

Assessment and Test Application of the Community Vulnerability Assessment Tool (CVAT) in Grand Bay-Westfield, NB

FINAL REPORT

Prepared for: Climate Change Secretariat
Department of Environment
Government of New Brunswick

and

Atlantic Climate Adaptation Solutions
Association (ACASA)

Date: March 30, 2012

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EXECUTIVE SUMMARY

This report summarizes the lead-up to and outcomes of using the Community Vulnerability Assessment Tool (CVAT) in a test application in Grand Bay-Westfield, New Brunswick on the climate change issue of flooding. Additionally, from conducting the test application, it assesses CVAT's process and tools; the ability of CVAT to realize its identified aims; and, the potential for CVAT's wider application in New Brunswick.

Lead-up planning to a community workshop held to examine the issue of flooding in Grand Bay-Westfield entailed the CVAT process steps of introducing CVAT to Grand Bay-Westfield's Planning Advisory Committee (PAC), conducting background informant interviews, acquiring relevant mapping of the community, and mailing out of letters of invitation to invited workshop participants.

Held February 20, 2012 in Grand Bay-Westfield's Municipal Building, the CVAT Workshop was attended by twelve participants. Using the provided CVAT Workbook on flooding, the attendees were asked to identify areas of the community that have been vulnerable in the past to river and localized flooding and what areas might be considered at risk going forward. In the course of this identification, another climate change adaptation tool, the LiDAR modelling tool, was introduced.

Of ten information outcomes gained by the participants from using the CVAT process in Grand Bay-Westfield, four key outcomes were the following:

1. Many of the climate changes already taking place in New Brunswick (e.g. rising temperatures, increased rainfall, less snowfall in southern part of province, extreme rainfall events, warmer winters, etc.) have been noted as occurring in Grand Bay-Westfield.
2. Changes in provincial river conditions (e.g. rising river levels, less ice, shorter ice season, etc.) have also been noted as occurring in Grand Bay-Westfield in recent years.
3. Years of past significant river floods in the community were identified as: 1936, 1973, 2005, 2008.
4. Areas of Grand Bay-Westfield that have been affected by river and localized flooding in the past and are on the community's 'watch list' going forward are:
 1. Brittain Road on the Nerepis River (river flooding)
 2. Willow Bank Trailer Park at the mouth of the Nerepis River (river flooding)
 3. Hoyt Brook (localized flooding)
 4. Brundage Point Ferry Landing (river flooding)
 5. 150 Nerepis Road (river flooding)
 6. Riverside Park Road (river flooding)
 7. Brandy Point Road (river flooding)
 8. River Steet homes (below Hardware store on river front) (river flooding)
 9. Oak Lane in its undeveloped portion (river flooding)
 10. Hazel Street with its lift station at the bottom of the street (river flooding)
 11. Subdivision including Ridge Way Edgemount roads (localized flooding)
 12. Shannon Road (river flooding)
 13. Sewage Lagoon on Shannon Road (river flooding)

Participants were asked at the end of the workshop to assess the usefulness of the Community Vulnerability Assessment Tool in determining town's potential risk to climate change issues. They concluded that for a community such as Grand Bay-Westfield, with extensive emergency measures plans in place, including additional plans for severe storm and floods, this tool would benefit from being modified (shortened). That said, as a result of the CVAT workshop session, participants indicated they

were better informed about climate change impacts on their community and would recommend the workshop to others.

Asked to list what Grand Bay-Westfield's potential next steps should be relative to adapting to the climate change impacts of flooding, the following actions were identified:

1. If available, LiDAR mapping be introduced for use by the community.
2. Continue public education on the issue of flooding in the community.
3. Continue periodic updating of the community's Emergency Contact Information for residents, businesses and the Emergency Measures Response Plan.

LPA's assessment of CVAT's test application in Grand Bay-Westfield concluded:

- The value of CVAT's use in assessing climate change impacts in a given community lies in its ability to capture local knowledge about past and current climate change issues plus to stimulate thinking about how adverse impacts of climate change going forward will require the community to stay on top of its EMO planning and be more cognizant of climate change impacts in its land use planning.
- CVAT provides the capability to create an informative benchmark document for community referral going forward on such climate change issues as flooding.
- It is the LiDAR-based wet areas and flood modelling tool, however, which achieves what the CVAT aims to do, but cannot achieve as readily, or effectively, namely, providing communities with a 'predictive capability'. LiDAR is able to assist community planners, landowners, development applicants, architects, and engineers in both seeing and assessing climate change impacts in 'what if' modelling scenarios. Further it is what motivates a community to action, as occurred in Grand Bay-Westfield in their staff using the LiDAR tool within two weeks of the CVAT Workshop.
- While the Town of Grand Bay-Westfield, population approximately 5000 people, was chosen for the test application of CVAT in consideration of it being a New Brunswick community having a relatively low level of human and financial capacity to deal with climate change adaptation issues, the town demonstrated that it had actually a relatively high capacity in view of its existing plans for emergencies and its well-organized departments, planning and emergency response committees.

Overall, with a few recommended modifications made, it is concluded that the Community Vulnerability Assessment Tool has a useful place in assisting other New Brunswick communities in understanding their past and present reality with respect to climate change issues and their impacts. It is, however, when CVAT is combined with LiDAR wet area and flood modelling, that community decision-makers will be in the best position to adapt to predicted climate change impacts in New Brunswick.

Out of this test application, recommended among the next steps for the Climate Change Secretariat's consideration were the following actions:

1. Rather than the Department of Environment continuing to go one-on-one to communities to either introduce tools or assist them in climate change planning, a more time and cost efficient approach would be to build on New Brunswick's Emergency Measures Response organization's Emergency Management Courses, with the Climate Change Secretariat both developing and offering a scheduled course module and trainer in climate change adaptation planning.
2. That the Department of the Environment and the Department of Natural Resources stage a one-day forum wherein the potential of LiDAR mapping would be showcased as a way to improve local planning efforts and reduce costs associated with climate change risk. In so doing, the aim of the forum would be to galvanize support for an initiative that would pull together funding partners from industry, municipalities, professional organizations and the province to see that all of New Brunswick has LiDAR modelling capability.

Assessment and Test Application of the Community Vulnerability Assessment Tool (CVAT) in Grand Bay-Westfield, NB

PART 1 - Overview

A. Purpose

This report summarizes the lead-up to and outcomes of using the Community Vulnerability Assessment Tool (CVAT), developed and piloted in Newfoundland and Labrador, in a test application in Grand Bay-Westfield, New Brunswick. Additionally, from conducting the test application, it assesses CVAT's process and tools; the ability of CVAT to realize its identified aims; and, whether or not the tool would be useful to use more extensively in New Brunswick.

The report is presented in three sections. Part I provides an overview of this test application's place within a larger Atlantic climate change initiative plus highlights its climate change adaptation tools. Part II presents the test application and its community generated outcomes, while Part III assesses CVAT.

B. Background

As part of the Atlantic Regional Adaptation Collaborative (Atlantic RAC), a joint Federal/Provincial funding agreement, the Province of New Brunswick is participating in projects designed to assist communities in reducing their risk to climate change, with the overall goal being to ensure that provincial and municipal decision-makers consider climate change adaptation in their day-to-day decisions. Of the six projects underway, the *Lower Saint John River Project*, which includes the communities of Grand Bay-Westfield, Saint John, Rothesay, Quispamsis, and Hampton, has identified the climate change issue of flooding as its focus.¹ It is therefore this issue that the test application of CVAT addressed in Grand Bay-Westfield. Grand Bay-Westfield was chosen as a small community considered as having a relatively low level of capacity to deal with climate change adaptation issues (human and financial resources, size, etc.) and hence a tool like CVAT might prove of use to them.

¹ The others being: the Acadian Peninsula Project; Richibucto Saltwater Intrusion Project; Greater Moncton Project; Grand Falls Project; Tantramar Dykelands Project.

C. Climate Change Adaptation Tools Used in Grand Bay-Westfield

Community Vulnerability Assessment Tool (CVAT)

The Community Vulnerability Assessment Tool (CVAT) developed for use in rural communities in Newfoundland and Labrador, represents a modified version of the National Oceanic and Atmospheric Administration's (NOAA) Community Vulnerability Assessment Tool. Refined by Dr. Kelly Vodden's team at Memorial University's Department of Geography, the Community Vulnerability Assessment Tool (CVAT) is designed as a toolkit comprised of various climate change adaptation tools, which, when used in a facilitated process, helps guide communities in looking at specific climate change issues. The tool's twofold aims are increasing community understanding of climate change impacts as well as moving a community to action in adapting to climate change.

Within the toolkit, CVAT uses the primary tool of individual workbooks developed for each of six climate change issues—river flooding, coastal issues, drinking water, slope movement, winter issues and forest fires. The workbook leads community participants through a seven-step process that starts with problem identification and ends with adaptation options. In going through the process, relevant background information and mapping are assembled and informant interviews are conducted. This leadup work is followed with a workshop session where the CVAT workbook and assembled community mapping are used to plan for current and future climate change issues. Both during and after the workshop, participants give consideration to the community's adaptation options. The outcomes of the process and the participants' evaluation of it are then conveyed to the community in a Community Report.

Light Detection And Ranging (LiDAR) Tool

New Brunswick's Atlantic RAC projects, and particularly its Lower Saint John River Project, have benefitted from an innovative wet areas mapping (WAM) application developed at the University of New Brunswick's Faculty of Forestry and Environmental Management under Dr. Paul Arp and his research associate Jae Ogilvie. Referred to simply as LiDAR modelling or mapping, this computer-based modelling tool uses laser pulse data obtained from aerial surveying in combination with Geographic Information Systems (GIS) data to create high resolution 'bare earth' digital elevation models that can be used to map wet areas and perform flood modelling.

Within Grand Bay-Westfield's test application of CVAT participants were additionally introduced to LiDAR modelling, which of their own accord, they evaluated as well.

