



Government
of Canada

Gouvernement
du Canada

Office of Critical
Infrastructure Protection and
Emergency Preparedness

Bureau de la protection
des infrastructures essentielles
et de la protection civile



Community-Wide Vulnerability and Capacity Assessment (CVCA)

Acknowledgments

This publication has been prepared by:

Office of Critical Infrastructure Protection and Emergency Preparedness

2nd Floor, Jackson Bldg.
122 Bank St.
Ottawa, ON K1A 0W6
Tel: (613) 944-4875
Toll Free: 1-800-830-3118
Fax: (613) 998-9589
Email: communications@ocipep-bpiepc.gc.ca
Internet: www.ocipep-bpiepc.gc.ca

Authors:

Ron Kuban, PhD, and Heather MacKenzie-Carey, M.Sc.
Turning Point Group Inc.

This material is based upon work supported by the Directorate of Research and Development (DRD) in the Office of Critical Infrastructure Protection and Emergency Preparedness (OCIEPEP), formerly Emergency Preparedness Canada, under Contract Reference No. 2000D013. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Office of Critical Infrastructure Protection and Emergency Preparedness.

© 2001 Minister of Public Works and Government Services
Catalogue No.: D-82-68/2002E-IN
ISBN: 0-662-32220-7

The authors and Turning Point Group (TPG) Inc. (renamed Pegasus Emergency Management Consortium Corp.) wish to acknowledge with thanks the financial support for this project by Emergency Preparedness Canada.

We would also like to thank the numerous researchers who graciously shared with us their knowledge about hazards, risk and vulnerability. In constructing our model we strove to build on the work of others - their theories, applications and feedback. We chose to rely on two specific models and would like to particularly thank the National Oceanic and Atmospheric Administration (NOAA) for its “Community Vulnerability Assessment Tool (New Hanover County, NC)” and Dr. Laurie Pearce for her research towards the HIRV model.

The material contained in this package was developed with great care to ensure its accuracy and relevance. Nevertheless, nothing in this material absolves its readers from using their sound judgement in the appropriate application of its content.

Executive Summary

When disasters occur, they do not affect everyone in the same way. In emergency planning, it is important to pay special attention to the needs of people who are deemed particularly at risk, or the “most vulnerable”. The aim of the Community-wide Vulnerability and Capacity Assessment (CVCA) model presented in this document is to help emergency managers and municipal planners to better understand and therefore be able to meet the needs of their vulnerable populations, particularly in an emergency situation.

The common view is that “vulnerable populations” include the very young, the very old, women, people with disabilities and perhaps aboriginal/First Nation peoples. Unfortunately, while partially accurate, this view of the “most vulnerable” is often misleading and could result in inappropriate response expectations or activities. Stated more specifically, not all seniors, youth, women, or aboriginal people are “vulnerable”. Some may in fact be more adept at responding to disaster than their general grouping or population category might first indicate. It is important in the emergency planning process to distinguish more specifically what group of people is deemed to be among the “most vulnerable”, their general location within the community, and their expected capacity to respond or recover from disasters. Worth noting is the fact that one criterion, poverty, clearly stands out as a common thread among the “most vulnerable.”

The CVCA model focuses on the population of a community with the objective of answering these three questions: who are the community’s “most vulnerable”; where do they generally reside; and, what is their capacity to respond or recover? The model is based on an 18 step process; first the model proposes a Planning Team that gathers up-to-date information according to set parameters. The Team can then define and map the population, as well as the high-density and high-risk areas of the municipality. The characteristics of the "most vulnerable" groups are then superimposed over the operational map in order to identify needs, expectations, and priorities to be considered during an emergency.

The CVCA model is intended to be applicable universally across diverse cultures, community sizes, geographic locations, or resource levels. However, to apply the model successfully, two key ingredients are required: a team effort by a broad group of people who reflect the community, as well as its key stakeholders; and a patient effort to continue to expand one’s understanding of “vulnerability”, the “most vulnerable” and the reality of emergency situations.

Although the model may serve as a stand-alone process, it is most informative as a component of a larger analysis. Its weakness is that it may be used as a complete process and assumed to provide the whole picture. Unfortunately, all hazard-risk-vulnerability (HRV) assessments provide only a piece of reality from a subjective perspective. CVCA analysis is not designed to be conducted once and then discarded. It must lead to action and must be followed by regular review and revision as necessary.

Table of Contents

Acknowledgments	ii
Executive Summary	iv
1.0 Context	1
1.1 Introduction: Why bother?.....	1
1.2 Definitions	2
1.3 Underlying assumptions	3
1.4 Underlying principles	4
1.5 How to use this instrument	4
2.0 Models of Hazard Assessment.....	5
3.0 The CVCA model	5
3.1 General Model	6
3.2 Instruments	20
3.3 Application	21
4.0 Summary	22
Appendix A – List of Potential “Vulnerable Populations”	A-1
Appendix B – Example	B-1
Appendix C – Templates	C-1
Appendix D – Key Models of Hazard Assessment.....	D-1
Appendix E – Select Bibliography.....	E-1

1.0 Context

1.1 Introduction: Why bother?

There is not a single facet of life, not a single act by any person, not a place on earth, and not a moment in time that does not inherently contain a degree of hazard. This reality, though often understood, is frequently overlooked.

The fact of the matter is that we live and operate in an environment that is both unpredictable and to some degree hazardous. Obviously, the degree of hazard (or risk) differs from one setting to another. In other words, the degree of hazard is established by a variety of factors including the nature of the activity itself, the people that perform it or those affected by it, the location where it unfolds, the resources used, time of day or year, and much more. In short, all activities or events have the potential to become more complex and more risky.

Events that unfold to affect a community of people contain greater complexity than those affecting single individuals. That is the nature of community-wide emergencies or disasters. Such events always demand a great deal of resources, far beyond what a single agency or jurisdiction could provide. Therefore, the response to these events requires a high degree of communication, decision-making, and coordination (i.e., resources and activities).

The typical scarcity of urgently-needed resources, with which to respond to the disaster event, provides a strong argument for the process of emergency planning. This is the process of reviewing potential hazards (or risks), deciding on a pre-determined course of action, identifying and allocating roles, determining needed resources, providing necessary training, and so on. When disasters strike, their impact is often felt far and wide. It is a common reality that disasters affect, either directly or indirectly, everyone that encounters them (Raphael, 1986). Nevertheless, the fact remains that disasters do not affect everyone in the same way.

The value or impact of emergency preparedness is much like the value of health, educational, or social programs. Each recipient – an individual, a family unit, an organization, or a community – benefits differently. In the case of emergency preparedness each has a unique capacity to respond or recover from a disaster event. That “capacity” is based on specific requirements or needs and the distinct ability at that time to either employ or access needed resources. The assessment of capacity level is also a function of time and is typically modified over time, following changes to the operational environment or personal circumstances.

Given the predictable and perennial shortage of resources for emergency planning and response, it is critically important that specific attention be given to those who are deemed to be particularly at risk, or the “most vulnerable”. Failure to do so often leaves these individuals or population groups at a distinct disadvantage, perhaps even disenfranchises them from the broad community response effort.

Recall that nearly all emergency planning processes begin with hazard or risk analysis. This step allows for a more meaningful approach to planning and a potentially more successful response to emergency or disaster situations. Most such analyses consider potential disaster agents (i.e., natural or human-induced), or the physical environment in which these agents would unfold (e.g., buildings, structures, containers, transportation routes). Some models, too few, also include a broad view of the community through a limited set of criteria: population size, demographics, or density.

However, few if any processes address the social structure from the more detailed perspective of vulnerability and capacity. In other words, the common view is that “vulnerable populations” include the very young, the very old, women, people with disabilities, and perhaps aboriginal/First Nations peoples. Unfortunately, while it is partially accurate, this view of the “most vulnerable” is often misleading and could result in inappropriate response expectations or activities.

Stated more specifically, not all seniors, youth, women, or natives are “vulnerable”. Some may in fact be more adept at responding to disaster than their general grouping or population category might first indicate. It is important, therefore, to distinguish more specifically what group of people is deemed to be among the “most vulnerable”, their general location within the community, and their expected capacity to respond or recover from disasters.

The aim of this document is to enhance existing hazard or risk analysis approaches by providing context and tools for incorporating a perspective of vulnerability and capacity as it relates to population segments.

A more comprehensive analysis, one that also accounts for the segmentation and vulnerability of population groups, would by necessity also enhance the capacity of a municipality to undertake mitigation and recovery actions.

1.2 Definitions

In the field of emergency management one has to be careful when discussing what otherwise might appear as common and readily-understood terms. The difficulty is that this field of practice does not have a consistent and universally understood set of terms. The following definitions are offered as a starting point, to clarify the discussion below. Please avoid getting concerned about the particular definitions used, and instead concentrate on their general meaning.

Threats or hazards are persons, things, events, or ideas, which pose accidentally or deliberately some degree or danger to an asset. (US National Institute of Standards and Technology) James A. Gordon provides another valuable definition of hazard as “anything that threatens the residents of a community or the things they value”.

Assets are those things or aspects that are considered valuable. They may be tangible (e.g., facility, equipment, supplies, data, finances, or people) or intangible (e.g., reputation, morale, goodwill, opportunity). (US National Institute of Standards and Technology)

Impact is the individual consequences and compounded effect of an event (e.g., disasters) upon those who experience it (i.e., individuals, family units, organizations, or communities).

Risk is defined as the expected degree and nature of loss, which is based on a relationship between the probability (how likely) and consequences (how bad) of that loss.

Safeguards are defined as the physical controls, mechanisms, policies and procedures that protect assets from threats. (US National Institute of Standards and Technology)

Capacity is the cumulative ability of a person to take action when necessary, based on a number of factors: cognitive faculties, physical characteristics, personality factors, financial and other resources, knowledge, experience, link to others, and opportunity.

Resiliency is “a measure of how quickly a system recovers from failure”. (Australia Emergency Measures Organization, 1998)

Vulnerability is the weakness in your safeguards to protect your assets. (US National Institute of Standards and Technology) Stated differently, vulnerability is a perception of the lack of capacity to defend against injury, harm or damage from a threat or a hazard.

