DISASTER FINANCIAL ASSISTANCE, FLOOD RECOVERY AND DEBRIS MANAGEMENT: THE B.C. MODEL

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DISASTER FINANCIAL ASSISTANCE, FLOOD RECOVERY AND DEBRIS MANAGEMENT: THE BRITISH COLUMBIA MODEL

Introduction:

British Columbia is Canada's Pacific coast province. It has a 7022 kilometre mainland coastline and an area of 952,263 square kilometres. It is Canada's third largest province, occupying almost 10 percent of the country's land surface (British Columbia 1990). British Columbia is nearly quadruple the size of Great Britain, two and a half times Japan and larger than all U.S. states except Alaska. Only thirty nations are larger than B.C. To the south, the U.S. States of Washington, Idaho and Montana border the province for 640 kilometres, to the east the province of Alberta has a contiguous border of 1545 kilometres, while to the North, the Northwest Territories and the Yukon form a 1062 kilometre boundary which in turn changes to the northwest to form a final 893 kilometre border with the State of Alaska panhandle.

The province has two large off-shore islands, Vancouver Island, separated from the mainland by the narrow Strait of Georgia, and to the north the Queen Charlotte Islands. The main land mass is mountainous with the Coast Mountain range running north to south along the Pacific Ocean, in places dropping precipitously into the sea, while to the east, the world renowned Rocky Mountains form a cordillera separating the province from the rest of Canada. Much of the population is concentrated in the south of the province along the border with the U.S. and on Vancouver Island. The total population exceeds 3,100,000 and is largely distributed amongst 38 cities, 14 towns and 46 villages.

The province continues to enjoy a buoyant economy and immigration approaching 80,000 a year, largely from the rest of Canada and from the Pacific Rim. Productive forest covers 43.3 million hectares or 46 percent of the province. The provincial government owns more than 90 percent of the Province's forest land. Timber exports account for in excess of $12 billion annually. Mining, principally for coal and copper, although zinc, gold and silver as well as molybdenum are also important, account for $4.2 billion of the provincial economy. Tourism is a major part of the economic income of the province yielding nearly $4 billion in 1989, spent by some 14.6 million overnight visitors travelling in the province. While only 4 percent of B.C. is considered arable, farm holdings cover some 2.4 million hectares and yield over $1 billion annually in farm cash receipts. More than 40 species of fish and marine life indigenous to provincial waters are harvested by British Columbia's fishing and aquaculture industry. The annual fish catch has a wholesale value in excess of $900 million.

An exceptionally rich resource is B.C.'s abundance of inland waterway, lakes, rivers and streams. Freshwater surfaces total almost 2 million hectares. In addition to fisheries and agriculture, these waterways support hydro-electric power and many forms of aquatic recreation. And they produce flooding, flooding than can, and does, have significant impact on each of the elements of the provincial economy.

British Columbia is, in fact, at risk from a variety of hazards. During a average year there are approximately 2900 forest fires affecting 30,000 hectares at an estimated cost of $90 million.

At least once a week an earthquake of sufficient magnitude to be noticed occurs somewhere in B.C. Severe earthquakes capable of causing serious damage in coastal areas occur every 35 to 40 years. The most recent, with an epicentre west of Port Alice on Vancouver Island, occurred on January second, 1994. It registered 5.5 Richter and was felt throughout the lower mainland of the province. A major subduction earthquake that would result in widespread damage to southwestern B.C. has been predicted to occur every 300 to 500 years. Much of this return cycle has elapsed, leading to the conclusion that extensive earthquake planning and exercising is prudent.

As the province continues to develop it's industrial and commercial base, it also becomes increasingly subject to a range of manmade hazards such as oil spills, chemical discharge and major industrial accidents. During a 12 month period in 1990/91, more than 1500 dangerous goods spills were reported on land and a 1,000 marine spill incidents were recorded. (British Columbia, 1992) However, much of the annual activity for emergency management is focused on flood planning, response and recovery.

The focus of this paper is to briefly examine this activity, and to outline the provincial procedures for damage assessment, debris removal and restoration through the provisions of the provincial Disaster Financial Assistance Program.

Historical Perspective

Our realization that flooding will occur in settlement areas is not new. The prologue to Simonds (1961) seminal work on landscape architecture tells of a hunter and a young boy examining a portion of prairie occupied by gophers. The hunter is intrigued by the careful planning of the gopher community. It is dry and warm and safe he observes to his young friend. By contrast, their own town faces north into the cold winter winds.

"At least our town is near the river and water" said the young boy defensively.

"Yes", replied the hunter. "But where near the river did we build our homes? On the low flat land inside the river bend, that's where. And each spring when the snow melts on the prairies and the river swells, it floods out every cellar in town".

"Gophers would plan things better than that", the small boy decided. "Yes", said the hunter, " a gopher would be smarter." "When gophers plan their homes and towns," the boy philosophized, "they seem to do it better than men do."

Susan Stacey (1993) writing about flood control on the Boise River notes that as early as 1876, Milton Kelly, then editor of the Idaho Daily observed:
deposition of debris, impacts on agricultural use, erosion, loss of topsoil inundations and loss of fencing was caused by the flooding (of the Boise)

Undoubtably settlement in high-risk areas such as flood plains and areas prone to flash floods has brought with it increased toll of human lives. The death rate has tripled from the 1940's to the 1970's (Quarantelli 1979). In fact, floods are the most serious natural disasters in the United States in terms of lives lost, personal suffering, property damage and frequency of occurrence (Auf der Heide 1989). Yet despite the fact that flood losses increase every year, people almost invariably move back into the same area after a flood, and sometimes in greater numbers. (Cigler 1986).

In British Columbia, excepting tidal flooding, major flooding of two types occur: freshet flooding, caused by spring snow melt, often accelerated by prolonged periods of heavy precipitation from cold low pressure systems coupled with warming temperatures, causing rapid reduction of the winter snow pack, and flash flooding, caused by intensive localized rain squalls.