PART 2 – Test Application of CVAT in Grand Bay-Westfield

D. Steps Leading to CVAT Workshop February 20, 2012

Lead-up to the community workshop that was held February 20, 2012 to use the CVAT planning workbook entailed the following steps, as outlined in the CVAT process, and agreed to by the community:

1. An initial meeting between Development Officer, David Taylor, and LPA's principal, Leone Pippard, to discuss proposed process steps and timelines. (January 3, 2012)
2. LPA's introduction of the CVAT tool to Grand Bay-Westfield's Planning Advisory Committee (PAC)² along with the envisioned workshop process. (January 16, 2012)
3. Conduct of LPA interviews with PAC members and selected informants, as chosen by the PAC, in order to gather background information on local climate and water-related issues along with any available photographs of past flooding events. (January 16-27, 2012)
4. Acquisition and assembly of aerial photographic mapping of Grand Bay-Westfield by the town's Development Officer for use by Jae Ogilvie of the University of New Brunswick's Faculty of Forestry and Environmental Management in preparing their LiDAR presentation modelling Grand Bay-Westfield. (January, 2012)
5. Preparation and mailout of letters of invitation by the PAC to selected Grand Bay-Westfield residents that in PAC's estimation would provide useful knowledge of, or first hand experience with, the issue of flooding in the community, along with provision for pick-up of the CVAT workbooks by those confirmed to attend the workshop. (January 26, 2012 and again February 13)³
6. Booking and setup of the workshop venue by the community. (February, 2012)

E. Workshop Summary

² It should be noted that Grand Bay-Westfield's Planning Advisory Committee's powers and duties accrue from the province's *Community Planning Act*, these being a) to advise and make recommendations to Council on any matter related to community planning, b) give its views to Council on any by-law proposed to be enacted under the *Community Planning Act*, and c) perform such powers and duties related to the community planning as given to it by the *Community Planning Act* or by Council. The PAC and Council of Grand Bay-Westfield receive professional planning advice from engineers, and surveyors etc., and use these firms' GIS mapping services.

³ On cancellation of the initial workshop to be held February 12 due to poor driving conditions following a storm.

Held February 20, 2012 in Grand Bay-Westfield's Municipal Building, the Centrum, the CVAT Workshop was attended by twelve participants (**Appendix 1 – Workshop Participants**), including all members of the town's Planning Advisory Committee, three municipal staff, and two area residents. The opening presentation by LPA explained the CVAT Process using an existing CVAT slide presentation⁴. This was followed with a brief overview of *Climate Change in New Brunswick*, a powerpoint presentation developed by the Climate Change Secretariat of New Brunswick's Department of Environment.⁵ Thereafter, using the Community Vulnerability Risk Assessment Tool *Workbook* on flooding, participants were asked to engage in a discussion identifying areas of the community that have been vulnerable to river and localized flooding in the past and what areas might be considered at risk going forward. In the course of this identification, the LiDAR predictive mapping tool was introduced⁶ showcasing four areas in the community that are currently known to be vulnerable to flooding, whether river flooding or localized flooding caused by heavy rainstorms. Additional community locations of interest, as identified by workshop participants, were reviewed using LiDAR. The workshop concluded with an evaluation of the CVAT Tool, the LiDAR mapping tool and of the CVAT workshop itself by the participants.

F. Workshop Outcomes

Lead-up to the February 20 workshop and the workshop itself identified:

- Many of the climate changes already taking place in New Brunswick (e.g. rising temperatures, increased rainfall, less snowfall in southern part of province, extreme rainfall events, warmer winters, etc.) have been noted as occurring in Grand Bay-Westfield. The mentioned impacts, obtained primarily from the informant interviews, are summarized in **TABLE 1 – Noted Climate Change Impacts in Grand Bay-Westfield**)⁷.
- Changes in provincial river conditions (e.g. rising river levels, less ice, shorter ice season, etc.) have also been noted as occurring in Grand Bay-Westfield in recent years (TABLE 1).

⁴ CVAT documentation had been previously supplied by the Department of the Environment to the municipality, including CVAT process and workbook section on Flooding, which was used in the Grand Bay-Westfield CVAT workshop.

⁵ At the community's request, this presentation has been provided to Grand Bay-Westfield by the Climate Change Secretariat for on-going education purposes.

⁶ The LiDAR map developed for Grand Bay-Westfield has been provided in PDF format for on-going community use, courtesy of Dr. P. Arp and J. Ogilvie.

⁷ Source: Interviews with residents. See **Appendix 2 – CVAT Informant Interviews: Grand Bay-Westfield**.

- Social, economic and environmental impacts of climate change in Grand Bay-Westfield, also shown in TABLE 1, are seen to be both positive and negative, with increased potable water supply for wells in the community and fertilization of agricultural land seen as positives, while power outages, overflow of streams, drainage ditches, and roads, being seen as negative.
- Years of past significant river floods in the community were identified as: 1936, 1973, 2005, 2008.
- The usual time that major river floods occur in the community is spring (the spring freshet).
- Sudden heavy rains/rain storms are considered to cause more damage to municipal infrastructure than river flooding, which affects mostly private property. This is recognized as likely to occur more frequently going forward.
- Localized flooding is not considered an issue unless there is a problem with drainage infrastructure in the community (e.g. active blockage of a drainage pipe/channel). The community is actively inspecting and maintaining its infrastructure to avoid localized flooding.
- Areas of Grand Bay-Westfield that have been affected by river and localized flooding in the past and are on the community's 'watch list' going forward (See **Map 1** following Table 1) are:
 14. Brittain Road on the Nerepis River (river flooding)
 15. Willow Bank Trailer Park at the mouth of the Nerepis River (river flooding)
 16. Hoyt Brook (localized flooding)
 17. Brundage Point Ferry Landing (river flooding)
 18. 150 Nerepis Road (river flooding)
 19. Riverside Park Road (river flooding)
 20. Brandy Point Road (river flooding)
 21. River homes (below Hardware store on river front) (river flooding)
 22. Oak Lane in its undeveloped portion (river flooding)
 23. Hazel Street with its lift station at the bottom of the street (river flooding)
 24. Subdivision including Ridge Way Edgemount roads (localized flooding)
 25. Shannon Road (river flooding)
 26. Sewage Lagoon on Shannon Road (river flooding)
- In addition to having an Emergency Measures Response Plan, Grand Bay-Westfield also has in place a Severe Flood Plan and a Severe Storm Plan, both of which are periodically updated. In this regard an Emergency Contact Sheet is sent out to the community occasionally for updating as it is used for the purpose of notifying residents in the event of an emergency.

- There is praise from participants for provincial EMO ability to provide information during river flooding events relative to when peak-of-flood comes down the St. John River.

TABLE 1 – Noted Climate Change Impacts in Grand Bay-Westfield

(Assembled from Informant Interviews – Appendix 2)

A. Weather Changes Noted for Grand Bay-Westfield in Recent Years

- Stronger and more frequent wind storms and rain storms.
- Heavier rains over a shorter period of time.
- Wind and severe rain storms causing more damage to community infrastructure than flooding.
- Timing of seasons: winter starts later and is shorter.
- Fall seems to be lasting longer.
- Seasons are not as distinct as they used to be.
- Snow in November is becoming more of an anomaly than in the past.
- There's less snow.
- Not as cold as it used to be; winters are 'yo-yoing' – warm, cold, warm....
- "Spring has lost its identity".

B. Changes Noted for the Lower St. John River at Grand Bay-Westfield

- River is more open in winter: December/January still no ice and river opens up earlier in the Spring
- River is now consistently a lot higher than it used to be, even in late fall and January.
- River level is not going down in late summer (August) like it used to.
- Ice is thinner when it forms and of poorer quality due to lack of early freeze-ups in late fall.
- Noticing mini-freshets in the late fall/early winter that didn't occur before.
- Sedimentation from runoff of Base Gagetown into Nerepis and beyond is making for murky chocolate-coloured waters, muddy river bottoms, and is filling in some coves.
- Major floods are coming closer together. Example 2005 then 2008. Last large flood was 1973.

C. Social, Economic, Environmental Impacts Noted

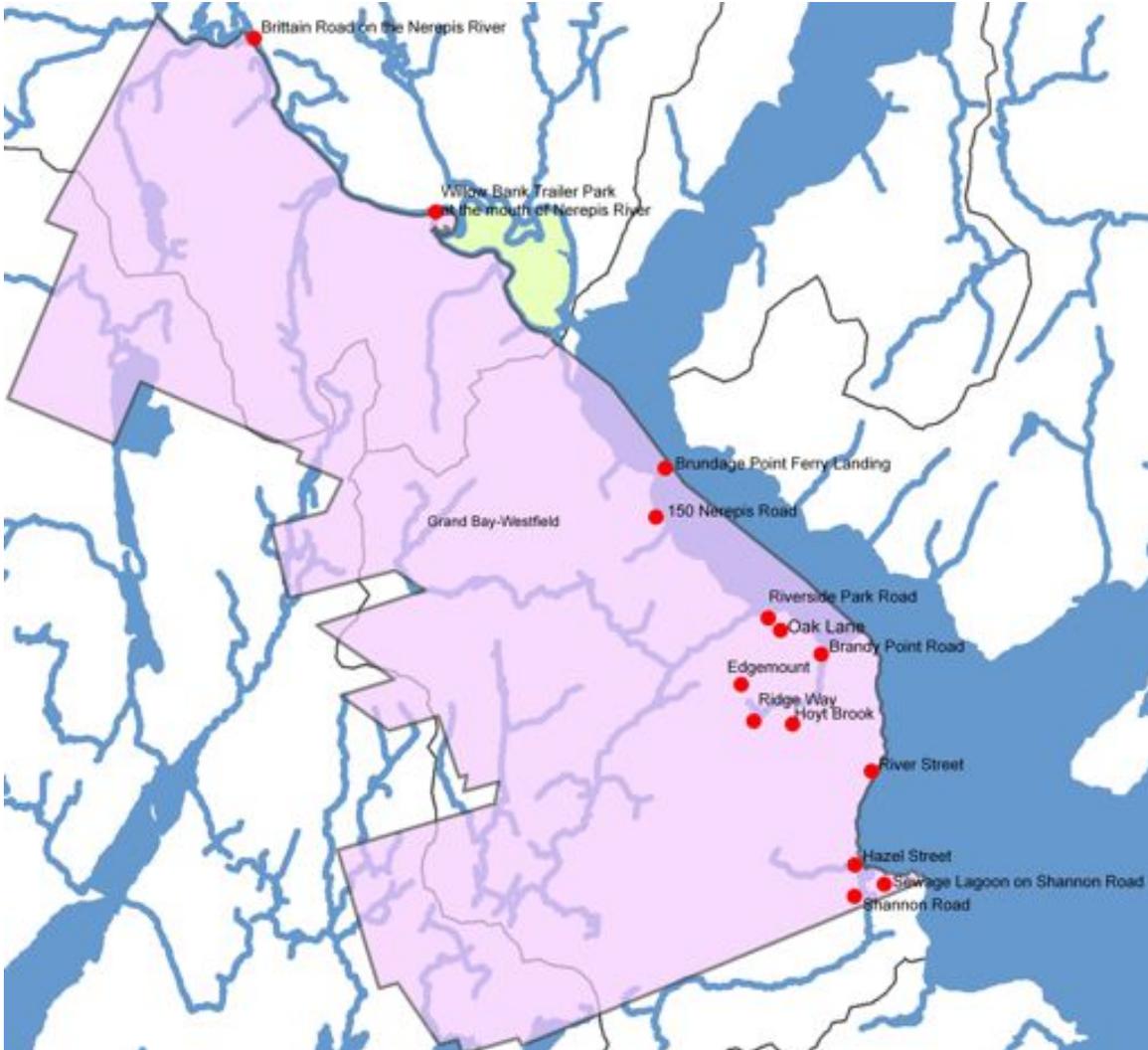
Negative Impacts:

- Past river ice fishing, snowshoeing, cross-country skiing, snow-mobiling in community during winter seems now a thing of the past.
- River is not as nice to swim in with water being turbid, and bottom having weeds and mud.
- Heavy rains overflow ditches, streams, and cause land erosion and occasional road washouts.
- Power outages increasing due to more intense storms.