Most vulnerable is the term assigned to those within a given population who are, through no fault of their own and relative to the general population, in an extraordinary state of reduced capacity to respond to or recover from emergency situations.

1.3 Underlying assumptions

The CVCA model is presented with the assumption that:

- Emergency planners, especially at the municipality level, value the process of hazard-risk-vulnerability (HRV) assessment and use it as part of their emergency planning process;
- Municipal emergency planning performed as a team representing key response agencies;
- Municipal emergency planners have adequate knowledge, gained directly or indirectly, of their community and its population;
- Municipal emergency planners have limited resources and would wish to maximize the effectiveness of their budgets, resources and effort;
- Municipal elected officials support the prioritization of their municipal emergency service recipients (i.e., single out certain groups for particular or advanced attention);
- Municipal emergency planners are willing to link with community groups to better prepare for the impact of emergencies on their members.

1.4 Underlying principles

The CVCA model is developed with the intent of being applicable universally across diverse cultures, community sizes, geographic locations, or resource levels. It is founded on a number of principles, which emphasize that:

- The population of every community, regardless of size, demographics, geographical location or dispersion, contains a diversity of needs and expectations;
- The primary responsibility to prepare for and respond to disaster rests with the individual;
- Individual capacity to respond to disaster varies from one person to another, and changes over time;
- Response agencies typically augment individual capacity and sustain the overall broad response effort;
- Public-funded emergency preparedness resources and effort are limited and must, therefore, be prioritized and focused;
- The planning process must consider the unique needs of the “most vulnerable” and enhance their capacity to respond and recover from disasters;
- None of the models of hazard analysis are infallible and none are as precise as their numerical outcome appears to imply. They are all based on some degree of subjectivity that cannot be ignored;
- The CVCA is best led by a representative of the primary jurisdiction in question (i.e., the municipality);
- The CVCA process does not necessarily require specific equipment (i.e., computers or GIS mapping) or a sophisticated level of detail about the population. However, the more detail-rich the process and visually supported (e.g., through GIS), the more precise and meaningful the outcome.

1.5 How to use this instrument

The intent of the CVCA model is to guide and enhance the assessment of hazard-risk vulnerability (HRV) at the municipal level and thereby to enhance the emergency planning process. The CVCA model is intended to augment existing assessment tools.

The following is developed in stages. The CVCA model is described beginning with the key principles and the assumptions that underlie its framework. The overall process is described step by step, and then key instruments are illustrated and defined. A number of Appendices are also included to provide a list of possible “vulnerable populations”, and key models of hazard-risk-vulnerability (HRV) assessment models.

It is critically important that this process be taken as a team approach, and involve emergency planners, municipal planners, public-service providers (e.g., social and health services), NGO representatives, and representatives of vulnerable groups or those who provide service to them. Without that degree of inclusion, of experience, information and linkages, the ultimate assessment may prove extremely weak. The CVCA analysis is not designed to be conducted

once, and then be discarded. It must lead to action and must be followed by regular review and revision as necessary.

2.0 Models of Hazard Assessment

The level of use of hazard-risk-vulnerability (HRV) assessment models or tools by emergency managers from across the world is not well documented. Nevertheless, the literature clearly defines a number of models that appear to be prominent among emergency managers and practitioners.

A few of these models, well documented and critiqued by Pearce (2000) stand out for being key and worthy of mention. They are briefly described below (see Appendix D). They are presented in no particular order and include:

- Canada – Emergency Preparedness Canada (EPC)*
- US – Federal Emergency Management Agency (FEMA)
- Sweden – Swedish Rescue Services APELL program
- Australia – Emergency Measures (SMUG model)
- US – National Oceanic and Atmospheric Administration (NOAA)
- UN – UN Disaster Relief Organization (UNDRO)
- HIRV (Pearce, 2000)

* [As of 5 February 2001, EPC has become the Office of Critical Infrastructure Protection and Emergency Preparedness (OCIEPEP).]

3.0 The CVCA model

The CVCA model intentionally focuses on the population of a community with the objective of helping answer three questions:

- Who are the community’s “most vulnerable”?
- Where do they generally reside?
- What is their capacity to respond or recover?

As noted earlier, the difficulty among most of the current hazard-risk-vulnerability assessment models is that they generally gloss over the matter of a community’s population. Their assessment is generally focused on the hazards related to the infrastructure, geography, or natural environment. Where people or populations are considered, they are often discussed in the context of their geographical location (i.e., place of work, or residence) or in the context of the physical hazards and disaster agents that they confront.

When the question of the most vulnerable is considered, the discussion is often restricted to general categories such as youth, the aged, women, people with disabilities, or the indigenous or “native” people. These broad groupings invariably lead to the misconception that everyone within the same categories or groups (e.g., women or seniors) has the same limited capacity. While there may be some validity to the categorization of a group as a “vulnerable population,”

not all of its members are vulnerable and incapable of caring for themselves in a disaster. For example, during the 1998 Ice Storm, because of their early-life experiences, some seniors proved more adept or capable than the rest of the population to respond to and recovery from the disaster.

There is a need, therefore, to be more specific in describing the “most vulnerable” and providing more meaningful sub-categories. The task is made difficult by the reality that they do not cleanly fall into one category or another. Those who are deemed to be “most vulnerable” are typically in that category not because of their age (very young or old), gender (i.e., female), or culture (e.g., native populations). They are “most vulnerable” because they lack the capacity to respond or recover, which is generally assumed to exist for the general population. That lack of capacity often translates into a wide range of obstacles:

- Limited resources to plan or respond (e.g., single parents, the poor);
- Limited awareness (e.g., about opportunities or the availability of resources);
- Limited opportunity to express their unique needs (e.g., to avoid being ignored in the planning, response or recovery process);
- The presence of significant health problems that significantly curtail the ability to respond or recover (these health problems are often compounded by dependency on technology, living aids or medication);
- The lack of education to understand emergency-related messages;
- Limited access to community resources (e.g., the poor, transients, homeless);
- The lack of sufficient mobility to appropriately respond (e.g., seniors, disabled);
- The lack of support networks (e.g., homeless);
- Cultural isolation from the bulk of the community (e.g., newcomers, indigenous people);
- Linguistic isolation from the bulk of the community (e.g., newcomers).

Often, those who are truly deemed to fit the category of “most vulnerable” simultaneously meet a number of the above criteria. It is that situation, and not necessarily their age, gender, or culture that makes them “vulnerable”. Having said that, there is one criterion that clearly stands out as a common thread among the “most vulnerable” — poverty.

In that regard, the research into the notion of vulnerability is particularly illuminating. To start with, every facet of human life contains an element of vulnerability. Moreover, all cases of vulnerability to disaster are exacerbated by poverty. Stated differently, poverty further aggravates all other facets of vulnerability.

3.1 General Model

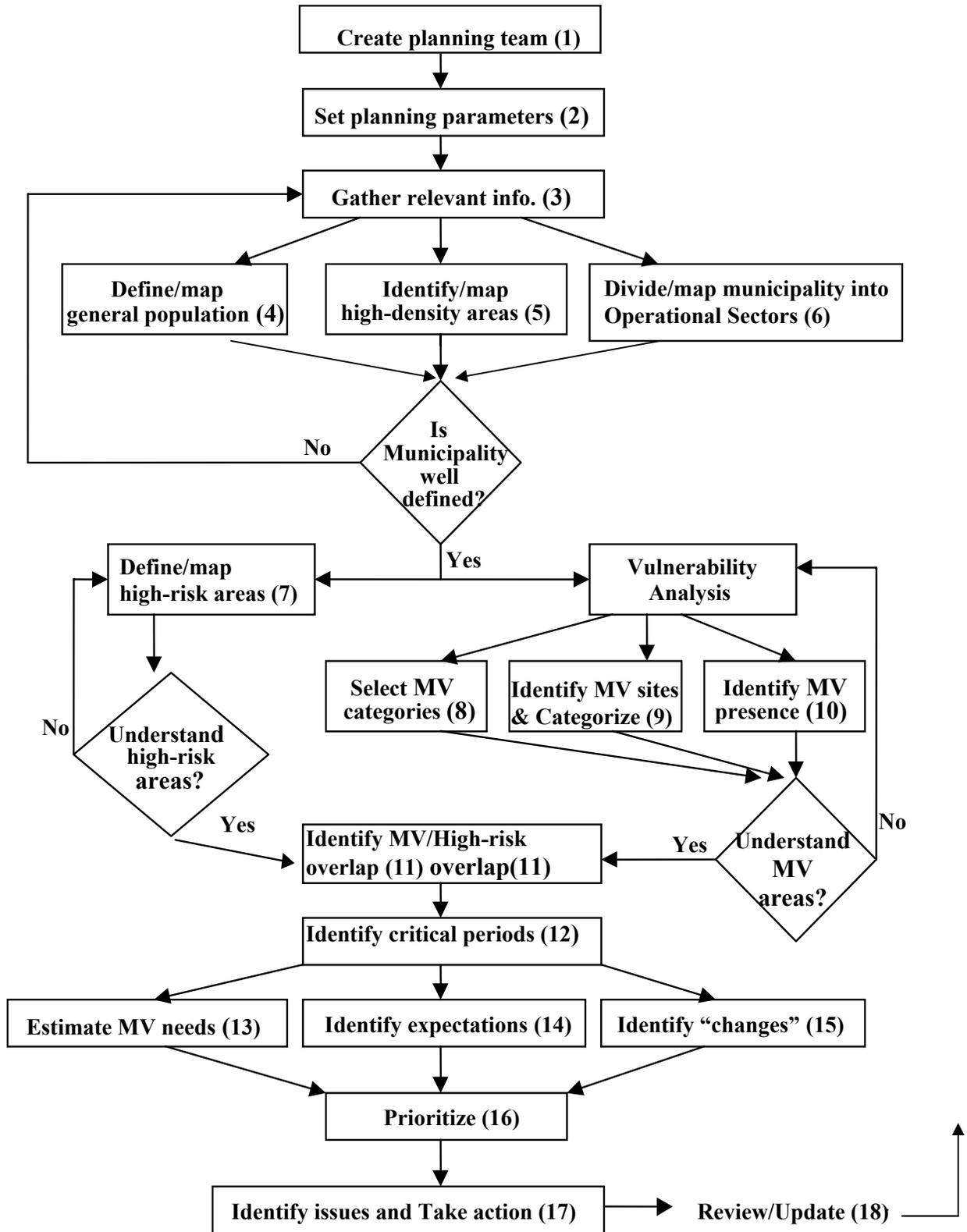
The analysis process of the CVCA model is intentionally sequential. One should firm up knowledge at one level or step before moving on to the next. The intent of each step is to provide further meaning or greater context to the understanding that one has of the “most vulnerable” segment of the population.

