/2 A 01

UNIVERSITY OF WATERLOO

Faculty of Environmental Studies

Reporting Flood Events

Environment Canada

Inland Waters/Lands Directorate

Ottawa, Ontario

prepared by

M.J.N. Slaats
ID 85258809
3A Honours Geography

January 20, 1988

January 20, 1988

M.J.N. Slaats,
56 Stormont Ave.,
Kingston, Ontario,
K7M 1P1.

Professor Bruce Mitchell, Chairman,
Department of Geography,
University of Waterloo,
Waterloo, Ontario,
N2L 3G1.

Dear Professor Mitchell:

This report, entitled "Reporting Flood Events", was prepared as my 3A work report for the Inland Waters/Lands Directorate, Environment Canada. This is my third work-term report.

My work term was supervised by Mr. Robert P. Farrell, administrator for the National Flood Damage Reduction (FDR) Program. Management of the FDR Program comes under the Water Planning and Management Branch directed by Mr. R.L. Pentland.

This report outlines flood reporting practices of Environment Canada's Regional Offices and suggests improvements by outlining a model flood report. Furthermore, the report emphasizes the need for consistent flood reporting for all flood events in Canada. The importance of proper flood reporting has also been discussed.

This report has been prepared and written by me and has not received any previous credit at this, or any other, institution. I would like to thank Mr. Robert P. Farrell and Mrs. L. Connolly for their assistance in preparing this document.

Sincerely,

Jan Slaats.

M.J.N. Slaats,
ID 85258809

TABLE OF CONTENTS

SUMMARY

This paper outlines how floods are reported by Environment Canada and suggests improvements to these reports. The need for consistent flood documentation and reporting procedures is emphasized.

Three types of flood reports are described: the situation report, the detailed technical report, and the historical flood overview. The purpose of a flood report is examined as well. An overview of regional differences in reporting flood events is included. A model flood report and its components are outlined and several important information sources for the preparation of a flood report have been highlighted.

Three conclusions have been reached. First, Environment Canada Regional Offices are unable to prepare consistent flood reports without guidelines which specify a report format. Second, flood reports can be a valuable tool for raising public awareness of flooding and the location and extent of flood-risk areas. Third, the preparation of flood reports will be simplified if a consistent outline is followed.

Guidelines should be formulated that specifically indicate which flood events should be reported. Furthermore, a model flood report must be drafted to provide a basis for consistent reporting of flood events across Canada. After completion, these reports should be updated if additional information becomes available.

CONCLUSIONS

Without guidelines specifying flood report format and contents, Environment Canada Regional Offices cannot prepare consistent, comparable reports to document flood events.

Public information through flood reports is important in raising awareness of flood problems in general and of specific flood-risk areas. Flood reports can also be of great value for government officials at all levels when compiling a record on flooding for a given area.

Reporting flood events will be simplified by specifying components within a flood report. The following components are suggested:

a) meteorological information,

b) a description of the areal extent of the flooding,

c) a description of causes and contributing factors,

d) progress of the flooding,

e) a statement on flood damages,

f) mention of injuries or deaths due to the flood,

g) a statement on the magnitude of the flood,

h) a description of the history of flooding in the affected area,

i) a description of emergency measures,

j) mention of financial disaster assistance,

k) a statement on Flood Damage Reduction Program designation in the locality flooded, and

l) a map showing the flooded area.

RECOMMENDATIONS

Guidelines should be formulated by Environment Canada's Inland Waters/Lands Directorate specifying which flood events require documentation in flood reports.

The guidelines should include a model flood report listing a report format. Information to be incorporated in a flood report must be itemized to ensure consistent reporting of different flood events.

Environment Canada's Regional staff should provide follow-up on completed flood reports as additional information becomes available, notably information on flood damage estimates and financial disaster assistance to flood victims. Such follow-up will help ensure accurate, complete flood reports.

REPORTING FLOOD EVENTS

I Introduction

Flooding occurs throughout Canada regularly. Flood damages can reach millions of dollars and occasionally lives are lost. Depending on where the floods occur, transportation and businesses are affected, residences are damaged or destroyed, and at times crops are lost. Flooding also causes considerable human suffering. One way in which flood damages may be reduced is by ensuring that flood events are reported properly. Flood reports can raise people's awareness of flood-prone areas and of flood problems in general. In turn, this greater awareness may discourage development of such flood-prone areas.

