



Herbert River Floods

January and February 2009



| | |
|---|---|
| 1 | 2 |
| 3 | |
| 4 | 5 |

1. Tuesday, February 3. Davidson Street, Ingham, appears just like the canals of Venice.
2. Tuesday, February 3. The road to Townsville from Ingham remains cut.
3. Tuesday, February 3. Floodwaters surge through Ingham's streets Picture-Mark and Belinda Doyle of Lee's Hotel.
4. Tuesday, February 3. Flooding in Ingham. Picture-Dale Johnson
5. Tuesday, February 3. Floodwaters enter shops in the retail and business centre of Ingham. Picture-Mark and Belinda Doyle of Lee's Hotel.

All photos from the Courier Mail Newspaper website <http://www.news.com.au/couriermail/>.

Note:

1. Data in this report has been operationally quality controlled but errors may still exist.
2. This product includes data made available to the Bureau by other agencies. Separate approval may be required to use the data for other purposes. See Appendix 1 for DNRW Usage Agreement.
3. This report is not a complete set of all data that is available. It is a representation of some of the key information.

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Herbert River Floods

January and February 2009

1. Introduction

The Herbert River has its headwaters in a high rainfall area of the Dividing Range near Herberton and flows through a gorge to the coastal plain near Ingham. The river continues to its mouth near Lucinda where the catchment area is approximately 9,000 square kilometres.

The Herbert River responds quickly to heavy rainfall and river rises can be rapid. The area around Ingham is very flat and the town itself is located on the floodplain of the river. Several natural watercourses distribute floodwaters through the town during major flooding and most areas of the town are subject to inundation.

The Herbert catchment received significant amounts of rainfall during January and February leading to major flooding and record river heights in some locations. There were two significant floods in this period, the first was between 12th and 13th January and the second between 29th January and 8th February. According to [Emergency Management Queensland](#), during the prolonged second flood event approximately 65 per cent of the Hinchinbrook Shire or upwards of 2900 homes and businesses were affected by floodwaters. About 50 homes experienced inundation in their living areas.

This report provides a technical summary and analysis of the hydrology of the Herbert River Floods of January and February 2009. For a full meteorological analysis of the rainfall events discussed in this report refer to the [Queensland Floods: January and February 2009](#).

A [Flood Warning Network Map for the Herbert River](#) catchment shows the location of flood warning stations referred to in this report.

2. Meteorological Summary

The first flood was caused by rainfall on 12th January in the lower Herbert River and resulted in minor flooding in the Abergowrie area and moderate flooding downstream at Halifax. For the rainfall totals, see Figure 3.3.1.

The second flood was widespread and prolonged which resulted from three different periods of heavy rainfall. These rainfall events occurred between the 29th and 30th January, the second between the 1st and 2nd February and the third was between the 6th and 7th February. Rainfall between the 29th and 30th January caused moderate to major flooding with the second and third periods of rainfall (1st and 2nd February and the 6th and 7th February) causing the widespread and prolonged major flooding as shown in Figure 3.2.

A low pressure system developed on the monsoon trough off the north tropical coast of Queensland, to the north-east of Cairns, on Thursday 29th January. This monsoon low moved southwards during Friday 30th January before moving northwards during the evening and deepening. This low hovered to the east north-east of Cairns during Saturday 31st January and developed into category 1 Tropical Cyclone Ellie very early on Sunday 1st February.

Large rainfall totals including 442mm at Ingham Pump Station and 278mm at Gairloch were recorded during the 48 hours to 9am on Monday 2nd February. This rainfall was due to the approaching Tropical Cyclone Ellie, which crossed the coastline near Mission Beach at 11:55pm on 1st February 2009. The cyclone rapidly weakened into a rain depression. The rain depression then continued in a generally west to south-west direction over the following few days, producing heavy rainfall particularly in the Herbert River catchment on the 1st and 2nd February.

A weak low developed on the monsoon trough to the east of Cairns on the 4 February, then drifted northwards with the monsoon trough. This produced further heavy rainfall on the Friday 6th and Saturday 7th of February in the Herbert River catchment. For the rainfall totals for this period of rainfall, see Figures 3.1.4 and 3.1.5.

For a more detailed discussion of the meteorology of the event and a summary of flooding in Queensland throughout January and February 2009, refer to the [Queensland Floods – January to February 2009](#).

3. Hydrology

The rainfall recorded in the lower Herbert River in the 24 hours to 9am on the 13th January was sufficient to produce a moderate flood at Halifax. This rainfall event saturated the Herbert River catchment, which provided conditions for higher river levels in early February. The first heavy rainfall event in February 2009, caused by the passage inland of Tropical Cyclone Ellie on 2nd February, produced severe major flooding throughout the Herbert River catchment. The Herbert River at Gairloch, near Ingham, peaked at 12.25 metres on 3rd February which is the highest level since March 1997 flood. River levels in the lower Herbert then began to ease, after the crossing of Tropical Cyclone Ellie; however, a second peak of 12.25 metres was recorded again at Gairloch on 7th February.

Due to the catchment-wide nature of the rainfall associated with Cyclone Ellie, floodwaters from the upper Herbert River prevented river levels returning to normal flows downstream. The combination of this and the short time between all three periods of heavy rainfall maintained the Herbert River above major flood level for one week in some locations. This also contributed to record flood levels at four locations as shown in Table 3.1.

Table 3.1 Herbert River catchment - Peak Height Comparison to Records.

| Gauging Station | Feb 3-4 2009 Peak (metres) | Start of Record | Ranking | Highest Since | Highest on Record |
|--|----------------------------|-----------------|-------------------|---------------|-------------------|
| Herbert River at Gleneagle Homestead | 14.40m | 1940 | 4 th | 1977 | 19.00m Mar 1967 |
| Herbert River at Gleneagle | 12.53m | 1925 | 6 th | 1940 | 17.73m Mar 1967 |
| Herbert River at Nash's Crossing | 11.20m | 1992 | 1 st | New Record | New Record |
| Herbert River at Abergowrie Alert | 15.93m | 1992 | 1 st | New Record | New Record |
| Herbert River at Abergowrie Bridge Alert | 17.24m | 2001 | 1 st | New Record | New Record |
| Herbert River at Peacock Siding | 14.10m | 1953 | 3 rd | 1998 | 14.63m Jan 1972 |
| Herbert River at Gairloch | 12.25m | 1956 | 4 th = | 1997 | 12.60m Mar 1967 |
| Herbert River at Halifax | 5.67m | 1998 | 1 st | New Record | New Record |

Table 3.1 shows that the highest flood peaks all occurred in February, with record floods in four locations. As shown in the table, the flooding in February was a significant flood throughout the catchment with all except one station recording at least its fourth highest flood peak.

Figure 3.1 Herbert River catchment – Peak Height Map for 12/01/2009 to 14/01/2009 flooding.

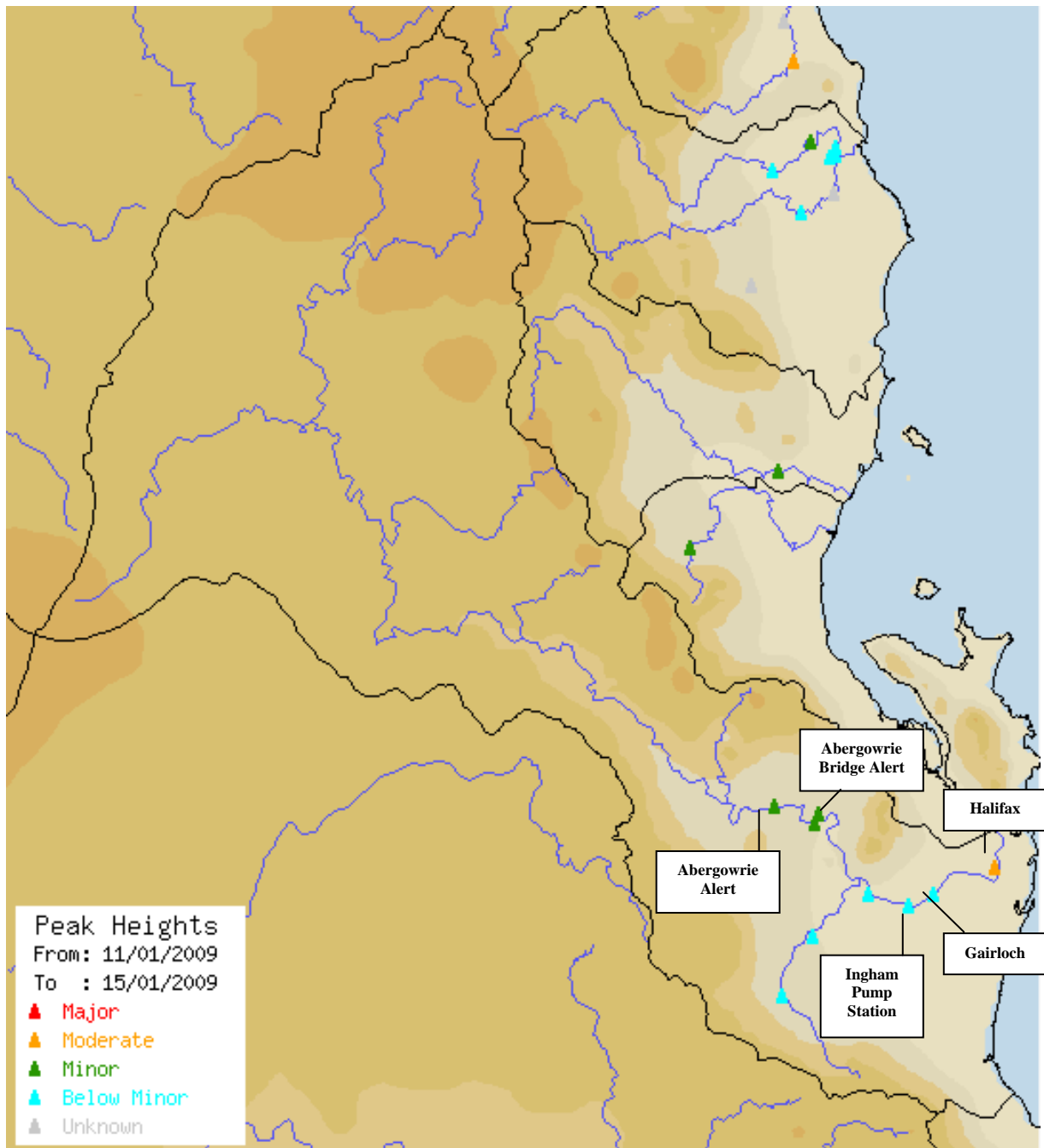


Figure 3.1 shows the flood classifications of the peak river levels during the January flooding. The localised nature of the rainfall means that the river rises were caused by local run-off. This led to Halifax exceeding moderate flood level and three minor flood levels (Abergowrie, Abergowrie Bridge Alert and Elphinstone pocket).

