a dozen families temporarily left their homes. One Sandspit house had a flooded basement and the cabins at Copper Bay took a beating. In Skidegate, waves threw debris over the seawall and came close to the base of the new poles at the museum. At Mariners Point in Tlell, the access road, camping site, and fire pit all washed away.

The fierce winds and a high tide that battered the coast of the Queen Charlotte Islands caused damage on a scale many islanders said "not been seen in living memory." In Queen Charlotte, a floathouse was swept into the ocean. High water flooded the lower rooms of the Spruce Point Lodge. The residents of a house at Tlell moved after the ocean chewed away the bank that had stood between their house and the ocean. The couple lost a strip of land 15-20 ft. (3.5-6 m) wide.

On December 24, the highway between Skidegate-Tlell was closed for approximately nine hours. Huge waves washed across the road in several places, depositing massive chunks of driftwood, rocks and other debris. After the highway was closed around 12:30 p.m., the situation kept getting worse until the high tide at 1:45 p.m. The storm

continued unabated for at least another two hours after that. O'Brien Road and Bridge Maintenance crews were unable to start clearing debris until 4 or 5 p.m. The highway reopened by 9 p.m.

The storm left the highway in an extremely vulnerable state. *1) The ocean broke through the riprap berms at the end of Wiggins Road and across the highway across "Dress for Less." Ministry of Highways district supervisor Al McKean said these areas would be repaired as soon as possible. Initial repairs will cost an estimated \$250,000. Placing additional riprap was also considered.

Richardson Ranch in Tlell lost large chunks of valuable pastureland and several hundred feet of fencing. The tide forced the Tlell River up higher than Doug Richardson had ever seen it, and it was river water, not ocean water, which flooded the animal clinic and kennels, the shop and one room of his house. Richardson blamed a "freak," or unusually high tide rather than the strong winds. The tide charts had predicted a 24-ft. high tide at 1:45 p.m., slightly lower than the previous day's high tide. He pointed out that the storm was not a particularly big one. "No trees were blown down, except those trees by the ocean which were washed out. The problem was that the tide was way higher than it was supposed to be."

Richardson said that he had heard of only three other occasions when water came close to the Ranch: in 1902 or 1903; sometime in the early 1940s, and in 1953. In each case, the ocean broke through to the river. This time, the flooding was due to the high level of the river. He added that it is not likely to happen again as he plans to build a dyke.

Just down the highway, 80-year old Lionel Andrews said it was the "worst storm damage he has seen in a lifetime of living in Tlell." Andrews said the road had been flooded before but in the 1960s it was raised 4 ft. (1.2 m) to fix this problem. He said he was surprised to see how much driftwood had washed into the fields between the highway and the ocean and on the road.

Further south in Tlell, John and Jennifer Davies lost between 12-20 ft. (3.6-6 m) of land. Davies described waves braking 30 ft. (9 m) in the air, tearing chunks of land and causing tall trees to fall in to the ocean. He was concerned the trees would stay in the waves in front of them but instead they were completely washed away. "It's the biggest one, the most dramatic in the time we've been there," he said.

Six years earlier when the Davies lost land in a storm, a new road was built to their house. The latest storm washed away the old road in two places. He managed to save the rain gauge at their weather station by tying a rope around it, but the sea washed away the gauge's shelter.

Davies also noted that it was the third year in a row that Tlell had lost power on either Christmas Eve or Christmas Day. The power was out in Queen Charlotte, Skidegate and Tlell on December 24 from 9 a.m. to 12:30 a.m. Tlell customers lost power again shortly afterwards until 8:30 p.m. On December 25, Port Clements was blacked out from 1:30 a.m. until 3:45 a.m. Tlell was out again that evening from 8 p.m. until just after midnight. All outages were storm-related.

On December 24 at 11 a.m., the Sandspit weather station recorded a peak wind speed of 60 kn. (111 km/h). The Air Canada/Jazz flight landed without incident at the Sandspit airport. But due to the cancellation of the ferry sailings of the *Kwuna*, the outbound flight had only two passengers. The storm washed debris all around the airport fence but none, except some seaweed, got on the runway.

*According to University of Victoria geography professor Ian Walker, the east coast of Graham Island is losing an average of 1-3 m of land a year. Walker, who is studying coastal erosion and shoreline response and dune growth between Oeanda-Hiellen rivers, noted that parts of Highway 16 may soon have to be moved inland. "Sections of the highway (near Tlell) will be gone in 20-30 years." Data from East Beach shows the average erosion rate is 1-3 m per year. However, in the previous year alone in some locations the sea swallowed as much as 5 m. The erosion is connected to rising sea levels, which are in turn related to global warming. The ocean around Graham Island, for example, is predicted to rise by 15 cm over the next 100 years. Global warming also causes an increase in the frequency and magnitude of storms (Walker In: The Observer, January 8 and June 10, 2004).

June 25, 2004

Event type: Avulsion and flooding.

Precipitation: Not available.

Source: Ministry of Environment files; Clague 1984.

Wondering Creek (also known locally as Boulder Creek) avulsed on the fan. Leaving its previous channel to Dragon Lake and flowed approximately 2 km to Nass camp. No buildings were flooded but water ponded around them. During similar flooding in 1974, there was 1 ft. (30 cm) of water in the kitchen of Tillicum Lodge.

The re-diversion work into the Dragon Lake channel took about two days of machine time. And is considered a temporary fix. The avulsion was not caused by the washout of the road bridge. This bridge had not been replaced but a "ford" had been constructed to allow access.

The area has been subject to debris flow and snow avalanche process (Clague 1984). Travel distance from the landslide source area to the highway is about 2.7 km. Length of fan is 350 m and the debris flow fan area is 4.6 ha in size.

*1) Dating of debris flow impact scars on trees located on the fan shows a history of landslides for the area. Over the last 50 years three debris flows occurred, with the largest in the fall of 1978. One large historic event reached the highway about 80-100 years previously.

July 15, 2004

Event type: Debris flow.

Precipitation: Not available (The event is not recorded at a nearby highways weather stations).

Source: J.W. Schwab, Research Geomorphologist, Northern Interior Forest Region. Summary Debris Flow Events Legate Fan 2004.

On July 15 at about 7:00 p.m., a debris flow was triggered at Legate Creek during an intense thunderstorm. The total volume of the flow was about 7,000 m³. Deposition of debris along the west side of the fan. Mud flowed onto the highway. Three additional debris flows were observed to have initiated from alpine areas within the Legate Creek watershed.

On July 16, Legate Creek and St. Croix Creeks were flowing mud red. A debris flow crossed the Legate Creek mainline at 4.7 km narrowly missing a camper parked next to a creek

August 27, 2004

Event type: Debris flow.

Precipitation: Not available.

Source: *The Province*, August 29, 2004; J.W. Schwab, Research Geomorphologist, Northern Interior Forest Region. Summary Debris Flow Events Legate Fan 2004.

On August 27 at approximately 6:15 p.m., a debris flow occurred at Legate Creek. The mudslide hit Highway 16 and swept away a westbound car. One of the occupants was buried up to his neck in mud for nearly an hour. The victim and the car were caught in a "torrent of mud, rock, huge trees and stumps" that originated 1,200 m up the mountain. The vehicle was carried over top of him before coming to rest against some trees on the embankment of the Skeena River, which runs next to the highway (*The Province*, August 29, 2004).

"Torrential downpours" in the Terrace area were blamed for the slide. Rain commenced in the Legate creek drainage at about 2:00 p.m. with intense rain falling later in the afternoon. The Ministry of Transportation and highways weather station located east of Usk recorded 16 mm rain per hour during a two-hour period leading up to the failure and 47 mm over the preceding four-hour period.

The slide was 3 m deep where it hit the road and covered a 300-m stretch of the highway, blocking traffic until 2 p.m. the next day. Ministry of Transportation spokesman Dan Ramsay said, "It started with a dozen little fingers right at the top." The slide was reported to have carried an estimated 50,000 to 100,000 m³ of debris down the mountain (*The Province*, August 29, 2004).

According to Jim Schwab, the total volume transported is in the order of 15 to 20,000 m³. About 3,000 m³ was deposited on the highway. A considerable volume of debris was remobilised from previous debris flows deposits from the apex of the fan. The landslide traveled down the west side of the fan.

Area officials called the slide the largest in 25 years. Observations along the channel above the fan suggest that August 2004 debris flow carried less volume than was transported down the channel during the 1978 event.

November 4-9, 2004

Event type: Flooding and landslides.

Precipitation: Not available.

Source: CBC newscasts November 5, 6, 8 and 9, 2004.

On November 4, a mudslide came down onto Highway 16 approximately 20 km east of Prince Rupert. The highway reopened to single-lane traffic on the evening of November 5. The slide also cut the natural gas pipeline to Prince Rupert and Port Edward.

Four days of heavy rain caused flooding and landslides in the Bella Coola-Hagensborg area. Floodwaters reached Highway 20. On November 8, slides closed Highway 20 twice. After the first, smaller slide was cleared, late on November 8 another one closed the highway again. The larger rockslide came down in the same area worked on during the previous year. Two slides came down into the water system. Debris plugging the intake cut off water to Hagensborg and Bella Coola.

Early January 2005

Event type: Icejam flooding.

Precipitation: Not available.

Source: *The Province*, January 27, 2005.

During early January, some low-lying land near Smithers flooded before the river broke through the icejam in the Bulkley River.

January 18-24, 2005

Event type: Flooding, icejam flooding and mudslide.

Precipitation: Not available.

Source: *The Vancouver Sun*, January 25, 2005; *The Province*, January 26 and 27, 2005; CBC newscasts January 18, 19, 20, 21, 23 and 24, 2005; David Jones, meteorologist Environment Canada, interview CBC January 18, 2005.

On January 18-19, freezing rain caused road closures and travel advisories throughout northern British Columbia. It was caused by the same system that brought flooding and mudslides to the Lower Mainland and Vancouver Island and avalanches in the southern Interior. Coming directly from the Tropics and thus carrying more moisture and heavier rain, it was dubbed a “tropical punch,” one step beyond the “Pineapple Express.” (David Jones, interview CBC January 18, 2005).

On January 18, sections of Highway 16 between Terrace-Prince Rupert and Terrace-Smithers and Highway 37 between Terrace-Kitimat were closed due to freezing rain.

On January 19, no public schoolbuses were operating in Prince George and Quesnel. At 5 a.m., Prince George reported rain and temperatures of 3° C. A spokesman for the company that operates the school buses in the School districts 57 and 91 said, “yesterday afternoon even with chains the buses slid all over the place.”

Early that day., Highway 37A between Meziadin Junction-Stewart was also closed for nine hours for avalanche control. Severe winter conditions/travel advisories were issued for Highway 16 between Prince Rupert-Endako and Prince George-McBride due to freezing rain; Highway 37 South between Terrace-Kitimat; Highway 26 between Quesnel-Barkerville; north of Quesnel and Highway 20 between Williams Lake-Anahim Lake.

On the morning of January 19, Highway 16 was closed between Prince George-McBride. On January 20, Highway 16 between McBride and the Alberta border closed due to poor driving conditions. Early the next day, this section of Highway 16 was still closed.

