Tsunami Warning Communications: Community and 'Last Mile' Considerations

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Outline

1. Warning as integrated system
2. Considerations for effective warning
3. Warning dissemination methods
4. Special needs
5. 'Last mile' tsunami warning reception and community activation
6. Case study: British Columbia 'Last Mile' communication challenges
7. Summary Points
8. References

Warning must be viewed as part of an integrated system and not simply a technology

Warning system elements

- Hazard identification, risk assessment and vulnerability analysis
- Detection and monitoring
- Emergency management structure
- Local dissemination
- Public education/exercises

Warning sub-system elements

- Deciding to issue a warning
- Framing the warning
- Targeting the warning
- Disseminating the warning
- Receiving and understanding the warning
- Validating the warning
- Taking appropriate action
- Feedback to assess impacts


Response
Recovery
WARNING!
Hazardous event
Preparedness
Mitigation

Any system is only as effective as its weakest link

Contributors to warning system failures

- Failure of forecasting/detection
- Ignorance of prevailing conditions of vulnerability
- Failure of warning system infrastructure
- Lack of coordination and interoperability
- Inability to remain up-to-date
- Failure to communicate the threat accurately or in sufficient time
- Failure to understand the warning
- Constrained capacity of communities to respond

Considerations for Effective Warning

Ultimately, the success of a warning is measured by what actions people take

A public warning comprises two essential components:

1. an alert
2. a message with instruction

An alert is intended to interrupt people from whatever they are doing at the time and secure their utmost attention.

The message should convey what, where, when, and how severe the hazard is, how likely the hazard is to occur, and what action(s) needs to be taken by the recipients of the message.

Alerts and messages are not always delivered by the same method or technology.

Ultimately,

- the warning must be capable of *interrupting* whatever people are doing, compelling them to understand the threat, and to act as instructed.
- people must *believe* that the warning is truthful and accurate.
- people must personalize the message as being *relevant* to them, and
- people must decide to *act* and overcome any constraints to taking the advised actions.

Warning recipient - factors to consider

- identifying who needs to be informed
- where they are located
- what they are doing
- time of day/season of year
- what they rely upon to receive local news and information
- what special needs they may have, and
- how well they understand and accept the warning in order to take action.

Warning system parameters

- Reliability
- Coverage
- Messaging
- Emergency/security Issues

Warning dissemination methods

Mass notification methods

not individually addressable and generally provide the same alert or message to everyone within a particular geographic area, regardless of level of individual risk.

Addressable/Personal notification methods

can be tailored to target alerts and messages only to those at risk or to specific groups.

Sample warning methods

Mass notification

- Fixed sirens
- Mobile sirens
- Bells/outdoor speakers
- Electronic signs
- Radio and television
- Cable television
- Low power broadcast radio
- Coast Guard/marine radio

Personal

- Door-to-door
- Residential route-warning

Addressable

- Telephone
- Mobile phone and SMS
- Satellite
- Subscriber paging and tone-alert
- Weather Radio
- Internet
- VoIP
- Amateur radio

Outdoor audible warning methods

- Many different sounds can be used for disseminating mass audible warnings.
- The basic requirements are that the sound should be clearly audible and the listener should know what it means.
- Factors affecting the ability of an audible warning to reach a potential listener include barriers to sound in the listener's immediate vicinity, distance from source and background or masking noise.

Indoor warning methods must rely upon technologies that are:

- capable of penetrating inside spaces;
- wide-spread enough to ensure that they can reach any space where people may be residing;
- sufficiently disruptive to capture undivided attention, and
- are capable of disseminating messages any time of day or night.

TIMELINESS OF METHODS TO DELIVER TUSNAMI WARNING	
GENERAL ***More quickly disseminated*** ↓ ***More slowly disseminated***	**Sirens** **Radio and television:** message: break-in community announcements or phone-in interviews with emergency officials **Scheduled news bulletin**: may take longer to go to air **Internet web sites** **Community notice boards (mobile electronic signs)** **Newspapers**
SPECIFIC ***More quickly disseminated*** ↓ ***More slowly disseminated***	**Two-way radio – group call** (commercial, marine, private, amateur radio) **Pagers and Tone Alert** (activated radios – Weather Radio) **Telephone** (including phone trees or cascades where each person contacted calls others) and automated mass dialing systems with pre-recorded messages **Cellular Phones** **Internet email** (may not always be at computer) **Facsimile**: especially for businesses and government institutions. **Loud hailers**: mobile public address systems, route warning or **Door-to-Door**

Special needs

- Sensory
  - Depending upon what activities people are engaged in at the time of the warning or if they are sensory impaired, it will be necessary to rely upon methods that cater to different senses (e.g., hearing, sight) to ensure that everyone is alerted and informed.
- Language
- Culture

'Last mile' tsunami warning reception and community activation

Every community needs to have an established Warning Reception Point that has:

- 24/7/365 accessibility.
- warning reception capability.
- communication/dissemination capability to alert local emergency managers.
- ability and authority to activate local public warning system(s).

Community emergency response and coordination

In accordance with local emergency plans, communities should have some form of an *Emergency Operations Centre* in order to execute and coordinate tsunami warning functions,

- staffed by trained emergency managers/ volunteers.
- able to communicate with adjacent EOCs/Warning Points.
- able to communicate with regional or national Emergency Operations Centres.

Other important communication considerations

Communication needs throughout the emergency period:

- Watch
- Initial warning
- Evacuation
- Rescue
- Warning duration
- All Clear
- Re-entry
- Relief/Recovery

'Last Mile' Communication Challenges

British Columbia Case Study

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Public Safety and Emergency Preparedness Canada | Sécurité publique et Protection civile Canada

An Assessment of the B.C. Tsunami Warning System and Related Risk Reduction Practices

Tsunamis and Coastal Communities in British Columbia

Canada

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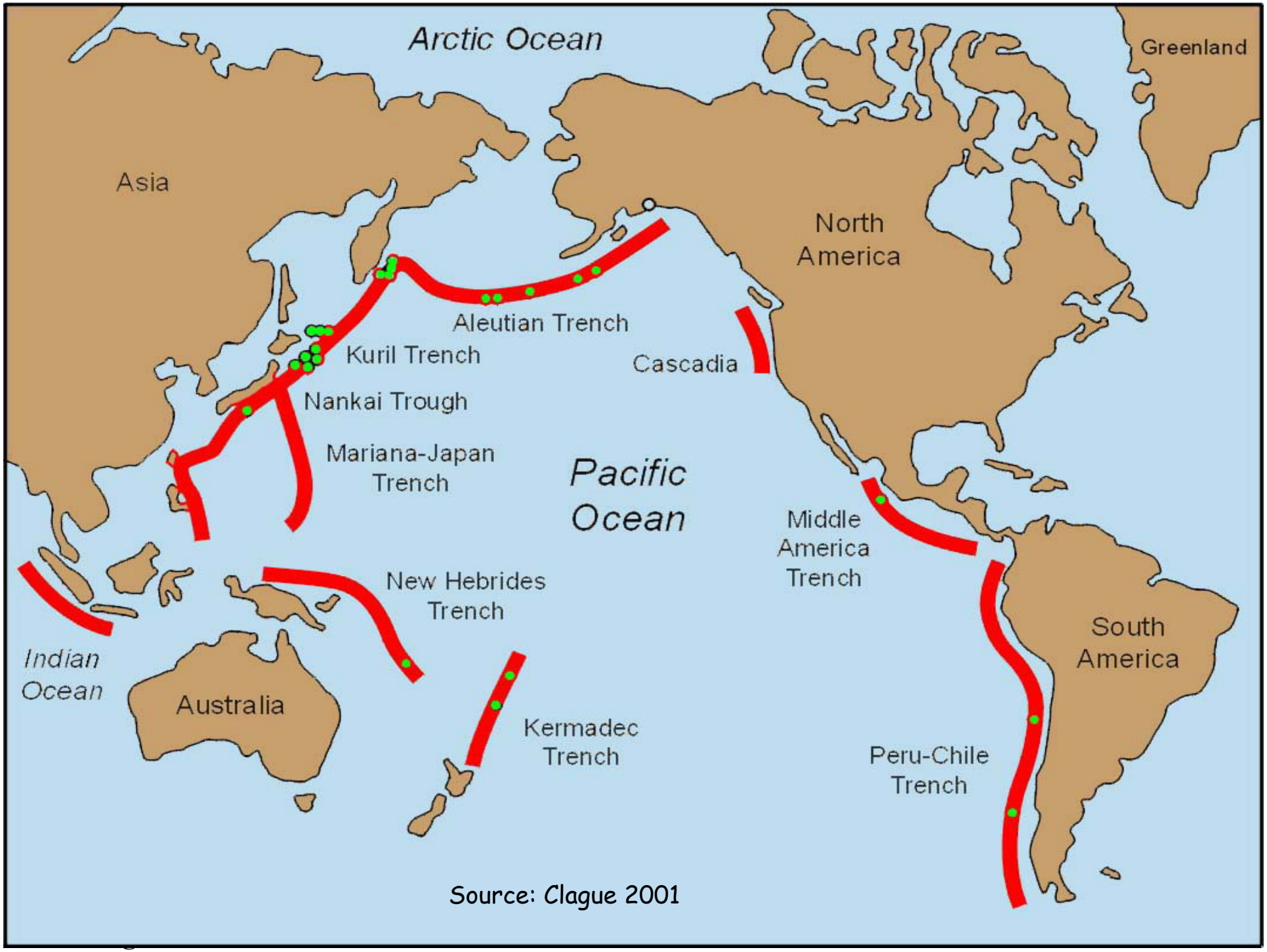

