

A Profile of Earthquake Risk for the District of North Vancouver

an opportunity to build community resilience

Christchurch Earthquake 2011
Image source: Gilly Needham

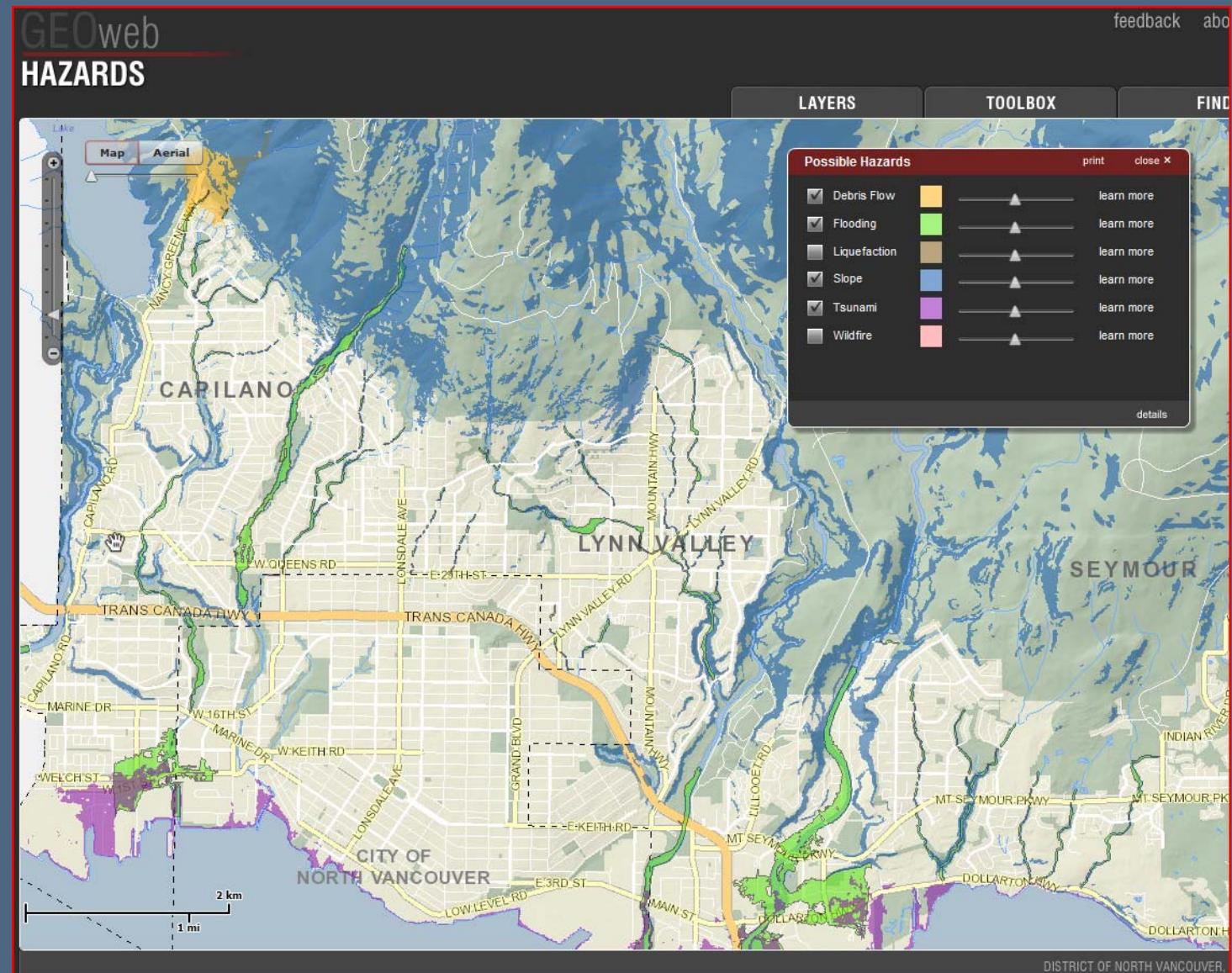
Natural Hazards Management Program



- Understand hazards & risks using proactive approach
- Encourage shared responsibility & community involvement
- Reduce risks to life, infrastructure & environment
- Maintain a geospatially-referenced hazard database
- Liaise with scientific, academic & government organizations to create and follow best practices

Raising Public Awareness

- Property owner notification
- Reports and maps posted on [GeoWeb](#)
- Presentations to Realtors
- Hazard Development Permit Areas

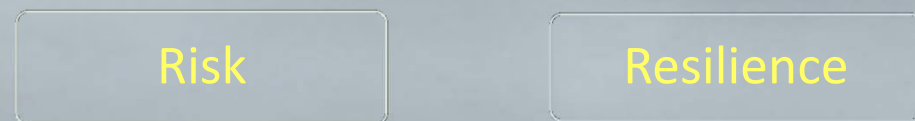


Successes

- Better understanding of hazards and risks
- Many existing risks reduced
- Proactive community planning
- Partnerships for continued improvement
- National and international recognition
- UN role model city



From Risk to Resilience



Christchurch Earthquake 2011
Image source: Gilly Needham

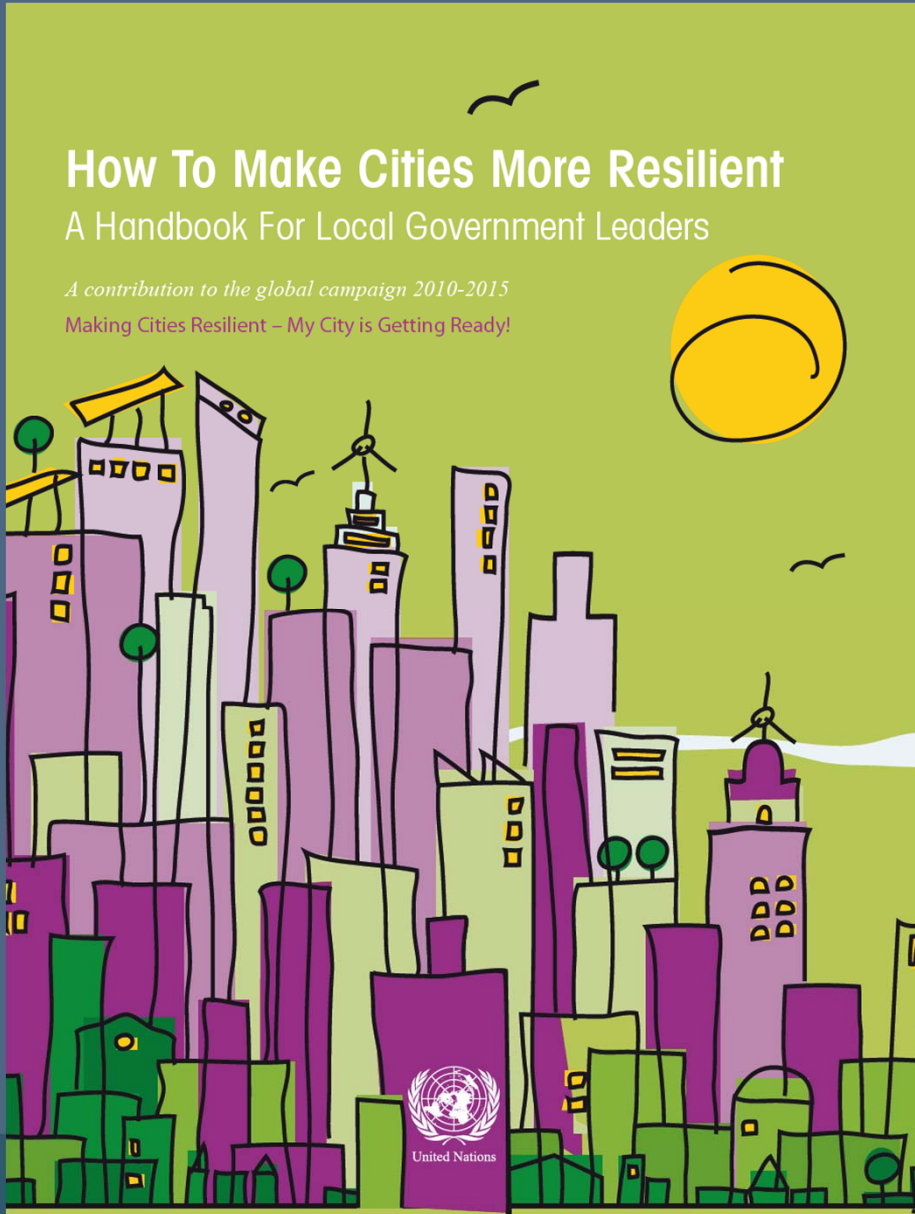
Risk Reduction & Disaster Resilience Planning

How To Make Cities More Resilient

A Handbook For Local Government Leaders

A contribution to the global campaign 2010-2015

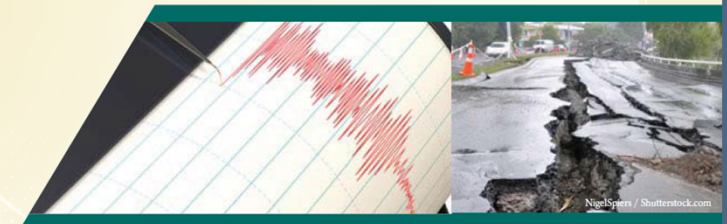
Making Cities Resilient – My City is Getting Ready!