Positive Impacts:

- More water in some community wells due to increased rain.
- Local farmers appreciate flooding because it fertilizes the land.
- Less heat being used in winter as winters now generally warmer.

MAP 1: Areas of Grand Bay-Westfield Affected by Flooding



G. CVAT Workbook Responses

In view of the community request that the timeframe for the workshop be limited to 2.5 hours on a weeknight and in view of two presentations on climate change and LiDAR, along with an ensuing discussion of each, this did not permit sufficient workshop time for answering all the CVAT workbook questions. Therefore, in order to complete the workbook (**Appendix 3 – CVAT Workbook Responses: Grand Bay-Westfield**), pre- and-post workshop input from PAC members and municipal staff, which had been acquired through individual interviews, was compiled to complete the questions not addressed at the workshop. Assembled, the workbook responses represent a useful background document on the issue of flooding in Grand Bay-Westfield. Key points in the workbook are presented in the above Workshop Outcomes (Section F above) and in Next Steps (Section I to come).

H. Participant Evaluation

Participants were asked at the end of the February 20 workshop to assess 1) the usefulness of the Community Vulnerability Assessment Tool in determining Grand Bay-Westfield's potential risk to climate change issues (in this case flooding); 2) the digital LiDAR wet-areas mapping tool also used in the workshop in relation to the community's flooding issues; and, 3) the workshop itself. Their evaluation follows.

CVAT Workbook Tool:

- Because the community considers it has a dedicated Planning Advisory Committee overseeing developments in the town, and has an excellent and hardworking EMO and Fire Department, which have developed up-to-date emergency plans for severe flooding, severe storms, fire, etc., the CVAT workbook tool was seen to be covering much of the same flood planning 'territory' in terms of what areas had been/could be affected, who to contact, what would need to be done, etc. Therefore, as a tool meant to assess the community's potential risk to future flooding and how it might need to adapt, the workbook was not seen to be as useful in a 'predictive' sense as the LiDAR mapping tool.
- However, it was concluded the CVAT workbook would be a useful tool to assess climate change risk for those communities in the province that perhaps don't

have comprehensive EMO plans, or developed understanding of their flood risk areas, or access to LiDAR mapping.

LiDAR Mapping:

- There was considerable appreciation by all workshop participants for the foreseen usefulness of the LiDAR mapping tool as it relates to hydrological risk assessment (where water will be on the landscape) in the community. LiDAR mapping supported some past land use decisions made by the Planning Advisory Committee and further indicated areas that may need further scrutiny relative to river flooding and localized flooding going forward.
- The ‘visualness’ of the LiDAR tool was considered its strength when it comes to assisting a community in land use planning (e.g. how stream channels in developments may contribute to flooding; where storm sewers should be, how areas may be prone to water ponding, etc.). Comments made were: “LiDAR mapping is the best thing about the Lower St. John River Project”. “LiDAR is a good groundtruthing tool. It can take the guesswork out of thinking what could happen.” “If the LiDAR tool is available for us to use, we’ll use it”.
- The participants recommended that LiDAR mapping and training be offered to all communities in the province who need to assess their risk to climate change issue of flooding.

CVAT Workshop:

Table 2 – CVAT Workshop Evaluation summarizes from individual CVAT feedback forms, evaluation of the February 20 workshop by eleven of its twelve participants. From their responses to the specific evaluation parameters, participants indicated:

- They had all necessary information to complete the workbook.
- The CVAT workbook was considered a tool perhaps more useful to a community with little Emergency Measures Response planning and where LiDAR is currently not available. For a community such as Grand Bay-Westfield, however, this tool should be modified (shortened) to take into account emergency flood and storm planning already in place.
- The introduction of the LiDAR mapping tool to help assess the community’s risk going forward from climate change issues such as flooding was considered especially useful in order to better inform decision makers and residents on land use planning.

TABLE 2 - CVAT Workshop Evaluation

Session: Community Vulnerability Assessment Tool Workshop

Date: February 20, 2012

Location: Grand Bay-Westfield, Centrum

Number of Participants who completed Feedback Form: 11 of 12 attending participants

Number Responses/Category: 1-strongly agree 2-agree 3-neutral 4-disagree 5-strongly disagree

	1	2	3	4	5	Comments
1. The style of the workbook is appropriate for my community	2	3	4	2	0	
2. The questions in the workbook are clear and understandable	2	6	2	1	0	"Didn't use workbook." (See: Author's Note below.)
3. I had the necessary information to complete the workbook	1	7	3	0	0	
4. The workbook is a suitable resource to help my community plan for climate change. ⁸	1	4	4	2	0	
5. The mapping exercise is useful for my community. ⁹	10	1	0	0	0	"This was the best part as one could see the impact." "Especially LiDAR tool."
6. I am better informed about the impacts of climate change on my community after this session.	8	3	0	0	0	
7. I am better informed about adaptation options available for my community after this workshop.	6	4	1	0	0	
8. This workshop will lead to actions that will make my community better able to respond to flooding and climate change.	7	4	0	0	0	"Knowing that RAC project will be using LiDAR tool."
9. Overall, the workshop was informative and valuable.	6	5	0	0	0	
10. The amount of time was appropriate given the content covered.	3	8	0	0	0	
11. Did you have the opportunity to read the workbook ahead of the workshop?	Yes, I read it: 9 responses No, I did not have time to read it: 1 response No, it was not made available to me: 0 responses					
12. Would you recommend this workshop to a colleague or another community?	Yes: 9 responses No: 0 responses Maybe: 0 responses "Especially in a community with little EMO planning"					
13. In what ways could the workshop have been improved to better suit your needs?	"Modified workbook." "More LiDAR coverage (of lower St. John river valley)." "More time (for workbook)." "No improvements required." "Good session."					
14. Any final thoughts?	"Great workshop. Thank you." "Very informative session." "A lot of food for thought." "Very informative." "Great job."					

⁸ Author's Note: The CVAT workbook was used in the session but due to time constraints posed in a 2.5 hour workshop to complete all workbook questions plus present and use the LiDAR tool and give the presentation 'Climate Change in New Brunswick', not all of the questions were covered. CVAT Workbook completion was achieved, however, by use of interview information obtained from PAC members and municipal staff members, in addition to the participant responses gained at the February 20 workshop.

⁹ Note: The mapping exercise participants are referring to is primarily LiDAR mapping, not reviewing tabletop mapping.

- As a result of the session, participants were better informed about climate change impacts on their community and would recommend the workshop to others.
- The workshop will lead to actions that will make Grand Bay-Westfield better able to respond to flooding and climate change.

The community's proposed actions are elaborated next.

I. Next Steps for Climate Change Adaptation

Asked to list what Grand Bay-Westfield's potential next steps should be respecting adapting to climate change impacts of flooding, the following aims and actions were identified by the workshop participants and municipal staff:

1. **LiDAR mapping be introduced by the community for use.** LiDAR mapping it was indicated can help take the guesswork out of what could happen going forward. It is considered a useful tool to know:
 - What culverts in community are likely to be most affected by heavy rains and runoff;
 - How stream channels can contribute to flooding indicating where new storm sewers should be placed;
 - If building setbacks in some areas should be increased or development limited.

Specific actions PAC members and municipal staff identified were:

- a) The Public Works Commissioner and Fire Chief demonstrating LiDAR mapping to Grand Bay-Westfield's Emergency Measures Response Committee;
- b) Providing a further in-depth demonstration of LiDAR to the Town Council;
- c) Putting the tool to use by PAC members as well as by development applicants in assist looking at proposed developments from the standpoint of seeing where watercourses tend to flow; and,
- d) Providing the LiDAR tool to the community's contracted engineers to use in viewing various scenarios of what might happen 'if', to assist in their determination of size and placements of culverts, road heights, etc.¹⁰

¹⁰ Of the four actions a) and c) have already been undertaken.

2. **Continued public education respecting flooding in the community.** Use of Department of Environment's NB Climate Change presentation was requested for educational purposes. Also LiDAR mapping was seen as a valuable tool in being able to inform development applicants, engineers, and architects as to a property's proneness to flooding and water ponding *before* development takes place.

Specific actions in public education were indicated to be the same as: a), b), and d) above.

3. **Continue periodic updating of the community's Emergency Contact Information** for residents, businesses and the **Emergency Measures Response Plan.** An emergency radio channel devoted to presenting continuous flooding information would be a good addition by the provincial EMO, for when electricity is lost, as residents are then not able to access EMO's website or news outlets.

PART 3 – Assessment of CVAT

Further to the participants' conclusions on the Community Vulnerability Assessment Tool (Section H), this final portion of the report presents LPA's assessment of CVAT's test application in Grand Bay-Westfield with respect to: 1) the outcomes of using CVAT in relation to achieving its own defined objectives; 2) CVAT's implementation process, 3) CVAT's Tools, and, finally, 4) the usefulness of the Climate Change Secretariat potentially offering CVAT to assist other New Brunswick communities in adapting to climate change impacts. The section concludes with five recommendations as to next steps.

J. Outcomes of CVAT's Test Application in Grand Bay-Westfield

In addition to the identified workshop outcomes of the participants themselves, (Sections F, G, H), use of the CVAT process in Grand Bay-Westfield, provided recognition that:

- the value of CVAT's use in assessing climate change impacts in a given community lies in its ability to capture local knowledge about past and current climate change issues plus to stimulate thinking about how adverse impacts of climate change going forward will require the community to stay on top of its EMO planning and be more cognizant of climate change impacts in its land use planning;
- CVAT further provides the capability to create an informative benchmark document for community referral going forward, relative to various identified climate change issues, such as flooding;¹¹ but,
- it is the LiDAR-based wet areas and flood modelling which achieves what the CVAT aims to do, but cannot achieve as readily, or effectively, namely, providing communities with a 'predictive capability' which can assist their planners, landowners, development applicants, architects, and engineers in both seeing and assessing climate change impacts in 'what if' modelling scenarios. Further, LiDAR has the capability of moving a community to action.