Around January 22-23, officials were keeping a close eye on icejams on the Bulkley River near Smithers and the Nechako River near Prince George. A coldsnap followed by a 20-degree temperature jump caused massive icejams.

*1) Water levels on Willow River outside Prince George were up significantly. East of Chetwynd, several icejams occurred in the East Pine River.

Early on January 24, three icejams, including two smaller ones on Naver Creek flooded four homes and Highway 97 near Hixon. Highway 97 was temporarily closed. The largest jam grew overnight to a length of 1.5 km. After the creek flooded its banks, a local state of emergency was called and more than 120 homes put under voluntary evacuation order. The flow in Naver Creek was reported as three times normal. All three jams posed risk of flooding; if the two smaller ones would breach this would more water to the bigger one downstream. On January 26, the state of emergency still remained in effect.

Near Quesnel, 25 low-lying homes were evacuated because of ice on Cottonwood River. On January 24, an icejam forced the closure of the Baker Creek bridge.

On the morning of January 24, highway and rail connections in the Pine Pass were disrupted by a mudflow and flooding. A mudflow in the Pine Pass area about 20 km north of the MacKenzie junction temporarily closed Highway 97. Soon after the highway reopened to single lane alternating traffic, it was closed again just before noon when Rollston Creek jumped its banks. The area had recently experienced higher than normal temperatures and heavy rain and snowmelt.

*1) According to Jim Whyte, manager of the Provincial Emergency Program, it is very uncommon to get these kinds of flows in January. “We’re getting flows that we’d expect in April.” (*The Province*, January 27, 2005).

June 13, 2005

Event type: Landslip.

Precipitation: Not available.

Source: *The Province*, June 16, 2005.

On the night of June 13, a 200-300-m section of Highway 29 between Chetwynd-Tumbler Ridge collapsed. Prior to the collapse, a “significant amount of rain” fell in the area. The highway closure forced traffic to make a 150-km detour.

November 22, 2005

Event type: Mudslide.

Precipitation: Not available.

Source: CBC newscast November 22, 2005.

Details: On November 22, a mudslide came down onto Highway 16 west of New Hazelton. The slide resulted in temporary single-lane alternating traffic.

November 29-30, 2005

Event type: Icejam flooding.

Precipitation: Not applicable.

Source: Memo December 2, 2005 Jim Whyte, Manager of Operations, Provincial Emergency Program.

Details: Between November 29-30, the Nechako River rose 1.4 m in two days due to the formation of an icejam. Near Vanderhoof, water levels went “over bank” and came within 1 m elevation of the foundation of the lowest house. On December 2, river levels were holding at a constant value and the ponded water had created a path around the icejam. Cold weather helped to stabilize the ice pack.

Base flow in the Nechako River had been above seasonal normals for some time as Alcan was trying to reduce storage in the Nechako Reservoir system.

October 28, 2006

Event type: Severe storm.

Precipitation: Not available.

Source: *The Province*, October 29, 2006; *The Interior News*, November 1, 2006; *The Vancouver Sun*, November 3, 2006.

On October 28, a massive snowstorm that hit northern British Columbia dumped 2.5-3 ft. (75-90 cm) of wet snow in some areas. It was a result of a combination of two weather systems, a warm Pacific and a large cold front, colliding. The Smithers airport set a 24-hour October record of 62 cm of snow. *1) Early on October 28, the 244-km section of Highway 16 between Moricetown-Fraser Lake was temporarily closed, to be reopened the next day.

The early season snowstorm left an estimated 15,000 BC Hydro customers in northwestern British Columbia without power. Affected communities included: Mackenzie, Prince George, Vanderhoof, Fort St. James, Fraser Lake, Burns Lake, Takla Landing, Houston, Telkwa, Smithers and Hazelton. Three transmission lines were down and due to impassable roads crews in some areas were relying on helicopters to access problem areas. On October 30, an estimated 2,500 customers were still without power.

On November 2, six days after the storm, about 200 households in about 10 communities near Burns Lake were still without power. Most of these were unlikely to get service back for several more days. The area most heavily affected was the south shore of Francois Lake, about 25 km south of Burns Lake. Large trees coated with ice hampered repair efforts. BC Hydro representative Elisha Moreno said, “There was about a metre-and-a-half of wet snow; then it froze.”

*1) It easily broke the previous record set in October 1973 with 15.2 cm. On January 16, 1947, Smithers set an all time snowfall record of 105.5 cm (*The Interior News*, November 1, 2006).

December 18-19, 2006

Event type: Flooding.

Precipitation: Terrace (94 mm/1 day), December 18, 2006.

Source: *Terrace Standard*, January 24 and 31, 2007.

On December 18-19, heavy rain hit the Terrace area. On December 18, Terrace received a record amount of 94 mm, causing parts of the city to flood. *1) The provincial government made financial support available to those suffering flood damage under the British Columbia’s Disaster Financial Assistance Program.

*1) This broke the previous record of 30.5 mm and also brought December’s total precipitation to 362.8 mm, compared to a normal for December of 191.6 mm. During October-November-December, Terrace recorded the third highest amount of snow. The 295 cm total was only surpassed in 1956 with 315 mm and 1990 with 303 mm (*Terrace Standard*, January 24, 2007).

Appendix 1 – Geographical index by rivers, creeks, and lakes.

Alice Creek: October 5-9, 1974.

Alsek River: Ca. 1852; August 1909.

Alwyn Creek: summer 1953.

American Creek: August 12-13, 1920; October 7-8, 1921; May 29-June 3, 1936; October 4-5, 1936.

Anderson Creek: November 30-December 3, 1913; November 21-25, 1914; September 21-25, 1954; October 27-November 2, 1958; October 13-16, 1974; September 26-29, 1988.

Andesite Creek: October 29-November 1, 1978; November 4-7, 1978.

Ape Lake: October 6-10, 1984.

Australian Creek: April 23- May 2, 1965.

Babine River: February 1, 1953.

Baker Creek (Quesnel): April 23- May 2, 1965; March 1997.

Baker Creek (Dunster): see: Holliday Creek.

Bannock Creek: November 1983.

Bear River (Stewart): November 9-13, 1933; November 5-7, 1935; May 29-June 3, 1936; October 13-15, 1945; May 25-June 10, 1948; October 5, 1960; October 1-4, 1961.

Bear River (Sustut): September 27, 1972.

Beaver River: September 26-29, 1988.

Bella Coola River: May-June 1894; November 12-14, 1905, December 19-25, 1905; November 26-28, 1908; October 28-November 19, 1917; August 5-6, 1920; August 12-13, 1920; October 7-8, 1921; September 25-30, 1922; August 23-26, 1924; December 11-13, 1924; November 16-19, 1932; August 18, 1934; October 7-11, 1934; October 4-5, 1936; November 9-19, 1936; June 18-20, 1945; October 8-13, 1949; November 2-4, 1950; October 16-21, 1965; January 17-21, 1966; January 21-23, 1968; September 25-26, 1973; October 13-16, 1974; October 29-November 1, 1978; December 7-15, 1980; October 6-10, 1984; September 26-29, 1988; November 7-9, 1989.

Bevier Creek: May 26-29, 1986; June 9-12, 1990.

Bigelow Creek: April 30-May 14, 1976.

Biggs Creek: September 26-29, 1988; September 26-29, 1988.

Big Oliver Creek: October 29-November 1, 1978.

Bissett Creek: July 26-August 1, 1987.

Bitter Creek: May 29-June 3, 1936; October 13-15, 1945; November 2, 1945; May 25-June 10, 1948; October 5-9, 1974.

Blackwater Creek: October 6-14, 1991.

Blackwater River: see: McKale River.

Blue River (Cassiar): July 16-18, 1974.

Blue River (Columbia): May 26-29, 1986.

Blueberry River: November 10, 1972.

Blunt Creek: June 14-16, 1986.

Bonanza Creek: January 21-27, 1984; September 19-20, 1985.

Bouchie Lake: April 23- May 2, 1965.

Boulder Creek (West): October 13-15, 1945; October 1-4, 1961.

Boulder Creek (NassCamp): see Wondering Creek.

Bowler Creek: July 26-August 1, 1987.

Bowron River: April 30-May 14, 1976.

Bowser River: Ca. 1927-30.

Buck Creek: May 10-12, 1951; June 26-27, 1962; May 31-June 8, 1964; May 20-23, 1968; May 14, 1995; April 10, 1996; May 13-19, 1997.

Buck River: see: Buck Creek.

Bulkley River: Ca. 1820; November 21-25, 1914; June 1916; October 28-November 19, 1917; January, 1919; Late May 1928; May 4, 1931; June 17-19, 1931; November 14-25, 1933; October 21-26, 1935; November 5-8, 1935; May 29-June 3, 1936; November 9-18, 1936; May 25-26, 1942; May 15-19, 1945; May 26-31, 1945; May-June, 1947; May 25-June 10, 1948; Early May 1949; December 28-30, 1949; June 14-18, 1950; November 22-26, 1950; May 10-12, 1951; May 18-20, 1957; November 30-December 5, 1959; May 31-June 8, 1964; June 8-11, 1964; April 8-12, 1966; October 21-24, 1966; April 9-10, 1968; May 20-23, 1968; May 15, 1972; May 31-June 2, 1972; June 12, 1972; October 29-November 1, 1978; December 23-28, 1984; June 14-16, 1986; October 6-14, 1991; December 23-29, 1992; May 13-19, 1997; Early July 1997; Early January 1998; Late December 2000; Late December 2001-early January 2002; May 23, 2002; June 12-18, 2002.

Burdick Creek: October 6-14, 1991.

Burnt Bridge Creek: October 29-November 1, 1978.

Burrage River: September 22, 1994.

Camp Creek: October 29-November 1, 1978; September 26-29, 1988.

Canyon Creek: May 29-June 3, 1936; May 31-June 8, 1964; June 14-16, 1986; October 6-14, 1991.

Cariboo Creek: October 13-16, 1974.

Carpenter Creek: October 29-November 1, 1978.

Castle (Cottonwood) Creek: May 26-29, 1986.

Casson Creek: October 6-14, 1991.

Cecil Creek: October 13-16, 1974; September 26-29, 1988.

Cedar River: December 4-7, 1925; November 14-25, 1933; October 21-26, 1935; October 6-14, 1991.

Centurion Creek: May 26-29, 1986; July 26-August 3, 1987.

Chambers Creek: June 10, 1996.

Chilako (Mud) River:

Chindemash Creek: October 29-November 1, 1978; September 26-29, 1988.

Chist Creek: October 13-16, 1974;

Clear Creek: November 14-25, 1933; October 29-November 1, 1978; September 26-29, 1988.

Clare River: October 13-15, 1974; October 29-November 1, 1978; September 17-21, 1987. September 26-29, 1988; October 6-14, 1991.

Cold Water Creek: January 4-5, 1903; October 11-14, 1903; November 12-14, 1905.

Columbia River: May 29-June 3, 1936; May 25-June 10, 1948.

Commotion Creek: July 26-August 3, 1987.

Copper River: see Zymoetz River.

