The PCL Team

The New St. Paul's, Reimagined.

Climate Hazards, Vulnerability and Risk Assessment Report

Final Report

July 3, 2020

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1 INTRODUCTION

1.1 Background

The design of the new St. Paul's development is a complex and multi-stage process. The first major step, the indicative design, is complete and included a site-wide climate risk assessment by Pinna Consulting in 2019. The Pinna Sustainability Consulting assessment is based upon the indicative design and received feedback from the City of Vancouver. The feedback included recommendations that:

- A more comprehensive assessment be carried out;
- A broader list of hazards should be reviewed; and
- A broader set of stakeholders be included.

1.2 Scope

This hazards, vulnerabilities and risk assessment focuses on specific systems and components of the proposed hospital campus design. It also includes impacts and associated vulnerabilities of critical infrastructural elements beyond the site that are essential to its operation and performance (e.g. utilities – roads, power, water). The intent of this assessment however is to focus on the redevelopment of the project site and parcel under rezoning review. Thus, this report focuses on the work that is proposed as part of the design-build scope and approved construction budget.

1.3 Limitations

The current stage of this project is that of a competitive pursuit, such that the design under review is one of two proposed to the client and pending a technical review only one project design will be awarded for completion.

One complexity this brings to the resilience assessment is the challenge of design details needing to remain confidential, which limits the public consultations at this stage. The scale of assessment required for such a critical post-disaster facility extends beyond the means of review available during a standard rezoning process. Additionally, given the competitive design-build nature of this project, there exist restrictions to the extent to which consultation and public facing dialogue can occur. It is typical for a development project undergoing rezoning to undertake public consultation and engage with the local community, relevant stakeholders, and specific organisations and representative groups. However, given the competitive nature of the design-build process, including the development of proprietary and confidential design material, it is not appropriate to disclose such information to the public as doing so would compromise the competitive bid setup.

The proposed project site is in a flood plain and high-risk seismic and liquefaction zone. These factors compound the challenges arising from the stress of a changing climate, with the system-wide shock a large-scale flood or earthquake would present.

1.4 Terminology

It is important to note that the language regarding vulnerability and risk is changing, with newer reference standards altering the definitions and approaches to climate change adaptation planning and climate risk assessments.

Specifically, there are differences between two key International Standards used:

- ISO 31000 (2018) Risk Management - The basis of the PIEVC Protocol
- ISO 14091 (under development, draft 2020) Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment

The difference in language used in each standard highlights the importance of clear definitions and a consistent approach by professionals. The development of ISO 14091 is a result of the 2014 IPCC report (Fifth Assessment Report, AR5) changing the conceptual framework for determining the impacts of climate change from a vulnerability-based approach (IPCC AR4, 2007) to a more risk-oriented conceptual framework (IPCC AR5, 2014). For the purposes of this report the following definitions will be used throughout this report and assessment:

- **Hazard** - Potential source of harm. Hazard comprises slow-onset developments (e.g. rising temperatures over the long term) as well as rapidly developing climatic extremes (e.g. a heatwave) or increased variability.
- **Impact** – The effect on natural and human systems, including lives, health, ecosystems, economies, services and infrastructure.
- **Adaptive capacity** - Ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.
- **Sensitivity** - Degree to which a system or species is affected, either adversely or beneficially, by climate variability or change.
- **Vulnerability** - Propensity or predisposition to be adversely affected.
- **Consequence** – The result or effect of an impact.
- **Probability** – the extent to which something is probable; the *likelihood* of an event occurring.
- **Risk** – the effect of uncertainty.
- **Mitigation –** measures taken to reduce emissions and the rate of climate change.
- **Adaptation** – measures taken to respond to existing and 'locked in' climate changes.

Though the approach outlined in this assessment follows the ICLEI BARC methodology, updates and revisions have been made to align with more recent IPCC assessment criteria and language.

1.4.1 Hierarchical Terms

Indicators help measure and determine the probability of a hazard occurring. *They are a quantitative, qualitative or binary variable that can be measured or described, in response to a defined criterion [ISO 14091, 2020].*

Parameters are a measurable factor forming one of a set that defines a system (e.g. temperature and precipitation are parameters for observing changes to the climate).

Example:

If temperatures exceed 32°C for >=3 days* (indicator threshold, **as defined by HealthLink BC*) this determines that a heatwave (hazard) is occurring because temperatures have changed (analysis parameter), and people with respiratory issues may begin to suffer (impact). The consequences of this may include loss of life, increased demand for medical care (including hospitalization), financial costs and psychological impacts.

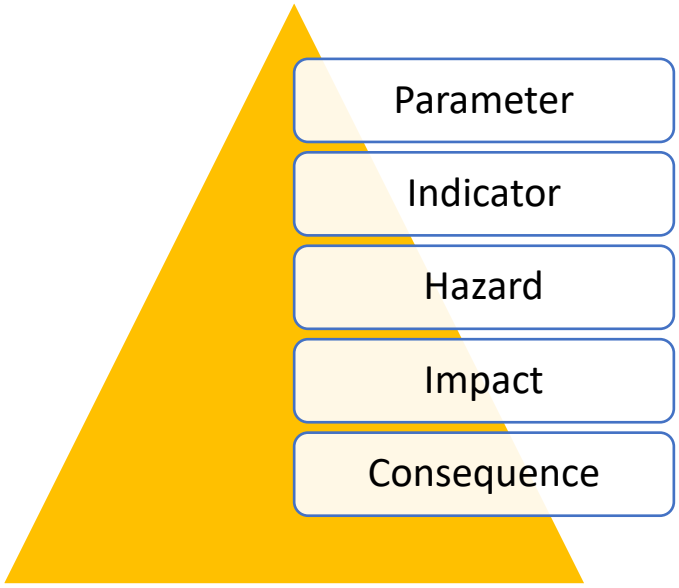

Figure 1 - Hierarchy of Terms

2 METHODOLOGY

2.1 Timescale of Assessment

The climate projections used for this assessment include 2050 and 2080, based on the half-life and end-life of the facility, and available data.

As the facility's design life is expected to be a minimum of 50 years, the timescale selected for this assessment covers climate projections up to 2100. The timescales used in climate projections cover 30-year timespans, as such, when referring to climate the following timelines are referred to in this report:

- **2020s**: 2011-2040; current or short-term
- **2050s**: 2041-2070; medium-term
- **2080s**: 2071-2100; long-term

There are currently no plans for Project deconstruction or rehabilitation. Refer to Appendix D – Climate Data Appendix D – for the general climate projections provided to the team and used in the assessment.

Table 1 - Representative Concentration Pathways

Representative Concentration Pathways (RCPs)
RCPs describe potential 21st century scenarios of GHG emissions, atmospheric GHG concentrations, air pollutant emissions, and land use. These RCPs are used for making projections and are based on the factors that drive anthropogenic GHG emissions: population size, economic activity, lifestyle, energy use, land use patterns, technology adoption, and climate policy. Each of the RCP emissions pathways is achievable, and directly relates to the choices made by global society.
(Source: Metro Vancouver, 2016)

2.2 Climate Projections

The climate projections were based on publicly available information and data from climate projection portals, and were provided to each design team by the City of Vancouver, which included:

- Climate Projections Metro Vancouver report (June 2016)
- City of Vancouver Climate Change Projections (2016)
- Pinna Sustainability Consulting – *Stress Test Scenarios* (2019)
- LMFM – Moving Towards Climate Resilient Health Facilities for VCH – *Stress Test Scenarios* (2018)
- City of Vancouver Coastal Flood Risk Protection – *Sea-level-rise projections* (2014)

Various future trajectories of GHG emissions are possible depending on global mitigation efforts in the coming years. Climate projection models uses various greenhouse gas (GHG) emissions trajectories, known as Representative Concentration Pathways (RCPs) (*see text box*), to predict how future climate will behave under different concentrations and rates of release of GHGs to the atmosphere, as well as different global energy balances.

RCPs are established by the Intergovernmental Panel on Climate Change (IPCC), the international body for assessing the science related to climate change. The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation (IPCC, 2014). The IPCC has established four GHG emissions scenarios based on RCPs:

1. RCP 8.5 – RCP 8.5 is considered the global 'business as usual' greenhouse gas emissions.
2. RCP 6.0 – in the RCP 6.0 scenario, GHG emissions double by 2060 and then dramatically fall but remain well above current levels.
3. RCP 4.5 - RCP 4.5 is considered the 'medium stabilization' scenario where global mitigation efforts result in about half of the emissions compared to RCP 8.5.
4. RCP 2.6 - the RCP 2.6 emissions scenario may be achievable with extensive adoption of biofuels/renewable energy and large-scale changes in global consumption habits, along with carbon capture and storage. RCP2.6 is representative of a scenario that aims to keep global warming likely below 2°C above pre-industrial temperatures.

Current estimates of GHG emissions reflect the RCP 8.5 path; this has been re-confirmed by the recent IPCC Special Report on Global Warming of 1.5°C (IPCC, 2018). Figure 2 shows the various RCPs scenarios mapped out to the year 2100 reflecting different rates of GHG emissions. **This assessment is thus based on climate projections estimated under the RCP 8.5 scenario.**

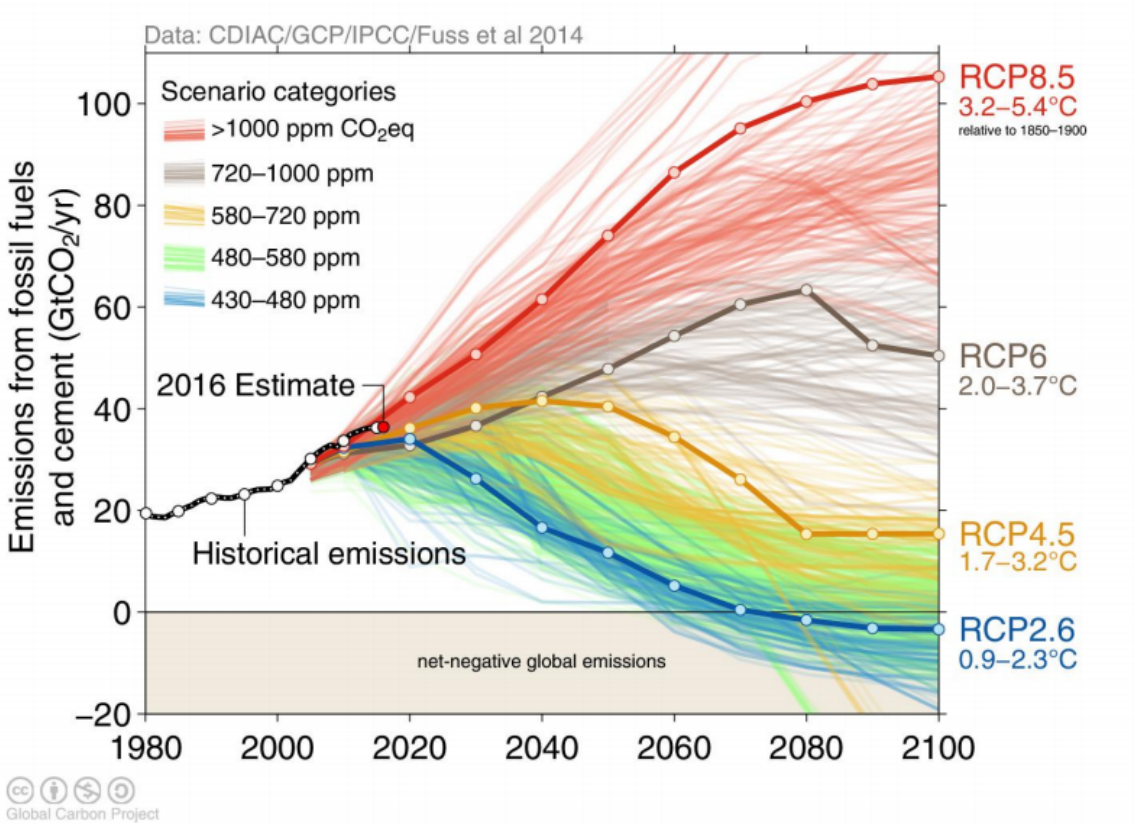

Figure 2 - Representative Concentration Pathways of Emissions

Source: Global Carbon Project, 2016

Future climate projections in this assessment were established based on data obtained from Metro Vancouver and City of Vancouver reports on climate change projections to the year 2050 based on RCP 8.5. "The results of their reports are based on a subset of climate models selected from the Coupled Model Intercomparison Project 5 (CMIP5). The CMIP5 climate models were first screened according to their ability to replicate historical data, and from them, the ensemble of 12 models was chosen to provide the widest range of projected change for a set of climate parameters" (Metro Vancouver, 2016, p3).

2.3 Approach

The approach used is based on working knowledge and application of climate risk tools including the PIEVC Protocol, Climate Lens assessments, ISO 31000 Risk Management framework and the ICLEI BARC (Building Adaptive and Resilient Communities) tool. This aligns with the approach taken by the Pinna report and ensures a systems interdependencies perspective is brought into the project development. The approach is graphically represented below.

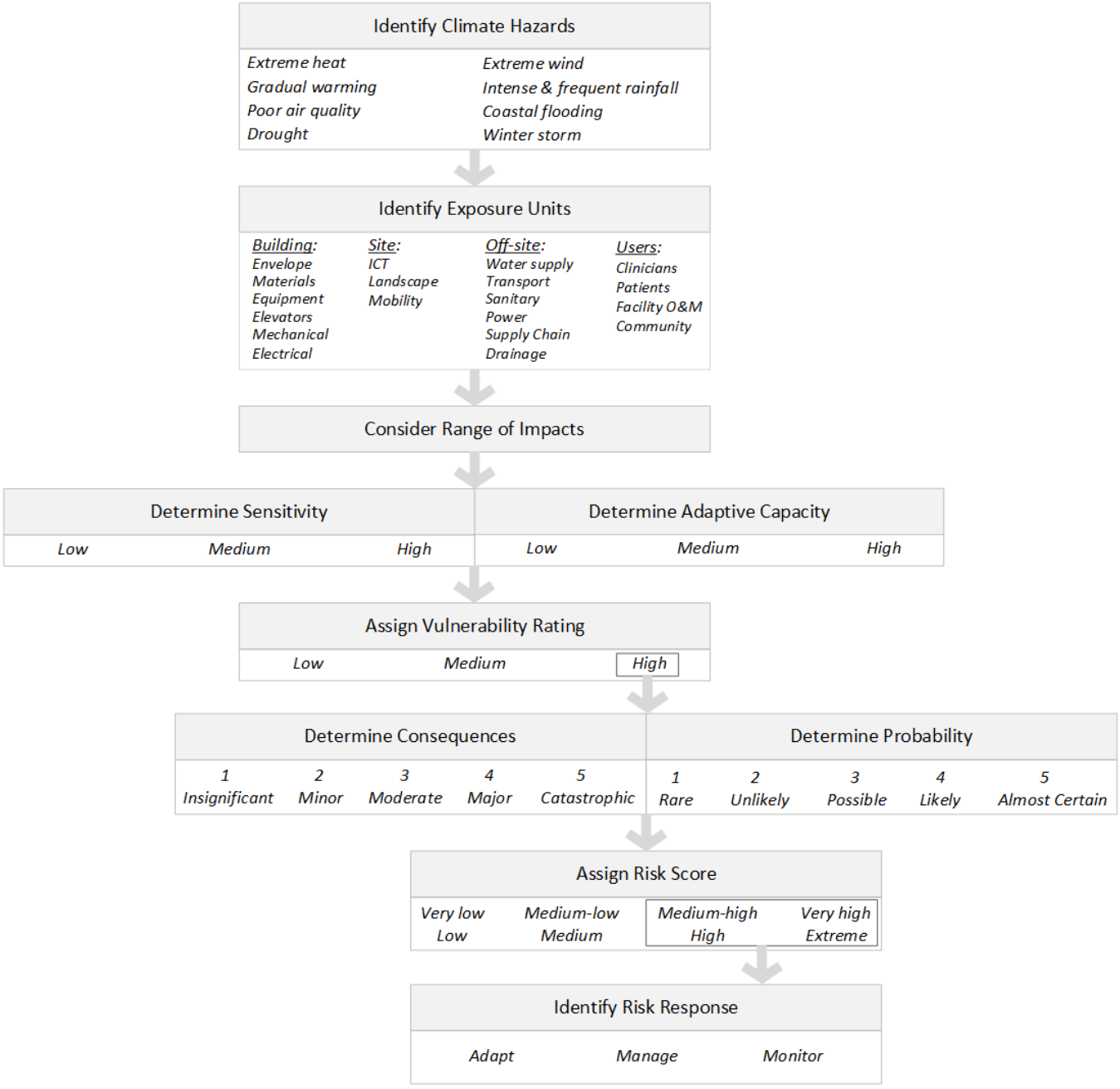

Figure 3 - Illustration of the vulnerability and risk assessment process

2.4 Engagement

A virtual climate hazard and vulnerability assessment workshop was held on April 30th, 2020. The purpose of the workshop was to:

- Validate the vulnerability ratings that had been assigned to each of the exposure units and climate hazards; and
- Identify the corresponding consequence criteria.

Participants at the workshop included representatives from the City of Vancouver (Engineering, Development, Neighbourhood Energy Utility, Sewer, Sustainability), utilities (BC Hydro, FortisBC), technical and clinical staff, compliance consultants, Indigenous/Downtown East Side and members of the PCL design team. The outputs from this workshop have informed, and are included in, this risk assessment report.

A copy of the presentation and process overview from this workshop can be found in Appendix F – Workshop Presentation Slides. Various working sessions were also conducted with the design team to identify risk response measures, adaptation actions and mitigation strategies.

2.5 Climate Hazards

Three *stress test scenarios* were defined in the 2019 Pinna Report and revised based on feedback and recommendations received from the City of Vancouver. For each of these stress tests, the underlying climate hazards were defined as outlined below.

Table 2 - Stress Tests and Corresponding Climate Hazards

Stress Test Scenario	Climate Hazard
Hot and Dry Scenario:	
• Temperatures in the region have been over 30°C for the past three weeks. • Several days in the last week have reached daytime highs of 36°C and nighttime lows of 25°C. VCH issued an Extreme Heat Alert (i.e. 20% increase in fatality rate) on day two of the heat wave. • This is year three of prolonged hot and dry conditions with unseasonably mild and dry winters. • The annual average temperature has increased gradually over the past 35 years, and is now 2.9C higher, whilst the warmest day in summertime is now 3.9C warmer. • Thirty years ago, Vancouver began experiencing tropical nights - whereby evening temperatures did not drop below 20C - for the first time; since then, the number of tropical nights per year has increased from zero to 15 by 2053. • The temperature has not gone below -10°C since 2040.	Extreme heat Gradual warming (increasing temperatures) Poor Air Quality (forest fires) Drought
Strong Wind Scenario:	
• During a hot and dry period, a windstorm hits the City, bringing gusts of extreme wind measuring in at 110km/h (20% percent larger than in the past three year average).	Drought Extreme wind

Storm Surge Scenario:	
• Large winter storm surge event has coincided with a king tide. • The winter has been wet. Over the last day, 103mm of rain has fallen at the site, and 248mm has fallen on the north shore. • Inundation of coastal infrastructure and localized flooding. Floodwater is at 4.8m. • Urban flooding is exacerbated by debris blocking the municipality's drainage system. • Climate change has been accelerating, and with current rates of melting, updated flood plain requirements for new buildings set ground floor levels at 5.4m. • High winds have knocked down power transmission lines, causing outages throughout the city.	Intense & frequent rainfall Coastal flooding Winter storm (extreme weather)

2.6 Exposure Units and Impacts

2.6.1 Exposure Units

For the purposes of this assessment, 19 *exposure units* have been considered. These exposure units are the people, systems and infrastructure which are vital for the successful operation and business continuity of the hospital and have the potential to be impacted by future climate change. These 19 exposure units are categorised into four *exposure categories*: building users, building structure, site systems and off-site systems. Details on these four exposure categories and the individual exposure units that they contain are detailed in the table below.

The use of exposure units and exposure categories provided participants with a structure for their review and assessments of impact statements, and ensured that impacts beyond the building-scale were thoroughly considered and documented through the assessment process.

Table 3 - Summary of Exposure Categories and Exposure Units

Exposure Categories	**Building structure**	**Site systems**	**Off-site systems**	**Users**
Exposure Units	Envelope / Enclosure Materials Medical / Clinical Equipment Elevators Mechanical Electrical	Information & Comm. Tech. (ICT) Landscape Mobility	Water supply Transport Sanitary Service / Sewerage Power Supply Chain Local Drainage / Storm Sewer	Clinicians Patients Facility O&M Community / Health Care

2.6.2 Impacts

An assessment of the potential impacts of the climate hazards on the 19 *exposure units* was undertaken. This assessment considered the potential impacts climate change could present to the; functionality, access, maintenance, operation, cost, safety, supplies, storage and emergency response for the site. Additionally, this impact assessment involved recognising where this team's specific design presented any significant deviations from the indicative design and how these may alter the impact of various hazards.

The outcome of this impact assessment was the development of 275 impact statements which have been organised into their climate hazard and associated exposure units. These were collectively considered during the vulnerability assessment for each exposure unit. Only the exposure units which were assessed to be impacted were taken forward to the vulnerability assessment.

2.7 Climate Vulnerability Assessment

To determine the vulnerability to each climate hazard, the impact statements for each exposure unit were collectively considered in assessing the given exposure units' vulnerability. The initial vulnerability assessment was carried out by the resilience assessment team, with further impact statements added and vulnerability re-evaluated during the stakeholder engagement workshop. Vulnerability is a function of sensitivity and adaptive capacity, and the equation used in the scoring of vulnerability was:

Vulnerability = Sensitivity * Adaptive Capacity

2.7.1 Sensitivity

The design team was given the following scoring criteria for sensitivity:

Table 4 - Descriptive Sensitivity Ranking

Sensitivity	***Description***
Low	Functionality will stay the same or likely stay the same. Barely affected.
Medium	Functionality is likely to get worse. Moderately affected.
High	Functionality will become unmanageable. Significantly affected.

2.7.2 Adaptive Capacity

The adaptive capacity or *effort to adapt* is the term used to describe the ability of a system to adjust to potential changes. For the purposes of this assessment a three-point assessment scale (low, medium and high) was used.

Though adaptive capacity [AC] is the term commonly used in vulnerability assessments, its use as a means of measurement creates discord as compared with the rating and measurement of sensitivity [S].

Using the equation V = S * AC, a highly sensitive system with a high adaptive capacity results in a *medium vulnerability*; the highly sensitive system is buffered and supported by a high ability to adapt to the change resulting in this *medium or moderate vulnerability*. Conversely, a system with a low sensitivity to change and a low adaptive capacity, also results in a *medium vulnerability*. This can cause confusion during vulnerability assessments. To ensure congruity between the measurement of variables; and a more consistent approach regarding semantics, a more appropriate measurement of adaptive capacity is *effort to adapt [EA]*. This measures the difficulty a system experiences when adjusting to a hazard.

Therefore, using the equation V = S *EA, a highly sensitive system requiring a high effort to adapt would result in a high vulnerability.

Table 5 - Descriptive Effort to Adapt Ranking

Example: *[inverse relationship of effort to adapt and adaptive capacity]*	***Adaptive Capacity***	*Effort to Adapt*
Structural form and building foundations. *Difficult to alter once constructed, and expensive to modify.*	Low	High
Staff emergency plans and protocols for disaster response. *Relatively cheap and easy to update and revise for changes.*	High	Low

The approach used in this assessment is thus based on *effort to adapt* and the below scoring for such.

Table 6 - Description of Effort to Adapt

Effort to Adapt	***Description***
Low	Little or slight effort and intervention required.
Medium	Some effort and intervention required.
High	Significant or substantial effort and intervention required.

2.7.3 Vulnerability Threshold

Impacts that ranked as a high vulnerability using the vulnerability thresholds detailed below were taken forward for consequence scoring in the risk assessment. A full list of the exposure units that were assessed to be high vulnerability, and which were taken through to the risk assessment are contained in Appendix B – Vulnerability Assessed Impact Statements.

Table 7 - Vulnerability Threshold Graphic

Effort to Adapt				
	High	Medium Vulnerability	High Vulnerability	High Vulnerability
	Medium	Low Vulnerability	Medium Vulnerability	High Vulnerability
	Low	Low Vulnerability	Low Vulnerability	Medium Vulnerability
		Low	*Medium*	*High*
			Sensitivity	

2.8 Climate Risk Assessment

In this assessment, the Risk Rating is defined as the product of two ratings.

Risk Rating = Probability Rating * Consequence of Impact Rating

Further information on the assessment process undertaken through the workshop can be found in Appendix F – Workshop Presentation Slides.

2.8.1 Consequence

During the climate hazard and vulnerability assessment workshop only exposure units rated as highly vulnerable were taken forward for consequence scoring (per ICLEI BARC methodology). Consequence was assessed against the ten consequence criteria provided to the design team by the City of Vancouver Resilience Rezoning Panel (see Table 8 - Consequence Assessment Criteria and Rating Scale). This was done on a six-point scale (0-5). Following the ICLEI BARC methodology, all consequence criteria are assumed to have an equal weight regarding scoring and were summed for a total consequence score (max score of 50). A summary of the individual consequence scores for each highly vulnerable exposure unit under each climate hazard are provided in Appendix C – Consequence Scoring.

Table 8 - Consequence Assessment Criteria and Rating Scale

Consequence Criteria	Consequence scale					
	No consequence 0	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Psychological impacts on patients and staff	No psychological impacts on patients and staff	Minimal expected reactions of fear, anxiety, or disruption to daily routine	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	Widespread, severe disturbance resulting in long-term psychological impacts (e.g. PTSD)
Morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	<2% of the patients and staff affected	<5% of the patients and staff affected	5%-15% of the patients and staff affected	15%-25% of the patients and staff affected	>25% of the patients and staff affected
Patients and staff loss of life	No possibility of patients and staff loss of life	<2% of the patients and staff affected	<5% of the patients and staff affected	5%-15% of the patients and staff affected	15%-25% of the patients and staff affected	>25% of the patients and staff affected
Patients and staff safety	Patients and staff safety will not be impacted	No intervention or treatment required	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Moderate harm, requiring medical treatment, small number of individuals impacted	Major harm, leading to long term incapacity or disability. Several individuals impacted	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.
Loss of social cohesion	Trust remains unchanged	Low potential for erosion of public trust	Minor erosion of public trust in health authority	Moderate erosion of public trust in health authority	Major erosion of public trust in health authority	Complete erosion of public trust in health authority
Public/Media	No community response, or media interest	Very little community response, or media interest	Isolated community complaints, local short-term media interest	Some community complaints, local long-term media interest	Negative community complaints, major loss of credibility, national short-term media interest	Parliamentary questions, national long-term media interest
Health service delivery	No impact on health service delivery	Dealt with by routine operations	Threaten the efficiency or effectiveness of some services, but dealt with internally	Require significant review or changed ways of operating	Threaten continued effective provision of services, require top-level management intervention	Threaten provision of key services, major problems for patients, clients, and staff.
Business continuity	No impact on business operation	Little impact on business operation (temporary nuisance)	Minor business operation impact manageable though alternatives. Some loss of revenue / cost (hours-long disruption)	Considerable impact in business operation with loss of revenue (days-long disruption)	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)
Hospital assets	No hospital assets are at risk	Little disruption of non-critical hospital assets	Minor short-term impacts (mainly reversible) on hospital assets	Considerable impact upon access to hospital assets	Extensive damage to hospital assets with widespread impacts	Hospital assets are completely damaged with irreversible loss
Monetary loss	No monetary loss	<$10K	$10K-$250K	$250K-$1M	$1M-$10M	>$10M

2.8.2 Probability

Risks are evaluated under current climate conditions (2020s) to establish a baseline. Future risks are assessed considering future (projected, 2050 and 2080) climate changes. A summary of the probability ratings used as part of this assessment are detailed below.

Climate projections were based upon climate data provided to the PCL team (see Appendix D – Climate Data). The probabilities generated for each climate hazard consider the *business as usual* or *high emissions* pathway for climate projections (representative concentration pathway 8.5, RCP 8.5).