Source: Clague 2001

1964 Alaskan Earthquake and Tsunami

Source: http://www.vancouverisland.travel/general/maps/

Courtesy: British Columbia Provincial Emergency Program

Courtesy: British Columbia Provincial Emergency Program

British Columbia
Tsunami Warning System

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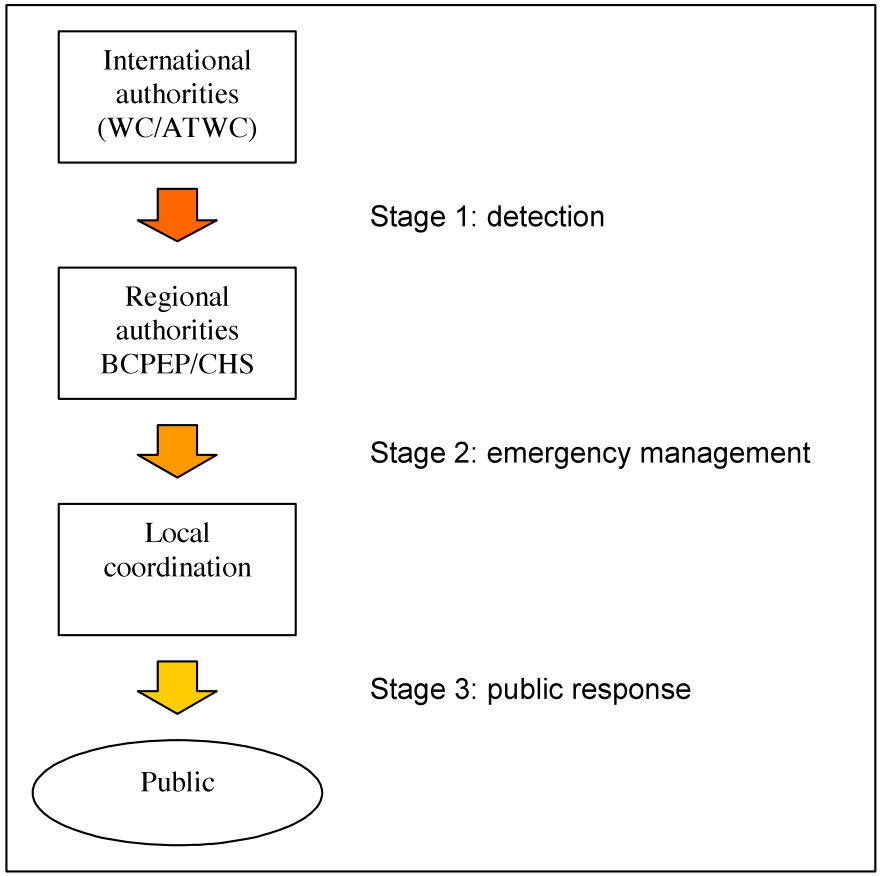
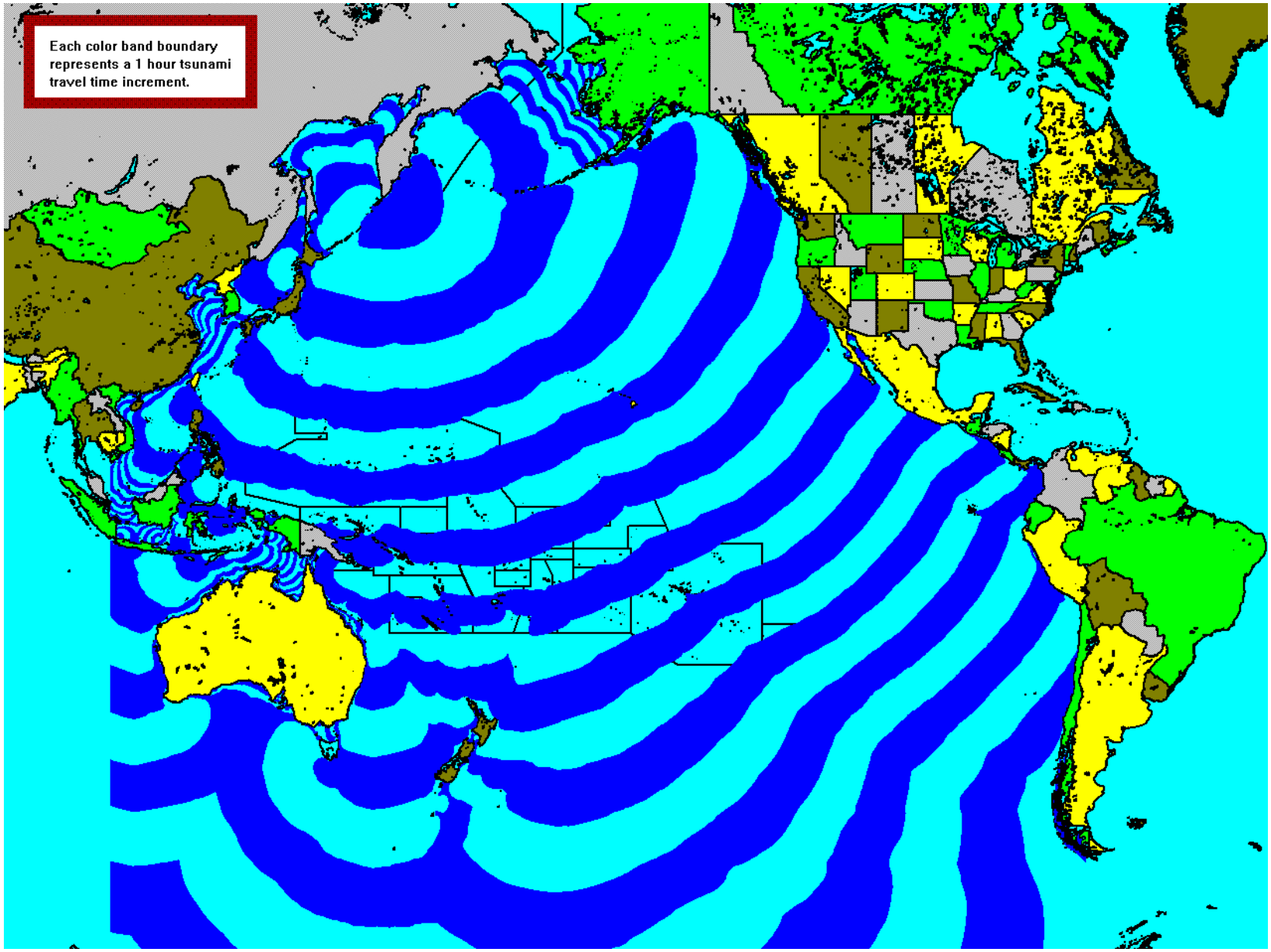
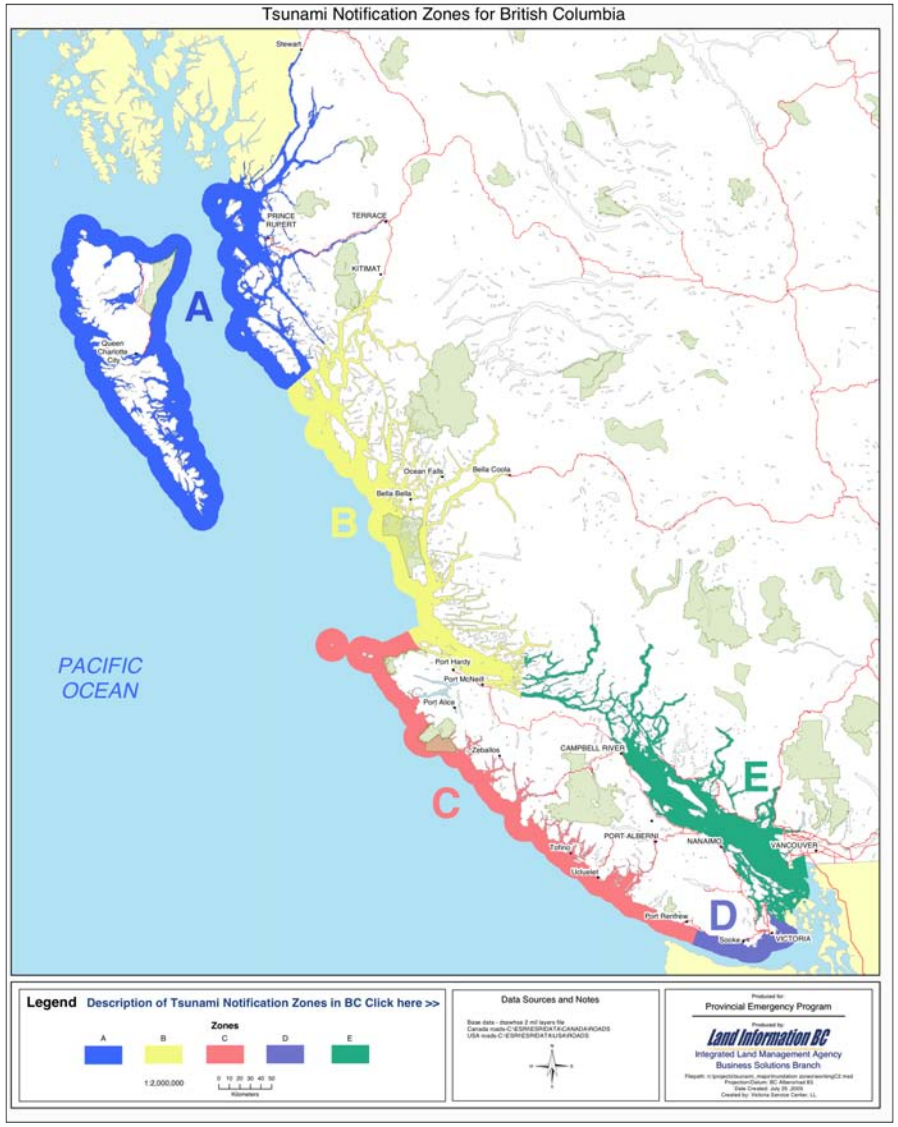
B.C. Tsunami Warning System Components