The CVCA model (see Diagram below) contains the following steps. (Each of the steps is explained separately below.)

1. Create the Planning Team;
2. Set planning parameters;
3. Gather relevant information;
4. Define and map the general population;
5. Define and map high-density areas;
6. Divide and map the municipality into “Operational Sectors”;
7. Define and map “high-risk” areas;
8. Select applicable categories for the “most vulnerable” (see category list);
9. Identify, categorize (as full or part-time), and map sites related or specific to the identified “most vulnerable” groups (e.g., seniors’ homes, long-term care facilities, day-care facilities, social services access points, or clinics);
10. Identify and map other areas where each of the “most vulnerable” groups has significant numerical presence;
11. Identify intersection or overlap of “most vulnerable” groupings and “high-risk” areas;
12. Identify critical periods (e.g., D=workday hours, N=workday night, H=weekend/holiday) when each group is particularly vulnerable;
13. Estimate likely emergency needs of the “most vulnerable”(i.e., of each vulnerable group within each sector);
14. Identify realistic expectations regarding the capacity of each identified group (consider physical, cognitive, resources, linkages, support system);
15. Consider conditions that change the presence or vulnerability level of the identified groups (e.g., population shifts during the day);
16. Categorize sectors, facilities or community segments into relative levels of priority (1 or highest, 2, or 3);
17. Identify issues or groups for further consideration or action;
18. Review and update your information as appropriate.

The steps of the CVCA model are explained below. At the end of each step are points or issues to consider. These are provided as thought-provoking points or reminders. Feel free to expand upon them.

The CVCA Model



Step 1: Create the Planning Team

This is the first step of the process and involves establishing a multi-disciplinary team of “experts” or people knowledgeable about a diversity of issues relating to emergency planning, disaster response and recovery operations.

The Team should include representatives of the following: The municipal Emergency Measures Organization (EMO), response organizations (e.g., police, fire, emergency medical services (EMS)), municipal planners, health services, social services, key industrial sites or industries, local utilities, non-governmental organizations (NGOs), and key volunteer organizations (i.e., those representing or those servicing vulnerable populations). While not all of these are required on a continuous basis, they should all provide an input in the determination of “vulnerability” and in the development of a meaningful solution to the problem.

The involvement of the related community-based organizations (CBOs) is critical. Typically, these organizations have direct contact, knowledge and the confidence of members of the vulnerable groups. Inclusion of their representatives could provide much needed and valuable information, a communication channel to these populations, and increased credibility of the process. These CBOs are useful from a number of other perspectives: They are often volunteer-based, have a greater degree of flexibility and adaptability than public organizations, and could better access donors. These organizations typically have established communication channels or networks to those deemed vulnerable, and often already deliver valuable services to them.

When forming the Planning Team consider the following:

- What information do you need and who could best provide it?
- Who must be included (i.e., to provide necessary resources or clout)?
- Which community-based organization needs to be included to provide credibility for the process and its outcome?
- Visibility and credibility are important.
 - How “visible” is the process going to be?
 - Does the Team include representatives of the vulnerable groups? (i.e., will it do things for, to, or with these groups?)
- Who will lead the Team and under what jurisdiction?
- Assign the vulnerable-group representatives a role that would allow them an opportunity to input into the process without taking over its agenda
- How is this Team to be linked to the on-going emergency planning process and network?

Step 2: Set the planning parameters for the Team

As early as possible, the Planning Team should establish the parameters for their planning process. In other words, they should attempt to define the boundaries of what they will strive to achieve, how they will work to do so, for how long, with what resources, and so on. The Team should consider answering the following questions:

- How detailed or specific should be the selection of vulnerable groups and the “most vulnerable”?
- What criteria should be used to determine the populations deemed as “most vulnerable”?
- Which groups, organizations, or areas of expertise are not currently included but should be in the Team?
- To what degree should each of the participants or organizations be involved (e.g., on-going or partial, decision-making or input)?
- What are the roles and responsibilities of those involved?
- How often should meetings occur, where, and how are they to be conducted?
- How will information be communicated to the public, by whom, and when?
- What is the link, if any, between this planning process and key political players?
- What information is required, how would it be gathered, and by whom?

Step 3: Gather relevant information

This analysis process, like all others, is as accurate as the information upon which it is based. Therefore, it *must have* accurate, comprehensive and timely information, which is best provided by those who know best. As noted in the previous section, Team members should be advised of the basic information desired or required, and be tasked to gather it *before* any other activity is commenced. Additional information is likely to be identified through the process. Nevertheless, by securing a basic level of data the Team ensures a strong start for the process.

The availability of data, and the form that the data takes when presented, will vary from one municipality to another. The CVCA process does NOT necessarily require high-tech resources, or extensive databases. If these exist they should be utilized, to provide the clearest, most extensive and meaningful analysis as possible. However, if such tools do not exist, Team members should use whatever is at their disposal to gain the best understanding from the data available to them at that time. As a rule, the data should be made as visual as possible. While there is no specific list of required information, one should consider the following:

- Population size and dispersion throughout the municipality
- Population demographics including:
 - Age
 - Gender
 - Linguistic (only if particularly significant)
 - Culture (only if particularly significant)
- Socio-economic factors, as related to the population
- Health factors or related issues
- Social service-related factors or related issues
- Cultural diversity and groupings
- Cultural issues affecting response or recovery
- Current and available risk analyses reports
- Municipal social planning factors or issues
- Municipal development plans

- Environmental analyses
- Key facilities (e.g., fire, police or emergency medical service stations; hospitals, long-term care facilities, or related specialty clinics; key public facilities and shopping malls) as appropriate
- Identify key information categories which you would like to illustrate on the municipal map

Step 4: Define and map the general population

This step is intended to establish a broad view of the municipality and its population. It should serve as a foundation upon which other layers of information are added. Planners are encouraged to:

- Secure an accurate, large, and current map of the municipality
- Define the boundaries of the municipality
- Mark all operational sectors and identify them
- In each sector describe visually on the map the general population
- In each sector identify areas or pockets of population high-density

The input for this step may be population statistics, census data, or development permits. The output is a marked map detailing the boundary of the municipality, key facilities within it, as well as a comprehensive list of relevant information on the municipality. Consider the following questions:

- Do you understand the nature of your municipality (e.g., size, dispersion, demographics, and other key characteristics)? (see Step 3 above)
- Does your municipal map accurately identify the populated areas throughout the community (i.e., residential as well as places of work)?
- Does it include visual markers for key facilities?
- If you have not already considered using colour, shapes, or shadings to illustrate layers of different information, what system of “visualization of data” would work for you? Start using it now.

Step 5: Identify and map high-density areas

This step is intended to focus upon high-density populated areas. The high density of the population in a relatively small area often presents a complex challenge for emergency planners and responders. Aside from the obvious challenges brought about by population density (e.g., large numbers, diversity of needs, limited relative resources), these areas are also the likely habitation of the most vulnerable. The Team is encouraged to:

- Establish the criteria for identifying population areas as “high-density”, which meets the reality of the local community;
- Analyze the community population-dispersion;
- Determine areas that are deemed to be “high-density”;

- Map these areas on the municipal map.

“High-density” areas should be marked as lightly shaded areas on a separate plastic sheet, or overlay, that is then added on top of the master map of the municipality.

Consider the following questions:

- Do you have meaningful and defensible criteria for determining populated areas as “high-density”?
- If you are having difficulty with defining which areas are high-density, have you considered using scaled levels of density, then picking the top few?
- Have these criteria been employed by others to identify high-density populated areas within the community? If so, by whom?
- Is your map appropriately shaded or marked to quickly identify the high-density areas within the community?

Step 6: Divide and map the municipality into Operational Sectors

An analysis of the municipality is more readily understood and action is more easily defined when one looks at manageable segments of the whole. How big should each sector be? It depends on the size of the municipality whole, plus the population and “high-risk” areas within each sector.

Ultimately, each “sector” should be clearly defined, easily identifiable, and manageable (i.e., during the planning or response processes). The boundaries of the “sectors” should then be marked on the map of the municipality. Each sector should be identified by a letter or a number.

The input for this step should come from the municipal planning section and from the emergency response agency representatives. The output should be a segmentation of the municipal populated area into manageable “sectors”. Consider the following:

- Do you have your community divided into a number of “operational sectors”?
- When recorded on your municipal map, do these sectors cover the whole community (i.e., residential as well as places of work)? They should!
- Are these sectors manageable from the perspectives of geographic and population size, as well as the resources allocated to them?
- If you have not already considered using colour, shapes, or shadings to illustrate layers of different information, what system of “visualization of data” would work for you?

Step 7: Define and map “high-risk” areas

This step is intended to focus attention on those areas that, for whatever reason, are deemed to be high risk. If the CVCA model is used with other HRV models, this information may already be well determined. In any case, consider natural hazards (e.g., rivers, lakes, mountain slopes, forested/bush area, or shorelines) as well as the potential of human-induced hazards (e.g., production or storage facilities, transportation corridors or facilities).

The intent of this step is to gain a broader perspective of risk, which would then provide a more meaningful context for the subsequent discussion on the “most vulnerable” segments of the population. The input for this step may be historical records, geographical analyses, industrial records, analysis of transportation routes, or the output of other hazard analyses. The output is a set of markings of the municipal map that identify those areas that are relatively “high-risk”. These “high-risk” areas should be marked as lightly shaded areas on a separate plastic sheet, or overlay, that is then added on top of the master map of the municipality. Consider the following:

- Do you have meaningful and defensible criteria for determining areas as “high-risk”? If not, revisit the definition of the term and its criteria.
- Have you consulted with key representatives of industry and the response community to determine these areas?
- Do you have historical data to support your decision?
- Is your map appropriately shaded or marked to quickly identify the high-risk areas within the community?