Table 9 - Probability Rating Summary

Probability Rating	Recurrent Impact	Single Event
5 - Almost Certain	Could occur several times per year	More likely than not – probably not greater than 50%
4 - Likely	May arise about once per year	As likely as not – 50/50 chance
3 - Possible	May arise about once in 10 years	Less likely than not but still appreciable – probability less than 50%but still quite high
2 - Unlikely	May arise once in 10 years to 25 years	Unlikely but not negligible – probability low but not noticeably greater than zero
1 - Rare	Unlikely during the next 25 years	Negligible – probability very small, close to zero

The following trends are observed based on the climate data sources provided:

Table 10 - Probability Scores and Trends

	Coastal Flood	***Frequent Intense Rain***	***Extreme Heat***	***Gradual Warming***	***Poor Air Quality***	***Winter Storm***	***Extreme Wind***
2020	1	3	4	3	3	3	4
2050	4	3	5	4	4	2	4
2080	5	4	5	5	4	2	4
Trend	Increasing	Increasing	Increasing	Increasing	Increasing	Decreasing	Stable

All climate hazards, except for extreme wind and winter storm events, are predicted to increase in frequency and/or intensity. Wind is more difficult to analyze using climate modelling and is projected to remain stable through 2100. Winter storms are predicted to decrease in frequency and/or intensity.

2.8.3 Risk Evaluation

Using the probability scores for each climate hazard along with its associated consequence score for each exposure unit, the risk scores were generated based on the climate projections for the 2020s, 2050s, and 2080s. This provides an understanding of how risk may change over time, and thus informs the appropriate risk response strategies. A summary of the risk rating for each of the highly vulnerable exposure units under each climate hazard are provided in Section 3 Analysis.

2.8.4 Risk Threshold

Though a risk assessment generates many scores and presents many items for analysis, not all risk response measures require the same level of treatment and effort. Using the ICLEI BARC methodology, the focus of the risk response strategies in Section 4 is on reducing risk where exposure units have risk scores higher than 131 or those in the risk category of *medium-high* or higher (see below).

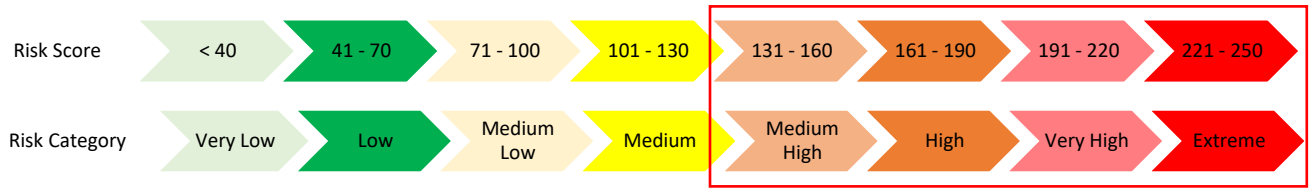

Figure 4 - Risk Spectrum

3 ANALYSIS

The following section is structured as follows with an identical format for each climate hazard to allow ease of comparison. For a full summary of all risk scores for all hazards see Appendix E – Risk Summary Table.

Hazard

General description of the individual climate hazard analyzed.

Impacts

High-level summary of the impacts generated by design team members and stakeholders as a result of a climate hazard event occurring.

Vulnerability

Description of the vulnerability rating for the hazard as it pertains to that exposure category and associated exposure units.

Risk

Description of the risk rating for the hazard as it pertains to that exposure category and associated exposure units.

3.1 Coastal Flood

3.1.1 Hazard

A coastal flood was examined as part of a large winter storm surge (December 2053) stress test scenario. This included heavy rainfall, the inundation of coastal infrastructure and localized flooding. It assumes a floodwater level of 4.8m. Urban flooding is exacerbated by debris blocking the municipality's drainage system.

Regional impacts include critical infrastructure being underwater, and sewage leaking into the environment resulting in contaminated pooling with storm drains over capacity.

3.1.2 Impacts

Building – Water ingress brought about through coastal flooding could damage the building structure, foundations, electrical systems and could result in the development of unsafe conditions through the growth of mould and mildew.

Site – Low lying areas may no longer be accessible such as loading docks and parking areas. Flooding may also result in the destruction of landscaping materials. Site level flooding may also impact the ability to move people and/or supplies around the site.

Off-site – Coastal flooding causing inundation of sewage systems could result in back up of water with potential impacts on the health and wellbeing of hospital users. This could also significantly increase the cost of response actions and clean-up after heavy rainfall events.

Users – Coastal flooding could affect both the buildings clinicians and patients through the psychological impacts caused by stresses and anxiety of flooding losses and impact to local transportation. For the facility management

team coastal flooding could increase their workload through maintenance and response efforts as areas become flooded. Waterborne diseases may become a challenge.

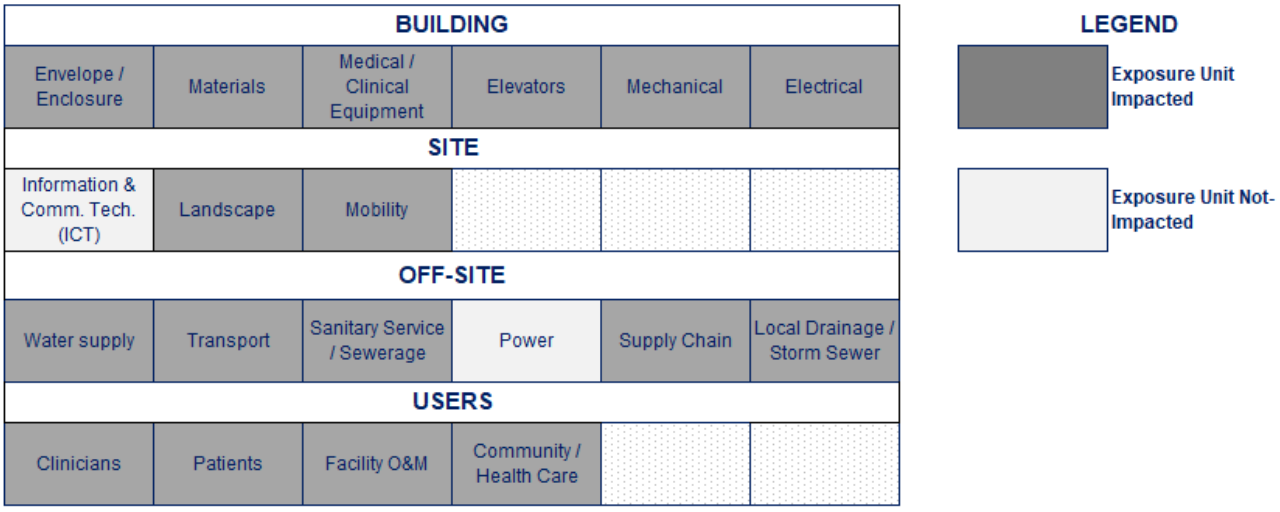

Figure 5 - Impact Assessment - Coastal Flood

3.1.3 Vulnerability

Based on the effort to adapt (adaptive capacity) and sensitivity to each impact, the vulnerability ratings for each exposure unit were reviewed and adjusted with stakeholder input, with clinicians, patients, facilities O&M, envelope/enclosure, electrical and sanitary service/sewerage rated as highly vulnerable to the impacts of a coastal flood event.

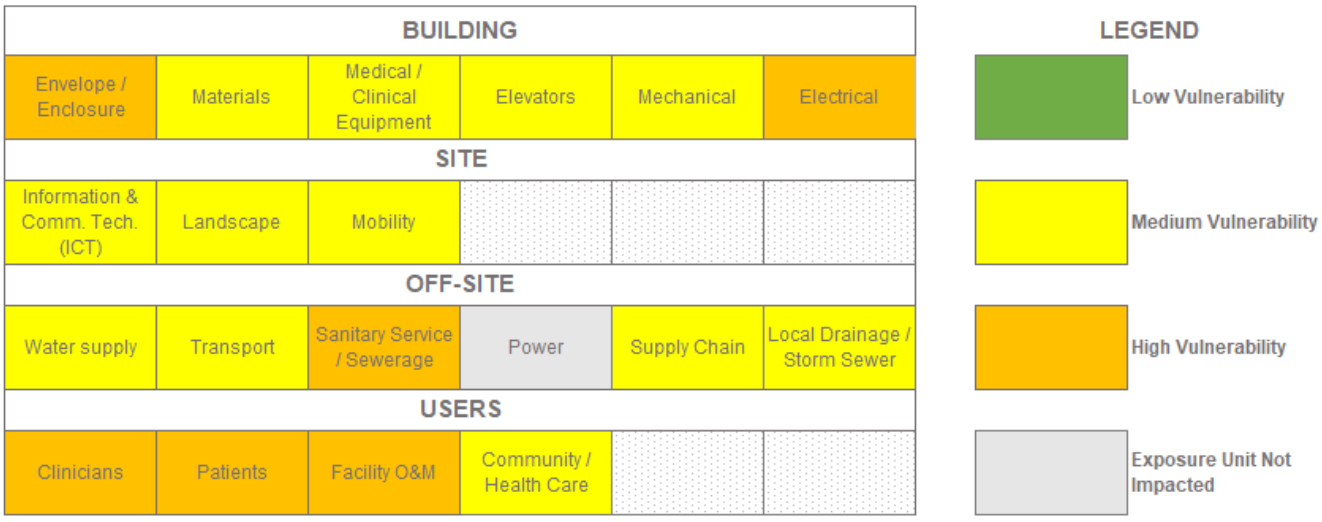

Figure 6 - Vulnerability Rating - Coastal Flood

3.1.4 Risk

Probability

The probability of a coastal flood event associated with sea level rise of 0.5m is projected to increase from a rating of *unlikely (2)* for the current period of the 2020s, to *likely (4)* for the 2050s, and *almost certain (5)* for the 2080s.

Consequence

Building – Damage to electrical systems and the building envelope were assessed as being of greatest consequence to hospital asset loss and monetary loss. It could also have the potential to affect business continuity and health service delivery.

Site – As no site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Off-site – The consequence of any damage or back-up in the sanitary system that could result in sewage leaks could have serious consequences for the safety and health of staff, patients, and result in potential infections and loss of life. There could also be negative media consequences as well as disrupting business continuity, damaging hospital assets and increasing costs to site operations and clean up.

Users – A coastal flood event could pose a threat to clinicians, patients and O&M staff. The consequences of such an event include psychological impacts, injury or disease, safety concerns, as well as disruption to business continuity.

Risk Score

The changing risk profile of this hazard is such that from the current time period through to the 2080s, the exposure unit at greatest increasing risk is that of the sanitary services. Associated with this is the risk posed to facility O&M staff through a failure of these sanitary service assets.

	Clinicians	Patients	Facility O&M	Envelope / Enclosure	Electrical	Sanitary Services
2020	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
2050	Medium Low	Medium	Medium High	Very Low	Low	Medium High
2080	Medium Low	Medium	High	Very Low	Low	High

Figure 7 - Risk Assessment - Coastal Flood

3.2 Intense and Frequent Rainfall

3.2.1 Hazard

Intense and frequent rainfall was examined as part of the winter storm surge (December 2053) stress test scenario. This included heavy rainfall (103mm rainfall at the site, 248mm on the north shore) with localized flooding, exacerbated by debris blocking the municipality's drainage system.

Regional impacts include critical infrastructure being underwater, and sewage leaking into the environment resulting in contaminated pooling with storm drains over capacity.

3.2.2 Impacts

Building – Flooding and water ingress may cause damage to the roof membrane as well as basement. Maintenance may be required on the building glazing as well as the potential for erosion of foundation components with ongoing rain events. Flooding may impact the development of mold and increase the likelihood of infections occurring. Water ingress may pose a threat to elevators and mechanical equipment, as well as inundating the power distribution system.

Site – Low lying areas may no longer be accessible such as loading docks and parking areas. Flooding may also result in the destruction of landscaping materials. Site level flooding may also impact the ability to move people and/or supplies around the site.

Off-site – Flooding causing inundation of sewage systems could result in back up of water with potential impacts on the health and wellbeing of hospital users. This could also significantly increase the cost of response actions and clean-up after heavy rainfall events.

Users – For the facility management team flooding may increase maintenance and response efforts as areas become flooded and repairs to drains and sumps are required. The potential impact of such intense rainfall events on the broader community and healthcare delivery includes mental health issues and increase demand for health services due to bacterial outbreaks from sewage overflows.

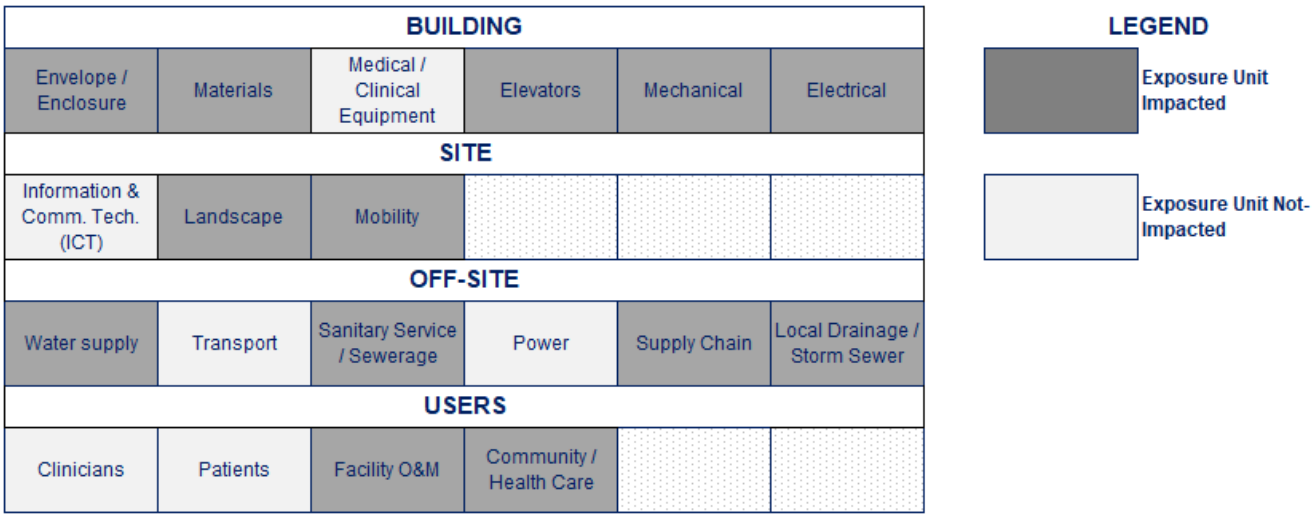

Figure 8 - Impact Assessment - Intense and Frequent Rainfall

3.2.3 Vulnerability

Based on the effort to adapt (adaptive capacity) and sensitivity to each impact, the vulnerability ratings for each exposure unit were reviewed and adjusted with stakeholder input, with clinicians, patients, facilities O&M, envelope/enclosure, electrical and sanitary service/sewerage rated as highly vulnerable to the impacts of an intense and frequent rainfall event.

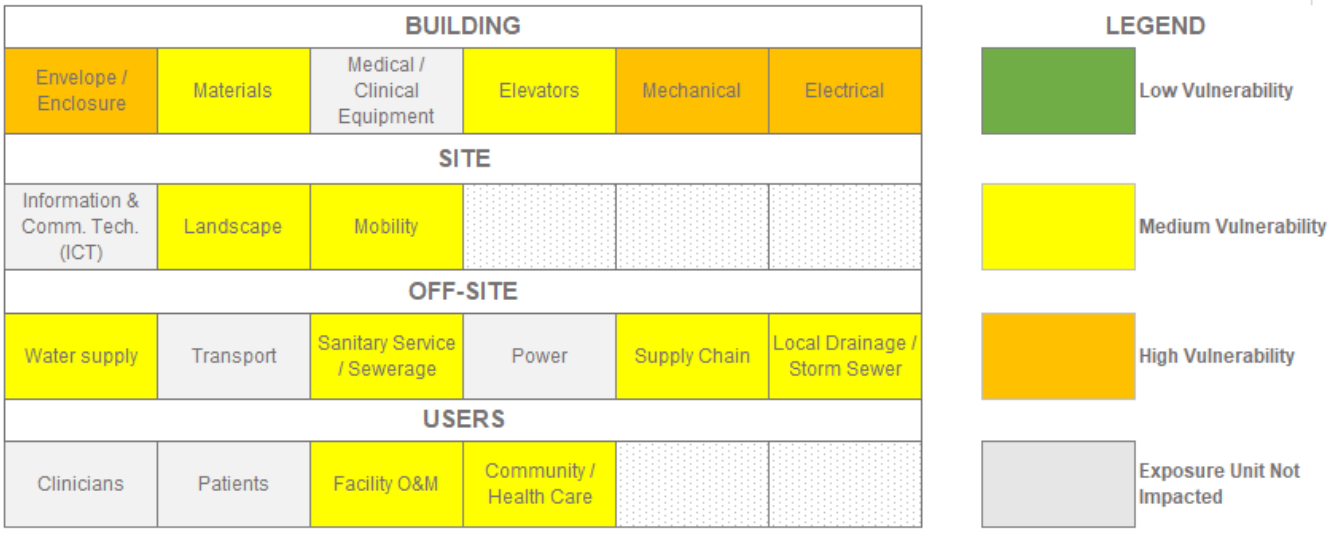

Figure 9 - Vulnerability Rating – Intense and Frequent Rainfall

3.2.4 Risk

Probability

The probability of a rainfall event as defined in the stress test scenario is projected to increase from a rating of *possible (3)* for the current period of the 2020s and the 2050s, to *likely (4)* for the 2080s.

Consequence

Building – Damage to mechanical and electrical systems, and the building envelope were assessed as being of greatest consequence to hospital asset loss and monetary loss. This could also have the potential to affect business continuity and health service delivery.

Site – As no site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Off-site – As no off-site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Users – As no user impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Risk Score

The changing risk profile of this hazard is such that from the current time period through to the 2080s, the exposure unit at greatest increasing risk is that of the mechanical systems.

	Envelope	Mechanical	Electrical
2020	Very Low	Medium	Very Low
2050	Very Low	Medium	Very Low
2080	Very Low	Medium High	Very Low

Figure 10 - Risk Assessment -Intense and Frequent Rainfall

3.3 Extreme Heat

3.3.1 Hazard

Extreme heat was examined as part of a hot and dry summer (August 2053) stress test scenario. Temperatures in the region have been over 30°C for the past three weeks. Several days in the last week have reached daytime highs of 36°C and nighttime lows of 25°C. VCH issued an Extreme Heat Alert (i.e. 20% increase in fatality rate) on day two of the heat wave. Thirty years ago, Vancouver began experiencing tropical nights - whereby evening temperatures did not drop below 20C - for the first time; since then, the number of tropical nights per year has increased from zero to 15 by 2053.

Regional impacts include water shortages with Level 4 water restrictions (i.e. outdoor watering prohibited, 50L personal use /day) with wildfires significantly larger and more extensive than in the past. The wildfire season has expanded to start both earlier in the spring and last later into the fall. BC Hydro's highest peak hourly demand is 15% higher, and high demand periods are significantly longer, than before the heat wave began.

From a community perspective there is an increase in visits for heat stress, respiratory and cardiovascular illnesses, schizophrenia, mood disorders and neurotic disorders, particularly from vulnerable populations.

3.3.2 Impacts

Building – Decreased service life of building components and accelerated deterioration of the façade through UV exposure. Extreme heat events could impact the reliability and accuracy of lab results as equipment rooms overheat. Heat waves would result in the building mechanical HVAC systems running at maximum capacity for prolonged periods of time resulting in additional wear and tear on the equipment and increasing the likelihood of mechanical failure and maintenance works. This could also result in premature failure of electrical systems.

Site – Vegetation may brown and die, leading to increased irrigation costs and/or replacement.

Off-site – At a regional level, extreme heat could impact regional power supply and result in increased frequency and intensity of power outages and overload of the grid.

Users – Increased workload for staff with patient admissions for heat stress and respiratory issues. Potential for increased violence and threats to user safety. Discomfort and lack of focus leading to errors and mistakes. Certain groups of patients require additional attention and support. Facilities O&M staff require more time to maintain chillers. Increases in community members seeking refuge and increased respiratory illness and disease vectors. Given the location of the proposed hospital and the specific needs of the surrounding Downtown Eastside communities, high temperature events will present additional pressures on the hospital from increased admissions and referrals.

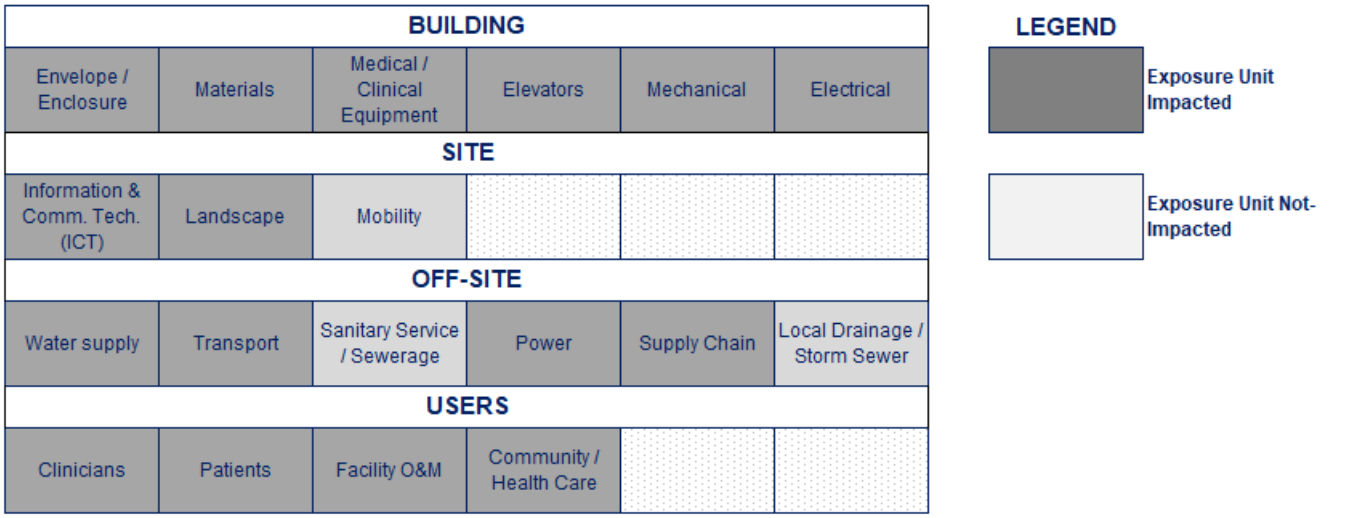

Figure 11 - Impact Assessment - Extreme Heat

3.3.3 Vulnerability

Based on the effort to adapt (adaptive capacity) and sensitivity to each impact, the vulnerability ratings for each exposure unit were reviewed and adjusted with stakeholder input, with medical equipment, mechanical and electrical systems, and power supply rated as highly vulnerable to the impacts of extreme heat.

Landscape elements and building materials were assessed as having a low vulnerability to extreme heat in part due to their low effort to adapt; there is time to respond to a changing climate through modifications to maintenance procedures (e.g. additional irrigation) and replacement of relevant components during the lifespan of the healthcare facility. All exposure units under the category of *users* were assessed as having a medium vulnerability. The users have time to adapt to a changing climate (medium effort to adapt), with the potential for management policies to be updated and temporary solutions developed (including regionally).

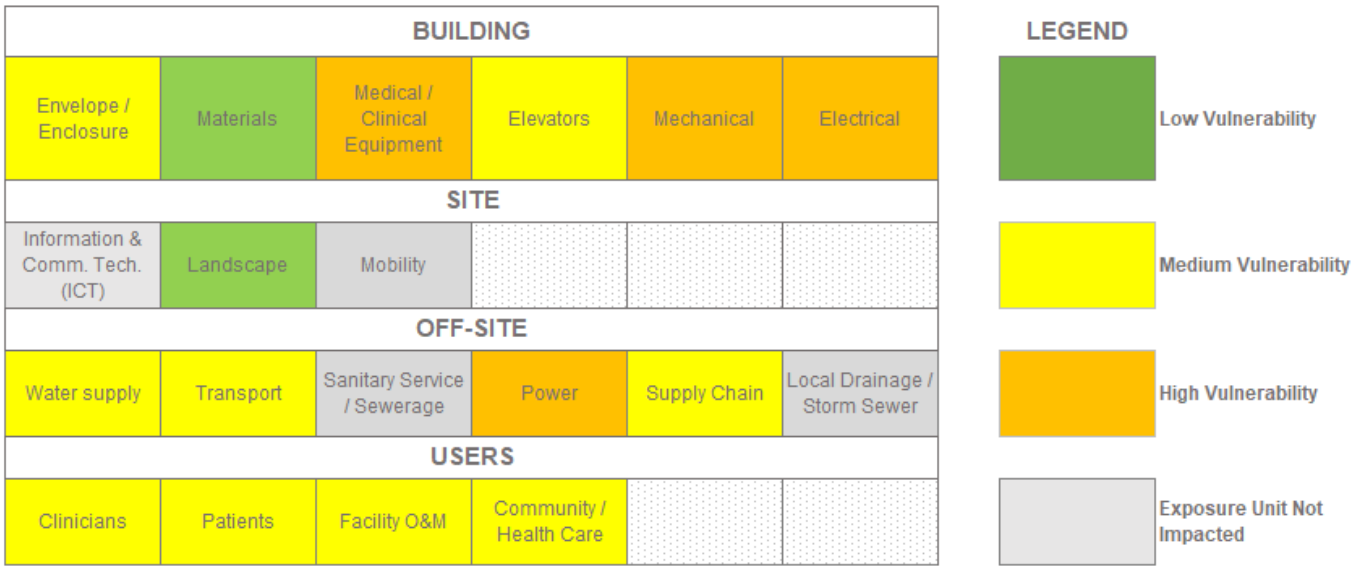

Figure 12 - Vulnerability Assessment - Extreme Heat

3.3.4 Risk

Probability

The probability of an extreme heat event as defined in the stress test scenario is projected to increase from a rating of *likely (4)* for the current period of the 2020s to *almost certain (5)* for the 2050s and 2080s.

Consequence

Building – The failure of mechanical and electrical systems could have moderate to catastrophic consequences including those on the psychological health of users, significant consequences on disease spread, the potential for loss of life, reduced safety, loss of social cohesion, damaged public perceptions, and reduced health service delivery.

Site – As no site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Off-site – The main consequences of potential loss of power are health service delivery, business continuity, safety and disease.

Users – As no user impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Risk Score

The changing risk profile of this hazard is such that from the current time period of the 2020s through to the 2080s, the exposure unit at greatest increasing risk is that of the medical and clinical equipment, with mechanical and power supply disruptions or failure also becoming a higher risk.

	Medical / Clinical Equipment	Mechanical	Electrical	Power
2020	High	Medium High	Medium	Medium High
2050	Very High	High	Medium High	High
2080	Very High	High	Medium High	High

Figure 13 - Risk Assessment - Extreme Heat

3.4 Gradual Warming

3.4.1 Hazard

Gradual temperature increases were examined as part of a hot and dry summer (August 2053) stress test scenario. The annual average temperature has increased gradually over the past 35 years, and is now 2.9°C higher, whilst the warmest day in summertime is now 3.9°C warmer. The temperature has not gone below -10°C since 2040.

Regional impacts include water shortages with Level 4 water restrictions (i.e. outdoor watering prohibited, 50L personal use /day) with wildfires significantly larger and more extensive than in the past. The wildfire season has expanded to start both earlier in the spring and last later into the fall.

3.4.2 Impacts

Building – Prolonged periods of high temperatures can result in having to shut down medical and imaging equipment and increasing the risk of medical equipment malfunctioning. Decreased service life of building components and accelerated deterioration of the façade through UV exposure. Gradual warming events could impact the reliability and accuracy of lab results as equipment rooms overheat. Gradual warming could result in the building mechanical HVAC systems running at for longer periods year-round resulting in additional wear and tear on the equipment and increasing the likelihood of mechanical failure and maintenance works. This could also result in premature failure of electrical systems.

Site – Vegetation may brown and die, leading to increased irrigation costs and/or replacement.

Off-site – At a regional level water supply may become compromised with extended warm periods impacting snow melt into reservoirs. This may also pose problems to power supply.

Users – Increased operating costs and the need for portable cooling devices which create noise and discomfort for some. Decreased productivity due to poor circulation of fresh air. Certain groups of patients require additional attention and support with exacerbated existing health conditions. Given the location of the proposed hospital and the specific needs of the surrounding Downtown Eastside communities, high temperature events will present additional pressures on the hospital from increased admissions and referrals.