Source: NOAA http://wcatwc.arh.noaa.gov/web_tsus/17371016/traveltime.gif



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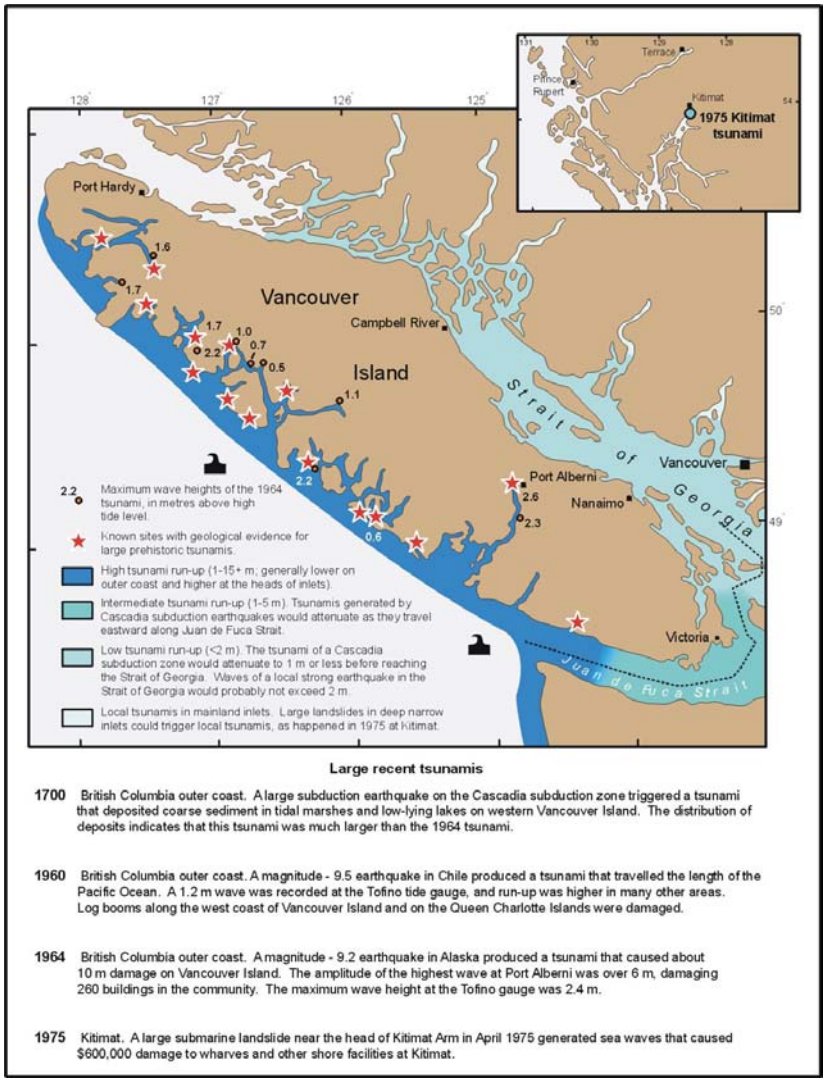
Special challenges for British Columbia

- Most effective in the case of far-field or telegenic tsunamis
- Not designed for locally generated tsunamis
- Changing coastal socio-economic considerations



Large recent tsunamis

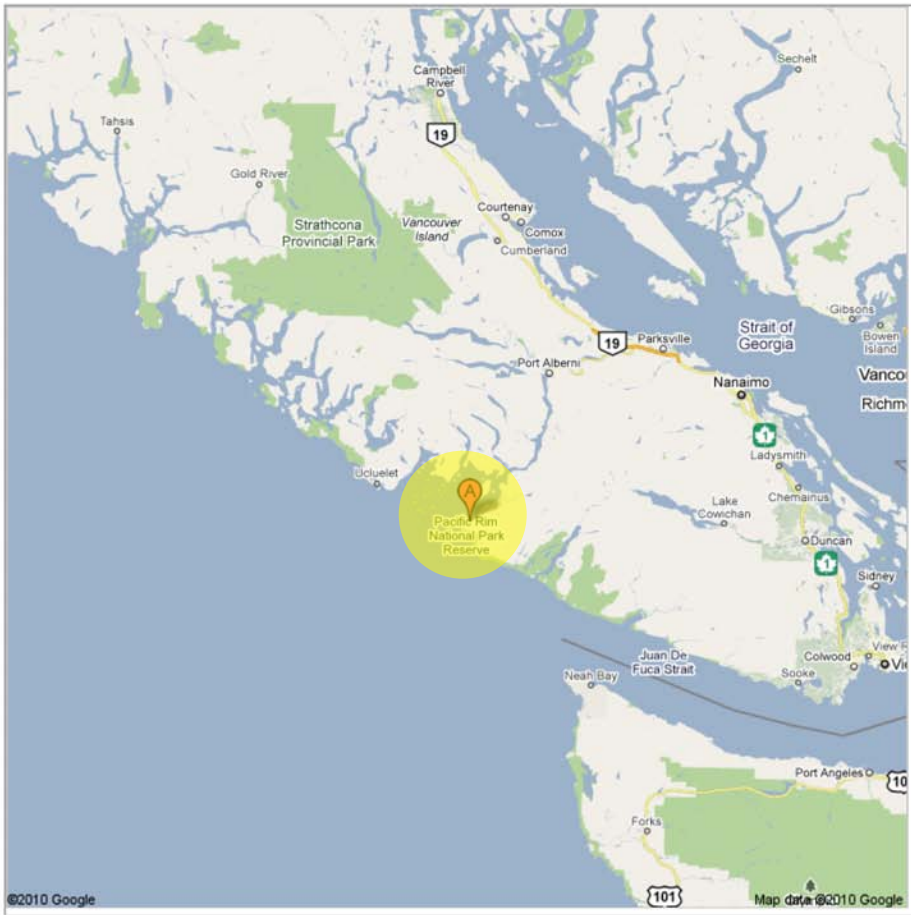
1700 British Columbia outer coast. A large subduction earthquake on the Cascadia subduction zone triggered a tsunami that deposited coarse sediment in tidal marshes and low-lying lakes on western Vancouver Island. The distribution of deposits indicates that this tsunami was much larger than the 1964 tsunami.

1960 British Columbia outer coast. A magnitude - 9.5 earthquake in Chile produced a tsunami that travelled the length of the Pacific Ocean. A 1.2 m wave was recorded at the Tofino tide gauge, and run-up was higher in many other areas. Log booms along the west coast of Vancouver Island and on the Queen Charlotte Islands were damaged.

1964 British Columbia outer coast. A magnitude - 9.2 earthquake in Alaska produced a tsunami that caused about 10 m damage on Vancouver Island. The amplitude of the highest wave at Port Alberni was over 6 m, damaging 260 buildings in the community. The maximum wave height at the Tofino gauge was 2.4 m.

1975 Kitimat. A large submarine landslide near the head of Kitimat Arm in April 1975 generated sea waves that caused $600,000 damage to wharves and other shore facilities at Kitimat.

(Source: Clague et al., 1999)



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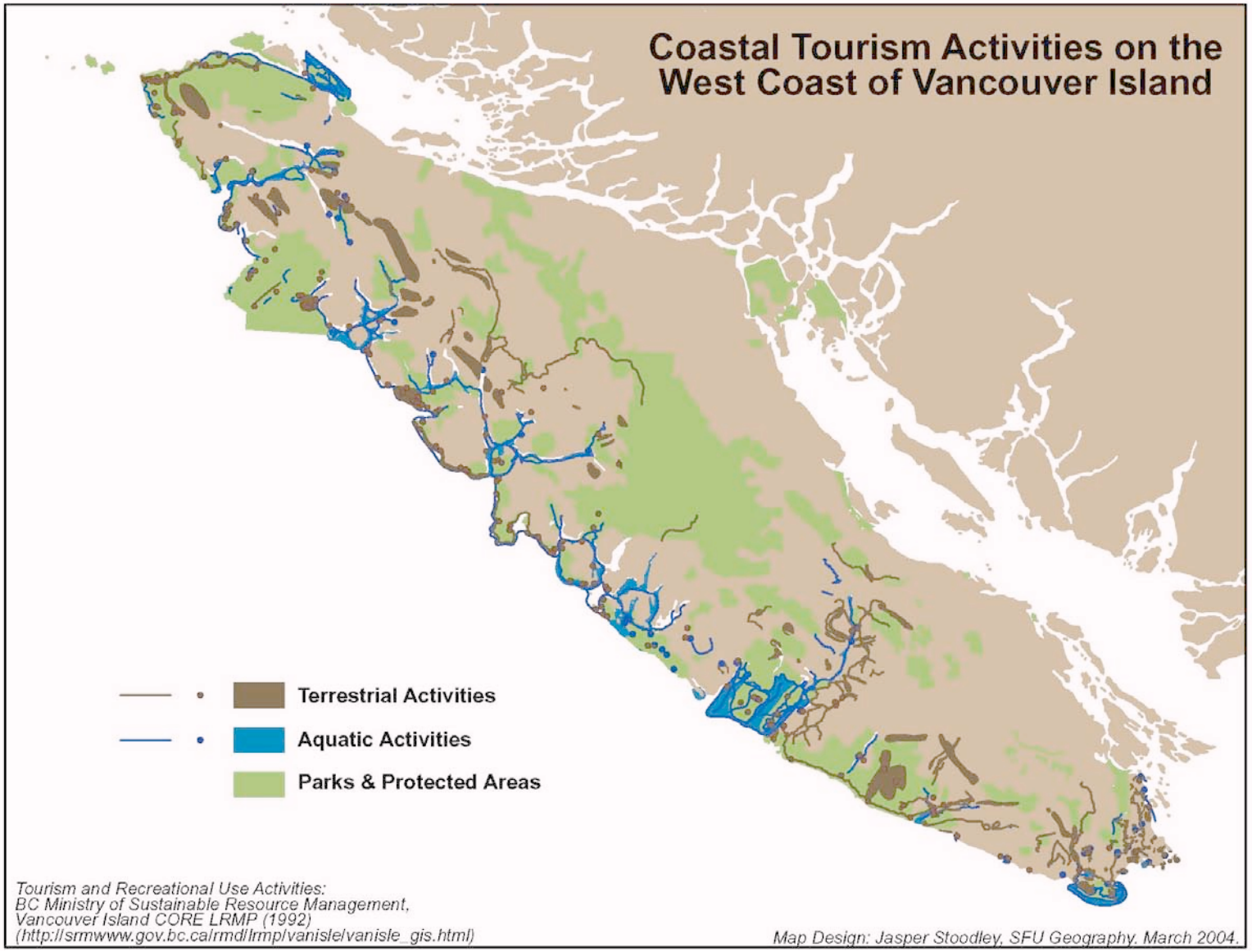