March 2014

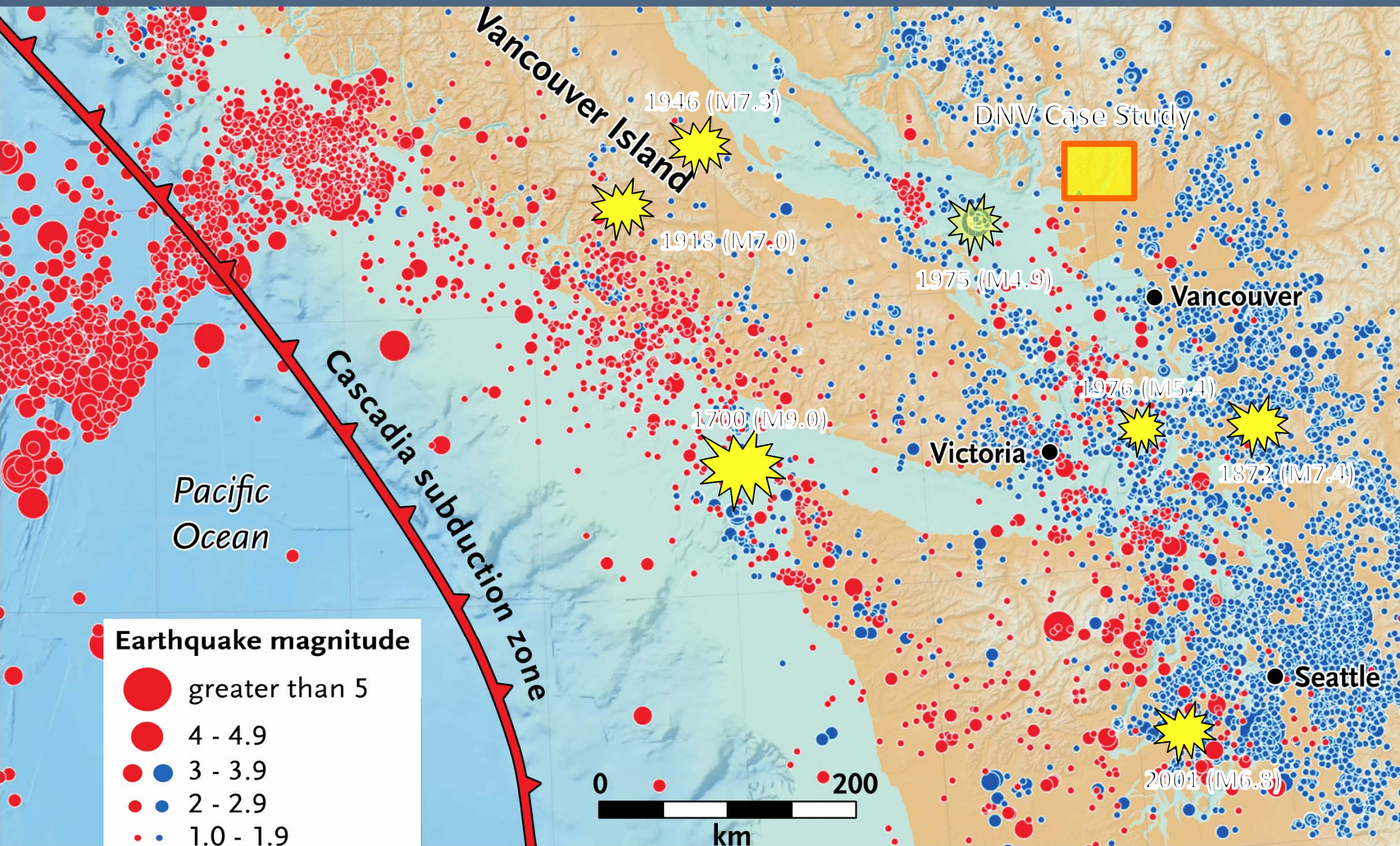
CATASTROPHIC EARTHQUAKE
PREPAREDNESS

www.bcauditor.com

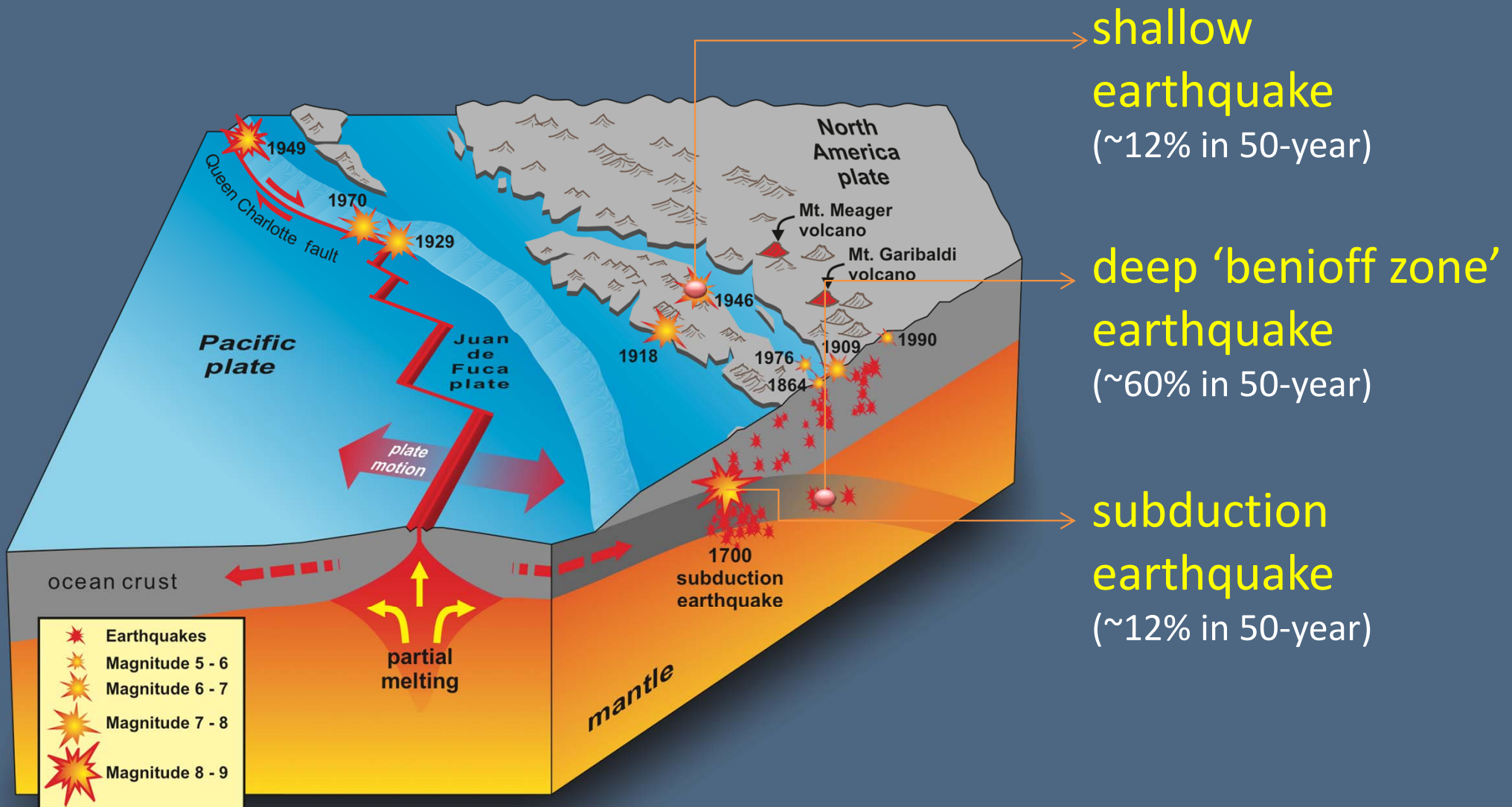


OFFICE OF THE
Auditor General
of British Columbia

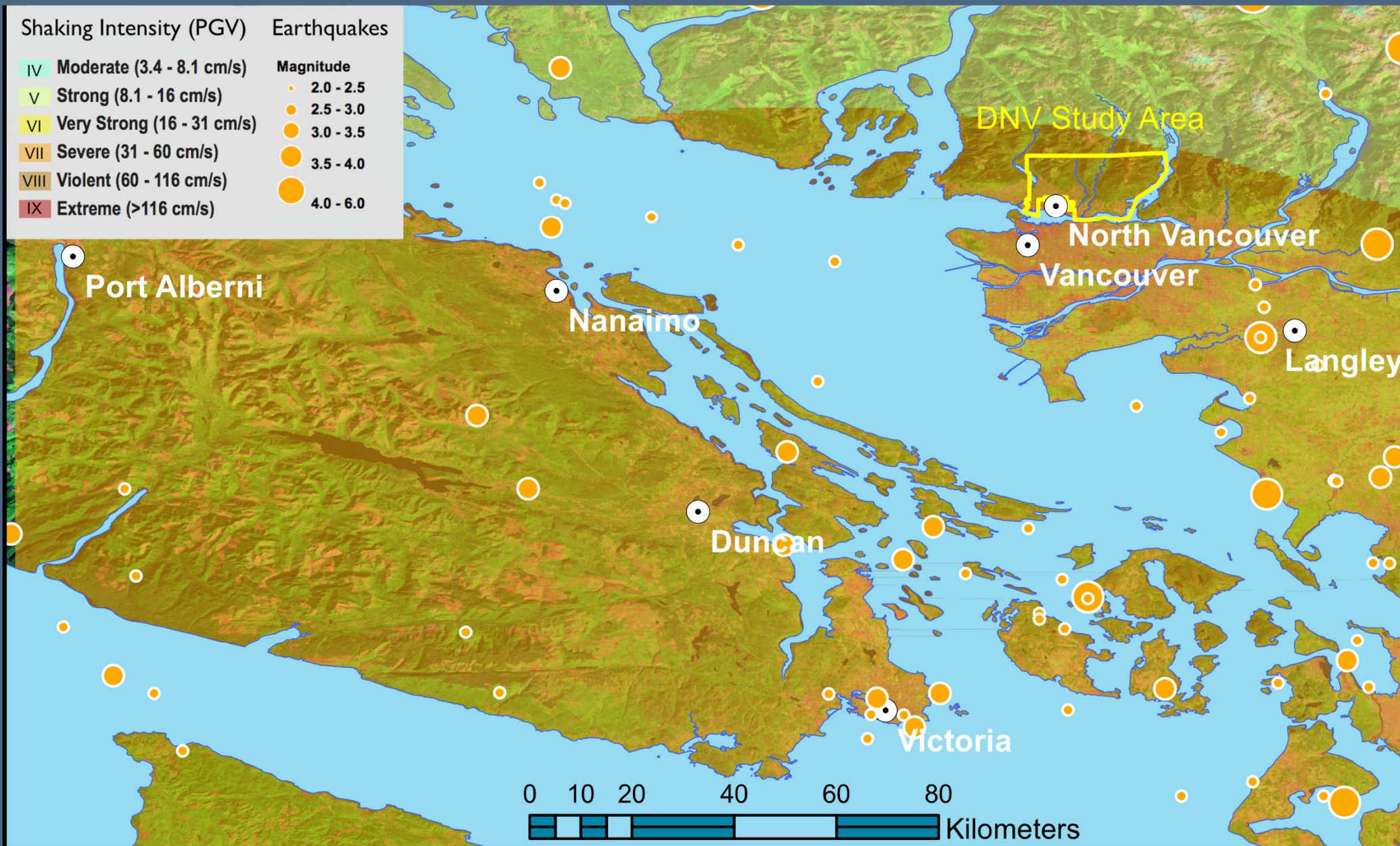
We live in earthquake country

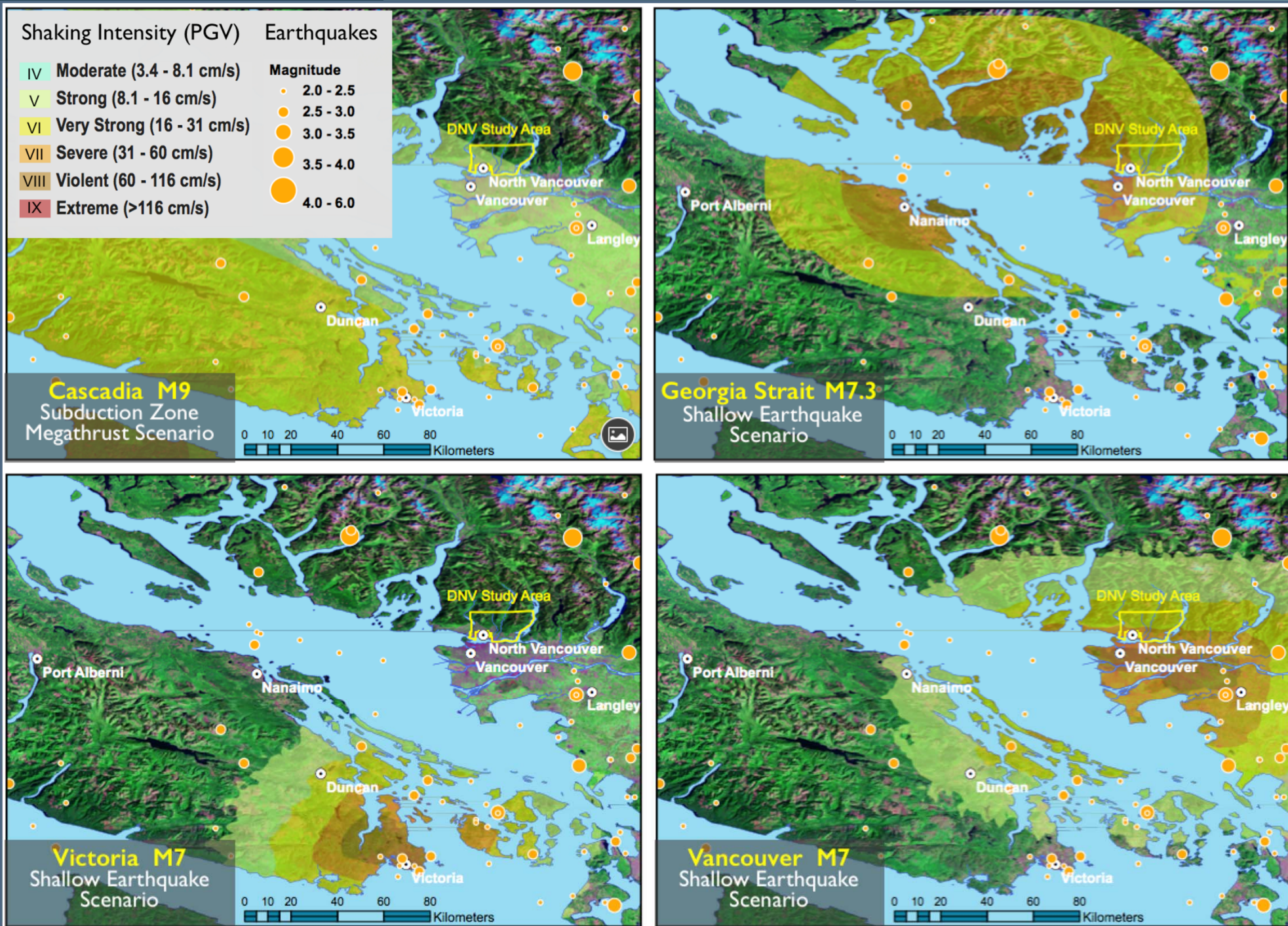