Flood reports are not prepared consistently, however. There are no guidelines on how to determine if a flood event warrants a report, nor are there guidelines on such reports. Depending on a flood's impact, brief reports may be prepared immediately after the flooding, or a detailed report may be prepared within months of the event. Normally, preparation of such detailed reports occurs when the flood affects a large number of people, or when damages are high. In other cases, completed flood reports and other information sources are used to produce an historic flood overview for a particular river or river basin.

These three types of flood reports are produced by Environment Canada's Regional Offices. In addition, the Environment Canada Head Office compiles a Significant Flood Events Report which incorporates regionally produced flood reports. Although there is no definition for a "significant flood event", the report contains descriptions of flooding in Canada which caused widespread damage or which disrupted many lives.

The lack of guidelines on flood report contents has hindered consistent flood reporting. This is further complicated by the very real regional differences in the types of flooding that do occur. A consistent report format would simplify reporting and result in more complete and accurate flood documentation. If Regional Offices used set criteria for preparing flood event reports, the Significant Flood Events Report could also be compiled more quickly and the individual descriptions contained in the report would be more complete and accurate. There would also be an important gain in that comparisons could be made between events.

This report describes the different kinds of flood reports prepared by Environment Canada, and highlights the purposes for reporting flood events. The need for consistent reporting is emphasized and a flood report format is suggested. Several primary information sources are described. Conclusions and recommendations on how to improve flood reports follow.

II Present Flood Reporting

A. Types of Flood Reports

At present three different types of flood reports are prepared by Environment Canada's Regional Offices: the situation report, the detailed flood report, and the historic flood overview. The Head Office uses these reports, and additional sources, to produce Significant Flood Events Reports that cover all of Canada for a number of years. Since the Regional Offices monitor flood events within their regions, the original information used to prepare the reports is gathered at the regional level. When the reports are then used for the Significant Flood Events Report, investigation of the original information sources should no longer be needed. The regionally prepared flood reports should provide adequate information and details about the flood. However, because there are no guidelines specifying what a flood report should contain, Environment Canada Regional Offices do not prepare consistent, comparable reports. Instead, the following reports are prepared.

1. Situation Reports

Situation reports are prepared by the Environment Canada Regional Offices or by Emergency Preparedness Canada to provide initial information about a flood event. These reports are brief, essentially acknowledging media coverage of the flooding. Situation reports are made on a daily basis as the flooding occurs. When the high water subsides and no further danger is anticipated, situation report preparation is ended.

The situation report normally mentions the cause of the flooding, where the flood has taken place, a note on damage, injuries and/or loss of life, a comment on emergency measures taken in the flood stricken area and when the

floodwaters have peaked or are expected to recede. The purpose of a situation report is to inform governments involved in flooding or water resource issues that a flood event took place. After the floodwaters subside, the impact of the event is assessed by a Regional Environment Canada office. Then several months pass during which a detailed flood report may be prepared if the event was considered significant.

2. Detailed Flood Reports

A flood event with a significant impact on an area is, in some cases, documented in greater detail in a detailed flood report or technical paper. Prepared by Environment Canada's Regional Offices, these reports include comprehensive information on the following:

- physiography and climatology of the affected region,
- a drainage basin description,
- contributing meteorological conditions,
- causes of the flood,
- progression of flooding through the river,
- flood magnitudes,
- emergency measures and flood forecasting capabilities,
- flood damages,
- comparisons with historic flood events, and
- disaster assistance efforts.

The Regional Offices decide whether or not an extensive flood report will be prepared. The criteria used to make this decision differ between the regions, therefore floods in some areas are better documented than the flood events in others. In addition, there are no guidelines from the Head Office to specify which floodings need to be reported in detail. Instead, time and financial constraints become important factors when deciding to research a flood event.