¹¹ This is in the form of the Community Report along with its accompanying appendices of CVAT workbook completion and the table of informant interviews.

Indeed, within two weeks of the CVAT workshop, Grand Bay-Westfield's Development Officer had made use of the LiDAR tool in reviewing with an applicant a property proposed for development, while the community's Emergency Measures Organization Committee had been introduced to use of the tool by the town's Works Commissioner and Fire Chief. According to Troy Gautreau, the Fire Chief, the town is now ready to use the LiDAR tool when it receives a forecast water level for St. John River flooding from provincial EMO, in the sense of both seeing and determining what effect that level will have on Grand Bay-Westfield's landscape.

As Bruce Gault, Works Commissioner indicated, LiDAR will help the Planning Advisory Committee and Public Works Department verify what they believe they know about any given site, plus it will help people, such as prospective buyers, who are not familiar with a property in understanding its potential constraints. And as David Taylor, the town's Development Officer said, 'Without being able to use LiDAR before, the Planning Advisory Committee would have had to visit a site themselves and eyeball interpret it. Now, LiDAR will aid their interpretation and their decisions.'

In essence, had LiDAR *not* been presented as part of the test application of CVAT in Grand Bay-Westfield, it would have been less likely that the community would have appreciated other vulnerabilities to flooding that they may have in addition to the ones they've identified. Now the community has a better sense of that and using LiDAR they indicate they will continue to explore their territory for these vulnerabilities.

To conclude, each of the tools presented in this test application had their own distinct strength. While CVAT provided Grand Bay-Westfield the capability of useful collective insight as to a community's history and current reality with respect to a climate change issue such as flooding, LiDAR provided and will continue to provide Grand Bay-Westfield with useful collective foresight as to how their wet areas, stream flows, and land height can be affected adversely by increased levels of flooding, thereby raising their awareness of flooding risks.

Hence in this test application of CVAT in Grand Bay-Westfield, it has demonstrated that CVAT does achieve its identified goal of increasing community understanding of climate change impacts, but it was the additionally offered LiDAR wet area and flood modelling that in reality has advanced the community's adaptations to climate change and further has moved the community to action. This is in fact considered a significant outcome of this test application relative to the province's intention to devise and offer means to assist New Brunswick communities in reducing their risk to climate change.

K. CVAT's Implementation Process

Looking at the timeframe for the test application of CVAT in Grand Bay-Westfield and its various process steps it can be concluded:

- The three-month period allocated by the Department of Environment for this test application was adequate to achieve all the intended steps in the CVAT implementation process.
- The in-kind contribution of the community, which was identified in project pre-planning to be ten days, proved to be the appropriate level of engagement by the town's Development Officer and the Planning Advisory Committee to assist in project delivery.

For reference, Grand Bay-Westfield's contribution to the test application included assembling photos of past flood events, pulling together community maps, preparing and sending the workshop invitations, editing the letter of invitation, photocopying all CVAT workshop materials, selecting the workshop venue, and setting up the workshop venue. The community also assisted LPA in pre-workshop planning, including determining possible flood risk scenarios, and locating LiDAR aerial survey base map information used for the community's wet area modelling.

- All CVAT process steps were used in this test application in accordance with the community's input respecting timing and parties involved. In addition to the CVAT steps noted in Section D, this application concluded with delivery of the Community Report¹² and presentation of that report's highlights before the Mayor and Council of Grand Bay-Westfield on March 12, an event open to the public and media to attend.¹³
- All the used CVAT process steps were considered logical and appropriate to gaining community understanding of the goals of the project plus in obtaining commitment to the project's execution.

L. CVAT Tools

Background Information: Informant Interview Questions

Given key informants in Grand Bay-Westfield were primarily members of the town's Planning Advisory Committee and key staff members, the preferred method of interview was by telephone (with many at work) rather than in-person. Most of the interviews ranged between 45 minutes to over an hour in duration, with LPA asking 16 of the 22 CVAT questions provided. The reason for the reduction being not all supplied

¹² The Community Report is incorporated in Part 2 of this report.

¹³ A *River Valley News* correspondent was present to report on the council meeting for their April publication. Only one member of the public was present.

CVAT interview questions related to Grand Bay-Westfield's issue of flooding, but to other climate change issues, while others were repeated in the CVAT workbook to which the same parties were responding, and still others were duplicated in the question format.¹⁴ Finally, given this was a phone interview, it was considered that participants would have been uncomfortable with a longer interview had all questions been asked.¹⁵

It can be concluded the information derived from informant interviews served their purpose of providing a useful snapshot of noted weather and river changes changes in Grand Bay-Westfield in recent years, along with their social, economic and environmental impacts (See TABLE 1).

Background Information: Community Maps, Photos

Not CVAT tools, per se, Grand-Bay Westfield's community maps, for use in the Workshop, consisted of a municipal street map, a commercially produced street map and a printout map of the community's wet areas.¹⁶ Missing, however, was a map delineating the community's floodplains (1 in 20 years, 1 in 100 years, 1973 and 2008) and development setbacks. The provided maps, in and of themselves, however, did not illuminate for the workshop participants other areas at risk to flooding than the ones already known to them, as none of the maps were at a level of detail that showed topographic contours, existing floodplains, setbacks, individual properties, etc. It can be said, however, that the 'mapping', which raised workshop participants' appreciation of the potential impacts of flooding in various parts of the community not necessarily known for flooding before, was the LiDAR modelling demonstration. For example, the community's golf course was seen to be prone to water pooling, once water levels intensified, as was a main road downtown where stream banks could overflow.

The posted community maps, however, did serve the workshop participants in identifying areas of past flooding that going forward would be considered prone to flooding again. These are listed in Section F and shown on Map 1.

Photographs that were assembled by the community and used in the workshop served the purpose of showing participants the effects of both river flooding and localized flooding on residential homes and community infrastructure and buildings. Showing photographs of areas affected by past flood events launched animated and informative workshop discussion as to how the community has dealt with their problem flood areas

¹⁴ Examples: Questions related to problems caused by flooding in the community; frequency of occurrence of flooding problems, emergency preparedness, etc.

¹⁵ Likely the interview would have then exceeded two hours in duration.

¹⁶ Previously provided LiDAR map provided during earlier RAC session with communities of the Lower Saint John River.

(e.g. raising roads, upgrading culverts, etc.). As such, photographs, in and of themselves were useful tools in developing appreciation of the community's flood history and current flood realities.

Two cases in point: the photos of past flooding events illustrated to both the workshop attendees and members of Council thereafter that 1) spring flooding at Grand Bay-Westfield in 1936, prior to the construction of St. John River dams, was significant and 2) that one aspect of community infrastructure is potentially threatened by major river flooding going forward, referring to the Brundage Point River Centre, which was affected by the 2008 spring flood event.

In this regard, again the LiDAR modelling tool deployed in this test application, was able to show participants just how flood level rise going forward might affect the ferry terminus and river centre at Brundage Point.

CVAT Workbook

The CVAT pilot workbook on flooding provided for use in Grand Bay-Westfield contains approximately 50 questions plus six summary checklists of questions and four fill-in tables.

In view of its comprehensiveness in addressing the issue of flooding, it became clear in preparing for the Grand Bay-Westfield CVAT workshop, that the three hours allocated for the workbook's completion would be quite inadequate, given the need to accommodate the other two presentations¹⁷ also being made in the workshop. It is estimated a full-day workshop would have been necessary to complete the workbook in the form provided along with all other elements of the workshop.

As already noted in Section H, Community Evaluation of CVAT, in view of Grand Bay-Westfield's preparedness for emergency situations including their in-place-plans for severe storms and floods, it became apparent in the workshop that its participants were not keen to spend time covering similar 'preparedness' territory, as in the workbook sections which pertain to identification of key community infrastructure, who is affected and who can help in the event of a flood, plus who has useful resources to help (i.e. boats, backhoes, generators, etc.).

¹⁷ *Climate Change in New Brunswick and Lidar-based Wet Areas and Flood Modelling for the Town of Grand Bay-Westfield.*

Recommendation:

It is recommended that in lead-up information gathering on the community, if the community has detailed emergency plans, that relevant information be gleaned from them to answer the workbook's questions regarding emergency response. Or, that Memorial University's CVAT team consider offering participating communities two types of workbooks. One designed for communities that have comprehensive emergency plans, and the other designed for use in those communities that don't have emergency measures plans.

Knowing that the development team at Memorial is in the process of re-crafting their tools as a result of their own piloting of CVAT¹⁸, and further knowing their tools were developed for use in remote rural communities, the only other point to be made on the workbook is the following:

As two participants indicated, using the CVAT workbook felt like having an elementary school lesson, pointing to such sections as, "Individuals in your community may also be able to help, such as those with first aid training, emergency response experience or amateur radio training. Cell service may be off-line during an extreme event. It is important to have up-to-date contact information for individuals and groups in case of an emergency." Such instructions came across as simply too basic, given Grand Bay-Westfield's existing preparedness for emergencies, which to a large degree have incorporated many of the items and community knowledge that CVAT was aiming to have the community either become aware of, or do.

Recommendation:

Raising the 'audience recognition bar' is suggested for those communities with emergency plans already in place. This can be achieved by removing in the workbook references to items, steps, etc., normally covered in such plans. Also, by removing the workbook's end-of-section checklists plus deleting repeated questions in the workbook, and between the interview questions and the workbook.

M. Grand Bay-Westfield's Adaptation Capacity to Climate Change

While the Town of Grand Bay-Westfield, population approximately 5000 people, was chosen for the test application of CVAT in consideration of it being a New Brunswick community having a relatively low level of human and financial capacity to deal with

¹⁸ Personal Communication: Dr. Kelly Vodden, March 14 teleconference.

climate change adaptation issues, the town demonstrated in the test application that it actually had a relatively high capacity in view of its existing plans for emergencies, its well-organized Public Works and Fire departments, and its dedicated and knowledgeable Planning Advisory and Emergency Measures Response committees. By contrast, it is believed truly small New Brunswick communities (with populations under 2000 people), would be the municipalities with less planning capacity and hence more likely to use the CVAT tool, given they are more in keeping with the relative size of the communities for which CVAT was developed in Newfoundland.¹⁹

N. Conclusion: Usefulness of CVAT for Other NB Communities

Changed in the ways suggested in Section L, the Community Vulnerability Assessment Tool has a useful place in assisting other New Brunswick communities in understanding their past and present reality with respect to climate change issues and their impacts. It is, however, when CVAT is combined with LiDAR wet area and flood modelling, that municipal decision-makers will be in the best position to adapt to predicted climate change impacts in New Brunswick.