Regional Earthquake Hazards



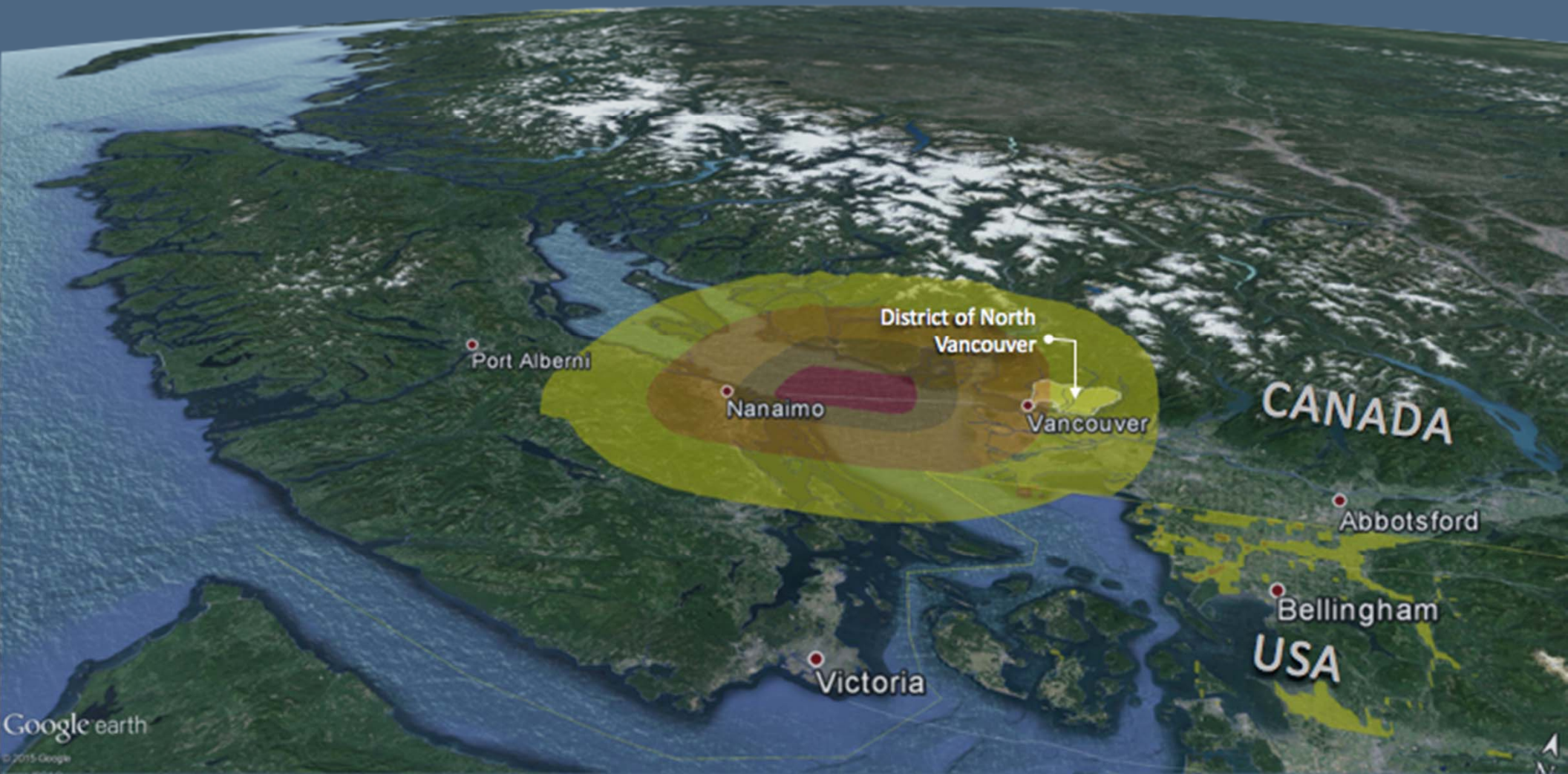
Earthquake Hazard Potential





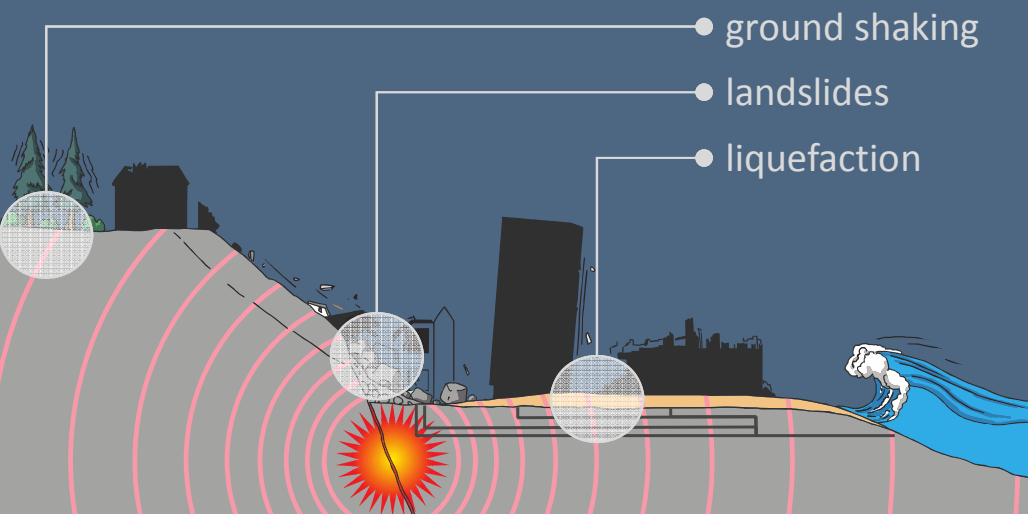
Earthquake Risk for the DNV

- What can we expect in the event of a major earthquake ?
- Who and what are most vulnerable ?
- What actions can be taken in advance to increase disaster resilience ?