3. Historical Perspectives

Besides reporting on a flood after the event takes place, some regions prepare historical flood overviews for rivers or river basins. These historical perspectives describe flood events over a range of years, or from the first years of settlement in flood-prone areas to the present. The more recent the event, the more detailed the information contained in the flood report. In comparison to the detailed flood reports, the historical overviews provide only limited information on individual flood events. Most often the following are described in an historical flood perspective:

- causes of the flood,
- associated meteorological events,
- progression of flooding,
- damages,
- injuries or deaths, and
- magnitude of the flooding.

An historic flood overview provides a reasonably comprehensive listing of all flooding which may have taken place over time along a particular river or in a river basin.

B. The Purposes for Reporting on Flooding

Flood reports are used by government officials, professionals, educators and the general public. A flood report represents a permanent record of a normally short-lived event. Residents can use the reports to identify where floods have occurred in the past.

The public information maps showing flood-risk areas designated under the Flood Damage Reduction Program, could be complemented with flood reports describing flooding in the designated area. Rather than providing residents with the map only, the flood report would offer a physical description of a flood event in the past which may occur again in the future. Used together, the public information maps and the flood reports would have a greater impact on the public.

Since a flood may inundate the same area at a future date, the flood report can, in a sense, provide a warning of potential flood problems. In addition, flood reports allow officials to evaluate what happened and to assess how a similar event may be avoided in the future. Comprehensive flood reports are also essential in the compilation of historical flood overviews. In turn, the historical perspective provides a broader base of information about flood problems in a particular area.

Government officials at all levels should have access to flood reports. Access will be improved when the reports are prepared consistently. Since flood risk areas are designated under the Federal-Provincial Flood Damage Reduction Program partly on the basis of historic flood lines, flood reports could function as a first source of information, especially when extensive technical reports are produced.

C. Regional Differences in Flood Reporting

Five Environment Canada Regional Offices are responsible for reporting flood events. Since the flood reports are produced without set guidelines specifying format or content, differences in reporting occur between the regions. Variations in reporting also result from the different nature of flood events from region to region. For example, causes of flooding in Atlantic Canada may differ from those in the Prairie Provinces.

As each region uses a variety of information sources, flood reports become less comparable. Some regions may use flood observations and measurements from their own staff while others may take media reports as information sources for the flood reports. Over the last five years the Regional Offices have reported flood events as follows.

1. Atlantic Region

The Environment Canada Atlantic Regional Office reports flood events in the Provinces of Newfoundland and Labrador, Nova Scotia, Prince Edward Island and New Brunswick. Flooding rarely occurs in Prince Edward Island, however. Reports are prepared consistently for each flood event using a comprehensive format. Events that have "a significant impact" on a particular area are documented in more detail in a detailed technical report. The amount of financial damage, degree to which lives are disrupted and magnitude of the event are used to determine if a flood had a significant impact.

The Atlantic Regional Office also has prepared historical flood perspectives and overviews. One such overview describes flooding along the Saint John River in New Brunswick from the first recorded flood event in 1696

until the early 1980's. The Atlantic Region has reported flood events on a regular basis using a comprehensive and consistent format. The reporting method used by the region was partially taken as a model for the recommended reporting format described in this report (see section D).

2. Quebec Region

The Environment Canada Quebec Regional Office reports flood events in the Province of Quebec. Most flooding is documented by the Provincial Civil Protection Bureau in great detail, although not always comprehensively. The reports prepared by the Bureau are in point form and feature detailed information on evacuations, flood damages, progression of the flooding and emergency measures taken. These reports, however, lack specific information on causes of the flooding, contributing meteorological factors, areal extent of the flood, magnitude of the flood, history of flooding in the affected area and information on Flood Damage Reduction Program designations.

Flood events with a substantial impact on communities or areas are documented more extensively. Like the Atlantic Region, the Quebec Region prepares a detailed technical paper describing the flood and its effects. For example, work is in progress to document extensively the July 14, 1987 flooding in Montreal. A severe rainstorm caused flash flooding and widespread damage.

No historic overview of flooding in Quebec has been prepared.

3. Ontario Region

The Environment Canada Ontario Regional Office reports flood events in the Province of Ontario. Minor events are documented using situation reports and by gathering of clippings from print media.