O. Next Steps

To advance the above conclusion, the following next steps are recommended for departmental consideration:

Community Vulnerability Assessment Tool:

1. As Memorial University's CVAT team is currently revising the CVAT tool, the Department of the Environment may wish to offer Memorial assistance to perform tool revisions that will assist its ongoing use by distinct community audiences.
2. Thereafter, once these revisions are complete, if required²⁰, proceed to produce a New Brunswick illustrated version of CVAT.

Training in Community Climate Change Adaptation:

3. Rather than continuing to go one-on-one to communities to either introduce or assist them in climate change planning, a more time and cost efficient approach

¹⁹ Five of the six Newfoundland communities where CVAT was piloted have populations under 2000 people.

²⁰ Unless Memorial produces a generic version, or distinct versions, of CVAT.

would be to build on New Brunswick's Emergency Measures Response organization's Emergency Management Courses, with the Climate Change Secretariat both developing and offering a scheduled course module and trainer in climate change adaptation planning. This would permit municipal planning staff and municipal planning advisory committee members to engage with other community representatives in a co-operative venture that would permit the Climate Change Secretariat to charge for the courses, thereby recouping the costs in developing them, plus facilitating earlier and more pervasive actions by communities to climate change.

LiDAR Modelling:

4. Given the highly favourable response of Grand Bay-Westfield's participants to the capabilities of Lidar-based wet area and flood modelling, as reflected in their recommendation that LiDAR mapping and training be offered to all communities in the province, and that similar conclusions have been drawn by other communities exposed to use of this tool, it is therefore recommended that the Department of the Environment and the Department of Natural Resources consider staging a one day forum wherein the potential of LiDAR mapping would be showcased as a way to improve planning efforts and reduce costs associated with climate change risk. In so doing, the aim of the forum would be to galvanize support for an initiative that would pull together funding partners from industry, municipalities, professional organizations and the province to see that all of New Brunswick has LiDAR modelling capability.

Currently, as only ten percent (10%) of the province has been surveyed with light detection and ranging, it is estimated that this comprehensive province-wide surveying project could cost upwards of \$15 million to execute. But, if savings from avoiding excessive mitigation and recovery costs of climate change impacts can be demonstrated, as LiDAR's proponents believe they can be, it is therefore conceivable that the project's large implementation cost could be offset, while further building in cost recovery approaches.²¹

Finally, given LiDAR's already demonstrated efficiency and cost-saving benefits to the forestry and mining sectors in New Brunswick and Alberta, it is worth the province considering having full LiDAR capability for all its communities in moving to a more prosperous and sustainable future.

²¹ Examples: Charging insurance brokers, professional associations of architects, engineers, etc., municipalities, industry for use of the mapping.

Provincial Mapping:

5. Recommended by Grand Bay-Westfield is that the province consider standardizing its aerial mapping to Caris, given, not every community has the same capability as Grand Bay-Westfield has had since 2002 (in using Caris), which according to David Taylor, the town's Development Officer, has made a world of difference to the Planning Advisory Committee and Council in view of offering more detailed aerial views than the province's mapping. According to Taylor, "LiDAR modelling wouldn't appear as effective if Grand Bay-Westfield didn't have the aerial view offered by Caris mapping to superimpose on it."

Acknowledgements

The test application of the Community Vulnerability Assessment Tool (CVAT) in the Town of Grand Bay-Westfield represented a partnership between the Municipality of Grand Bay-Westfield and New Brunswick's Climate Change Secretariat in New Brunswick's Department of Environment (DOE). Providing municipal assistance to Leone Pippard & Associates in the use of CVAT was David Taylor, Town Development Officer, and members of the Planning Advisory Committee of Council. Leone Pippard facilitated the workshop.

The author and the Department of Environment wish to thank the Town of Grand Bay-Westfield and particularly its Development Officer, David Taylor, and members of the Planning Advisory Committee for their full and timely co-operation in mounting a test application of the Community Vulnerability Assessment Tool (CVAT) in their community. Additional thanks is extended to Dr. Paul Arp and Jae Ogilvie of the University of New Brunswick's Faculty of Forestry and Environmental Management for their willingness to demonstrate first hand the usefulness of LiDAR to Grand Bay-Westfield's workshop participants. And to Dr. Kelly Vodden, Department of Geography, Memorial University for providing all the tools used in this test application of CVAT in New Brunswick.

Finally, Leone Pippard & Associates appreciates the opportunity provided to assist the Climate Change Secretariat of the Department of Environment with the conduct and evaluation of CVAT in this test application.

APPENDICES

APPENDIX 1 - Workshop Participants

“WEATHER, CLIMATE CHANGE AND MY COMMUNITY”

Community Vulnerability Assessment Tool Workshop

February 20, 2012 (7:00 p.m. – 9:30 p.m.)

Centrum

Participants	Affiliation	Telephone #:
James Burke	Member, Planning Advisory Committee (PAC)	738-8084
Chyann Kirby	Member, Planning Advisory Committee	757-1909
Bev Day	Counsellor, Member PAC	738-6249
Ralph Stevens	Chair, Planning Advisory Committee	757-8640
Ron Daigle	Member, Planning Advisory Committee	757-8838
Linda Estabrooks	Member, Planning Advisory Committee	636-1125
James Evans	Member, Planning Advisory Committee	738-2767
Howard Heans	Owner, Hardings Point Camping Inc.	763-2517
Hudson Heans	Manager, Hardings Point Camping Inc.	763-2517
Troy Gautreau	Fire Chief, Fire Department	738-6427
Bruce Gault	Works Commissioner, Public Works Department	738-6422
David Taylor	Development Officer, Municipality	738-6409
Presenters	Affiliation	Telephone #:
Leone Pippard	Leone Pippard & Associates / LPA	506 488-2020
Jae Ogilvie	Research Associate, Faculty of Forestry and Environmental Management, UNB	506 451-6823
Paul Arp	Professor, Faculty of Forestry and Environmental Management, UNB	506 453-4931

APPENDIX 2 - CVAT Informant Interviews Grand Bay-Westfield

	A	B	C	D	E	F
1	Interviewee	1. How long lived in GBW?	2. Occupation	3. Age	4. Any probs re quality/availability of drinking water in GBW?	5. Changes in weather/climate observed in GBW in your residency/lifetime in community?
2						
3	Chyann Kirby	6 years (since 2005)	Env. Consulting AMEC	31	No	Wind: Really windy in last couple of years. Frequency of wind storms is up.
4	Linda Estabrooks	7-8 years	Commercial Property Coordinator		No. Drinking water very good. Everybody is on a well.	No change
5	James Evans	since 1973	Retired project engineer	79	Some wells have silt in them, not all. Depends on the depth of the well. Haven't seen any changes in the quality of the water	Timing of Seasons: Seems the winters start later and lasts longer. Rather than winter starting in November it seems to start in January. River is still open in January and is opening up earlier in the spring. Seasons seem to be changing. Very variable re: snowfall accumulation.
6	Ralph Stevens	all my life; 59 years	Chair PAC	60	Not in my area but in other parts of the community. Problem is with supply and having to drill deeper. Attribute that to new developments but also some summers where we have had very little rain.	Yes, more noticeable in recent time...last 5 years. Biggest thing is winter is later; there is less snow; not as cold as it used to be. Heavier rain storms over a shorter period of time.

APPENDIX 2 - CVAT Informant Interviews Grand Bay-Westfield

	A	B	C	D	E	F
1	Interviewee	1. How long lived in GBW?	2. Occupation	3. Age	4. Any probs re quality/availability of drinking water in GBW?	5. Changes in weather/climate observed in GBW in your residency/lifetime in community?
7	Bev Day	since Dec. 1992		55+	No	Definitely. Number of storms per year has increased. My 1st years in GBW I noticed how cold it was, don't see that anymore. Winters are not cold like they were. And nothing like the snow fall of old days. They used to be cold for long periods. Now winters are 'yo-yoing' back and forth...warm...cold...warm. My husband works in furnace repairs. He doesn't have the overtime cheques he used to. Timing of seasons seems changed. Spring is not what it used to be - can be very hot or very wet. Timing has changed from the 1st of April to the 1st of May. Timing of winter varies. Last year it set in in Dec; this year hasn't set in yet. Rain is more driving and is not coming from the direction you expect it to come from. Used to hit the front of our house, facing east; now hits the back of our house which is west facing.
8	Ronald Daigle	10 years in March, since 2002	Retired Manager	70	Not yet	No trend yet, but a lot of variability. Snow - up and down with snow. Timing of seasons seems to be changing: We've 'evolve' beautiful falls. They are the most beautiful season. Spring is a let down...keep waiting for it. Less summer and more fall. Fall itself lasts longer. Used to be cold in November, now not cold temperatures in Nov. Spring comes in May. Because of longer fall, we now have shorter winters. Winter begins 1st of January. Not as long. Ends in March. Snow went fast in March last year (2011). April however was miserable. Easter as a kid you wore summer clothes. Not now.
9	Greg Parker	since 1945	Retired CM Accountant	66	Area where I live in has very low recoverability (lives 3 km west of Hwy 102 on Maclean Road). Surmises issue is density of housing above him. There is a new subdivision for 600 homes. Sewage another issue for this subdivision as there is no sewage system extension this far so all lots (1/3 acre) will have septic fields. Issue is the rock - no place for the sewage water to go because of the rock. Also part of this sub-division is in the watershed of Loch Alva so grey water runs into the the Loch Alva watershed. Also swamps were drained for the development, therefore, no aquifers for wells.	Absolutely. When I was a boy the seasons were distinct, now they're not so. Winters have less snow than in the past. We used to be able to shovel off the river, but now you'd go through the ice. Spring is just not distinct. It lingers and is cold, damp weather. Summer - we don't get the really nice weather for very long. Fall there is alot of rain but it runs off and things return to dry. While heavy rain, the water is gone. Winters are milder. Used to consistently get a week of straight -30C between Christmas and New Year's but we don't get that anymore. Winter is starting later. Mixed period late fall and early winter (Nov-Dec). Snow in November now seems an anomaly than regular as in the past. And we now may have January thaws. Not as much snow as years ago. Also alot more wind in the community. Storms are accompanied by high winds. Wind does alot of damage by taking the tops off young trees. Rain: Last couple of years there have been significant downpours: greater intensity and volume of rain. We're now cutting our cedar and black spruce swamps which used to hold water back.
10	Howard Heans	since 1946	Campground owner	68	No. No water quality problems in our campground. No shortage of water	Noticed warming in winter time. Have cold days still but have warm spells too. Winters much colder in older days - 20 to 30 (F) below zero. Less snow as well. More heavy levels of rain. Timing of seasons: getting warmer earlier in the spring. About 3 years ago was as warm as June in April. This past January we've had temperature highs of 30s(F) and 40s (F) - above freezing. We use our wood stove less in winter now. Warmer later in the fall as well. Due to nice weather in fall, now our campground customers want to stay on site later than our closing date (3rd week of September). People would like to stretch their season but the operation cost of staying open later for us is challenging - hired students at minimum wage have gone back to school etc.