Step 8: Select applicable categories for the “most vulnerable”

A key purpose of this step is to look at vulnerable populations in a broad perspective and to steer away from the more common and often misleading categories of vulnerable groups: young children, seniors, women, people with disabilities, or indigenous populations.

The CVCA model is not designed to identify specific individuals (or family units) within the “most vulnerable” population groups. Rather, the model seeks patterns or meaningful generalities within these groups. The list of categories in Appendix A is intended as a starting point for discussion (consider the “obstacles to capacity”, hence the basis of vulnerability, that were mentioned in Section 3.0 above). The list is not all-inclusive and should be adjusted as appropriate to fit the reality of your community. New categories of “vulnerable populations” may be added at any time in the process. Each added group needs to be incorporated into the analysis process.

The input for this step is the list in Appendix A plus input from representatives of interest groups, social services, education, and the municipal planning section. The output is a list of identifiable populations groups that are deemed to be “most vulnerable” to disasters. This step is likely to raise much sensitivity. You should consider the following:

- What general criteria would your Team use to determine “vulnerability”?
- What general criteria would define the “most vulnerable”?
- Have you consulted with and involved the appropriate specialists or group representatives?
- A solid basis for your analysis is an understanding of who is vulnerable in day-to-day life. Have you defined that “basic” vulnerability, and are you ready to build on it in the context of disaster?
- Have you created a mechanism that would allow a review of the selection, at a later date, with its possible revision?

- Are you locked into groupings (e.g., seniors, youth) or their issues relating to the lack of capacity? The latter is preferable!

Step 9: Identify, categorize, and map sites related or specific to the identified “most vulnerable” groups.

This step focuses on *sites* that either relate to or service the needs of those previously identified as “most vulnerable”. Such sites or facilities may include seniors’ homes, long-term care facilities, day-care facilities, social services access points, specific health clinics, and so on.

Emergency planners are encouraged to seek the advice of representatives of credible interest groups that work with or serve the “most vulnerable”. These representatives should be able to identify the key sites, which either house or attract the “most vulnerable”.

These sites or facilities should be categorized as being full-time (e.g., long-term care facilities), or part-time and limited basis (e.g., day-care facilities). This categorization should help determine the attention level that a site may require. Each of the sites should be recorded within its appropriate “sector” and marked on the map to visibly identify its location. A colour code (e.g., health-related facilities in yellow, social services-related facilities in red, residences in green, and so on) may be used to allow for quick analysis of the map.

The input for this step is information gained from development or municipal planning organizations, emergency planning agencies (e.g., fire, police, Emergency Medical Services), health or social services agencies. The output is a list of related sites and corresponding map markings. Consider these:

- What are the key service points for the most vulnerable, including:
 - General shopping
 - Health services
 - Social services
 - Financial services
 - Recreational services
- Where are the key facilities that provide these services? (Consider especially those that are heavily used by the “most vulnerable” populations.)
- Does your map include all of the key facilities mentioned above? Ensure to do so visually.

Step 10: Identify and map other areas where each of the “most vulnerable” groups has significant numerical presence

This step is somewhat similar in nature to Step 9. However, while Step 9 focused on “sites”, this step strives to identify those who are located throughout the community.

You are encouraged to look at your community from a holistic perspective and ask: “Where in our community are large concentrations of people whom we identified as the ‘most vulnerable’?” Seek to understand the nature, life style and limitations of the “most vulnerable” and you will start to see *patterns* that would point to their presence. Remember to focus on these patterns and the vulnerable populations, and not on the individuals or family units within these groups. The CVCA is not intended to result in a registry of vulnerable individuals.

Inputs for this step may best be gained from those who work with vulnerable populations. These individuals are likely to be in more frequent and “intimate” contact with the people that you are trying to understand. The municipal planning section and the local health and social services may also be of great assistance. The output is a list of key locations within the community with a high concentration of the most vulnerable and corresponding map markings. (As in the case of the marking of “high-risk” areas, high concentrations of the “most vulnerable” should be marked as shaded areas on a separate plastic sheet that is then added on top of the master map of the municipality.)

As in Step 9, consider all general *areas*, versus specific *locations*, where those deemed to be in the “most vulnerable” groups are in significant presence. Consider, therefore, the following:

- What do you consider “significant presence” within the local population group?
- You will likely have to *estimate* the presence of the “most vulnerable”. Can you do it well? If not, identify your estimates and give them a level of certainty (H, M, L).
- The “most vulnerable” often wish or require easy access to the following facilities and typically attempt to reside near them. Consider these as a starting point:
 - Shopping malls or centres
 - Health services
 - Social services
 - Financial services
 - Recreational services
 - Transportation routes or centres
 - High-density areas
- Have you relied upon those organizations that provide daily or routine service to the “most vulnerable”?
- Does your map clearly reflect (i.e., through shading or colour patches) areas with actual or likely high presence of the selected groups?

Step 11: Identify intersection or overlap of “most vulnerable” groupings or sites and “high-risk” areas

The aim of this step is to understand where the two vulnerabilities (i.e., of people and activities or things) intersect or overlap to result in a relatively higher risk level.

The input for this step comes from the previous steps. These overlaps or intersections should be abundantly clear if the map has been marked correctly (the use of different colours or shades is highly recommended). The outcome should be the map markings and the clarity they

provide regarding the areas with higher risk due to the double exposure of people and activities or things. Consider the following:

- Does your map easily and clearly reflect the various categories of information, especially, high-density and high-risk?
- Does the map reflect areas where both categories overlap, hence identifying a higher level of risk for the “most vulnerable”?
- Are your conclusions defensible?

Step 12: Identify critical periods when each group is particularly vulnerable

Vulnerability and risk change over time, with relocation, or with changes in activity. Even for those who are included among the “most vulnerable”, the level of risk or vulnerability changes over time. It is necessary, therefore, to provide another layer of clarity regarding the change of vulnerability over time.

A simple three-category time-frame analysis is recommended. It involves the workday hours (D), workday night hours (N), and weekend or holiday hours (H). You need to revisit each of the “most vulnerable” groups and each of the sectors, to determine the vulnerability level (High, Medium, Low) during each of the three categories of time (i.e., D, N, H). You may wish to use the matrix in Appendix C (Template 1). Additionally, those wishing more detail should consider further analysis of their data based on the four seasons.

The input of this step is information gained in the previous steps, plus the knowledge or experience of key service providers (e.g., interest groups, NGOs, social services, or health services). The output is a completed matrix of available information. In identifying the impact of time, consider these questions or issues:

- What is your community pattern of life or routine (regular or erratic)?
- Predict as best as you can some of the community routines. What are:
 - The population shifts-in-concentration?
 - What routes are most heavily utilized?
 - When do these “shifts” typically occur, and for how long?
- Within the day’s 24-hour cycle, when are vulnerable groups most vulnerable, and why?
- For how long does that peak in vulnerability typically last?
- What are the vulnerability differences between workday-time (D), workday evening or night (N), and weekend or holiday time (H)?
- Have you consulted with or included such representatives of social service groups, community-based groups, municipal transportation and planning, taxi or special transport companies?

Step 13: Estimate likely emergency needs of the “most vulnerable”

The intent of this step is to gain a *broad understanding* of the likely emergency needs of the various vulnerable populations. This is likely going to be an on-going effort of refining one’s

perception of the unique needs, services or resources that may be required by each vulnerable population, and within each sector.

The input would be information from key service providers, including emergency response agencies. The output would be a secondary matrix, which identifies for each sector the likely needs of its identified vulnerable groups (see Appendix C, Template 2). This step may become endless and because of this may be overwhelming. Concentrate on the most fundamental of emergency-related needs and expand as time and resources permit. Nevertheless, consider the following general needs as a starting point for discussion:

- Does your discussion include representatives of the relevant community-based organizations, social services, health and mental services?
- What services are you prepared to look at?
 - Health care (i.e., short and long-term)
 - Health support (e.g., prescription replacement, aids-to-daily-living or life-support equipment)
 - Emergency Social Services (ESS) (e.g., food, shelter, clothing)
 - Transportation
 - Cultural, religious or linguistic requirements
- What are you prepared to do for pets, which often provide comfort for the “most vulnerable”?
- The care of the “most vulnerable” is likely to be more challenging than the general population. Do you have a reasonable understanding of their needs, and the appropriate resources to address the matter?
- How can you best link your effort in a disaster to existing regular or daily service of other agencies, including community-based organizations?

Step 14: Identify realistic expectations regarding the capacity of each identified group

Having identified who is involved, where they may be located, and what services/resources they might need, it is time to analyze the expectations regarding the capacity of these group members to respond or recover from disasters.

Be realistic with your expectations of them as well as of the response organizations. When assessing the capacity of the “most vulnerable”, consider the following factors: physical capability, cognitive ability, resource availability (e.g., access to transportation, shelter, or medicine), linguistic capacity (i.e., comprehension of key messages), key linkages (e.g., to warning or response systems), degree of isolation (i.e., physical, political, or cultural), strength or availability of support systems (e.g., neighbours, family, NGOs, or service providers).

Once again, the input is the information gained from the various service providers (e.g., volunteer, public-funded, and public-based). The outcome should be a list of general expectations by vulnerable group. These may be prioritized into High, Medium or Low to reflect the impact, which they may have on the planning or response process. This task is best seen as a work-in-progress. You should begin by considering the following:

- Have you involved all key players, including relevant community-based organizations, social services agencies, emergency response organizations, as well as municipal transportation and planning departments?
- Have you identified, with reasonable certainty, the general expectations of the “most vulnerable” for the response and recovery periods? Are these realistic? If not, can they be modified or met differently?
- What are your expectations of the “most vulnerable”, and are they realistic?
- Can you categorize these “expectations” into political versus operational-focused? Deal with them accordingly.
- Begin with expectations regarding general issues (e.g., personal safety, transportation) and as time or resources are available proceed with more and more detailed issues.