Flood events having a more significant impact in terms of damage, disruption of lives or having significant magnitudes are described in detailed reports. Although these detailed reports provide less information about the event, in comparison with the technical papers prepared by the Atlantic Regional Office, they are comprehensive. Ontario Region staff often make field observations during or immediately after the flood, which ensures accurate damage descriptions.

No historic overview of flooding in Ontario has been prepared.

4. Western and Northern Region

The Environment Canada Western and Northern Regional Office reports flooding in the Provinces of Manitoba, Saskatchewan, Alberta and in the Northwest Territories. Similar to the Ontario Region situation reports, the Western and Northern Regional Office documents minor flooding with short situation reports and news clippings. Consistent coverage of all minor events is lacking in some cases.

Technical and detailed papers are prepared only to report flood events which cause severe damage or disruption of life. Due to a lower occurrence of significant flooding in comparison with other regions over the last five years (1983 to 1987) just two events were reported in technical reports.

The Western and Northern Regional Office has an office for the Northwest Territories in Yellowknife. Although the latter does not produce flood reports, it does prepare and contribute data and observations for reports describing events in the Northwest Territories.

No historic overview of flooding in the Western and Northern Region has been prepared.

5. Pacific and Yukon Region

The Environment Canada Pacific and Yukon Regional Office reports flood events in the Province of British Columbia and in the Yukon Territory. Minor flood events are covered consistently by situation reports and, in some cases, short (2-3 page) flood event descriptions. Media sources are monitored continually and relevant flood information is gathered and filed.

Extensive flood reports are seldom prepared to document severe flood events. In the 1983 to 1987 period no events were described in technical papers or detailed flood reports.

The region has not produced historic flood overviews of flooding in British Columbia or the Yukon floodings.

D. The Need for Consistent Reporting

Flood reports are prepared at the discretion of individual Environment Canada Regional Offices. The flood report format and contents have evolved differently in each region and there is no consistent reporting procedure for all regions. Even within a given region, report formats and components may be inconsistent. These inconsistencies may affect the accuracy of flood reports and without a set report format, basic information may be excluded. In addition, a lack of guidelines specifying what a flood report should contain impedes consistent reporting.

Flood reporting guidelines are necessary for several reasons. First, the task of preparing flood reports would be simplified since those involved could follow the guidelines specifying report contents step by step. Secondly, greater accuracy in flood reports could be achieved since the report would conform to a model outlined in the guidelines. Thirdly, consistency in reporting flood events across Canada would raise comprehensiveness, which, in turn could allow comparison between flood events documented in different regions. In addition, Significant Flood Event Reports for all of Canada could be compiled more simply and with less additional work by contributors and would be available more readily for distribution.

Developing a standard flood report would require input from all contributors in the preparation of the reporting. However, the following components should be included in a model flood report. The suggested format was based on research on Canadian flood reports produced from 1983 to 1987, which were adapted by the author for the report on Significant Flood Events in Canada - 1983 to 1987.

1. Format

Three broad divisions can be made in each flood report: meteorological information, hydrologic information, and a description of flood damages. The latter receives the most attention in the majority of flood reports, but hydrologic information is often missing. Most reports include some statement about meteorologic factors that contributed to the flood. Within this broad subdivision a number of elements require description.

2. Flood Report Components

a) Meteorological Information

Meteorological events cause or contribute to flooding. For example, a winter with below average temperatures may lead to a thick river ice pack. Spring thaw could then include flooding due to ice jams. Normally a variety of factors such as snow pack conditions, temperature fluctuations and rainfall combine to produce flooding. The following information could be included:

- snowfall conditions previous to the flooding (if applicable),
- snowmelt conditions (if applicable),
- storm description (if applicable),
- precipitation data (if applicable),
- temperature data, and
- wind direction and speed (if applicable).