Corya Creek: June 14-16, 1986.

Coyote Creek: October 13-15, 1945; November 2, 1945.

Cranberry River: May 29-June 3, 1936; October 29-November 1, 1978.

Crater Creek: October 14-15, 1974.

Crooked River: May 18-19, 1939.

Cumming Creek: June 14-16, 1986.

Cypress Creek: June 10-13, 2001.

Dahl Creek: October 13-16, 1974;

Dawson Creek: July 11-12, 1971.

Deception Creek: October 13-16, 1974;

Deena Creek: January 17-21, 1984.

Deep Creek (Quesnel): April 23- May 2, 1965.

Deep Creek (Smithers): October 29-November 1, 1978; October 6-14, 1991; winter 1992.

Deep Creek (Terrace): winter 1992.

Delta Creek: December 10, 1951; October 1-4, 1961; October 15-17, 1962.

Derrick Creek: October 29-November 1, 1978.

Diana Creek: September 20-24, 1967; November 17-19, 1971.

Diana Lake: October 29-November 1, 1978.

Dockerill Creek: June 14-16, 1986.

Dokie Creek: July 26-August 3, 1987.

Donna Creek: June 2-10, 1992.

Dore River: spring 1986; May 26-29, 1986.

Douglas Creek: November 14-25, 1933; October 29-November 1, 1978.

Draney Creek: December 19-25, 1905

Driftwood Creek: May 29-June 3, 1936; May 24, 1942; October 13-15, 1945; May-June, 1947; May 18-20, 1957; June 26-27, 1962; June 14-16, 1986; June 13, 2001.

Ecstall River: December 14-16, 1931.

Edgar Creek: October 21-26, 1935.

8-Mile (Tower) Creek: July 26-August 1, 1987.

Eighteen Mile Creek: October 29-November 1, 1978.

Eliza Creek: November 9-18, 1936.

Emerson Creek: June 14-16, 1986.

Emmet Slough: May 25-June 10, 1948.

Eustis (Big) Creek: May 26-29, 1986.

Exchamsiks River: October 15-17, 1962; October 13-15, 1974; October 29-November 1, 1978.

Exstew River: October 12-15, 1927; October 15-17, 1962.

Falling Creek: July 13-14, 1982.

Fernando Creek: July 26-August 3, 1987.

Fiddler Creek: January 30-February 2, 1935; November 5-8, 1935; May 29-June 3, 1936; November 9-18, 1936; October 17-20, 1940; November 2, 1945; October 29-November 1, 1978.

Fifteen Mile Creek: October 29-November 1, 1978.

Five Mile Creek: October 21-26, 1935.

Flint Creek: October 29-November 1, 1978.

Flood Lake: ca. August 1918; August 13, 1979.

Flood River: August 13, 1979

Fontas River: July 7, 1973; July 26-August 3, 1987.

Frame Creek: 1996.

Fraser River: June 1911; Late May 1928; May 29-June 3, 1936; May 18-19, 1939; May 18, 1942; May 26-28, 1942; Late May-early June 1943; May 26-31, 1945; May 25 -June 10, 1948; May 15-22, 1954; November 15, 1955; February 4-7, 1962; February 2-8, 1963; May 29-June 3, 1964; June 8-11, 1964; April 23-May 2, 1965; January 8, 1966; June 5-6, 1967; January 15-20, 1970; May 31-June 2, 1972; June 12-16, 1972; June 13-25, 1974; April 30-May

14, 1976; December 16-17, 1980; May 26-29, 1986; May 31-June 7, 1990; June 9-12, 1990; March 29-April 16, 1997; May 13-19, 1997; May 22-23, 1999; June 1999; June 12-18, 2002.

Furlong Creek: October 30-November 1, 1959; December 2-5, 1959; December 28-31, 1963; October 29-November 1, 1978; September 26-29, 1988.

George Creek: June 9-12, 1990.

Gingit Creek: May 25-June 10, 1948.

Ginluklak Slough: October 10-14, 1961.

Ginmiltkin Creek: September 26-29, 1988.

Gitzyon Creek: May 29-June 3, 1936.

Glacier Creek (Morictown): May 25-26, 1942.

Glacier Creek (Stewart): August 12-13, 1920; May 29-June 3, 1936; November 9-19, 1936; May 24, 1942.

Glacier Creek (Terrace): November 14-25, 1933; October 21-26, 1935; November 9-18, 1936; October 17-20, 1940; May 25-26, 1942; October 1-4, 1961; October 21-24, 1966; October 29-November 1, 1978.

Glacier Gulch Creek: September 26-29, 1988.

Goat Creek: October 21-26, 1935; October 17-20, 1940; November 2, 1945; October 29-November 1, 1978.

Goat River: Early July 1997.

Goathorn Creek: June 14-16, 1986; September 26-29, 1988.

Goose Creek: October 13-16, 1974; October 6-14, 1991.

Gore Creek: October 29-November 1, 1978.

Gosling Creek: June-July 1999.

Granite Creek: see Hatchery Creek

Gull Creek: November 2, 1945.

Haans Creek (Hands Creek): October 29-November 1, 1978.

Haddow Creek: September 26-29, 1988.

Hadenschild Creek: October 5-9, 1974.

Halfway River: May 25-June 10, 1948; August 25, 1976; July 26-August 1, 1987; June 10-13, 2001.

Hall Creek: November 14-25, 1933; October 21-26, 1935; May 29-June 3, 1936.

Hardscrabble Creek: November 5-8, 1935.

Harold Price Creek: Ca. June 22-24, 2002.

Hatchery (Granite) Creek: October 29-31, 1931; November 16-18, 1932; November 17-24, 1933; October 21-26, 1935; November 9-18, 1936; October 17-20, 1940; December 22-27, 1956; October 27-November 2, 1958; October 30-November 1, 1959; October 1-4, 1961; October 21-24, 1966; November 26-December 2, 1969; October 29-November 1, 1978; September 26-29, 1988.

Hays Creek: December 2-5, 1959; October 29-November 1, 1978; September 23-26, 1983; December 2-7, 1990.

Hays Slough: November 28-December 8, 1990.

Hells Bells Creek: November 2, 1945; December 2-5, 1959; October 16-22, 1965; October 21-24, 1966.

Henry Creek: May 13-19, 1997.

Herman Creek: Late September 1992.

Herrick River: December 16-17, 1980.

Hirsch Creek: October 13-16, 1974; October 29-November 1, 1978; September 26-29, 1988; October 6-4, 1991.

Hixon Creek: June 9-12, 1990.

Holliday (Baker) Creek: May 26-29, 1986.

Holmes River: May 26-29, 1986.

Horetzky Creek: October 13-16, 1974;

Horse Creek: May 26-29, 1986.

Howe Creek: December 2-18, 1990.

Humphrey's Creek: October 13-16, 1974;

Hunter Creek: September 27-28, 1988; October 6-14, 1991.

John Brown Creek: May 25-26, 1942.

Jonas Creek: June 14-18, 1986; September 26-29, 1988.

Illiance River: November 9-18, 1936.

Inklin River: April 1979.

Kalum Lake: October 13-15, 1945; November 21-22, 1984.

Kasiks River: October 26-28, 1951.

Kelly Creek: October 29-November 1, 1978; September 27-28, 1988.

Kemano River: October 13-16, 1974; Late September 1992.

Khyex River: January 24-27, 1934; October 21-26, 1935; November 9-18, 1936; November 27, 2003.

Kilbella Creek: November 7-9, 1989.

Kildala River: Late September 1992.

King Creek: January 17-21, 1984.

Kingcome River: October 16-21, 1965.

Kispiox River: October 28-November 19, 1917; November 14-25, 1933; May 29-June 3, 1936; October 16-20, 1964; October 21-24, 1966; October 29-November 1, 1978; October 6-14, 1991.

Kiteen River: October 12-14, 1961; September 26-29, 1988.

Kitimat Inlet: October 17, 1974; April 27, 1975.

Kitimat River: November 30-December 3, 1913, November 21-25, 1914; October 10-14, 1953; October 25-27, 1953; January 30-February 3, 1954; September 21-25, 1954; November 2-3, 1956; October 27-November 2, 1958; November 30-December 5, 1959; October 14-16, 1960; February 4-5, 1961; October 12-14, 1961; October 15-17, 1962; May 31-June 8, 1964; October 16-21, 1965; October 21-24, 1966; September 20-24, 1967; November 26-December 2, 1969; October 13-16, 1974; October 29-November 1, 1978; December 25-27, 1979; December 7-15, 1980; September 23-26, 1983; October 26-28, 1986; September 17-21, 1987; September 26-29, 1988; November 15-18, 1989; November 11-12, 1990; November 28-December 8, 1990; October 6-14, 1991; Late September 1992; September 6-7, 1993.

Kitnayakwa River: October 13-15, 1974; October 29-November 1, 1978; September 17-21, 1987; September 27-29, 1988.

Kitsault River: October 28-November 19, 1917; November 9-13, 1933; November 5-8, 1935; December 31, 1935-January 2, 1936; October 13-16, 1974; October 29-November 1, 1978.

Kitsequecla River: November 9-13, 1933; November 14-25, 1933; October 21-26, 1935; May 29-June 3, 1936; May 25-26, 1942; November 2, 1945; Early May 1949; October 21-24, 1966.

Kitsumkalum Lake: November 9-13, 1933; October 29-November 1, 1978; October 6-14, 1991.

Kitsumkalum River: October 28-November 19, 1917; May 29-June 3, 1936; November 2, 1945; October 29-November 1, 1978.

Kitwanga River: October 29-November 1, 1978.

Kleanza Creek: October 29-November 1, 1978; September 26-29, 1988.

Kloiya Creek: October 26-28, 1951.

Kootenai River: May 25-June 10, 1948.

Kouwthpega (Anderson's) Creek: see Anderson Creek.

Kwinitsa River: May-June, 1947.

Lake Alsek: Ca. 1852; August, 1909.

Lakelse Lake: October 21-26, 1935; October 17-20, 1940; October 13-15, 1945; October 26-28, 1951; October 27-November 2, 1958; May 24, 1962; June 7, 1962; October 29-November 1, 1978; November 4-7, 1978; November 28-December 8, 1990; October 6-14, 1991; Mid December 1993-early January 1994; Early July 1997; Late September 1992.

Lakelse River: October 11-14, 1903; September 6, 1904; September 29-October 1, 1904; November 12-14, 1904; November 12-14, 1905; Late September 1992.

Lava Lake: October 6-14, 1991.

Lean-to Creek: October 21-26, 1935; November 9-18, 1936; October 5-9, 1974; October 29-November 1, 1978.

Le Bleu Creek: July 26-August 1, 1987.

Legate Creek: October 29-November 1, 1978; July 15, 2004; August 27, 2004.

Leona Creek: Early July 1997.

Limonite Creek: October 13-15, 1974; October 6-14, 1991; September 11, 1999.

Link Lake: October 29-31, 1931; December 14 (?), 1957.

Little Cedar River: October 5-9, 1974.

Little Klupa Creek: November 21-25, 1914.

Little Oliver Creek: October 29-November 1, 1978.