Major freshet flooding events within British Columbia's largest catchment area, the Fraser River, have occurred in 1876, 1882, 1894, 1948 and 1972. The 1948 Fraser River flood for example damaged two thousand homes and forced the evacuation of sixteen thousand people (Smith 1991). Fifty-five thousand acres of farm land were inundated up to depths of 8 metres with damage estimated at $20 million. (Fraser River Board 1963) while 82 bridges were destroyed and 10 people killed (Emergency Preparedness Canada 1992). Examples of flash flooding include November 5th of 1988 when 52.8 millimetres of rain fell in Vancouver in a 24 hour period. The Trans-Canada Highway out of British Columbia was closed, as were most low lying arterial roads in the lower mainland (Vancouver Sun, 1988). Severe flooding occurred in the Pemberton, Whistler, Squamish, Britannia Beach corridor from August 27th to the 30th, when some 243.4 millimetres fell in a four day period. On the 29th alone there 128 millimetres of rain. This was not the first time that

Pemberton had experienced flooding. This prime seed potato growing area had experienced almost complete inundation in October of 1984 when 300 residents were evacuated and 174 homes damaged. (Scanlon et al 1985). It was the second time also for residents of Britannia Beach. This time the Britannia Creek brought down immense quantities of gravel and rock debris that engulfed the adjacent housing, school and businesses, plugged the river channel and destroying an abandoned copper mine contaminated water outfall.

Whistler too had it's scare. This picturesque and world famous ski resort was almost evacuated after a major land slip fault threatened to block Fitsimmons Creek, damming water with a potential later failure that would cause a debris and water torrent that could engulf the city centre. Very fortunately, this did not occur. Deposition of the slide, with and estimated volume of one million cubic metres of material, (Golder 1992) into the creek during this high rainfall event would have had catastrophic results. As it was, abnormally high flows in the creek destroyed most of the downstream bridges in Whistler Village, eroded significant bank areas and deposited trees, rock and gravel debris for two miles.

Transport of large quantities of debris and material is not just a function of steep tributary streams in the Coast Mountains. It is estimated that some 7,500,000 tons of sediment in the Fraser River pass into the lower mainland delta annually (Fraser River Board, 1963). While much of this erosion is natural removal of material by water from river bottom and banks, there is growing concerns that this transport and deposition of material is accelerated by poor logging practice and also a contributing factor to many flash flood problems. Certainly the risk is increasing in the lower mainland of British Columbia where increased residential development on slopes and near creeks has resulted in severe damage to urbanizing areas. (Anderson et al 1990). Much of this development in the steeper treed areas of the province is caused, in large part, by an agricultural land freeze enacted in 1973 that eliminated arable land as a source of easy housing development sites (Gardner 1993).

Hazard Reduction Approaches in British Columbia

While extensive programs of dyking, pump station construction drainage works, slide gate culvert construction, water storage and water diversion projects have provided some engineered solutions to flooding in B.C. they are costly and not always effective. The Fraser River Flood Control Program, launched in 1968, has spent some $120,000,000, while a winter storm in 1982 caused damage to sea dykes around Delta required $900,000 worth of repairs (Fraser River Joint Advisory Board, 1990).

Each year both B.C. Hydro and the Hydrology Section of the Water Management Branch of the Provincial Ministry of Environment monitor snowpack throughout the winter and provide a monthly bulletin forecasting weather conditions and outlook for run-off, peak flows and flooding potential based on a summary of snow water equivalents. These forecasts are fed into the annual spring freshet planning strategy sessions. These meetings follow formal run-up procedures laid out in the British Columbia Flood Plan, (British Columbia, 1991), and for the lower mainland in a more detailed South Coast Region Spring Freshet Flood Plan (Ministry of Transportation and Highways 1991).

The province has long recognized the flooding potential that the topography, hydrology, geology and climate of British Columbia conspire to render on the inhabitants, infrastructure and resources of the province. In order to reduce the impact of flooding, the province has entered into an agreement with the federal government in 1987 to better identify areas of high flood risk. (Environment Canada 1992). The agreement provides for the identification, mapping and designation of flood areas throughout British Columbia. This work supplements work originally started by the province in the 1970's. The maps, drawn to a scale of 1:5000, allow designation of floodplains to which restrictions on future development that could be vulnerable to floods would apply. These maps are distributed to local municipalities as they are produced. Each municipality in turn, through the subdivision or Development Permit process, can examine applications to build on hazardous sites and prevent or restrict such development. The *Municipal Act* of British Columbia from which municipalities draw their power to regulate land allows:

For areas subject to potential flooding, a Section 215 covenant to be registered on title of the property which sets out floodproofing requirements and contains a "save harmless clause" absolving the Ministry of Environment, Lands and Parks, and the Corporation of Delta from all claims and damages arising from potential flooding. (Delta 1992).

The objective of the floodplain mapping program then is to identify flood-prone areas to:

- reduce vulnerability of people and property to danger and damage from flooding;

- manage the natural and cultural resource of floodplains.

Planning and regulatory initiatives and tools that are available to protect development on the floodplain and to ensure public safety arising from the floodplain designation include:

- Sections 945 and 952 of the *Municipal Act* respecting the identification of lands hazardous to development in official

community plans and rural land use bylaws;

- regulation of development of lands subject to flooding under Section 969 of the *Municipal Act* respecting the establishment of setbacks and elevation requirements for new development;
- identification of floodable land and the regulation of subdivision under Section 82 of the *Land Title Act;*
- selection of school, hospital sites and other critical land uses that are not located in the floodplain; and
- policy that provincially funded development (BCBC developments, education facilities, health facilities, government offices, etc.) is not constructed in the floodplain except in accordance with provincial floodplain development control standards.

Under the provisions of the Floodplain Mapping Agreement both the federal and provincial governments agree to **not** provide flood damage recovery funds to new development constructed in the floodplain after designation, unless constructed to provincial floodplain management standards. Therefore, it is imperative that the local authority undertake appropriate planning and regulatory responses to ensure public safety, protect private investment, and reduce liability associated with new development constructed after the date of designation. This requires that future land uses planned for the floodplain are appropriate and that the regulatory tools established under the *Municipal Act* are utilized.

In this way, those who wish to build in hazard prone areas, whether approved by a municipality or, in unincorporated areas, by the province, must shoulder the responsibility of flood damage and repair. Building restriction such as no inhabitation of the first floor of structures on low lying areas may also apply, thus reducing the overall potential for personal loss. Flood insurance is not a form of protection that can be purchased in British Columbia. Thus development controls provide a measure of public treasury protection as it legally limits access to disaster relief funds for those who have consciously chosen to live with flood risk.

The Public Safety Net and Flood Relief in British Columbia

Notwithstanding the planning process efforts to minimize the public cost of flood damage in British Columbia there is, nevertheless, substantial cost to the public purse. Public

policy is that those who loose their homes or livelihoods as a result of flooding and their inability to buy flood insurance in the open market, should be protected from catastrophic loss.