Figure 3.2 Herbert River catchment – Peak Height Map for 29/01/2009 to 08/02/2009 flooding.

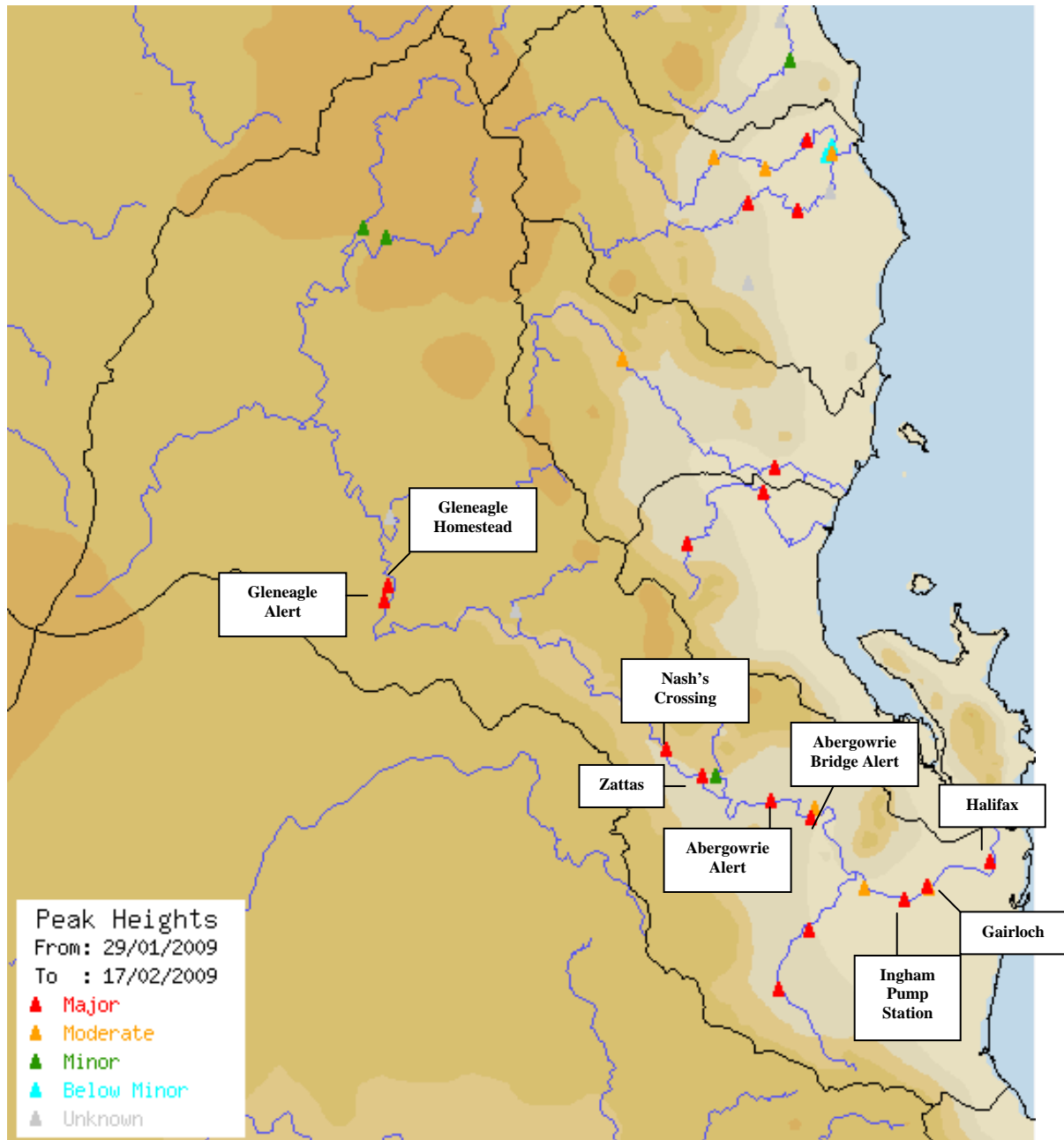


Figure 3.2 shows the peak flood classifications for the flood in February in the Herbert River catchment. Nearly all stations experienced major flooding during this event. The 11 days to 9am on the 8th February 2009 recorded large amounts of rainfall as shown in Figure 3.1.5 and 3.1.6. The effect of this was widespread major flooding throughout the catchment as shown above. This produced record floods in four locations as shown in Table 3.1.

3.1. Rainfall Maps

The rainfall maps give the total amount of rainfall for the two events. The second event between 29th January and 8th February is shown in Figures 3.1.4 and 3.1.5. Figures 3.1.2 and 3.1.3 are radar images that show when Ex-Tropical Cyclone Ellie crossed over the coast and show the bands of heavy rain in the Ingham area.

For all station names please refer to [Flood Warning Network Map for the Herbert River](#).

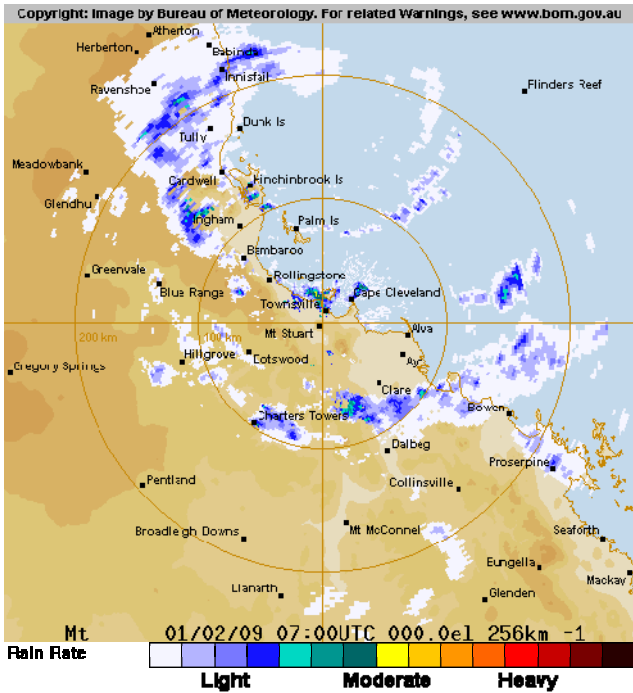
Figure 3.1.1 Rainfall Map for the 24 hour period to 9am on the 13/01/2009.



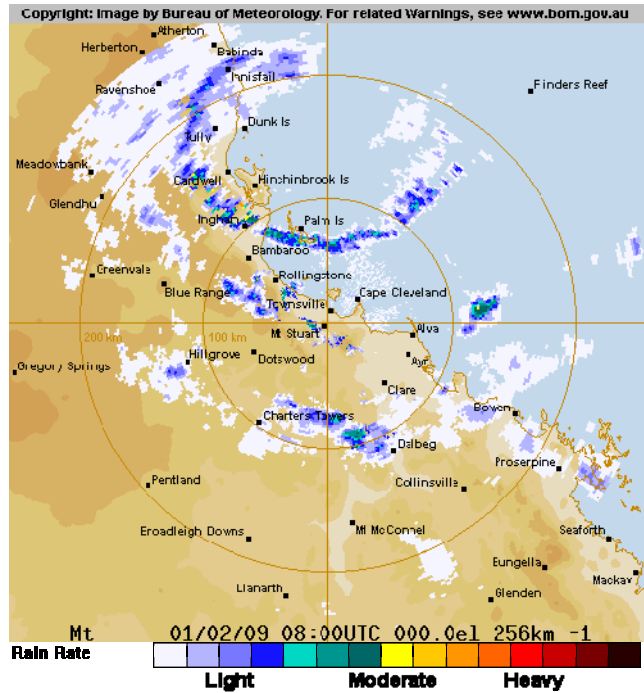
Figure 3.1.1 shows that the first flood was caused by intense rainfall in the lower Herbert River, between Abergowrie and Halifax. All rainfall stations in the lower Herbert recorded over 110mm in 24 hours to 9am on the 13th January, with the highest rainfall total recorded at Ingham Pump Station of 290mm. As a result the river level rose above minor flood level at Abergowrie, Abergowrie Bridge Alert and Elphinstone Pocket. The river level reached above moderate flood level at Halifax Alert.

Figure 3.1.2 Radar images of Tropical Cyclone Ellie crossing the coast.