Little Wedeene River: October 21-24, 1966; October 13-16, 1974; October 29-November 1, 1978; October 26-28, 1986.

Long Lake: October 4-6, 1936.

Lorne Creek: October 17-20, 1940; October 13-15, 1945; November 2, 1945; October 25-27, 1953.

Lund Creek: May 18-20, 1957.

Mactush Creek: November 10-14, 1975.

Manson Creek: October 26-28, 1951; January 30-February 3, 1954.

Manson River: June 2-10, 1992.

Marble Creek: November 2-3, 1945; October 1-4, 1961.

Marmot River: October 7-8, 1921.

Maroon Creek: October 17-20, 1940.

Martin (Spieker) Creek: July 26-August 3, 1987.

Matson Creek: September 26-29, 1988.

McGregor River: April 30-May 14, 1976.

McKinnon Creek: September 26-29, 1988.

McKale (Blackwater) River: May 26-29, 1986.

McNair Creek: November 7-9, 1989.

Medicine Woman Creek: July 26-August 1, 1987.
Meikle Creek: July 26-August 1, 1987.
Mess Creek: November 1947; Late summer 1949.
Miller Creek: October 29-November 1, 1978; November 1991?
Mink Creek: Mid December 1993–early January 1994.
Mission Creek: October 21-26, 1935.
Moore Creek (Kitimat): October 13-16, 1974.
Moore Creek (Meziadin): October 13-16, 1974.
Morice River: December 2-5, 1959; June 26-27, 1962; April 9-10, 1968.
Mosquito Creek: May 29-June 3, 1936.
Muncho Lake: July 15-18, 1974.
Murray River: March 25, 1939; May 5, 1990.
Nalabila Creek: October 13-16, 1974.
Nanika River: June 26-27, 1962.
Nass (Naas) River: October 28-November 19, 1917; November 9-13, 1933; May 29-June 3, 1936; October 13-15, 1945; October 12-14, 1961; June 8-11, 1964; October 16-20, 1964; October 5-9, 1974; October 13-15, 1974; October 29-November 1, 1978; December 2-7, 1990; October 6-14, 1991; May 27-28, 1998.
Naver Creek: June 9-12, 1990.
Nechako River: 1917; November 28-December 5, 1921; May 18-19, 1939; May 26-31, 1945; May 25-June 10, 1948; December 22, 1949; January 19, 1955; January 28-29, 1955; June 5-6, 1967; April 30-May 14, 1976; November 20-27, 1996; May 13-19, 1997; Early July 1997; June 12-18, 2002; November 29-30, 2005.
Neeleetsconnoy River: December 19-25, 1905, October 29-November 3, 1913; September 24-27, 1917; October 1-5, 1917; August 23-26, 1924; November 9-18, 1936.
Nekite River: November 7-9, 1989.
Nelson River: October 5-9, 1974; September 23-26, 1983; September 26-29, 1988.
Nevin (King) Creek: May 26-29, 1986.
Nine Mile Creek: May 29-June 3, 1936.
Noble Five Creek: October 29-November 1, 1978.
No Name Creek: October 25-27, 2003.
Nooklikonnik Creek: October 29-November 1, 1978.
North Fork Creek: October 8-12, 1949.
North Kalum River: October 16-20, 1964.
Nusatsum River: December 19-25, 1905; November 26-28, 1908; January 21-23, 1968; December 7-15, 1980; September 26-29, 1988.
Oliver Lake: October 25-27, 1976.
Owikeno Lake: December 7-15, 1980; November 7-9, 1989.
Packsaddle Creek: May 26-29, 1986.
Pandemonium Creek: July 1959.
Parsnip River: spring 1965; October 22, 1965.
Peace River: May 25-June 10, 1948; May 18-20, 1957; October 16, 1957; February 3, 1970; June 12-16, 1972; May 26, 1973; June 13-25, 1974; January 27-29, 1997.
Phillips Creek: November 5-7, 1935; May 25-June 10, 1948.
Pine River: June 12-16, 1972.
Pine Tree Lake: July 16-18, 1974.
Pingle Creek: July 26-August 1, 1987; early July 1997.
Polymar Creek: June 14-18, 1950; June 8-11, 1964; October 29-November 1, 1978.
Polywog Creek: November 15-18, 1989.
Porphyry Creek: November 14-25, 1933; May 29-June 3, 1936.
Prespatou Creek: July 26-August 1, 1987.
Price Creek: October 13-15, 1945; November 2, 1945; October 29- November 1, 1978.
Prudhomme Lake: October 26-28, 1951; April 15-18, 1952; November 2-4, 1957; March 14-16, 1959; December 2-5, 1959; October 29-31, 1961; September 20-24, 1967; October 29-November 1, 1978.
Quesnel River: spring 1951; February 2-8, 1963; April 23- May 2, 1965; January 7-8, 1966; December 27-29, 1968; January 15-20, 1970; March 29-April 16, 1997; June 1999.
Racing River: July 15-18, 1974.
Rainbow Creek: October 21-26, 1935.
Rainey Creek: October 5-9, 1974.
Rolla Creek: July 26-August 1, 1987.
Rollston Creek: January 18-24, 2005.
Sachs Creek: October 5-9, 1974; November 10-14, 1975; October 29-November 1, 1978.

Salmon Creek: November 26-December 2, 1969.

Salmon River: October 7-8, 1921; January 4-6, 1932; November 5-7, 1935; October 13-15, 1945; May 25-June 10, 1948; December 26-28, 1961; December 1-2, 1965; March 26-31, 1966; September 11-17, 1967; January 21-23, 1968; November 13-20, 1968

Salloompt River: November 26-28, 1908; January 19-23, 1968; October 29-November 1, 1978; December 7-15, 1980; September 26-29, 1988; November 7-9, 1989.

Saul Creek: June 26-27, 1962.

Schulbuckhand Creek: October 29-November 1, 1978.

Scree Creek: October 1-4, 1961.

Sedan Creek: October 29-November 1, 1978.

Seekwyakin Creek: October 13-16, 1974.

Seventeen Mile Creek: May 29-June 3, 1936.

Shames River: November 16-18, 1932; October 21-26, 1935; November 2, 1945; May-June, 1947; May 25-June 10, 1948; October 1-4, 1961; January 23-February 2, 1962; June 10-11, 1964; September 26-29, 1988.

Shandilla Creek: May 29-June 3, 1936; May 25-June 10, 1948; October 29-November 1, 1978.

Shawatlan Lake: October 8-12, 1949; November 14, 1956.

Shazah Creek: August 18-21, 1932.

Sheslay River: 1980.

Shotbolt Bay: October 7-9, 1989.

Silver Creek: September 26-29, 1988.

Silver Lake: October 4-6, 1936.

Simpson Creek (Smithers): September 26-29, 1988; October 6-4, 1991.

Simpson Creek (Terrace): September 26-29, 1988.

Sisters Creek: June 25-28, 1955.

Skeena River: May - June 1894; May - June 1898; May - June 1916; October 28-November 19, 1917; Late May 1928; June 17-19, 1931; December 14-16, 1931; November 16-18, 1932; November 9-13, 1933; November 14-25, 1933; November 23-December 2, 1933; January 24-27, 1934; October 21-26, 1935; November 5-8, 1935; May 29-June 3, 1936; November 9-18, 1936; December 1-5, 1939; October 17-20, 1940; May 25-26, 1942; October 13-15, 1945; May-June, 1947; May 25-June 10, 1948; Early May 1949; June 14-18, 1950; December 1-4, 1950; October 26-28, 1951; December 10, 1951; April 15-21, 1952; January 30-February 3, 1954; June 10, 1954; October 11-16, 1954; May 29-June 3, 1964; June 8-11, 1964; October 16-20, 1964; October 21-24, 1966; January 21-23, 1968; May 20-23, 1968; May 31-June 2, 1972; June 12, 1972; October 5-9, 1974; October 13-15, 1974; October 29-November 1, 1978; November 4-7, 1978; January 5-12, 1982; October 20-22, 1988; May 31-June 7, 1990; June 15-20, 1990; October 6-14, 1991; Early June 1993; May 27-28, 1998; June 1999; June 12-18, 2002.

Skidoo Creek: October 6-14, 1991.

Slickenside Creek: October 29-November 1, 1978.

Slims River: July 1988.

Smokehouse Creek: November 7-9, 1989.

Snootshlee Creek: June 18-20, 1945, September 3-5, 1980.

South Seaskinnish Creek: October 5-9, 1974.

Sowchea Creek: Early July 1997.

Spittle Creek: May 26-29, 1986.

Spring Creek: October 25-29, 1976; October 29-November 1, 1978; October-November 1991.

St. Croix Creek: October 29-November 1, 1978; September 26-29, 1988; October 6-14, 1991.

Star Creek: September 20-24, 1967; October 5-9, 1974; September 23-26, 1983.

Stikine River: May 29-June 3, 1936; November 1947; May 25-June 10, 1948; Late summer 1949; August 13, 1979.

Stone Creek: (Prince George): June 25-28, 1955; October 5-14, 1955; June 9-12, 1990.

Stone Creek: (Peace River): July 26-August 1, 1987.

Stoney Creek: May 29-June 3, 1964; October 29-November 1, 1978.

Strohn Lake: October 19, 1958; October 26-28, 1959; October 6, 1960; October 21-22, 1961; Ca. August 13, 1962; July 23, 1967.

Summit Lake: May 18-19, 1939; December 26-28, 1961; December 1-2, 1965; March 26-31, 1966; September 11-17, 1967; November 13-20, 1968.

Sweetin River: October 16-20, 1964.

Tats Lake: June 28, 1990.

Taku River: January 1926; August 18-21, 1932; May 29-June 3, 1936.

Taylor Lake: September 20-24, 1967; October 29-November 1, 1978.

Tee Creek: October 21-26, 1935.

Telkwa River: June 1916; November 14-25, 1933; October 21-26, 1935; November 5-8, 1935; May 29-

June 3, 1936; November 9-19, 1936; May 26-31, 1945; Early May 1949; October 26-28, 1951; May 18-20, 1957; December 25, 1959; May 31-June 8, 1964; June 26-27, 1962; October 21-24, 1966; May 20-23, 1968; October 29-November 1, 1978; June 14-16, 1986; September 26-29, 1988; October 6-14, 1991; April 10, 1996.

Tenas (Mud) Creek: June 14-16, 1986.

Thompson River: May 29-June 3, 1936.

Thornhill Creek: October 30-November 1, 1959; October 6-14, 1991.

Thorsen Creek (Bella Coola): October 8-15, 1947; October 29-November 1, 1978; October 12-17, 1985; September 26-29, 1988.

Thorsen Creek (Queen Charlotte Islands): January 21-27, 1984.

Tibbets Creek: June 27, 1962.

Tide Lake: Ca. 1927-30.

Toboggan Creek: October 21-26, 1935; November 2, 1945; October 21-24, 1966; October 6-14, 1991.

Tower Creek: see: 8-Mile Creek

Townsend Creek: July 26-August 1, 1987.

Tremblay Creek: July 26-August 1, 1987.