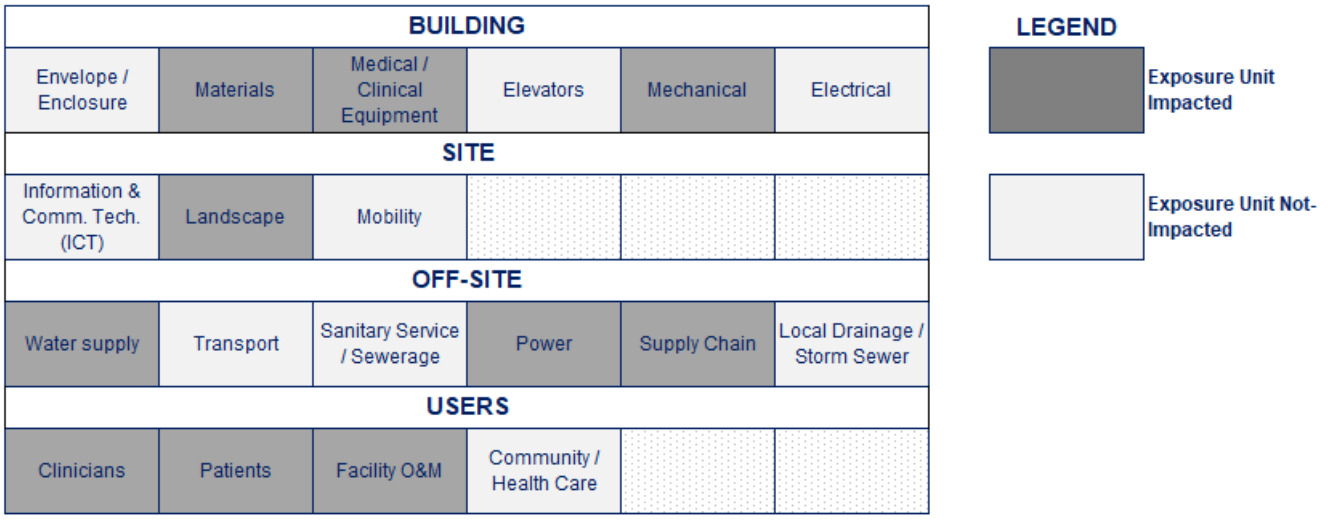

Figure 14 - Impact Assessment - Gradual Warming

3.4.3 Vulnerability

Based on the effort to adapt (adaptive capacity) and sensitivity to each impact, the vulnerability ratings for each exposure unit were reviewed and adjusted with stakeholder input, with medical equipment and mechanical systems rated as highly vulnerable to the impacts of gradual warming.

Landscape elements were assessed as having a medium vulnerability to drought in part due to their medium effort to adapt; there is time to respond to a changing climate through modifications to maintenance plans (e.g. increased irrigation) and replacement of relevant plant material during the lifespan of the healthcare facility.

Similarly, the effects of UV exposure and building material degradation are gradual, allowing for updates to maintenance procedures, replacement options, and thus have a medium effort to adapt resulting in a low vulnerability to gradual warming.

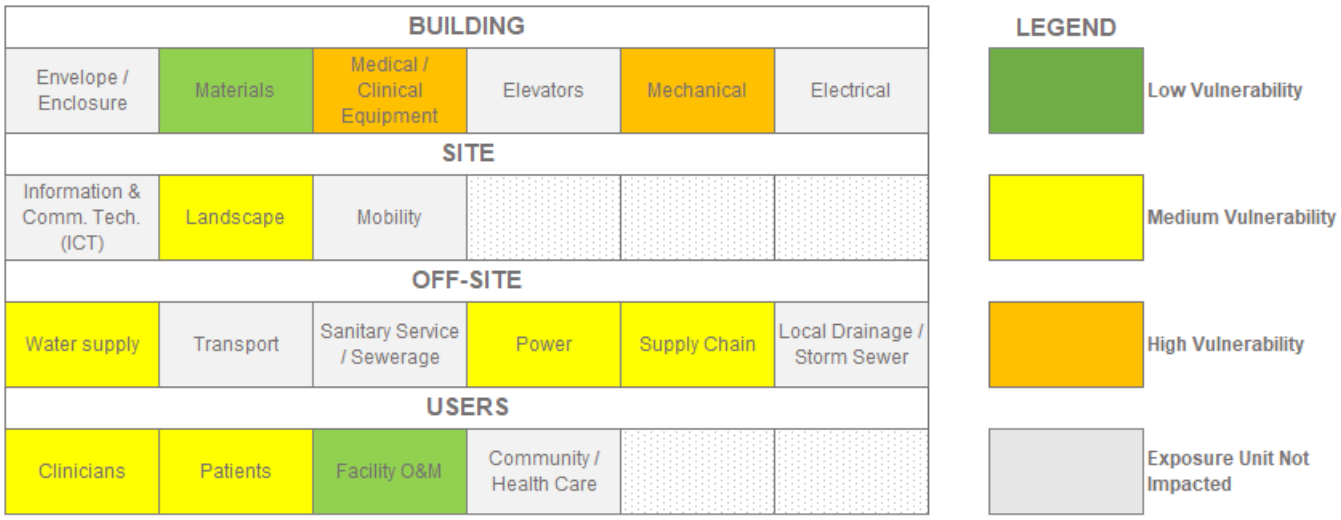

Figure 15 - Vulnerability Assessment - Gradual Warming

3.4.4 Risk

Probability

The probability of a rainfall event as defined in the stress test scenario is projected to increase from a rating of *possible (3)* for the current period of the 2020s to *likely (4)* for the 2050s, and *almost certain (5)* for the 2080s.

Consequence

Building – Damage to mechanical and medical systems were assessed as being of greatest consequence to business continuity, health service delivery, user safety and monetary loss. There were minor to moderate consequences across psychological impacts, disease, hospital asset loss and public media relations as well as loss of social cohesion.

Site – As no site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Off-site – As no off-site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Users – As no user impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Risk Score

The changing risk profile of this hazard is such that from the current time period through to the 2080s, the exposure unit at greatest risk is that of the mechanical systems.

	Medical Equipment	Mechanical
2020	Low	Medium Low
2050	Low	Medium Low
2080	Medium Low	High

Figure 16 - Risk Assessment – Gradual Warming

3.5 Drought

3.5.1 Hazard

A drought was examined as part of hot and dry summer event. This included tropical nights, three years of hot and dry conditions, gradual warming over 35 years and three weeks of daytime temperatures over 30°C.

Regional impacts included Level 4 water restrictions (no outdoor watering), wildfires (>12 small to mid-sized fires) and increases in hospital visits for heat stress.

3.5.2 Impacts

Building – Water restrictions may limit available supplies for sanitation and sterilization of medical supplies/equipment. Cooling towers and boilers may be affected by water shortages.

Site – Water shortages could lead to landscape vegetation loss, and with extended drought the soils may not absorb any flash flood or rainfall events leading to flooding following summer storms.

Off-site – Water restrictions or supply shortages pose the great impact to landscaping, the provision of adequate drinking water and if a drought was extended may extend to potentially impact power supply.

Users – Drought was assumed to have minimal impact on the building users, though there may be impacts to landscaping irrigation operations for O&M staff. There were concerns for water quality and quantity for clinicians and health service delivery, for example with bathing, dialysis and sterilization.

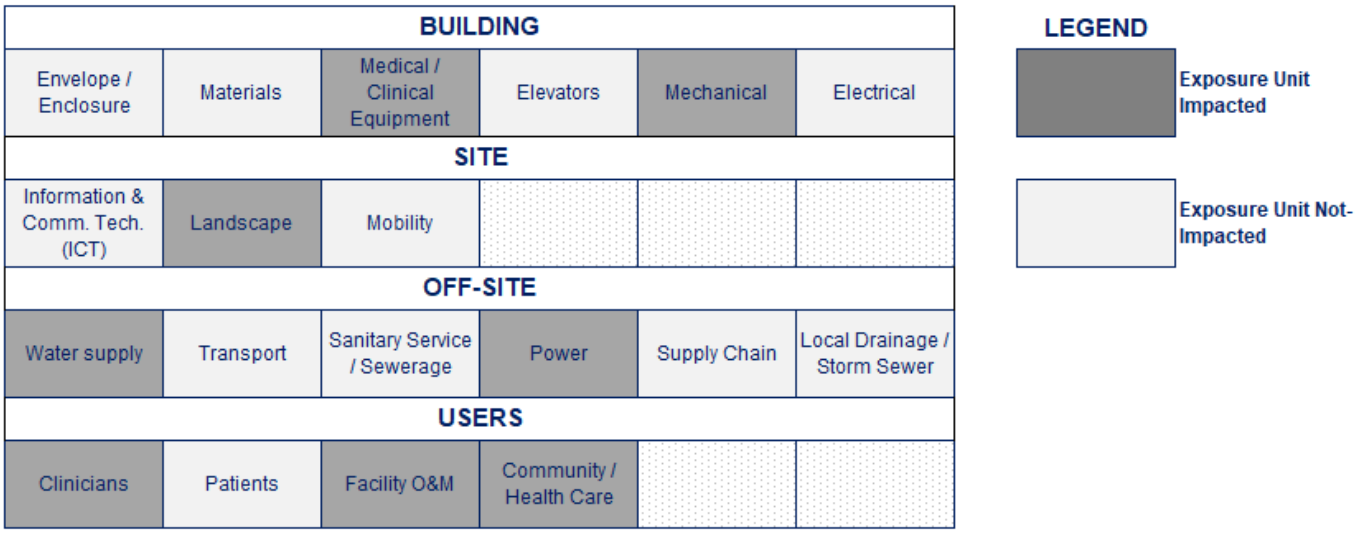

Figure 17 - Impact Assessment - Drought

3.5.3 Vulnerability

No *exposure unit* had impacts rated as high vulnerability, based on the sensitivity and existing adaptive capacity ratings assigned.

Landscape elements were assessed as having a medium vulnerability to drought in part due to their medium effort to adapt; there is time to respond to a changing climate through modifications to maintenance plans and replacement of relevant plant material during the lifespan of the healthcare facility.

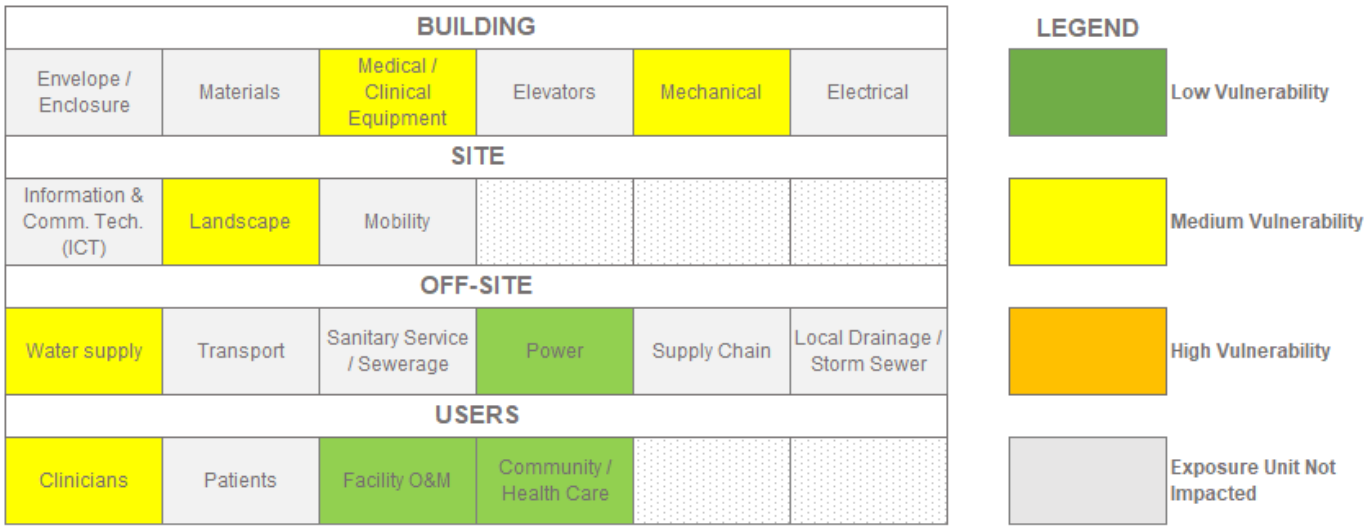

Figure 18 - Vulnerability Rating – Drought

3.5.4 Risk

As there were no exposure units rated as highly vulnerable, none were taken forward for consequence scoring and the risk assessment.

3.6 Poor Air Quality

3.6.1 Hazard

Poor air quality was examined in the context of a hot and dry summer (August 2053) stress test scenario.

Wildfires: Forest fires are significantly larger and more extensive than in the past. The wildfire season has expanded to start both earlier in the spring and last later into the fall. There are currently over a dozen small to mid-sized fires burning in the region – current conditions threaten to exacerbate this.

High concentrations of fine particulate matter due to wildfire smoke from fires burning throughout the Pacific Northwest triggered an air quality alert issued by Metro Vancouver that has lasted for 2.5 weeks. The Smoky Skies Bulletin indicates that wildfire smoke will continue to affect regional air quality for the next 48 hours.

The Air Quality Health Index has been above level 10 - Very High Health Risk - for two weeks.

From a community perspective there is an increase in visits for heat stress, respiratory and cardiovascular illnesses, schizophrenia, mood disorders and neurotic disorders, particularly from vulnerable populations.

3.6.2 Impacts

Building – Mechanical equipment may require increased maintenance; increased contaminants may infiltrate systems and decrease ability to provide adequate indoor environmental quality. Changes in HVAC systems or filters may be necessary. The efficiency of generators may be reduced.

Site – There were no impacts provided or generated by stakeholders for vulnerability assessment at the site scale.

Off-site – Related impacts from poor air quality as a result of forest fires may include disruption to water supply and transportation systems.

Users – Decreased work performance, potential for higher number of staff absences, decreased ability to discharge patients with respiratory issues or those requiring oxygen. Additional increased emergency admissions and a community surge for vulnerable populations seeking care. For O&M staff this could include increased efforts replacing filters as well as associated material costs. The surrounding community and Downtown Eastside residents are particularly vulnerable to deteriorating air quality and this could increase the number of patients and referrals the hospital receives during this type of event.

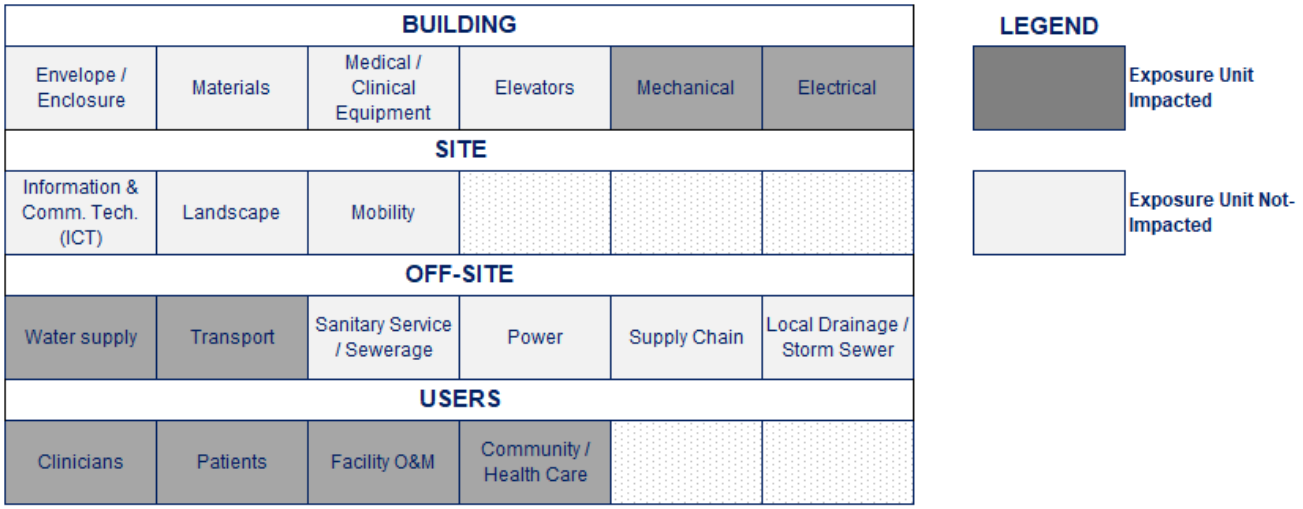

Figure 19 - Impact Assessment – Poor Air Quality

3.6.3 Vulnerability

Based on the effort to adapt (adaptive capacity) and sensitivity to each impact, the vulnerability ratings for each exposure unit were reviewed and adjusted with stakeholder input, with facility O&M staff and mechanical systems rated as highly vulnerable to the impacts of poor air quality.

Clinicians, patients and the community were assessed as having a medium vulnerability to poor air quality events due to their ability to adapt over time with updates to management policies, as well as regional efforts and the potential for temporary solutions (medium effort to adapt, with no changes required to building design).

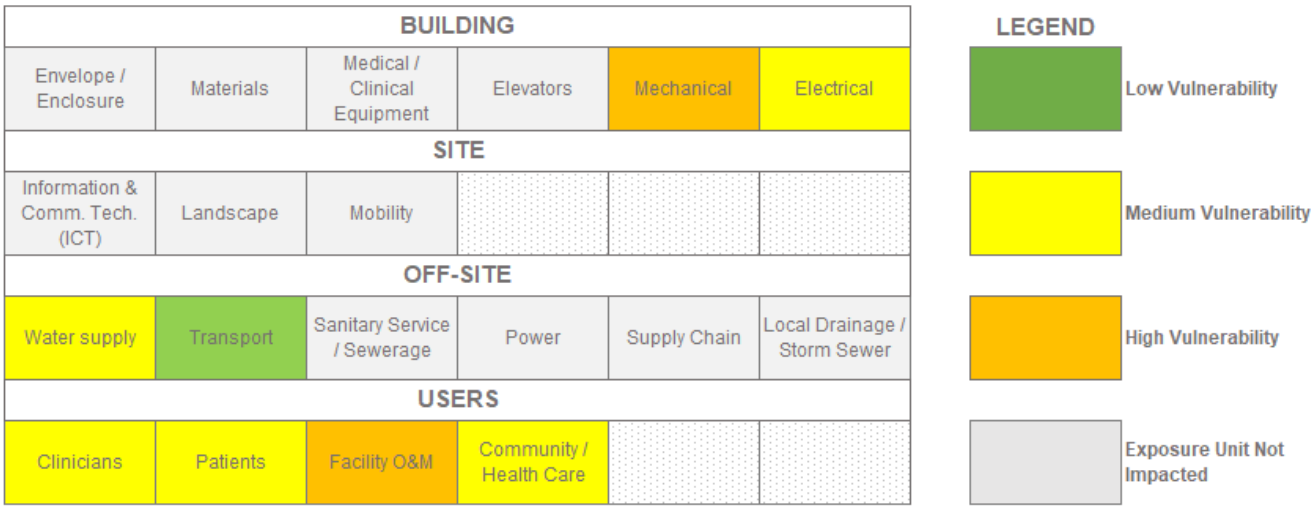

Figure 20 - Vulnerability Assessment - Poor Air Quality

3.6.4 Risk

Probability

The probability of a poor air quality event as defined in the stress test scenario is projected to increase from a rating of *possible (3)* for the current period of the 2020s to *likely (4)* for the 2050s and 2080s.

Consequence

Building – Damage to mechanical systems were assessed as being of minor to moderate consequence to business continuity and health service delivery.

Site – As no site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Off-site – As no off-site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Users – A poor air quality event and its associated impacts may have minor to moderate consequences for psychological impacts to staff, reductions in safety, social cohesion, media attention and business continuity.

Risk Score

The risk profile for poor air quality changes only slightly from a very low to a low score from current day 2020s through to the 2080s.

	Facility O&M	Mechanical
2020	Very Low	Very Low
2050	Low	Very Low
2080	Low	Very Low

Figure 21 - Risk Assessment - Poor Air Quality

3.7 Winter Storm

3.7.1 Hazard

Winter storms were examined as part of a large winter storm surge (December 2053) stress test scenario. This included heavy rainfall, a king tide, the inundation of coastal infrastructure and localized flooding. Floodwater is at 4.8m. Urban flooding is exacerbated by debris blocking the municipality's drainage system. High winds have knocked down power transmission lines, causing outages throughout the city. Examined as part of this though not explicitly listed in the stress test scenario were severe ice/snow events such as winter storms.

Regional impacts include critical infrastructure being underwater, with sewage leaking into the environment. Multiple landslides have occurred on steeper slopes, and water quality is reduced. Strong gusts (more than 130km/hr) associated with the storm have spread debris and knocked down power lines all over the city.

3.7.2 Impacts

Building – Decreased service life of components including fenestration and roof membrane, air intakes and exhausts requiring cleaning/inspection.

Site – Damage to landscaping and reduced mobility of goods and people on site.

Off-site – Transportation disruptions resulting in delays to supplies delivery. Damage to utilities and roads, including power interruptions and access issues.

Users – Increases in staff absenteeism, access issues, increased snow removal/cleaning/repair costs, increased slip and falls, rescheduling of appointments and surgeries.

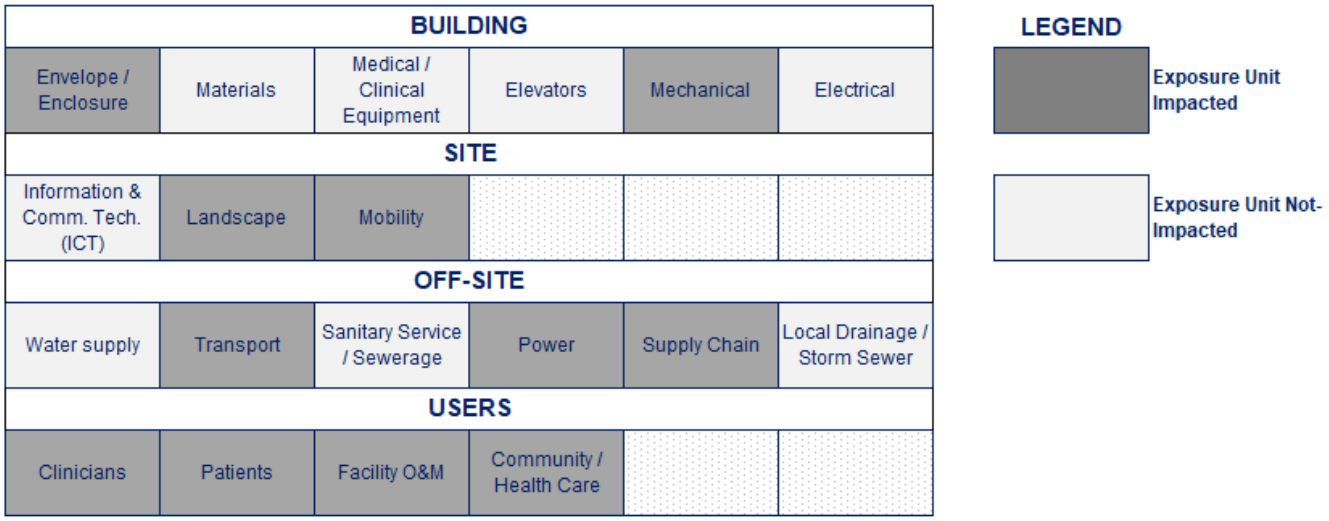

Figure 22 - Impact Assessment – Winter Storm

3.7.3 Vulnerability

Based on the effort to adapt (adaptive capacity) and sensitivity to each impact, the vulnerability ratings for each exposure unit were reviewed and adjusted with stakeholder input, with clinicians, facility O&M staff, community care and power rated as highly vulnerable to the impacts of a winter storm.

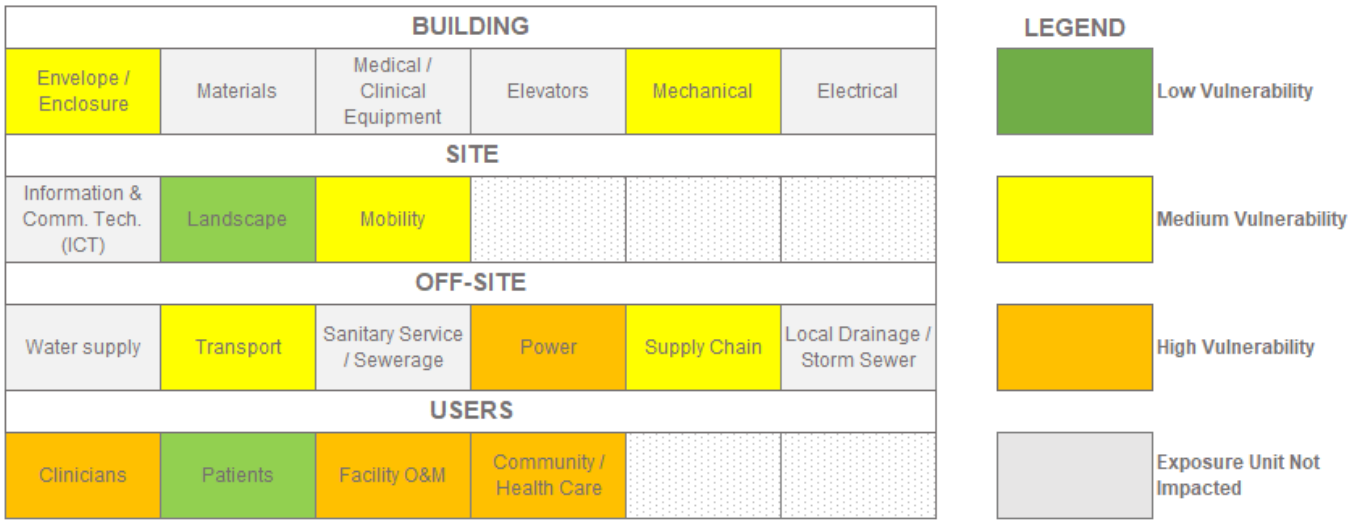

Figure 23 - Vulnerability Assessment - Winter Storm

3.7.4 Risk

Probability

Climate projections for winter storms depict a decrease in severity and/or frequency from *possible (3)* during the current 2020s to *unlikely (2)* for the 2050s and 2080s.

Consequence

Building – As no building impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Site – As no site impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Off-site – The loss of power was assessed as having moderate consequences to business continuity and psychological impacts on users.

Users – Based on the impacts outlined above, the consequences of a winter storm event include psychological impacts, increased morbidity and injury, safety implications, disruptions to health service delivery and business continuity and damage to hospital assets.

Risk Score

The risk profile of a winter storm event changes only very slightly and remains low from current day 2020s through to the 2080s.

	Clinicians	Facility O&M	Community / Healthcare	Power
2020	Very Low	Low	Low	Very Low
2050	Very Low	Low	Very Low	Very Low
2080	Very Low	Low	Very Low	Very Low

Figure 24 - Risk Assessment - Winter Storm

3.8 Extreme Wind

3.8.1 Hazard

An extreme wind event was examined in the context of a hot and dry summer period, bringing gusts of extreme wind measuring in at 110km/h (20% percent larger than in the past three year average). An extreme wind event had impacts upon 18 of 19 exposure units.

Regional impacts included power lines down across the region, and many roads and public transit services are closed due to downed trees and power lines. Ferries and airports are closed for 24 hours.

A critical mass of integrated services in the hospital's primary care and community health network have lost connectivity to the electrical grid for over 72 hours, resulting in the need to relocate patients including to the hospital as shelter-in-place is longer an option due to shortage of supplies on-site and disrupted local supply chains. Trees that were weakened due to prolonged hot and dry conditions over the past three years result in more toppled trees, and related injuries, than experienced in the past.

3.8.2 Impacts

Building – High winds could accelerate the degradation of the building envelope and roof structure resulting in water ingress during rainfall event and potential damage to service rooms and mechanical equipment. Damage may occur to mechanical intake and exhaust systems, as well as electrical supply.

Site – High winds in and around the site could impact local landscaping and result in tree collapse, vegetation damage. Additional impacts could be to local ICT infrastructure and communication networks.

Off-site – Within the regional context, high winds could result in a drop in municipal water pressure, acceleration of forest fires, disruption to public transport networks (light rail) and emergency vehicles (helicopters) and impacts on the availability of local supply chains. Regional wide power outages could result in increased patient numbers as residents are no longer able to meet there heating, cooling and healthcare needs at home. Fallen branches and debris may block drainage and result in flooding.

Users – High wind events could result in a temporary loss of mains power and a higher dependency on backup generators. This disruption in mains power could result in delays to scheduled procedures (medical imaging), transportation of patients within the hospital, interruptions to equipment operations, loss of phone and IT communication and delays to discharging patients. Additional impacts could be increased visits to hospital from wind related injuries' (slips, trips, falls and falling debris).