Step 15: Consider conditions that change the presence or vulnerability level of the identified groups

The population of the community does not remain static. Major shifts occur during the day and, with lesser intensity, even during the night. It is important to capture these changes in the presence or vulnerability of the identified “most vulnerable” groups. You are encouraged to understand current or expected changes to:

- The movement of the most vulnerable in the run of “an average day” (e.g., patterns of shopping, visits to health or social service facilities, worksites, or gathering places)
- The impact that these “movements” have on the vulnerability of the “most vulnerable” (i.e., are they suddenly isolated from their major support system?)
- The impact that these population shifts have on the anticipated risk level at each sector (i.e., where or when is the risk reduced? increased?)

The inputs for this step are the feedback gained from representatives of the “most vulnerable” or their service providers. The output is a broad sense of the pattern of the “most vulnerable” across the community. A potential output is a list of clarifying information about the “most vulnerable” and specific sectors of the community.

Step 16: Categorize sectors, facilities or community segments into relative levels of priority

Having gained the above-mentioned information, you are now able to make a more informed assessment regarding risk and the “most vulnerable” population segments of their community.

You are encouraged to weigh the factors, observations and recommendations to determine priorities of response. Each community sector, vulnerable-group facility, or vulnerable-group concentration should be categorized into one of three priority levels: 1 (highest), 2, or 3. While this task is somewhat subjective, it is nevertheless not completely so. The greater the degree of detail or clarity, gained through the process of selection, the less subjective the determination of priority.

The inputs for this step include all the data gained through the previous steps. The outcome is the assignment of priority to each sector of the municipality. This is a priority for attention during the planning process, and may also be a priority during the response or recovery process. Consider the following:

- Is your categorization defensible?
- Force yourself to prioritize, in each sector, those areas that would need direct and special attention.
- Will your analysis soon lead to allocation of the necessary resources, as appropriate? If not, why not? You may have to revisit your expectations in Step 14.
- Is your prioritization flexible enough to allow shifting of resources or attention? If so, how will that re-prioritization occur and under what circumstances?
- Do you have a general buy-in or acceptance for the priorities by all key players including the community-based groups?

Step 17: Identify issues or groups for further consideration or action

The process is likely never really over, if for no other reason because people and their capacity undergo change on an on-going basis. In addition, there is the fact that people physically move in and out of the municipality, as well as within it. None of it is “predictable”.

Neither the CVCA process, nor its outcome (i.e., the assessment) can remain static. In fact, emergency planners are encouraged to use the CVCA process to move beyond the basic analysis towards more concrete results and actions. Many questions could and should be asked, including:

- What are the related issues that have been identified, but not addressed?
- Which groups have been left out of this analysis, either as its key players or as information providers, and how could they be brought into the process?
- What action may be taken, by whom and when, to reduce vulnerability of one group or another?
- What resources may be brought into the process of planning or response to reduce vulnerability in the identified groups?
- What effort by other agencies, on apparently other issues (e.g., poverty), may be of assistance to further reduce vulnerability in your community? How?

Step 18: Review and update

The process demands that its results be reviewed at least annually, and revised as appropriate. Revisions must be considered if conditions change significantly (e.g., a vulnerability of a group can change due to evolving environmental, social, political, or economic conditions).

3.2 Instruments

Each step of the CVCA model requires forethought, planning, and the layering of information in a way that makes it meaningful at a glance. You are strongly encouraged to identify population, site, or risk-related information in a *visible way*.

The simplest and least resource-demanding way to do so is to focus all key details on a large-scale map of the community, which would become the foundation for additional layers of information. Therefore, ensure that the map is:

- The latest and most accurate reflection of the community
- Large in size yet manoeuvrable
- Marked with:
 - Relevant natural or geographical barriers (e.g., lakes, rivers)
 - Key human-constructed structures
 - Political or jurisdictional boundaries
- Located in a place away from the general public and safe from defacing, or damage

Only data that is not likely to change easily should be marked directly on the map. All other information should be illustrated using other tools. These tools may include small pins (i.e., colour-coded or ones with small paper “flags”), stickers (i.e., in colour, or white with significant markings), or plastic overlays (see below). Another option is the use of thin strings or threads. These can be attached at one end by a pin to a key point on the map, and on the other to a space off the map area where there is more space to expand on the desired information.

Plastic overlays are an inexpensive and simple way to portray information. This technique could be used in many ways, but in the case of the CVCA we suggest that it be used to display broad or general information prior to the use of other tools (e.g., pins). Consider using overlays to identify high-risk areas or high-density population areas. In that case:

- Get a sufficiently large sheet of clear and sturdy plastic
- Lay it on the map so that it covers a little more than the area desired
- Use clear tape or pins to secure the overlay into place
- Mark on the overlay the boundaries of the area that you want to illustrate
- Use light shading or different colours to define the information you wish to highlight
- Be creative!

You may mark onto the overlays the location of specific sites or other key data. When doing so, ensure that the overlay is on the main map and that sites marked on the overlay are also aligned correctly with the map coordinates. One trick is to identify the map coordinates or reference points at two opposite corners of the overlay, when it is secured on top of the map. In this way, the overlay could be taken off the map but quickly and accurately realigned back onto the map.

In addition to the above, consider using various *templates or matrices* (see Appendix C) to capture, in graph or table format, information you consider valuable. As a minimum, you should consider identifying the information by operational sector or vulnerable population. A more comprehensive template may bring all of that together. Whichever tool you use in this process, the result of your effort must be a meaningful view of your community and its vulnerable populations.

3.3 Application

The CVCA model may serve as a stand-alone process. As such, it provides a view of a community's population focusing on those considered "most vulnerable" within the context of the current population as a whole. However, the CVCA is most informative or useful as a component of a larger analysis.

Its weakness, as is the case for many hazard-risk-vulnerability (HRV) assessment processes, is that it may be seen or used as an end-all-be-all process and assumed to provide the whole picture. This is not so. In reality, *all* HRV assessments provide a slice of reality, a picture of time, and ultimately a subjective perspective of reality at a very specific period of time. Think of it as the process of slicing a bowl of jellied fruit salad to assess the composition of the bowl's content. Every "slice" is likely to reveal a different view. In the dynamic nature of life, the perspective of every analysis could change rapidly and easily with time or with the modification of the assessment approach. The gathering of *meaningful* information must, therefore, involve process layering, data richness, as well as outcome review and update.

"Layering" involves the use of numerous perspectives or analyses to refine one's understanding of the current reality. One layer of analysis-gained information then helps clarify or refine previously-gained information. We could never see the absolute total picture, nor see it in complete clarity. Nevertheless, we could further refine our understanding with each successive layer until we reach a certain comfort zone about our knowledge.

"Data richness" is the degree of sophistication inherent to the data we gather, based on the sources used to gather or give it meaning. Does it contain just the basic facts or is there an effort to collect as much relevant detail as possible? Examples of "data-rich" information include the use of multi-sources to construct meaning, the application of databases or other information sources, or the application of such tools as geographic information systems (GIS), to better illustrate the information.

The need to regularly review and update available information should be obvious. This is especially necessary in those environments where information changes quickly or profoundly. In such circumstances, the information must be reviewed and appropriately updated on a regular basis. Failure to do so, especially in a rapidly changing environment, results in the stagnation of meaning.

Ultimately, the successful application of the model is achieved through two key ingredients:

- Team effort by a broad group of people “in the know” who reflect the community and all its key stakeholders, especially the “most vulnerable”.
- Patient effort to continue to expand one’s understanding of “vulnerability”, the “most vulnerable”, and the reality of emergency situations.

4.0 Summary

The Community-wide Vulnerability and Capacity Assessment (CVCA) is intended to guide the effort of emergency managers and municipal planners to better understand the needs of their vulnerable populations, and meet the needs of the “most vulnerable”. The process is intended to work with any other hazard-risk-vulnerability (HRV) model, and is designed to provide an often-missing component: A comprehensive view of the population in question.

The following steps outline the CVCA model:

1. Create the Planning Team.
2. Set planning parameters.
3. Gather relevant information.
4. Define and map the general population.
5. Define and map high-density areas.
6. Divide and map the municipality into “Operational Sectors”.
7. Define and map “high-risk” areas.
8. Select applicable categories for the “most vulnerable”.
9. Identify, categorize, and map sites related or specific to the identified “most vulnerable” groups.
10. Identify and map other areas where each of the “most vulnerable” groups has significant numerical presence.
11. Identify intersection or overlap of “most vulnerable” groupings or sites and “high-risk” areas.
12. Identify critical periods when each group is particularly vulnerable.
13. Estimate likely emergency needs.
14. Identify realistic expectations regarding the capacity of each identified group.
15. Consider conditions that change the presence or vulnerability level of the identified groups.
16. Categorize sectors, facilities or community segments into relative levels of priority.
17. Identify issues or groups for further consideration or action.
18. Review and update your information as appropriate.

The CVCA is only as good as the information that is applied to its process. That information is only as good as the team that strives to collect, analyze, communicate, and act on it. That team must include representatives of the agencies that service the vulnerable populations. They are “from the trenches” and could provide invaluable data, as well as the necessary buy-in during implementation.