The recently proclaimed provincial *Emergency Program Act* (1993) provides for (at Section 20) (i) establishment of criteria by which to establish the eligibility of a person to receive disaster financial assistance and (2) the provision of disaster financial assistance in accordance with regulation to persons who suffer loss as a result of a disaster. The Regulations to establish the criteria and process for application are now in final draft.

The process is not, however, new. For example, in 1991, severe flooding occurred in the Pemberton, Whistler and Squamish and Britannia Beach coastal region of British Columbia. Some $16.6 million was allocated for recovery for this and the Terrace and Williams Lake areas. (Provincial Emergency Program 1992). A new system to allow quick financial assistance to victims provided trained private adjusters and provincial emergency finance staff to be on site almost immediately. Eighty-three percent of individual claims were paid in the six weeks following flooding. Major municipal infrastructure repairs have been ongoing through 1993. In that year the program was administering a total of $70.7 million in flood relief resulting from eleven separate flooding events. (Provincial Emergency Program 1993).

The essence of the Disaster Financial Assistance Program in British Columbia is laid out in two simple guideline packages. (Provincial Emergency Program 1991 (a) and (b)). The first, Part I, outlines the process for private sector claims, while the second, Part II, deals with Public Sector Claims. Background to both parts notes that:

Disaster Financial Assistance is a federal/provincial cost-sharing program to help the victims of a disaster cope with financial hardship brought about by the disaster when the costs exceed what they might reasonably be expected to bear on their own.

In British Columbia, Disaster Financial Assistance (DFA) is provided under the *Flood Relief Act,* RS Chap. 138, and is restricted to flooding victims. Assistance must be authorized by Order in Council and is normally for a single event defined geographically and in time. When damage costs exceed approximately $3,000,000, the province may request federal assistance. Federal funding is based upon a specific formula discussed later:

The purpose of Part I of these Guideline is to outline the terms and conditions governing the provision of DFA to homeowners/renters, small businesses, farm operations and

charitable/volunteer organizations, and the requirements and procedures for the submission of claim. Part II, deals with the provision of DFA to local governments, provincial ministries and Crown agencies.

Once eligibility has been established and the claim category determined, the processing procedure is simple for both claimants and insurance adjusters who assist the province in a professional capacity. Each adjuster has undergone a specific training program developed by the finance section of the Provincial Emergency Program. The intent is not to make the process onerous but for the adjusters to help claimants obtain a just, allowable claim settlement. A number of General Terms and Conditions have been developed to clarify what criteria will be used to judge the voracity of individual claims.

- *Disaster Financial Assistance is not available to large businesses as they usually have sufficient resources to cover damage costs and to continue operations.*

- *Claimants must make every reasonable effort to prevent damage on their own behalf and with their own resources. Funding is provided in the form of unconditional grants but where it i found that the claimant took no action during the disaster to protect his/her property, or after the disaster there is an indication of neglect of indifference regarding the loss or damage, funding may be reduced of denied.*

- *Title searches are completed on all properties for which an assistance claim is made and if restrictive covenants are found, they shall apply.*

- *Claims may not exceed the estimate of costs required to restore an item or facility to its immediate pre-disaster condition. When items such as furniture, fixtures or appliances are to be replaced, only basic models of such item are allowed as replacements. When there is a choice between repair or replacement, determination will be based upon which option is the least costly.*

- *Assistance for the reconstruction of private property in a disaster-prone area will only be given once, unless effective action to avoid recurrence was not feasible.*

- *No assistance will be provided to meet the cost of repairing or replacing flood-damaged structures built or installed in areas designated as flood-plains by the B.C. Ministry of Environment if the structures have been built or installed subsequent to flood-plain designation. Exceptions may be made in the case of new or retrofitted structures determined by the Ministry of Environment and/or Canada Mortgages and Housing Corporation to have been properly flood-protected.*

- *When structures have been destroyed or rendered uninhabitable or unusable and reconstruction is not permitted or possible on the subject property, no consideration will be give to purchase of the land or to providing compensation for the loss of use or benefit of the land. Only the loss of the structure will be considered for claim in accordance with the real estate market value of the structure.*

- *When a structure is considered to be unsafe because of damage to the property on which it is situated, no consideration will be given to purchasing the structure outright or moving it to a different location. Compensation may be awarded in the amount of estimated repair costs to the structure, subject to deductibles.*

- *When civil litigation to recover losses is intended, assistance may be withheld pending the outcome of Court proceedings, or a declaration may be required of the claimant stating that any provincial assistance provided will be refunded in the amount awarded the claimant through litigation. Failure to disclose impending litigation may be considered fraud.*

Eligible costs exclude those which:

(a) *are recoverable at law, or for which insurance was reasonably and readily available.*

(b) *are of a class or kind for which provision is made in whole or in part under any other government program.*

(c) *are damages to property or facilities for which assistance was previously provided to prevent such damage.*

(d) *are a normal risk of a business, trade, calling or enterprise.*

(e) *are for restoration or rehabilitation that cannot be considered essential to a home, livelihood or community service, e.g., non-essential roads and bridges, landscaping, or pleasure items.*

(f) *are for the restoration of property owned by a large business, industry or Crown Corporation.*

(g) *are normal operating expenses of a government agency, such as regular salaries or equipment operating costs.*

(h) *are items or facilities for which there is no proof of ownership, title, or rights and privileges assigned by*

way of lease or permit.

(j) are structures that were found to have significantly depreciated prior to the disaster through neglect, undue wear and tear, or deterioration. Examples are, buildings,fixtures, retaining walls, dikes, septic tank systems.

Four limitations apply to claims by homeowners/renters:

- *Only 80 percent of the total claim for eligible damages and/or loss is payable after a deductible of $1,000 has been applied.*
- *The maximum payment is $100,000 per claim after deductibles have been applied.*
- *Only items to replace or restore the necessities of life will be considered.*
- *Items claimed as necessities will be restricted in number to the needs of permanent occupants only.*

Nine limitations apply to claims by local governments or provincial Crown Corporations

- *Only 80 percent of the total claim for eligible damages and/or loss is payable, with the exception of the "Emergency Response Measures" detailed in sub-paragraph 2.3d below, which are 100 percent recoverable.*
- *Assistance will be restricted to actual property damage and will exclude loss of income derived by a local government through its operations.*
- *Only facilities essential to local government functions and operations will be considered.*
- *Construction standards must adhere to the prevailing codes in the affected area, and to those approved by the provincial government (and by the federal government if it is providing assistance).*
- *Only in exceptional circumstances should standard tendering practices and wage rates for reconstruction and restoration programs in the post-disaster period differ from normal approved procedures and policies approved by the local government and the provincial government (and by the federal government if it is providing assistance).*
- *Eligible costs payable to a local government are net costs. Contributions from agencies such as the Canadian Disaster*

Relief Fund, or which result from disaster fund-raising drives will be subtracted from the total costs before eligible costs are determined.