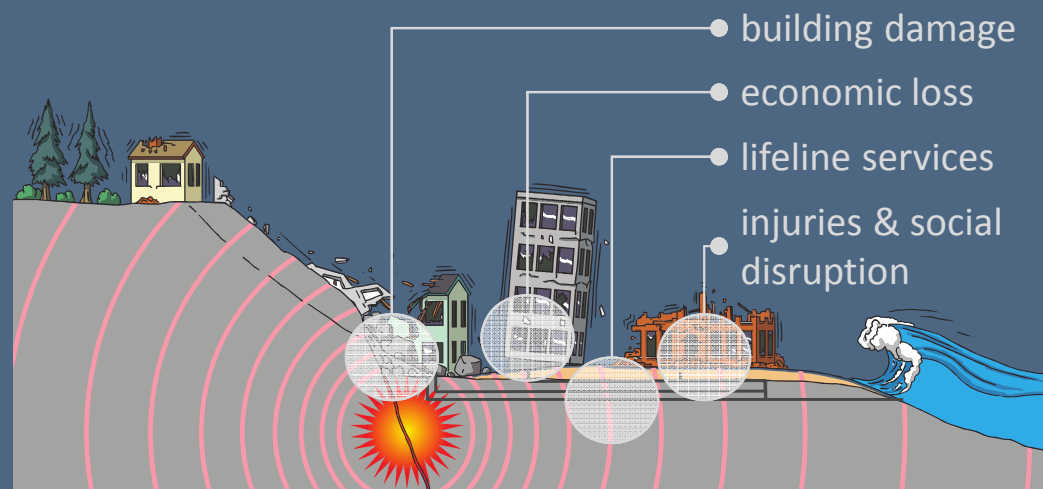


A Profile of Earthquake Risk

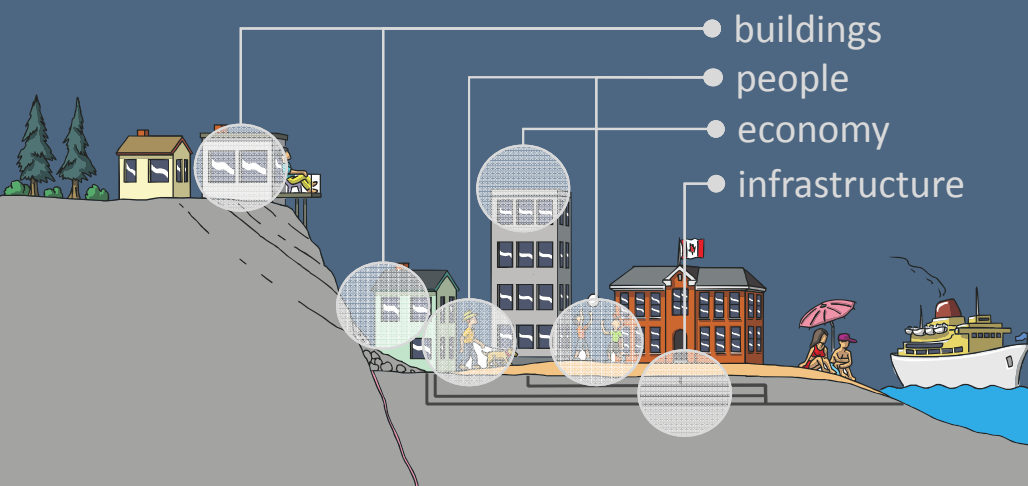
Hazard Potential



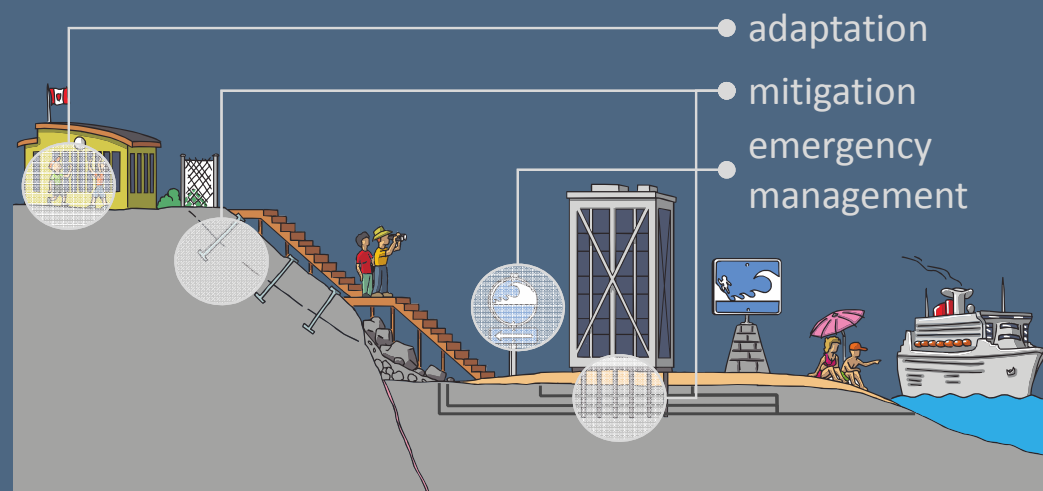
Impacts & Consequences



Vulnerability



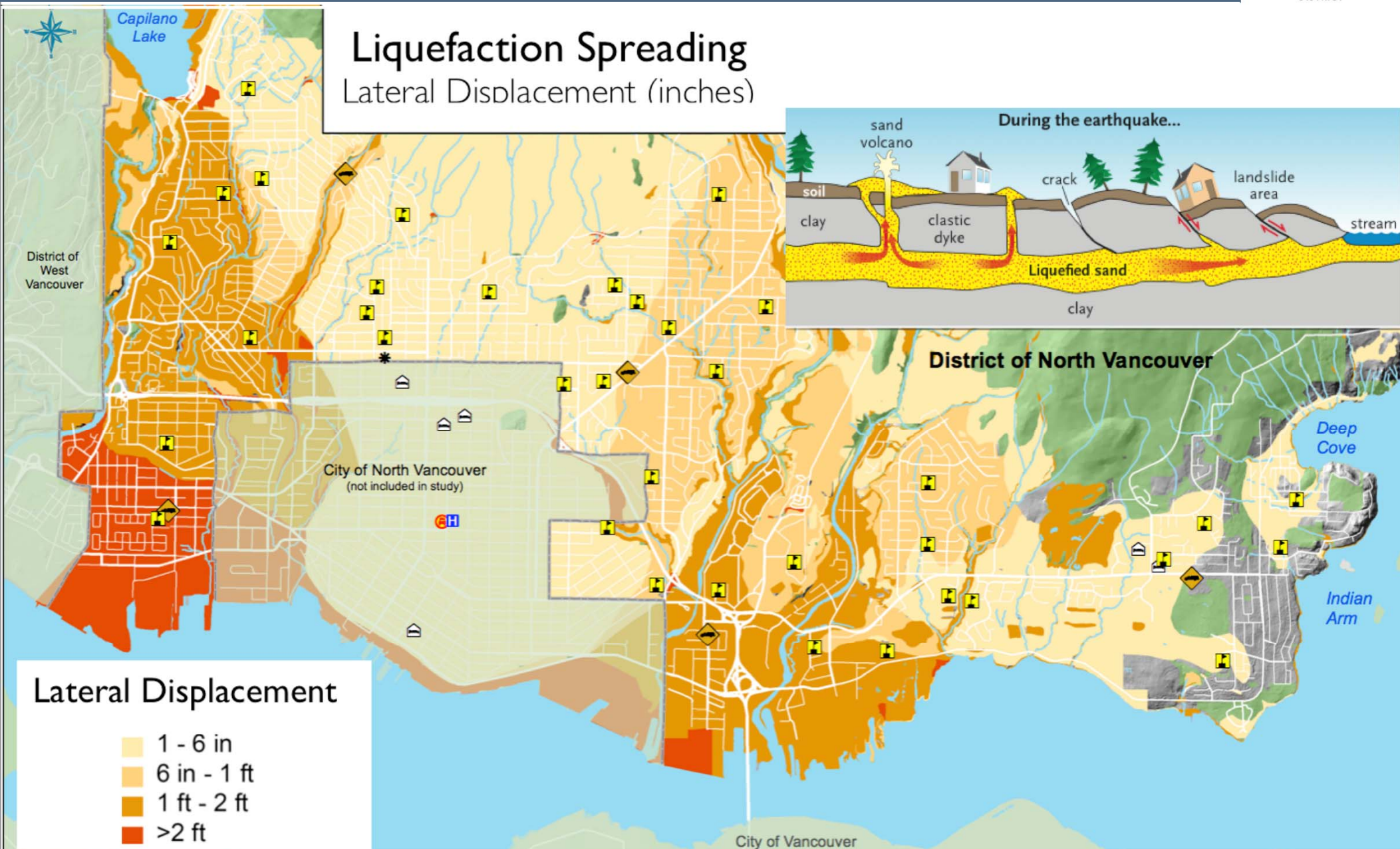
Disaster Resilience





Seismic Hazards

Liquefaction Spreading Lateral Displacement (inches)



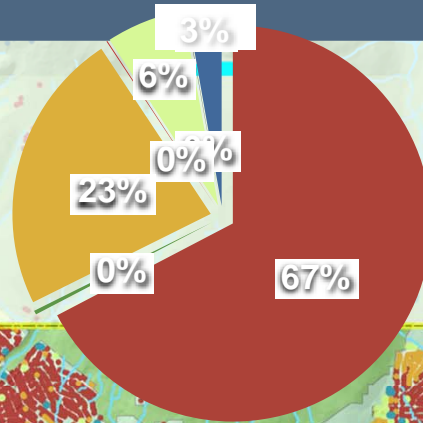
Lateral Displacement

- 1 - 6 in
- 6 in - 1 ft
- 1 ft - 2 ft
- >2 ft



Physical Vulnerability

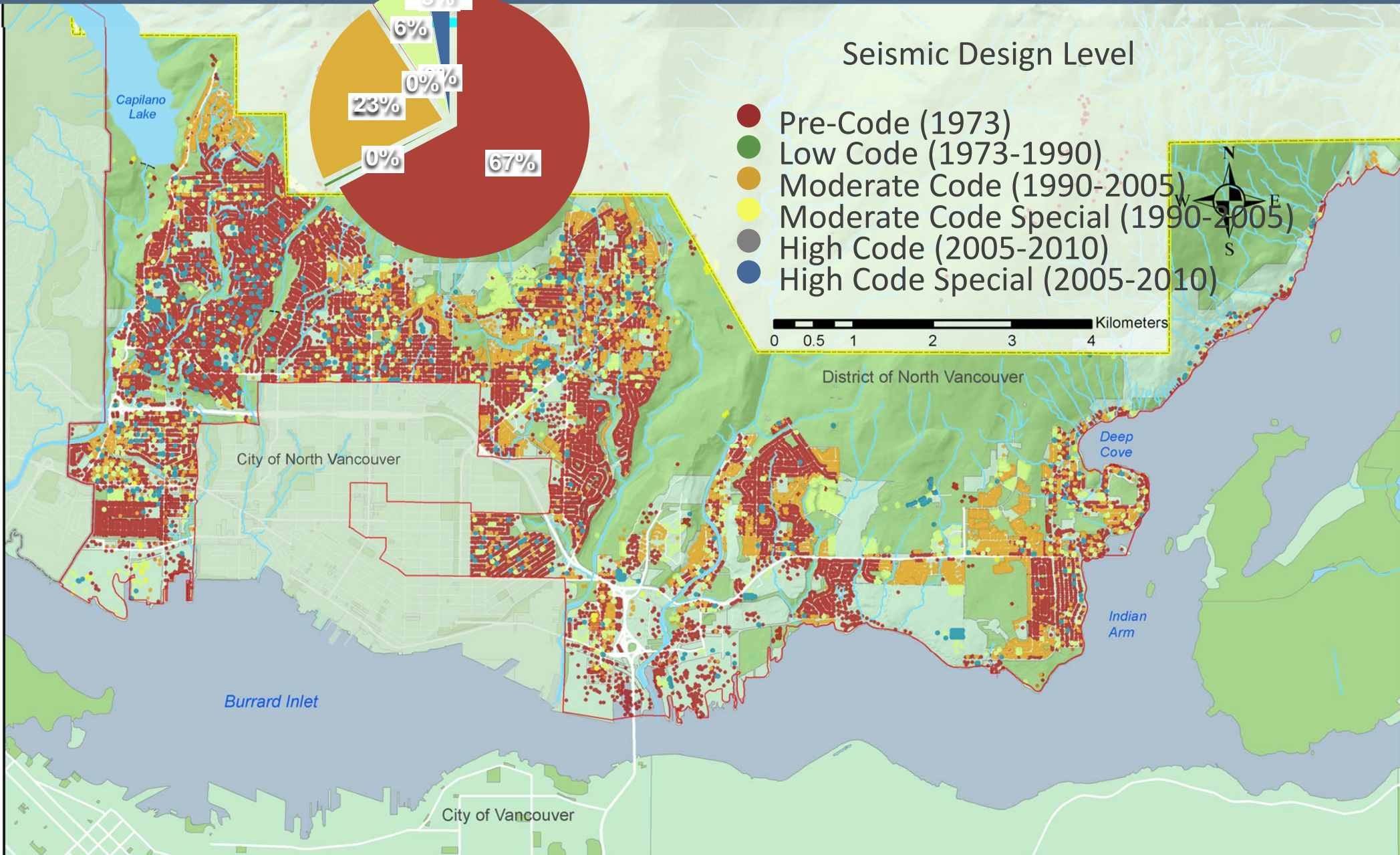
Design Code



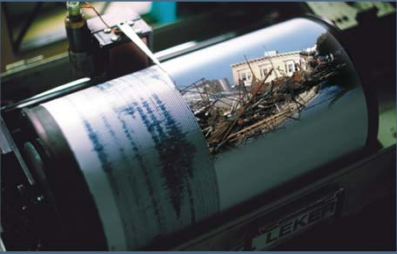
Seismic Design Level

- Pre-Code (1973)
- Low Code (1973-1990)
- Moderate Code (1990-2005)
- Moderate Code Special (1990-2005)
- High Code (2005-2010)
- High Code Special (2005-2010)