Appendix A – List of Potential “Vulnerable Populations”

The following is a list of potential population groups, which *may be* considered “vulnerable” given a specific context. *It is up to you to assess the relevance of the entries below, and other unlisted possibilities, to your community.*

The identification or service targeting of potentially at-risk populations does not necessarily make them helpless individuals or groups. Nevertheless, these groups should be considered because they are at a greater likelihood of being at risk. In making your assessment, remember that:

- Not all “seniors, youth, women and people with disabilities” are automatically and exclusively vulnerable;
- Most likely, those who are considered vulnerable fit into more than one of the categories below;

The following list was developed based on research conducted in a variety of fields of practice, and is in *alphabetical* order:

- Aboriginal or indigenous people
- Alcohol/Drug dependent individuals
- Children (especially those of pre-school age)
 - When isolated from parents during impact
 - When gathered in large groups (i.e., schools)
 - When the ratio of children to adults is significantly high (e.g., daycares, day homes)
- Ethnic minorities
- Families of emergency service personnel
- Homeless or “street people”
- Immigrants (especially those from “visible” cultures, or cultures that are diverse from the local “mainstream”)
- Incarcerated individuals
- Language-limited (i.e., those who do not speak the mainstay language)
- Large and high-density households
- Livestock owners
- Marginalized groups (i.e., by society or the community)
- Medication dependent individuals (e.g., diabetics, schizophrenics)
- Migrant workers
- People depending on public transport (versus car owners)
- People living below the poverty line
- People on social assistance
- People with disabilities
 - Mobility-specific
 - Hearing-related
 - Visual

- Communication
 - Physical
 - Mental or cognitive
 - Multiple chemical sensitivities
 - Dependency on electricity for life-support systems
- Pet owners
- Renters (especially in low-rental areas)
- Seniors
 - Limited mobility
 - Isolated or confined
 - Medically fragile
 - Heavily dependent on medication
 - Heavily dependent on life-support systems
- Single-parent families, especially those who are:
 - On public “assistance”
 - Unable to take time off (e.g., during the response or recovery period)
- Socially isolated people
- Tourists
- Transients
- Unemployed
- Women, especially those who are:
 - Single
 - Single parents
 - Unemployed

Appendix B – Example

The following example is not intended to be comprehensive. Instead, it should serve as a tool to assist in the comprehension of the CVCA model.

Welcome to the municipality of Pretend, which covers approximately 1,500 square kilometres and is home to 7,000 residents. The community prospers mostly due to the agriculture (i.e., cattle-farming) industry. Approximately 5,000 of the residents reside in the town, supplying local farmers with the basic necessities such as groceries, banking, hardware, and entertainment. Eight years ago a meat-processing plant on the outskirts of the town was “revived” by a foreign parent corporation and has brought an influx of workers and cash flow into the area. Many improvements to the community have been made as a result.

With one river and various deep-water lakes, the municipality also enjoys a reputation as an excellent fishing spot, and three fishing lodges, accessible by floatplane or snowmobile, cater to tourists and corporate clients all year long. A seasonally-operated campground with hook-ups as well as tenting sites provides further recreational opportunities during the summer. It is usually full on the weekends. A small municipal airport is located west of the town and is utilized by corporate heads and a few ranchers.

The river splits the town in half. The north end is predominately the business section, older homes and the three schools (i.e., elementary, middle and high). All emergency services stations are on the north side providing quick response to the business area. The south side is predominately residential and new homes have been built to support the local boom in economy. A new elementary school was built there three years ago. Prime real estate is considered to be along the banks of the river. Two road bridges as well as a railway bridge connect the two sides of town.

The area has experienced flooding, which isolated both sides of the town. Forest fires have caused damage to crops and forced evacuations. The bingo hall suffered fire damage a few years ago on a busy Friday night. Minor injuries to several people occurred during the evacuation of the building. Over ten years ago there was some concern when a train car derailed, but the spill was contained and no evacuation was required. During these and other emergencies mutual aid was utilized from the city, which is approximately 100 km away from the town site.

A meeting has been called for all parties interested in assessing the community for its capacity during emergencies and disasters.

Step 1 – Create Planning Team

The municipality of Pretend has decided it may have some gaps in its emergency response planning. In order to address these gaps and enhance the community’s level of preparedness, a planning committee has been organized under the direction of the Director of Emergency Services. The rest of the Team consists of the following representatives:

- Town planner
- Fire Chief
- Chief of Emergency Medical Services
- Emergency Measures Officer for the Municipality
- Chamber of Commerce President
- Hospital Administrator
- Long-Term Care Director
- United Farmer's League President
- Meat-Processing Plant Occupational Health and Safety (OH&S) Officer
- Red Cross Chapter President
- Salvation Army
- Family and Community Social Services (FCSS) Director

Step 2 – Set Parameters

During the first meeting the Team goals were identified. It has been decided that the group will attempt to identify what special resources may be required to provide adequate response and recovery to the population since money has become available expressly for this objective. The Team has agreed to use the CVCA model to achieve this purpose with the additional support of past hazard and risk analysis documentation.

The original Team will continue to meet on a once-a-month basis for a total of 6 months by which time the aim is to have a “wish list” of required resources. This Team will maintain the core “team of planners” but additional committees and meetings may be required to achieve the goals and objectives.

The group has agreed to meet in the town office boardroom, which is also the designated Emergency Operations Centre. Formal minutes and documentation will be taken and information on the group's process will be distributed through the various organizations' newsletters.

Step 3 – Gather Information

Information has been gathered from various sources to provide a starting point for discussion. Emergency services personnel have provided area maps and summaries of the types of calls and emergencies that have required a multi-agency response. A copy of the latest census information has been collected. The town planners have provided statistics on the types of building construction and planning that have occurred within the past 10 years. Past copies of risk analyses performed are available for both the municipality and the plant. FCSS has made available information on services, cultural groups and socio-economic demographics for the municipality.

Step 4 – Define and Map Population

The Planning Team maps out the general population. Using detailed municipal maps with defined boundaries, they identify the population density, as it currently exists.

Step 5 – Define High Densities

The Team, now using a plastic overlay, shades in the areas of the municipality that are considered high-density with respect to population. They identify the downtown core, the heavy residential areas, the campground and the plant as some of these high-density places.

Step 6 – Divide into Operational Sectors

The municipality is divided into sectors. Areas such as the downtown core and residential areas are divided into multiple sectors. Less densely-populated areas such as the farms, forested areas and so on are divided into larger sectors. Another sheet of plastic is laid down over the map and these sectors are mapped out and identified by number. A total of 25 sectors are identified.

Step 7 – Define High-Risk areas

A hazard/risk analysis is done. Together the group members identify the high-risk areas of their municipality. This is done by past history or events, knowledge of the geographical layout of the area, as well as input from the group members. The following risks are identified:

- Banks of the river (flooding)
- Heavily forested areas (forest fires)
- Train line (derailments, hazardous materials)
- Airport (air traffic accidents)
- Processing plant (fires, bomb threats, industrial accidents, chemical leaks)
- Transportation routes (vehicle accidents)

A sheet of plastic is placed over the area map, and these high-risk areas are shaded in grey.

Step 8 – Identify Most Vulnerable categories

As a group the planners brainstorm which groups they believe are “most vulnerable” in their municipality according to the categories provided. Some of the groups identified include:

- Children in daycares and elementary schools;
- Immigrants (who have arrived to work in the plant);
- Language-limited;
- Persons within the downtown core relying on public transport (including many seniors);
- Large numbers of social assistance recipients;
- People with disabilities (i.e., in long-term care facility, hospital complex and various group homes);
- Medically fragile seniors in long-term care facility;

- Tourists (particularly campers);
- Pet owners;
- Livestock owners;
- Families of emergency services personnel.

Step 9 – Categorize Most Vulnerable sites

The planners now identify sites, which may be vulnerable or contain “most vulnerable” groups during emergencies. They include sites such as the long-term care facility, schools, the women’s shelter, the campground, bingo hall, processing plant, and isolated farm areas with large herds of animals (difficult to manage during evacuation). Each site is identified with a small red dot.

Step 10 – Identify MV “presence”

The group identifies other areas where “most vulnerable” groups may be found. These include the various farms in the area and a poorer section of town where many living on the poverty line reside.

Step 11 – Identify risk intersection

The planners and expanded Team now begin to analyze each sector of the municipality. This is done by looking at the map overlays and finding areas of intersection of both “high-risk” and “most vulnerable” groupings.

Step 12 – Identify critical periods

Still working with individual sectors of the municipality, the planners now identify how each group is affected by time (day, night and weekends). A matrix is completed for each sector, which identifies the time during which each “most vulnerable” group identified is most at risk. These times (day, night and holiday/weekend) are prioritized as to high, medium, and lowest risk for each group. For instance, it is identified that elementary schools and daycares are high risk during daytime hours and lowest during weekends and holidays.

Step 13 – Estimate needs

With significant input from “most vulnerable” group representatives, the planners now begin to compile a list of the likely emergency needs for each of the groups identified in each sector. Needs identified include such items as daily living aids, large animal truck hauling capacity, temporary day-care arrangements, and language translators.

Step 14 – Identify expectations

The capacity of each “most vulnerable” group within each sector is also considered. This is done by additional groups/participants that have agreed to meet with each of the “most

vulnerable” groups identified to get a realistic perception of how they would be impacted. This information once collected is brought back to the core team meetings for analysis.

Step 15 – Identify changes

Conditions that might change or affect the “most vulnerable” group within each sector is identified. For instance, it is determined that the only time the campground contains a “most vulnerable” group is during the summer season, particularly weekends and holidays.

Step 16 – Prioritize

Each identified sector is now considered relative to the entire municipality. Sectors are identified as to priority of need in an emergency if the entire municipality were affected by an incident.

Step 17 – Identify issues and take action

Concerns, issues, resources needed, and further development plans are now set in place. The “wish list” of resources has been completed. Ideas for future development have also been documented. Various groups have been established as a result of the planning process itself and have begun to informally consider the impact of an incident and how resources may be enhanced.

Step 18 – Review and update regularly

Appendix C – Templates

Template 1: Degree of hazard by vulnerable group within each Sector

The following template should be completed for *each Sector*. The horizontal (“Y”) axis is for the likely hazards, while the vertical (“X”) axis is for the identified vulnerable populations. Each hazard is also divided into time periods of day (D), night (N), and weekend or holidays (H). That should give the data more meaning.

Where known, the level of vulnerability (High, Medium, or Low) of each group should be identified in the respective column of the Hazard and Time.