- *When a public work is to be repaired to better than its pre-disaster condition, the estimated amount required to repair it to pre-disaster conditions will be eligible amount payable.*

- *Costs related to the use of publicly owned resources are not eligible except for incremental costs, e.g., overtime wages, fuel, oil, lubricants.*

- *When local government resources are inadequate and work must be undertaken by private contractors, rates shall not exceed those listed in the B.C. Equipment Rental Rate Guide.*

The categories of claimable items cover:

- structural losses
- contents
- clean up and debris removal
- precautionary Emergency Measures

Of interest in the context of this paper is the wording for debris removal, which is explicitly recognized in the DFA guidelines for both private and public sector claims.

Clean-Up and Debris Removal - Private

- *casual labour, including the owner, at the British Columbia minimum hourly rate, up to a maximum of 100 person-hours, unless authorized by an appointed adjuster who may authorize up to a total of 500 person-hours.*

- *commercial services and rentals provided such rentals are not on a continuing basis and conform to rates listed in the Province of B.C. Equipment Rental Rate Guide, copies of which are held by adjusters.*

Clean-Up and Debris Removal - Public Sector

- *removal of damaged buildings which constitute a threat to public safety.*

- *pruning or removal of trees which constitute a threat to public safety.*

- *necessary clearance of debris and wreckage from channels and streams. (Removal of debris from channel and stream beds unless there has been an unusually heavy, disaster related, deposition. Then, only the cost of removing the disaster related deposition, as closely as can be estimated, is eligible.)*

In addition to outlining viable items for claim, the guidelines provide guidance on what is not eligible for claim under the DFA. Each category of claimant is different but in essence, lost opportunity, lost wages, jewellery, or antiques, pets, recreational equipment, out-buildings, chemicals stored, construction material, wharves, docks, and jetties, seasonal or recreational properties, vehicles that would have been reasonably and readily insured and fuels are not eligible in the private sector, while the purchase of special or additional equipment to fight the disaster, works intended to prevent future disasters, internal handling costs and eroded or damaged land *except* for essential access routes and removal of debris, are not claimable in the public sector.

Disaster Financial Assistance is not a burden shouldered only by the provinces in Canada. It is a shared responsibility with the Federal Government. Formal Disaster Financial Assistance Arrangements exist with the Provinces and Territories. Guidelines are approved by the federal Cabinet and a manual has been developed to assist in the interpretation of the Federal guidelines, (Emergency Preparedness Canada 1991).

In the context of debris, these guidelines also speak specifically to the question of debris clean up.

Clean up Payments. When an individual is faced with a considerable amount of property damage, he is required to put considerable time and effort into simply clearing up the property. It would not be logical to allow an individual to hire someone to do the work and treat those costs as eligible while not allowing, as eligible costs, work which the individual does himself. Therefore, it has become practice under the arrangements to accept compensation provided by provinces to individuals for cleaning up their own property, provided a maximum number of hour's compensation is set, the rate for that compensation is at the provincial minimum wage, and any such payments are substantiated by appropriate damage appraisal reports.

Emergency Preparedness Canada administers the federal DFA on behalf of the Government of Canada. The program was established to assist the provincial governments where the cost of dealing with a disaster would place an undue burden on the provincial economy.

Under the arrangements, the federal government provides, at the request of a province, financial assistance in accordance with a formula based on provincial population. Generally, payments are made to restore public works to their pre-disaster condition and to facilitate the restoration of basic, essential, personal property of private citizens, farmsteads, and small businesses.

Under the formula, no sharing occurs unless provincial expenditures exceed an amount equal to $1 pre capita of the provincial population. When a provinces's expenditures exceed this level, the amount of federal financial assistance payable to a province is determined as set out in Table I:

When cost-sharing is arranged with a province, the EPC regional director is usually designated as the representative of the federal government. As such, they responsible for arrangements for damage assessment, detailed interpretation of the guidelines, a general surveillance of private damage claims and the development of joint federal-provincial teams to review claims for agricultural and public sector damage.

Since the inception of the program in 1970, the federal government has paid about $100 million in post-disaster assistance to the province.

Federal Post-Disaster Financial Assistance in Canada

(per capita sharing)

Provincial Eligible Expenditures	Federal Share
First $1	nil
Next $2	50%
Next $2	75%
Remainder	90%

TABLE I

Conclusions

It can be seen then that in an administrative way at least, British Columbia has addressed debris management in an explicit manner, providing for clean up expenditures to be reimbursable, at least for flooding events. It is anticipated that the new Regulation following the latest Act will broaden the scope of coverage beyond flood incidents. New guidelines will follow. What has yet to develop are technical guidelines on the re-use, re-cycling or redundancy of debris and it's subsequent treatment. All hazards, from the earthquake to oil spills, generate debris. Environmental constraints limit ready destruction, while economic and moral issues govern simple disposal. The challenge is how to develop effective, efficient, post-event management procedures for debris that do not unduly inhibit restoration and recovery.

FEMA (1992) notes that this is a major issue in disaster recovery operations and that explicit plans of action are required.

An equally important issue is that of identifying the extent and quantity of the debris to be dealt with early in the post-disaster phase. Dexter Peach (1993) in testimony before a Senate subcommittee noted that the U.S. Federal Response Plan lacked provision to comprehensively assess damage and disaster magnitude.

This concern was echoed by the Hurricane Andrew Performance Audit Team whose critical finding was that no timely damage assessment was made (FEMA 1993) and by Lewis (1993) in chairing the Governor's Disaster Planning and Response Review Committee in Florida who found that:

Immediate and accurate damage assessments are essential for ensuring the proper actions are take by decision makes in the post disaster environment.

Debris will be unmanageable, technically and administratively if emergency and environmental managers have no information on the nature, location, quantity, condition, hazardous nature, and degree of contamination or mixing of the debris if early assessment is not conducted. Moving debris, treating it, separating out usable components and safely disposing of the residue, is a continuum that starts with an accurate statistical information base of knowledge on the nature of the problem. It is only then that innovation in treatment, and simplicity of administration, can speed the path to efficient community recovery.