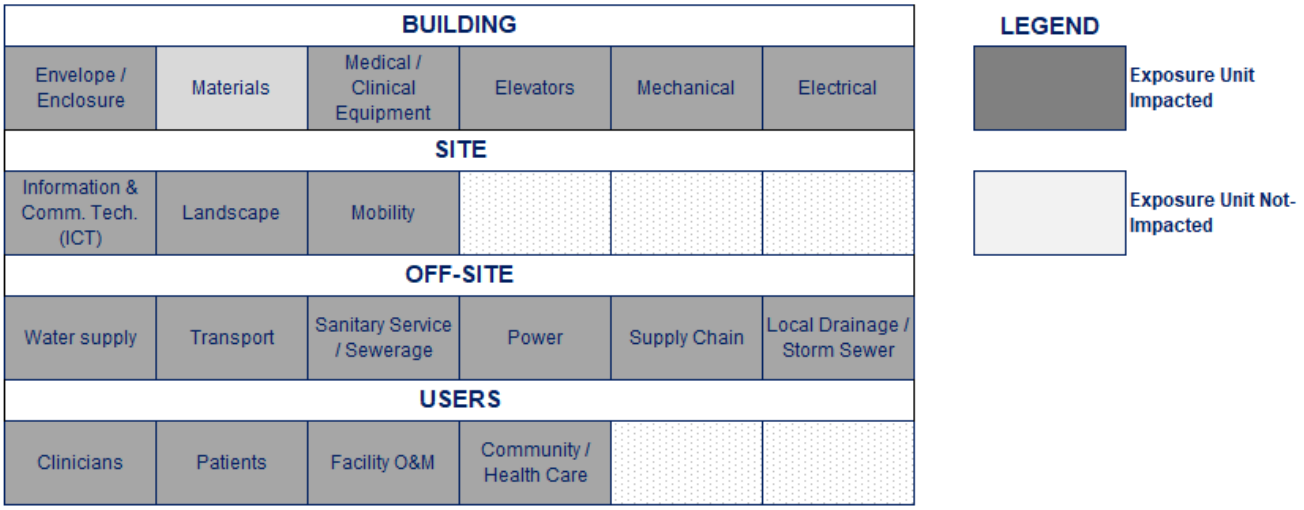

Figure 25 - Impact Assessment - Extreme Wind

3.8.3 Vulnerability

Based on the effort to adapt (adaptive capacity) and sensitivity to each impact, the vulnerability ratings were determined with patients, facilities O&M, community care, envelope/enclosure, transportation, power and supply chain rated as highly vulnerable to the impacts of an extreme wind event.

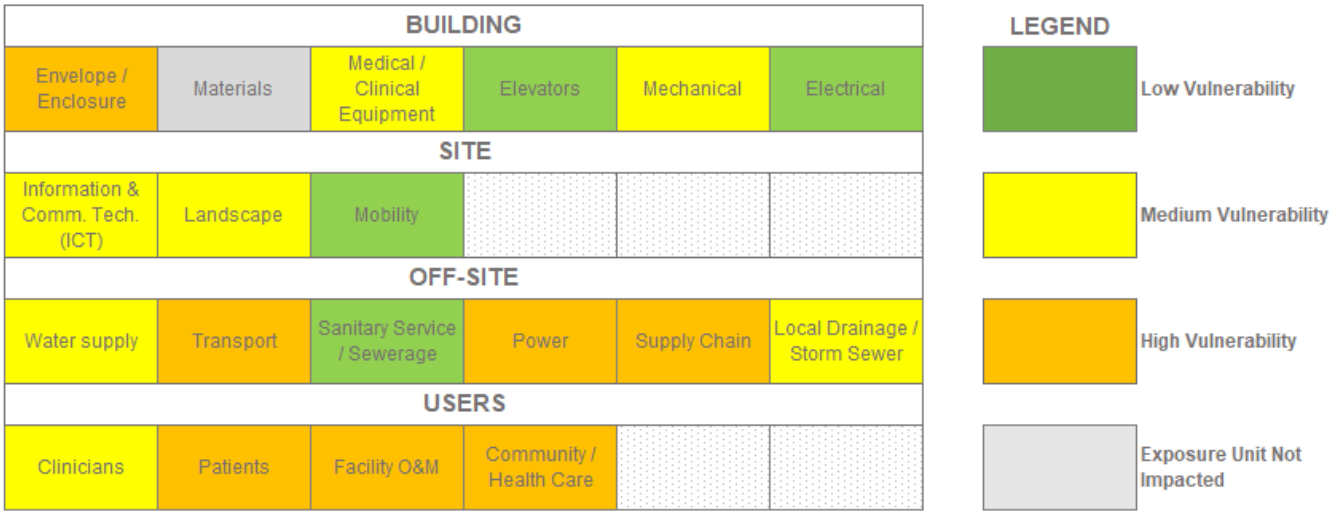

Figure 26 - Vulnerability Rating – Extreme Wind

3.8.4 Risk

Probability

The probability of an extreme wind event as outlined in the stress test scenario maintains a consistent probability of *likely (4)* from the current period of the 2020s through to the 2080s. Note: wind events are more difficult to model and thus projections for wind are less well understood.

Consequence

Building – Damage to the building envelope was assessed as being of moderate consequence to health service delivery, business continuity and monetary loss.

Site – As no site level impacts were rated with a high vulnerability, none were taken through for consequence scoring and risk assessment.

Off-site – The potential loss of power was understood to have major to catastrophic consequences for the hospital, including injuries and morbidity, safety, media attention, health service delivery, business continuity and monetary loss. Interruptions to the supply chain similarly have consequences such as morbidity, injury and disruption to health service delivery.

Users – The consequences of power outages increases demands on O&M staff and could result in psychological impacts, reduced safety and disruptions to health service delivery including community care.

Risk Score

Due to the stable probability rating of an extreme wind event into the 2080s, the risk profile of this hazard remains stable also. The loss of power remains the highest risk.

	Patients	Facility O&M	Community / Healthcare	Envelope / Enclosure	Transportation	Power	Supply Chain
2020	Very Low	Low	Low	Medium Low	Low	Medium High	Medium Low
2050	Very Low	Low	Low	Medium Low	Low	Medium High	Medium Low
2080	Very Low	Low	Low	Medium Low	Low	Medium High	Medium Low

Figure 27 - Risk Assessment - Extreme Wind

4 ADAPTATION ACTIONS AND RISK MITIGATION MEASURES

4.1 Risk Response Strategies Overview

This section highlights the response measures taken to reduce potential future risk. It is structured according to exposure category; that is the *building, site, off-site*, and *user* scales. While risk response measures are defined for all risks, the emphasis is on risk scores higher than 131 or those in the risk category of *medium-high* or higher (see below, orange box).

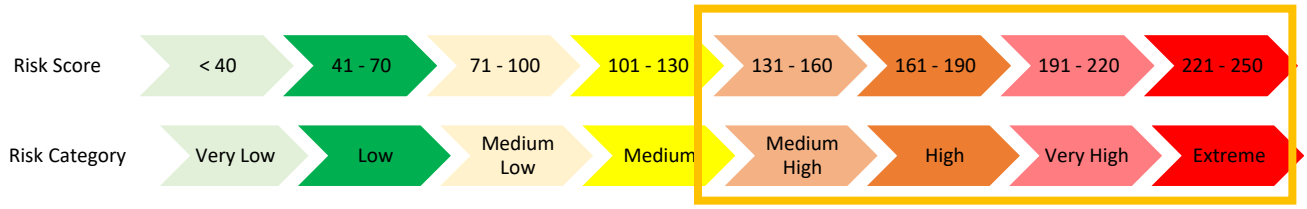

Figure 28 - Risk Spectrum

As discussed in Section 2.8 under Risk Threshold, not all risk response measures require the same level of treatment and effort. Per the ICLEI BARC methodology, response strategies are defined for:

- Design adaptation;
- Management; and
- Monitoring.

This corresponds to actions and measures that are, to some extent, within reasonable control of the facility design team and Providence Health, in addition to those actions and measures that rely on regional or third-party entities for collaboration.

Adaptation measures are prioritized given that each measure can function to break a chain of **cascading impacts**. For instance, by responding to a high risk impact that is within the control of the design team or building operator, further cascading (downstream) impacts on building users or third-party entities can be reduced or eliminated. An example of this is the impact of a heat wave. The primary impact is that HVAC systems have insufficient cooling capacity for extreme heat events (*exposure category: building*). The secondary impact is that patients and staff may become uncomfortable and health complications may increase (*exposure category: user*). The risk response is to therefore to design the building with additional cooling capacity and redundancy measures. Additional measures may be taken at the operational level of the users to respond to the risk, however the priority during planning and design is to mitigate risk as early as possible in the impact chain.

As such the following response sections are structured in that order, from exposure categories within the control of the building design team, to those beyond the control of designers: *building, site, off-site*, and *users*.

The following table identifies all risk response measures incorporated as part of the building design and operational strategies. This list is to be referred to and used in conjunction with the risk matrix for each exposure category and exposure unit in the following subsections. **Bold** text aligns the risk event with its associated risk response measure (design adaptation, management or monitoring).

Table 11 - List of Risk Response Strategies (Adaptation, Management, and Monitoring)

Design adaptation (DA)	
1	Mechanical systems are designed with increased capacity and redundancy (N+1) to respond to increased cooling loads.
2	Durable building envelope designed for service life >50yrs, with rainscreen details.
3	Building has redundant capacity for power generation. Electrical systems feature N+1 redundancy, in addition to re-route options (bypasses) for power supply.
4	Sanitary Sewer system features a 50,000 gallon storage tank with pump-out connections for the event of a municipal sewer failure.
5	Water entry features redundant backflow prevention.
6	Major systems, critical departments and equipment are located above the flood construction level.
7	Anti-bacterial interior finishes to inhibit mould growth.
8	Site is accessible via bicycle routes and multiple entry points for emergency vehicles.
9	Extensive biking facilities.
10	Increased tree canopy.
11	Mobile Medical Unit Hookups and Parking Location.
12	Permeable paving.
13	Operationally critical elevators will be provided with redundancy by multiple elevators in one group.
14	All elevators will be able to operate on emergency power.
15	Stormwater management - reuse of water from roof and into process water tank.
Management (MNG)	
1	Building features on-site generators with 72hr fuel supply and ability to connect to portable hook-ups for temporary power provision.
2	Multiple generators configured so a unit failure or being in maintenance does not affect power delivery to critical loads or areas.
3	Fully redundant generator master control systems (MGCS) will be provided. The master control systems will be designed to have no single point-of-failure.
4	Gradual upgrades and updates to equipment based on heat sensitivity allows for adaptation.
5	HEPA filtration.
6	Mass Disaster Preparation at Emergency Department ambulance garage and immediate surrounding site.
7	Adjacent to large park and civic plaza for crowd control.
8	Emergency Operations Centre for command and control functionality during emergency.
Monitoring (MON)	
1	Regional / Third-party issue.

4.2 Response: Building

The measures and responses outlined below intend to mitigate risk at the building scale, in order to break the potential chain of cascading impacts with specific concern for the building users.

4.2.1 Overview

The table below summarizes the risk scores for all building category exposure units. The following exposure units were assessed a medium-high to extreme risk: (list them). Corresponding emergency response strategies are defined.

Table 12 - Risk Matrix for 2020s, 2050s, 2080s with corresponding risk response strategies - Building

		Coastal flood			Rainfall			Extreme Heat			Increasing Temperature		
		2020	2050	2080	2020	2050	2080	2020	2050	2080	2020	2050	2080
Building	Envelope / Enclosure	DA 2 →			DA 2 →								
	Materials	DA 7 →											
	Medical / Clinical Equipment							DA 1, DA 3	MNG 1, MNG 2 →		DA 1, DA 3	MNG 1, MNG 2 →	
	Elevators	DA 13, DA 14											
	Mechanical				DA 1 →			DA 1	→		DA 1 →		
	Electrical	DA 3, DA 6 →			DA 3, DA 6 →			DA 3	MNG 1, MNG 2 →				
		Poor AQ			Extreme Weather			Extreme Wind					
	Envelope / Enclosure							DA 2 →					
	Materials												
	Medical / Clinical Equipment												
	Elevators												
	Mechanical	MNG 5 →											
	Electrical												

4.2.2 Envelope

Over the short term the hospital's building envelope and enclosure is at a very-low risk to **coastal flooding** and **rainfall** and medium-low risk to extreme wind which could lead to consequences for the structural integrity of the building and its internal infrastructure. This could have cascading impacts on the building users and could compromise their comfort, safety and productivity.

Risks to the building's envelope will be mitigated through design adaptation 2 – DA 2.

4.2.3 Materials

One of the consequences of **coastal flooding** on building users were identified as increasing risks of waterborne disease vectors for facilities management team and potential corresponding psychological impacts on clinicians and patients.

The risks associated with flooding would be mitigated through design adaptation 7 – DA 7.

4.2.4 Medical and Clinical Equipment

Over the short term, medical and clinical equipment is at a high risk to **extreme heat** potentially leading to consequences for the comfort, safety and productivity of the building's users. This level of risk will increase to very high over the short to medium term as extreme heat events increase in frequency and severity and could result in delays and inaccuracies in lab results due to loss of refrigeration, postponement of scheduled treatments and surgeries and increased demand on hospital supplies**.**

The medial and clinical equipment at the hospital relies on the continuous and effective running of the buildings mechanical and electrical equipment. The short and long term risks to clinical equipment will therefore be mitigated through the same design adaptation and management measures detailed in – DA 1, DA 3, MNG 1 and MNG 2.

4.2.5 Elevators

The effective and continuous mobility and transport of patients around the hospital is vital to healthcare services. The building elevators will be reliant on the continuous operation of the buildings electrical and mechanical systems (as mitigated through DA 1 and DA 3). Additional mitigation measures which will ensure elevators are able to continue to operate during extreme climate events will be through design adaptation measures detailed in - **DA 13** and **DA 14**.

4.2.6 Mechanical

Over the short term the mechanical equipment is at a medium high risk to **extreme heat** which could lead to consequences for the medical and clinical equipment in the building and the comfort, safety and productivity of the building's users. This level of risk will increase to high over the short to medium term as extreme heat events increase in frequency and severity and could result in HVAC equipment operating at maximum stress for extended levels of time, increased wear and tear on HVAC systems and potential overloading of the HVAC system.

The risk to the mechanical systems from extreme heat will be mitigated through – DA 1.

Over the medium term the mechanical equipment is at a medium low risk to **gradual warming,** this risk level would increase to high over the medium to long term. This could result in impacts on the capacity, efficiency and lifespan of the buildings HVAC equipment as outlined above.

The risk to the mechanical systems from intense and frequent rainfall will be mitigated through – DA 1.

Over the medium term the mechanical equipment is at a medium risk to **intense and frequent rain** events which could lead to consequences for the medical and clinical equipment in the building and the comfort, safety and productivity of the building's users. This level of risk will increase to medium high over the medium to long term as rainfall is predicted to increase and could result in damage to HVAC equipment through localised flooding.

The risk to the mechanical systems in the building will be mitigated through – DA 1 and DA 6.

The risk to the buildings mechanical systems from deteriorating air quality, as a results of increasing forest fires, is assessed to be very low over the short term.

The risks associated with deteriorating air quality will be mitigated through – MNG 5.

4.2.7 Electrical

Over the short term the electrical equipment is at a medium risk to **extreme heat** which could lead to consequences for the medical and clinical equipment in the building and the comfort, safety and productivity of the building's users. This level of risk will increase to medium-high over the short to medium term as extreme heat events increase in frequency and severity and could result in both regional and site wide impacts to energy distribution and the increasing frequency and duration of blackouts.

The short-term risks to the electrical systems from extreme heat will be mitigated through – DA 1 and DA 3.

The medium-term risk to the electrical systems from extreme heat will be mitigated through management measures – MNG 1 and MNG 2.

4.3 Response: Site

4.3.1 Overview

Table 13 - Risk Matrix for 2020s, 2050s, 2080s with corresponding risk response strategies - Site

		Coastal flood			Rainfall			Extreme Heat			Increasing Temperature		
		2020	2050	2080	2020	2050	2080	2020	2050	2080	2020	2050	2080
On-site	Information & Comm.												
	Landscape				DA 12 →			DA 10 →			DA 10 →		
	Mobility	DA 8, DA 9											
	Information & Comm. Tech. (ICT)												
	Landscape												
	Mobility												

During the assessment no on-site user groups were found to be highly vulnerable to the impacts of climate change and as such have not been carried through to the risk and adaptation assessment.

Design mitigation measures that will be included in the on-site design and will contribute to mitigating some of the impacts of climatic hazards include installing trees and tree canopy and adequate provision of public transport accessibility routes for emergency vehicles - **DA 8, DA 9, DA 10** and **DA 12**.

4.4 Response: Off-site

The response to off-site exposure units focuses on systems redundancy, communications, monitoring, and emergency response.

4.4.1 Overview

Table 14 - Risk Matrix for 2020s, 2050s, 2080s with corresponding risk response strategies – Off-Site

		Coastal flood			Rainfall			Extreme Heat			Increasing Temperature		
		2020	2050	2080	2020	2050	2080	2020	2050	2080	2020	2050	2080
Off-site	Water supply							DA 15 →			→		
	Transport	MON 1 →											
	Sanitary Service / Sewerage	DA 4, DA 5 →			DA 15 →								
	Power							MNG 3, MNG 4 →					
	Supply Chain												
	Local Drainage / Storm Sewer				DA 15 →			DA 15 →			→		
		Poor AQ			Extreme Weather			Extreme Wind					
	Water supply												
	Transport							DA 8 →					
	Sanitary Service / Sewerage												
	Power				MNG 3, MNG 4 →			MNG 3 →					
	Supply Chain							MNG 8 →					
	Local Drainage / Storm Sewer												

4.4.2 Water supply

During the assessment, the off-site water supply was not found to be highly vulnerable to the impacts of climate change and as such have not been carried through to the risk and adaptation assessment. Design mitigation measures which will be included in the design of the building to reduce the buildings reliance on external water supply and protect potable water includes – **DA 15 and DA 5**.

4.4.3 Transport

During the assessment, off-site transport was found to be at a very-low risk to the impacts of extreme wind. Design mitigation measures which will be included to increase the buildings resilience to interruptions in regional transport disruptions include – **DA 8**.

4.4.4 Sanitary services

Over the short term the regional sanitary and sewage system which services the site is at a very low risk to **coastal flooding**, this increased to medium high risk over the medium term and high risk over the long term. The regional wide impact of this sewage system inundation could include bacterial outbreaks and compromised sanitary condition and increased surface water flooding. These regional impacts could directly affect the hospital by reducing the ability for the building to discharge black water and increasing the costs for the facility to clean up after heavy rain events. Indirectly these regional events could increase the number of patients being admitted to the hospital through the increased prevalence of waterborne infections and illnesses.

The risk to the hospital building from localised inundation of sewage system will be mitigated through the medium term by design adaptation measures – DA 4 and DA 5.

4.4.5 Power

Over the short term the regional power supply to the site is at a medium high risk to **extreme heat** which could lead to consequences for the continuous operation of the buildings electrical and mechanical equipment and all related building systems (elevators, ITC, medical and clinical equipment). This level of risk will increase to high over the short- medium term as extreme heat events are predicted to increase in frequency and severity and could results in the duration of regional blackouts and disruptions to power supplies.

Over the short term the regional power supply to the site is at a medium high risk to high wind events. These events could disrupt regional power supplies brought about by potential power lines being blown down or impacted by falling trees and debris.

The risk to the hospital building from regional power supplies shortages and blackouts will be mitigated through onsite management as detailed in – MNG 1, MNG 2, MNG 3 and MNG 4.

4.5 Response: Users

After incorporating response measures at the building, site and off-site scale, some risk remains that affects users. This risk is treated and responded to through monitoring and management measures and includes emergency planning to utilize the site for post-disaster response. Where external users are impacted, including the broader healthcare community, this is also dealt with through regional response measures that are beyond the design of the facility (e.g. City-level strategies and policies).

4.5.1 Overview

Table 15 - Risk Matrix for 2020s, 2050s, 2080s with corresponding risk response strategies - Users

		Coastal flood			Rainfall			Extreme Heat			Increasing Temperature		
		2020	2050	2080	2020	2050	2080	2020	2050	2080	2020	2050	2080
Users	Clinicians	DA 8, DA9	MNG 1 →										
	Patients	DA 6, DA 7, DA 8	MNG 1 →										
	Facility O&M	MNG 2, MNG 3, MNG 4 →						MNG 4 →					
	Community / Health Care	MNG 6, MNG 7, MNG 8 →											
		Poor AQ			Extreme Weather			Extreme Wind					
	Clinicians				MON 1, DA 8 →								
	Patients							MON 1, DA 8, MNG 8 →					
	Facility O&M	MNG 4, MNG 5 →			MON 1, DA 8, MNG 8 →			MON 1, DA 8, MNG 8 →					
	Community / Health Care				MON 1, MNG 6, MNG 8 →			MON 1, MNG 6, MNG 8 →					

4.5.2 Clinicians

Over the short-term clinicians are at a very low risk to **coastal flooding**, this risk increases to medium-low risk over the medium to long term. These risks are primarily associated with the psychological impact incurred by potential losses and damages and impact on the ability for staff to access the site.

The main impacts to clinicians from coastal flooding events were related to the psychological impacts associated with stress and anxiety, as well as those related to business continuity and health service delivery. The risk associated with this could be partially mitigated through – MNG 1. The impact to regional transport networks from coastal flooding and extreme weather (winter storms) will be managed at a municipal level – MON 1. At a site level, the design of the building to incorporate alternative transport routes and entry points will help to mitigate any mobility issues for site users over the short to long term – DA 8 and DA 9.

4.5.3 Patients

Over the short-term patients are at a very low risk to **coastal flooding**, this risk increases to medium over the medium to long term. These risks are primarily associated with the psychological impact incurred by potential losses and damages, increased rate of waterborne disease vectors, delays to procedures and discharges and impact of local mobility.

The main impacts to patients from coastal flood events were related to the psychological impacts associated with stress and anxiety. The design adaptation measures incorporated into the building will help protect critical assets from water damage during extreme weather events and where damage does occur the

measures incorporated will help minimise its impacts, accelerate the site's recovery and ensure that healthcare delivery can continue – DA 6. The incorporation of DA 7 will further reduce the potential spread of waterborne disease vectors and any psychological impacts.

4.5.4 Facility O&M Staff

The operations and maintenance team are at a very low risk to **coastal flooding** in the short term, this risk level will increase to medium-high and high over the medium to long term. This increasing risk level is primarily due to the potential damages to the building and the necessary clean up after a flood event. Additional risks are presented by the potential for exposure to waterborne disease vectors during these clean-up efforts.

The main impacts to facility O&M staff from coastal flood events were related to the psychological impacts, as well as those related to business continuity and health service delivery. The design adaptation measures incorporated into the building will help protect critical assets from water damage during extreme weather events and where damage does occur the measures incorporated will help minimise its impacts, accelerate the site's recovery and ensure that healthcare delivery can continue. The provision of adequate onsite management provisions and procedures will help to mitigate some of the ongoing risk associated with the continuous operation of the site while experiencing hazardous weather events – MNG 4.

4.5.5 Community / Healthcare

The wider risks to the community and the delivery of community healthcare systems will be managed through regional and municipal monitoring schemes – **MON 1**. In addition, site wide emergency planning will increase the site's resilience and ensure the site is able to maintain business continuity in the event of an emergency event – **MNG 6, MNG 7 and MNG 8**. This may include temporary cooling shelters or other methods of protecting at-risk groups on the healthcare campus, making use of available outdoor plaza space on site.

REFERENCE MATERIAL

Pinna Sustainability, Site Level Climate Resilience Risk Assessment, July 2019

Metro Vancouver, Climate Projections for Metro Vancouver, 2016

City of Vancouver, Climate Adaptation Plan, 2012

ISO 31000 Risk Management, 2018

ISO 14091 Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment, 2020

New York City, NYC Climate Resiliency Design Guidelines V3.0, 2019

Lower Mainland Facilities Management, Moving Towards Climate Resilient Health Facilities for Vancouver Coastal Health, 2018

PIEVC Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate Principles & Guidelines, Engineers Canada, Revision PG-10, May 2012

Infrastructure Canada, Climate Lens General Guidance v1.1 June 1 2018

Canada's Climate Change Report - Environment and Climate Change Canada, 2019

APPENDIX A – HAZARD IMPACT STATEMENTS

Text Legend:

Black – Provided by the client and CoV review panel

Green – Additions from the PCL Design Team

Red – Additions from stakeholders during the Climate Hazards and Vulnerability Workshop

APPENDIX B – VULNERABILITY ASSESSED IMPACT STATEMENTS

APPENDIX C – CONSEQUENCE SCORING

APPENDIX D – CLIMATE DATA

APPENDIX E – RISK SUMMARY TABLE

APPENDIX F – WORKSHOP PRESENTATION SLIDES

Buiding	Coastal Flood	Intense & Frequent Rainfall	Extreme Heat	Increasing temperature	Drought	Poor Air Quality (PM 2.5 alert)	Extreme Weather (e.g. Winter Storms - snow, ice)	Extreme Wind
Envelope / Enclosure	Ground floor flooding may increase infection and mold risk at the facility Increased damage to structures and landscapes from storm surge, flooding and saltwater intrusion increase in risk to foundation and / or slabs due to sub-surface erosion	flooding of roof membrane Water ingress into basement causing damage to equipment. As seepage is a result of the water table, it is hard to push the water out Mud in the basement rises over time, closer to pipes a lot of maintenance to building glazing increase in risk to foundation and / or slabs due to sub-surface erosion Increased rain intensities may result in more water being driven into building façade assemblies, potentially causing mold increase in risk to foundation and / or slabs due to sub-surface erosion	overheating causes operation mechanism of sliding glass doors to seize decrease service life of building components (e.g. fenestration)				decrease service life of fenestration decrease service life of roof membrane decrease service life of concrete structures, steel frames, wood	create higher loads on the building envelope which could lead to early degradation of the envelope and potentially create hazards from flying objects - also safety of people on upper patios is a concern water ingress into the builidng through fenestration (e.g. window wall, sliding doors, skylights) reduce effectiveness of roof membrane against water ingress increase need for building structure stability Roof damage - most likely building is leaking taking rooms out of service
Materials	increase infection and mold risk Corrosion risk due to salt water intrusion	flooding may increase infection and mold risk	compromise integrity, reduce functionality and shorten lifespan Increased UV exposure may result in deterioration of flexible elements (such as sealants), requiring a change in the products used, or existing replacement cycles will need to be shortened.	Increased UV exposure may result in deterioration of flexible elements (such as sealants), requiring a change in the products used, or existing replacement cycles will need to be shortened.				
Medical / Clinical Equipment	reduction in water quality, compromise in process water (e.g. sanitizers, sterilization) if water contaminated, depending on time if over 72 hours, vulnerability becomes higher potential increase in turbidity of the water supply		Lab results were lost/questionable due to higher temperature in Lab Equipment Room. Refrigeration failure in mortuary and laboratory led to loss of laboratory specimens and need to relocate bodies Over-stretched supplies, e.g. medical supplies; higher rate of usage in high temperatures (e.g. bed linens changed more frequently) Decreased efficacy of some medication in storage, as many manufactured medications are licensed for storage at 25°C or less. Medications shown to have decreased efficacy include cephalexin, ampicillin, erythromycin, furosemide, benzyl penicillin. municipal water supply temperature (sometimes used to cool MRIs when there is a cooling system failure) was over 20°C, resulting in the temporary shutdown of the MRI. Basis of any treatment is lab results, so if lab results are inaccurate, the treatment options would be limited, ineffective. When move into failure of equipment and limited supplies. Impacts a lot of staff and patients. Not localized (re: psychological). Consideration of how many patients affected by ineffective meds. Rated moderate re: loss of life, as patients that come in are already not healthy, so more vulnerable to additional issues. Comment: possibly more public forgiveness for the short term event than the gradual warming. Costs: need to redo lab results, replacement of medications.	cause some medical imaging equipment to shut down or malfunction increase risk of medical equipment mal-functionality Note: due to the gradual nature, may not need to be a high vulnerability if able to adapt in time.	water shortage for sterilization, sanitation			Medical Imaging equipment and rooms not appropriately connected to emergency generator power resulting in cancellation of outpatients after site lost connectivity to electrical grid
Elevators	Elevators may require protective measures or become water damaged	Elevators may require protective measures or become water damaged	overheating of elevator controllers and / or main distribution transformer					Patient transfer elevators not connected to emergency generator power resulting in delayed patient movement after the site lost connectivity to electrical grid
Mechanical	Equipment or systems may become water damaged requiring replacement or repair Parkade ventilation likely impacted	Equipment may become damaged due to moisture ingress or localised flooding *Note to Shane - Scenario was envisioned as critical equipment in place on the roof, and worst case of losing HVAC due to water ingress	have to have water hoses on cooling systems to meet temperature needs in summer HVAC equipment operating at maximum stress level for extended periods of time, resulting in the possibility of failure (e.g. mechanical, electrical, communications) increased wear on HVAC/elec/mechanical systems, may affect protection and coordination of systems, and require earlier replacement need to pre-cool the areas that tend to become too warm by decreasing the thermostat temperature in the morning such that those areas would not warm up as quickly overloading of the HVAC system can sometimes also affect humidity control and ventilation, resulting in excess humidity and poor air quality due to poor ventilation strain cooling system, indoor temperatures are too warm, refrigerators may not be able to keep food at a safe storage temperature Note: re: provision of services and food for non-hospital service area.	With rising temperature every year, some times it is hard to maintain the required building temperature with one chiller (noting that the other chiller is on stand-by) buildings overheating frequently, increasing energy needs for ventilation systems to ensure operational levels are maintained Note: comment on level of inability to maintain setpoint. (e.g. if it's minimal, less of a concern). Assumption for this analysis: some areas within facility experiencing unacceptable temperatures, while others in moderate condition, some fine. increase the need for cooling (electricity) - if generators are required to help relieve the strain on the grid, the generators output is lessened as the temperature increases increase the need for chillers to be used year-round, increasing operational costs greater variability in conditions will place increased strain on equipment, leading to mechanical failure and unexpected equipment purchases. HVAC equipment operating at maximum stress level for extended periods of time, resulting in the possibility of failure (e.g. mechanical, electrical, communications)	backup cooling water affected by water shortage cooling towers affected by water shortage boilers affected by water shortage	increase maintenance on outdoor air intakes for critical air systems (e.g. operating room, medical device reprocessing) Increases in air contaminants from heat-related ozone, wildfire activity, and other sources can infiltrate through building envelopes, impacting the ability of HVAC systems to maintain adequate indoor environmental quality force shut down of south facing intake AHUs (air handling units) increase levels and types of contaminants, more frequent air filters changes, more on-site storage require different air filters for particular contaminants	ice and snow may accumulate on the air intakes requiring frequent inspections and clearing during the event	Impact indoor air quality impacting air intake and exhaust systems impact ability to deliver care for increased complexity of patients
Electrical	inundate power distribution, and essential power generation and distribution systems (if on ground floor, and / or not on a raised platform) - incoming feed flooded Flooding and storm surges may result in global transportation limitations, impacting access to building supplies for capital projects (fuel delivery for generators) - Assuming backup generators are on, even though incoming feed flooded	inundate power distribution, and essential power generation and distribution systems (if on ground floor, and / or not on a raised platform)	overheating of elevator controllers and / or main distribution transformer strain cooling system, indoor temperatures are too warm, refrigerators may not be able to keep food at a safe storage temperature premature failure of electrical systems impacts on main, and / or secondary, MV distribution equipment impacts exterior lighting impacts on main, and / or secondary, MV (Medium Voltage) distribution equipment Assumption: MV is for hospital equipment, generators, switch gears. (Equip for hospital as opposed to city equip) Assumption made: focus strictly on electrical. Impact statement re: mechanical failure. If HVAC fails, pick higher consequencwe of the two.					damage electrical supply