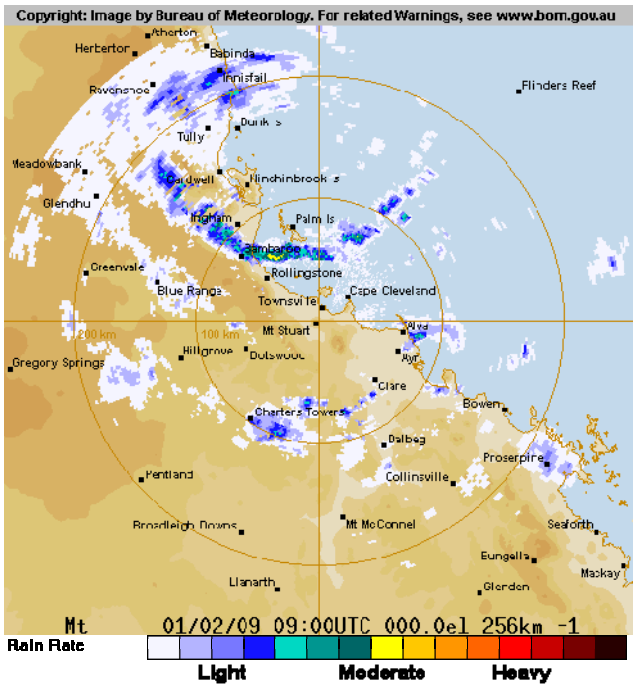
01/02/2009 17:00



01/02/2009 18:00



01/02/2009 19:00



01/02/2009 20:00

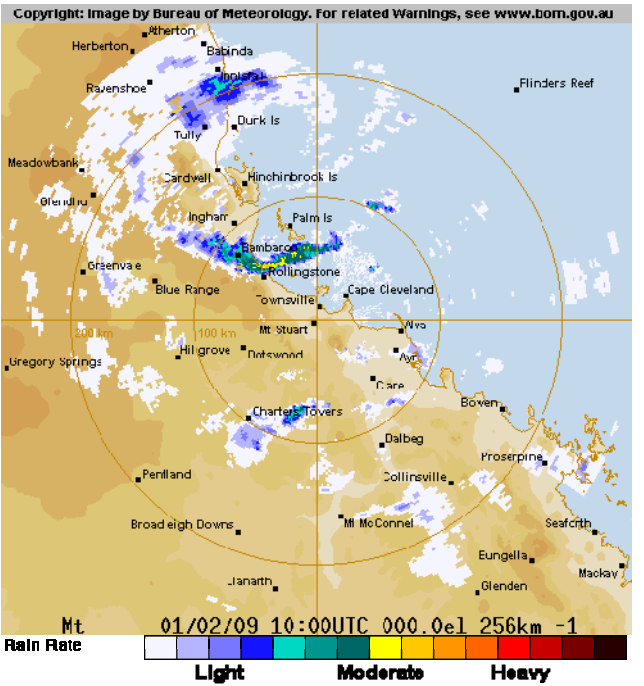
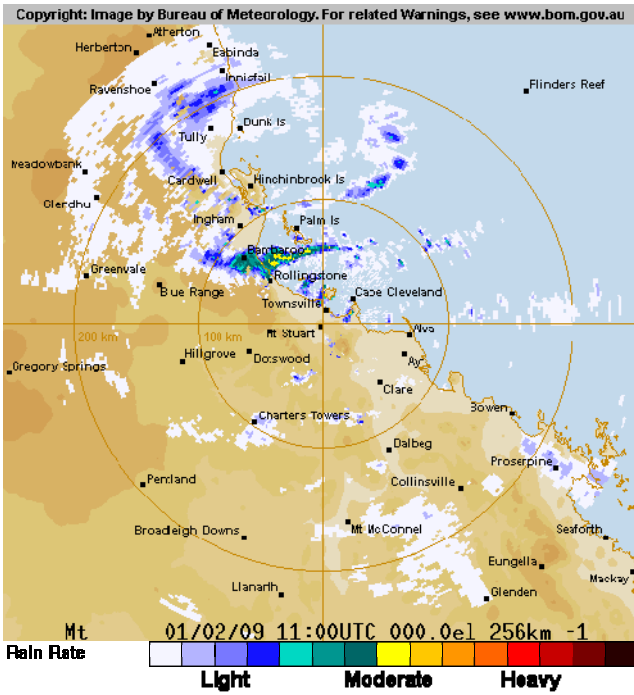


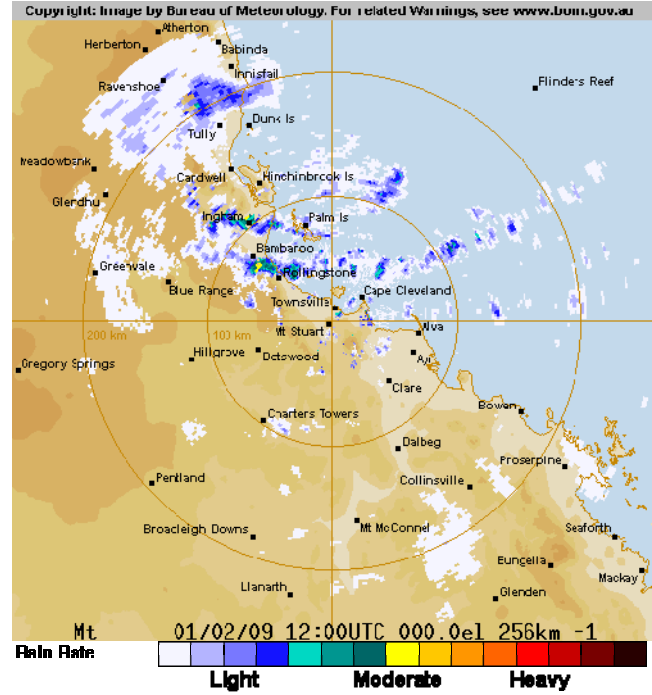
Figure 3.1.2 shows radar images of the low pressure system crossing the coast. The images from 17:00 to 20:00 on 01/02/2009 show heavier rainfall echoes over the Ingham and the Gairloch area, which is reflected in the totals shown at these stations in Figure 3.1.4.

Figure 3.1.3 Radar images of Tropical Cyclone Ellie crossing the coast.

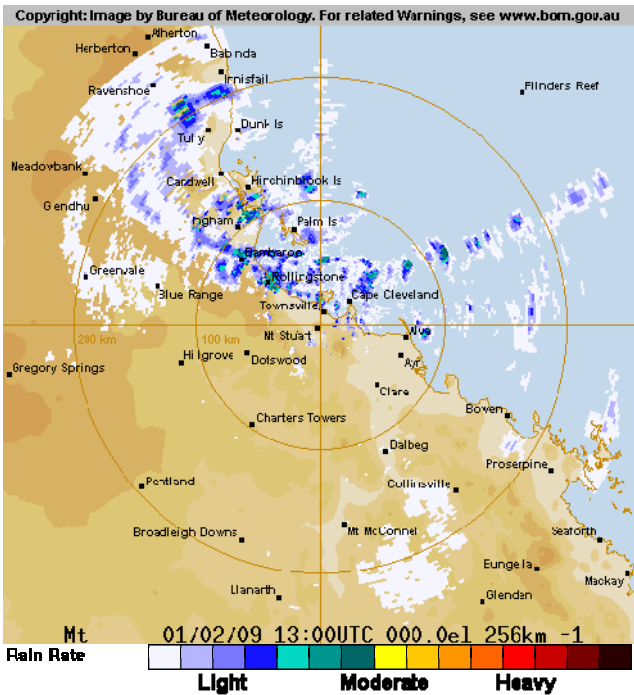
01/02/2009 21:00



01/02/2009 22:00



01/02/2009 23:00



02/02/2009 00:00

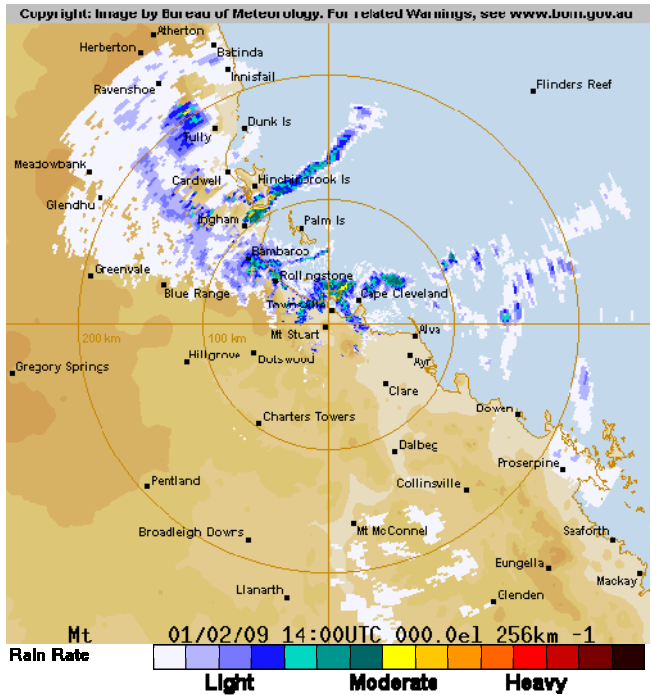


Figure 3.1.3 shows radar images of the low pressure system crossing the coast. The images from 21:00 on 01/02/2009 to 00:00 on 02/02/2009 show heavier rainfall echoes over the Ingham and Gairloch area, which is reflected in the totals shown at these stations in Figure 3.1.5.

Figure 3.1.4 Rainfall Map for the 96 hour period to 9am on the 05/02/2009.



Figure 3.1.4 shows the extent of the heavy rainfall between the 01/02/09 and 05/02/09. The rainfall fell across the whole catchment with over 250mm during the four days in the upper Herbert and as much as 758mm at Ingham Pump Station in the lower Herbert with many rainfall stations in excess of 500mm. This led to widespread and prolonged major flooding and record floods in four locations in the lower Herbert.

Figure 3.1.5 Rainfall Map for the 96 hour period to 9am on the 09/02/2009.



Figure 3.1.5 shows the extent of the heavy rainfall between the 05/02/09 and 09/02/09. The rainfall fell across the whole catchment with an average of 175mm in the upper Herbert River above Gleneagle and an average of 265mm in the lower Herbert River below Gleneagle. This prolonged the widespread flooding, keeping river levels above major flood level until 11/02/09.

The average total rainfall over the eight days shown in Figures 3.1.4 and 3.1.5 was nearly 500mm in the upper Herbert River above Gleneagle and over 1000mm in the lower Herbert River below Gleneagle.