Troitsa Lake: October 6, 1998.

Troitsa River: October 6, 1998.

Trout Creek: October 21-26, 1935; December 2-5, 1959; October 21-24, 1966.

Trout River (Liard): July 15-18, 1974.

Trout River (Terrace): see Lakelse River.

Troutline Creek: July 16-18, 1974.

Tulsequah (Talsekwe) River: 1910; January 1926; 1929; August 18-21, 1932; May 29-June 3, 1936; August 1, 1988; September 16, 1988; August 17, 1989; July 19, 1990; August 20, 1990.

Tumbledick Creek: May 26-29, 1986.

Tumbling Creek: October 29-November 1, 1978; September 26-29, 1988.

Twist Creek: November 2, 1945.

Unnamed Creek (Chetwynd): July 26-August 1, 1987.

Van Winkle Creek: June 17, 1866.

Virginia Creek: November 5-7, 1935.

Wachwas Creek: October 13-16, 1974.

Wallace Bay: October 30-November 1, 1959.

Wannock River: November 7-9, 1989.

Wardman Creek: May 26-29, 1986.

Wathl Creek: October 13-15, 1974; November 4-7, 1978; September 27-28, 1988.

Wedene River: October 13-16, 1974; October 26-28, 1986.

Weewanie Creek: October 13-16, 1974.

West Twin Creek: May 26-29, 1986.

Whiskey Creek (Williams Lake): April 15-21, 1952.

Whiskey Creek (Terrace): November 14-25, 1933; October 17-20, 1940; November 2, 1945; May 25-June 10, 1948; June 8-11, 1964; September 17-21, 1987.

Widmark Creek: July 26-August 1, 1987.

Wildmare Creek: July 26-August 1, 1987.

Williams Creek: October 17-20, 1940; November 2, 1945; April 15-21, 1952; October 21-24, 1966; November 26-December 2, 1969; October 13-15, 1974; October 29-November 1, 1978; September 17-21, 1987; September 26-29, 1988; October 6-14, 1991.

Williams Lake: April 23- May 2, 1965.

Williston Lake: June 2-10, 1992.

Willow River: May 18, 1942; May 31-June 7, 1990.

Wilson Creek: October 29-November 1, 1978.

Windrem Creek: July 26-August 1, 1987.

Wolf Creek: August 19-20, 1962; September 3-4, 1985.

Wondering (Boulder) Creek: June 25, 2004.

Woodworth Lake: October 8-12, 1949.

Yeth Creek: April 1979.

Zymagotitz (Zymacord) River: May 29-June 3, 1936; November 2, 1945; October 13-16, 1960; October 13-16, 1974; October 29-November 1, 1978; September 26-29, 1988; Early July 1997.

Zymoetz (Copper) River: October 21-26, 1935; May 29-June 3, 1936; November 9-18, 1936; November 2, 1945; June 14, 1950; October 26-28, 1951; January 30-February 3, 1954; October 29-31, 1961; October 15-17, 1962;

October 16-20, 1964; October 21-24, 1966; October 13-15, 1974; October 29-November 1, 1978; September 17-21, 1987; September 26-29, 1988; October 6-14, 1991; June 8, 2002.

Appendix 2 - Geographical index by community.

Aiyansh: 1936; May 25-June 10, 1948; October 10-14, 1961; October 16-20, 1964.

Alice Arm: 1917; November 9-13, 1933; October 21-26, 1935; November 5-8, 1935; December 31, 1935-January 2, 1936; May 29-June 3, 1936; November 9-19, 1936; October 5-9, 1974; October 13-16, 1974; October 29-November 1, 1978.

Anyox: November 3-5, 1923.

Barkerville: May 16, 1866.

Bella Coola: May-June 1894; December 19-25, 1905; November 26-28, 1908; October 1-2, 10-11, 1913; October 29-November 3, 1913; March 6-10, 1916; October 1-5, 1917; October 28-November 19, 1917; September 25-30, 1922; August 23-26, 1924; December 9-13, 1924; November 16-19, 1932; October 7-11, 1934; November 9-19, 1936; October 15-22, 1965; January 13-21, 1966; January 19-23, 1968; September 25-26, 1973; October 29-November 1, 1978; December 7-15, 1980; September 26-29, 1988.

Burns Lake: June 26-27, 1962; April 30-May 14, 1976.

Canyon City: November 9-19, 1936; October 10-14, 1961; October 6-14, 1991.

Cedarvale: May 29-June 3, 1936; May 25-June 10, 1948; May 29-June 3, 1964; June 8-15, 1964; June 12, 1972; October 29-November 1, 1978.

Chetwynd: July 13-14, 1982; May 26-29, 1986; July 26-August 3, 1987.

Dawson Creek: May 31-June 7, 1990; June 9-12, 1990.

Decker Lake: June 26-27, 1962.

East Pine: March 25, 1939.

Engen: December 18-20, 1933.

Forestdale: May 10-12, 1951.

Fort Fraser: Late June-early July 1937.

Fort Nelson: July 26-August 3, 1987.

Fort St. John: winter 1942-1943; October 16, 1957; June 30-July 2, 1979; July 26-August 3, 1987.

Giscome: May 18, 1948.

Gitlakdamiks: see: New Aiyansh.

Greenville (Lakalzap): October 28-November 19, 1917; May 29-June 3, 1936; November 9-13, 1933; 1936; October 10-14, 1961; October 16-20, 1964; October 5-9, 1974; October 29-November 1, 1978; November 28-December 8, 1990; October 6-14, 1991; May 27-28, 1998; October 25-27, 2003.

Gwinoha: October 28-November 19, 1917.

Hagensborg: November 26-28, 1908; November 16-19, 1932; November 22-24, 1932; October 7-11, 1934; June 18-20, 1945; November 2-4, 1950; January 13-21, 1966; January 19-23, 1968; September 26-29, 1988.

Hagwilget: Ca. 1820.

Hazelton: June 17-19, 1931; May 29-June 3, 1936; June 12-16, 1972; November 28-December 8, 1990.

Houston: May 10-12, 1951; June 26-27, 1962; May 29-June 3, 1964; April 9-10, 1968; May 20-23, 1968; June 12, 1972; May 14, 1995; May 13-19, 1997; May 23, 2002.

Hubert: January 1919.

Kemano: October 13-16, 1974; Late September 1992.

Kincolith: January 23-29, 1989; November 7-9, 1989; October 25-27, 2003.

Kispiox: May 29-June 3, 1936; October 16-20, 1964; October 29-November 1, 1978; October 6-14, 1991.

Kitamaat Village: November 30-December 3, 1913; November 20-25, 1914; October 21-24, 1966; October 17, 1974; April 27-28, 1975; October 29-November 1, 1978; September 23-26, 1986.

Kitimat: November 30-December 3, 1913; November 20-25, 1914; September 21-25, 1954; November 2-4, 1956; November 21-24, 1957; October 27-November 2, 1958; February 4-5, 1961; December 28-31, 1963; October 15-22, 1965; February 8-10, 1966; October 21-24, 1966; November 26-December 2, 1969; October 13-16, 1974; October 17, 1974; April 27-28, 1975; October 29-November 1, 1978; December 25-27, 1979; September 26-29, 1988; November 11-12, 1990; October 6-14, 1991; Late September 1992.

Kitkatla: December 12, 2002.

Kitsault: October 5-9, 1974.

Kitsequecla: November 9-13, 1933; November 14-25, 1933; October 7-11, 1934; October 21-26, 1935.

Kitwanga: May 29-June 3, 1936; June 8-15, 1964; October 29-November 1, 1978.

Kwinitsa: June 8-15, 1964.

Lakalzap: see: Greenville.

Masset: October 28-November 19, 1917.

McBride: June 12-16, 1972; May 26-29, 1986; January 23-29, 1989; June 9-12, 1990.

Moricetown: May-June 1898; June 1916; June 14-16, 1986.

Nass Camp: October 5-9, 1974; October 6-14, 1991.

New Aiyansh (Gitlakdamiks): October 5-9, 1974; October 6-14, 1991.

New Hazelton: October 29-November 3, 1913; March 16-19, 1915; October 28-November 19, 1917; November 14-25, 1933.

Ocean Falls: March 6-10, 1916; September 25-30, 1922; December 1-5, 1923; October 29-31, 1931; November 9-19, 1936; December 2, 1957; October 30-November 1, 1959; January 12-14, 1961; January 11-13, 1965; January 14-21, 1974; January 16-18, 1977; October 21-24, 1977.

Old Aiyansh: October 28-November 19, 1917.

Oweekeno: November 7-9, 1989.

Penny: December 16-17, 1980.

Port Edward: September 14-15, 1972; November 27, 2003.

Pouce Coupe: July 26-August 3, 1987.

Prince George: June 1911; Late May-early June 1920; November 28-29, 1921; Late May 1928; December 18-20, 1933; May 29-June 3, 1936; May 18-19, 1939; May 26-28, 1942; May 26-31, 1945; December 22, 1949; January 19, 1955; January 28-29, 1955; June 8-15, 1964; June 5-6, 1967; December 27-29, 1968; January 15-20, 1970; October 29-November 1, 1978; November 14, 1979; May 26-29, 1986; May 31-June 7, 1990; November 20-27, 1996; May 13-19, 1997; Early July 1997.

Prince Rupert: July 5-7, 1891; September 13-15, 1909; December 11-12, 1910; March 31-April 2, 1912; February 24-28, 1914; October 28-November 19, 1917; December 1-5, 1923; January 22-25, 1932; November 14-25, 1933; January 24-27, 1934; October 21-26, 1935; November 21-24, 1957; March 27-29, 1964; October 25-28, 1976; November 28-December 8, 1990; October 6-14, 1991; November 1-2, 1993; December 19, 1994.

Queen Charlotte City: November 28-December 8, 1990.

Queen Charlotte Islands: December 8-9, 1913; October 28-November 19, 1917; November 13-15, 1923; November 23-December 2, 1933; January 24-27, 1934; October 21-26, 1935; November 5-7, 1935; December 25-26, 1959; October 20-25, 1963; September 28-October 7, 1965; January 17-21, 1966; December 1-2, 1967; January 11-14, 1968; September 30-October 2, 1974; October 5-9, 1974; October 13-15, 1974; October 30-November 2, 1975; November 10-13, 1975; November 2-3, 1976; October 21-28, 1977; October 29-November 1, 1978; November 19-21, 1979; December 25-27, 1979; September 23-26, 1983; January 21-27, 1984; September 19-20, 1985; October 2, 1990; October 6-14, 1991; December 24, 2003.

Quesnel: June 17, 1866; July 1875; May-June 1894; February 1898; January 30-31, 1934; May 29-June 3, 1936; March 25, 1939; spring 1951; April 6-8, 1955; April 10-16, 1958; February 4-7, 1962; February 2-8, 1963; April 10, 1965; April 23-May 2, 1965; January 8, 1966; June 5-6, 1967; March 29-April 16, 1997; June 1999.

Quick: December 24-30, 1949; April 8-12, 1966; December 23-28, 1984.