APPENDIX 2 - CVAT Informant Interviews Grand Bay-Westfield

	G	H	I
1	6. Have you noticed change in the St. John River's conditions?	7. Have these been slow or sudden changes?	8. Have these changes created problems (or opportunities) in your community?
2			
3	No. Not so much. 1st couple of years in GBW never noticed the water level would get high. This has changed (water rising higher) in more recent years.	River level remains higher longer. Recedes late summer.	Not that I am aware of.
4	River is still open water in winter; used to be frozen over wider area. In last 3 years in particular getting later and later in January before basin freezes. Haven't had the cold so far this year.	I don't know exactly. Maybe 'slowly evolving'.	I don't think we've had any problems as yet. Real estate values are holding or increasing for waterfront properties. Westfield Beach Area more prone to flooding.
5	When I was a kid, you used to go swimming on the 24th of May....Now you'd need to be a polar bear to do that. River is also a lot higher than it used to be. I used to keep my boat and canoe on the beach - 25 to 50 feet of beach. In past two summers I haven't had enough beach to put a boat on it. This past year I had only 6 or 7 feet of beach. River is nearly 3 to 5 feet higher than it used to be. Now it is a 'consistently higher river'. Lower wharf in Gagetown is under water all summer. Black Duck Marsh in Lower Jemseg - water higher in the marsh in the last 2 years. Last 2 winters, river still open here, river hasn't been freezing as solid. The river might have been open to Christmas in the past then after Christmas temperature went down dramatically to minus 10 and greater - bitter cold. Definitely warmer in winter now. Used to cross-country-ski on the river in winter and smelt fish at Public Landing. There was alot of ice in December there and it stayed frozen to March as there isn't as much current there as at GB-W. Now I don't think they dare put out a smelt shack in December. During the last big flood in 2008 there were some days when the tide never penetrated the river because the outflow was so great.	I don't think there has been a dramatic consistent change in the weather. More sudden than slow. Something is going on re: higher level of water in the river in the summer. Either it is due to 1) the ocean getting higher, or 2) how the dams are being managed on the St. John River or 3) greater rain events occurring, or perhaps 4) its a combination of all of the above. Personally, I have the feeling it is how the dams are being controlled to maximize power generation but I don't believe there is consideration for the people downriver of the dams...managing water release to the best advantage of the people living below the dams. I think an independent hydrologist should examine our dam management practises as to release of water. Perhaps we need to be letting more snow melt water go through the dams in the spring rather than holding it back.	In the 2008 flood our home was surrounded by water and there was 2 feet of it in the basement. We stayed in the house completely surrounded by water. Our electricity was shut off; we had a generator; didn't have a well pump; used a small row boat and caoe to get to shore. I'm surprised the waste treatment plant hasn't been impacted. Our lift stations have been flooded out. Not working, pumps quite leting sewage go through overflow outlets into the river. Lift stations if ot built high enough are susceptible to flooding. Lift station by mall/hardware store is very close to river level. One area of concern is the Nerepis River. When there is heavy rain in the army camp, tons and tons of mud dumped in Nerepis and St. John River - makes the water chocolate coloured. I believe this is filling in our coves with soft mud when in the past our coves had hard bottoms. Army camp should have settling ponds to trap the silt. The accumulation of mud is ruining whatever beaches we have here.
6	Freezing over of the river is in January/February not December as in the past. Winter I think is a little shorter in duration. River level is not going down in summere like it used to.	Probably a little more recent...over last 10 years a bigger change.	Heavier rains was out culverts, cause land erosion and roads also get washed out. We've experienced some of this.

APPENDIX 2 - CVAT Informant Interviews Grand Bay-Westfield

	G	H	I
1	6. Have you noticed change in the St. John River's conditions?	7. Have these been slow or sudden changes?	8. Have these changes created problems (or opportunities) in your community?
7	River is not frozen the way it used to be. We are located at Brandy Point so we look upriver to the ferry landing. Ice is not like it used to be. Used to be channel in the ice for the ferry to go back and forth. Now, either open water or very light film of ice. 9 degrees C today - no ice (Jan 24/12). This isn't just a fluck year. It's just not there anymore. We used to see ice at Xmas time; when it forms now it is not safe ice to even put a deer on. Water level in St. John River is staying up, even in this time of year (January).	Years ago, there were hugh concerns about enough water supply. In the past used to be able to do 6 or 7 loads of laundry before well has to recharge. Now don't have to limit yourself with loads. There's plenty of water.	If you are a person who likes winter, particularly ice fishing, snowshoeing, snow mobiling...they are long gone. With water level rising what is going to happen to home values? Some residents don't want to discuss this because of the impact on their home values.
8	This year because of mild temperatures can't get shacks on ice. I live on La Croix Drive up Hwy 102 from Bridge crossing the Nerepsis. I look up the St. John River. Used to be frozen up early; now about mid-January freezes up. Used to cross-country ski on the river.	Just some sudden changes - example temperature mild this year compared to last (winter season being referred to), but not a trend as yet.	Not that I'm aware of.
9	Ice is either thinner or lower quality ice (or both). Not getting the early freeze-ups in late fall. When ice gets rain on it instead of snow it is not good ice. I used to swim in the Nerepis R (tributary of the St. John River), and it used to have a heavy tide run. Now due to the causeway and the sedimentation load in the river from Base Gagetown, the mouth of the Nerepsis is silted up and the water is like chocolate milk stretching down the St. John River into the Harbour in Saint John, which has to be dredged out occasionally. Sewer also runs out into the Salmon Rock Pool in the Nerepsis (3 miles up from causeway). A new bridge was built in the 1990s there to replace the covered one washed out. Its cason foot goes right into the salmon pool. 1996-1997 below Salmon Rock Pool sewage from a holding tank or treatment plant was released into the Nerepis. Not ongoing. Stopped. We used to have sandy beaches on the lower St. John in GBW (e.g. Westfield Beach). Not the beaches they used to be now. With sedimentation and pollution, alot of seaweed growth, mud. St. John River at GBW is now open in the winter - no ice where there used to be.	In recent time - last ten-fifteen years.	I don't know the impact on the community. River is not nice to swim in any more with the water being turbid, weeds and mud.
10	We're having mini-freshets in the late fall. Had one at Christmas time a few years ago. They're not as high as the spring freshet, but they are higher than usual (past) fall water levels. Last year (2011) water remained high in the lower river all summer. By contrast, water level used to be at its lowest in August in years past. There were years you could walk out on the exposed bottom of the river - 50 to 60 fet of beach was exposed right out of the river - mucky though. In 2012 river has been frozen over for only 5 or 6 days thus far; the rest of the time at Harding's Point the river has been open. Ice that forms is not safe. In past river was frozen December through end of March or early April. This winter at Lincoln (referring to end of Feb)there was measured only 6 inches of ice. Affects events such as snowmobiling on the river, etc. Normally the our Harding Point store sits 100 feet back from the shoreline and is 6 to 7 feet above high tide level. Flood of 2008 came across the driveway at our campground and right to the front door of the store. This store was built in 1785 and has a 3foot stone basement wall - that's its saving grace as the store has survived all river floods thus far. (in the 1930s, 1973, 2005, 2008). After the flood of 2008 we had to change the electrical boxes.	Changes to the river have been quite drastic in recent time - last five years. Most startling thing is major floods are coming closer together - 2005-2008. Last big one was 1973.	Recent floods have caused DOT to build up and change the ferry landing at Brundage Point further. Originally the ferry landing at Brundage Point was built too steeply - couldn't get the big motorhomes on or off the ferry during low periods of water (usually mid-July through September). Solved by lengthening the landing. This took place in August 2011. DOT put in 15 to 20 loads of rock which lengthened and lessened the angle of approach (steepness). In 2008 the water was in the furnace room of the River Centre. Perhaps the building should have been built up 3 or 4 feet higher.

APPENDIX 2 - CVAT Informant Interviews Grand Bay-Westfield

	J	K	L
1	8. What has been done, or is being done, to cope or minimize these impacts?	9. Have there been any big/significant or unusual/infrequent events that either in your lifetime, or your parents/grandparents, that you have heard about?	10. Are some weather/climate events of greater concern than others? Can you rank them in terms of negative impact?
2			
3	Emergency Measures Response (EMO) group has been increasing awareness in the community of flood conditions.	No	Probably not. No.
4	n/a	Railway track washed out. Culvert wasn't broad enough. Work done there. Ice-jamming on the St. John River in the Hartland area.	Stronger storms occurring now. Seem to have a lot more wind events as well. Power outages increasing. NB Power has done a lot of cutting branches. Intensity of wind greater too.
5	Nothing that I am aware of. Emergency Response did a good job in the 2008 flood. They kept us informed where the peak of flooding was to be that day.	The two floods of 2005 and 2008 are the big events. They make be 'freaks', only time will tell.	Not that I can really think of, except for the flood events.
6	I really haven't noticed anything.	Before Mactaquac Dam was built it was a common occurrence for river to reach higher levels in the spring than it reaches now in spring. Old Fire Station over from Westfield School used to flood bad there. This didn't happen every year. But now if water level in spring is very high, this impacts more development built up along the shore. The 1973 flood was in fact probably lower than some of the spring floods before the dam was built. Past floods: 1973, 2005, 2008. Heavy rainstorm washed the covered bridge out at Wellsford in recent time. In 2005 flood conditions, the Brundage Point River Centre was closed due to high water.	If we speak of floods, they are apart of life around here. Probably heavy rainstorms are the biggest problem we are faced with.