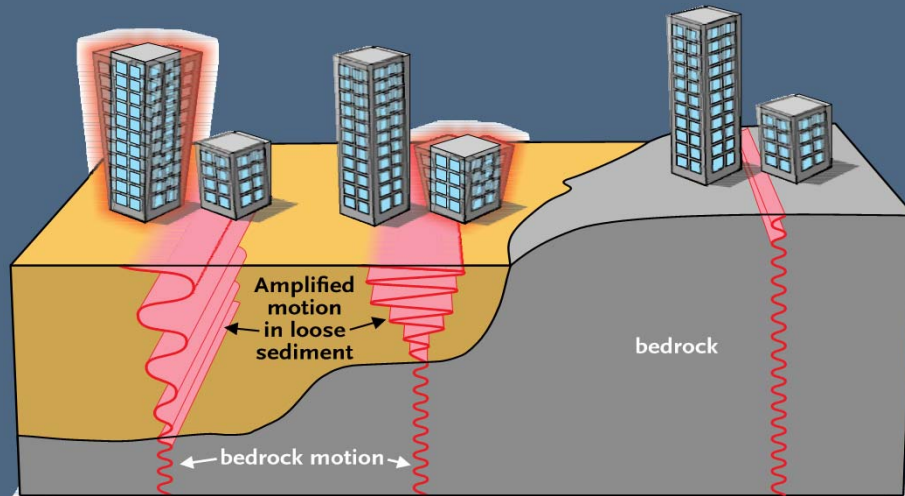
0 0.5 1 2 3 4 Kilometers



Analysis of Damage Potential

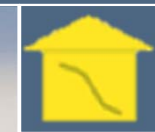


Likelihood of damage



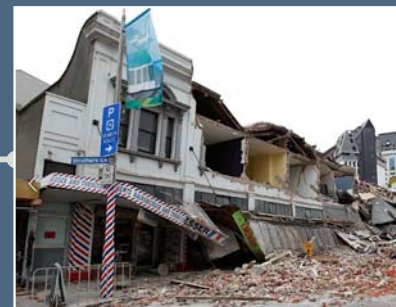
None & Slight

*minor damage to walls
& supports*



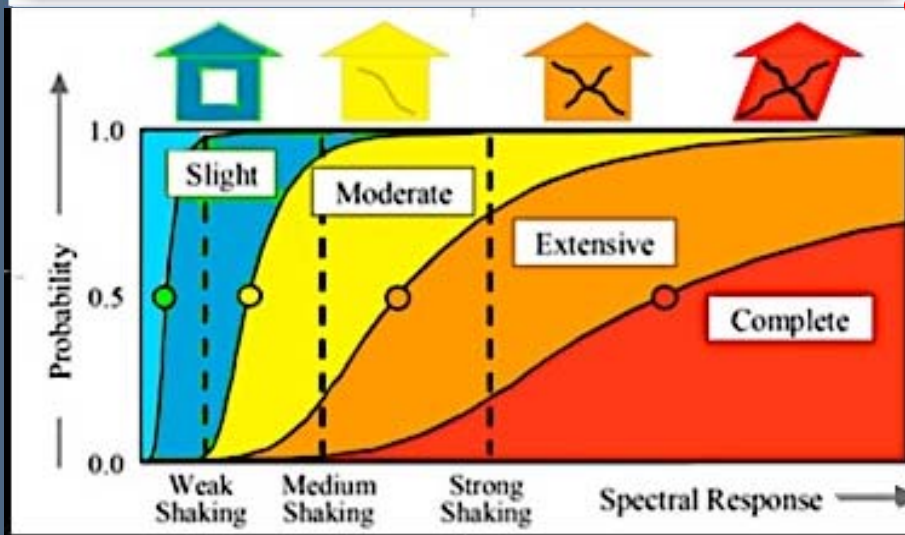
Moderate

*localized failure of walls
& supports*



Extensive &
Complete

*permanent structural
failure & imminent danger
of collapse*





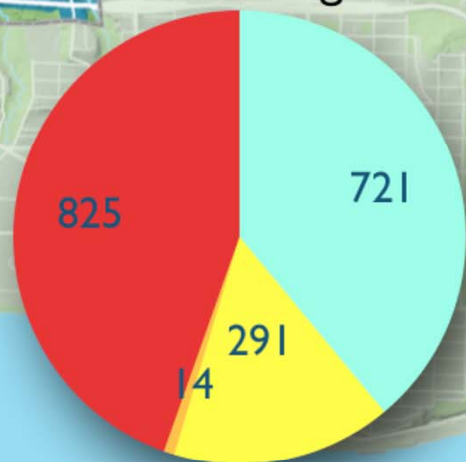
Building

Building Damage Baseline Scenario

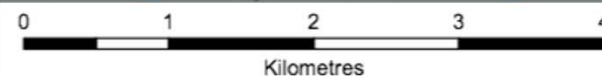
Damage State

- Complete
- Extensive
- Moderate
- Slight
- None

Buildings

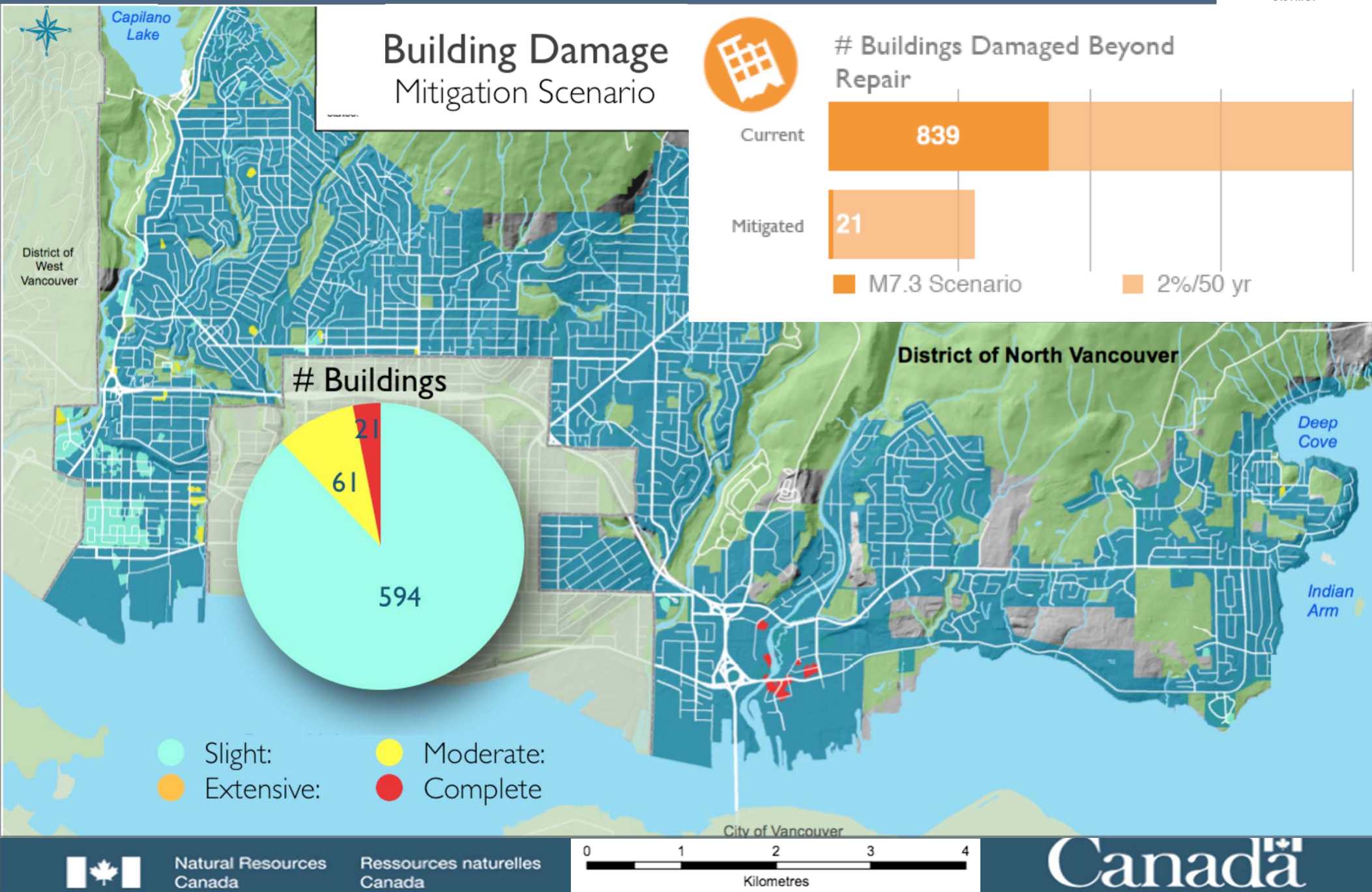


- Slight
- Moderate
- Extensive
- Complete





Building Performance





Public Safety

Injury Rate Baseline Scenario



Life Threatening Injuries daytime scenario

Current

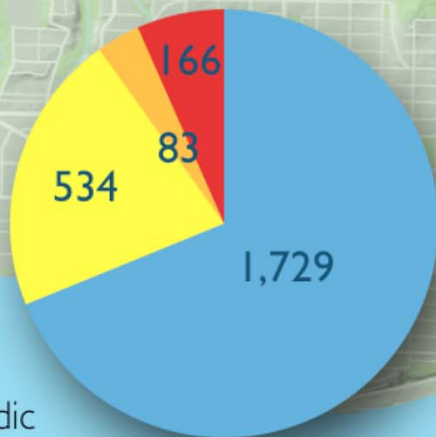
249

Mitigated

197

■ M7.3 Scenario ■ 2%/50 yr

People Effected

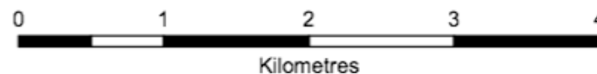


- Level 1: Paramedic
- Level 2: Hospital
- Level 3: Critical
- Level 4: Fatal

Burrard Inlet

District of North Vancouver

City of Vancouver



Natural Resources
Canada

Ressources naturelles
Canada

Canada



Lifeline Resilience

Potable Water Systems Baseline Scenario



Buildings Without Lifeline Services after 7 Days

Water

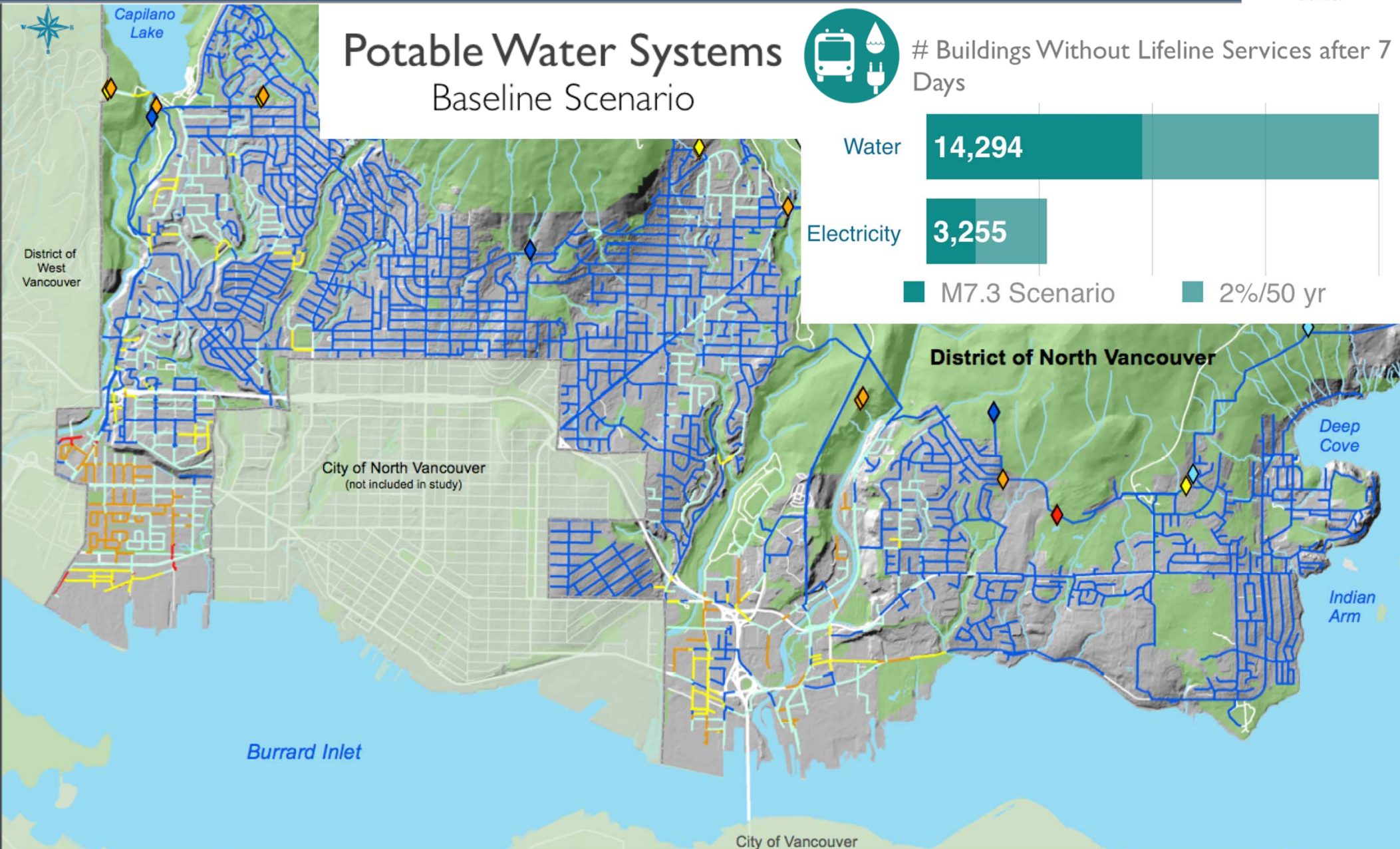
14,294

Electricity

3,255

M7.3 Scenario

2%/50 yr

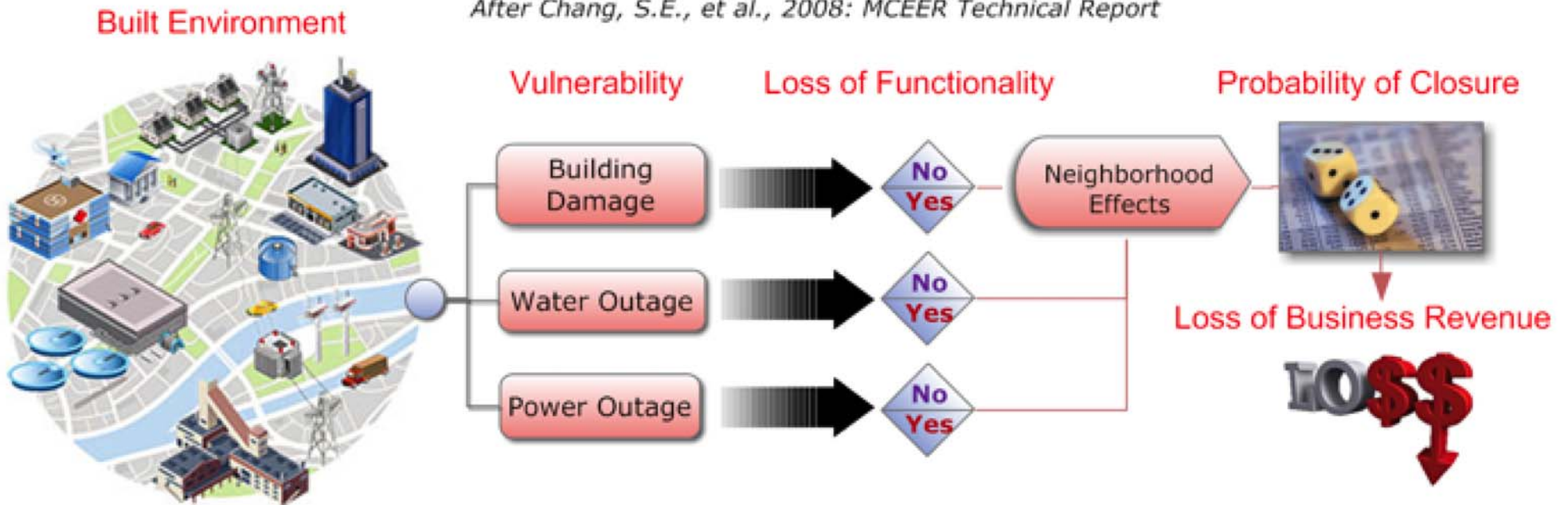




Economic Security

UBC Business Disruption and Loss Model

After Chang, S.E., et al., 2008: MCEER Technical Report



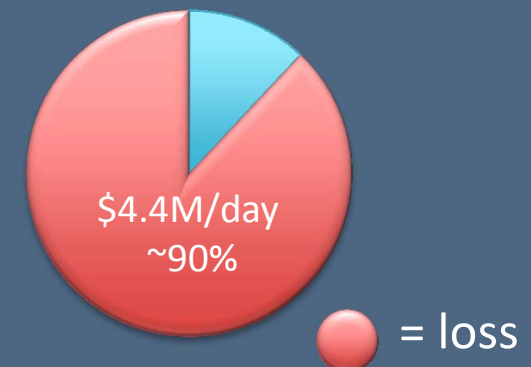
Graphic Adapted from NIST, 2013