To provide a complete picture of the causes of a flood, meteorological information should not be excluded from any flood report.

b) Actual Extent of Flooding

Flood reports should contain an accurate description of the area in which the flooding occurred. Some flooding occurs in rural areas affecting small

communities with which the readers of the report may not be familiar. In such cases the affected area should be referred to in terms of more familiar locations, for example, "in small town, x kilometres northwest of large town". When a description of the flood's extent is insufficient, a basic map showing the area may prove more informative (see subsection l below).

c) Causes and Contributing Factors

Flooding often occurs due to combinations of factors. For example, a combination of high early summer water levels and rain or a combination of heavy rain and snowmelt may result in flooding. A flood report should mention all causes of a flood, and should describe how these causes combined to bring about the flood.

Contributing factors also require description. For example, high antecedent soil moisture levels in rural areas or inadequate drainage facilities in urban areas could be important in combination with the direct causes of the flood. Effort must be made to include in each flood report all apparent causes and factors that directly or indirectly contributed to the flooding.

d) Progress of the Flooding

River flooding often creates problems for a number of communities or areas along a river as high water moves downstream. Flood reports would improve if this progress of flooding is described in chronological order. Other relevant information is the duration of the flooding at a given point along the water body, the speed with which the event struck and the time of day the inundation started (Mitchell, 1986). Hydrologic information such as peak discharges, if measured, could also be included in the flood report.

e) Damages

Flood damage descriptions comprise the largest part of most flood reports. While such descriptions are useful, information on damages overshadows the report in some cases. A flood report should not be a damage report. And, even though public awareness of a flood problem may increase when the flood damage is publicized, the flood report should never chiefly be a damage report. When newspaper accounts of flood damage are used, the accuracy of the reports must be investigated.

Although the physical flood damage is apparent relatively soon after the flooding, the financial losses often take months or years to process. Flood reports are completed before such financial losses are available. If the distribution of the flood reports were to be recorded, then a follow-up statement of the financial losses could be distributed when this information becomes available.

The degree of detail with which flood damages are described should be consistent in all flood reports, and a consensus on this would be required by those reporting on floods.

f) Injuries or Deaths

Occasionally people are injured or killed as a result of flooding. Such information should also be included in a flood report.

g) Magnitude of the Flood

Flood magnitude, when much above average, is sometimes a reason for preparation of a flood report. The magnitude of a flood relates to the peak

discharge and flood frequency (Inland Waters Directorate, Atlantic Region, 1974). The hydrologic component of a flood report should contain flood magnitude information, if data were gathered. When data are unavailable, long-time residents living along the flooded water body are asked if they can recall a worse flood in the area. Statements of this nature should not be used to determine the magnitude of an event since the accuracy cannot be verified. At most, a resident's account may help to gauge the public's perception of the magnitude of an event.

h) History of Flooding in the Affected Area

Flooding often recurs in areas which have previously experienced flood problems. A flood report should mention the history of flood problems to put the flooding in perspective. For example, areas which experience flooding each spring should be so described in a flood report. Public perception of a flood problem would improve with the realization that flooding is a recurring natural phenomenon.

i) Emergency Measures

Another component of a flood report is the description of emergency measures taken to avoid damage, injury or death. In many cases residents are evacuated and accommodated in shelters while a flood progresses through an area. Firemen, police, ambulance attendants and volunteers all participate in the organization of evacuations. Documentation of the emergency measures taken, simplifies the evaluation of the assistance after the flood. An evaluation may point out weaknesses in the organization and may help in the improvement of services should the area flood again.

j) Financial Disaster Assistance

Governments, provincial and/or federal, may provide financial disaster assistance to flood victims. The decision to assign relief funding is sometimes made soon after the flooding. When this information becomes available, it could be included in the flood report. However, the final amount of financial assistance paid is not normally known until years after the flood. As with the damages, the information could be distributed at a later date if the distribution of flood reports is recorded. Inclusion of financial disaster assistance information in flood reports would raise public awareness of governments' response to flooding. Flood victims cannot expect government relief payments in all cases.

k) Flood Damage Reduction Program Designations

Flood prone areas are mapped and designated under the National Flood Damage Reduction (FDR) Program which is a co-operative effort of the federal, provincial, and territorial governments (Environment Canada, 1987). In a designated area, development is discouraged. Numerous flood-risk areas along rivers, lakes and seas are designated, and governments would withhold flood relief payments for damage to anything constructed there in the time after the area was designated as a flood risk (Inland Waters Directorate, 1978). Since the designations influence financial disaster relief payments, they should be mentioned in the flood report.