Off-Site	Coastal Flood	Intense & Frequent Rainfall	Extreme Heat	Increasing temperature	Drought	Poor Air Quality (PM 2.5 alert)	Extreme Weather (e.g. Winter Storms - snow, ice)	Extreme Wind
Water supply	increase turbidity decrease quantity of potable water reduce community health, and increase health service demands Flooding impacts water quality, which may compromise process water	increase turbidity decrease quantity of potable water reduce community health, and increase health service demands Flooding impacts water quality, which may compromise process water	Increased drought stress on green space plants and trees (including street trees) leading to increased irrigation costs and/or replacement	decrease water quantity available for drinking, washing and bathing; rationing/loss of prssure, etc. may occur warmer domestic water supply affects back up cooling water in cooling plant	warmer domestic water supply affects back up cooling water in cooling plant water shortages affect plumbing fixture supply Summer water restrictions are in effect every summer now. Increased stress on the provision of safe drinking water from regional and municipal water systems as health facilities compete with other water users.	disrupt availability of water (filter plants on North Shore)		Water pressure loss in (both) incoming city water mains due to loss of power at City pump station, impacting renal patient care and reducing capacity for sanitation and hygiene. SAM Resevoir problem possibly? Usually water will be pulled from deeper area in resevoir so ususally ok from flowating debris. Pressure loss - we have high pressure from elevation so we don't need pump stations. We have pressure reducing systems not impacted by windwe think. Worry might be a pump station but not relevant here. Extreme wind event might cause fires and impact water supply possibility but low.
Transportation	Access to the site may be limited Flooding may inundate parking, damaging vehicles	Access to the site may be limited Flooding may inundate parking, damaging vehicles	Transportation disruptions challenging delivery of community health care, resulting in more hospital visits.			Barge fire (scrap cars and tyres) in the Fraser river across from the hospital caused toxic smoke to drift over the site	impacts on transportation system during and after storm causes delays of supplies to the hospital	disturb transportation and disrupt community health care, resulting in increasing numbers of hospital visits disrupt utility and transportation networks, challenging hospital resupply decrease transportation and access impacting community connection for patients transportation system failures impacting travel patterns of staff light rail disruption is significant as we have very specialty services so patiets from outer areas rely on transit. Skytrain sensitieve to trees Helicopter transport impacted
Sanitary Service Connections / Sewerage	back-up of sanitary system, reducing ability to discharge black water Increased costs for response actions and clean-up after heavy rain events	sewer backup overwhelmed municipal sewer infrastructure, leading to bacterial outbreaks and associated compromise in sanitary conditions Increased surface water flooding from ponding of rainfall in low lying areas or heavy rainfall overcoming the capacity of the drainage system						
Power			extended black outs, catastrophic failure Outage due to overloaded grid and generators (e.g. staff used portable air conditioners) Assumptions: week of power outage. Concerns about generators. Costs due to staffing implications (time off, rescheduling of services/events), costs due to delay services. Sick leave.	potential for prolonged blackouts Assumptions: Seems like a lower probability in the gradual warming. However, if there are truly prolonged blackouts, refer to analysis within Extreme Heat Hazard.	Summer energy supply may become a challenge for our province, as hydropower capacity is decreased due to reduced snowpack and receding glaciers that feed storage reservoirs. With increasing electrical loading during climate stress events, more back-up energy may be required.		Damage to utilities and roads as a result of extreme weather events can impede supply chains and the ability of people to reach the facility cold snaps could lead to extended power outages Winter wind storms stronger than previous years, resulting in more frequent power interruptions	disrupt power resulting in reduced operating capacity at the hospital ("operating" as in function) damage electrical supply disruption of power which will reduce the buildings ability to provide cooling, which could affect occupants & medical items (equip, samples) - also this could limit access to the facilities for patients, staff, maintenance, supplies result in subsequent power outages bring in a large number of home health clients into hospitals increasing operating and facility demands Extended power outages at multiple sites due to downed hydro lines
Supply Chain	impede access to building supplies disrupt delivery of generator fuel decrease patients and staff ability to access the site Flooding and storm surges may result in global transportation limitations, impacting access to building supplies for capital projects (fuel delivery for generators) Depending on where loading dock is located on-site, might have to clean up or have an alternate site	decrease patients and staff ability to access the site	prolonged blackouts that impact food security and safety	prolonged blackouts that impact food security and safety			Building supplies for capital projects may be scarce or unavailable due to regional and global transportation limitations.	impact access to supplies and maintenance of supplies disrupt supply chain logistics - need for adequate space for breakup supplies (operates the 72hrs)
Local Drainage Systems / Storm Sewer	increases in sewer back-ups in combined sewer areas due to high rainfall volume in sewer system.	Strain on municipal sewer infrastructure can lead to bacterial outbreaks that in turn place additional strain on hospitals Flooding of municipal storm sewer systems not sized for higher volumes during extreme events (extreme precipitation, run-off, and sea level rise).						Fallen leaves and branches may block drainage system (e.g. catch basin) and cause local flooding

Site	Coastal Flood	Intense & Frequent Rainfall	Extreme Heat	Increasing temperature	Drought	Poor Air Quality (PM 2.5 alert)	Extreme Weather (e.g. Winter Storms - snow, ice)	Extreme Wind
Information & Communications Technology (ICT)	Similar to electrical above; More impact on capacity based on calls in/out If servers are impacted, no access to electronic health records		Failure due to operating in temperatures above design thresholds					impact digital infrastructure on the site affecting internal communications affect internal data management + digital infrastructure affecting patient information management, care and internal/external communications
Landscape	Low lying areas flood flood site access systems (e.g. loading docks, roads, parking areas)	Low lying areas flood flood site access systems (e.g. loading docks, roads, parking areas)	Trees / grass / other vegetation dies Increased drought stress on green space plants and trees (including street trees) leading to increased irrigation costs and/or replacement	Increased drought stress on green space plants and trees (including street trees) leading to increased irrigation costs and/or replacement	Trees / grass / other vegetation dies Level 4 H2O restrictions will lead to dead of vegetation and higher fire risk After long dry summers with minimal rain, soils may be unable to accept an increase in the intensity and flashiness of autumn storms, likely resulting in increased flooding along rivers, creeks, and streams,		damage to landscaping (trees, shrubs) due to snow and ice accumulation	Trees are down impacting access to services / entry points (e.g. main entrance) Trees / grass / other vegetation dies some good winds, removed trees damage from fallen trees / tree limbs
Mobility	reduce movement of goods & people around site (e.g. pharmaceutical supplies) If water ingress into the building and damages occur due to rainfall flooding, then the movement of goods and people around the site would also be affected (e.g. pharmaceutical supplies) Mobility of patients between wings/emerg	If water ingress into the building and damages occur due to rainfall flooding, then the movement of goods and people around the site would also be affected (e.g. pharmaceutical supplies)					Reduced mobility of goods and people during and after event	

USERS	Coastal Flood	Intense & Frequent Rainfall	Extreme Heat	Increasing temperature	Drought	Poor Air Quality (PM 2.5 alert)	Extreme Weather (e.g. Winter Storms - snow, ice)	Extreme Wind
Clinicians	losses and damages increase mental health issues Flooding may decrease the ability for staff and patients to access the facilities		delay discharges if patients home environment contributed to the admission (e.g. asthma, dehydration, etc.) Increased work load and number of work hours due to increases in emergency admissions; addressing discomfort and/or exacerbated health outcomes of in-patients; and, admission of patients transferred from other affected facilities. lack of focus leading to errors and mistakes increase incidents of violence / safety some clinical staff and building residents in extreme discomfort Comment: clinicians bearing the brunt of additional workload. Question whether this should be moved to High.	increase operating costs across the board increase code white incidents portable cooling devices in some areas are very noisy, create an uncomfortable acoustic environment for the occupants, and impede the not allowed to use hand-held fans because of infection control related considerations. decrease productivity due to poor air circulation of fresh air	Diminished ability to provide care with increased turbidity, reduced water quality, and potential lack of supply, as sterilization, dialysis, medical device reprocessing equipment, drinking, washing, and bathing, etc. is compromised.	Hot smoky temperature for a prolonged period impact staff's ability to perform their job Decreased air quality will decrease ability to discharge patients due to oxygen needs (congestion) Poor air quality may result in higher number of absences wildfire smoke force hospital closures and redirection to other facilities Complaints from staff on smell while particle counts meet requirements.	Mobility of clinicians would be affected by extreme weather events resulting in reduced staff and stress on the personnel available Increase in staff absenteeism during events when staff are most needed to respond to community needs and incoming patients Transit issues for staff getting to site	mobility issues due to broken tree limbs, downed power lines, may reduce availability of staff causing stress on available personnel in time of increased admissions due to increase in injuries due to extreme wind Loss of power due to wind, flood or high loads may affect internal data management + digital infrastructure affecting patient information management, care and internal/external communications Increase in staff absenteeism during events when staff are most needed to respond to community needs and incoming patients Strong winds may disrupt transportation and the ability to access the site for patients and staff
Patients	losses and damages increase mental health issues Flooding may decrease the ability for staff and patients to access the facilities Increased physiological issues (disease from flooding and contaminated water) Inability for people to leave the hospital Loss of belongings/domicile		increase cancellation of procedures Increased risk of perioperative complications in elderly surgical patients and trauma patients Certain groups of patients require additional attention, e.g. more hydration. Less mobile patients may resist drinking more liquid to avoid walking to bathrooms more frequently. Certain mental health patients may not feel thirsty due to their medication even when their body requires hydration can lead to additional complications e.g. renal infections resulting from dehydration increase incidents of violence / safety	exacerbate existing health conditions e.g. chronic pulmonary diseases, mental illnesses, respiratory illnesses additional health impacts e.g. dehydration, heat stroke, bladder infections, heart failure, chest infections		increase requests for release of information Smoky environment may cause cancellation in scheduled procedures as vulnerable population will stay indoors increase our emergency volumes and hospital admissions with respiratory problems increased length of seasonal pollen can exacerbate allergies community surge in particular aging population	mobility challenges would require longer retention of patients resulting in capacity issues Surgery scheduled, unable to access the site	Impact indoor air quality impacting air intake and exhaust systems Loss of power without connection to emergency generator for over 48 hours resulting in significant impact to the health service delivery for substance abuse patients due to loss of phones, computers, food Substance abuse patient transfers due to loss of power in community health center resulting in hospital emergency room congestion.
Facility Maintenance & Operations	damage to flooded portions of the building, including cleanup efforts losses and damages increase mental health issues increased disease potential from interaction with contaminated water	damage to drain, storm drain, sump systems	record breaking temperatures in the middle of March caught our site off guard, having our central chillers shut down and cooling towers drain over the winter shoulder and only to have re energise in April One of my acute sites has the chilling systems running at 100% capacity with an outside air temp of about 32, so when we have a heat wave the site has difficulty keeping cool and only manages to do so by catching up when it cools down at night.	increasing temperatures will result in higher O&M costs, e.g., energy)	Increased water consumption to maintain landscaping	Filter costs have tripled or quadrupled. Buying portable heap filters for use in cleansing air in facilities was $50,000. Not a major impact as we will close any air inlet and recirculate the air in the ducts. However, this cannot go for too long because we will starve the O2 level areas with reduced IAQ: OR's, ER, Long term care, all systems operating on 100% outdoor air. Longterm care sites Maternity/NICU. IMU/FMU, Surgical We have redundancy and sufficient resources to weather most catastrophes for a short duration. If it goes beyond 72 hours, then we get into some difficult circumstances We creatively recirculate air through stairwells to open doors on air handlers to avoid using outside air. We use water hoses on coils to cool air in summer	Damage due to ice buildup increased snow removal costs. My largest hospital has spent triple the budget for snow removal over the last 3 years. accumulation, removal / clearing, elevated removal cost, ice damming and water penetration gas curtailment, rupture of heating coils resulting from cold The un-known and unpredictable nature of weather events is difficult to prepare for however ensuring adequate supplies on hand is critical, i.e. appropriate air filter changes for the summer fire season, adequate supplies of ice melt/salt early in the fall, fuel sources are always topped off	impact FMO and make them feel stressed high winds in Dec/Jan, causing multiple site outages High Wind condition made our site with a flickering hydro power but never loss of power resulted in 5 facilities in the portfolio being on generator ranging from 12 to 79 hrs and consuming approx 2000 liters of fuel Decrease in durability and lifecycle of infrastructure leading to increased maintenance and replacement requirements Increased resources required to respond and clean-up during and following storm events
Community / Health Care	damage increases mental health issues Community flooding will reduce community health, and increase demand for health services	turbidity and decrease in potable water quality damage increases mental health issues Community flooding will reduce community health, and increase demand for health services	surge of people (not needing treatment) for refuge emotional health, ability to cope, and incidents of negative behaviour home health staff are at risk of heatstroke because they often do not work in air-conditioned environments and need to travel to different locations Increase in the number and frequency of community members seeking refuge at VCH facilities equipped with power, cooling, water, and food. Increase in multi-system failures at sites that are not climate resilient, including facility closures during extreme events. Increasing vectors for disease and respiratory illness are expected health impacts from increasing temperatures	decrease water quality available for drinking, washing and bathing	decrease water quality available for drinking, washing and bathing	increase our emergency volumes and hospital admissions with respiratory problems increased length of seasonal pollen can exacerbate allergies Smoky environment may cause cancellation in scheduled procedures as vulnerable population will stay indoors	increase injuries in the community due to falling on icy surfaces Surgery scheduled, unable to access the site Health authority may be responsible for assisting patients to come to site for procedures, or going to their site for routine procedures	disturb transportation and disrupt community health care, resulting in increasing numbers of hospital visits loss of power to a leased long term care facility resulting in generator use and fuel depletion Home health (community program) loss of access to phone and internet, resulting in inability to receive referrals or contact patients who also lost phone services Essential services and equipment not connected to emergency generator power including medical devices, elevators, air quality systems, security systems and lighting Hospital discharge delays and emergency department congestion due to home oxygen / vent dependent patients who lost power in their homes. Storm events may result in increasing numbers and frequency of community members seeking refuge at facilities equipped with power, cooling, water, and flood

APPENDIX B – VULNERABILITY ASSESSED IMPACT STATEMENTS

CLIMATE HAZARDS EXPOSURE UNITS	COASTAL FLOOD	S	EA	V
USERS	**IMPACT STATEMENTS**			
Clinicians	losses and damages increase mental health issues	H	M	H
	Flooding may decrease the ability for staff and patients to access the facilities			
Patients	losses and damages increase mental health issues	H	M	H
	Flooding may decrease the ability for staff and patients to access the facilities			
	Increased physiological issues (disease from flooding and contaminated water)			
	Inability for people to leave the hospital			
	Loss of belongings/domicile			
Facility Maintenance & Operations	damage to flooded portions of the building, including cleanup efforts	H	M	H
	losses and damages increase mental health issues			
	increased disease potential from interaction with contaminated water			
Community / Health Care	damage increases mental health issues	M	M	M
	Community flooding will reduce community health, and increase demand for health services			
BUILDING				
Envelope / Enclosure	Ground floor flooding may increase infection and mold risk at the facility	M	H	H
	Increased damage to structures and landscapes from storm surge, flooding and saltwater intrusion			
	increase in risk to foundation and / or slabs due to sub-surface erosion			
Materials	increase infection and mold risk	M	M	M
	Corrosion risk due to salt water intrusion			
Medical / Clinical Equipment	reduction in water quality, compromise in process water (e.g. sanitizers, sterilization)	M	M	M
	if water contaminated, depending on time if over 72 hours, vulnerability becomes higher			
	potential increase in turbidity of the water supply			
Elevators	Elevators may require protective measures or become water damaged	M	M	M
Mechanical	Equipment or systems may become water damaged requiring replacement or repair	M	M	M
	Parkade ventilation likely impacted			
Electrical	inundate power distribution, and essential power generation and distribution systems (if on ground floor, and / or not on a raised platform) - incoming feed flooded	H	H	H
	Flooding and storm surges may result in global transportation limitations, impacting access to building supplies for capital projects (fuel delivery for generators) - Assuming backup generators are on, even though incoming feed flooded			
SITE				
Information & Communications Technology (ICT)	Similar to electrical above; More impact on capacity based on calls in/out			
	If servers are impacted, no access to electronic health records			
Landscape	Low lying areas flood	M	M	M
	flood site access systems (e.g. loading docks, roads, parking areas)			
Mobility	If water ingress into the building and damages occur due to rainfall flooding, then the movement of goods and people around the site would also be affected (e.g. pharmaceutical supplies)	M	M	M
	Mobility of patients between wings/emerg			
OFF-SITE				
Water supply	increase turbidity	M	M	M
	decrease quantity of potable water			
	reduce community health, and increase health service demands			
	Flooding impacts water quality, which may compromise process water			
Transportation	Access to the site may be limited	M	M	M
	Flooding may inundate parking, damaging vehicles			
Sanitary Service Connections / Sewerage	back-up of sanitary system, reducing ability to discharge black water	H	M	H
	Increased costs for response actions and clean-up after heavy rain events			
Power				
Supply Chain	impede access to building supplies	M	M	M
	disrupt delivery of generator fuel			
	decrease patients and staff ability to access the site			
	Flooding and storm surges may result in global transportation limitations, impacting access to building supplies for capital projects (fuel delivery for generators)			
	Depending on where loading dock is located on-site, might have to clean up or have an alternate site			
Local Drainage Systems / Storm Sewer	Increases in sewer back-ups in combined sewer areas due to high rainfall volume in sewer system.	M	M	M

CLIMATE HAZARDS EXPOSURE UNITS	INTENSE & FREQUENT RAINFALL	S	EA	V
USERS	IMPACT STATEMENTS			
Clinicians				
Patients				
Facility Maintenance & Operations	damage to drain, storm drain, sump systems, or loss of capacity of systems that causes local flooding, backups, etc.	M	M	M
BUILDING				
Envelope / Enclosure	flooding of roof membrane	M	H	H
	Water ingress into basement causing damage to equipment. As seepage is a result of the water table, it is hard to push the water out			
	Mud in the basement rises over time, closer to pipes			
	a lot of maintenance to building glazing			
	Increased rain intensities may result in more water being driven into building façade assemblies, potentially causing mold			
	increase in risk to foundation and / or slabs due to sub-surface erosion			
Materials	flooding may increase infection and mold risk	M	M	M
Medical / Clinical Equipment				
Elevators	Elevators may require protective measures or become water damaged	M	M	M
Mechanical	Equipment may become damaged due to moisture ingress or localised flooding	H	M	H
Electrical	inundate power distribution, and essential power generation and distribution systems (if on ground floor, and / or not on a raised platform)	H	H	H
SITE				
Information & Communications Technology (ICT)				
Landscape	Low lying areas flood	M	M	M
	flood site access systems (e.g. loading docks, roads, parking areas)			
Mobility	If water ingress into the building and damages occur due to rainfall flooding, then the movement of goods and people around the site would also be affected (e.g. pharmaceutical supplies)	M	M	M
OFF-SITE				
Water supply	increase turbidity	M	M	M
	decrease quantity of potable water			
	reduce community health, and increase health service demands			
	Flooding impacts water quality, which may compromise process water			
Transportation	Access to the site may be limited			
	Flooding may inundate parking, damaging vehicles			
Sanitary Service Connections / Sewerage	sewer backup	M	M	M
	overwhelmed municipal sewer infrastructure, leading to bacterial outbreaks and associated compromise in sanitary conditions			
	Increased surface water flooding from ponding of rainfall in low lying areas or heavy rainfall overcoming the capacity of the drainage system			
Power				
Supply Chain	decrease patients and staff ability to access the site	M	M	M
Local Drainage Systems / Storm Sewer	Strain on municipal sewer infrastructure can lead to bacterial outbreaks that in turn place additional strain on hospitals	M	M	M
	Flooding of municipal storm sewer systems not sized for higher volumes during extreme events (extreme precipitation, run-off, and sea level rise).			

CLIMATE HAZARDS EXPOSURE UNITS	EXTREME HEAT	S	EA	V
USERS	**IMPACT STATEMENTS**			
Clinicians	delay discharges if patients home environment contributed to the admission (e.g. asthma, dehydration, etc.)	M	M	M
	Increased work load and number of work hours due to increases in emergency admissions; addressing discomfort and/or exacerbated health outcomes of in-patients; and, admission of patients transferred from other affected facilities.			
	lack of focus leading to errors and mistakes			
	increase incidents of violence / safety			
	Comment: clinicians bearing the brunt of additional workload. Question whether this should be moved to High.			
	some clinical staff and building residents in extreme discomfort			
Patients	increase cancellation of procedures	M	M	M
	Increased risk of perioperative complications in elderly surgical patients and trauma patients			
	Certain groups of patients require additional attention, e.g. more hydration. Less mobile patients may resist drinking more liquid to avoid walking to bathrooms more frequently.			
	Certain mental health patients may not feel thirsty due to their medication even when their body requires hydration			
	can lead to additional complications e.g. renal infections resulting from dehydration			
	increase incidents of violence / safety			
Facility Maintenance & Operations	One of my acute sites has the chilling systems running at 100% capacity with an outside air temp of about 32, so when we have a heat wave the site has difficulty keeping cool and only manages to do so by catching up when it cools down at night.	M	M	M
	record breaking temperatures in the middle of March caught our site off guard, having our central chillers shut down and cooling towers drain over the winter shoulder and only to have re energise in April NOTE: Provided impact statement refers to an event outside of the Scenarios requested for review.			
Community / Health Care	surge of people (not needing treatment) for refuge	M	M	M
	emotional health, ability to cope, and incidents of negative behaviour			
	home health staff are at risk of heatstroke because they often do not work in air-conditioned environments and need to travel to different locations			
	Increase in the number and frequency of community members seeking refuge at VCH facilities equipped with power, cooling, water, and food.			
	Increasing vectors for disease and respiratory illness are expected health impacts from increasing temperatures			
	Increase in multi-system failures at sites that are not climate resilient, including facility closures during extreme events.			
BUILDING				
Envelope / Enclosure	overheating causes operation mechanism of sliding glass doors to seize	M	M	M
	decrease service life of building components (e.g. fenestration)			
Materials	compromise integrity, reduce functionality and shorten lifespan	L	L	L
	Increased UV exposure may result in deterioration of flexible elements (such as sealants), requiring a change in the products used, or existing replacement cycles will need to be shortened.			
Medical / Clinical Equipment	Lab results were lost/questionable due to higher temperature in Lab Equipment Room.	H	H	H
	Refrigeration failure in mortuary and laboratory led to loss of laboratory specimens and need to relocate bodies			
	Over-stretched supplies, e.g. medical supplies; higher rate of usage in high temperatures (e.g. bed linens changed more frequently)			
	Decreased efficacy of some medication in storage, as many manufactured medications are licensed for storage at 25°C or less. Medications shown to have decreased efficacy include cephalexin, ampicillin, erythromycin, furosemide, benzyl penicillin.			
	municipal water supply temperature (sometimes used to cool MRIs when there is a cooling system failure) was over 20°C, resulting in the temporary shutdown of the MRI.			
	Basis of any treatment is lab results, so if lab results are inaccurate, the treatment options would be limited, ineffective. When move into failure of equipment and limited supplies. Impacts a lot of staff and patients. Not localized (re: psychological). Consideration of how many patients affected by ineffective meds. Rated moderate re: loss of life, as patients that come in are already not healthy, so more vulnerable to additional issues. Comment: possibly more public forgiveness for the short term event than the gradual warming. Costs: need to redo lab results, replacement of medications.			
Elevators	overheating of elevator controllers and / or main distribution transformer	M	M	M
Mechanical	have to have water hoses on cooling systems to meet temperature needs in summer	H	H	H
	HVAC equipment operating at maximum stress level for extended periods of time, resulting in the possibility of failure (e.g. mechanical, electrical, communications)			
	increased wear on HVAC/elec/mechanical systems, may affect protection and coordination of systems, and require earlier replacement			
	need to pre-cool the areas that tend to become too warm by decreasing the thermostat temperature in the morning such that those areas would not warm up as quickly			
	overloading of the HVAC system can sometimes also affect humidity control and ventilation, resulting in excess humidity and poor air quality due to poor ventilation			
	strain cooling system, indoor temperatures are too warm, refrigerators may not be able to keep food at a safe storage temperature Note: re: provision of services and food for non-hospital service area.			
Electrical	overheating of elevator controllers and / or main distribution transformer	H	H	H
	premature failure of electrical systems			
	impacts on main, and / or secondary, MV (Medium Voltage) distribution equipment Assumption: MV is for hospital equipment, generators, switch gears. (Equip for hospital as opposed to city equip)			
	impacts exterior lighting			
SITE				
Information & Communications Technology (ICT)	Failure due to operating in temperatures above design thresholds	M	M	M
Landscape	Trees / grass / other vegetation dies	L	L	L
	Increased drought stress on green space plants and trees (including street trees) leading to increased irrigation costs and/or replacement			
Mobility				
OFF-SITE				
Water supply	Increased drought stress on green space plants and trees (including street trees) leading to increased irrigation costs and/or replacement	M	M	M
Transportation	Transportation disruptions challenging delivery of community health care, resulting in more hospital visits.	M	M	M
Sanitary Service Connections / Sewerage				
Power	extended black outs, catastrophic failure	H	M	H
	Outage due to overloaded grid and generators (e.g. staff use portable air conditioners)			
	Assumptions: week of power outage. Concerns about generators. Costs due to staffing implications (time off, rescheduling of services/events), costs due to delay services. Sick leave.			
Supply Chain	prolonged blackouts that impact food security and safety	M	M	M
Local Drainage Systems / Storm Sewer				