Remo: June 17-19, 1931; May 29-June 3, 1936; December 1-5, 1939; May 25-June 10, 1948; May 29-June 3, 1964; June 8-15, 1964; May 31-June 2, 1972; October 29-November 1, 1978; September 26-29, 1988; May 31-June 7, 1990; June 15-20, 1990; Early June 1993; June 1999; June 12-18, 2002.

Rosswood: October 29-November 1, 1978; November 21-22, 1984.

Sandspit: January 13-21, 1966.

Shelley: May 13-19, 1997.

Smithers: November 20-25, 1914; November 3-5, 1923; October 21-26, 1935; May 29-June 3, 1936; May 25-June 10, 1948; November 22-26, 1950; May 29-June 3, 1964; April 8-12, 1966; October 21-24, 1966; May 15, 1972; April 9, 1976; April 30-May 14, 1976; June 14-16, 1986; September 26-29, 1988; October 6-14, 1991; December 23-29, 1992; May 13-19, 1997; Late December 2000; May 23, 2002; June 12-18, 2002.

Soda Creek: November 12, 1966.

Stewart: December 3-5, 1921; November 3-5, 1923; January 4-6, 1924; January 7-12, 1928; January 4-6, 1932; February 20-26, 1932; August 18, 1934; February 28-29, 1936; May 29-June 3, 1936; October 4-6, 1936; November 9-19, 1936; January 20-26, 1938; October 1-4, 1961; October 5-9, 1974; October 13-16, 1974; November 28-December 8, 1990; October 6-14, 1991.

Stoner (Stone Creek): June 25-28, 1955; June 9-12, 1990.

Taylor: February 3, 1970; July 26-August 3, 1987; January 27-29, 1997.

Telkwa: June 1916; October 28-November 19, 1917; January 1919; October 21-26, 1935; November 9-19, 1936; May 25-June 10, 1948; June 26-27, 1962; June 8-15, 1964; October 21-24, 1966; April 9-10, 1968; May 31-June 2, 1972; October 29-November 1, 1978; June 14-16, 1986; October 6-14, 1991; April 9-13, 1996; May 23, 2002.

Terrace: May-June 1898; January 4-5, 1903; October 11-17, 1903; September 6, 1904; September 29-October 1, 1904; November 12-14, 1904; September 17-18, 1905; October 1-3, 1905; November 12-14, 1905; December 19-25, 1905; June 1916; December 1-5, 1923; February 8-10, 1926; January 7-12, 1928; June 17-19, 1931; October 29-31, 1931; November 16-19, 1932; November 22-24, 1932; November 9-13, 1933; November 23-December 2, 1933; January 24-27, 1934; May 29-June 3, 1936; December 1-5, 1939; December 1-4, 1950; October 26-28, 1951; April 15-

21, 1952; October 25-27, 1953; May 29-June 3, 1964; November 26-December 2, 1969; June 12, 1972; January 17-23, 1973; October 13-16, 1974; October 25-28, 1976; January 16-18, 1977; October 29-November 1, 1978; September 26-29, 1988; November 26-December 4, 1989; June 15-20, 1990; November 28-December 8, 1990; October 6-14, 1991; November 10-15, 1991; 1992; Winter 1992; Late September 1992; Early June 1993; November 1-2, 1993; Mid February 1996; May 27-28, 1998; June 1999; June 12-18, 2002; December 18-19, 2006; December 18-19, 2006.

Tête Jaune: June 11, 1913.

Tintagel: June 26-27, 1962.

Tumbler Ridge: July 26-August 3, 1987.

Usk: May 29-June 3, 1936; November 9-19, 1936; May 25-26, 1942; May 25-June 10, 1948; June 14-18, 1950; May 29-June 3, 1964; January 11-17, 1968; May 20-23, 1968; May 31-June 2, 1972; June 12, 1972; May 31-June 7, 1990.

Vanderhoof: Late June-early July 1937; April 30-May 14, 1976; November 20-27, 1996.

Williams Lake: April 23- May 2, 1965; May 31- June 7, 1990; 1992.

Appendix 3 - Reported fatalities caused by slope failures and snow avalanches in northern British Columbia.

Ca. 1852 A glacial outburst flood “destroyed several Indian villages and killed countless people,” including a settlement at the confluence of the Alsek and Tatshenshini rivers.

July 6, 1891 Debris avalanches near Port Edward killed 41 people at the Inverness cannery and nine at the North Pacific cannery.

Winter 1915-1916 A snow avalanche on the southeastern shoulder of Mount Cronin killed a man carrying mail for the Cronin mine.

December 28, 1917 A snowslide killed two mining employees on their way up to Rocher de Boule mountain.

October 1, 1922 A debris avalanche at Eicho Harbor near Ocean Falls killed five people and buried some houses.

May 4, 1931 The locomotive and three fish cars derailed when an eastbound train No. 6 hit a rockslide east of Amsbury. One trespasser riding on a fish car was killed.

Ca. February 20, 1932 Snowslides buried three men at the Jumbo mine near Wrangell, Alaska, killing at least one of them.

March 25, 1939 Ice jams caused the Murray River to suddenly overflow its banks west of Dawson Creek, taking a total of nine lives.

October 19, 1940 A passenger train plunged off the flood-weakened bridge across Lorne Creek. The engineer, fireman, and two passengers were drowned. According to another source, five lives were lost.

February 11, 1943 A series of three snow avalanches at MacLean Point west of Terrace killed three men and injured 12 others in the camp of the Tomlinson Construction Company.

January 15, 1947 A CNR foreman was killed when his speeder struck a rock on the track near Pacific.

October 27, 1953 A rockslide near Dorreen killed one miner at a placer mine at Lorne Creek.

May 15, 1954 A fireman was killed west of Prince George after a CNR passenger train dropped into a deep washed-out culvert caused by the breaching of a beaver dam.

October 18, 1954 A debris slide killed two construction workers at Mile 28 on the rail line between Terrace-Kitimat.

October 6, 1955 A PGE speeder hit a rock and jumped the tracks at Stone Creek south of Prince George, killing two members of a bridge and buildings crew and injuring two others.

November 21, 1957 A debris avalanche on Mount Oldfield near Prince Rupert killed seven people and destroyed three houses.

March 21, 1959 An eastbound freight train hit a slide west of Smithers and derailed, killing the engineer.

April 7, 1959 A snow avalanche at the Torbrit Silver Mine near Alice Arm killed one miner.

December 4, 1959 A rock and snowslide killed one employee and injured another on the Stewart/Cassiar Road project north of Stewart.

September 7, 1960 A mud and debris slide down a steep ravine 18 mi. (28.8 km) west of McBride killed three highway construction workers. Another man was injured while a fifth man escaped.

November 18, 1962 A snow avalanche on Hudson Bay's Glacier Gulch near Smithers killed one mine employee.

July 21, 1963 A section of roadway north of Fort Nelson and just inside the Yukon Territory, gave way and buried a truck with two men, killing one and injuring the other one.

January 13, 1965 A snow avalanche on Mt. Caro Marion near Ocean Falls wiped out two duplex homes, killing seven and injuring five other people.

February 18, 1965 A snow avalanche on the Leduc Glacier near Stewart killed 26 and injured 20 workmen in the Granduc Mining Co. camp.

February 10, 1966 Heavy snowload on the roof of a welding shop in Kitimat collapsed, killing one man.

November 24, 1968 A massive slide of "overburden" of a mining operation west of Natal on Highway 3 killed two motorists and their small dog.

March 14, 1973 A snow avalanche on Nine Mile Mountain near Hazelton killed one snowmobile operator.

January 22, 1974 A snow avalanche wiped out a service station and motel/restaurant complex on Highway 16 west of Terrace. Seven people were killed.

February 17, 1974 an avalanche on Mica Mountain west of Valemount killed one man and seriously injured two others.

October 30, 1978 A mudslide coming down in the BC Rail yard north of Prince George killed two employees. One man was buried alive and the second died of a heart attack while attempting to rescue the other.

November 2, 1978 Part of a CNR work train plunged into the Skeena River, killing an engine man and a conductor.

July 1980 A debris avalanche in the Beaver Valley near Terrace killed an equipment operator. The vibration of a caterpillar tractor set off the accident.

September 28, 1981 A mudslide killed a 25-year old man working on the new BC Rail line near the Tumbler Ridge coal site.

January 12, 1982 A snow avalanche at slidepath Rockface west of Terrace killed a 53-year old CNR section man and injured three other CNR employees.

February 13, 1984 An avalanche in the Red Fern Lake area south of Fort Nelson swept down a five-man snowmobiler party, killing an 18-year old Fort St. John man and a 20-year old man from Taylor.

February 22, 1985 An avalanche on Onion Mountain near Smithers killed a 29-year old man snowmobiling in the darkness.

March 29, 1986 An avalanche on the Cariboo Mountain trail south of Valemount killed four Alberta snowmobilers.

March 23, 1987 An avalanche near Blue River in the Cariboo Range killed seven heli-skiers. Another five skiers, who were trailing behind the group, escaped.

January 28, 1989 A snow avalanche near Telegraph Creek wiped out two houses, killing an 80-year old woman.

March 25, 1989 A piece of falling ice on Highway 16 at Carwash Rock west of Terrace killed the driver of a pick-up truck.

November, 1989 A logging truck driver was killed when his truck left Highway 37A after hitting a rock fall at the entrance to Little Canyon near Stewart.

June 11, 1990 A van carrying eight tree planters plunged off a partly washed out bridge over George Creek, killing four occupants.

November 27, 1991 An avalanche coming down Twin Falls near Smithers killed one ice-climber and injured four others.

January 3, 1992 A snow avalanche on Thornhill Mountain near Terrace buried and killed two local snowmobilers.

November 19, 1993 A small debris flow on the eastern shore of Alan Reach south of Kitimat buried and killed one logging employee.

May 22, 1994 A small snow avalanche killed one member of a ski-mountaineering group near Europa Lake south of Kitimat. The victim was swept over a 360-metre cliff.

September 28, 1994 A heavy equipment operator was killed when a section of road under construction at Kiseadin Creek near Greenville gave way.

May 17, 1996 An avalanche down the slope of Cerberus Mountain about 70 km from Bella Coola killed four skiers.

April 16, 1997 In West Quesnel, shifting soil snapped a gas line and caused an explosion that killed five people and injured 20 others.

January 7, 1999 An avalanche near Meziadin killed two Terrace-based Ministry of Transportation and Highways avalanche technicians.

December 28, 2002 Two Alberta snowmobilers got caught in an avalanche south of Valemount. One of the victims was killed.

LITERATURE CITED

Asante, N. 1972. The history of Terrace. Terrace Public Library Assn., Terrace, B.C. 243 p.

B.C. Ministry of Energy, Mines and Petroleum Resources. 1993. Landslides in British Columbia. Geological Survey Branch. Information circular 1993-7

B.C. Ministry of Mines. 1960. Annual report 1959. Victoria, B.C., pp. 231-232.

B.C. Ministry of Mines and Petroleum Resources. 1966. Annual report 1965. Victoria, B.C., pp. 366-374.

B.C. Ministry of Public Works. 1957. Report for the fiscal year 1955-56. Victoria, B.C., p. N 35.