3.2. Rainfall Intensity

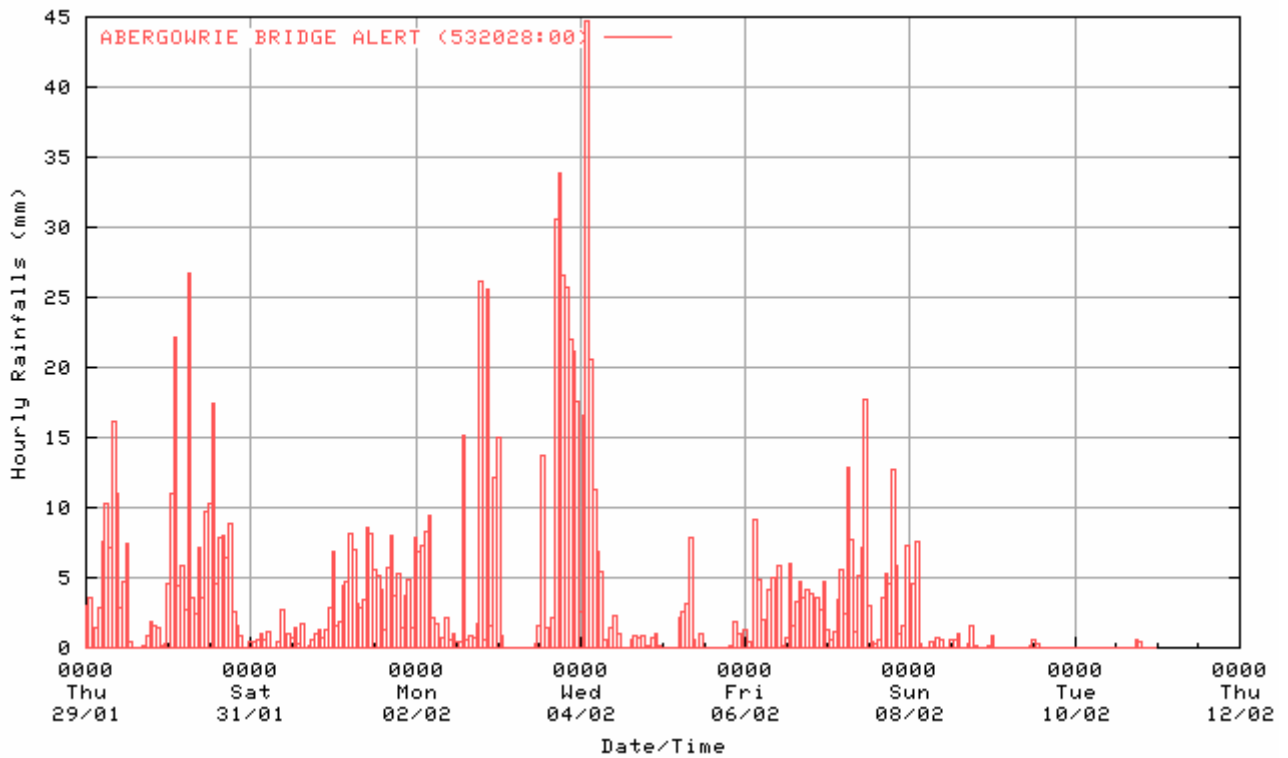
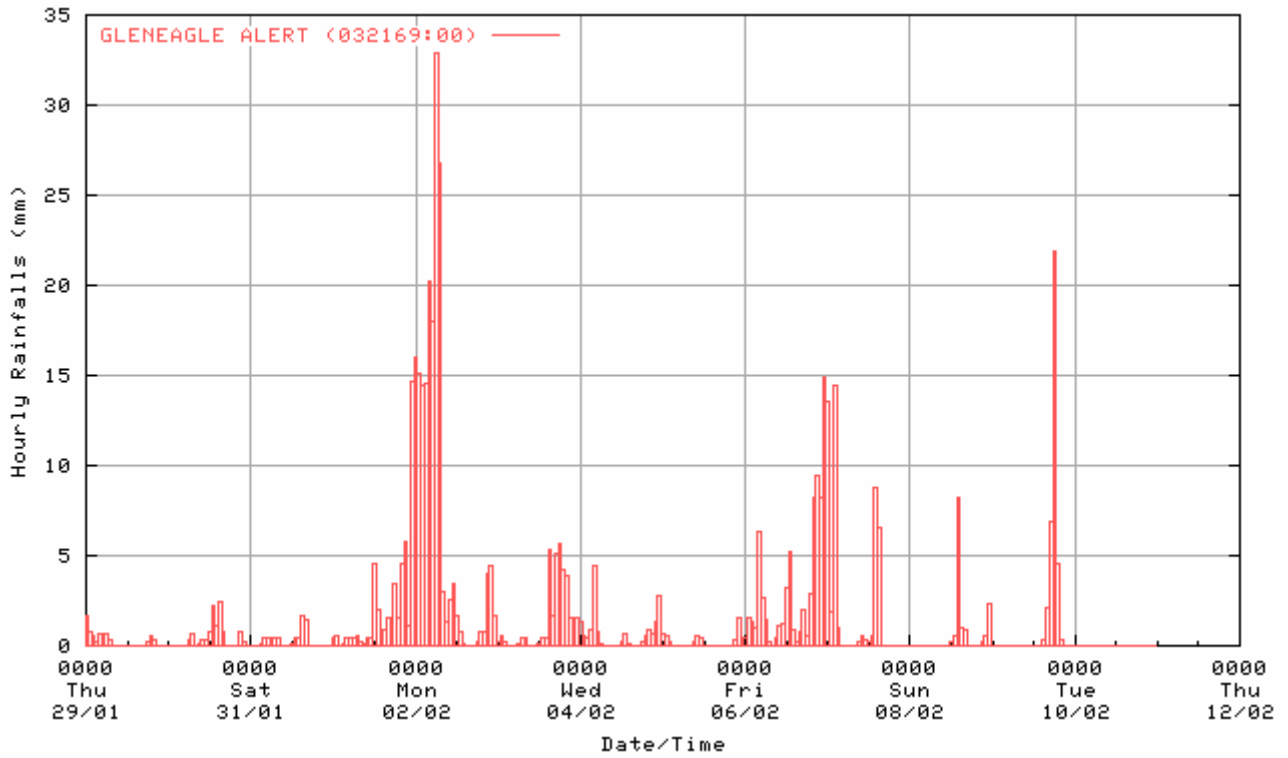
The rainfall intensity of the first flood event between 13/01/09 and 14/01/09 was below a one-year flood for all durations and therefore an IFD analysis of the event is not shown in this report.

Gleneagle Alert, Abergowrie Bridge Alert, Gairloch Alert and Halifax Alert have been chosen for the Intensity Frequency Duration (IFD) analysis to show the differences between upstream and downstream locations in the catchment. The hyetographs of hourly rainfall throughout the flooding are shown in Figure 3.2.1 and the results of the IFD are shown in Figure 3.2.2.

The most statistically significant rainfall occurred at Gleneagle Alert on the upper Herbert River where for the 12 hour duration the observed total of 184mm was assessed as being a 1% AEP (1 in 100 year) intensity. The dates are shown above the table next to each IFD curve.

Note: A flood frequency analysis would be required to assess the probability of flood levels reached at each location. The frequency analysis in this report is for rainfall only.

Figure 3.2.1 Hyetographs for Gleneagle AL, Abergowrie Br AL, Gairloch AL and Halifax AL.