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Introduction:

British Columbia is Canada's Pacific coast province. It has a 7022 kilometre mainland coastline and an area of 952,263 square kilometres. It is Canada's third largest province, occupying almost 10 percent of the country's land surface (British Columbia 1990). British Columbia is nearly quadruple the size of Great Britain, two and a half times Japan and larger than all U.S. states except Alaska. Only thirty nations are larger than B.C. To the south, the U.S. States of Washington, Idaho and Montana border the province for 640 kilometres, to the east the province of Alberta has a contiguous border of 1545 kilometres, while to the North, the Northwest Territories and the Yukon form a 1062 kilometre boundary which in turn changes to the northwest to form a final 893 kilometre border with the State of Alaska panhandle.

The province has two large off-shore islands, Vancouver Island, separated from the mainland by the narrow Strait of Georgia, and to the north the Queen Charlotte Islands. The main land mass is mountainous with the Coast Mountain range running north to south along the Pacific Ocean, in places dropping precipitously into the sea, while to the east, the world renowned Rocky Mountains form a cordillera separating the province from the rest of Canada. Much of the population is concentrated in the south of the province along the border with the U.S. and on Vancouver Island. The total population exceeds 3,100,000 and is largely distributed amongst 38 cities, 14 towns and 46 villages.

The province continues to enjoy a buoyant economy and immigration approaching 80,000 a year, largely from the rest of Canada and from the Pacific Rim. Productive forest covers 43.3 million hectares or 46 percent of the province. The provincial government owns more than 90 percent of the Province's forest land. Timber exports account for in excess of $12 billion annually. Mining, principally for coal and copper, although zinc, gold and silver as well as molybdenum are also important, account for $4.2 billion of the provincial economy. Tourism is a major part of the economic income of the province yielding nearly $4 billion in 1989, spent by some 14.6 million overnight visitors travelling in the province. While only 4 percent of B.C. is considered arable, farm holdings cover some 2.4 million hectares and yield over $1 billion annually in farm cash receipts. More than 40 species of fish and marine life indigenous to provincial waters are harvested by British Columbia's fishing and aquaculture industry. The annual fish catch has a wholesale value in excess of $900 million.

An exceptionally rich resource is B.C.'s abundance of inland waterway, lakes, rivers and streams. Freshwater surfaces total almost 2 million hectares. In addition to fisheries and agriculture, these waterways support hydro-electric power and many forms of aquatic recreation. And they produce flooding, flooding than can, and does, have significant impact on each of the elements of the provincial economy.

British Columbia is, in fact, at risk from a variety of hazards. During a average year there are approximately 2900 forest fires affecting 30,000 hectares at an estimated cost of $90 million.

At least once a week an earthquake of sufficient magnitude to be noticed occurs somewhere in B.C. Severe earthquakes capable of causing serious damage in coastal areas occur every 35 to 40 years. The most recent, with an epicentre west of Port Alice on Vancouver Island, occurred on January second, 1994. It registered 5.5 Richter and was felt throughout the lower mainland of the province. A major subduction earthquake that would result in widespread damage to southwestern B.C. has been predicted to occur every 300 to 500 years. Much of this return cycle has elapsed, leading to the conclusion that extensive earthquake planning and exercising is prudent.

As the province continues to develop it's industrial and commercial base, it also becomes increasingly subject to a range of manmade hazards such as oil spills, chemical discharge and major industrial accidents. During a 12 month period in 1990/91, more than 1500 dangerous goods spills were reported on land and a 1,000 marine spill incidents were recorded. (British Columbia, 1992) However, much of the annual activity for emergency management is focused on flood planning, response and recovery.

The focus of this paper is to briefly examine this activity, and to outline the provincial procedures for damage assessment, debris removal and restoration through the provisions of the provincial Disaster Financial Assistance Program.

Historical Perspective

Our realization that flooding will occur in settlement areas is not new. The prologue to Simonds (1961) seminal work on landscape architecture tells of a hunter and a young boy examining a portion of prairie occupied by gophers. The hunter is intrigued by the careful planning of the gopher community. It is dry and warm and safe he observes to his young friend. By contrast, their own town faces north into the cold winter winds.

"At least our town is near the river and water" said the young boy defensively.

"Yes", replied the hunter. "But where near the river did we build our homes? On the low flat land inside the river bend, that's where. And each spring when the snow melts on the prairies and the river swells, it floods out every cellar in town".

"Gophers would plan things better than that", the small boy decided. "Yes", said the hunter, " a gopher would be smarter." "When gophers plan their homes and towns," the boy philosophized, "they seem to do it better than men do."

Susan Stacey (1993) writing about flood control on the Boise River notes that as early as 1876, Milton Kelly, then editor of the Idaho Daily observed:
deposition of debris, impacts on agricultural use, erosion, loss of topsoil inundations and loss of fencing was caused by the flooding (of the Boise)

Undoubtably settlement in high-risk areas such as flood plains and areas prone to flash floods has brought with it increased toll of human lives. The death rate has tripled from the 1940's to the 1970's (Quarantelli 1979). In fact, floods are the most serious natural disasters in the United States in terms of lives lost, personal suffering, property damage and frequency of occurrence (Auf der Heide 1989). Yet despite the fact that flood losses increase every year, people almost invariably move back into the same area after a flood, and sometimes in greater numbers. (Cigler 1986).

In British Columbia, excepting tidal flooding, major flooding of two types occur: freshet flooding, caused by spring snow melt, often accelerated by prolonged periods of heavy precipitation from cold low pressure systems coupled with warming temperatures, causing rapid reduction of the winter snow pack, and flash flooding, caused by intensive localized rain squalls.