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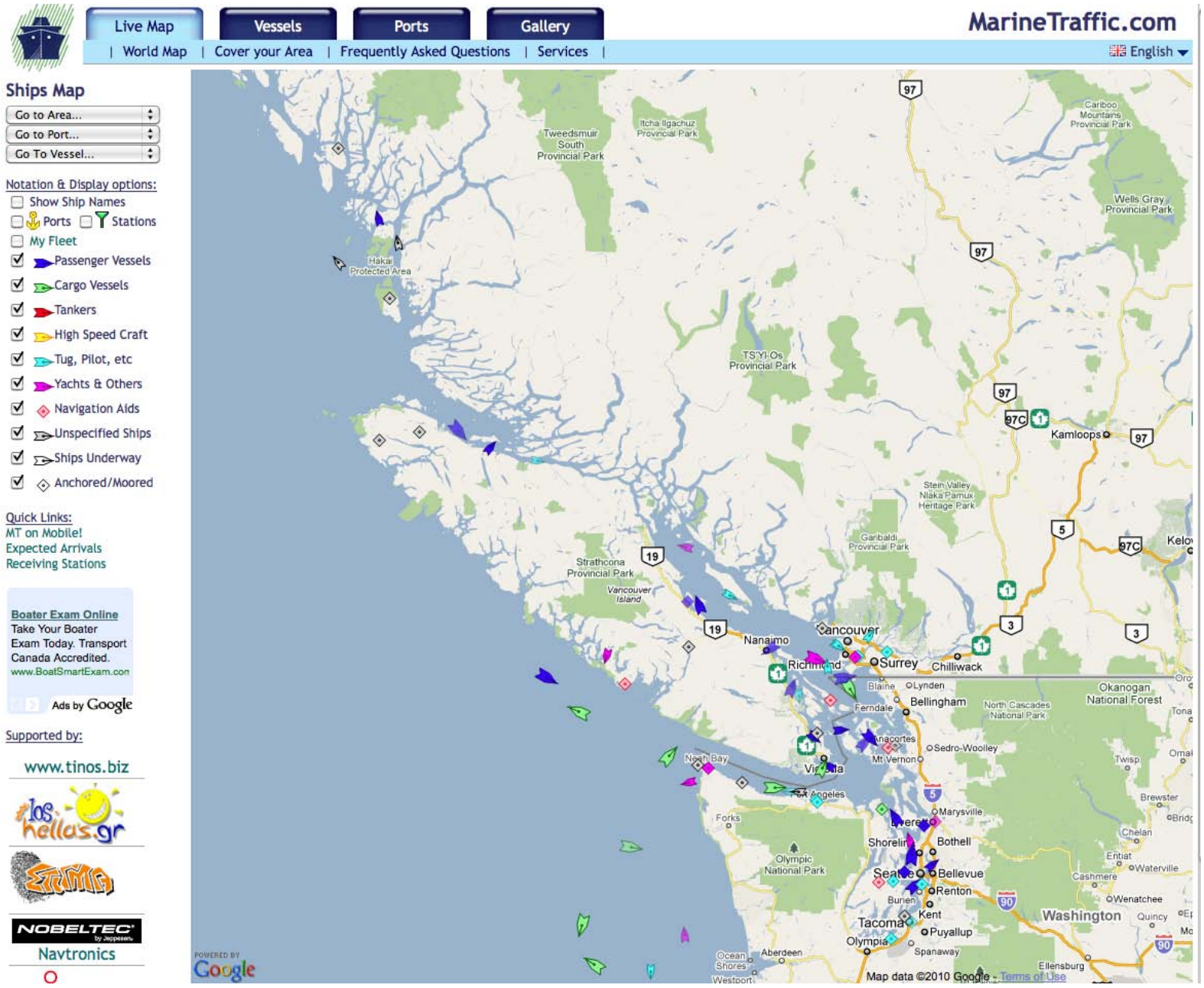
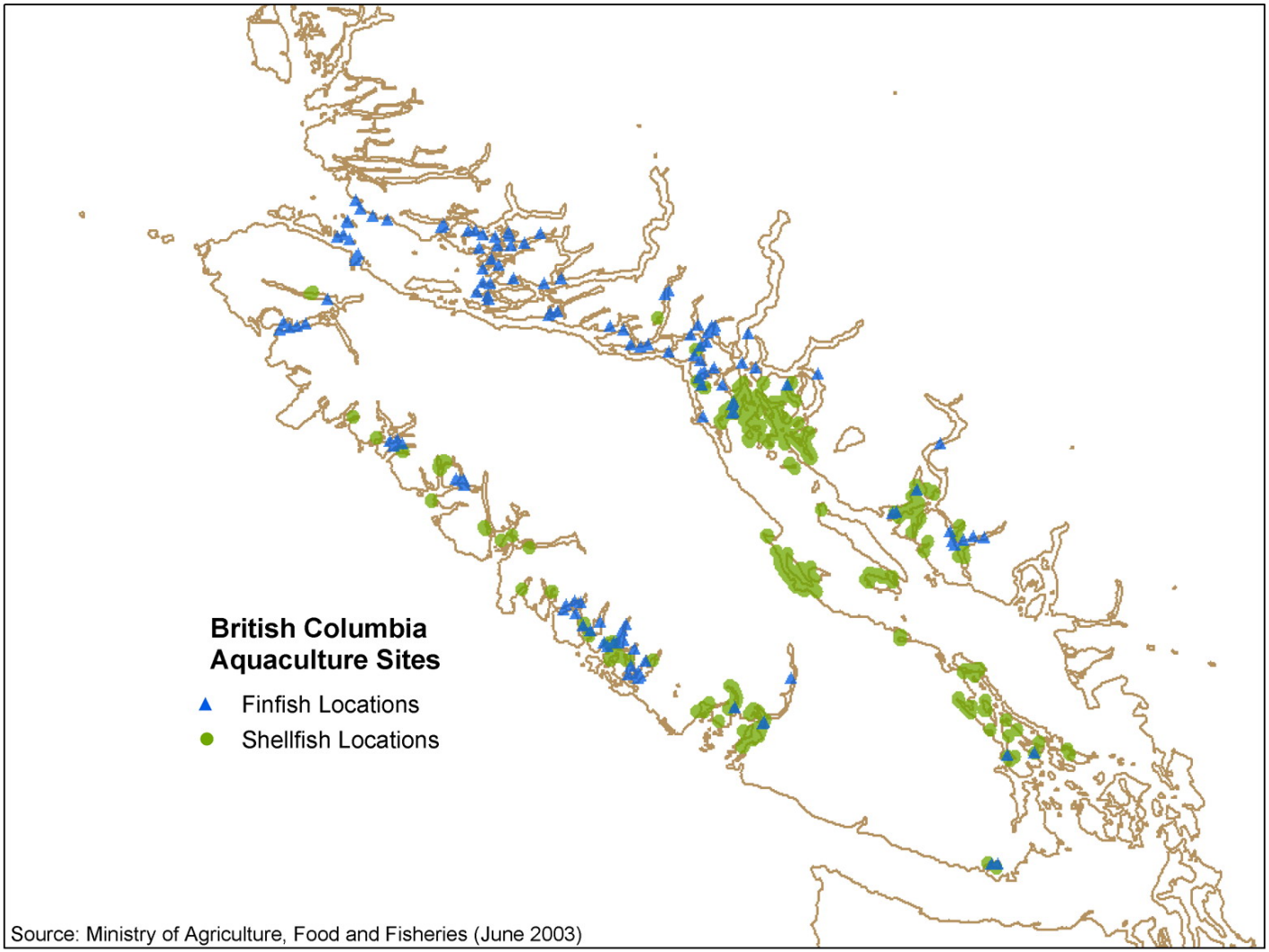