Hazards: Sector ____

	Flood			Wind storm			Snow storm			Power outage			DG event		
	D	N	H	D	N	H	D	N	H	D	N	H	D	N	H
Youth															
Single parents															
Unemployed															
Homeless															

Template 2: Potential needs or key issues by Most Vulnerable group

The following template should assist you to capture the potential needs by each of the “most vulnerable” population groups, or their significant and related issues. While the list of issues may be as lengthy as you wish to make it, consider the following:

- Access (to facilities)
- Accessibility (to programs, services)
- Accommodation
- Animal care (e.g., pets, live stock)
- Cultural boundaries (e.g., mixing men and women)
- Duration and intensity of care
- Evacuation
- Family reunification
- Feeding (food, water, dietary requirements, feeding systems)
- Financial (e.g., out-of-pocket outlay, access to loans)
- Legal, insurance, procedural support
- Medications
- Notification
- Re-entry (to their homes, businesses, society)
- Sanitation
- Security (personal and property)
- Translation and language aid
- Transportation
- Warning

Potential Needs or Issues

	Notification	Transport	Accommodation	Meds.	Access	
Youth						→
Single parents						→
Unemployed						→
Homeless						→
	↓	↓	↓	↓	↓	↓

Appendix D – Key Models of Hazard Assessment

The following are some key models of hazard assessment that provide a broad perspective of the community's operational environment, infrastructure and so on.

The EPC model

This model, which is detailed in the *Evaluation of Peacetime Disaster Hazard* (Emergency Preparedness Canada, 1992), follows seven steps:

- Review and update as necessary a list of hazards.
- Collect relevant historical data (e.g., whether the hazard has occurred; if “yes”, how frequently, degree of damage, number of persons affected, problems encountered, and costs incurred). The information is then rated on a scale from 1 to 5.
- Consider changes to risk factors or circumstances that affect the probability of the hazard. These are given a value from -3 for significantly reduced risk to +3 for significantly increased risk.
- Consider the risk factors external to the community. These are given values from -3 to +3 as in the above step.
- Express community vulnerability as a value from 0 (i.e., no change from previous assessment) to 3 (i.e., high change).
- For each hazard add the values (Steps 2 – 5), compare values, and assign priorities.

The FEMA model

The FEMA model assesses four criteria, which are then given a rating (i.e., High, Medium, Low). The model asks planners to look at the following criteria:

- History of the event in the area in question
- Vulnerability of people. This involves two factors:
 - Population (e.g., vulnerable groups, density, proximity to hazard areas)
 - Property (e.g., value, proximity to danger areas)
- Maximum degree of threat, or the portion of the community likely to be affected
- Probability of occurrence over a period of a year

These four criteria are not valued equally. (They are given the following values: 2, 5, 10 and 7 respectively.) Planners need to score each hazard by multiplying the rating given in each criterion by its “value” and then adding the four sub-totals for a hazard-specific rating. The model suggests that hazard scores of over 100 should place those hazards as “priority”.

The APELL model (Awareness and Preparedness for Emergencies at Local Level)

This model is “based on the 1989 *Swedish Rescue Services Board Handbook* and refined by the United Nations Environment Programme Industry and Environment Program Activity Centre (UNEP) (1991). It is primarily aimed at reducing technological accidents and improving emergency preparedness” (Pearce, 2000). It contains the following steps (Pearce, 2000):

- Choose the object of study (industrial facility, school, commercial operation).
- Determine what operations are being conducted at that object (e.g., manufacturing, selling, service, etc.).
- List the items capable of producing a hazard (e.g., chemicals, processes, or geological features) along with an estimate of the amount of the items in question (if possible).
- Determine the risk types – the type of hazardous event that might occur (e.g., explosion, fire, earthquake).
- Determine who or what would be threatened. The guidelines indicate three primary areas: people, the environment, and property.
- Consider the consequences of the event taking place (e.g., contaminated drinking water, damage to infrastructure).
- Examine and rank four possible consequences: life and health, the environment, property, and the speed of development of the hazard. These areas fall under the category “seriousness”, and each has a range of values associated with it.
 - Consequences for life and health range from unimportant (temporary slight discomfort) to catastrophic (more than 20 deaths, hundreds of serious injuries, and more than 500 evacuated).
 - Consequences for the environment range from unimportant (no contamination) to catastrophic (very heavy contamination, or widespread effects).
 - Consequences to property range from unimportant (less than \$1,000) to catastrophic (greater than \$20,000).
 - The speed of development is the attempt to determine if there is an adequate warning system, with values ranging from one for having an early and clear warning system to five for having no warning system.
- The probability is determined from a range of one for improbable (occurring less than once per 1,000 years) to five for probable (occurring more than once a year).
- Based on these rankings, compare the consequences and then rank them in terms of priority.
- Include any additional comments.

The SMUG model

This model assesses each hazard according to five factors, each rated from 1 (Low) to 10 (High). This approach allows for consensus building regarding the relative importance of each hazard by key stakeholders. The five factors are:

- Seriousness: the relative impact of the hazard in terms of dollars and people.
- Manageability: Can the community act before the event (High) or only after (Low)?
- Urgency: When is action needed? Now (High) or later (Low)?
- Risk: What is the probability of this hazard occurring?
- Growth: If nothing is done, will the hazard grow worse (High) or remain static (Low)?

The relative “value” of each hazard is the sum of the weighted factors.

The NOAA model

The NOAA model is available on CD-ROM at no cost through NOAA Coastal Services Center home page (www.csc.noaa.gov). It and the HIRV model by Pearce (2000) are the basis of the CVCA model.

The NOAA model, which encourages the use of GIS, provides an eight-step process for conducting community-wide HRV analyses. Each of the steps focuses on a separate component of the community and encourages an analysis of available data against those areas or facilities that are considered “critical”.

The process outlines the “input”, process, and “output” for each of the steps. The following summary highlights the eight steps and their subcomponents:

1. Hazard identification

- Determine hazards to be considered.
- For each selected hazard establish its relative probability, area of potential impact, and likely magnitude. Score each hazard based on a scale of 1 to 5, where 1 is Low and 5 is High, and list them in a matrix:

(Frequency + Area of impact) x Magnitude = Total score

2. Hazard Analysis

- For each selected hazard, map “risk consideration” areas to identify high potential impact areas.
- Assign scores or relative ranking within the risk areas. (The model accepts that some risk areas are ranked along a different scale.)

3. Critical Facilities Analysis

- Identify critical facility categories for the community (e.g., shelters, care facilities, response, utilities, hospitals, schools, communication, government, financial, transportation).
- Complete the inventory of “critical facilities”.
- Identify the overlap between critical facilities and high-risk areas.
- Conduct a vulnerability assessment for each critical facility within the hazard risk areas. (Include structural and operational factors.)

4. Societal Analysis

- Identify areas of special consideration (i.e., those areas that include a high concentration of populations at risk, or vulnerable populations).
- Identify situations in which special consideration areas are located in high-risk areas.
- The third step is to complete an inventory (i.e., number of households) in each area of

special consideration that is located in a high-risk area.

5. Economic Analysis

- Identify primary economic sectors and locate key economic centres.
- Identify intersections (or overlap) of economic centres and high-risk areas.
- Conduct a general inventory of high-risk economic centres.
- Identify large employers and their intersection with high-risk areas.
- Conduct a vulnerability analysis on structures of large employers as “critical facilities.”

6. Environmental Analysis

- Identify secondary-hazard risk consideration sites (e.g., areas with potential for secondary environmental impact from natural hazards) and key environmental resource sites (e.g., hazardous or toxic material sites).
- Identify intersections (or overlap) of secondary-hazard risk consideration areas, environmental resource sites, and high-risk consideration areas.
- Identify key environmental resource locations (i.e., areas particularly sensitive to secondary hazard impacts) and their proximity to secondary risk sites.
- Conduct vulnerability analysis on priority secondary-risk sites, as “critical facilities.”

7. Mitigation Opportunities Analysis

- Identify intersection or overlap of undeveloped land and high-risk areas.
- Complete an inventory of high-risk undeveloped land.
- Assess the status of existing (US) flood insurance program.

8. Results Summary

This final section is intended to provide:

- Summary of the preceding seven steps.
- Recommendations and priorities for completing mitigation-related actions.

An addendum note: The NOAA model should include an eighth factor – “Political Analysis,” which would contain the following steps:

- a) Identify the key political issues inherent to high-risk areas.
- b) Identify the political forces for or against mitigation-related actions in the high-risk areas.
- c) Weight the likely political dynamics.
- d) Identify “reasonable expectations” or corrective (political) action.

The UNDRO model

The UNDRO model is limited to natural hazards (divided into hydrological and geological events) and only one technological hazard (i.e., pollution from damage to industrial plants). The model has the following steps:

- Review historical records and prevailing geological or topological conditions.
- Identify hazards (H).
- Determine the elements at risk (E). The model requires an inventory of:
 - Structures
 - Special structures, homes, prevalent building types
 - Infrastructure
 - Waterways, telecommunications, sewage systems
- Groupings of elements at risk:
 - Roads, railways, water supplies, electricity supplies, gas and oil supplies
 - Determine vulnerability (V), or the ability to withstand damage, of the elements at risk. The model uses a scale of 0 (no damage) to 10 (total damage)
- Determine expected degree of loss (Rs) due to each hazard, which includes:
 - Community services
 - Infrastructure
 - Housing areas
 - Economic areas
- Classify the risks as:
 - Acceptable (i.e., accumulated value below safety margin)
 - Marginally acceptable (i.e., accumulated value above safety margin)
 - Marginally unacceptable
 - High
 - Very high
 - Critical
 - Actual disaster
- Map the various risk overlaps
- Total risk expressed as: $R_t = (E) (R_s) = (E) (H \times V)$
- Consider the socio-economic impact of disaster (i.e., in both quantifiable and qualitative cost terms)

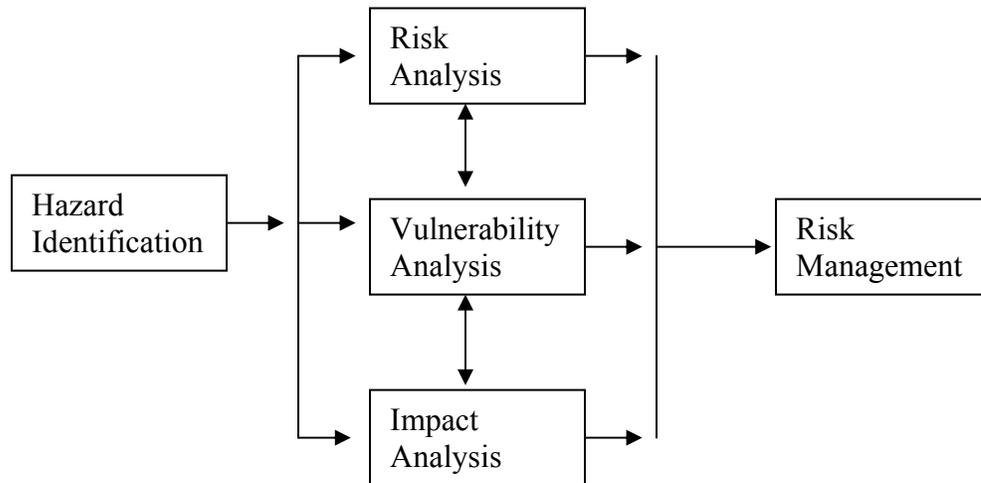
The UNDRO model uses the Human Capital Approach, which assesses lives and suffering in economic terms. It measures, in direct costs, the value of damage to public investments and housing and the economic impact.