DNV Gross Daily Revenue
~\$5M per day

~ \$4.4 M per day of business-related losses

- lost wages & business income
- rental & relocation costs





Economic Security

Direct Economic Loss Baseline Scenario



Total Economic Losses

Buildings

M7.3 =
\$2.33 billion

Income

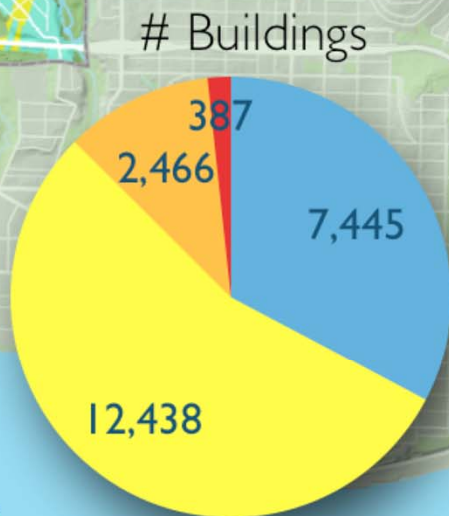
M7.3 =
\$645.4 m

Lifelines

M7.3 =
\$26.3 m

M7.3 Scenario

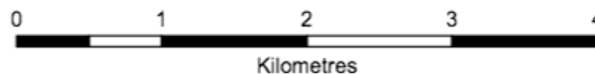
2% in 50 yr



- < 10%
- 10-20%
- 20-30%
- > 30%

Burrard Inlet

City of Vancouver



Natural Resources
Canada

Ressources naturelles
Canada

Canada

Benefits to the Community



single family



multi family



public



commercial

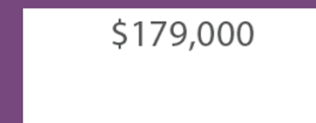
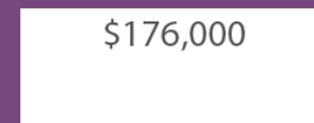
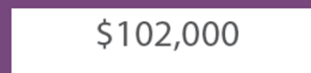
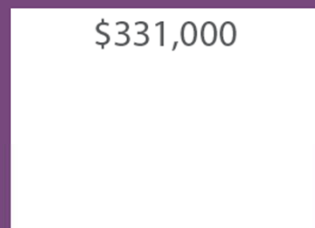


industrial

cost-benefit ratio



mean capital loss avoided (\$)



total daytime injuries avoided
(= 10 people)



mean recovery time avoided

(= 4 weeks)

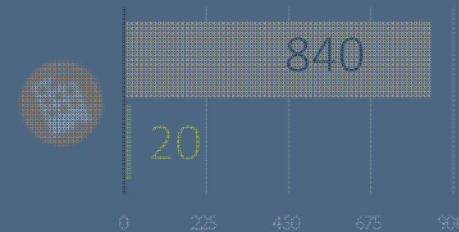
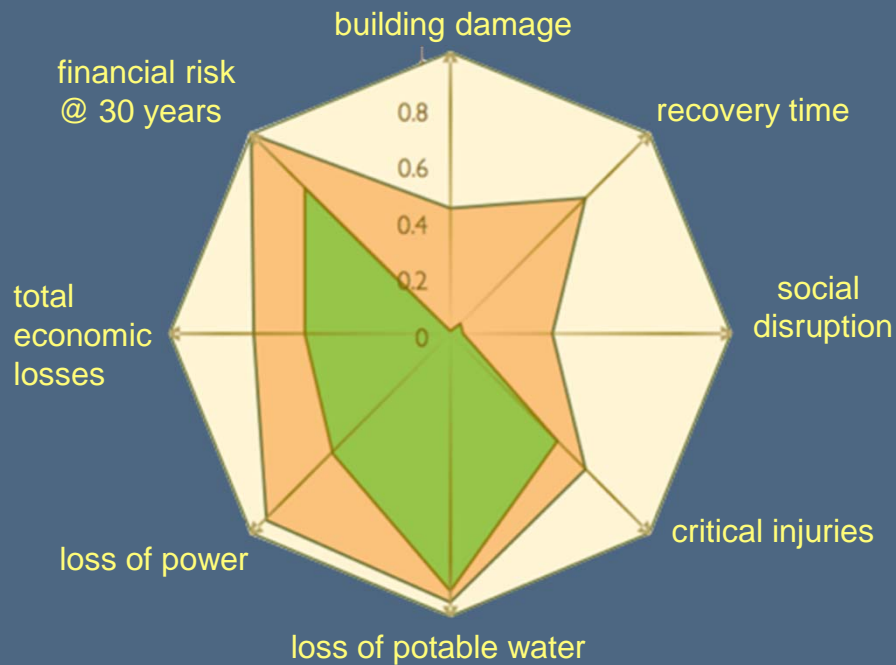


Natural Resources
Canada

Ressources naturelles
Canada

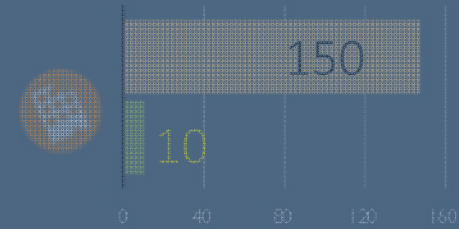
Canada

Opportunities to Increase Resilience



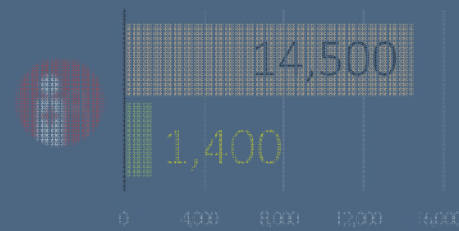
Building Damage

Number of buildings that are likely to sustain extensive or complete damage in the scenario earthquake



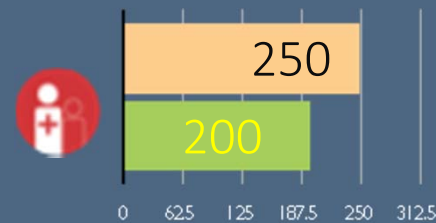
Recovery Time

Average number of days to restore baseline levels of functionality to individual buildings after the earthquake



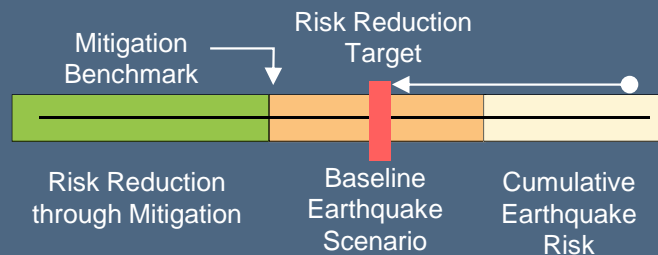
Social Disruption

Number of people who are displaced from their home and/or place of work for more than 3 months.