l) Maps

To simplify the reading of a flood report, a basic map may be included. A map should be at a sufficiently large scale to show the extent of the flooding

and the communities and transportation routes affected by the high water. Factors such as ice jam locations, bridge washouts or other information mentioned in the report could be placed on a map for a clearer understanding of the flood event. A topographic map or provincial road map may be used as a base map. Like all other maps, the flood report map should include a north arrow, a scale statement and/or scale bar, as well as legend and title boxes.

E. Primary Information Sources for Flood Reporting

Several sources of information may be consulted when investigating a flood event and before writing a flood report. There is a wide range in reliability and accuracy of the gathered information and this should be taken into consideration.

1. Observation/Measurements

When Environment Canada Regional staff are at the flood scene during, or immediately after a flood event, observations and measurements can be made for use in the flood report. The information gathered at the scene almost ensures a high degree of accuracy in the flood report. Photographs are especially useful to record the situation, and local meteorological data could be gathered from weather stations. The extent of the flood, the progression of the flooding, and damages can all be examined. Compared to other sources, observations and measurements made on the scene are the most valuable in the preparation of accurate flood reports.

2. The Water Survey of Canada

Hydrologic information should be compiled from the Water Survey of Canada. Peak flood discharges, flood frequencies, downstream progression of flood waters and statistical information related to the flooding could be obtained from the Survey. Although some of the data may be too technical for a regular flood report, the data become important in the preparation of detailed technical papers as described in section A2. However, the information available from the Water Survey should be examined for relevance before inclusion in a flood report.

3. Atmospheric Environment Service (AES)

Meteorological information and data can be obtained from Environment Canada's Atmospheric Environment Service (AES). Initial general information about weather conditions prior to the flooding is often summarized in the AES weekly publication entitled Climatic Perspectives. Temperature, precipitation, snow cover data and storm system tracks are described as well as the influence of weather on economic activities and agriculture across Canada. Climatic Perspectives is useful as an initial source of meteorologic information for flood reports. More detailed information would have to be obtained from monthly weather records prepared by the AES. These records include the measurements for a given month of all weather stations located within one province, and are available on microfiche. The data would need to be analyzed by the individual preparing the flood report. Therefore, the AES would be the most important source of meteorological information for those preparing a flood report.

4. Provincial Emergency Measures Organizations

The provincial emergency measures organizations gather information on flood damages, evacuations, and emergency assistance efforts. In addition, Emergency Preparedness Canada files short reports documenting flooding. The latter source lacks detail. The degree of detail with which the provincial organizations report a flood is unknown by the author, but probably varies a great deal from province to province. Both sources, however, could be considered when preparing a flood report.

5. Radio, Television and Newspaper Accounts

Media reports of flooding often become the principal sources of information for flood reports. Convenience and accessibility have created a reliance on the media.

The media are often at the scene of the flooding which should result in accurate reporting. However, these reports are not always reliable. Factors may be under or over-emphasized creating a misleading interpretation of the actual event. If possible, media reports should be compared with other sources to verify their accuracy.

Media reports provide valuable information in the form of photographs or video recordings of a flood event. Examination of these graphic sources can be helpful during the flood report preparation. Subjects, including damages to public and private property and aerial views, give a good impression of the extent of the flooding. Thus, media accounts of flood events should not be excluded as information sources for flood reports, even though their accuracy must be questioned.

REFERENCES

Environment Canada. Reducing Flood Damage. Brochure, Ministry of Supply and Services Canada, 1987.

Inland Waters Directorate, Atlantic Region. New Brunswick Flood, April-May 1973. Technical Bulletin No. 81. Environment Canada, Halifax, Nova Scotia, 1974.

Inland Waters Directorate, Environment Canada. Cutting Our Flood Losses. Brochure, Ministry of Supply and Services, Canada, 1978.

Mitchell, Bruce. Geography 356 Lecture Notes. University of Waterloo, unpublished, 1986.