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	J	K	L
1	8. What has been done, or is being done, to cope or minimize these impacts?	9. Have there been any big/significant or unusual/infrequent events that either in your lifetime, or your parents/grandparents, that you have heard about?	10. Are some weather/climate events of greater concern than others? Can you rank them in terms of negative impact?
7	At Brundage Point River Centre we've put plans in place for dealing with flooding. Water did go into the sub-basement and did some damage to the electrical. Municipality is also done a lot of curb and gutter work to control water flow. Road construction standards have been upgraded to deal with flooding, backups. Sewage has been upgraded with extension of sewage lines. More people now on sewer system.	Ice storm in Quebec well over 10 years ago. Damage in Quebec and Montreal took the power out; major power outages in this community. A lot of people were without electricity and had it gone on much longer it would have been worse.	I think flooding is more of a concern than other issues because we are a riverfront community. Erosion comes from flooding.
8	Not aware.	No.	Not at all. There was a developer who was going to build in our community - 500 homes. Because the area was wetlands, affect on well supply. Heavy rainfalls affecting wetlands. Catch basins. If not there, it would affect community - surging streams and culverts and probably cause erosion.
9	An improvement in water quality in the St. John River was made when the treatment plant was introduced as formerly 131 sewage outlets flowed directly into the St. John. Sewage lagoon in GBW (near boundary with City of Saint John) would not be allowed to be so close to the river with new standards today. Liquid from this lagoon is not treated and increasingly will be prone to high tides, which will put the overflow/outflow either into Henderson Brook or back on the beach. Municipality is expanding its sewage facilities to tie in with new sub-divisions such as the one above where I live.	1973 and 2008 floods affected people around Wickham living close to the St. John River. They were at risk. In GBW, however, elevation of ground is higher for the majority of houses - so they are outside the major 100 year flood zone.	Did have a major ice storm a few years ago (referring to the one that was also in Quebec). One in a 100 years type of thing. Major storms/hurricanes used to track up the Bay of Fundy now they seem to be veering more to the east coast of Nova Scotia.
10	One could see at your workshop that LIDAR mapping is going to be a valuable tool to assist us in determining where water flows. I'm amazed at the expensive homes still being built on the river (Bellisle mentioned). Royal District Planning Commission is ten years too late. However, LIDAR will benefit planning decisions going forward.	Groundhog day storm.	My biggest concern would be a combination weather event: when water levels are extremely high combined with a southerly storm creating 3 to 4 foot waves. This would overtake low lying roads taking the rock bases out. So 'wave action' combined with a big flood. Photos of flood events on St. John River can be found in "River Rising", published by Brunswick News. Edited by John Wishart. Hurricanes Edna and Carol. More hurricanes in our area in the past than now. Now we have more tropical storms (not hurricanes) coming into our latitude and our area. Hurricanes affecting east side of N.S. Hurricane Quan in Halifax in 2003. In order of rank: Ice storm of 1998 (most damage to trees); River Flooding of 2008 (erosion and wind with it); Flood of 1973.

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	M	N	O	P	Q	R	S
1	11. Are new issues related to weather/climate/water starting to arise in GBW that we haven't already discussed?	12. Considering past weather/cc impacts, could anything have been done differently to reduce negative impacts? What could be done in the future?	13. If there is an emergency in GBW do you know what to do? Who can help? Resources? Do you have any emergency plan?	Other: 1. Other parties to speak to?	Other: 2. Any locations I should visit to see what we have talked about?	Other: 3. Anything else to add?	
2							
3	No. Just flooding.	n/a. Not that I would know.	GBW has an emergency centre, but we don't have a 'family' emergency plan. Flyers are sent out from time to time with numbers to call.	No	No	No	
4	I'm not aware of many issues in GBW	Used to be several town flyers (once a month). We've NOT been communicating as much. Might be time again to put out all critical phone numbers. Doesn't hurt to do this.		Perhaps someone in the senior's home. If they had to move the seniors from an effectd facility, what is their plan?	Pamdenec Area - Nursing home (senior's home) by water. Older sections of GBW were there used to be waterfront cottages now made into permanent residences with finished basements. These homes (e.g. Riverside Park) are vulnerable to flooding.	Hampton Lighthouse Park River Centre was built so that water could leave the basement. Not so for our Brundage Point River Centre.	
5		Recommend that there should be radio channel one can turn to to get information. EMO puts all there info on computer, but if power goes out, one can't get the information. Also how to get sandbags wasn't very well organized. You had to go the hardware store and out behind were special hoppers where you could fill sandbags. Thought it wasn't properly thought out. You can only carry so many sandbags in an SUV (limits on weight load); thought bags should have been filled ahead of time.	We have an Emergency Centre. I know to call the Fire Department. That's where the Emergency Centre is located. Not aware that the community has an Emergency Plan related to Flooding.			I have a copy of "Upcountry Memories". In it are a number of pictures of ice and bridges that washed out in the past. Beechwood Dam was built in 1957-58. Mactaquac Dam in 1967 1968.	
6	Where people are developing in a flood plain that is prone to flooding. A lot of former cottages have been turned into year-round homes.	With respect to flooding, there has to be more due diligence in flood prone areas; development has to be better controlled. Ditches and size of culverts likely needs to be reassessed with respect to the having rain events.	EMO kicks in. There are people ready to help; someone will come around home to home and inform you of what needs to occur.		Drop down to Riverside Park where James lives.	No.	

APPENDIX 2 - CVAT Informant Interviews Grand Bay-Westfield

	M	N	O	P	Q	R	S
1	11. Are new issues related to weather/climate/water starting to arise in GBW that we haven't already discussed?	12. Considering past weather/cc impacts, could anything have been done differently to reduce negative impacts? What could be done in the future?	13. If there is an emergency in GBW do you know what to do? Who can help? Resources? Do you have any emergency plan?	Other: 1. Other parties to speak to?	Other: 2. Any locations I should visit to see what we have talked about?	Other: 3. Anything else to add?	
7		EMO has done a lot to prepare should an ice storm like the one that happened ten years ago happen again; a lot of thinking forward has been done; emergency plans. Nothing that I can think of.	Definitely. We have an emergency plan and an emergency centre.	No.	Across from the Home Hardware - Stater Street, First Street	Aside: Halifax Harbour used to be frozen solid in winter. Not now, wide open. Over Moncton way, my mother relates in the past fishing in December was not possible, but it is now. Lobster seasons is now 2 seasons, not one. How many days are sunny days in southern N.B. now? Seems like there are more. With the change of climate, I'm convinced we need to use more solar energy.	
8	No	Nothing comes to mind.		No	No	No	
9	Potable water will become an issue if they keep building these subdivisions that are so compact. Old Westfield has 1 acre lots - I like that. Open spaces are disappearing so its just a question of time before the water supply starts to disappear. Need to have a greater balance between development and conservation.	Flooding is not a major issue here. Farmers like flooding because it fertilizes their land. I recommend we go back to 1/3rd acre lots. Small communities much easier to manage than large communities. Our standards for sewage treatment are not up to European standards where you can drink the water coming out the other end of the treatment pipe.	no comment	No.	No.	State of Mactaquac Dam is so bad it's a big question whether it should be rebuilt or torn down and a new dam built. Dam is moving all the time. One side is on clay, the other on rock. They cannot turn on all the turbines at the same time as the vibration is too great. Could build a new dam below the old one.	
10	River flooding and tropical storms (heavy sudden rain events), and erosion due to the above which tends to block culverts and causes water to back up and overflow normal water courses. Weather we are getting now seems more intense whether rain storms or wind storms. Example: Tropical storm of August 2011 -we had no electricity, no water. In my 50 acre campground we had to pick up after the storm 15 dump truck loads of trees and brush. Wind was so strong for so long that it sunk 2 boats, shred the covers off many other boats.	EMO does a really good job on the whole informing us of river levels (recordings on the phone) when the river is flooding. Also weather forecasts are good as to what weather events are coming but sometimes the intensity of storms is not indicated (rain yes, but wind intensity they often don't speak to that and need to).	Yes.	No	No	No	

APPENDIX 3 - CVAT WORKBOOK RESPONSES: GRAND BAY- WESTFIELD

“WEATHER, CLIMATE CHANGE AND MY COMMUNITY” ISSUE: Flooding

P. Preamble

This document presents responses to questions asked in the CVAT Workbook Section ‘Flooding’ at the workshop held February 20 as well as during interviews conducted with PAC members and key members of Grand Bay-Westfield’s municipal staff²² in the course of the project.

Q. Questions and Responses

Step 1: Understanding Flooding in My Community

Past Flooding:

1. How have floods impacted your community in the past? Please note positive and negative impacts.

Yes. Major floods of the 30s (1936), 1973, 2005, 2008 have impacted the community. Negative Impacts: In the 1936 flood the salmon tagging building was flipped on its side and broken up. In the 1973 flood, water came over the retaining walls by the river in the Pamdenec area. Then all cottages were on posts close to the river. The lift station on Young Street (same area) was also affected. The current, combined with the ice, broke the ferry cable. The ferry service was occasionally stopped. The floods of 2005-2008 were not as high as 1973. High water in 2008 covered several roads, On Riverside Park water entered homes, causing power to be shut off. Well water was not available and septic systems were under water.

Impact on community depends on height of flood. Sudden heavy rains cause more damage to public property whereas river flooding affects primarily private property/residences close to the water. Train track and road washouts are due to localized flooding.

²² David Taylor, Development Officer, Troy Gautreau, Fire Chief, Bruce Gault, Commissioner of Public Works

2. What caused these floods?

High river level. Spring runoff entering the river throughout the St. John River watershed.

When do floods occur in your community? What time of year?

3. When do floods occur in your community? What time of year?

Spring (April, May) primarily. In 2005 and 2008 spring freshet was 3 to 4 feet above normal spring level of the river in Grand Bay-Westfield. Flooding can occur at other times (local flooding) due to rain events but these are minor in impacts compared to major spring floods. There was a rise in the river, however, to almost spring freshet levels in November 2010 or 2011.

4. How often do they occur?

Every spring the river floods (normal) due to spring snow melt and runoff.

Flooding in the Future

5. Are flood events changing, and if so, how?

Yes, major floods are closer together as witnessed in 2005 and 2008's floods. River is higher in recent years throughout the summer and again in late fall, early winter (November/December). The St. John's water level used to be quite low in August/September in the past but in 2011 it stayed at its summer high. Release of water from the dams in the river may have an influence on the river's changed height in late summer/late fall.

6. What types of flooding are occurring and what are some of the reasons why flooding may be more likely to occur in the future?

Types of flooding: river (fluvial) flooding, flash flooding and localized flooding (ponding) due to heavy rain events. No more waterfront left for development in community. Development has moved elsewhere (higher ground). Currently localized flooding and flash floods are more problematic for community, if infrastructure fails, than river flooding.