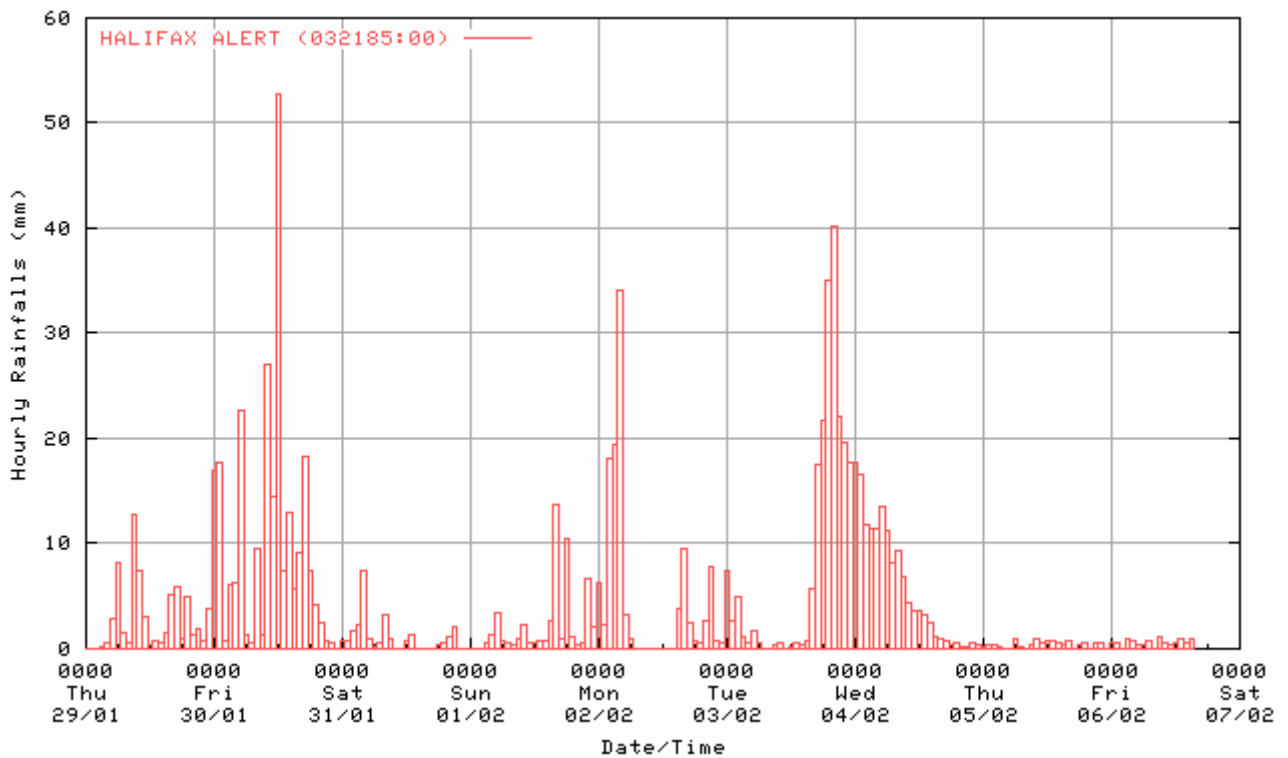
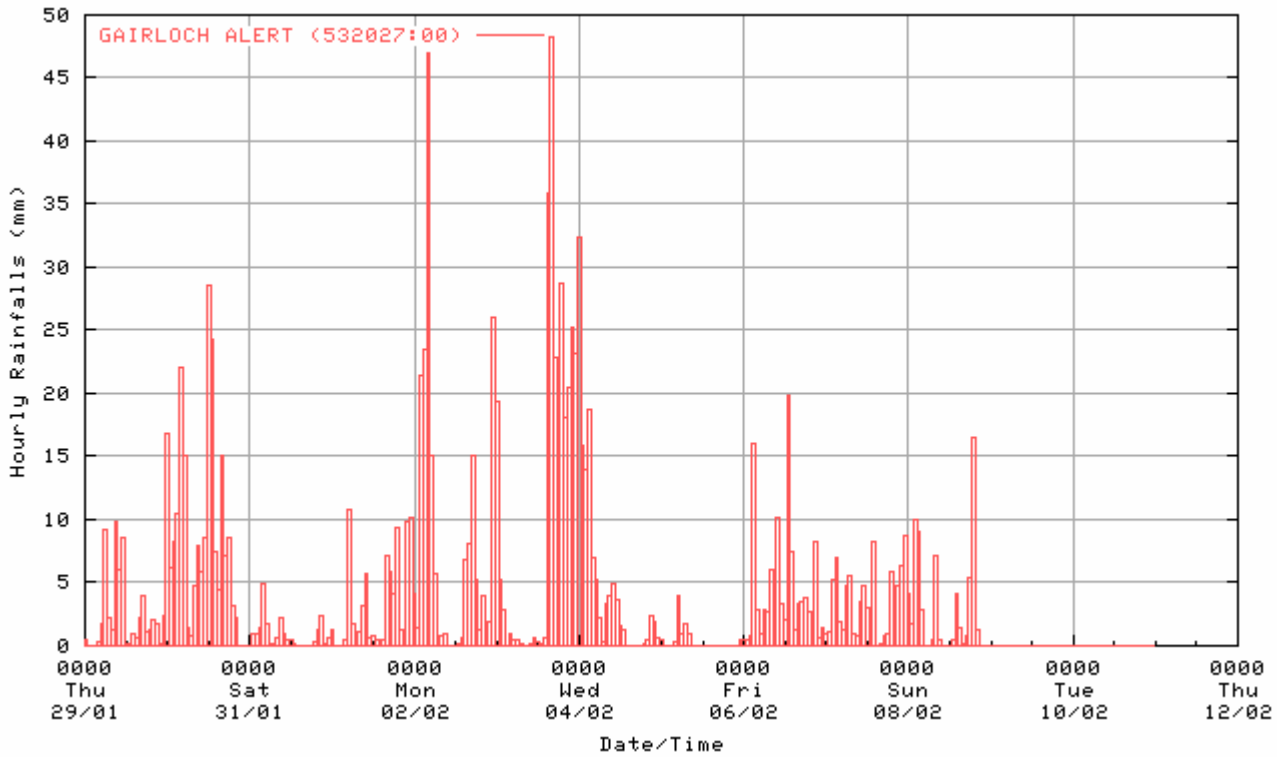
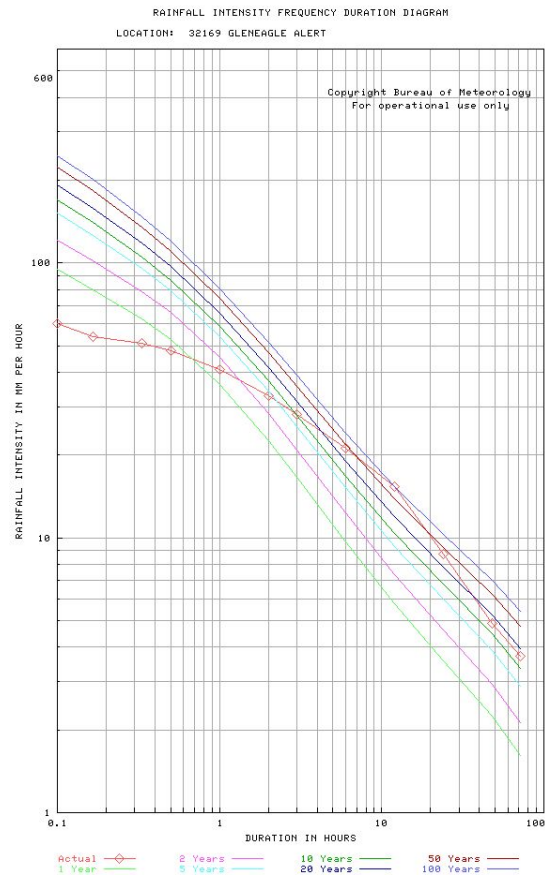


Figure 3.2.2 IFD Analysis for Gleneagle AL, Abergowrie Br AL, Gairloch AL and Halifax AL.

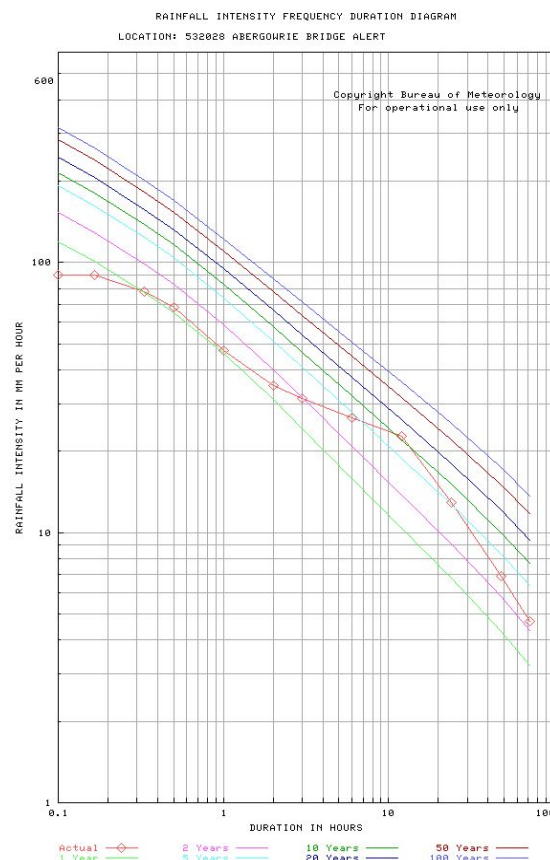
RAINFALL INTENSITY FREQUENCY DURATION ANALYSIS
 LOCATION: 32169. Gleneagle Alert.
 Analysis of the rainfall for the 72 hours to Wed Feb 4 00:00:00 2009

| Rain (mm) | Period Ending | ARI (years) |
|-----------|--|-------------|
| 5 | 5 mins ending at 06:15:00 02/02/2009 | < 1 |
| 6 | 6 mins ending at 06:16:00 02/02/2009 | < 1 |
| 9 | 10 mins ending at 06:15:00 02/02/2009 | < 1 |
| 17 | 20 mins ending at 06:20:00 02/02/2009 | < 1 |
| 24 | 30 mins ending at 06:20:00 02/02/2009 | < 1 |
| 41 | 60 mins ending at 06:20:00 02/02/2009 | 1-2 |
| 66 | 2 hours ending at 06:25:00 02/02/2009 | 2-5 |
| 84 | 3 hours ending at 06:20:00 02/02/2009 | 10-20 |
| 127 | 6 hours ending at 06:20:00 02/02/2009 | 20-50 |
| 184 | 12 hours ending at 07:15:00 02/02/2009 | > 100 |
| 209 | 24 hours ending at 11:30:00 02/02/2009 | 20-50 |
| 234 | 48 hours ending at 19:10:00 03/02/2009 | 10-20 |
| 268 | 72 hours ending at 05:10:00 04/02/2009 | 10-20 |



RAINFALL INTENSITY FREQUENCY DURATION ANALYSIS
 LOCATION: 532028. Abergowrie Bridge Alert
 Analysis of the rainfall for the 72 hours to Fri Feb 6 00:00:00 2009

| Rain (mm) | Period Ending | ARI (years) |
|-----------|--|-------------|
| 7 | 5 mins ending at 01:35:00 04/02/2009 | < 1 |
| 9 | 6 mins ending at 01:36:00 04/02/2009 | < 1 |
| 15 | 10 mins ending at 01:40:00 04/02/2009 | < 1 |
| 26 | 20 mins ending at 01:45:00 04/02/2009 | 1-2 |
| 34 | 30 mins ending at 01:50:00 04/02/2009 | 1-2 |
| 47 | 60 mins ending at 02:20:00 04/02/2009 | 1-2 |
| 70 | 2 hours ending at 18:20:00 03/02/2009 | 1-2 |
| 94 | 3 hours ending at 19:20:00 03/02/2009 | 2 |
| 160 | 6 hours ending at 22:05:00 03/02/2009 | 2-5 |
| 273 | 12 hours ending at 04:05:00 04/02/2009 | 10-20 |
| 310 | 24 hours ending at 11:00:00 04/02/2009 | 5-10 |
| 332 | 48 hours ending at 11:00:00 05/02/2009 | 2-5 |
| 337 | 72 hours ending at 00:00:00 06/02/2009 | 2-5 |