Source: http://www.marinetraffic.com/ais/



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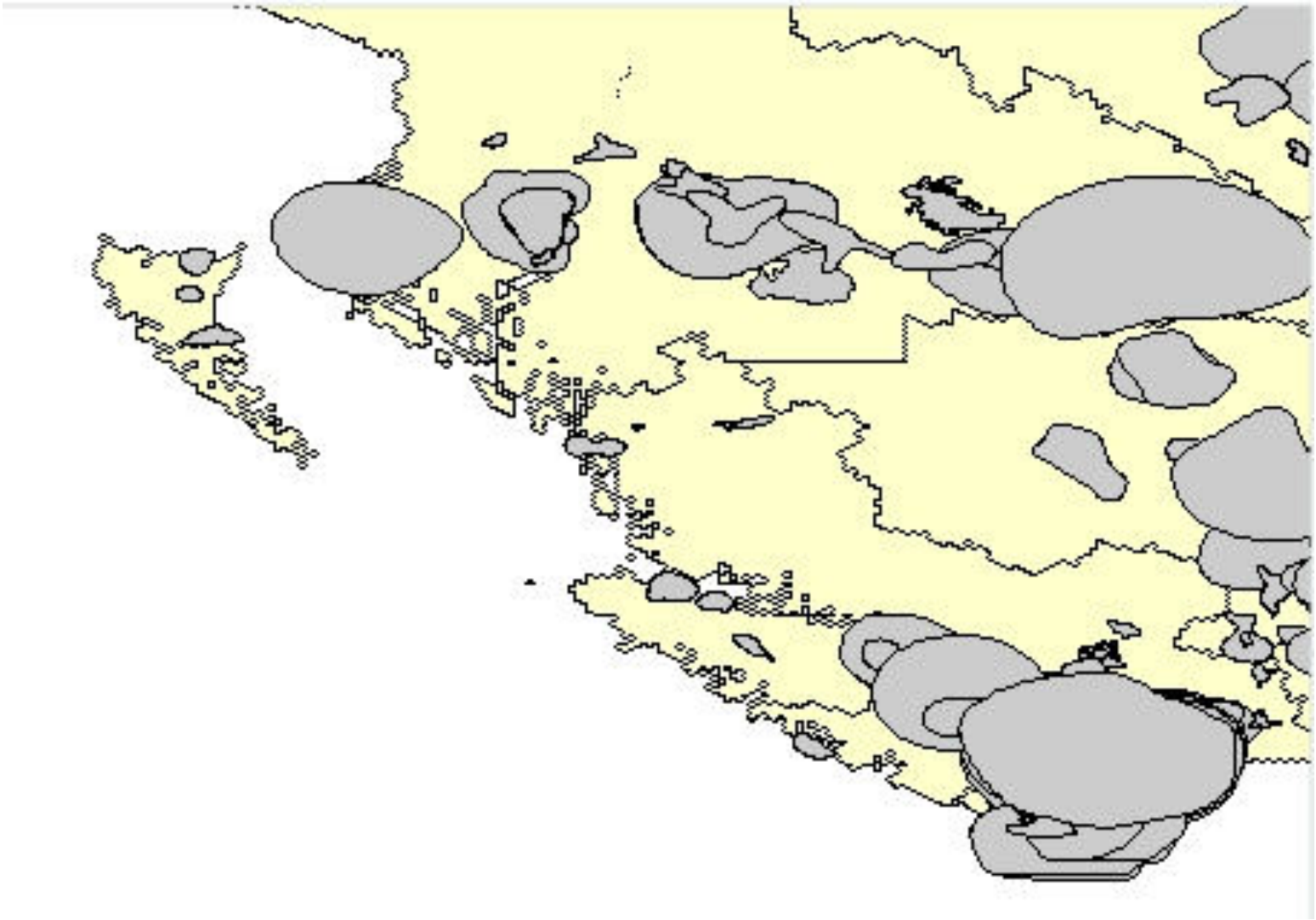
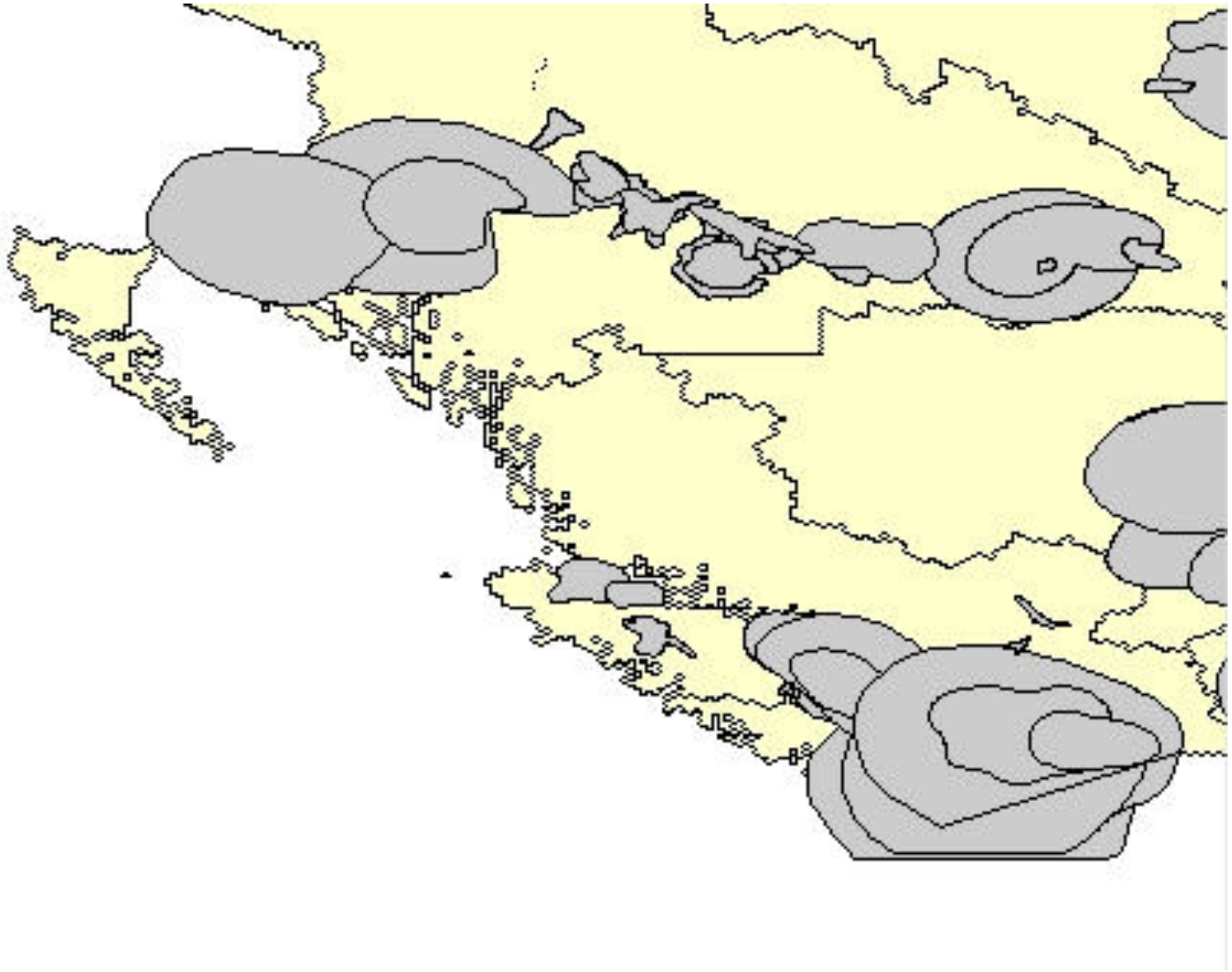
Canadian West Coast Tsunami Warning System limitations

- Coverage – community
- Coverage - terrain
- Coverage – transient populations
- Means of communication and warning
- Community and industry preparedness
- Public education and awareness

Broadcast Radio Coverage



Off-air Television Coverage

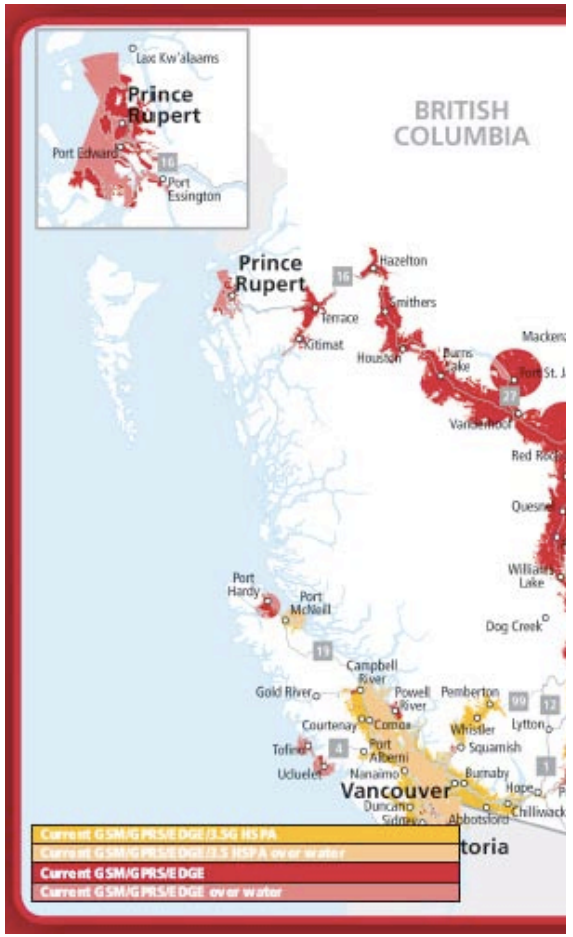


Cellular Phone Coverage

Telus/Bell

http://www.telusmobility.com/en/BC/hspa/canada3gmaps.shtml

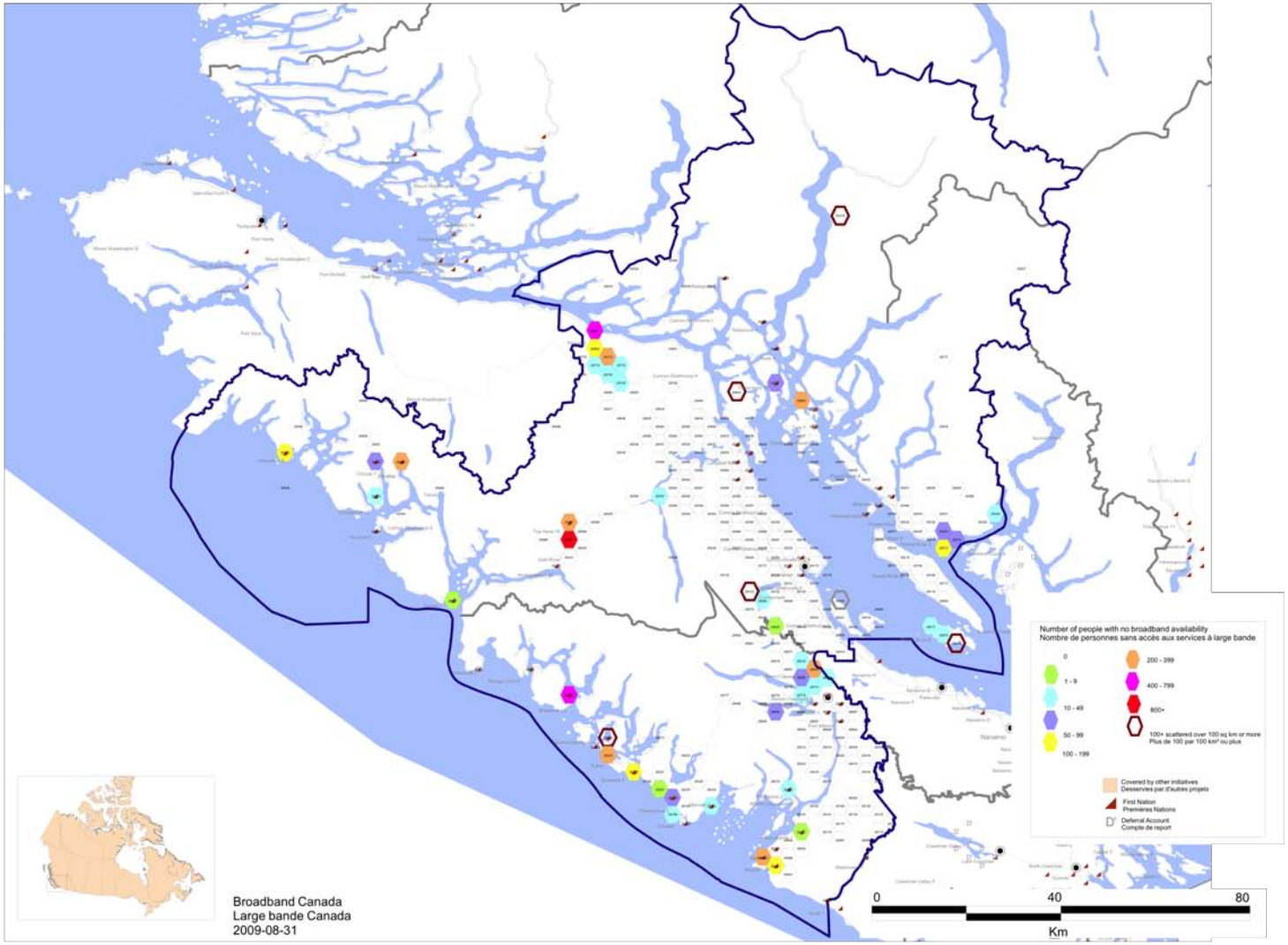
Rogers



http://your.rogers.com/Store/Wireless/coverage/info.asp?