The HIRV model

The Hazard Impact Risk Vulnerability (HIRV) model was developed by Laurie Pearce (2000) as part of her doctoral thesis. It is a tool designed for local communities or regional governments, and is based upon local knowledge supplemented by experts. The model calls for the creation of a broad-based committee of experts.

The model (see below) has five major components, each relating to a specific process. Their collective outcome leads to a vulnerability assessment of a region, a community, or even a segment of a community.

The HIRV model



Source: Pearce (2000)

The “*Hazard Identification*” component is intended to identify and clarify those hazards that may lead to a disaster. The model contains a list that is divided into three categories: “(1) natural; (2) diseases, epidemics, and infestations; and (3) person-induced.” This process also includes a review of the history of each hazard.

The “*Risk Analysis*” component aims to provide a clearer understanding of the risks confronted by the community. Each hazard is analyzed to determine the history of that hazard in the area, current risk factors (i.e., those that exist against a list of potential), the degree of certainty of the data upon which the analysis is made, and a risk rating (i.e., from +3 or “hazard is most likely to occur” to -3 or “hazard is most likely not to occur”).

The “*Vulnerability Analysis*” component aims to provide a clearer understanding of the vulnerability confronted by the community to the identified hazards. “Vulnerability” is analyzed by reviewing each hazard against four key categories: people, places, preparedness, and time. Each of the four categories, of each hazard, is rated for its vulnerability. A scale of +3 to -3 is used (i.e., similar to the “Risk Analysis” above).

The certainty of the assessment for each hazard is then identified.

The “*Impact Analysis*” component aims to provide a clearer understanding of the impact of each hazard on the population. The model recommends four areas of consideration of “impact”: social, environmental, economic, and political. A scale of +3 (very high impact) to +1 (no impact) is used. The impact analysis of each hazard is then

supplemented with an identification of the degree of “certainty”, and an overall “impact rating” is assigned.

The “*Risk Management*” component combines the previous analyses into one frame to illustrate the level of risk and vulnerability for each hazard within each area. The model encourages the use of colours to illustrate the various levels or categories.

Appendix E – Select Bibliography

- Alexander, D. “The Study of Natural Disasters, 1977-1997: Some Reflections on a Changing Field of Knowledge.” *Disasters* 21, 4 (1998): 284-304.
- Atchley, R. “Defining the Vulnerable Older Population.” In *The Vulnerable Aged—People, Services, and Politics*. Z. Harel, P. Ehrlich, R. Hubbard, eds. Springer Publishing Company, 1990, pp. 18-31.
- Barrow, G. . *Aging, the Individual, and Society*. St. Paul, MN: West Publishing Company, 1989, pp. 7-11.
- Blaikie, Piers, T. Cannon, I. Davis, and B. Wisner. *At Risk: Natural Hazards, People's Vulnerability, and Disasters*. New York: Routledge, 1994.
- Bolin, R., and D. Klenow. “Response of the Elderly to Disaster: An Age Stratified Analysis.” *International Journal of Aging and Human Development* 16, 4 (1983): 283-96.
- Bolin, R.C., and P. Bolton. *Race, religion, and ethnicity in disaster recovery*. Boulder, CO: University of Colorado, 1986.
- Buckle, P., G. Mars, and S. Smale. “New approaches to assessing vulnerability and Resilience.” *The Australian Journal of Emergency Management* 15, 2 (2000): pp. 8-14.
- California Governor’s Office of Emergency Services.. *Meeting the needs of vulnerable people in times of disaster: A guide for Emergency Managers*. California: Author, May 2000.
- Chambers, R. Editorial Introduction: “Vulnerability, Coping and Policy.” *IDS Bulletin* 20 2 (1989):1-7.
- Emergency Preparedness Canada. “Evaluation of Peacetime Disaster Hazard.” An Emergency Preparedness Program Course – including Annexes A-D. Ottawa: Emergency Preparedness Canada, 1992.
- Enarson, E., and B.H. Morrow, eds. *The Gendered Terrain of Disaster: Through Women's Eyes*. Westport, CT: Praeger Publishers, 1998.
- FEMA. *Multi-hazard identification and risk assessment: A cornerstone of the national mitigation strategy*. Washington, DC: FEMA, 1997.
- Fothergill, A. “Gender, risk and disaster.” *International Journal of Mass Emergencies and Disasters* 14, 1 (March 1996): pp. 33-56.

- Fothergill, A., E.G.M. Maestras, and J.D. Darlington. "Race, ethnicity and disasters in the United States: A review of the literature." *Disaster* 23, 2 (1999): pp. 156-173.
- Gordon, J. "Risk assessment and management in local government emergency planning, Part 1: Basic concepts." *Canadian Journal of Emergency Management* 2, 2 (2000): pp. 11-12.
- Haas, J.E., R.W. Kates, and M.J. Bowden, eds. *Reconstruction following disaster*. Cambridge, MA: MIT Press, 1977.
- Health Canada. *Risk, vulnerability, resiliency – Health system implications: Background paper, roundtable discussion, reflections, selected applications*. Ottawa: Queen's Printers, February 1997.
- International Federation of Red Cross and Red Crescent Societies (ICRC). *Vulnerability and Capacity Assessment*. Geneva: Author, 1993.
- Kane, R. "Venerable and Perhaps Vulnerable: The Nature and Extent of Vulnerability Among the Aged." In *The Vulnerable Aged — People, Services, and Politics*. Z. Harel, P. Ehrlich, R. Hubbard, eds. Springer Publishing Company, 1990, pp. 4-17.
- King, D., and C. MacGregor. "Using social indicators to measure community vulnerability to natural hazards." *The Australian Journal of Emergency Management* 15, 3 (2000): pp. 52-57.
- Lewis, J. *Development in Disaster-Prone Places: Studies of Vulnerability*. London: Intermediate Technology Publications Ltd., 1999.
- Lillibridge, S. "Tornadoes." In *The Public Health Consequences of disasters*. E. Noji, ed. Oxford University Press, 1997, pp. 228-44.
- McFarlane, A.C., and R. Yehuda. "Resilience, vulnerability, and the course of posttraumatic reactions." In *Traumatic stress: The effect on mind, body and society*. B. Kolk, A. McFarlane, and L. Weisaeth, eds. New York: Guilford Press, 1996.
- Melick, M., and J. Logue. "The Effect of Disaster on the Health and Well-Being of Older Women." *International Journal of Aging and Human Development* 21, 1 (1985): 27-38.
- Merriman, P.A., and C.W.A. Browitt, eds. *Natural Disasters: Protecting Vulnerable Communities*. London: Thomas Telford, 1993.
- Mileti, D.S. *Disasters by Design: A Reassessment of Natural Hazards in the United States*. Washington, D.C.: Joseph Henry Press, 1999.
- Morrow, B.H. "Identifying and Mapping Community Vulnerability." *Disasters* 23, 1 (1999): 1-18.

- Moser, Caroline O.N. "The Asset Vulnerability Framework: Reassessing Urban Poverty Reduction Strategies." *World Development* 26, 1 (1998): 1-19.
- Newburn, T. *Disaster and after: Social work in the aftermath of disaster*. London: Jessica Kingsley, 1993.
- Pearce, L. *An integrated approach for community Hazard, Impact, Risk and Vulnerability analysis: HIRV*. Unpublished doctoral thesis. Vancouver: UBC, 2000.
- Phifer, J.F., and F.H. Norris. "Psychological Symptoms in Older Adults Following Natural Disaster: Nature, Timing, Duration, and Course." *Journal of Gerontology* 44, 6. (November 1989): S207-17.
- Poulshock, S., and E. Cohen. "The Elderly in the Aftermath of a Disaster." *Gerontologist*. (August 1975): 357-1.
- Raphael, B. *When disaster strikes: How individuals and communities cope with catastrophe*. New York: Basic Books, 1986.
- Rivers, J. "Women and Children last: An essay on sex discrimination in disaster." *Disasters* 6, 4 (1982): pp. 256-267.
- Shapiro, J.H. *Communities of the alone: Working with single room occupants in the city*. New York: Association Press, 1971.
- Solis, G.Y., H.C. Hightower, and J. Kawaguchi. *Guidelines on cultural diversity and disaster management*. Report for Emergency Preparedness Canada. Ottawa: EPC, 1997.
- Staes, C., J.C. Orengo, J. Malilay, J. Rullan, and E. Noji. "Deaths Due to Flash Floods in Puerto Rico, January 1992: implications for prevention." *International Journal of Epidemiology* 23 (1994): 968-975.
- Townsend, A. and Z. Harel. "Health Vulnerability and Service Need Among the Elderly." In *The Vulnerable Aged—People, Services, and Politics*. Z. Harel, P. Ehrlich, R. Hubbard, eds. Springer Publishing Company, 1990, pp. 32-52.
- Winchester, P. *Power, choice and vulnerability: A case study in disaster management in South India 1977-1988*. London: James & James Science Publishers, 1992.
- Yasui, E. *Analyzing People's Vulnerability to the Great Hanshin Earthquake: Interface Between Physical and Human Aspects of Disasters*. Master's Thesis, International Studies Program. Eugene, OR: University of Oregon, 1997.