CLIMATE HAZARDS EXPOSURE UNITS	INCREASING TEMPERATURES	S	EA	V
USERS	**IMPACT STATEMENTS**			
Clinicians	increase operating costs across the board	M	M	M
	increase code white incidents			
	portable cooling devices in some areas are very noisy, create an uncomfortable acoustic environment for the occupants, and impede the clinical team from hearing patients and nurse call bells.			
	not allowed to use hand-held fans because of infection control related considerations.			
	decrease productivity due to poor air circulation of fresh air			
Patients	exacerbate existing health conditions e.g. chronic pulmonary diseases, mental illnesses, respiratory illnesses	M	M	M
	additional health impacts e.g. dehydration, heat stroke, bladder infections, heart failure, chest infections			
Facility Maintenance & Operations	increasing temperatures will result in higher O&M costs, e.g., energy)	M	L	L
Community / Health Care				
BUILDING				
Envelope / Enclosure				
Materials	Increased UV exposure may result in deterioration of flexible elements (such as sealants), requiring a change in the products used, or existing replacement cycles will need to be shortened.	L	L	L
Medical / Clinical Equipment	cause some medical imaging equipment to shut down or malfunction	H	M	H
	increase risk of medical equipment mal-functionality			
Elevators				
Mechanical	With rising temperature every year, some times it is hard to maintain the required building temperature with one chiller (noting that the other chiller is on stand-by)	H	H	H
	buildings overheating frequently, increasing energy needs for ventilation systems to ensure operational levels are maintained. Note: comment on level of inability to maintain setpoint. (e.g. if it's minimal, less of a concern). Assumption for this analysis: some areas within facility experiencing unacceptable temperatures, while others in moderate condition, some fine.			
	increase the need for cooling (electricity) - if generators are required to help relieve the strain on the grid, the generators output is lessened as the temperature increases			
	increase the need for chillers to be used year-round, increasing operational costs			
	greater variability in conditions will place increased strain on equipment, leading to mechanical failure and unexpected equipment purchases.			
	HVAC equipment operating at maximum stress level for extended periods of time, resulting in the possibility of failure (e.g. mechanical, electrical, communications)			
Electrical				
SITE				
Information & Communications Technology (ICT)				
Landscape	Increased drought stress on green space plants and trees (including street trees) leading to increased irrigation costs and/or replacement	M	M	M
Mobility				
OFF-SITE				
Water supply	decrease water quantity available for drinking, washing and bathing; rationing/loss of prssure, etc. may occur	M	M	M
	warmer domestic water supply affects back up cooling water in cooling plant			
Transportation				
Sanitary Service Connections / Sewerage				
Power	potential for prolonged blackouts	M	M	M
Supply Chain	prolonged blackouts that impact food security and safety	M	M	M
Local Drainage Systems / Storm Sewer				

CLIMATE HAZARDS EXPOSURE UNITS	DROUGHT	S	EA	V
USERS	IMPACT STATEMENTS			
Clinicians	Diminished ability to provide care due to lack of water for sterilization, dialysis, medical device reprocessing equipment, drinking, washing, and bathing, etc	M	M	M
Patients				
Facility Maintenance & Operations	Increased water consumption to maintain landscaping	M	L	L
Community / Health Care				
BUILDING				
Envelope / Enclosure				
Materials				
Medical / Clinical Equipment	Water shortage for sterilization and sanitation	M	M	M
Elevators				
Mechanical	Backup cooling water affected by water shortage	M	M	M
	Cooling towers affected by water shortage			
	Boilers affected by water shortage			
Electrical				
SITE				
Information & Communications Technology (ICT)				
Landscape	Trees / grass and other vegetation dies	M	M	M
	Level 4 H2O restrictions will lead to dead of vegetation and higher fire risk			
	After long dry summers with minimal rain, soils may be unable to accept an increase in the intensity and flashiness of autumn storms, likely resulting in increased flooding along rivers, creeks, and streams, especially in floodplains			
Mobility				
OFF-SITE				
Water supply	Increased stress on the provision of safe drinking water from regional and municipal water systems as health facilities compete with other water users	M	M	M
	Water shortages affect plumbing fixture supply			
	Summer water restrictions are in effect every summer now			
	Decreased water quantity available for drinking, washing and bathing; rationing/loss of pressure, etc. may occur			
Transportation				
Sanitary Service Connections / Sewerage				
Power	Summer energy supply may become a challenge for our province, as hydropower capacity is decreased due to reduced snowpack and receding glaciers that feed storage reservoirs	M	L	L
	With increasing electrical loading during climate stress events, more back-up energy may be required.			
Supply Chain				
Local Drainage Systems / Storm Sewer				

CLIMATE HAZARDS EXPOSURE UNITS	POOR AIR QUALITY (PM 2.5 ALERT, e.g. FOREST FIRES)	S	EA	V
USERS	IMPACT STATEMENTS			
Clinicians	Hot smoky temperature for a prolonged period impact staff's ability to perform their job	M	M	M
	Poor air quality will decrease ability to discharge patients due to oxygen needs (congestion)			
	Poor air quality may result in higher number of absences			
	Wildfire smoke force hospital closures and redirection to other facilities			
	Complaints from staff on smell while particle counts meet requirements			
Patients	Community surge due to aging population	M	M	M
	Smoky environment may cause cancellation in scheduled procedures as vulnerable population will stay indoors			
	Increase our emergency volumes and hospital admissions with respiratory problems			
	Increased length of seasonal pollen can exacerbate allergies			
	We creatively recirculate air through stairwells to open doors on air handlers to avoid using outside air - We use water hoses on coils to cool air in summer	M	H	H
Community / Health Care	Smoky environment may cause cancellation in scheduled procedures as vulnerable population will stay indoors	M	M	M
	Increase our emergency volumes and hospital admissions with respiratory problems			
	Increased length of seasonal pollen can exacerbate allergies			
BUILDING				
Envelope / Enclosure				
Materials				
Medical / Clinical Equipment				
Elevators				
Mechanical	Increase maintenance on outdoor air intakes for critical air systems (e.g. operating room, medical device reprocessing)	M	H	H
	Increases in air contaminants from heat-related ozone, wildfire activity, and other sources can infiltrate through building envelopes, impacting the ability of HVAC systems to maintain adequate indoor environmental quality			
	Forced shut down of south facing intake AHUs (air handling units)			
	Increased levels and types of contaminants, more frequent air filters changes, more on-site storage			
	Require different air filters for particular contaminants			
	Maintaining optimal range for inertanl relative humidity			
Electrical	Efficiency of generators reduced	M	M	M
SITE				
Information & Communications Technology (ICT)				
Landscape				
Mobility				
OFF-SITE				
Water supply	Disrupt availability of water (filter plants on North Shore)	M	M	M
Transportation	Barge fire (scrap cars and tyres) in the Fraser river across from the hospital caused toxic smoke to drift over the site	M	L	L
Sanitary Service Connections / Sewerage				
Power				
Supply Chain				
Local Drainage Systems / Storm Sewer				

CLIMATE HAZARDS EXPOSURE UNITS	EXTREME WEATHER (E.G. WINTER STORMS - SNOW, ICE)	S	EA	V
USERS	IMPACT STATEMENTS			
Clinicians	Mobility of clinicians would be affected by extreme weather events resulting in reduced staff and stress on the personnel available	H	M	H
	Increase in staff absenteeism during events when staff are most needed to respond to community needs and incoming patients			
	Transit issues for staff getting to site			
Patients	mobility challenges would require longer retention of patients resulting in capacity issues	M	L	L
	Surgery scheduled, unable to access the site			
Facility Maintenance & Operations	Damage due to ice buildup	H	H	H
	increased snow removal costs. My largest hospital has spent triple the budget for snow removal over the last 3 years.			
	accumulation, removal / clearing, elevated removal cost, ice damming and water penetration			
	gas curtailment, rupture of heating coils resulting from cold			
	Strong storm events may impact supply chain logistics (including fuel and medical supplies)			
	The un-known and unpredictable nature of weather events is difficult to prepare for however ensuring adequate supplies on hand is critical, i.e. appropriate air filter changes for the summer fire season, adequate supplies of ice melt/salt early in the fall, fuel sources are always topped off			
Community / Health Care	increase injuries in the community due to falling on icy surfaces	M	H	H
	Surgery scheduled, unable to access the site			
	Health authority may be responsible for assisting patients to come to site for procedures, or going to their site for routine procedures			
BUILDING				
Envelope / Enclosure	decrease service life of fenestration	M	M	M
	decrease service life of roof membrane			
	decrease service life of concrete structures, steel frames, wood			
Materials	See Envelope / Enclosure			
Medical / Clinical Equipment				
Elevators				
Mechanical	ice and snow may accumulate on the air intakes requiring frequent inspections and clearing during the event	M	M	M
Electrical				
SITE				
Information & Communications Technology (ICT)				
Landscape	damage to landscaping (trees, shrubs) due to snow and ice accumulation	M	L	L
Mobility	Reduced mobility of goods and people during and after event	M	M	M
OFF-SITE				
Water supply				
Transportation	impacts on transportation system during and after storm causes delays of supplies to the hospital	M	M	M
Sanitary Service Connections / Sewerage				
Power	Damage to utilities and roads as a result of extreme weather events can impede supply chains and the ability of people to reach the facility	H	H	H
	cold snaps could lead to extended power outages			
	Winter wind storms stronger than previous years, resulting in more frequent power interruptions			
Supply Chain	Building supplies for capital projects may be scarce or unavailable due to regional and global transportation limitations.	M	M	M
Local Drainage Systems / Storm Sewer				

CLIMATE HAZARDS EXPOSURE UNITS	EXTREME WIND	S	EA	V
USERS	IMPACT STATEMENTS			
Clinicians	mobility issues due to broken tree limbs, downed power lines, may reduce availability of staff causing stress on available personnel in time of increased admissions due to increase in injuries due to extreme wind damages	M	M	M
	Loss of power due to wind, flood or high loads may affect internal data management + digital infrastructure affecting patient information management, care and internal/external communications			
	Increase in staff absenteeism during events when staff are most needed to respond to community needs and incoming patients			
	Strong winds may disrupt transportation and the ability to access the site for patients and staff			
Patients	Impact indoor air quality impacting air intake and exhaust systems	H	M	H
	Loss of power without connection to emergency generator for over 48 hours resulting in significant impact to the health service delivery for substance abuse patients due to loss of phones, computers, food preparation; minimal lighting (emergency only) a safety issue.			
	Substance abuse patient transfers due to loss of power in community health center resulting in hospital emergency room congestion.			
Facility Maintenance & Operations	impact FMO and make them feel stressed	H	M	H
	high winds in Dec/Jan, causing multiple site outages			
	High Wind condition made our site with a flickering hydro power but never loss of power			
	resulted in 5 facilities in the portfolio being on generator ranging from 12 to 79 hrs and consuming approx 2000 liters of fuel			
	Increased resources required to respond and clean-up during and following storm events			
	Decrease in durability and lifecycle of infrastructure leading to increased maintenance and replacement requirements			
Community / Health Care	disturb transportation and disrupt community health care, resulting in increasing numbers of hospital visits	**H**	M	H
	loss of power to a leased long term care facility resulting in generator use and fuel depletion			
	Home health (community program) loss of access to phone and internet, resulting in inability to receive referrals or contact patients who also lost phone services			
	Essential services and equipment not connected to emergency generator power including medical devices, elevators, air quality systems, security systems and lighting			
	Storm events may result in increasing numbers and frequency of community members seeking refuge at facilities equipped with power, cooling, water, and flood			
	Hospital discharge delays and emergency department congestion due to home oxygen / vent dependent patients who lost power in their homes.			
BUILDING				
Envelope / Enclosure	create higher loads on the building envelope which could lead to early degradation of the envelope and potentially create hazards from flying objects - also safety of people on upper patios is a concern	H	H	H
	water ingress into the builidng through fenestration (e.g. window wall, sliding doors, skylights)			
	reduce effectiveness of roof membrane against water ingress			
	increase need for building structure stability			
	Roof damage - most likely building is leaking taking rooms out of service			
Materials	**Covered under envelope and landscape etc**			
Medical / Clinical Equipment	Medical Imaging equipment and rooms not appropriately connected to emergency generator power resulting in cancellation of outpatients after site lost connectivity to electrical grid	M	M	M
Elevators	Patient transfer elevators not connected to emergency generator power resulting in delayed patient movement after the site lost connectivity to electrical grid	M	L	L
Mechanical	Impact indoor air quality impacting air intake and exhaust systems	M	M	M
	impact ability to deliver care for increased complexity of patients			
Electrical	damage electrical supply	M	L	L
SITE				
Information & Communications Technology (ICT)	impact digital infrastructure on the site affecting internal communications	M	M	M
	affect internal data management + digital infrastructure affecting patient information management, care and internal/external communications			
Landscape	Weak branches on trees break and can cause injuries to incoming staff and patients	**M**	M	M
	Trees / grass / other vegetation dies reslting in increased maintenance and replacement costs			
	some good winds, removed trees			
	damage to site elements from fallen trees / tree limbs			
Mobility	**Walking on the campus between buildings and spaces**	**M**	**L**	**L**
	Usage of outdoor spaces especially upper floors			
	mobility impared reaching building and around site			
OFF-SITE				
Water supply	**Water pressure loss in (both) incoming city water mains due to loss of power at City pump station, impacting renal patient care and reducing capacity for sanitation and hygiene.**	M	M	M
	SAM			
	Resevoir problem possibly? Ususally water will be pulled from deeper area in resevoir so ususally ok from flowating debris. Pressure loss - we have high pressure from elevation so we don't need pump stations. We have pressure reducing systems not impacted by windwe think. Worry might be a pump station but not relevant here.			
	Extreme wind event might cause fires and impact water supply possibility but low.			
Transportation	disturb transportation and disrupt community health care, resulting in increasing numbers of hospital visits	M	**H**	H
	disrupt utility and transportation networks, challenging hospital resupply			
	decrease transportation and access impacting community connection for patients			
	transportation system failures impacting travel patterns of staff			
	light rail disruption is significant as we have very specialty services so patiets from outer areas rely on transit. Skytrain sensitieve to trees			
	Helicopter transport impacted			
Sanitary Service Connections / Sewerage		**L**	**L**	**L**
Power	disrupt power resulting in reduced operating capacity at the hospital ("operating" as in function)	H	H	H
	damage electrical supply			
	disruption of power which will reduce the buildings ability to provide cooling, which could affect occupants & medical items (equip, samples) - also this could limit access to the facilities for patients, staff, maintenance, supplies			
	result in subsequent power outages bring in a large number of home health clients into hospitals increasing operating and facility demands			
	Extended power outages at multiple sites due to downed hydro lines			
Supply Chain	impact access to supplies and maintenance of supplies	M	H	H
	disrupt supply chain logistics - need for adequate space for breakup supplies (operates the 72hrs)			

APPENDIX C – CONSEQUENCE SCORING

Coastal Flooding

Coastal Flood EXPOSURE UNITS	S	EA	V	Description	Consequence Criteria: Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
USERS														
Clinicians	H	M	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	[redacted]	[redacted]
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	**Low potential for erosion of public trust in health authority**	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)		
				Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	**<5% of the patients and staff affected**	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	**Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally**	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs		
				Moderate [3]	**Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	Moderate erosion of public trust in health authority	**Some community complaints, local long-term media interest**	Consequences would require significant review or changed ways of operating	**Considerable impact in business operation with loss of revenue (days-long disruption)**		
				Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)		
				Catastrophic [5]	Widespread and severe disturbance resulting in long term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)		
Patients	H	M	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	[redacted]	[redacted]
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)		
				Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs		
				Moderate [3]	**Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	**Moderate erosion of public trust in health authority**	**Some community complaints, local long-term media interest**	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)		
				Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)		
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Facility Maintenance & Operations	H	M	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
				Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	**Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally**	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
				Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	**Some community complaints, local long-term media interest**	Consequences would require significant review or changed ways of operating	**Considerable impact in business operation with loss of revenue (days-long disruption)**	Considerable impact upon access to hospital assets	$250K-$1M
				Major [4]	**Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)**	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	**Major harm, leading to long term incapacity or disability. Several individuals impacted**	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	**Extensive damage to hospital assets with wide spread impacts**	$1M-$10M
				Catastrophic [5]	Widespread and severe disturbance resulting in long term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	**>25% of the patients and staff affected**	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	**>$10M**
Envelope / Enclosure	M	H	H	No consequence [0]	[redacted]								No hospital assets are at risk	No monetary loss
				Insignificant [1]									Little disruption of non-critical hospital assets	<$10K
				Minor [2]									Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
				Moderate [3]									**Considerable impact upon access to hospital assets**	$250K-$1M
				Major [4]									Extensive damage to hospital assets with wide spread impacts	$1M-$10M
				Catastrophic [5]									Hospital assets are completely damaged with irreversible loss	**>$10M**
Electrical	H	H	H	No consequence [0]	No psychological impacts on patients and staff	[redacted]			**Trust in health authority remains unchanged**	**No community response, or media interest**	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine				Low potential for erosion of public trust in health authority	Very little community response, or media interest	**Consequences will be dealt with by routine operations**	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
				Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**				Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	**Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs**	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
				Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)				Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	**Considerable impact upon access to hospital assets**	$250K-$1M
				Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)				Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
				Catastrophic [5]	Widespread and severe disturbance resulting in long term psychological impacts (e.g. post-traumatic stress disorder(PTSD))				Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Sanitary Service Connections / Sewerage	H	M	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
				Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
				Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	**Moderate erosion of public trust in health authority**	**Some community complaints, local long-term media interest**	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
				Major [4]	**Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)**	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	**Extensive damage to hospital assets with wide spread impacts**	**$1M-$10M**
				Catastrophic [5]	Widespread and severe disturbance resulting in long term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	**>25% of the patients and staff affected**	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	**Consequences would threaten provision of key services causing major problems for patients, clients, and staff.**	**Significant disruption in business operation (virtually dysfunctional), (months-long disruption)**	Hospital assets are completely damaged with irreversible loss	>$10M

Intense/Frequent Rain

CLIMATE HAZARDS EXPOSURE UNITS	V	Description	Consequence Criteria: Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
USERS												
BUILDING												
Envelope / Enclosure	H	No consequence [0]	[redacted]								No hospital assets are at risk	No monetary loss
		Insignificant [1]									Little disruption of non-critical hospital assets	<$10K
		Minor [2]									Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
		Moderate [3]									Considerable impact upon access to hospital assets	$250K-$1M
		Major [4]									**Extensive damage to hospital assets with wide spread impacts**	$1M-$10M
		Catastrophic [5]									Hospital assets are completely damaged with irreversible loss	**>$10M**
Mechanical	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
		Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
		Moderate [3]	**Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	**Moderate erosion of public trust in health authority**	**Some community complaints, local long-term media interest**	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	**Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)**	Extensive damage to hospital assets with wide spread impacts	**$1M-$10M**
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	**>25% of the patients and staff affected**	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	**Consequences would threaten provision of key services causing major problems for patients, clients, and staff.**	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	**Hospital assets are completely damaged with irreversible loss**	>$10M
Electrical	H	No consequence [0]	No psychological impacts on patients and staff	[redacted]			**Trust in health authority remains unchanged**	**No community response, or media interest**	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	**No monetary loss**
		Insignificant [1]	**Minimal expected reactions of fear, anxiety, or disruption to daily routine**				Low potential for erosion of public trust in health authority	Very little community response, or media interest	**Consequences will be dealt with by routine operations**	**Little impact on business operation (temporary nuisance)**	**Little disruption of non-critical hospital assets**	<$10K
		Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)				Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
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		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))				Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M

Extreme Heat

					Consequence Criteria									
				Description	Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
Medical / Clinical Equipment	H	H	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
				Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
				Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	**5%-15% of the patients and staff affected**	**Moderate harm, requiring medical treatment, small number of individuals impacted**	**Moderate erosion of public trust in health authority**	Some community complaints, local long-term media interest	Consequences would require signficant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	**Considerable impact upon access to hospital assets**	$250K-$1M
				Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	**15%-25% of the patients and staff affected**	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	**Negative community complaints, major loss of credibility, national short-term media interest**	**Consequences would threaten continued effective provision of services and require top-level management intervention**	**Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)**	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
				Catastrophic [5]	**Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))**	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	**>$10M**
Mechanical	H	H	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
				Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
				Moderate [3]	**Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	**Moderate erosion of public trust in health authority**	**Some community complaints, local long-term media interest**	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
				Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	**15%-25% of the patients and staff affected**	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	**Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)**	**Extensive damage to hospital assets with wide spread impacts**	**$1M-$10M**
				Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	**Consequences would threaten provision of key services causing major problems for patients, clients, and staff.**	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Electrical	H	H	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
				Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	**Minor short-term impacts(mainly reversible) on hospital assets**	$10K-$250K
				Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	**5%-15% of the patients and staff affected**	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	**Moderate erosion of public trust in health authority**	**Some community complaints, local long-term media interest**	Consequences would require signficant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	**$250K-$1M**
Power	H	M	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
				Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	**<5% of the patients and staff affected**	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	**Minor erosion of public trust in health authority**	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	**Minor short-term impacts(mainly reversible) on hospital assets**	$10K-$250K

Increasing Temperature

		Consequence Criteria									
	Description	Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
Medical / Clinical Equipment	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
	Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	**<2% of the patients and staff affected**	**<2% of the patients and staff affected**	No intervention or treatment required	**Low potential for erosion of public trust in health authority**	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
	Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	<5% of the patients and staff affected	<5% of the patients and staff affected	**Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention**	Minor erosion of public trust in health authority	**Isolated community complaints, local short-term media interest**	**Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally**	**Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)**	**Minor short-term impacts(mainly reversible) on hospital assets**	**$10K-$250K**
	Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
	Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
	Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Mechanical	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
	Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
	Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	**<5% of the patients and staff affected**	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	**Minor erosion of public trust in health authority**	**Isolated community complaints, local short-term media interest**	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	**Minor short-term impacts(mainly reversible) on hospital assets**	$10K-$250K
	Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	**Consequences would require significant review or changed ways of operating**	**Considerable impact in business operation with loss of revenue (days-long disruption)**	Considerable impact upon access to hospital assets	$250K-$1M
	Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	**$1M-$10M**
	Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M

Poor Air Quality

CLIMATE HAZARDS EXPOSURE UNITS	V	Description	Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
			Consequence Criteria									
Facility Maintenance & Operations	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	**<2% of the patients and staff affected**	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	**Consequences will be dealt with by routine operations**	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
		Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	<5% of the patients and staff affected	<5% of the patients and staff affected	**Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention**	**Minor erosion of public trust in health authority**	**Isolated community complaints, local short-term media interest**	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	**Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)**	**Minor short-term impacts(mainly reversible) on hospital assets**	**$10K-$250K**
		Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Mechanical	H	No consequence [0]	**No psychological impacts on patients and staff**	**No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff**	**No possibility of patients and staff loss of life**	**Patients and staff safety will not be impacted**	**Trust in health authority remains unchanged**	**No community response, or media interest**	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
		Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	**Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs**	**Minor short-term impacts(mainly reversible) on hospital assets**	**$10K-$250K**
		Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	**Consequences would require significant review or changed ways of operating**	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M

Extreme Weather

CLIMATE HAZARDS EXPOSURE UNITS	V	Description	Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
			Consequence Criteria									
USERS												
Clinicians	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	[redacted]	
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	**Low potential for erosion of public trust in health authority**	Very little community response, or media interest	Consequences will be dealt with by routine operations	**Little impact on business operation (temporary nuisance)**		
		Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	**<5% of the patients and staff affected**	<5% of the patients and staff affected	**Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention**	Minor erosion of public trust in health authority	**Isolated community complaints, local short-term media interest**	**Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally**	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs		
		Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)		
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)		
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)		
Facility Maintenance & Operations	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	**<2% of the patients and staff affected**	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	
		Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	**Isolated community complaints, local short-term media interest**	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs	Minor short-term impacts(mainly reversible) on hospital assets	
		Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	**Moderate erosion of public trust in health authority**	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	**Considerable impact in business operation with loss of revenue (days-long disruption)**	**Considerable impact upon access to hospital assets**	
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	**Consequences would threaten continued effective provision of services and require top-level management intervention**	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	
Community / Health Care	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	[redacted]	
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)		
		Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	**<5% of the patients and staff affected**	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	**Isolated community complaints, local short-term media interest**	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs		
		Moderate [3]	**Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	**Moderate erosion of public trust in health authority**	Some community complaints, local long-term media interest	**Consequences would require significant review or changed ways of operating**	**Considerable impact in business operation with loss of revenue (days-long disruption)**		
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)		
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)		
Power	H	No consequence [0]	No psychological impacts on patients and staff	[redacted]			**Trust in health authority remains unchanged**	**No community response, or media interest**	Consequences will have no impact on health service delivery	No impact on business operation		
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine				Low potential for erosion of public trust in health authority	Very little community response, or media interest	**Consequences will be dealt with by routine operations**	Little impact on business operation (temporary nuisance)		
		Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**				Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	**Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs**		
		Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)				Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)		
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)				Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)		
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))				Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)		

Extreme Wind

CLIMATE HAZARDS EXPOSURE UNITS	V	Description	Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
Users			Consequence Criteria									
Patients	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	**No possibility of patients and staff loss of life**	Patients and staff safety will not be impacted	**Trust in health authority remains unchanged**	**No community response, or media interest**	Consequences will have no impact on health service delivery	**No impact on business operation**	No hospital assets are at risk	No monetary loss
		Insignificant [1]	**Minimal expected reactions of fear, anxiety, or disruption to daily routine**	**<2% of the patients and staff affected**	<2% of the patients and staff affected	**No intervention or treatment required**	**Low potential for erosion of public trust in health authority**	Very little community response, or media interest	**Consequences will be dealt with by routine operations**	Little impact on business operation (temporary nuisance)	**Little disruption of non-critical hospital assets**	**<$10K**
		Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
		Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Facility Maintenance & Operations	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	**No possibility of patients and staff loss of life**	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	**No community response, or media interest**	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	**<2% of the patients and staff affected**	**<2% of the patients and staff affected**	No intervention or treatment required	**Low potential for erosion of public trust in health authority**	**Very little community response, or media interest**	Consequences will be dealt with by routine operations	**Little impact on business operation (temporary nuisance)**	Little disruption of non-critical hospital assets	<$10K
		Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	<5% of the patients and staff affected	<5% of the patients and staff affected	**Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention**	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	**Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally**	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs	**Minor short-term impacts(mainly reversible) on hospital assets**	**$10K-$250K**
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Community / Health Care	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	**Trust in health authority remains unchanged**	**No community response, or media interest**	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	**<2% of the patients and staff affected**	**<2% of the patients and staff affected**	No intervention or treatment required	Low potential for erosion of public trust in health authority	**Very little community response, or media interest**	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	**Little disruption of non-critical hospital assets**	**<$10K**
		Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	<5% of the patients and staff affected	<5% of the patients and staff affected	**Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention**	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	**Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally**	**Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs**	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
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		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Envelope / Enclosure	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	**<2% of the patients and staff affected**	**<2% of the patients and staff affected**	No intervention or treatment required	**Low potential for erosion of public trust in health authority**	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
		Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	<5% of the patients and staff affected	<5% of the patients and staff affected	**Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention**	Minor erosion of public trust in health authority	**Isolated community complaints, local short-term media interest**	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs	**Minor short-term impacts(mainly reversible) on hospital assets**	$10K-$250K
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		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Transportation	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	**Trust in health authority remains unchanged**	**No community response, or media interest**	Consequences will have no impact on health service delivery	No impact on business operation	**No hospital assets are at risk**	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	**Little impact on business operation (temporary nuisance)**	Little disruption of non-critical hospital assets	**<$10K**
		Minor [2]	**Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	<5% of the patients and staff affected	**<5% of the patients and staff affected**	**Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention**	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
		Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	**5%-15% of the patients and staff affected**	5%-15% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	**Consequences would require significant review or changed ways of operating**	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Power	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	**Low potential for erosion of public trust in health authority**	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	**Little disruption of non-critical hospital assets**	<$10K
		Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
		Moderate [3]	**Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	5%-15% of the patients and staff affected	<5% of the patients and staff affected	**Moderate harm, requiring medical treatment, small number of individuals impacted**	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	**Consequences would require significant review or changed ways of operating**	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
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		Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post-traumatic stress disorder(PTSD))	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted.	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media interest	Consequences would threaten provision of key services causing major problems for patients, clients, and staff.	Significant disruption in business operation (virtually dysfunctional), (months-long disruption)	Hospital assets are completely damaged with irreversible loss	>$10M
Supply Chain	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended) hospitalization of patients and staff	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	**No hospital assets are at risk**	No monetary loss
		Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	**Low potential for erosion of public trust in health authority**	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	**<$10K**
		Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	**Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention**	**Minor erosion of public trust in health authority**	**Isolated community complaints, local short-term media interest**	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	**Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs**	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
		Moderate [3]	**Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)**	**5%-15% of the patients and staff affected**	**5%-15% of the patients and staff affected**	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	**Considerable impact in business operation with loss of revenue (days-long disruption)**	Considerable impact upon access to hospital assets	$250K-$1M
		Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	**15%-25% of the patients and staff affected**	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	**Consequences would threaten continued effective provision of services and require top-level management intervention**	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
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APPENDIX D – CLIMATE DATA

2016 Climate Change Projections for the City of Vancouver
All projections are to the year 2050

Climate Variable	Description of Metric
Precipitation	
5% in winter increase 7% in spring and 12% in fall with 19% decrease in summer	Average seasonal changes
Length of dry spells increase 23% (from 23 to 29 days on avg per year)	Max length of consecutive days with precip. < 1mm
63% more precip. on extremely wet days	Annual total precip. that falls on days where precip. exceeds 99th percentile of precip. (intensity and frequency)
33% more precip. on very wet days	As above but 95th percentile
A 1:20 year return precipitation event will increase in intensity by 36%	Max daily precipitation expected to occur on average once in 20 years (intensity only)
Temperature	
2.9 average increase	Annual average temp increase
Summer days above 25 degrees more than double from 18-43	Frequency of summer days where maximum temperature is above 25 degrees
Warmest summer day is 3.9 degrees warmer	Maximum temperature of the warmest summer days
Coldest winter nights 4.9 warmer (from -9.4 to -4.7)	Min temp of the coldest day in winter
Very cold days are projected to warm from -16 to -11 Very hot days increase in intensity from 32 to 37 degrees	Minimum and maximum daily temp expected to occur on average 1:20 years
Hot summer days that occur only once per year on average are projected to occur 12 times annually	Days above 30 degrees
Heating and Cooling	
29% fewer HDD	Total of the number of degrees below 18°C that occur daily, summed over each day of the year. Indicator for heating demand.
CDD from 60 to 250 days (25% more than Portland's historic average)	Total of the number of degrees above 18°C that occur daily, summed over each day of the year. Indicator for cooling demand.
Snowpack	
For our watersheds as a whole April 1 snowpack projected decrease 58%	Lower elevations will no longer have snowfall
Growing Season	
15% increase in length of growing season	Growing season length is the length between the first span of six days above 5°C in spring, and the first span of six days below 5°C in the fall.
72% decrease in number of frosty days	Annual count of days when maximum temperature is below 0°C
44% increase in Growing degree days	Total of the number of degrees above 5°C that occur daily, summed over each day of the year. Indicator for plant growth.