Broadband Unserved Areas

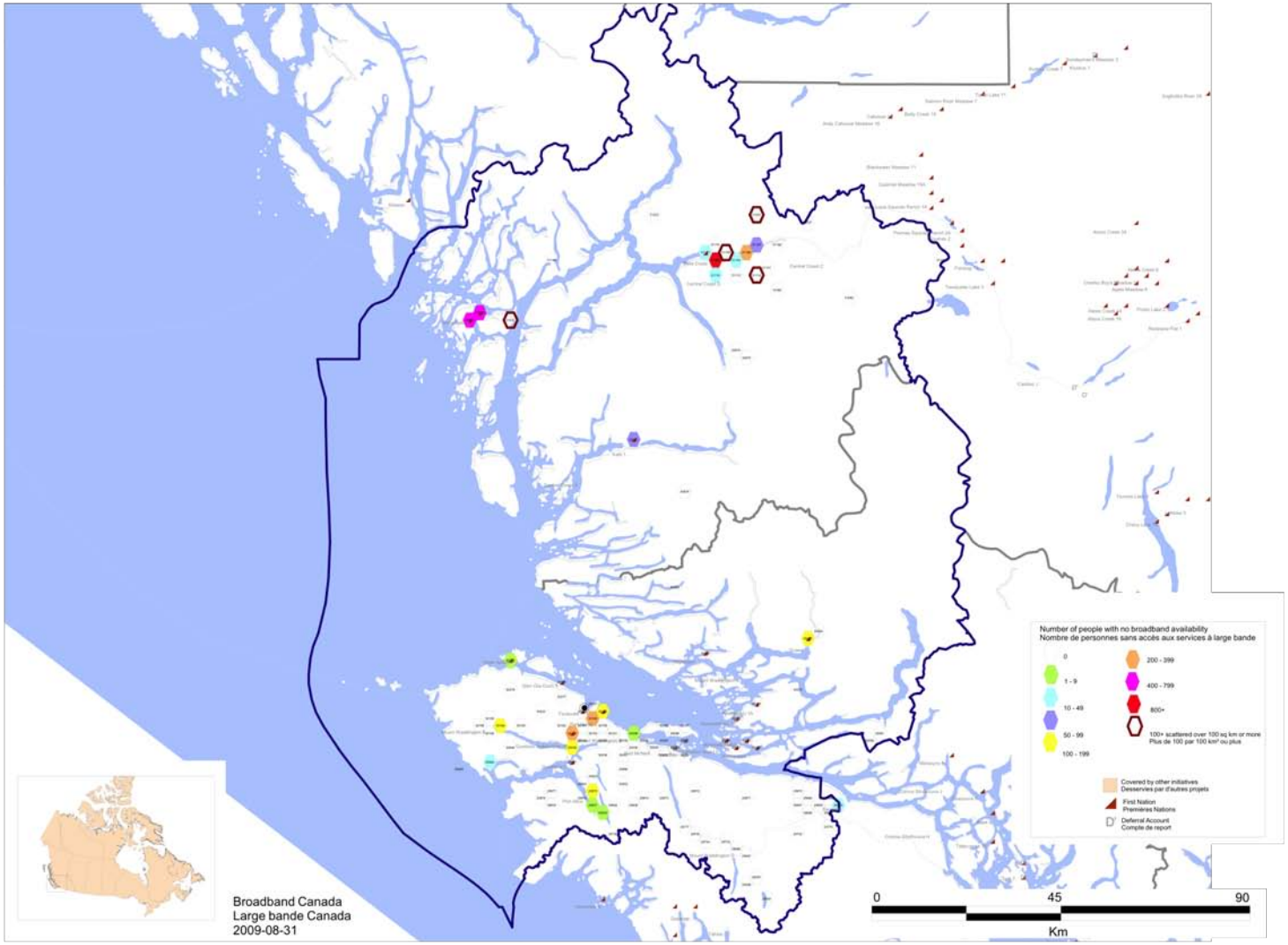
British Columbia / Colombie-Britannique
GSA: BC5910C / ZGS: BC5910C



Source: http://www.ic.gc.ca/eic/site/720.nsf/eng/home

Broadband Unserved Areas

British Columbia / Colombie-Britannique
GSA: BC5910B / ZGS: BC5910B



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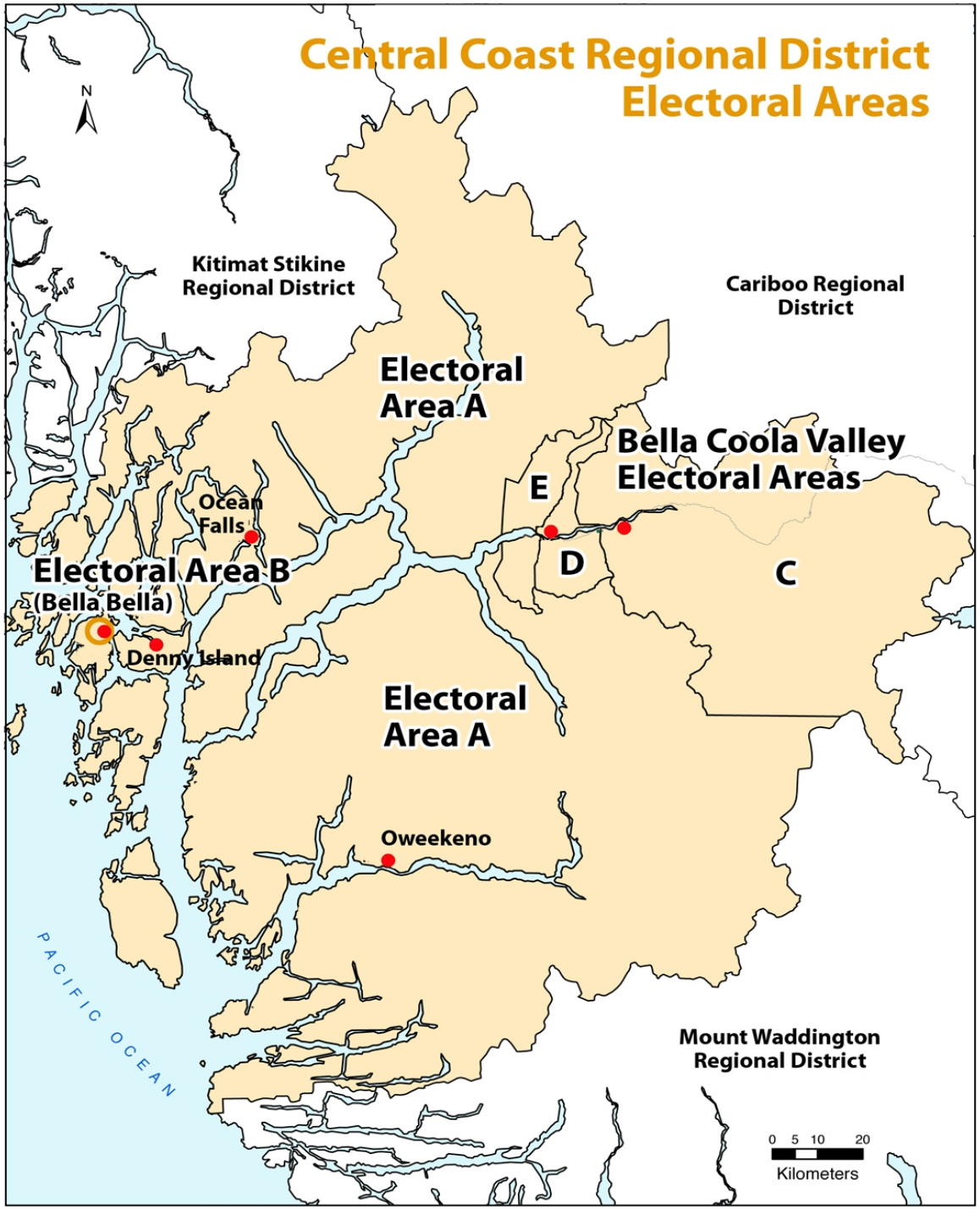
Terrain