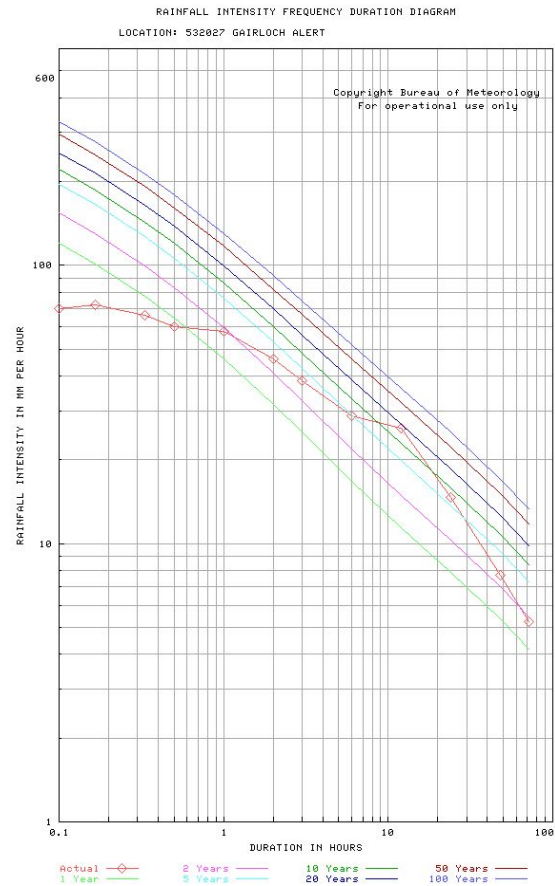


RAINFALL INTENSITY FREQUENCY DURATION ANALYSIS

LOCATION: 532027. Gairloch Alert

Analysis of the rainfall for the 72 hours to Fri Feb 6 00:00:00 2009

| Rain (mm) | Period Ending | ARI (years) |
|-----------|--|-------------|
| 6 | 5 mins ending at 15:00:00 03/02/2009 | < 1 |
| 7 | 6 mins ending at 15:01:00 03/02/2009 | < 1 |
| 12 | 10 mins ending at 15:00:00 03/02/2009 | < 1 |
| 22 | 20 mins ending at 15:00:00 03/02/2009 | < 1 |
| 30 | 30 mins ending at 15:05:00 03/02/2009 | < 1 |
| 58 | 60 mins ending at 15:40:00 03/02/2009 | 1-2 |
| 92 | 2 hours ending at 16:25:00 03/02/2009 | 2-5 |
| 115 | 3 hours ending at 17:20:00 03/02/2009 | 2-5 |
| 172 | 6 hours ending at 20:25:00 03/02/2009 | 2-5 |
| 312 | 12 hours ending at 02:20:00 04/02/2009 | 10-20 |
| 352 | 24 hours ending at 12:20:00 04/02/2009 | 5-10 |
| 368 | 48 hours ending at 00:00:00 05/02/2009 | 2-5 |
| 376 | 72 hours ending at 00:00:00 06/02/2009 | 1-2 |

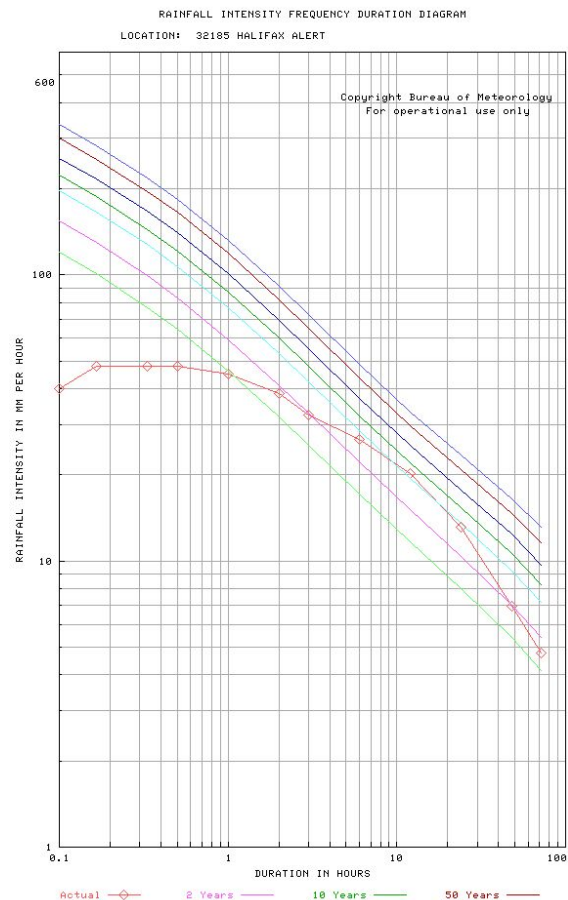


RAINFALL INTENSITY FREQUENCY DURATION ANALYSIS

LOCATION: 032185. Halifax Alert

Analysis of the rainfall for the 72 hours to Fri Feb 6 00:00:00 2009

| Rain (mm) | Period Ending | ARI (years) |
|-----------|--|-------------|
| 4 | 5 mins ending at 18:55:00 03/02/2009 | < 1 |
| 4 | 6 mins ending at 18:56:00 03/02/2009 | < 1 |
| 8 | 10 mins ending at 19:00:00 03/02/2009 | < 1 |
| 16 | 20 mins ending at 19:05:00 03/02/2009 | < 1 |
| 24 | 30 mins ending at 19:10:00 03/02/2009 | < 1 |
| 45 | 60 mins ending at 19:35:00 03/02/2009 | 1 |
| 77 | 2 hours ending at 20:15:00 03/02/2009 | 1-2 |
| 97 | 3 hours ending at 21:00:00 03/02/2009 | 1-2 |
| 159 | 6 hours ending at 22:40:00 03/02/2009 | 2-5 |
| 242 | 12 hours ending at 04:10:00 04/02/2009 | 5-10 |
| 316 | 24 hours ending at 14:50:00 04/02/2009 | 2-5 |
| 334 | 48 hours ending at 00:00:00 05/02/2009 | 1-2 |
| 343 | 72 hours ending at 00:00:00 06/02/2009 | 1-2 |



The IFD analysis showed that although the majority of the rainfall fell in the lower catchment, the most intense rainfall in terms of ARI was in the upper Herbert River. The hydrograph for Gleneagle in Figure 3.5.1 shows that it did not receive significant rainfall on the 29th and 30th January, but the intensity of the rainfall on 2nd February caused a rapid rise in the hydrograph to above major flood level.

3.3. Rainfall Totals

The abbreviations used in the following tables include:

AL - ALERT Radio Telemetry
 TM - Telephone Telemetry
 AWS - Automatic Weather Station
 SYN - Bureau Synoptic Station

Note: * signifies automatic station, N/A signifies missing data.

Please refer to the [Flood Warning Network Map for the Herbert River](#) for the locations of the rainfall stations listed in table 3.3.1.

Table 3.3.1 Rainfall Totals for the Herbert River.

| Station Name | 24 Hour Rainfall to 9am on | | | Total (mm) |
|--------------------------------------|----------------------------|------------|------------|------------|
| | 12/01/2009 | 13/01/2009 | 14/01/2009 | |
| Herbert River below Gleneagle | | | | |
| Nash's Crossing AL * | 10 | 139 | 12 | 161 |
| Zattas AL * | 10 | 159 | 28 | 197 |
| Abergowrie AL * | 10 | 158 | 18 | 186 |
| Abergowrie Bridge AL * | 16 | 154 | 32 | 202 |
| Peacock Siding AL * | 20 | 120 | 55 | 195 |
| Ingham Pump Station AL * | 21 | 289 | 52 | 362 |
| Gairloch AL * | 19 | 242 | 44 | 305 |
| Halifax AL * | 18 | 229 | 39 | 286 |
| Numerical Average | 15 | 186 | 35 | 236 |
| Maximum | 21 | 289 | 55 | 362 |

Table 3.3.2 Rainfall Totals for the Herbert River.

| Station Name | 24 Hour Rainfall to 9am from 29 th January 2009 to 10 th February 2009. | | | | | | | | | | | | | Total (mm) | |
|--------------------------|---|------------|------------|-----------|------------|------------|------------|-----------|-----------|------------|------------|-----------|-----------|-------------|--|
| | 29 | 30 | 31 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| Herbert River | | | | | | | | | | | | | | | |
| Gleneagle AL * | 6 | 2 | 11 | 7 | 204 | 23 | 40 | 9 | 18 | 90 | 17 | 14 | 36 | 477 | |
| Nash's Crossing AL * | 55 | 119 | 107 | 29 | 114 | 56 | 131 | 20 | 65 | 238 | 59 | 6 | 2 | 1001 | |
| Zattas AL * | 54 | 128 | 113 | 32 | 74 | 66 | 125 | 29 | 55 | 205 | 101 | 7 | 1 | 990 | |
| Abergowrie AL * | 77 | 106 | 93 | 42 | 94 | 47 | 173 | 25 | 70 | 146 | 84 | 6 | 2 | 965 | |
| Abergowrie Bridge AL * | 89 | 111 | 89 | 58 | 113 | 104 | 308 | 24 | 36 | 88 | 89 | 5 | 1 | 1115 | |
| Peacock Siding AL * | 14 | 70 | 60 | 28 | 164 | 82 | 171 | 8 | 15 | 177 | 64 | 17 | 0 | 870 | |
| Ingham Pump Station AL * | 41 | 114 | 111 | 26 | 251 | 191 | 281 | 15 | 34 | 111 | 63 | 25 | 2 | 1265 | |
| Gairloch AL * | 50 | 126 | 128 | 25 | 178 | 100 | 342 | 25 | 34 | 100 | 89 | 30 | 0 | 1227 | |
| Halifax AL * | 52 | 121 | 183 | 14 | | | | | | | | | | 370 | |
| Numerical Average | 49 | 100 | 100 | 29 | 149 | 84 | 196 | 19 | 41 | 144 | 71 | 14 | 6 | 920 | |
| Maximum | 89 | 128 | 183 | 58 | 251 | 191 | 342 | 29 | 70 | 238 | 101 | 30 | 36 | 1265 | |

3.4. Peak Heights

Table 3.4.1 Peak Flood Heights between 13/01/2009 and 08/02/2009.