Major freshet flooding events within British Columbia's largest catchment area, the Fraser River, have occurred in 1876, 1882, 1894, 1948 and 1972. The 1948 Fraser River flood for example damaged two thousand homes and forced the evacuation of sixteen thousand people (Smith 1991). Fifty-five thousand acres of farm land were inundated up to depths of 8 metres with damage estimated at $20 million. (Fraser River Board 1963) while 82 bridges were destroyed and 10 people killed (Emergency Preparedness Canada 1992). Examples of flash flooding include November 5th of 1988 when 52.8 millimetres of rain fell in Vancouver in a 24 hour period. The Trans-Canada Highway out of British Columbia was closed, as were most low lying arterial roads in the lower mainland (Vancouver Sun, 1988). Severe flooding occurred in the Pemberton, Whistler, Squamish, Britannia Beach corridor from August 27th to the 30th, when some 243.4 millimetres fell in a four day period. On the 29th alone there 128 millimetres of rain. This was not the first time that

Pemberton had experienced flooding. This prime seed potato growing area had experienced almost complete inundation in October of 1984 when 300 residents were evacuated and 174 homes damaged. (Scanlon et al 1985). It was the second time also for residents of Britannia Beach. This time the Britannia Creek brought down immense quantities of gravel and rock debris that engulfed the adjacent housing, school and businesses, plugged the river channel and destroying an abandoned copper mine contaminated water outfall.

Whistler too had it's scare. This picturesque and world famous ski resort was almost evacuated after a major land slip fault threatened to block Fitsimmons Creek, damming water with a potential later failure that would cause a debris and water torrent that could engulf the city centre. Very fortunately, this did not occur. Deposition of the slide, with and estimated volume of one million cubic metres of material, (Golder 1992) into the creek during this high rainfall event would have had catastrophic results. As it was, abnormally high flows in the creek destroyed most of the downstream bridges in Whistler Village, eroded significant bank areas and deposited trees, rock and gravel debris for two miles.

Transport of large quantities of debris and material is not just a function of steep tributary streams in the Coast Mountains. It is estimated that some 7,500,000 tons of sediment in the Fraser River pass into the lower mainland delta annually (Fraser River Board, 1963). While much of this erosion is natural removal of material by water from river bottom and banks, there is growing concerns that this transport and deposition of material is accelerated by poor logging practice and also a contributing factor to many flash flood problems. Certainly the risk is increasing in the lower mainland of British Columbia where increased residential development on slopes and near creeks has resulted in severe damage to urbanizing areas. (Anderson et al 1990). Much of this development in the steeper treed areas of the province is caused, in large part, by an agricultural land freeze enacted in 1973 that eliminated arable land as a source of easy housing development sites (Gardner 1993).

Hazard Reduction Approaches in British Columbia

While extensive programs of dyking, pump station construction drainage works, slide gate culvert construction, water storage and water diversion projects have provided some engineered solutions to flooding in B.C. they are costly and not always effective. The Fraser River Flood Control Program, launched in 1968, has spent some $120,000,000, while a winter storm in 1982 caused damage to sea dykes around Delta required $900,000 worth of repairs (Fraser River Joint Advisory Board, 1990).

Each year both B.C. Hydro and the Hydrology Section of the Water Management Branch of the Provincial Ministry of Environment monitor snowpack throughout the winter and provide a monthly bulletin forecasting weather conditions and outlook for run-off, peak flows and flooding potential based on a summary of snow water equivalents. These forecasts are fed into the annual spring freshet planning strategy sessions. These meetings follow formal run-up procedures laid out in the British Columbia Flood Plan, (British Columbia, 1991), and for the lower mainland in a more detailed South Coast Region Spring Freshet Flood Plan (Ministry of Transportation and Highways 1991).

The province has long recognized the flooding potential that the topography, hydrology, geology and climate of British Columbia conspire to render on the inhabitants, infrastructure and resources of the province. In order to reduce the impact of flooding, the province has entered into an agreement with the federal government in 1987 to better identify areas of high flood risk. (Environment Canada 1992). The agreement provides for the identification, mapping and designation of flood areas throughout British Columbia. This work supplements work originally started by the province in the 1970's. The maps, drawn to a scale of 1:5000, allow designation of floodplains to which restrictions on future development that could be vulnerable to floods would apply. These maps are distributed to local municipalities as they are produced. Each municipality in turn, through the subdivision or Development Permit process, can examine applications to build on hazardous sites and prevent or restrict such development. The *Municipal Act* of British Columbia from which municipalities draw their power to regulate land allows:

For areas subject to potential flooding, a Section 215 covenant to be registered on title of the property which sets out floodproofing requirements and contains a "save harmless clause" absolving the Ministry of Environment, Lands and Parks, and the Corporation of Delta from all claims and damages arising from potential flooding. (Delta 1992).

The objective of the floodplain mapping program then is to identify flood-prone areas to:

- reduce vulnerability of people and property to danger and damage from flooding;

- manage the natural and cultural resource of floodplains.

Planning and regulatory initiatives and tools that are available to protect development on the floodplain and to ensure public safety arising from the floodplain designation include:

- Sections 945 and 952 of the *Municipal Act* respecting the identification of lands hazardous to development in official

community plans and rural land use bylaws;

- regulation of development of lands subject to flooding under Section 969 of the *Municipal Act* respecting the establishment of setbacks and elevation requirements for new development;
- identification of floodable land and the regulation of subdivision under Section 82 of the *Land Title Act;*
- selection of school, hospital sites and other critical land uses that are not located in the floodplain; and
- policy that provincially funded development (BCBC developments, education facilities, health facilities, government offices, etc.) is not constructed in the floodplain except in accordance with provincial floodplain development control standards.

Under the provisions of the Floodplain Mapping Agreement both the federal and provincial governments agree to **not** provide flood damage recovery funds to new development constructed in the floodplain after designation, unless constructed to provincial floodplain management standards. Therefore, it is imperative that the local authority undertake appropriate planning and regulatory responses to ensure public safety, protect private investment, and reduce liability associated with new development constructed after the date of designation. This requires that future land uses planned for the floodplain are appropriate and that the regulatory tools established under the *Municipal Act* are utilized.

In this way, those who wish to build in hazard prone areas, whether approved by a municipality or, in unincorporated areas, by the province, must shoulder the responsibility of flood damage and repair. Building restriction such as no inhabitation of the first floor of structures on low lying areas may also apply, thus reducing the overall potential for personal loss. Flood insurance is not a form of protection that can be purchased in British Columbia. Thus development controls provide a measure of public treasury protection as it legally limits access to disaster relief funds for those who have consciously chosen to live with flood risk.

The Public Safety Net and Flood Relief in British Columbia

Notwithstanding the planning process efforts to minimize the public cost of flood damage in British Columbia there is, nevertheless, substantial cost to the public purse. Public

policy is that those who loose their homes or livelihoods as a result of flooding and their inability to buy flood insurance in the open market, should be protected from catastrophic loss.