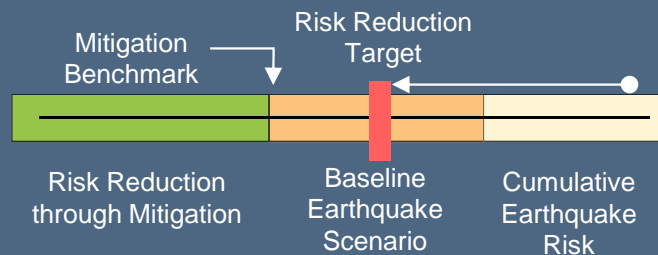
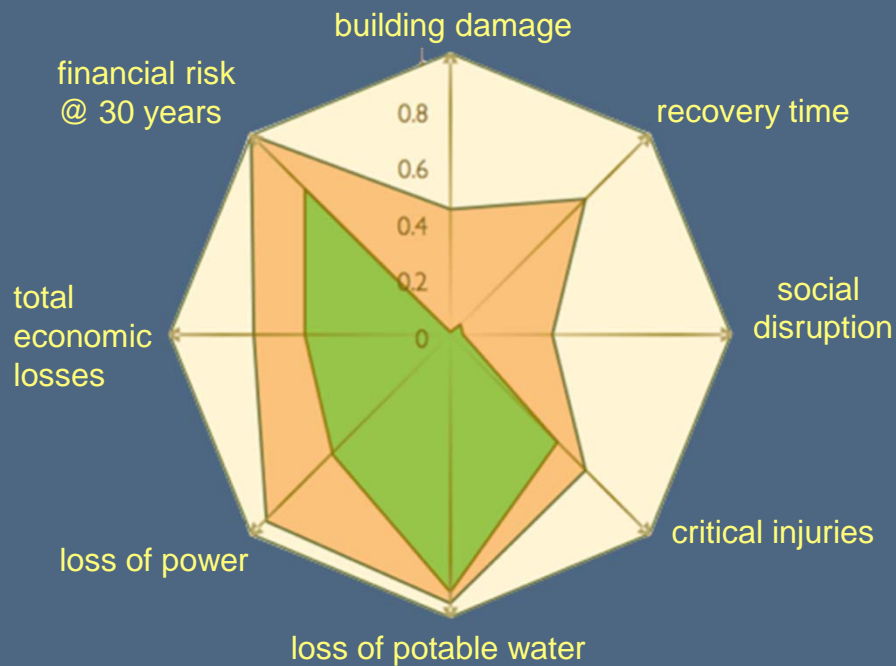
Critical Injuries

Number of people likely to sustain life-threatening injuries in the scenario earthquake

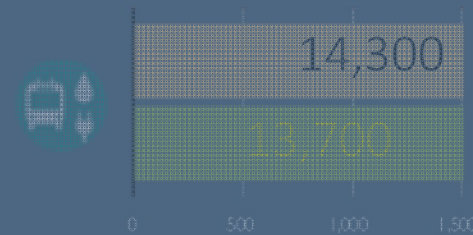


Performance Measures

Opportunities to Increase Resilience

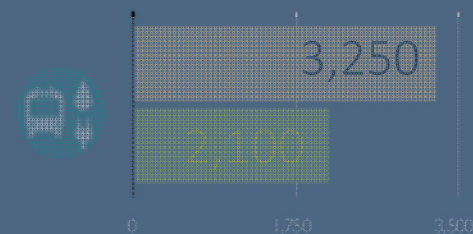


Performance Measures



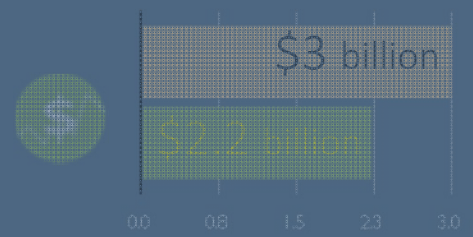
Potable Water

Number of homes and businesses without access to potable water services 7 days after the earthquake



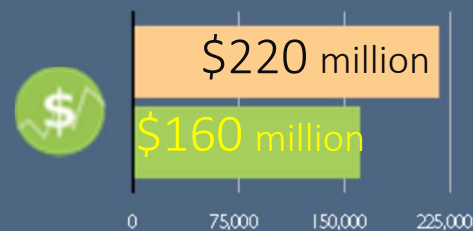
Electrical Power

Number of homes and businesses without access to electrical power services 7 days after the earthquake



Economic Loss

Billions of dollars in capital and income-related losses if the earthquake were to occur within the next year



Financial Risk

Potential Maximum Loss (PML) over a 30-year planning horizon

The 2011 Christchurch earthquake

M6.3 Earthquake Event and Related Aftershocks

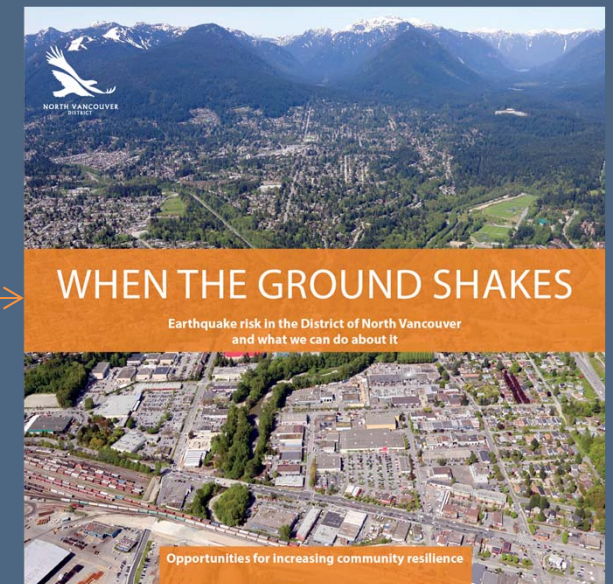
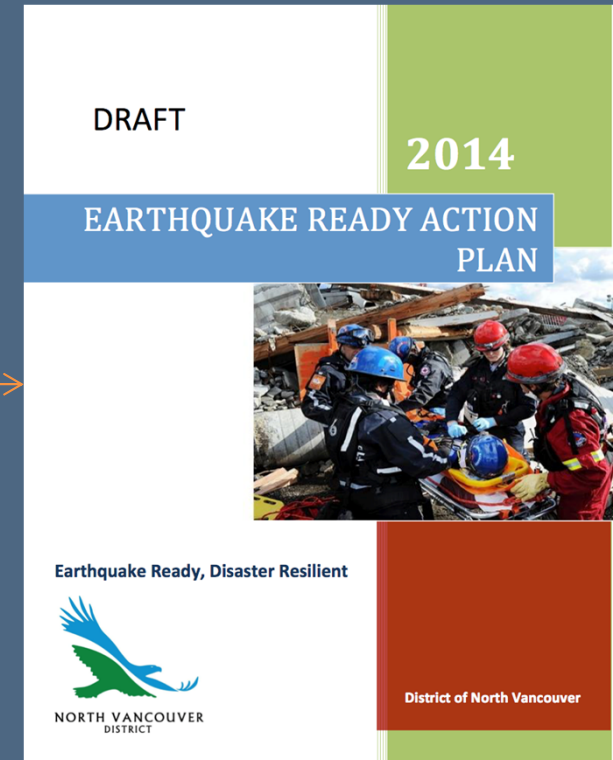


Mean Economic Loss Ratio ~12%

- 24 seconds** of violent ground shaking which triggered **liquefaction** and **landslides**
- 837 buildings** have so far been demolished
- 7000 buildings** classified as being in suburban red zone, -not economically viable to repair
- 1200+ police officers** from Christchurch and nationwide on duty 7 days following quake
- 185 died** as a result of the earthquake
- 11310 people** uprooted two weeks after February quake
- 300km** of sewer pipes and about **124km** of water pipes are being fixed
- 4 million tonnes** (~160,000 trucks) of rubble carted away from commercial and residential areas
- \$2 billion-** Christchurch City Council's predicted cost to rebuild city infrastructure
- \$30 billion-** Reserve Bank's estimated total cost of earthquake claims