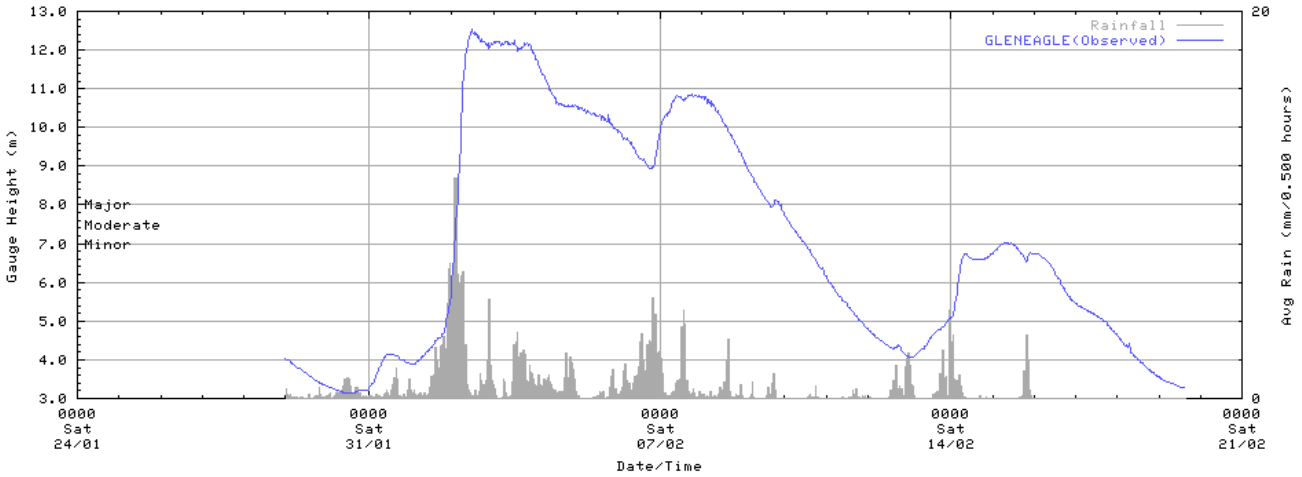
| Station No. | Station Name | Date | Height (metres) | Flood Class |
|---------------------------------------|-------------------------|------------------|-----------------|-------------|
| Herbert River upstream of Gleneagle | | | | |
| 531015 | SILVER VALLEY TM | 02/02/2009 2:12 | 5.92 | Minor |
| 531059 | RAVENSHOE TM | 02/02/2009 1:20 | 4.51 | Unknown |
| 531021 | ARCHERS CREEK TM | 02/02/2009 2:40 | 6.39 | Minor |
| 531078 | CAMERON CREEK TM | 02/02/2009 7:00 | 8.37 | Unknown |
| 531078 | CAMERON CREEK TM | 07/02/2009 5:00 | 6.37 | Unknown |
| 32018 | GLENEAGLE | 02/02/2009 11:30 | 14.4 | Major |
| 532066 | GLENEAGLE TM | 02/02/2009 11:10 | 12.47 | Major |
| 32169 | GLENEAGLE ALERT | 02/02/2009 11:10 | 12.53 | Major |
| 32169 | GLENEAGLE ALERT | 07/02/2009 15:54 | 10.88 | Major |
| Herbert River downstream of Gleneagle | | | | |
| 532080 | BLENCOE FALLS TM | 2/02/2009 9:00 | 6.51 | Unknown |
| 532080 | BLENCOE FALLS TM | 7/02/2009 5:00 | 7.57 | Unknown |
| 32170 | NASH'S CROSSING ALERT | 30/01/2009 19:25 | 4.65 | Minor |
| 32170 | NASH'S CROSSING ALERT | 2/02/2009 11:30 | 10.5 | Major |
| 32170 | NASH'S CROSSING ALERT | 7/02/2009 5:50 | 11.2 | Major |
| 32170 | NASH'S CROSSING ALERT | 7/02/2009 19:40 | 8.95 | Major |
| 32184 | ZATTAS ALERT | 30/01/2009 20:00 | 4.33 | Minor |
| 32184 | ZATTAS ALERT | 2/02/2009 14:05 | 9.28 | Major |
| 32184 | ZATTAS ALERT | 7/02/2009 6:55 | 9.73 | Major |
| 532010 | GOWRIE CREEK TM | 30/01/2009 14:50 | 6.21 | Minor |
| 32174 | ABERGOWRIE ALERT | 13/01/2009 7:50 | 6.23 | Minor |
| 32174 | ABERGOWRIE ALERT | 14/01/2009 7:30 | 6.18 | Minor |
| 32174 | ABERGOWRIE ALERT | 30/01/2009 22:00 | 9.13 | Moderate |
| 32174 | ABERGOWRIE ALERT | 2/02/2009 6:00 | 15.08 | Major |
| 32174 | ABERGOWRIE ALERT | 2/02/2009 22:45 | 15.03 | Major |
| 32174 | ABERGOWRIE ALERT | 2/02/2009 22:45 | 15.03 | Major |
| 32174 | ABERGOWRIE ALERT | 7/02/2009 14:15 | 15.93 | Major |
| 32091 | ELPHINSTONE PKT | 13/01/2009 9:00 | 6.75 | Minor |
| 32091 | ELPHINSTONE PKT | 29/01/2009 18:00 | 6.7 | Minor |
| 32091 | ELPHINSTONE PKT | 30/01/2009 21:00 | 10.3 | Moderate |
| 532028 | ABERGOWRIE BRIDGE ALERT | 13/01/2009 10:16 | 6.84 | Minor |
| 532028 | ABERGOWRIE BRIDGE ALERT | 31/01/2009 0:27 | 10.64 | Moderate |
| 532028 | ABERGOWRIE BRIDGE ALERT | 3/02/2009 0:40 | 16.64 | Major |
| 532028 | ABERGOWRIE BRIDGE ALERT | 4/02/2009 7:00 | 16.69 | Major |
| 532028 | ABERGOWRIE BRIDGE ALERT | 7/02/2009 15:15 | 17.24 | Major |
| 532011 | RUNNING CREEK TM | 14/01/2009 1:00 | 4.49 | Below Minor |
| 532011 | RUNNING CREEK TM | 2/02/2009 6:40 | 8.39 | Major |

| Station No. | Station Name | Date | Height (metres) | Flood Class |
|-------------|------------------------|------------------|-----------------|-------------|
| 32149 | PEACOCK SIDING | 2/02/2009 11:30 | 14.1 | Major |
| 32173 | PEACOCK SIDING ALERT | 14/01/2009 7:50 | 8.85 | Below Minor |
| 532067 | TREBONNE AL | 13/01/2009 8:30 | 9.03 | Below Minor |
| 532067 | TREBONNE AL | 31/01/2009 2:15 | 11.68 | Moderate |
| 32171 | INGHAM PUMP STATION AL | 13/01/2009 9:00 | 9.03 | Below Minor |
| 32171 | INGHAM PUMP STATION AL | 31/01/2009 3:10 | 11.68 | Moderate |
| 32171 | INGHAM PUMP STATION AL | 3/02/2009 4:00 | 14.63 | Major |
| 32094 | GAIRLOCH | 31/01/2009 6:00 | 10.9 | Moderate |
| 32094 | GAIRLOCH | 3/02/2009 6:00 | 12.25 | Major |
| 32094 | GAIRLOCH | 4/02/2009 9:00 | 12.25 | Major |
| 32094 | GAIRLOCH | 7/02/2009 21:00 | 12.25 | Major |
| 32185 | HALIFAX ALERT | 13/01/2009 13:15 | 4.87 | Moderate |
| 32185 | HALIFAX ALERT | 31/01/2009 2:55 | 5.37 | Major |
| 32185 | HALIFAX ALERT | 2/02/2009 21:50 | 5.67 | Major |
| 32185 | HALIFAX ALERT | 8/02/2009 10:13 | 5.62 | Major |

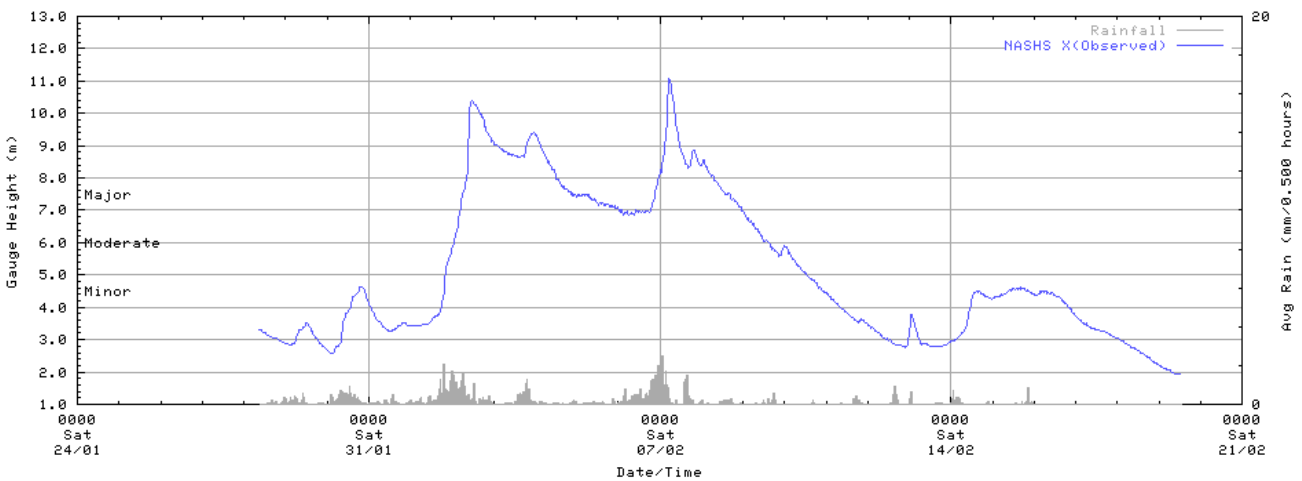
3.5. Flood Hydrographs for the Herbert River

Figure 3.5.1 Hydrographs from the 24/01/2009 to the 21/02/2009.