The recently proclaimed provincial *Emergency Program Act* (1993) provides for (at Section 20) (i) establishment of criteria by which to establish the eligibility of a person to receive disaster financial assistance and (2) the provision of disaster financial assistance in accordance with regulation to persons who suffer loss as a result of a disaster. The Regulations to establish the criteria and process for application are now in final draft.

The process is not, however, new. For example, in 1991, severe flooding occurred in the Pemberton, Whistler and Squamish and Britannia Beach coastal region of British Columbia. Some $16.6 million was allocated for recovery for this and the Terrace and Williams Lake areas. (Provincial Emergency Program 1992). A new system to allow quick financial assistance to victims provided trained private adjusters and provincial emergency finance staff to be on site almost immediately. Eighty-three percent of individual claims were paid in the six weeks following flooding. Major municipal infrastructure repairs have been ongoing through 1993. In that year the program was administering a total of $70.7 million in flood relief resulting from eleven separate flooding events. (Provincial Emergency Program 1993).

The essence of the Disaster Financial Assistance Program in British Columbia is laid out in two simple guideline packages. (Provincial Emergency Program 1991 (a) and (b)). The first, Part I, outlines the process for private sector claims, while the second, Part II, deals with Public Sector Claims. Background to both parts notes that:

Disaster Financial Assistance is a federal/provincial cost-sharing program to help the victims of a disaster cope with financial hardship brought about by the disaster when the costs exceed what they might reasonably be expected to bear on their own.

In British Columbia, Disaster Financial Assistance (DFA) is provided under the *Flood Relief Act,* RS Chap. 138, and is restricted to flooding victims. Assistance must be authorized by Order in Council and is normally for a single event defined geographically and in time. When damage costs exceed approximately $3,000,000, the province may request federal assistance. Federal funding is based upon a specific formula discussed later:

The purpose of Part I of these Guideline is to outline the terms and conditions governing the provision of DFA to homeowners/renters, small businesses, farm operations and

charitable/volunteer organizations, and the requirements and procedures for the submission of claim. Part II, deals with the provision of DFA to local governments, provincial ministries and Crown agencies.

Once eligibility has been established and the claim category determined, the processing procedure is simple for both claimants and insurance adjusters who assist the province in a professional capacity. Each adjuster has undergone a specific training program developed by the finance section of the Provincial Emergency Program. The intent is not to make the process onerous but for the adjusters to help claimants obtain a just, allowable claim settlement. A number of General Terms and Conditions have been developed to clarify what criteria will be used to judge the voracity of individual claims.

- *Disaster Financial Assistance is not available to large businesses as they usually have sufficient resources to cover damage costs and to continue operations.*

- *Claimants must make every reasonable effort to prevent damage on their own behalf and with their own resources. Funding is provided in the form of unconditional grants but where it i found that the claimant took no action during the disaster to protect his/her property, or after the disaster there is an indication of neglect of indifference regarding the loss or damage, funding may be reduced of denied.*

- *Title searches are completed on all properties for which an assistance claim is made and if restrictive covenants are found, they shall apply.*

- *Claims may not exceed the estimate of costs required to restore an item or facility to its immediate pre-disaster condition. When items such as furniture, fixtures or appliances are to be replaced, only basic models of such item are allowed as replacements. When there is a choice between repair or replacement, determination will be based upon which option is the least costly.*

- *Assistance for the reconstruction of private property in a disaster-prone area will only be given once, unless effective action to avoid recurrence was not feasible.*

- *No assistance will be provided to meet the cost of repairing or replacing flood-damaged structures built or installed in areas designated as flood-plains by the B.C. Ministry of Environment if the structures have been built or installed subsequent to flood-plain designation. Exceptions may be made in the case of new or retrofitted structures determined by the Ministry of Environment and/or Canada Mortgages and Housing Corporation to have been properly flood-protected.*

- *When structures have been destroyed or rendered uninhabitable or unusable and reconstruction is not permitted or possible on the subject property, no consideration will be give to purchase of the land or to providing compensation for the loss of use or benefit of the land. Only the loss of the structure will be considered for claim in accordance with the real estate market value of the structure.*

- *When a structure is considered to be unsafe because of damage to the property on which it is situated, no consideration will be given to purchasing the structure outright or moving it to a different location. Compensation may be awarded in the amount of estimated repair costs to the structure, subject to deductibles.*

- *When civil litigation to recover losses is intended, assistance may be withheld pending the outcome of Court proceedings, or a declaration may be required of the claimant stating that any provincial assistance provided will be refunded in the amount awarded the claimant through litigation. Failure to disclose impending litigation may be considered fraud.*

Eligible costs exclude those which:

(a) *are recoverable at law, or for which insurance was reasonably and readily available.*

(b) *are of a class or kind for which provision is made in whole or in part under any other government program.*

(c) *are damages to property or facilities for which assistance was previously provided to prevent such damage.*

(d) *are a normal risk of a business, trade, calling or enterprise.*

(e) *are for restoration or rehabilitation that cannot be considered essential to a home, livelihood or community service, e.g., non-essential roads and bridges, landscaping, or pleasure items.*

(f) *are for the restoration of property owned by a large business, industry or Crown Corporation.*

(g) *are normal operating expenses of a government agency, such as regular salaries or equipment operating costs.*

(h) *are items or facilities for which there is no proof of ownership, title, or rights and privileges assigned by*

way of lease or permit.

(j) are structures that were found to have significantly depreciated prior to the disaster through neglect, undue wear and tear, or deterioration. Examples are, buildings,fixtures, retaining walls, dikes, septic tank systems.

Four limitations apply to claims by homeowners/renters:

- *Only 80 percent of the total claim for eligible damages and/or loss is payable after a deductible of $1,000 has been applied.*
- *The maximum payment is $100,000 per claim after deductibles have been applied.*
- *Only items to replace or restore the necessities of life will be considered.*
- *Items claimed as necessities will be restricted in number to the needs of permanent occupants only.*

Nine limitations apply to claims by local governments or provincial Crown Corporations

- *Only 80 percent of the total claim for eligible damages and/or loss is payable, with the exception of the "Emergency Response Measures" detailed in sub-paragraph 2.3d below, which are 100 percent recoverable.*
- *Assistance will be restricted to actual property damage and will exclude loss of income derived by a local government through its operations.*
- *Only facilities essential to local government functions and operations will be considered.*
- *Construction standards must adhere to the prevailing codes in the affected area, and to those approved by the provincial government (and by the federal government if it is providing assistance).*
- *Only in exceptional circumstances should standard tendering practices and wage rates for reconstruction and restoration programs in the post-disaster period differ from normal approved procedures and policies approved by the local government and the provincial government (and by the federal government if it is providing assistance).*
- *Eligible costs payable to a local government are net costs. Contributions from agencies such as the Canadian Disaster*

Relief Fund, or which result from disaster fund-raising drives will be subtracted from the total costs before eligible costs are determined.