Climate Indicators for Vancouver Downtown East Side (DTES)

Source: Moving Towards Climate Resilient Health Facilities for VCH report, Technical Appendix 2 (2018, page 104)

DOWNTOWN EAST SIDE (DTES) / 1ST & CLARK HEALTH, HOUSING & SOCIAL ENTERPRISE CENTER

Table 3: Hot Temperatures - Downtown East Side

	Past	2020 Change (range)	2050 Change (range)	2080 Change (range)
Days above 25°C	22 days	20 days (11 to 27)	44 days (24 to 63)	73 days (44 to 105)
Days above 30°C	2 days	4 days (2 to 5)	13 days (5 to 21)	32 days (14 to 60)
BCBC 97.5	27°C	2°C (1 to 2)	4°C (3 to 5)	6°C (4 to 9)
CLIMDEX (TXX) Hottest Day	30°C	2°C (1 to 3)	4°C (3 to 5)	6°C (4 to 9)

Table 4: Cooling Degree Days (CDD) and Heating Degree Days (HDD) - Downtown East Side

Indicator	Past (degree days)	2020 Change (range)	2050 Change (range)	2080 Change (range)
CDD	90	100 degree days (60 to 140)	270 degree days (130 to 450)	530 degree days (280 to 820)
HDD	2710	-16% (-21 to -11)	-29% (-39 to -20)	-45% (-57 to -33)

Table 5: Tropical Nights (TR) and Growing-Season Length (GSL) - Downtown East Side

Indicator	Past (days)	2020 Change (range)	2050 Change (range)	2080 Change (range)
TR	0.1	0.8 (0 to 1)	9 (1 to 22)	30 (7 to 65)
GSL	312	22 (17 to 27)	38 (29 to 44)	48 (42 to 53)

Table 6: Total Seasonal Precipitation - Downtown East Side

	Past (mm)	2020 Percent Change (range)	2050 Percent Change (range)	2080 Percent Change (range)

Table 7: Extreme Precipitation - Downtown East Side

Indicator Description	Indicator	Past (mm)	2020 Percent Change (range)	2050 Percent Change (range)	2080 Percent Change (range)
Wettest day of the year precipitation	Rx1day	54	5% (-2 to 13)	9% (1 to 22)	18% (5 to 28)
Wettest 5-day period of the year precipitation	Rx5day	126	3% (-4 to 14)	7% (-3 to 19)	17% (9 to 27)
Precipitation on wet days	R95p	287	11% (2 to 20)	25% (7 to 52)	50% (29 to 65)
Precipitation on very wet days	R99p	84	13% (-2 to 35)	43% (13 to 105)	91% (50 to 148)
1-in-20 wettest day	RP20 PR	86	11% (-5 to 31)	12% (-4 to 33)	23% (4 to 38)

Climate projections for the New St Paul's Hospital

Source: Site Level Climate Resilience Risk Assessment for the New St Paul's Hospital - Final Report July 2019

NOTES:

The tables below are based on the climate projections provided by PCIC for the DTES; and are presented in the "Moving Towards C

The 2050 nSP half-life is calculated by adding "Past" to the "2050 Change" average. The 2100 nSP end-life is calculated by adding

Table 1b. Humidity is sourced from "Initial Draft Project Agreement Rev. 1 Schedule 3 - Design and Construction Specifications (Th

Table 1a. Temperature

	Past	2050 nSP half-life	2100 nSP end-life
# Days > 25°C	22 days	66 days (3x)	127 days (6x)
# Days > 30°C	2 days	15 days (8x)	62 days (31x)
Hottest days (°C)	30°C	34°C	39°C
# Nights >20°C	0 nights	9 nights	65 nights

https://bcgreencare.ca/system/files/resource-files/VCH_ClimateReport%2BAppendices_Final_181025.pdf

Table 1b. Humidity

NOTES:

Peak design conditions used for the Facility cooling load equipment and system sizing will be based on the year 2050 weather file c

For the purposes of designing for the peak cooling conditions as well as allowance for future provisions, the following weather files [

July peak occurrence (%)	Dry Bulb °C	Wet Bulb °C	Enthalpy (KJ/kg)
Year 2050			
1.0%	31.9 °C	24.6 °C	74.22 KJ/kg
2.5%	32 °C	23.54 °C	69.72 KJ/kg
5.0%	27.6 °C	22.9 °C	67.45 KJ/kg
Year 2080			
1.0%	33.3 °C	24.6 °C	74.14 KJ/kg
2.5%	33.1 °C	23.83 °C	70.80 KJ/kg
5.0%	29 °C	23.17 °C	68.54 KJ/kg

Table 2. Precipitation

	Past	2050 nSP half-life	2100 nSP end-life
Wet days (R95P)+	287mm	0.25	0.65
Very wet days (R99P)+	84mm	0.43	1.48
Average Rainfall Increase*		0.45	0.75

Wet Days and wettest days refer to the total amount of rain that falls on days then precipitation exceeds a 95th /99th percentile thre

*http://www.metrovancouver.org/services/liquid-waste/LiquidWastePublications/Climatechangeimpactsprecipitationstormwater2050-

Table 3. Wind

	Past	2050 nSP half-life	2100 nSP end-life
Annual peak	70km/h	0.2	0.4
3-year peak	70-90km/h	0.2	0.4
Historic gusts	145km/h	0.2	0.4

Table 4. Wildfire / Air Pollution

	Past	2050 nSP half-life	2100 nSP end-life
Forest fires	1.2M hectares	0.4	0.75
PM2.5 exceedances	250 hours	0.4	0.75

http://www.ncceh.ca/sites/default/files/Responding%20to%20Wildfire%20Smoke%20Events%20EN.pdf

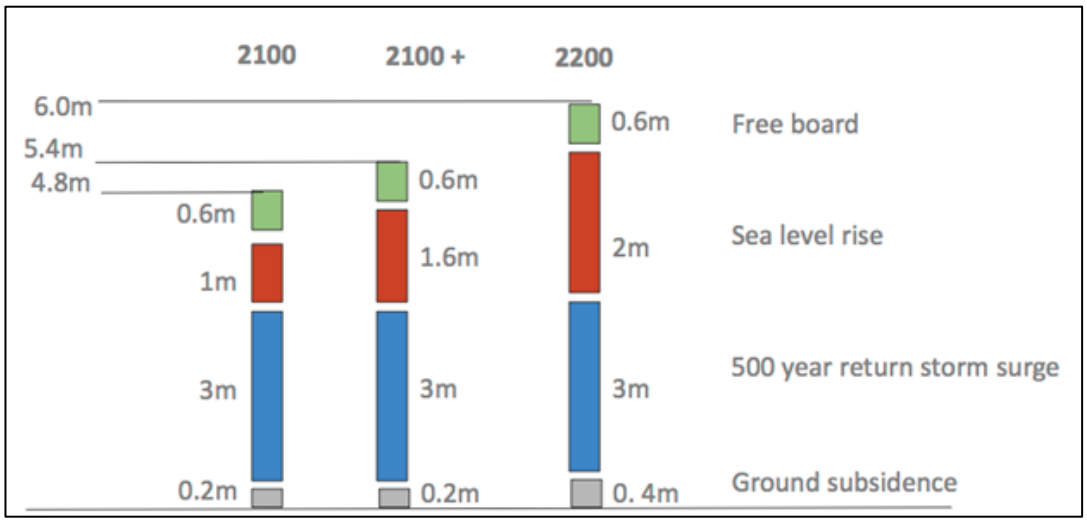


Figure 4: Flood Related to Sea Level Rise / Storm Surge

https://vancouver.ca/files/cov/CFRA-Phase-1-Final_Report.pdf

https://vancouver.ca/files/cov/CFRA-Phase-1-Final_Report-Maps.pdf

https://council.vancouver.ca/20180725/documents/pspc2.pdf

Climate Hazard Probabilities

Parameter	Threshold	Current P	2050s P	2080s P	Justification
Temperature	Increasing T T >= 30	3 4	4 5	5 5	Mean temp used, Average implies happens 50% of time historically; will occur more like 75% of time in 2050s, 90% of time in 2080s as Average 1 every 2 years in historical; Increases by multiple times per year by 2050s, regular occurrence 2080s
Precipitation	Intense/Frequent Rainfall (Increasing value of R95p) Drought	3 3	3 4	4 4	Intense rainfall amounts increase under climate forcing; 2050 increases are not substantial enough to change probability range (50-yr storm still in the 11 - 50 year range). 2080s suggest that amount of rainfall associated with a 50 year storm (annual p of 2%) may become recur annualy up with a probability of 10% While precipitation in intense events is likely to increase, overall precipitation in summer months is expected to decrease, leading to
Air Quality	Matching with drought and wildfire risk	3	4	4	While precipitation in intense events is likely to increase, overall precipitation in summer months is expected to decrease, leading to increased likelihood of drought in future climate; This increases available fuel for forest fires in the future
Wind	70 - 90 km/h (3 year peak value)	4	4	4	Wind projections are poorly handled in climate models; Likely that wind events remain constant, with wind speeds of 70 - 90 km/hr occurring every 3 - 10 years.
Extreme Wx	Snow, ice, wind	3	2	2	Reduction in likelihood of snow events; Snow events currently occur every ~15 years or so. Likelihood decreases in the future, but
Coastal Flood	SLR - threshold (0.5 m of rise)	1	4	5	Scenario currently does not occur; 0.5m of rise projected to occur by 2050; up to 1.5m (extreme scenario) by 2100

Table 5. Likelihood Rating Scale for Discrete and Ongoing Climate-Related Risk Events

Likelihood	Rating	Criteria for Discrete Climate-Related Risk Events	Criteria for Ongoing Climate-Related Risk Events
Almost certain	5	Event is expected to happen about once every two years or more frequently (i.e., annual chance ≥ 50%*).	Event is almost certain to cross critical threshold.
Likely	4	Event is expected to happen about once every 3-10 years (i.e., 10% ≤ annual chance < 50%).	Event is expected to cross critical threshold. It would be surprising if this did not happen.
Possible	3	Event is expected to happen about once every 11-50 years (i.e., 2% ≤ annual chance < 10%).	Event is just as likely to cross critical threshold as not.
Unlikely	2	Event is expected to happen about once every 51-100 years (i.e., 1% ≤ annual chance < 2%).	Event is not anticipated to cross critical threshold.
Almost certain not to happen	1	Event is expected to happen less than about once every 100 years (i.e., annual chance <1%).	Event is almost certain not to cross critical threshold.

*Annual chance is the probability that an event will occur in a given year

2.3.1.2 Evidence base for likelihood ratings

Selection of data sources for the likelihood ratings should follow the following hierarchy:

1) Existing peer-reviewed or other authoritative (e.g., government-approved) studies of the topic – If such data are available exploring changes in a specific climate-related risk event, or associated risk cause, leverage this work.
2) Analysis of climate model data – If no existing studies have evaluated the change in the relevant risk event or risk cause(s), review and analyze existing climate model data from sources such as the Pacific Climate Impacts Consortium (PCIC) data portal. A list of potential and recommended climate data resources is provided in Appendix C. For a new climate data analysis, follow these guidelines:
    - Use the RCP 8.5 (when available) or A2 emission scenarios (which correspond to high global greenhouse gas emissions).
    - Use the full range of model results available, including a multi-model ensemble average, plus the range of values across models.

Document all sources in the risk assessment template, and denote confidence (high, medium, or low) in the final rating based on the guidelines in Table 6. These confidence rating guidelines are adapted from the UK Climate Change Risk Assessment (UK Committee on Climate Change, 2017) and indicate the strength and consistency of the knowledge base.

APPENDIX E – RISK SUMMARY TABLE

	Coastal flood			Rainfall			Extreme Heat			Increasing Temperature			Poor AQ			Extreme Weather			Extreme Wind		
	2020	2050	2080	2020	2050	2080	2020	2050	2080	2020	2050	2080	2020	2050	2080	2020	2050	2080	2020	2050	2080
Clinicians	18	72	90													39	26	26			
Patients	28	112	120																28	28	28
Facility O&M	34	136	170										39	52	52	66	44	44	64	64	64
Community / Health Care																60	40	40	48	48	48
Envelope / Enclosure	8	27	40	27	27	36													80	80	80
Materials																					
Medical / Clinical Equipment							176	220	220	51	68	85									
Elevators													15	20	20						
Mechanical				126	126	156	136	170	170	72	96	179									
Electrical	13	52	65	12	12	16	116	145	145												
Information & Comm. Tech. (ICT)																					
Landscape																					
Mobility																					
Water supply																					
Transport																			60	60	60
Sanitary Service / Sewerage	37	148	185																		
Power							132	165	165							15	10	10	136	136	136
Supply Chain																			96	96	96
Local Drainage / Storm Sewer																					

Extreme	221 - 250
Very High	191 - 220
High	161 to 190
Medium High	131 to 160
Medium	101 to 130
Medium Low	71 to 100
Low	41 to 70
Very Low	10 to 40

APPENDIX F – WORKSHOP PRESENTATION SLIDES

The PCL Team

The New St. Paul's, Reimagined.

Climate Hazard and Vulnerability Assessment Workshop

April 30, 2020

REMINDER

CONFIDENTIAL AND PROPRIETARY INFORMATION

AGENDA

Workshop – Thursday April 30th 2020 – 8am-1pm

- **Introduction + Overview** **8:05-9:05am**
  - Process
  - Site Context
  - Climate Stress Tests
  - Demonstration + Questions
- BREAKOUT GROUPS 9:05-9:15am
- **Sample Exercise** **9:15-9:40am**
  - Group Introductions
  - Overview of Stress Tests & Exposure Units
  - Exposure Unit Vulnerability Validation + Consequence Scoring
- **Vulnerability Validation** **9:40-10:15am**
  - Climate Hazard A
  - Climate Hazard B
- BIG BREAK 10:15-11:00am
- **Consequence Scoring** **11:00-1:00pm**
  - Climate Hazard A
- SMALL BREAK
  - Climate Hazard B

We will not reconvene – when you're done you're done!

AGENDA

Breaks and Pauses

Mute yourself
Turn video off

If you have to step away, please let facilitator know - use the Chat function

Meet your Workshop Hosts

Shane O'Hanlon
Workshop Facilitator

Guy Felio
Workshop Advisor

Rhonda Lui
Host / Workshop Administrator

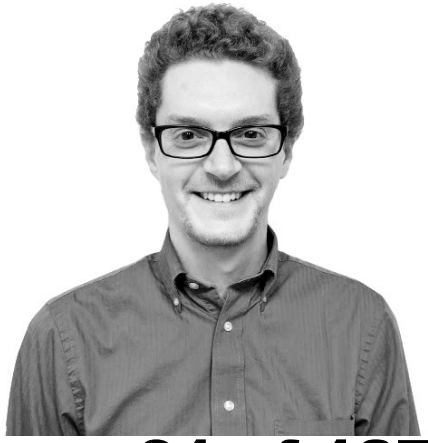
Monitoring Waiting Room
Assigning Breakout Rooms
Re-Admitting Participants
Technical Issues

Meet your Workshop Hosts

Bernadette Middleton
Breakout Facilitator

Lourette Swanepoel
Breakout Facilitator

Wendy Macdonald
Breakout Facilitator



Norm Shippee
Breakout Facilitator

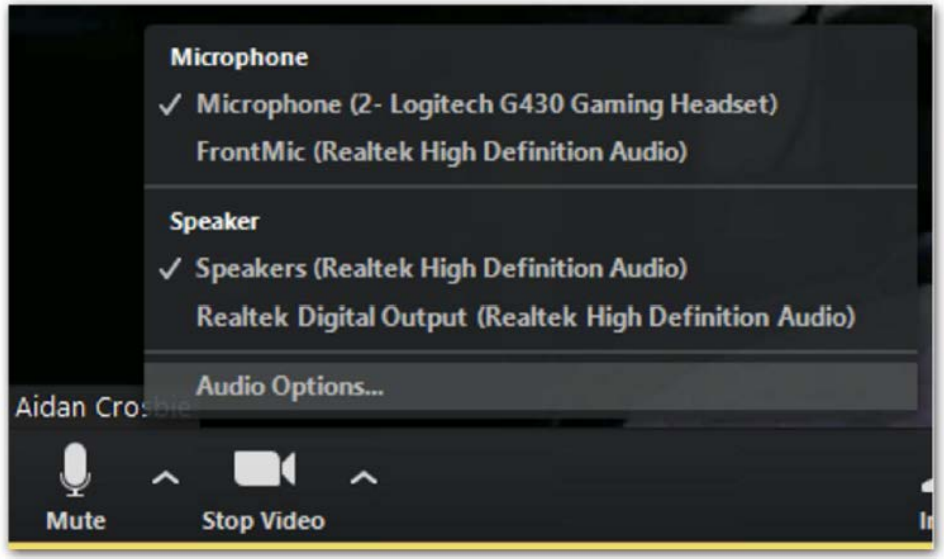
ONLINE WORKSHOP

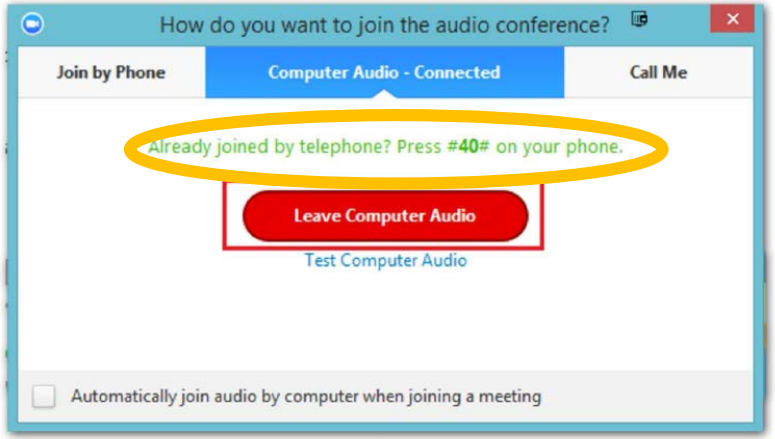
Values

- **Patience**
  - New technologies
  - New world
- **Focus**
  - Long sessions
  - Meaningful input
- **Respect**
  - Time
  - Opinion
  - Effort

TECHNICAL ISSUES

IF YOU HAVE AUDIO QUALITY ISSUES CONSIDER DIALLING IN





PURPOSE

VALIDATE OUR VULNERABILITY RATINGS

AND

SCORE THE CONSEQUENCE CRITERIA FOR POTENTIAL CLIMATE HAZARD IMPACTS

PROCESS

1. **REVIEW THE CLIMATE HAZARDS**

2. **REVIEW THE IMPACTS OF THE CLIMATE HAZARDS**

3. **VALIDATE THE VULNERABILITY OF OUR PROJECT* TO THOSE POTENTIAL IMPACTS**

4. **SCORE IMPACTS AGAINST CONSEQUENCE CRITERIA**

***ASSUMING NO DESIGN MEASURES HAVE BEEN INCORPORATED**

After this workshop we identify the impacts with the highest risk score and demonstrate through our design how we have responded to these.

PURPOSE – WHAT THIS SESSION IS NOT

THIS SESSION IS NOT ABOUT:

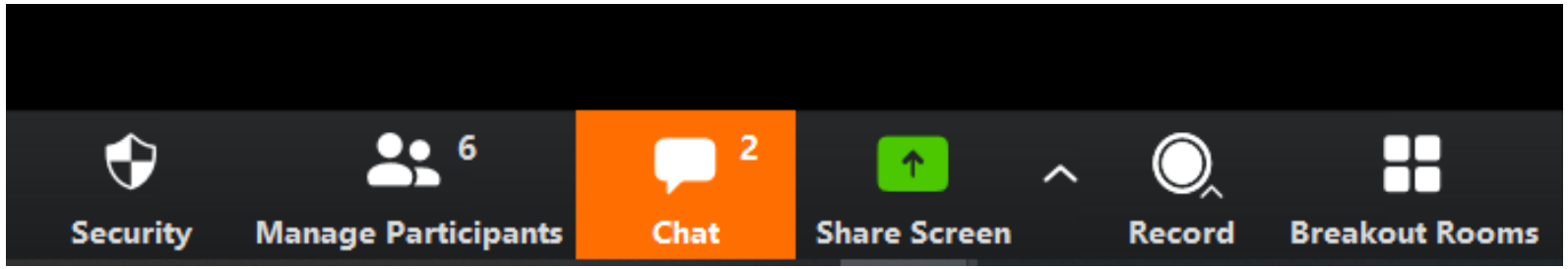
- Risk Scores
  - Calculated afterward
- Exploring or discussing existing design responses or elements
  - We do not get into discussions about how the building is designed, or what measures are already in place, e.g. flood construction levels, over-sized mechanical systems, architectural details

PROCESS

PAUSE

Any questions on timing?

Any questions on purpose?



NEXT: A DETAILED RUN THROUGH OF OUR WORKSHOP

PROCESS

STEP 1 – Validate

SENSITIVITY * EFFORT TO ADAPT = **VULNERABILITY**

STEP 2 - Score

CONSEQUENCE * PROBABILITY = RISK

HOT AND DRY
WIND
STORM SURGE

Scenario 2

CLIMATE HAZARDS EXPOSURE UNITS	EXTREME WIND	S	EA	V
Patients	Impact indoor air quality impacting air intake and exhaust systems			
	Loss of power without connection to emergency generator for over 48 hours resulting in significant impact to the health service delivery for substance abuse patients due to l[illegible]ones, computers, food pre[illegible]nal lighting (emergency [illegible]safety issue.			
	Substance [illegible] patient transfers due to loss of pow[illegible]ommunity health center resulting [illegible]ital emergency room [illegible]gestion.	H	M	H

1

Consequence Scoring Scale	Consequence Criteria									
Description	Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended)	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	Low potential for erosi[illegible]rust	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor [illegible] public trus[illegible]n authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
Catastrophic [5]	Widespread and severe disturbance resulting in long[illegible]	>25% of the [illegible] staff [illegible]	>25% of the [illegible]ents and [illegible]staff affected	Death or major harm, leading [illegible] permanent incapac[illegible] [illegible] individ[illegible]	Complete erosion of [illegible]st in health authority	Parliamentary questions, national long-[illegible]	Consequences would threaten provision of key services causing major problems for [illegible]	Significant disruption in business operation (virtually [illegible]	Hospital assets are completely damaged with irreversible loss	>$10M

2

VULNERABILITY ASSESSMENT

SENSITIVITY * EFFORT TO ADAPT = VULNERABILITY

IMPACT STATEMENT:

CLIMATE HAZARDS EXPOSURE UNITS	INCREASING TEMPERATURES	S	EA	V
Facility Maintenance & Operations	increasing temperatures will result in higher O&M costs, e.g., energy)	M	L	L

SENSITIVITY:

Sensitivity	Description
Low	Functionality will stay the same or likely stay the same. Barely affected.
Medium	Functionality is likely to get worse. Moderately affected.
High	Functionality will become unmanageable. Significantly affected.

EFFORT TO ADAPT

Effort to Adapt	Description
Low	Little or slight effort and intervention required.
Medium	Some effort and intervention required.
High	Significant or substantial effort and intervention required.

Effort to Adapt				
	High	Medium Vulnerability	High Vulnerability	High Vulnerability
	Medium	Low Vulnerability	Medium Vulnerability	High Vulnerability
	Low	Low Vulnerability	Low Vulnerability	Medium Vulnerability
		Low	Medium	High
		Sensitivity		

EXPOSURE CATEGORIES

EXPOSURE UNITS

Users

- Clinicians
- Patients
- Facilities O&M
- Community / Health Care

Building

- Envelope / Enclosure
- Materials
- Medical / Clinical Equipment
- Elevators
- Mechanical
- Electrical

Site

- Information & Communications Technology
- Landscape
- Mobility

Off-Site

- Water supply
- Transportation
- Sewerage
- Power
- Supply Chain
- Storm Sewer

SENSITIVITY * EFFORT TO ADAPT = **VULNERABILITY**

HOT AND DRY WIND STORM SURGE	Scenario 2			
CLIMATE HAZARDS EXPOSURE UNITS	EXTREME WIND	S	EA	V
Patients	Impact indoor air quality impacting air intake and exhaust systems	H	M	H
	Loss of power without connection to emergency generator for over 48 hours resulting in significant impact to the health service delivery for substance abuse patients due to loss of phones, computers, food preparation; minimal lighting (emergency only) a safety issue.			
	Substance abuse patient transfers due to loss of power in community health center resulting in hospital emergency room congestion.			