Central Coast Regional District
Electoral Areas
N
Kitimat Stikine
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Cariboo Regional
District
Electoral
Area A
Bella Coola Valley
Electoral Areas
E
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C
Ocean
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Electoral Area B
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Denny Island
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Mount Waddington
Regional District
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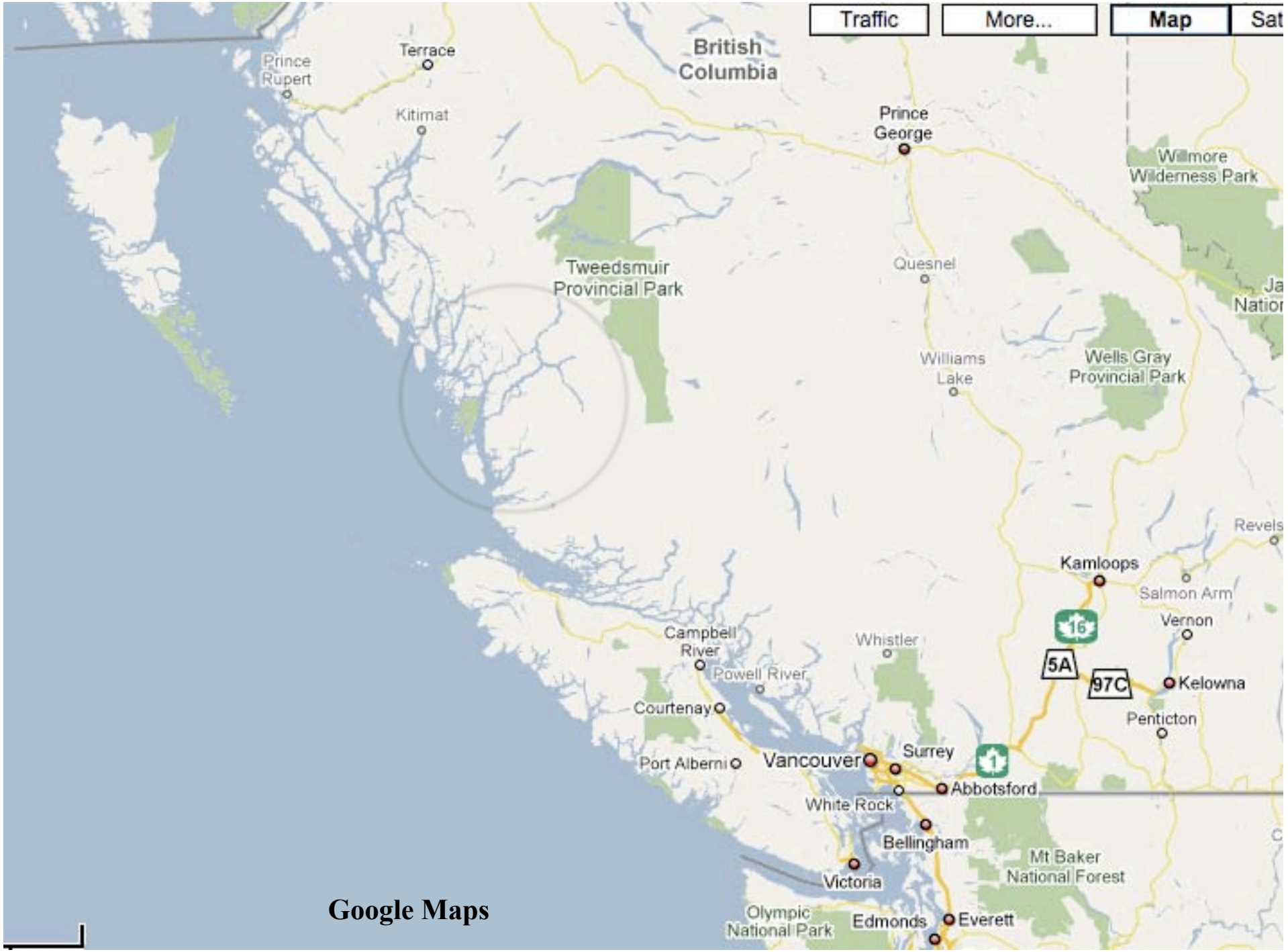
Kilometers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British Columbia
Prince Rupert
Terrace
Kitimat
Prince George
Willmore Wilderness Park
Tweedsmuir Provincial Park
Quesnel
Williams Lake
Wells Gray Provincial Park
Revels
Kamloops
Salmon Arm
Vernon
Campbell River
Whistler
Powell River
Courtenay
Kelowna
Penticton
Port Alberni
Vancouver
Surrey
Abbotsford
White Rock
Bellingham
Mt Baker National Forest
Victoria
Olympic National Park
Edmonds
Everett
16
5A
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1
Google Maps


Terrace
British Columbia
Prince Rupert
Prince George
Quesnel
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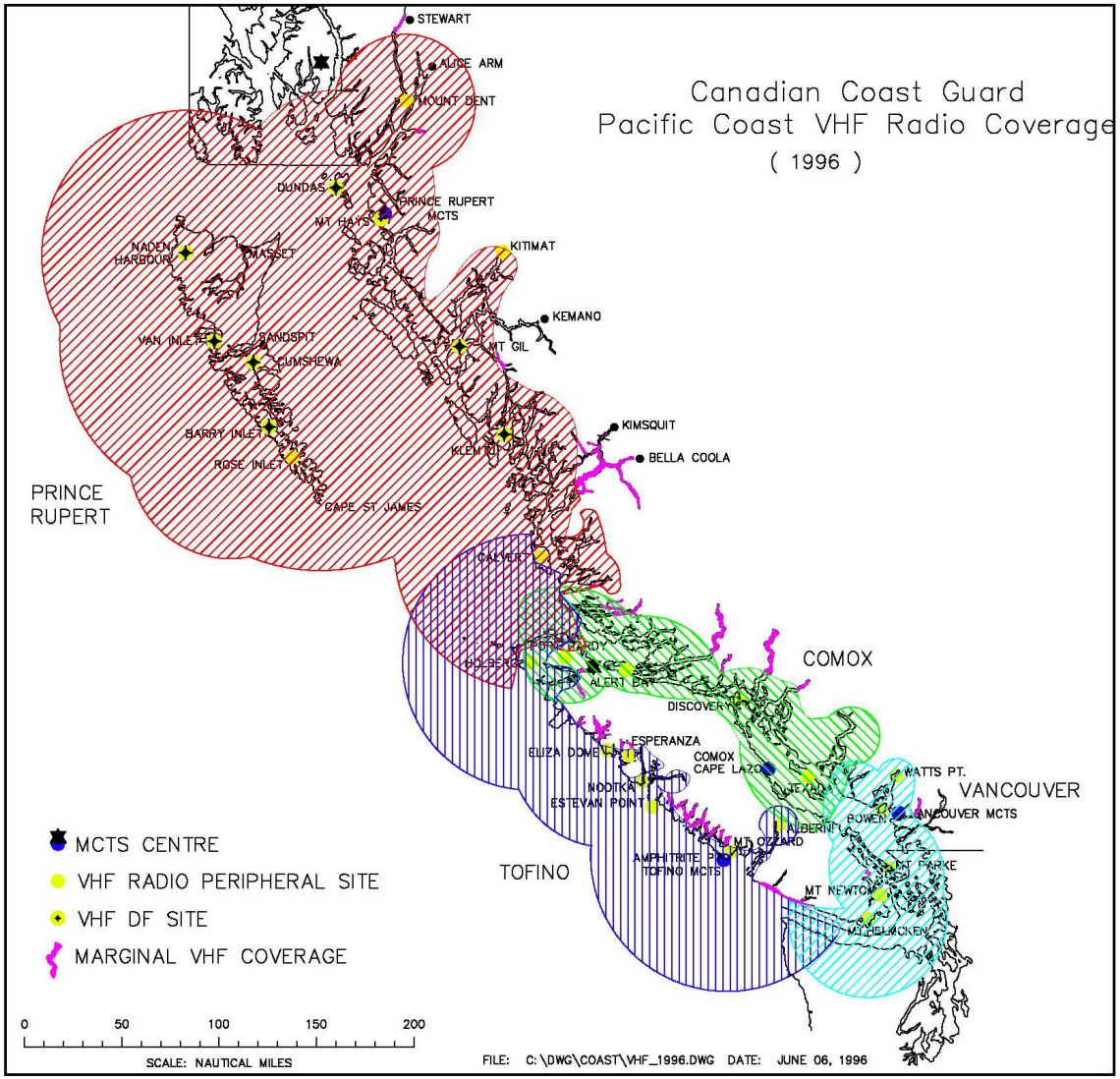
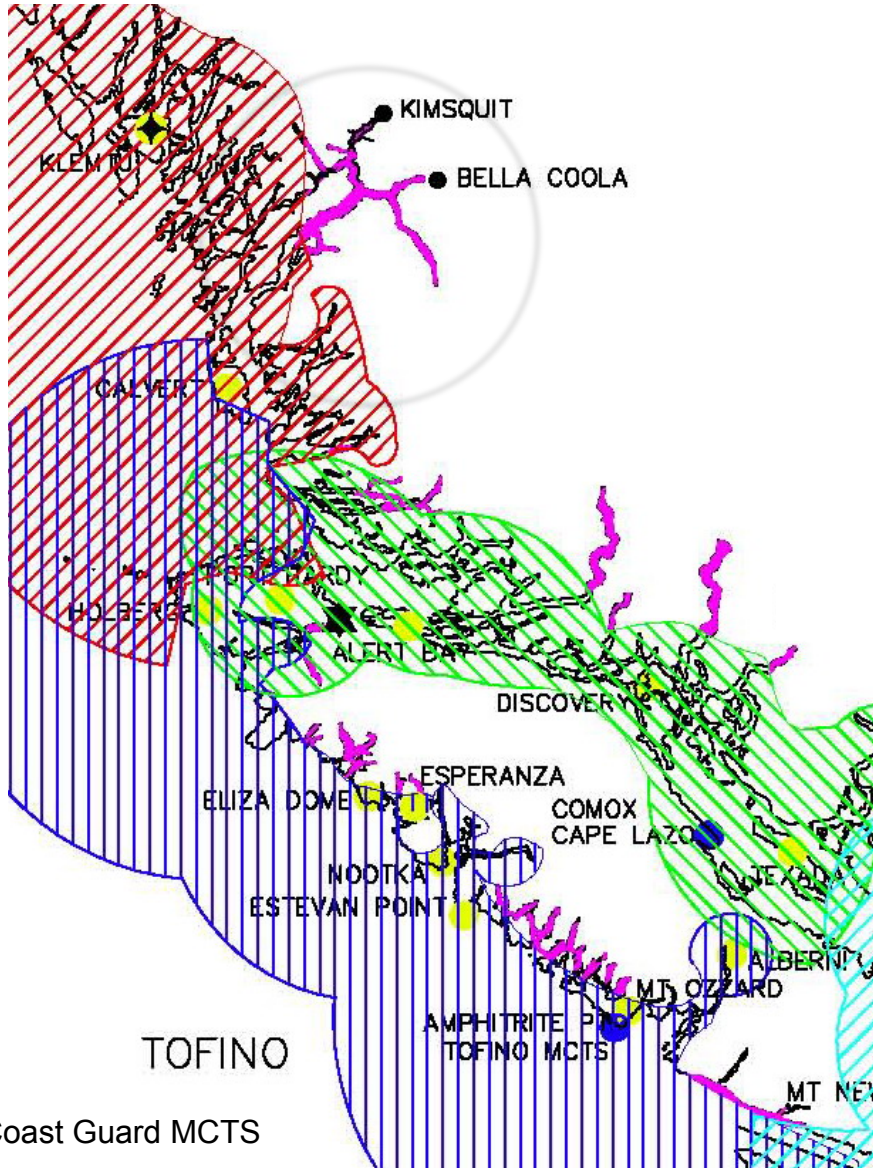
Canada Coast Guard VHF Radio