- *When a public work is to be repaired to better than its pre-disaster condition, the estimated amount required to repair it to pre-disaster conditions will be eligible amount payable.*

- *Costs related to the use of publicly owned resources are not eligible except for incremental costs, e.g., overtime wages, fuel, oil, lubricants.*

- *When local government resources are inadequate and work must be undertaken by private contractors, rates shall not exceed those listed in the B.C. Equipment Rental Rate Guide.*

The categories of claimable items cover:

- structural losses
- contents
- clean up and debris removal
- precautionary Emergency Measures

Of interest in the context of this paper is the wording for debris removal, which is explicitly recognized in the DFA guidelines for both private and public sector claims.

Clean-Up and Debris Removal - Private

- *casual labour, including the owner, at the British Columbia minimum hourly rate, up to a maximum of 100 person-hours, unless authorized by an appointed adjuster who may authorize up to a total of 500 person-hours.*

- *commercial services and rentals provided such rentals are not on a continuing basis and conform to rates listed in the Province of B.C. Equipment Rental Rate Guide, copies of which are held by adjusters.*

Clean-Up and Debris Removal - Public Sector

- *removal of damaged buildings which constitute a threat to public safety.*

- *pruning or removal of trees which constitute a threat to public safety.*

- *necessary clearance of debris and wreckage from channels and streams. (Removal of debris from channel and stream beds unless there has been an unusually heavy, disaster related, deposition. Then, only the cost of removing the disaster related deposition, as closely as can be estimated, is eligible.)*

In addition to outlining viable items for claim, the guidelines provide guidance on what is not eligible for claim under the DFA. Each category of claimant is different but in essence, lost opportunity, lost wages, jewellery, or antiques, pets, recreational equipment, out-buildings, chemicals stored, construction material, wharves, docks, and jetties, seasonal or recreational properties, vehicles that would have been reasonably and readily insured and fuels are not eligible in the private sector, while the purchase of special or additional equipment to fight the disaster, works intended to prevent future disasters, internal handling costs and eroded or damaged land *except* for essential access routes and removal of debris, are not claimable in the public sector.

Disaster Financial Assistance is not a burden shouldered only by the provinces in Canada. It is a shared responsibility with the Federal Government. Formal Disaster Financial Assistance Arrangements exist with the Provinces and Territories. Guidelines are approved by the federal Cabinet and a manual has been developed to assist in the interpretation of the Federal guidelines, (Emergency Preparedness Canada 1991).

In the context of debris, these guidelines also speak specifically to the question of debris clean up.

Clean up Payments. When an individual is faced with a considerable amount of property damage, he is required to put considerable time and effort into simply clearing up the property. It would not be logical to allow an individual to hire someone to do the work and treat those costs as eligible while not allowing, as eligible costs, work which the individual does himself. Therefore, it has become practice under the arrangements to accept compensation provided by provinces to individuals for cleaning up their own property, provided a maximum number of hour's compensation is set, the rate for that compensation is at the provincial minimum wage, and any such payments are substantiated by appropriate damage appraisal reports.

Emergency Preparedness Canada administers the federal DFA on behalf of the Government of Canada. The program was established to assist the provincial governments where the cost of dealing with a disaster would place an undue burden on the provincial economy.

Under the arrangements, the federal government provides, at the request of a province, financial assistance in accordance with a formula based on provincial population. Generally, payments are made to restore public works to their pre-disaster condition and to facilitate the restoration of basic, essential, personal property of private citizens, farmsteads, and small businesses.

Under the formula, no sharing occurs unless provincial expenditures exceed an amount equal to $1 pre capita of the provincial population. When a provinces's expenditures exceed this level, the amount of federal financial assistance payable to a province is determined as set out in Table I:

When cost-sharing is arranged with a province, the EPC regional director is usually designated as the representative of the federal government. As such, they responsible for arrangements for damage assessment, detailed interpretation of the guidelines, a general surveillance of private damage claims and the development of joint federal-provincial teams to review claims for agricultural and public sector damage.

Since the inception of the program in 1970, the federal government has paid about $100 million in post-disaster assistance to the province.

Federal Post-Disaster Financial Assistance in Canada

(per capita sharing)

Provincial Eligible Expenditures	Federal Share
First $1	nil
Next $2	50%
Next $2	75%
Remainder	90%

TABLE I

Conclusions

It can be seen then that in an administrative way at least, British Columbia has addressed debris management in an explicit manner, providing for clean up expenditures to be reimbursable, at least for flooding events. It is anticipated that the new Regulation following the latest Act will broaden the scope of coverage beyond flood incidents. New guidelines will follow. What has yet to develop are technical guidelines on the re-use, re-cycling or redundancy of debris and it's subsequent treatment. All hazards, from the earthquake to oil spills, generate debris. Environmental constraints limit ready destruction, while economic and moral issues govern simple disposal. The challenge is how to develop effective, efficient, post-event management procedures for debris that do not unduly inhibit restoration and recovery.

FEMA (1992) notes that this is a major issue in disaster recovery operations and that explicit plans of action are required.

An equally important issue is that of identifying the extent and quantity of the debris to be dealt with early in the post-disaster phase. Dexter Peach (1993) in testimony before a Senate subcommittee noted that the U.S. Federal Response Plan lacked provision to comprehensively assess damage and disaster magnitude.

This concern was echoed by the Hurricane Andrew Performance Audit Team whose critical finding was that no timely damage assessment was made (FEMA 1993) and by Lewis (1993) in chairing the Governor's Disaster Planning and Response Review Committee in Florida who found that:

Immediate and accurate damage assessments are essential for ensuring the proper actions are take by decision makes in the post disaster environment.

Debris will be unmanageable, technically and administratively if emergency and environmental managers have no information on the nature, location, quantity, condition, hazardous nature, and degree of contamination or mixing of the debris if early assessment is not conducted. Moving debris, treating it, separating out usable components and safely disposing of the residue, is a continuum that starts with an accurate statistical information base of knowledge on the nature of the problem. It is only then that innovation in treatment, and simplicity of administration, can speed the path to efficient community recovery.

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