B.C. Ministry of Public Works. 1958. Report for the fiscal year 1956-57. Victoria, B.C., p. J. 39

B.C. Ministry of Public Works. 1963. Report for the fiscal year 1961-62. Victoria, B.C., p. J 104.

B.C. Ministry of Public Works. 1966. Report for the fiscal year 1964-65. Victoria, B.C., pp. C 104-106.

- B.C. Ministry of Public Works. 1967. Report for the fiscal year 1965-66. Victoria, B.C., p. C 105.
- B.C. Ministry of Public Works. 1968. Report for the fiscal year 1966-67. Victoria, B.C., p. C 105.
- B.C. Ministry of Public Works. 1969. Report for the fiscal year 1967-68. Victoria, B.C., p. C 109.
- B.C. Ministry of Public Works. 1970. Report for the fiscal year 1968-69. Victoria, B.C., p. C 120
- B.C. Ministry of Public Works. 1973. Report for the fiscal year 1971-72. Victoria, B.C., p. C 130.
- B.C. Ministry of Transportation and Highways. 1976. Report for the fiscal year 1974-75. Victoria, B.C., p. B 127.
- B.C. Ministry of Transportation, Communications and Highways. 1980. Report for the fiscal year 1978-79. Victoria, B.C., pp. 301-303.
- B.C. Ministry of Transportation and Highways. 1980. Snow avalanche atlas Terrace-Tyee. Snow Avalanche Section, Victoria, B.C. 180 p.
- B.C. Ministry of Transportation and Highways. 1982a. Snow avalanche atlas Bear Pass Stewart-Hyder. Snow Avalanche Section, Victoria, B.C. 202 p.
- B.C. Ministry of Transportation and Highways. 1982b. Report for the fiscal year 1980-81. Victoria, B.C., pp. 338-339.
- Bourgon, N. 1979. Rubber boots for dancing. D.W. Friesen & Sons Ltd., Cloverdale, B.C. 138 p.
- Campbell, D.B. and N.A. Skermer. 1975. Report to British Columbia Water Resources Service on investigation of seawave at Kitimat, B.C. Golder Associates, Vancouver. 9 p.
- Campbell, D.B. and N.A. Skermer. 1979. Report to Unecon project consultants on assessment of ground stability at Kitsault townsite, Alice Arm, British Columbia. Golder Associates, Vancouver, B.C. 14 p.
- Champagne-Aishihik Band. 1988. From trail to highway. Victoria, B.C. 48 p.
- Church, M. 1983. Pattern of instability in a wandering gravel bed channel. Spec. Publs. Int. Sediment. Vol. 6, pp. 169-180.
- Church, M. 1988. Floods in cold climates. Flood geomorphology. Edited by V.R. Baker, R.C. Kochel, and P.C. Patton. John Wiley & Sons, London. pp. 205-229.
- Clague, J.J. 1984. Quaternary geology and geomorphology, Smithers-Terrace-Prince Rupert area British Columbia. Geolog. Surv. Can. Memoir 413. 71 p.
- Clague, J.J. (Compiler). 1989. Quaternary geology of the Canadian Cordillera. In Quaternary geology of Canada and Greenland. Ch. 12. R.J. Fulton (ed.) Geology of Canada No. 1 Geolog. Surv. Can.
- Clague, J.J. and S.G. Evans. 1992. A self-arresting moraine dam failure, St. Elias Mountains, British Columbia. In: Current Research. Part E. Geol. Surv. Can. Paper 92-1A. pp. 185-188.
- Clague, J.J. and S.G. Evans. 1994. Formation and failure of natural dams in the Canadian Cordillera. Geolog. Surv. Can. Bulletin 464. 35 p.
- Clague, J.J. and V.N. Rampton. 1982. Neoglacial Lake Alsek. Can. J. Earth Sciences 19: 94-117.

- Clague, J.J. and W.H. Mathews. 1992. The sedimentary record and Neoglacial history of Tide Lake, northwestern British Columbia. *Can. J. Earth Sciences* 29: 2383-2396.
- Clarke, G.K.C. 1982. Glacier outburst floods from "Hazard Lake," Yukon Territory, and problem of flood magnitude prediction. *J. of Glaciology* 28: 3-21.
- Clarke, G.K.C. 1989. Paleohydraulic modelling of outburst floods from Neoglacial Lake Alsek, Yukon Territory, Canada [abstract]. *Annals of Glaciology* 13: 295.
- Clarke, G.K.C. and D.A. Waldron. 1984. Simulations of the August 1979 sudden discharge of glacier-dammed Flood Lake, British Columbia. *Can. J. Earth Sciences* 21:502-504.
- Clarke, G.K.C., W.H. Mathews, and R.T. Pack, 1984. Simulation of the August 1979 sudden discharge of glacier-dammed Flood Lake, British Columbia. *Can. J. Earth Sciences*. 21: 502-504.
- Coates, Ken. 1992. North to Alaska, Fifty years on the world's most remarkable highway. McLelland & Stewart, Inc. Toronto, Ont. 304 p.
- Cohen, Stan. 1992. Alcan and Canol. A pictorial history of two great World War II construction projects. Pictorial Histories Publishing Company, Inc. Missoula, Mont. 262 p.
- Cornforth, D.H. and Lowell, J.A. 1996. The 1994 slope failure at Skagway, Alaska. In: Landslides. Ed. K. Sennesett. Proceedings, 7th International Symposium on Landslides. Trondheim, Norway. 1: 527-532.
- Coulter, H.W. and Migliaccio, R.R. 1966. Effects of the earthquake of March 27, 1964 at Valdez, Alaska. United States Geological Survey. Professional Paper 542-C. 35 p.
- Cruden, D.M. and Z.Y. Lu. 1992. The rockslide and debris flow from Mount Cayley, B.C. in June 1984. *Canadian Geotechnical Journal*. 29. pp. 614-626.
- Cruden, D.M. and D.J. Varnes. 1996. Landslide types and processes. In: Turner, A.K. and R.L. Schuster (Editors) Landslides investigation and mitigation, Special Report 247, Transportation Research Board, National Research Council, Washington, DC, pp. 36-75.
- Dawson, G.M. 1889. Report on an exploration in Yukon District, N.W.T., and adjacent northern portion of British Columbia. *Geol. Surv. Can., Ann. Rep. Vol. III. Pt. 1*.
- DeLaguna, Frederica. 1972. Under Mount Saint Elias: The history and culture of the Yakutat Tlingit. Smithsonian Contributions to Anthropology. Vol. 7 (in 3 parts) Washington, D.C. U.S. Government Printing Office.
- Department of Mines and Resources. 1937. Surface water supply of Canada: Climatic years 1930-1931 and 1931-1932, British Columbia and Yukon Territory, Pacific Drainage. Water Resources Paper No. 72. 316 p.
- Donna Creek Technical Investigative Team. 1992.
- Eisbacher, G.H. and J.J. Clague. 1981. Urban landslides in the vicinity of Vancouver, British Columbia, with special reference to the December 1979 rainstorm. *Can. Geotech. J.* 18: 205-216.
- Environment Canada. 1988. Historical water levels summary British Columbia to 1987. Inland Waters Directorate, Water Resources Branch, Water Surv. Canada, Ottawa, Ont. 171 p.
- Environment Canada. 1991. Historical streamflow summary British Columbia to 1990. Inland Waters Directorate, Water Resources Branch, Water Surv. Canada, Ottawa, Ont. 1116 p.
- Evans, S.G. 1982. Landslides and surficial deposits in urban areas of British Columbia: A Review. *Can. Geotech. J.* 19: 269-287.
- Evans, S.G. 1986. Landslide damming in the Cordillera of western Canada. In: Landslide dams: processes, risk and mitigation. (Ed.) R.L. Schuster. American Society of Civil Engineers. Geotechnical Special Publication 3. pp. 111-130.

- Evans, S.G. and J.J. Clague. 1989. Rain-induced landslides in the Canadian Cordillera. Geoscience Canada. Vol. 16. pp. 193-200. July 1989.
- Evans, S.G. and J.J. Clague. 1999. Damaging landslides and related processes in the Canadian Cordillera: Impact and mitigation in the historical period 1855-1999. Geological Survey of Canada. Bulletin. (unpublished).
- Gabrielse H. and C.J. Yorath (ed.). 1992. Introduction, Chapter 1. In: Geology of the Cordilleran Orogen in Canada. Geological Survey of Canada. Geology of Canada. No. 4. pp. 3-11.
- Geertsema, Marten. 1998. Flowslides in waterlain muds of northwestern British Columbia, Canada. Proceedings of 8th IAEG Congress September 1998. 9 p.
- Gilbert, R. 1972. Drainage of ice-jammed Summit Lake, British Columbia. Environ. Can., Water Resources Branch, Ottawa, Ont. Scientific Series No. 20. 17 p.
- Godfrey, D.D., P.A. Schaerer, R. Tremblay, G.L. Freer, and S.G. Evans. 1974. British Columbia Department of Highways Avalanche Task Force, report on findings and recommendations. Mimeo Rep. Victoria, B.C. 33 p.
- Grove, E.R. 1971. Geology and mineral deposits of the Stewart area, British Columbia. British Columbia Department of Mines and Petroleum Resources. Bulletin No. 98. 219 p.
- Hay, Duncan. 1983. Tsunamis. *The BC Professional Engineer* 34 (12): 17-20.
- Hungr, O. and D. Smith. 1990. Debris flow hazard assessment Oweekeno Village, Rivers Inlet, B.C. File 16-10-19. Thurber Engineering Ltd. Vancouver, B.C. 20 p.
- Hungr, O., Evans, S.G., Bovis, M. and J.N. Hutchison. 2001. Review of classification of landslides of the flow type. *Environmental and Engineering Geoscience*, 7:221-238.
- Hutchison, B. 1950. The Fraser. Clarke, Irwin & Company Limited, Toronto, Ont. 349 p.
- Jackson, L.E. Jr. 1994. Terrain inventory and Quaternary history of the Pelly River area, Yukon Territory. Geological Survey of Canada. Memoir 437. 41 p.
- Jamieson, Bruce and Torsten Geldsetzer. 1996. Avalanche Accidents in Canada Volume 4: 1984-1996. Canadian Avalanche Association. Revelstoke, B.C. 193 p.
- Johnson, L. W. 1984. Loggers versus fishermen: is coexistence possible? *Logging & Sawmilling J.* 15 (10): 53-56.
- Jones, D. P., K. E. Ricker, J. R. Delonges, and M. Maxwell. 1985. Glacier outburst flood on Noeick River: the draining of Ape Lake, British Columbia, October 20, 1984. Open File Report 1139. Geolog. Surv. Can. 81 p.
- Kelsey, Vera. 1958. British Columbia rides a star. Harper & Brothers Publishers, New York. 309 p.
- Kendrick, J. 1987. People of the snow: the story of Kitimat. NC Press Limited, Toronto, Ont. 179 p.
- Kerr, F.A. 1936. Extraordinary natural floods of Talsekwe River, Taku District, northern British Columbia and southeastern Alaska. *Trans. Royal Soc. Can.*, 3rd Ser. Vol. 30, Sect. IV. pp.133-135.
- Kerr, F.A. 1948. Lower Stikine and western Iskut river areas, British Columbia. Can. Dep. Mines and Resources, Ottawa, Ont. Geolog. Surv. Memoir 246.
- Kerr, F.A. 1948. Taku River Map-area, British Columbia. Can. Dep. Mines and Resources, Ottawa, Ont. Geolog. Surv. Memoir 248.
- Kopas, Cliff. 1970. Bella Coola. Mitchell Press Limited, Vancouver, B.C. 296 p.
- Kulikov, E.A., Rabinovich, A.B., Thompson, R.E. and B.D. Bornhold. 1996. The landslide tsunami of November 3, 1994, Skagway Harbour, Alaska. *Journal of Geophysical Research*. v. 101, No. C3, pp. 6609-6615.