Reasons flooding more likely to occur in future: More water in river system due to heavy rain/snow events (in northern part of province) contributing to higher spring runoffs or forcing a release of water from the dams. Combination event: Examples: High spring freshet coupled with major rain storm, or, high spring freshet coupled with lunar cycle contributing to higher spring tides coming into the river from the Bay of Fundy. River flooding will affect private property. Heavy rains now and in future, however, can lead to more local flooding (if, for example, there are blockages in pipes) and hence will have a greater impact on municipal infrastructure.

Step 2: What Locations Will Be Affected by Flooding?

7. What areas of your community have been affected by flooding? Please explain.

27. Brittain Road on the Nerepis River (river flooding)
28. Willow Bank Trailer Park at the mouth of the Nerepis River (river flooding)
29. Hoyt Brook, just south of River Valley Drive and Station Street intersection (localized flooding)
30. Brundage Point Ferry Landing (river flooding)
31. 150 Nerepis Road (river flooding)
32. Riverside Park Road (river flooding)
33. Brandy Point Road (river flooding)
34. River Steet homes (below Hardware store on river front) (river flooding)
35. Oak Lane in its undeveloped portion (river flooding)
36. Hazel Street with its lift station at the bottom of the street (river flooding)
37. Subdivision including Ridge Way Edgemount roads (localized flooding)
38. Shannon Road (river flooding)
39. Sewage Lagoon on Shannon Road (river flooding)

8. Are certain areas affected more by flooding than others?

Yes, the areas above.

9. Which of the following factors have made a difference in where flooding has occurred in your community:

- a) Shape of the landscape (i.e. topography)
- b) Drainage
- c) Elevation

- d) Proximity to lakes and/or rivers
- e) Vegetation
- f) Overloaded infrastructure (e.g. culverts, storm water systems)
- g) Infrastructure maintenance
- h) Town planning/zoning and land uses
- i) Other:

All that apply: a), b), c), d), f).

10. An aerial photo is a valuable tool for identifying areas sensitive to flooding in your community. Is this tool available to you.

Yes.

11. A flood risk map is also a helpful tool in showing areas that might flood. Is this tool available to you?

Yes, from the province.

12. Do you know the flood zones in your community. If yes, what are they?

(Areas indicated in Question 5 are listed as the flood zones).

13. Do you expect that the areas affected by flooding in your community will change in the future? If so, how? What are some of the factors that you think will lead to this change?

Don't know.

Step 3: Which Facilities and Infrastructure will be affected?

TABLE response (What infrastructure could be impacted by flooding?)

- Roads – little damage done to road surface; its more a question of residents not being able to access homes or community (as when houses are surrounded with water)
- Lift Stations – Power could be cut off. This would affect residents with respect to their flushes. Potential for back-ups in sewer system.
- Sewage Lagoon – Could be topped by flooding but hasn't happened yet. Also ice and debris on a very high flood could erode walls. This would be an extreme case.

- River Centre at Brundage Point – depending on height of water
- Ferry Service could be impacted (not related to Community but to Department of Transportation)

14. What is the status of the culverts in your community? Do any need upgrades, replacement or maintenance?

Culverts have been upgraded. All culverts need to be maintained. Community carries out periodic inspections to keep culverts in good shape.

15. Is there other infrastructure in your community that helps divert, control water or help avoid blockages and backup of water flow? If so, is this infrastructure adequate, well maintained and working well?

No.

16. How is the build up of water in roadside ditches dealt with in your community?

If ditches are blocked causing water ponding, municipality will clean them. Community keeps ditches maintained to the best of our ability to facilitate water flow and avoid water ponding.

17. Have any of the buildings in your community been damaged by flooding in the past? If yes, list examples.

- River Centre at Brundage Point
- Homes in Riverside Park area

18. Do you have the types of information to answer these questions? If not, do you know how to obtain this information?

Yes.

Step 4: Who Will Be Most Affected and Who Can Help?

19. Who is affected by flooding in your community?

Residents living along the riverfront can be affected by flooding. This is a limited number of homes, however, and where re-building is occurring, people are building up their homes to a higher floor plate elevation.

20. Do you have a plan for how you will let people know if flooding is forecasted?

Yes. Grand Bay-Westfield has the Sentinel Alert System which is provincially used by EMO. Allows community to send mass messages to email addresses, phone numbers, text messages. Fire department and police also go door-to-door, if no other means to reach residents.

21. What are the main barriers for these people to receive help during a flood? (e.g. communication, transportation)?

Only barrier so far is a lack of desire on the part of a resident to receive help in a flood situation. This is the only problem we have experienced thus far.

22. Do you have an up-to-date emergency plan?

Yes, along with Severe Flood and Severe Storm Emergency Response Plans.

23. If 'Yes', does this plan address the barriers for people affected by flooding?

Yes.

24. If 'No', do you have the time, people, and money to create an emergency plan?

25. Are there important heritage or recreation areas that have been affected by flooding in the past or may be affected in the future? If yes, please describe.

Only building affected so far is the Brundage Point River Centre where recreation activities take place.

26. Are there any other ways that local lifestyles and/or culture have been or may be impacted by flooding?

Not for Grand Bay-Westfield in the past.

TABLES in workbook on pages A27 and A28 respecting agencies or individuals or equipment owners that could help in a flood:

Information on contacts is covered in the community's Emergency Measures Response Plans.

Step 5: How Might Your Economy Be Affected By Flooding?

27. What are the most important economic activities in your community today?

- Retail plaza – Grand Bay Plaza
- Commercial strip from municipal boundary with the City of Saint John to Woolastok Drive

28. Has flooding impacted these economic activities in the past? If yes, how?

Not to community's knowledge.

29. What economic activities are expected to be most important in the future?

Developing a new commercial area on Col. Nase Blvd.

30. How could flooding impact these economic activities in the future?

Localized flash flooding possible if a culvert becomes blocked.

31. What will happen to your tax base if these economic activities are impacted?

Not anticipated that it would affect tax base.

32. What are the costs associated with a flooding event and what revenue sources exist to pay for these costs? What costs would have to be covered by your municipality?

If costs of flooding are significant, they are classed as 'Disaster Events' and provincial funding is utilized. This occurred in 2005 and 2008. Both municipalities and residents can apply for disaster funding. The municipality of Grand Bay-Westfield applied and it received full compensation.

Step 6: How Could the Environment be Impacted by Flooding?

33. Will flooding cause environmental problems in your community? If 'Yes', what kinds of problems might occur?

Fish habitat and sensitive habitats normally flood and have for a long time. Community has designated conservation and environment zones on municipal zoning map (examples: Sagwa area; Inglewood area; Lagoon on Shannon Road). Sedimentation in Nerepsis River and beyond its mouth at the time of strong runoff from Base Gagetown has contributed to coves along the community's shore filling in with silt and mud.

34. Are there any endangered species or habitats in your community that may be threatened by flooding?

No. Nothing has been officially designated as endangered.

35. Are there concentrations of hazardous wastes in your community?

No.

36. If 'Yes' are these wastes stored safely?

Not applicable.

37. Does flooding increase the risk of release of the wastes into the local environment?

Not applicable.

38. If 'Yes', briefly describe the risks and how flooding might increase them.

Not applicable.

39. Do you have an environmental protection plan in place?

No. Community has an Emergency Plan. Could be required, however, in the course of doing a specific development (e.g. Col Nash Blvd; past e.g. River Centre at Brundage Point)

40. Are there any positive environmental impacts (or improvements in the local environment) that might occur because of flooding in the community?

Replacement of nutrients in environmentally designated areas.

Step 7: What Can You Do?

41. Considering all of the information in Steps 1 to 6, what are the main flooding issues in your community?

- River flooding
- Localized flooding due to heavy rains leading to ponding, over-swollen streams and culverts

42. Have you done things in the past that have helped reduce the impacts of flooding in your community? If 'Yes', what were they?

- Raising road heights (e.g. Riverside Park; Brandy Point Rd.; Shannon Rd.)
- Replacing culverts and adding culverts to add capacity for overflow (e.g. Brandy Point Rd.)
- Closed a road due to erosion (e.g. Riverbend Rd.)
- Railway culvert was replaced (near Westfield Cres.) when it collapsed due to heavy rains (NB Southern Railway did this work, not the municipality).
- Municipality has done a good deal of curb and gutter work to control water flow.

43. Did certain things work better than others? If 'Yes' what were the most effective measures?

Work that was done was effective. Raising roads and replacing culverts worked to deal with heavy rain impacts.

44. Are there things that you have tried or wanted to do but couldn't because of various barriers or challenges?

No, not really.

45. If 'Yes' explain what adaptation options you tried and what were the barriers or challenges you faced?

Not applicable

46. Are there ways these challenges could be overcome?

Not applicable

47. Considering the alternatives discussed above (potential adaptation options presented in the workbook) (and any others you may be able to think of) please identify adaptation options that you have not tried before that might address flooding in your community.

- LiDAR mapping is seen as a very useful planning tool going forward. Particularly if there is an increase in 'pool type' flooding due to heavy rainfall. Community then could use this tool to conduct an assessment of what could potentially happen in various areas of the community.
- Possible option is to move people away from severely affected areas but that raises legal issues respecting landowner rights and land valuation and compensation. A bylaw to forbid development outright is problematic given the property devaluation impact on either businesses/landowners.

Grand Bay-Westfield has dealt effectively with maintaining its infrastructure (i.e. roads, culverts, ditching, etc.); informing the public about closed roads (education) during flood and rain events; foundations are required to be 30 inches above road grade; some restrictions apply to developments on steep slopes; 30 metre setbacks from watercourses (streams or river) are required for developments; and wetlands are identified in municipal plan (Preventative zoning and permitting); an up-to-date Emergency Plan also exists (Emergency measures).

48. List the options for adapting to flooding in your community that you believe should be pursued now or in the future.

4. **LiDAR mapping introduced.** LiDAR can help take the guesswork out of what could happen going forward. Useful tool to know:
 - What culverts in community are likely to be most affected by heavy rains and runoff
 - How stream channels can contribute to flooding indicating where new storm sewers should be
 - If building set-backs in some areas should be increased or development limited.
5. **Continued public education respecting flooding in the community.** Use of Department of Environment's NB Climate Change presentation requested for use in this regard. Also LiDAR mapping can assist in informing residents, engineers, architects and builders as to a property's proneness to water ponding, flood, etc.

- 6. Continue periodic updating of the community's Emergency Contact Information for residents, businesses and the Emergency Measures Response Plan.**