Herbert River – Gleneagle Alert



Herbert River – Nash's Crossing Alert



Herbert River – Zattas Alert

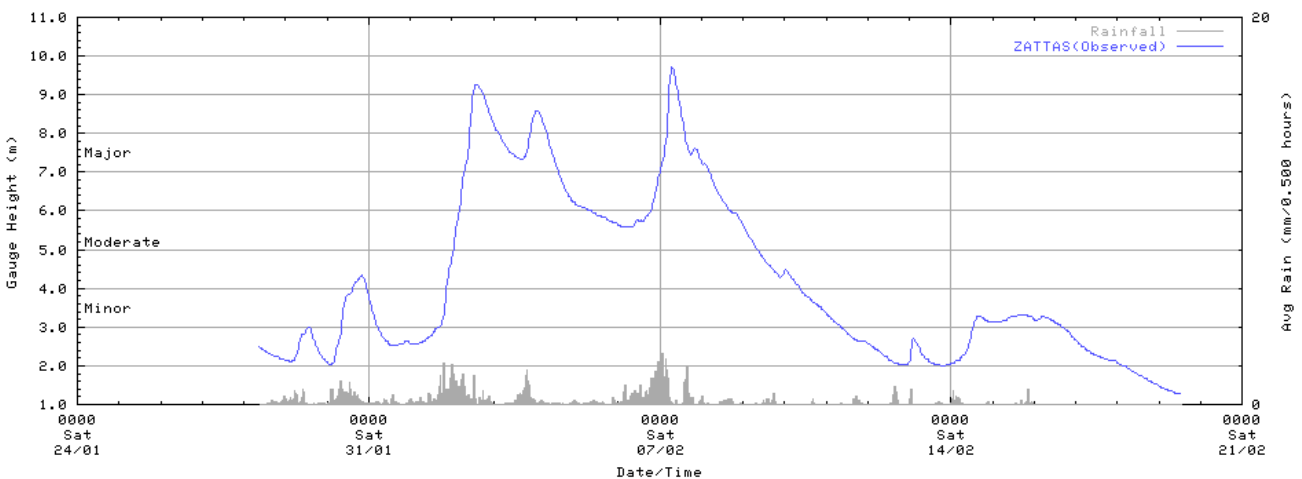
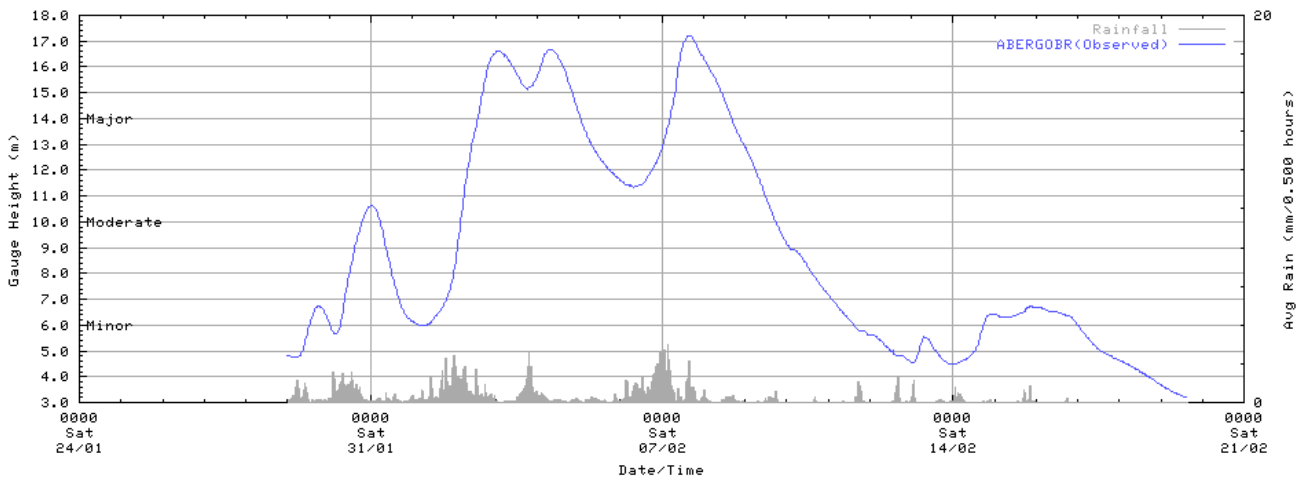
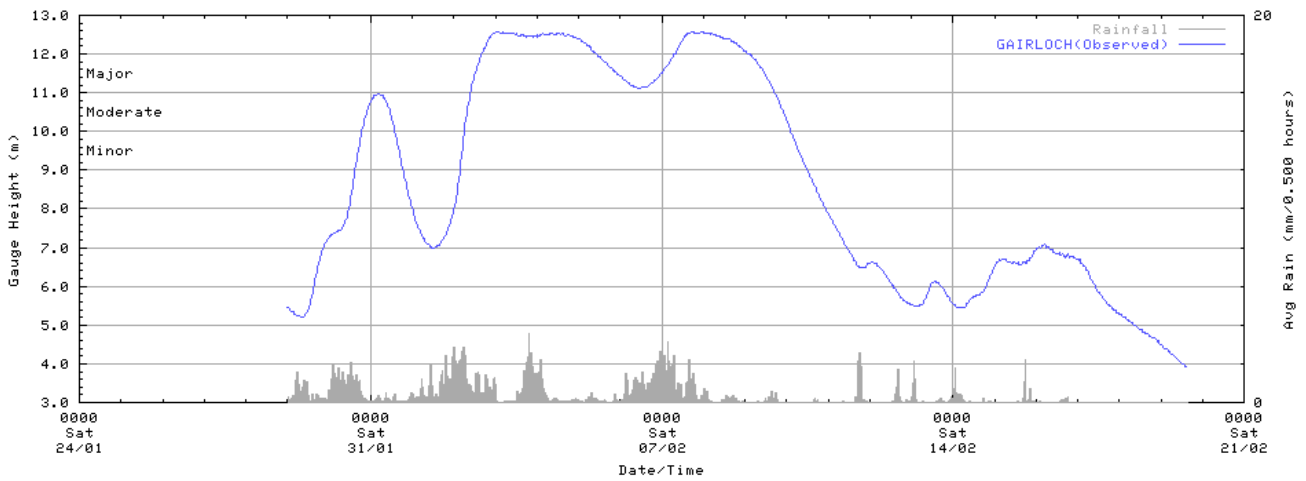


Figure 3.5.2 Hydrographs from the 24/01/2009 to the 21/02/2009.

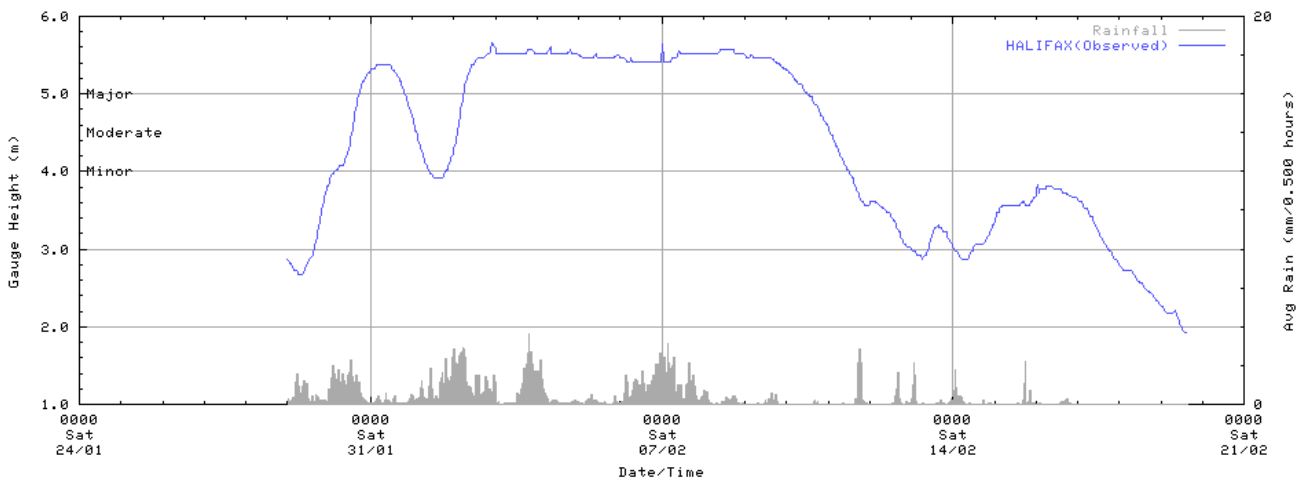
Herbert River – Abergowrie Bridge Alert



Herbert River – Gairloch Alert



Herbert River – Halifax Alert



3.6. Warning Services for the Herbert River

Table 3.6.1 Flood Warnings and Predictions issued between 30/01/2009 and 11/02/2009.

| Number of Warnings | Number of Major Warnings | Number of Predictions | Number of Locations | First Warning | Last Warning |
|--------------------|--------------------------|-----------------------|---------------------|-----------------------|------------------------|
| 52 | 20 | 55 | 4 | 6.50 am Mon 30/1/2009 | 7.56 am Wed 11/02/2009 |

Table 3.6.2 River Height Predictions issued for the Herbert River Catchment.

| Location | Issued | Predicted | | Actual | |
|----------|------------------|-------------|----------------|--------|------------------|
| | | Height | Time | Height | Time |
| Gairloch | 02/02/2009 04:03 | Exceed 10.5 | Midday 02/02 | 12.25 | 03/02/2009 01:00 |
| | 02/02/2009 08:07 | Exceed 11.5 | 1 pm 02/02 | | |
| | 02/02/2009 11:29 | Reach 12.2 | Midnight 02/02 | | |
| | 02/02/2009 16:15 | Reach 12.2 | 3 am 02/02 | | |
| Gairloch | 07/02/2009 04:58 | Reach 12 | Morning 07/02 | 12.25 | 07/02/2009 21:00 |
| | 07/02/2009 07:50 | Reach 12.2 | Late 07/02 | | |
| | 07/02/2009 11:58 | Reach 12.3 | Late 07/02 | | |
| | 07/02/2009 16:05 | Peak 12.4 | 9 pm 07/02 | | |
| | 07/02/2009 18:56 | Peak 12.4 | 9 pm 07/02 | | |

Table 3.6.3 Severe Weather Warnings issued between 29/01/2009 and 12/02/2009.

| Severe Weather Warning Title | Number of warnings issued |
|--|---------------------------|
| Severe Weather Warning for heavy rainfall and flash flooding | 23 |
| Damaging winds | 5 |
| Flash flooding | 2 |
| Cancellation | 1 |

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