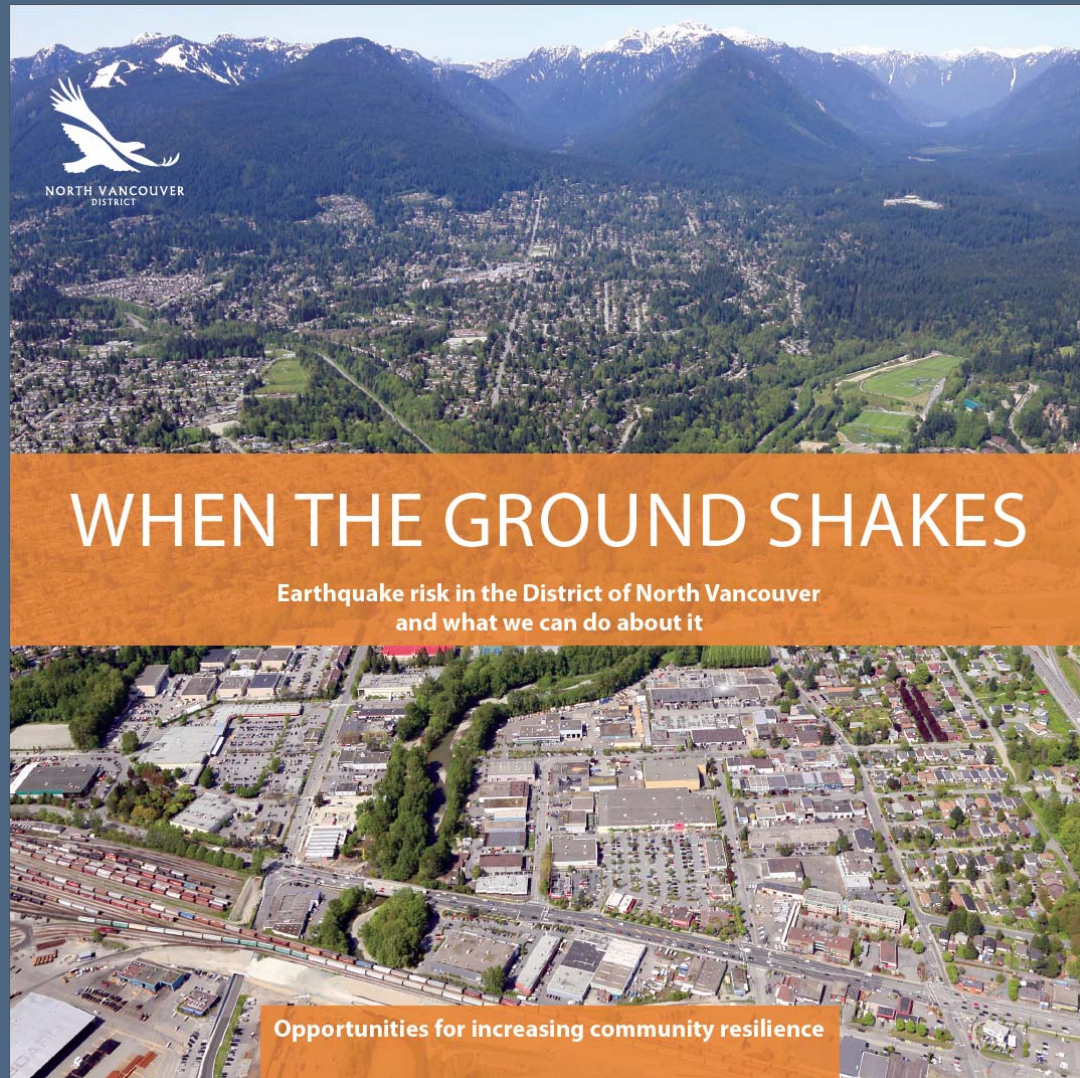
From Knowledge to Action



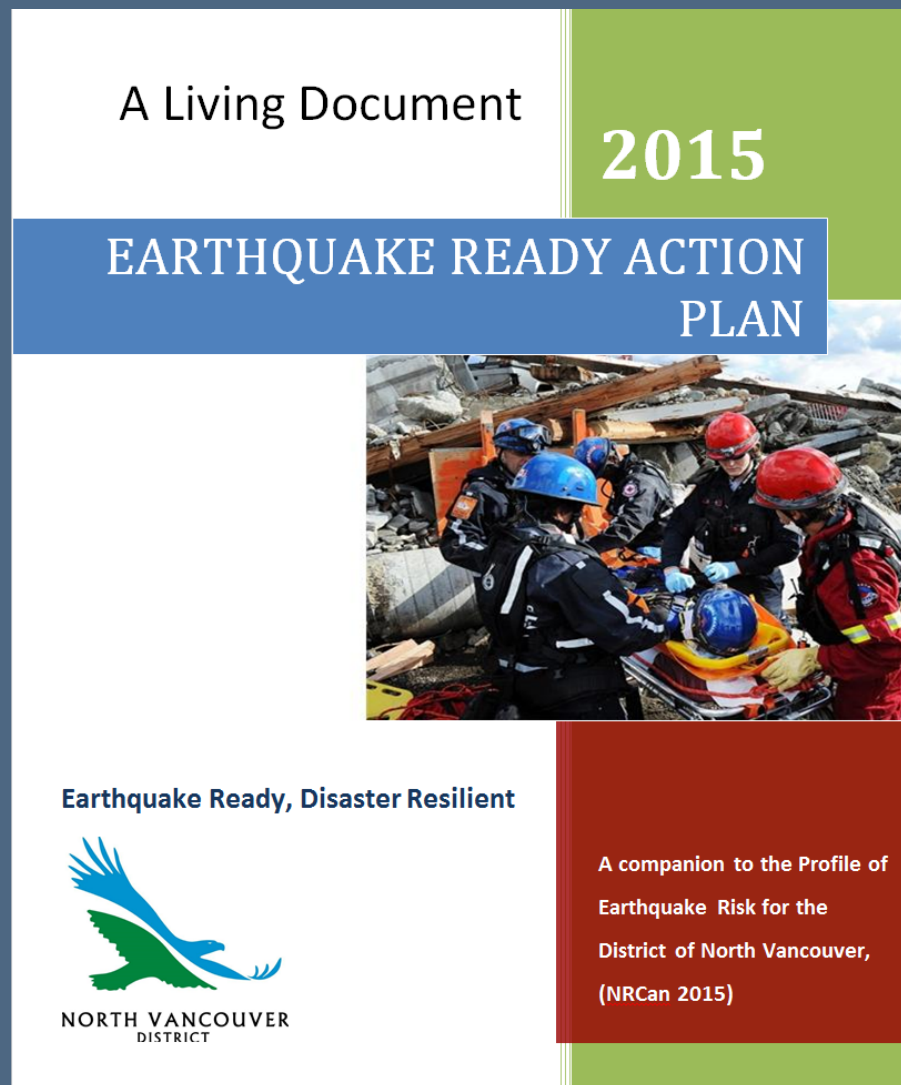
The earthquake risk exists whether we talk about it or not.

We are using the results of this study to focus our efforts on the most vulnerable areas of our community.

- Narrative companion
- Plain language
- Fictional characters
- Supported by facts
- Stimulate action



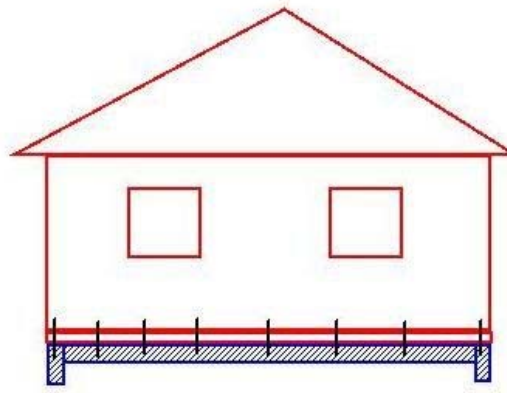
- ☐ Manage risk to District assets
- ☐ Encourage preparedness
- ☐ Promote business continuity
- ☐ Prepare for effective response
- ☐ Plan for recovery
- ☐ Collaborate with stakeholders



Earthquake Ready Action Plan

MITIGATION

1. Facilities
2. Utilities
3. Building & Development



Earthquake Ready Action Plan

EARTHQUAKE READY COMMUNITY

1. Staff
2. Residents
3. Businesses
4. Senior facilities
5. Daycare facilities
6. Recreation Centers
7. Libraries and museums

NORTH SHORE
BUSINESS & EMPLOYER EMERGENCY
PREPAREDNESS GUIDE



North Shore Emergency
Management Office
City of North Vancouver District of North Vancouver District of West Vancouver



Earthquake Ready Action Plan

COORDINATED RESPONSE

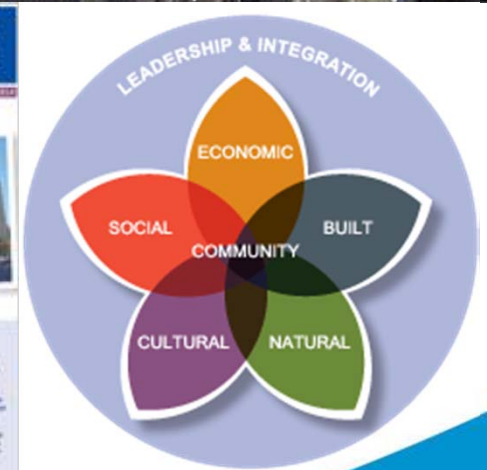
1. Rapid Damage Assessment
2. Integrated North Shore Emergency Operations Centre
3. Engineering DOC
4. Operational Response
5. Emergency Communications



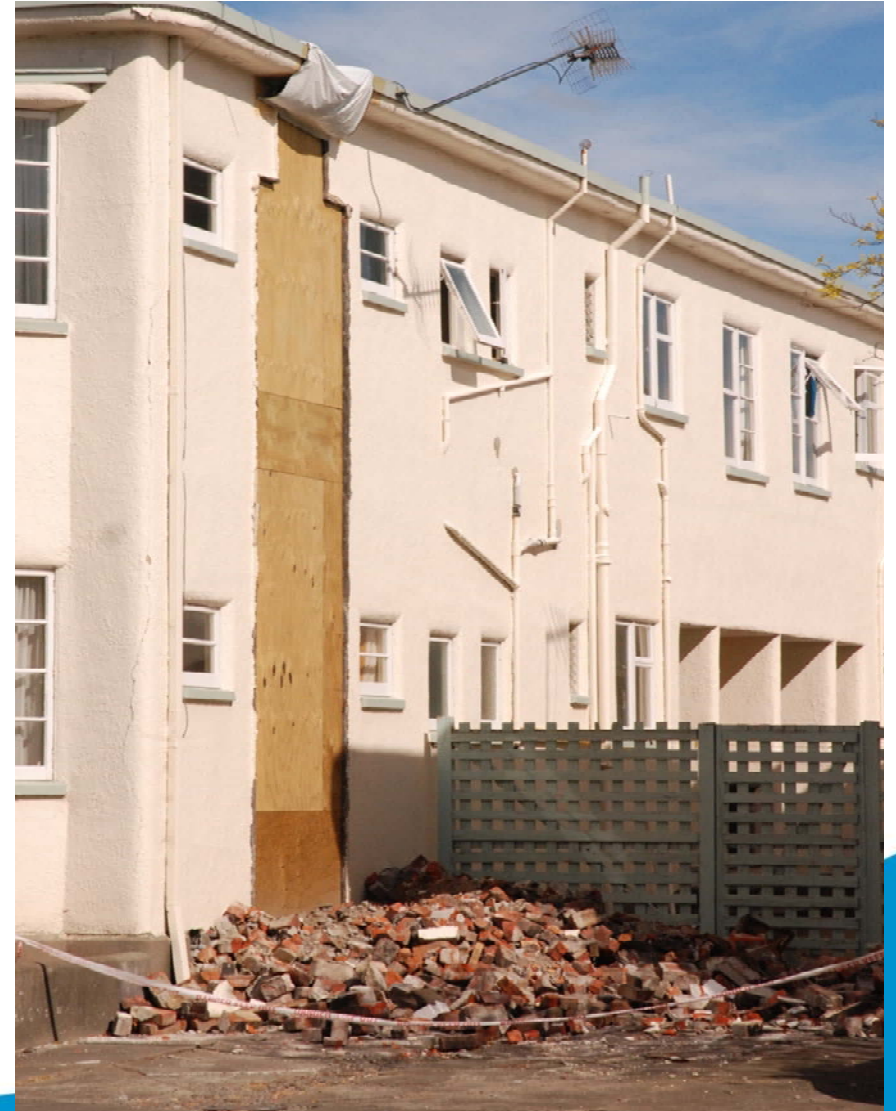
Earthquake Ready Action Plan

RAPID and LONG TERM RECOVERY

1. Community Recovery Plan
2. Re-development Plan
3. Utilities restoration



We all have a Personal Responsibility to be Prepared







Emergency Preparedness Week

Activities

May 2-9, 2015

Emergency Preparedness Displays and Quake Cottage

May 1st	5 – 10 pm	Night Market - 138 Victory Ship Way City of North Vancouver
May 2nd	10 am - 5pm	Park Royal Mall - 2002 Park Royal South District of West Vancouver
May 9th	1 – 5 pm	Lynn Valley Village - 1277 Lynn Valley Road District of North Vancouver

Emergency Preparedness in a Day – Free Workshop

May 3rd	9 am – 4 pm	North Shore Emergency Management Office, 2 nd Floor 147 East 14 th Street, North Vancouver <i>Pre-register: nsemo.org</i>
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More Information on Preparedness

North Shore Emergency Management Office
2nd Floor, 147 East 14th Street, North Vancouver

604.969.7000

Twitter/Facebook:

NorthShoreEMO

www.nsemo.org