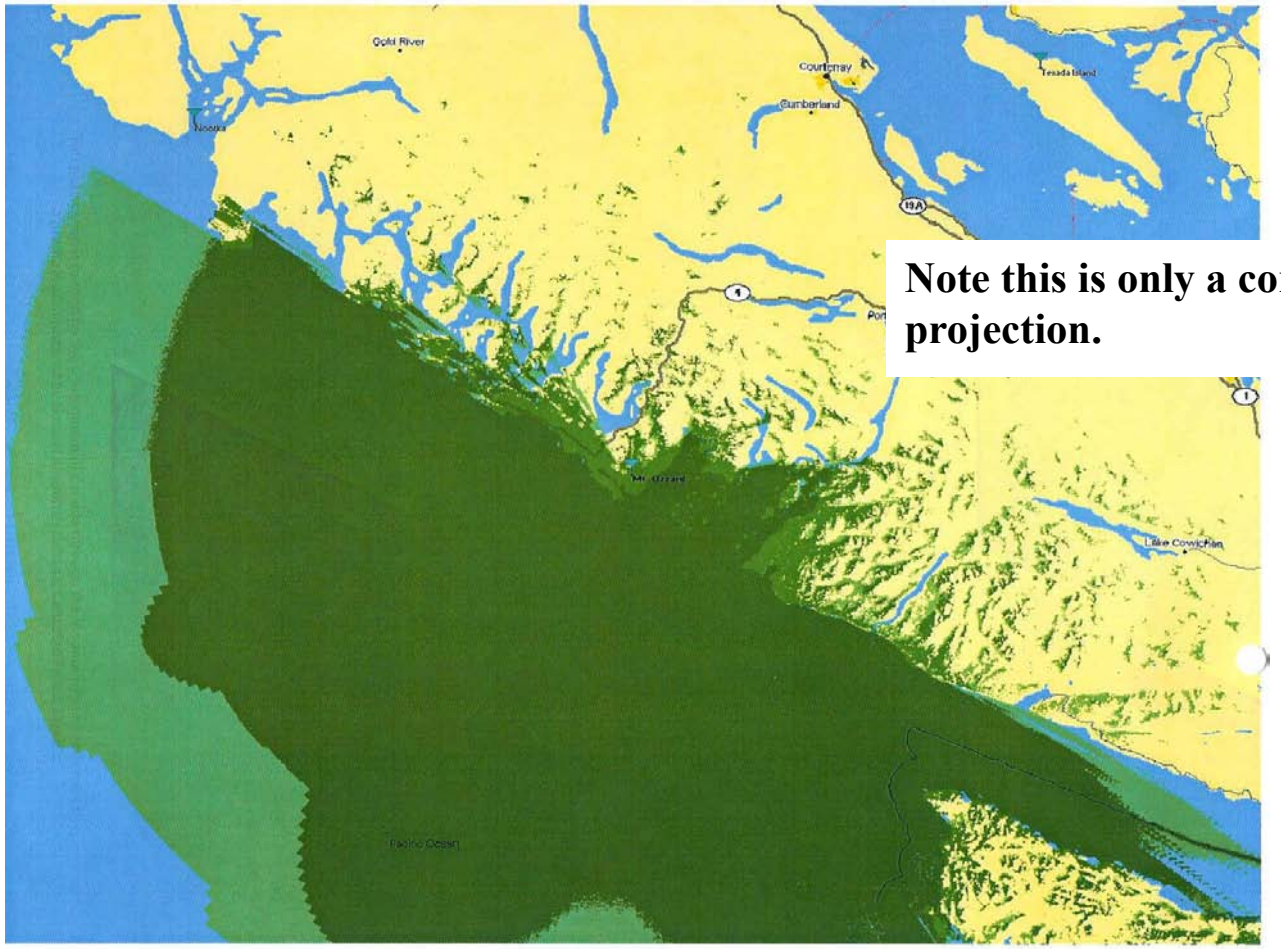
Source: Canada Coast Guard MCTS

Canada Coast Guard VHF Radio



Source: Canada Coast Guard MCTS

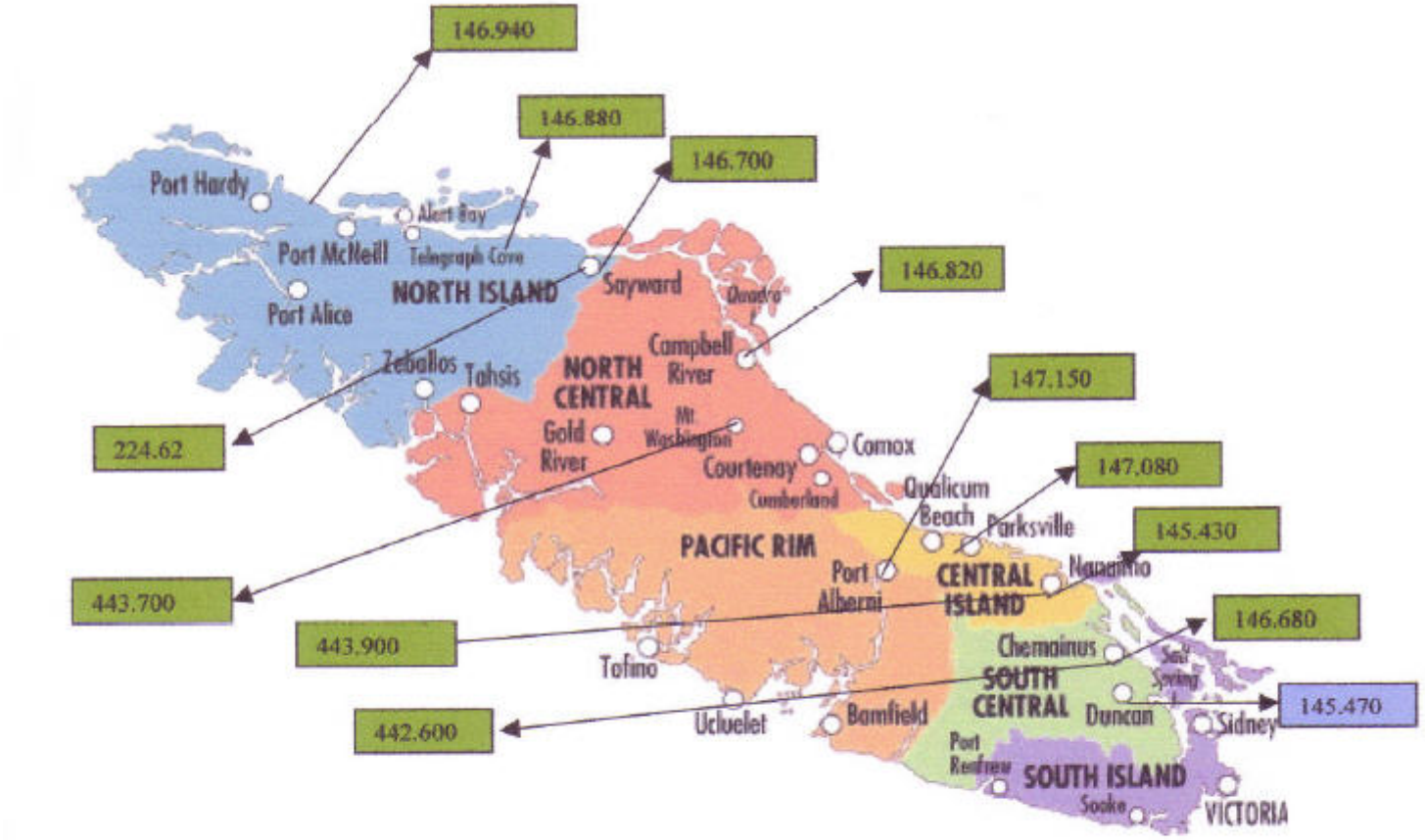
Environment Canada VHF Weatheradio Coverage From Mt Ozzard (Tofino-Ucluelet Areas)



Note this is only a computer projection.

Source: Environment Canada

Amateur VHF/UHF Radio



Island Trunk System

29 June 2005

Source:http://www.islandtrunksystem.org/index.htm

Present Warning Methods – EMBC to communities and remote populations

- Telephone notification (dial-down) systems
  - Fixed telephone
  - Mobile telephone
  - Satellite telephone
- Facsimile
- Electronic mail
- Canada Coast Guard Marine Radio Channel 16
- Amateur Radio
- Environment Canada Weatheradio (where available)
- Agency/defence/aviation radio
- Local and regional broadcast stations

Community Warning Methods

- Fixed sirens, speakers and horns
- Local and regional broadcasting stations
- Vehicle and boat sirens and public address systems
- Telephone notification (dial-down) systems
- Indoor public address systems
- Outdoor mobile electronic signs
- Fixed signage with flashing lights and instructions (e.g., "Emergency Info when Flashing: Proceed Inland and Away from Water")
- Door-to-door verbal notification and leafleting
- Marine and local two-way radio
- SMS – text messaging
- Social networks- Twitter, Facebook, etc.

Summary Points

1. No single method of warning will reach all and a strategy is needed to integrate and support multiple methods and channels to disseminate messages.
2. Warnings are primarily issued by government. But warning distribution systems are often owned/ operated by private entities.
3. Improvements of warning systems depend on all stakeholders developing standards and systems that are mutually beneficial.

Summary Points …

4. The tsunami warning phase contains a limited window of opportunity to capture public attention and encourage appropriate action.
5. Appropriate response to warnings is most likely to occur when people have been educated about the hazard well before the warning.
6. It is important to recognize that a warning is the trigger for all of the subsequent activities that will occur during the emergency period, including response, rescue, relief and recovery.

Summary Points …

7. The warning portion (initial alert to the all-clear) may be relatively short or could go on for a prolonged period depending upon the nature of the hazard incident.
8. Investing wisely in flexible, robust, redundant, multi-purpose communication systems can yield dividends for all emergency needs.

Tsunami Warning Communications: Community and 'Last Mile' Considerations: References

- Anderson, Peter. (2006).British Columbia Tsunami Warning Methods: A Toolkit for Community Planning. Simon Fraser University. Telematics Research Lab. Burnaby. [http://www.pep.bc.ca/hazard_preparedness/Tsunami/Tsunami_Toolkit.pdf]
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