- Lebuis, J.J., Robert, M. and P. Rissman. 1983. Regional mapping of landslide hazard in Quebec. In: Bergren, B. and J. Lindgren (eds.) Symposium on slopes on soft clays. Swedish Geotechnical Institute. Report No. 17, Linköping, pp.205-262.
- Lewis, C.J. and M.D. Moran. 1985. Severe storms off Canada's west coast: a catalogue summary for the period 1957 to 1983. Canadian Climate Centre Report 85-7. Environ. Can., Atmos. Environ. Serv., Downsview, Ont. 381 p.
- McMullen, B.R., R.J. Talbot, and P.J. Woods. 1979. Terrace area flooding. B.C. Min. Environ., Victoria, B.C. 19 p.
- Marcus, M.G. 1960. Periodic drainage of glacier-dammed Tulsequah Lake, British Columbia. The Amer. Geograph. Soc. Geograph. Review 50: 89-106
- Mathews, W.H. 1965. Two self-dumping ice-dammed lakes in British Columbia. The Amer. Geograph. Soc. Geograph. Review 55: 46-52.
- Mathews, W.H. 1973. Record of two jökulhlaups. Association Internationale D'Hydrologie Scientifique, pp. 99-110.
- Mathews, W.H. and J.J. Clague. 1993. The record of jökulhlaups from Summit Lake, northwest British Columbia. Can. J. Earth Sciences. 30: 499-508.
- Meziadin Environmental Advisory Team. 1975. CN Meziadin project. Environmental impact study mile 0-75. Vol. 1-5. Can. Nat. Railway, Edmonton, Alta. 582 p.
- Ministry of Energy, Mines and Petroleum Resources. 1993. Landslides in British Columbia. Information Circular 1993-7.
- Ministry of Environment, Lands and Parks. N/D. Dam safety in British Columbia. Who is responsible? Water Management pamphlet.
- Moeran, J.J.W. 1923. McCullagh of Aiyansh. Marshall Brothers Ltd., London. 232 p.
- Morice, A.G. 1904. The history of the Northern Interior of British Columbia. William Briggs, Toronto. 349 p.
- Muralt, D. E. 1985. Steel rails and silver dreams. Benchmark Publications, Los Altos, Cal. 183 p.
- Murty, T.S. 1979. Submarine slide-generated water waves in Kitimat Inlet, British Columbia. J. Geophys. Res. 84 (C12): 7777-7779.
- Nesbitt-Porter, H.H. 1986. Damage Assessment May 1986 Flood and debris flows East Central British Columbia (O.I.C. 1106) Water Management Branch. Rivers Section. File P86-8. 11 p.
- Nesbitt-Porter, H.H. 1987. Damage Assessment July-August 1987 Flooding Northeastern British Columbia. Province of British Columbia. O.I.C. 1797. Water Management Branch. Rivers Section. File P87-7. 19 p.
- Nesbitt-Porter, H.H. 1989. Southwestern B.C. flooding November 9, 1989. (O.I.C. 1790) Province of British Columbia. Water Management Branch. Rivers Section. File P89-8. 19 p.
- Northwest Hydraulic Consultants Ltd. 1987. Skeena Cellulose, Inc. Hatchery Creek Impact Study. 1492. Northwest Hydraulic Consultants Ltd., North Vancouver, B.C. 19 p.
- O'Neill, W. 1960. Whitewater men of the Skeena. Northern Sentinel Press, Kitimat. 28 p.
- Orchard, R. I. 1983. Floodland and forest: memories of the Chilliwack valley. Provincial Archives of British Columbia. Sound Heritage Series No. 37. 92 p.
- Phillips, D. 1990. The climates of Canada. Environ. Can., Ottawa. Ont. 176 p.
- Pincock, G.L. 1951. An analysis of precipitation on the British Columbia coast. Local Forecast Study No. 9 Circ. 1974. Tec 94. Dept. of Transport Meteorological Division. 13 p.

- Pollock, D.M. 1975. An index to storm rainfall in Canada, CLI-1-75. Environ. Can. Atmos. Environ., Downsview. Ont. 37 p.
- Ramsey, Bruce. 1962. PGE. Railway to the North. Mitchell Press, Vancouver, B.C. 264 p.
- Reader's Digest. 1976. Scenic Wonders of Canada. The Reader's Digest Association (Canada) Ltd. 384 p.
- Rogers, F. 1992. More shipwrecks of British Columbia. Douglas & McIntyre. 241 p.
- Scanlon J. and B. Taylor. 1979. The Terrace floods, 1978: defining a disaster. Carlton Univ., Communications Research Unit, Ottawa, Ont. 109 p.
- Schaefer, D.G. 1979a. The multi-day rainstorm of October-November 1978 on the Queen Charlotte Islands. Atmos. Environ. Serv., Scientific Serv. Vancouver, B.C. 16 p.
- Schaefer, D.G. 1979b. Meteorological developments contributing to the Terrace area flood of early November 1978. Atmos. Environ. Serv. Scientific Serv., Vancouver, B.C. 7 p.
- Schaefer, D.G. 1983. Storms. BC Professional Engineer 34 (12): 21-22.
- Schwab, J.W. 1983. Mass wasting: October-November 1978 storm, Rennell Sound, Queen Charlotte Islands, British Columbia. B.C. Min. For., Victoria, B.C. Res. Note No. 91. 23 p.
- Schwab, J.W. 1999. Tsunamies on Troitsa Lake, British Columbia. Extension Note No. 35. Forest Sciences, Prince Rupert Forest Region. 4 p.
- Schwab, J.W., Blais-Stevens, A. and M. Geertsema. 2004. The Khyex River flowslide, a recent landslide near Prince Rupert, British Columbia. 8 p.
- Schwab, J.W., Geertsema, M. and S.G. Evans. 2003. Catastrophic rock avalanches, west-central British Columbia. 3rd Canadian Conference on Geotechnique and Natural Hazards. The Canadian Geotechnical Society. pp. 291-298.
- Septer, D. 1995. Highway 16: Prince Rupert-Terrace 1944-1994. In: *B.C. Historical News*, Vol. 29 No. 1. pp. 24-26.
- Septer, D. and J.W. Schwab. 1995. Rainstorm and flood damage Northwest British Columbia 1891-1991. Province of British Columbia. Ministry of Forests Research Program. Land Management Handbook 31. 196 p.
- Skermer, N.A. 1976. Earthquakes, avalanches, landslides. BC Professional Engineer, 27 (1): 5-8.
- Spooner, I., Osborn, G. and A. Groot. 1996. Resident oral histories: a tool for the study of recent environmental change on the Stikine Plateau of northwestern British Columbia. In: *Geomorphic Hazards*. Ed. H.O. Slaymaker. J. Wiley and Sons. pp. 9-28.
- Stethem, C.J. and P.A. Schaerer. 1979. Avalanche accidents in Canada I. A selection of case histories of accidents, 1955 to 1976. Nat. Res. Counc. Can., Div. Building Res., Ottawa, Ont. D.B.R. Paper No. 834 NRCC 17292. 114 p.
- Stethem, C.J. and P.A. Schaerer. 1980. Avalanche accidents in Canada II. A selection of case histories of accidents, 1943 to 1978. Nat. Res. Counc. Can., Div. Building Res. Ottawa, Ont. D.B.R. Paper No. 926 NRCC 18525. 75 p.
- Sword, C.B. 1904. Skeena River Hatchery, B.C. Annual report Department of Marine and Fisheries: Fisheries 36 (1903) Ottawa, Ont., pp. 254-255.
- Sword, C.B. 1905: Lake Lakelse Hatchery, Skeena River. Annual report Department of Marine and Fisheries: Fisheries 37 (1904) Ottawa, Ont., pp. 238-239.
- Tarr, R.S. and L. Martin. 1914. Alaskan glacier studies of the National Geographic Society in the Yakutat Bay, Prince William Sound and lower Copper River regions. Nat. Geogr. Soc. Washington, D.C. 498 p.

- Tempest, W. 1974. Bella Coola River: flood and erosion control. File 0254122 No. 11. B.C. Dep. Lands, Forests and Water Resources, Victoria, B.C. 83 p.
- Thompson, R.E. 1981. Oceanography of the British Columbia Coast. Canadian Department of Fisheries and Oceans. Canadian Special Publication of Fisheries and Aquatic Sciences. 56. 291 p.
- Trenhaile, Alan S. 1998. Geomorphology: A Canadian perspective. Oxford University Press. 340 p.
- Varley, A. E. 1981. Kitimat my valley. Northern Times Press, Terrace, B.C. 228 p.
- Viberg, L. 1983. Experiences of mapping and classification of stability conditions. In: Bergren, B. and J. Lindgren (eds.) Symposium on slopes on soft clays. Swedish Geotechnical Institute. Report No. 17, Linköping, pp.455-461.
- Walbran, J. T. 1909. British Columbia coast names 1592-1906. Their origin and history. Government Printing Bureau, Ottawa, Ont. 546 p.
- Watt, W. E., K. W. Latham, C. R. Neill, T. L. Richards, and J. Rouselle (editors). 1989. Hydrology of floods in Canada, a guide to planning and design. Nat. Res. Council. Can., Ottawa, Ont. 245 p.
- Weber, E. L. (editor) 1986. The way we were. Skeena valley pioneer memories. Totem Press, Terrace, B.C. 136 p.
- Wicks, W. 1976. Memories of the Skeena. Hancock House, Saanichton, B.C. 215 p.
- Wigen, S.O. and W.R. White. 1964. Tsunami of March 27-29, 1964, west coast of Canada. Canadian Department of Mines and Technical Surveys. Ottawa, Ont. 6 p.
- Whitwell, T. 1906. Skeena River Hatchery. Annual report Dept. of Marine and Fisheries: Fisheries 38 (1905) Ottawa, Ont. pp. 257-259.
- Williams, K. 1975. The snowy torrents. Avalanche accidents in the United States 1967-71. USDA For. Serv. Gen. Tech. Rep. RM-8, Rocky Mt. For. and Range Exp. Stn. Fort Collins, Col. 190 p.
- Williams, K. and B. Armstrong. 1984. The snowy torrents. Avalanche accidents in the United States 1972-1979. Col. Avalanche Inf. Cent., Denver, Col. 212 p.