FROM VULNERABILITY TO RISK

BARC METHODOLOGY

Building Adaptive and Resilient Communities

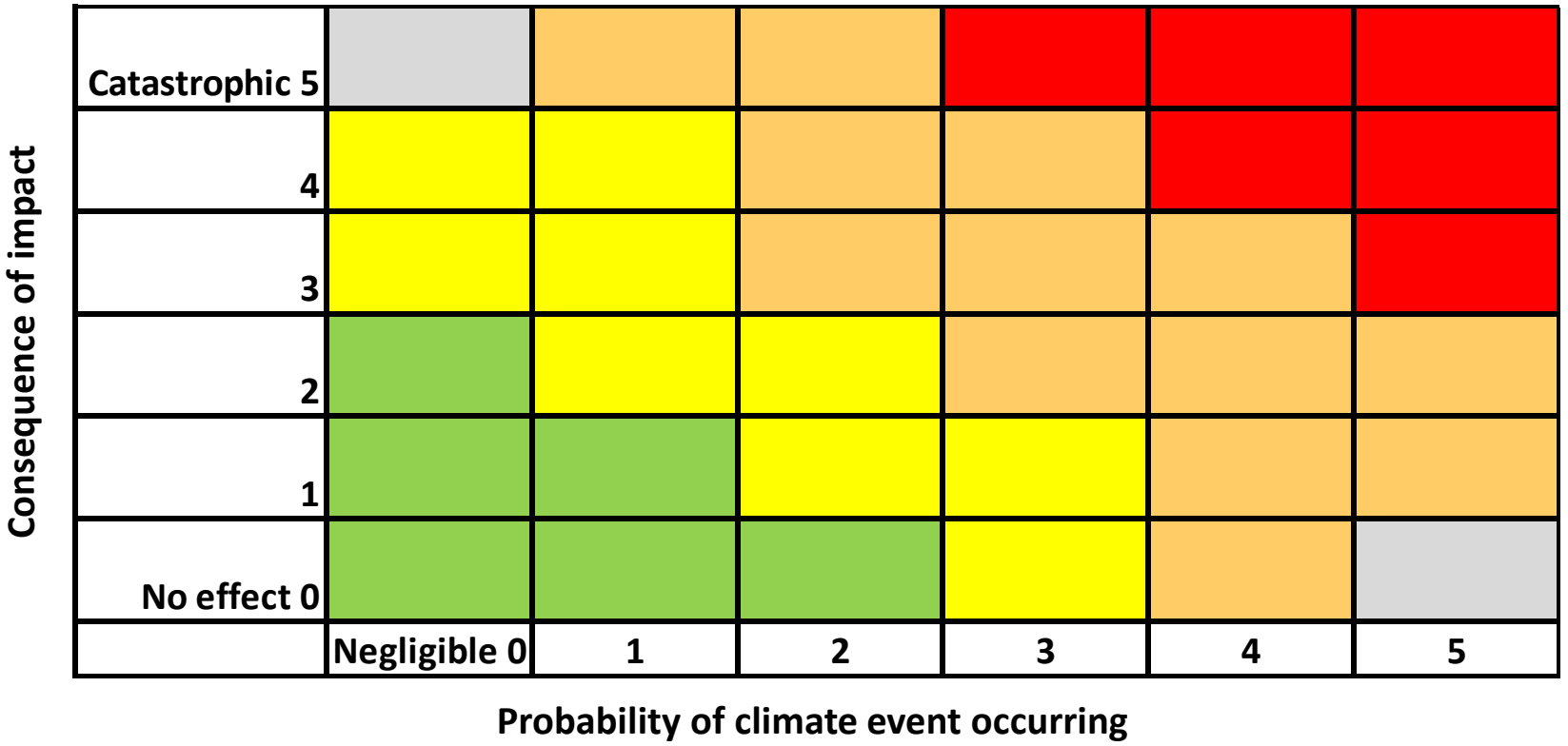
Take all Exposure Units that are High Vulnerability forward to determine their Consequence Score

RISK ASSESSMENT

CONSEQUENCE * PROBABILITY = RISK

Consequence *– what we will explore and score today*

Probability *– comes from climate science*

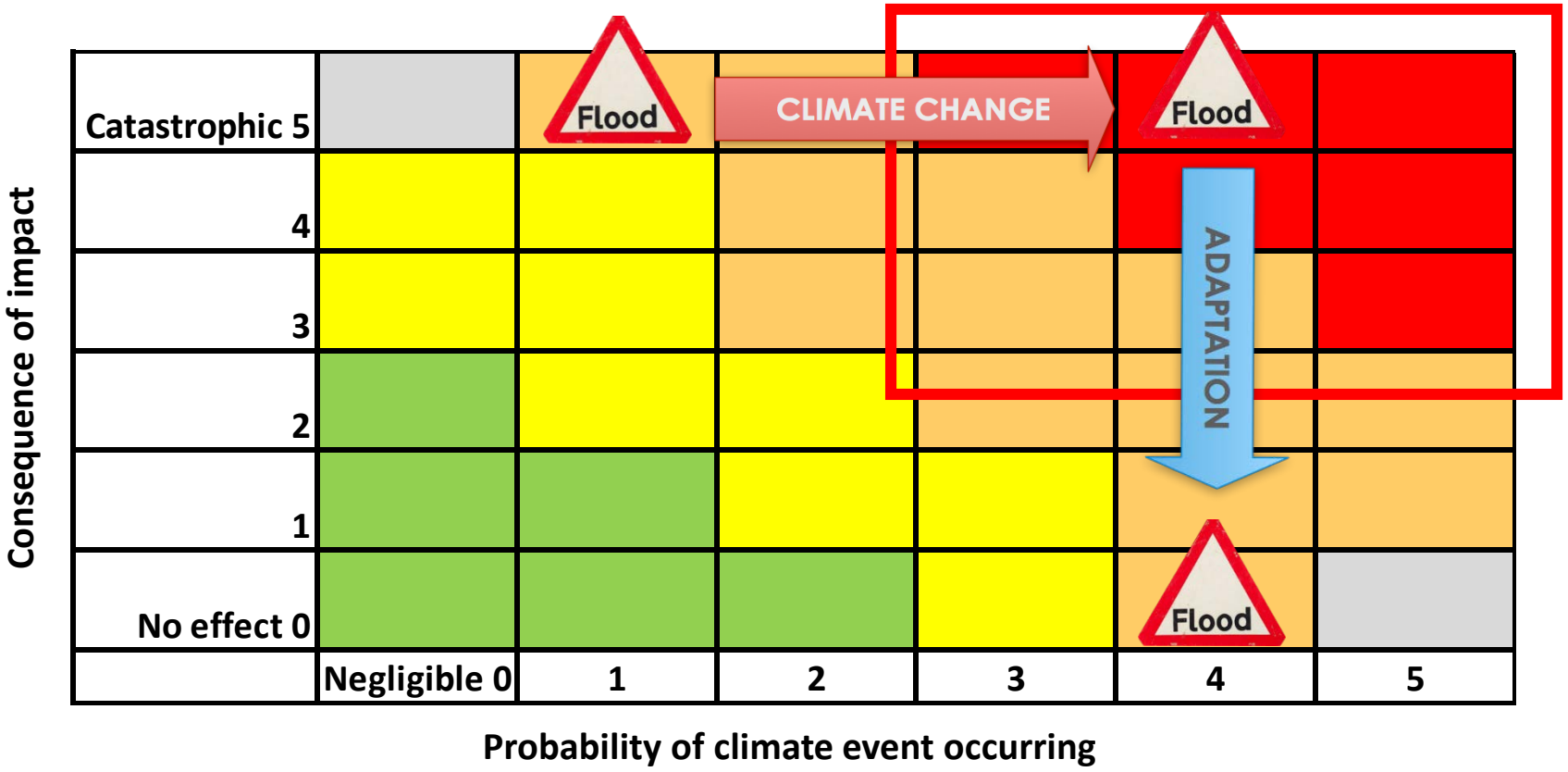


RISK ASSESSMENT

CONSEQUENCE * PROBABILITY = RISK

Following the workshop we will focus our efforts on documenting design measures and strategies that reduce our highest risks

Not part of today's work!



RISK ASSESSMENT

CONSEQUENCE SCORING – 10 CRITERIA TO ASSESS

Consequence Scoring Scale	Consequence Criteria									
Description	**Psychological impacts on patients and staff**	**Morbidity, injury, disease, or (extended) hospitalization of patients and staff**	**Patients and staff loss of life**	**Patients and staff safety**	**Loss of social cohesion**	**Public/Media**	**Health service delivery**	**Business continuity**	**Hospital assets**	**Monetary loss**
No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended)	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
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Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals	Complete erosion of public trust in health authority	Parliamentary questions, national long-	Consequences would threaten provision of key services causing major problems for	Significant disruption in business operation (virtually dysfunctional)	Hospital assets are completely damaged with irreversible loss	>$10M

RISK ASSESSMENT

CONSEQUENCE SCORING – WORK THROUGH EACH CRITERIA SEQUENTIALLY

Consequence Scoring Scale	Consequence Criteria									
Description	**Psychological impacts on patients and staff**	**Morbidity, injury, disease, or (extended) hospitalization of patients and staff**	**Patients and staff loss of life**	**Patients and staff safety**	**Loss of social cohesion**	**Public/Media**	**Health service delivery**	**Business continuity**	**Hospital assets**	**Monetary loss**
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CONSEQUENCE CRITERIA

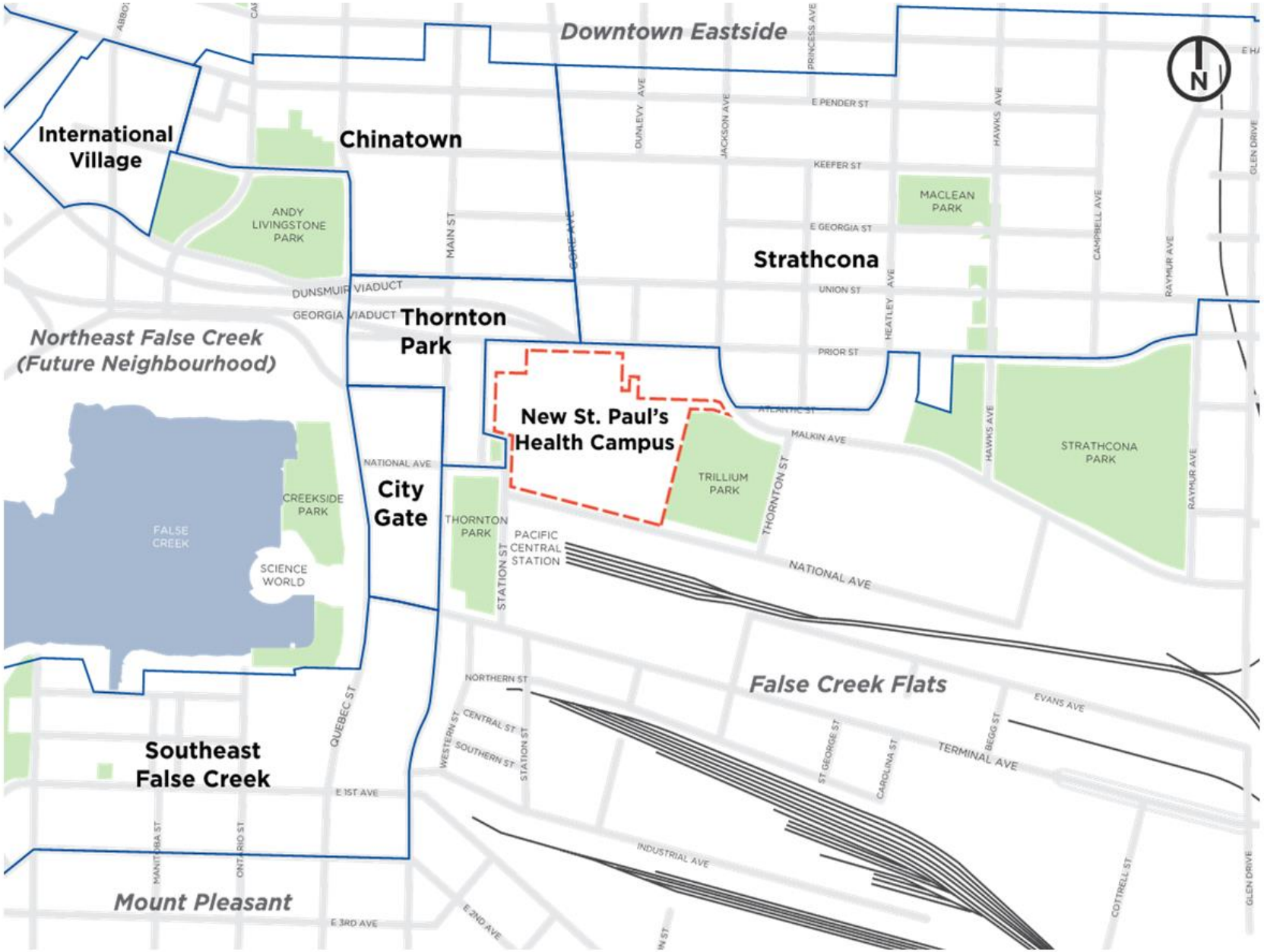
ASSESS THE WORST CASE OF ALL IMPACTS OCCURRING

Risk is about preparing for worst case scenarios and cascading impacts

HOT AND DRY WIND STORM SURGE	Scenario 2				Consequence Scoring Scale	Consequence Criteria									
CLIMATE HAZARDS EXPOSURE UNITS	EXTREME WIND	S	EA	V	Description	Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
Patients	Impact indoor air quality impacting air intake and exhaust systems	H	M	H	No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended)	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
	Loss of power without connection to emergency generator for over 48 hours resulting in significant impact to the health service delivery for substance abuse patients due to loss of phones, computers, food preparation; minimal lighting (emergency only) a safety issue.				Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	Low potential for erosion of public trust in health authority	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
	Substance abuse patient transfers due to loss of power in community health center resulting in hospital emergency room congestion.				Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor erosion of public trust in health authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
					Moderate [3]	Widespread moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	5%-15% of the patients and staff affected	5%-15% of the patients and staff affected	Moderate harm, requiring medical treatment, small number of individuals impacted	Moderate erosion of public trust in health authority	Some community complaints, local long-term media interest	Consequences would require significant review or changed ways of operating	Considerable impact in business operation with loss of revenue (days-long disruption)	Considerable impact upon access to hospital assets	$250K-$1M
					Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
					Catastrophic [5]	Widespread and severe disturbance resulting in long-term psychological impacts (e.g. post	>25% of the patients and staff affected	>25% of the patients and staff affected	Death or major harm, leading to permanent incapacity. Large numbers of individuals impacted	Complete erosion of public trust in health authority	Parliamentary questions, national long-term media	Consequences would threaten provision of key services causing major problems for patients, clients, and staff	Significant disruption in business operation (virtually dysfunctional)	Hospital assets are completely damaged with irreversible loss	>$10M
						No possibility for									

PROJECT SITE CONTEXT

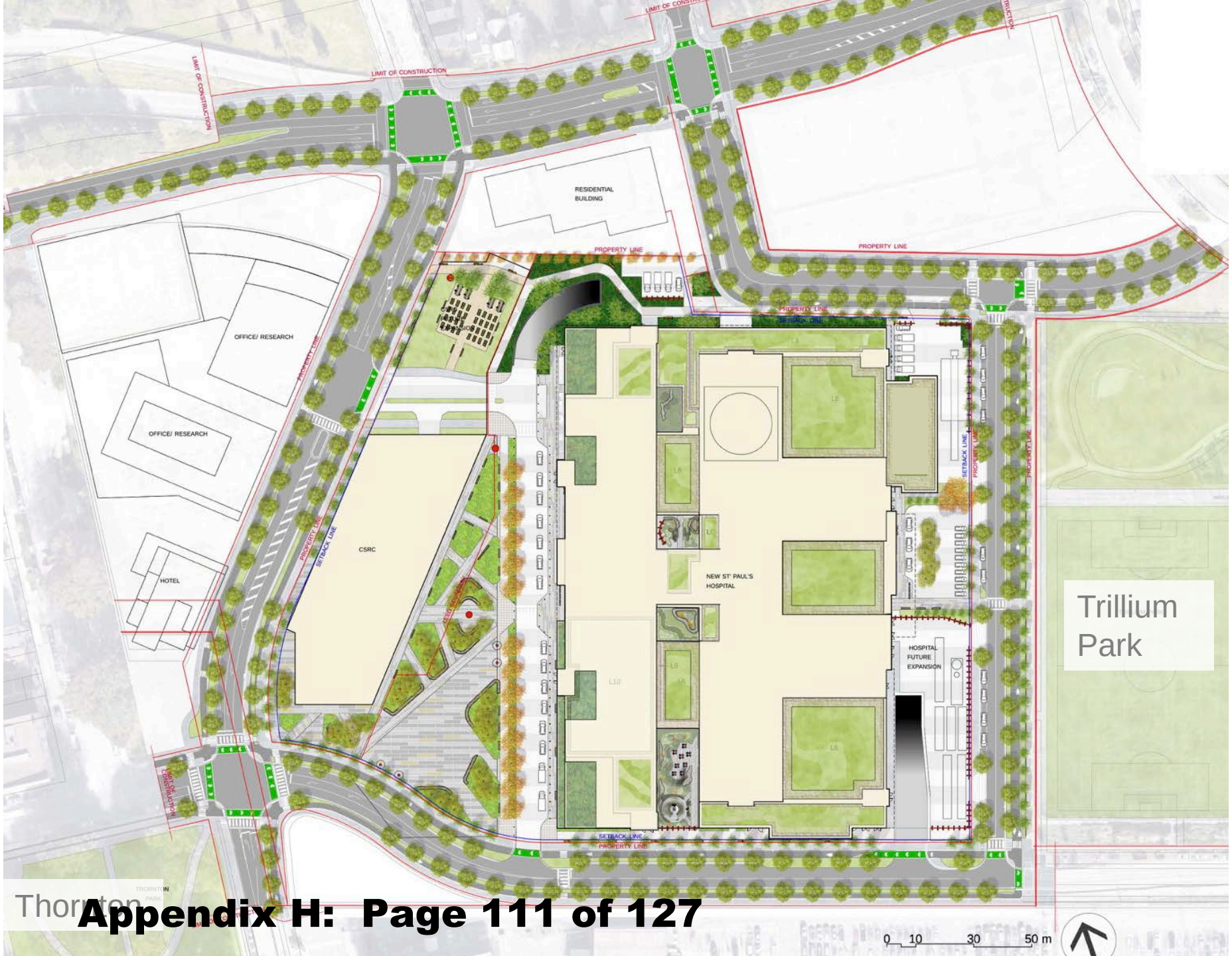
SITE CONTEXT



Map 1-1: 2016 Context Map for the new St. Paul's


ST. PAUL'S HOSPITAL

Master Plan


LIMIT OF CONSTRUCTION
RESIDENTIAL BUILDING
PROPERTY LINE
OFFICE/ RESEARCH
OFFICE/ RESEARCH
HOTEL
CSRC
SETBACK LINE
NEW ST' PAUL'S HOSPITAL
HOSPITAL FUTURE EXPANSION
Trillium Park
Thornton
0 10 30 50 m

STRESS TESTS AND CLIMATE HAZARDS

STRESS TESTS

SCENARIO 1: August 2053 – Hot and Dry

CLIMATE

- Temperatures in the region have been over 30°C for the past three weeks.
- Several days in the last week have reached daytime highs of 36°C and nighttime lows of 25°C. VCH issued an Extreme Heat Alert (i.e. 20% increase in fatality rate) on day two of the heat wave.
- This is year three of prolonged hot and dry conditions with unseasonably mild and dry winters.
- The annual average temperature has increased gradually over the past 35 years, and is now 2.9°C higher, whilst the warmest day in summertime is now 3.9°C warmer.
- Thirty years ago, Vancouver began experiencing tropical nights - whereby evening temperatures did not drop below 20°C - for the first time; since then, the number of tropical nights per year has increased from 0 to 15 by 2053.
- The temperature has not gone below -10°C since 2040.

REGIONAL IMPACTS

Water shortage: Level 4 water restrictions as per the BC Drought Response Plan (i.e. outdoor watering prohibited, 50L personal use /day)

Wildfires: Forest fires are significantly larger and more extensive than in the past. The wildfire season has expanded to start both earlier in the spring and last later into the fall. There are currently over a dozen small to mid-sized fires burning in the region – current conditions threaten to exacerbate this.

STRESS TESTS

SCENARIO 1: August 2053 – Hot and Dry

REGIONAL IMPACTS (continued)

High concentrations of **fine particulate** matter due to wildfire smoke from fires burning throughout the Pacific Northwest triggered an air quality alert issued by Metro Vancouver that has lasted for 2.5 weeks. The Smoky Skies Bulletin indicates that wildfire smoke will continue to affect regional air quality for the next 48 hours.

The **Air Quality Health Index** has been above level 10 - Very High Health Risk - for two weeks.

Drought and dry conditions: Increase the risk of fire by increasing the abundance of dry fuel causing concern about urban wildfires in the hospital's service delivery area.

Energy demand: BC Hydro's highest peak hourly demand is 15% higher, and high demand periods are significantly longer, than before the heat wave began. It breaks another record for summer power consumption for the third year in a row. Households with insecure sources of income are challenged to make monthly utility payments, resulting in heightened anxiety.

Community health: Increase in visits for heat stress, respiratory and cardiovascular illnesses, schizophrenia, mood disorders and neurotic disorders, particularly from vulnerable populations.

STRESS TESTS

SCENARIO 2: September 2053 – Strong Wind Event

CLIMATE

During a hot and dry period, a windstorm hits the City, bringing gusts of extreme wind measuring in at 110km/h (20% percent larger than in the past three-year average).

REGIONAL IMPACTS

Utilities: Power lines down across the region, 80,000 customers without power in the southwest region including businesses.

Transportation & transit: Many roads and public transit services are closed due to downed trees and power lines. Ferries and airports are closed for 24 hours.

Continuum of care: A critical mass of integrated services in the hospital's primary care and community health network have lost connectivity to the electrical grid for over 72 hours, resulting in the need to relocate patients including to the hospital as shelter-in-place is no longer an option due to shortage of supplies on-site and disrupted local supply chains.

Community: Trees that were weakened due to prolonged hot and dry conditions over the past three years result in more toppled trees, and related injuries, than experienced in the past.

STRESS TESTS

SCENARIO 3 December 2053 – Storm surge event

CLIMATE

- Large winter storm surge event has coincided with a king tide.
- The winter has been wet. Over the last day, 103mm of rain has fallen at the site, and 248mm has fallen on the north shore.
- Inundation of coastal infrastructure and localized flooding. Floodwater is at 4.8m.
- Urban flooding is exacerbated by debris blocking the municipality's drainage system.
- Climate change has been accelerating, and with current rates of melting, updated flood plain requirements for new buildings set ground floor levels at 5.4m.
- High winds have knocked down power transmission lines, causing outages throughout the city.

REGIONAL IMPACTS

Infrastructure: Critical infrastructure is underwater across the region, with sewage leaking into the environment.

Localized flooding: Contaminated water is pooling around the city as stormwater management systems in the downtown area are over capacity.

Landslides: Multiple slides have occurred on steeper slopes, and water quality is reduced.

Wind: Strong gusts (more than 130km/hr) associated with the storm have spread debris and knocked down power lines all over the city.

CLIMATE HAZARDS

CLIMATE HAZARDS

Temperature

- Extreme heat
- Increasing temperatures (gradual warming)
- Poor Air Quality (forest fires)
- Drought

Extreme events

- Extreme wind
- Extreme weather (winter storms)

Precipitation

- Intense & frequent rainfall

Sea-level rise

- Coastal flooding

STRESS TESTS

Stress Test #1 – August 2053 Hot and Dry

- Extreme heat
- Increasing temperatures (gradual warming)
- Poor Air Quality (forest fires)
- Drought

Stress Test #2 – September 2053 Strong Wind Event

- Drought
- Extreme wind

Stress Test #3 – December 2053 Storm Surge Event

- Extreme weather (winter storms)
- Intense & frequent rainfall
- Coastal flooding

HAZARDS FOR REVIEW

BREAKOUT GROUPS

STRESS TESTS

Wendy / Breakout Group 1

Bernadette / Breakout Group 3

Stress Test #1 – August 2053 Hot and Dry

- Extreme heat
- Increasing temperatures (gradual warming)
- Poor Air Quality (forest fires)
- Drought

Lourette / Breakout Group 2

Stress Test #2 – September 2053 Strong Wind Event

- ~~Drought~~
- Extreme wind

Norm / Breakout Group 4

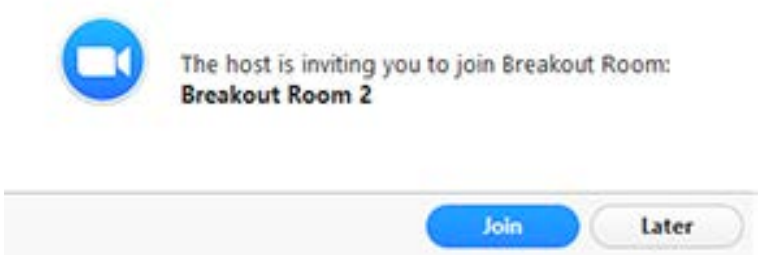
Stress Test #3 – December 2053 Storm Surge Event

- Intense & frequent rainfall
- Coastal flooding
- Extreme weather (winter storms)

DEMONSTRATION

Breakout Rooms

The host will assign you to your specific Breakout room.
You will see this pop up on your screen:



There will be a facilitator in each breakout room

Facilitators: If you need the host to join a specific breakout room:

Zoom Etiquette

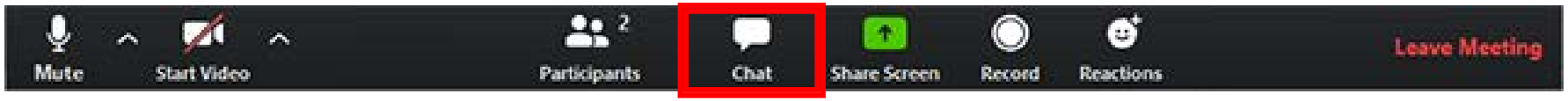
Mute / Unmute

You will automatically be muted when you enter the workshop

If you want to unmute yourself, click on the bottom left hand “Mute” Button in the bottom black bar

Chat / Conversation Options

Click on the “Chat” button in the bottom black bar



A preview message will appear at the bottom of your window and the “Chat” Icon will flash orange

DEMONSTRATION

PROCESS

- You will be sent to breakout rooms
- Your facilitator will introduce themselves and ask you to introduce yourself (name and title, go alphabetically by last name)
- Your facilitator will review the *Exposure Categories* and *Exposure Units*
- Your facilitator will review your specific *Climate Stress Test* and tell you which specific *Climate Hazard* you are starting with
- Practice on one *Exposure Unit* the *Vulnerability Rating* (Step 1) and *Consequence Criteria Scoring* (Step 2)

STEP 1 – VULNERABILITY RATING

- Your facilitator will work through each *Exposure Unit* in turn gathering input on:
    - Do you agree with the existing *Impact Statement* or wish to add any new *Impact Statements*?
        - Do you agree with or want to modify its *Vulnerability Rating (L,M,H)*?
    - Repeat for each Climate Hazard

STEP 2 – CONSEQUENCE CRITERIA SCORING

- Taking the *Exposure Units* with a *High Vulnerability Rating* the facilitator will move forward with the *Consequence Scoring:*
    - The facilitator will give you time to read and reflect on each Consequence Criteria Category
        - Score each relevant *Consequence Criteria Category (0-5)*
    - Repeat for each Climate Hazard

DEMONSTRATION

GROUP 4 – STRESS TEST 3 – STORM SURGE EVENT

		USERS				BUILDING						SITE			OFF-SITE					
Vulnerability Ratings	# High Vuln.	Clinicians	Patients	Facility O&M	Community / Health Care	Envelope / Enclosure	Materials	Medical / Clinical Equipment	Elevators	Mechanical	Electrical	Information & Comm. Tech. (ICT)	Landscape	Mobility	Water supply	Transportation	Sanitary Service / Sewerage	Power	Supply Chain	Local Drainage / Storm Sewer
COASTAL FLOOD	2	M	M	M	M	H	M	M	M	M	H		M	M	M	M	M		M	M
INTENSE & FREQUENT RAINFALL	2			M	M	H	M		M	M	H		M	M	M		M		M	M
EXTREME WEATHER (E.G. WINTER STORMS - SNOW, ICE)	2	M	L	H	L	M				M			L	M		M		H	M	

DEMONSTRATION

STEP 1 – Validate

SENSITIVITY * EFFORT TO ADAPT = **VULNERABILITY**

STEP 2 - Score

CONSEQUENCE * PROBABILITY = RISK

HOT AND DRY
WIND
STORM SURGE

Scenario 2

CLIMATE HAZARDS EXPOSURE UNITS	EXTREME WIND	S	EA	V
Patients	Impact indoor air quality impacting air intake and exhaust systems			
	Loss of power without connection to emergency generator for over 48 hours resulting in significant impact to the health service delivery for substance abuse patients due to [illegible]ones, computers, food pre[illegible]nal lighting (emergency [illegible]safety issue.			
	Substance [illegible] patient transfers due to loss of pow[illegible]mmunity health center resulting [illegible]ital emergency room [illegible]gestion.	H	M	H

1

Consequence Scoring Scale	Consequence Criteria									
Description	Psychological impacts on patients and staff	Morbidity, injury, disease, or (extended) hospitalization of patients and staff	Patients and staff loss of life	Patients and staff safety	Loss of social cohesion	Public/Media	Health service delivery	Business continuity	Hospital assets	Monetary loss
No consequence [0]	No psychological impacts on patients and staff	No possibility for morbidity, injury, disease, or (extended)	No possibility of patients and staff loss of life	Patients and staff safety will not be impacted	Trust in health authority remains unchanged	No community response, or media interest	Consequences will have no impact on health service delivery	No impact on business operation	No hospital assets are at risk	No monetary loss
Insignificant [1]	Minimal expected reactions of fear, anxiety, or disruption to daily routine	<2% of the patients and staff affected	<2% of the patients and staff affected	No intervention or treatment required	Low potential for erosi[illegible]rust	Very little community response, or media interest	Consequences will be dealt with by routine operations	Little impact on business operation (temporary nuisance)	Little disruption of non-critical hospital assets	<$10K
Minor [2]	Localized moderate disturbance resulting in temporary psychological impacts (e.g. feelings of fear and anxiety)	<5% of the patients and staff affected	<5% of the patients and staff affected	Isolated event. One individual impacted. Minor harm requiring first aid or minor intervention	Minor [illegible] public trus[illegible] authority	Isolated community complaints, local short-term media interest	Consequences would threaten the efficiency or effectiveness of some services, but would be dealt with internally	Minor impact on business operation as disruption mostly can be managed through standby or alternate options. However, some loss of revenue or cost occurs (hours-long disruption)	Minor short-term impacts(mainly reversible) on hospital assets	$10K-$250K
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Major [4]	Localized severe disturbance resulting in long-term psychological impacts (e.g. loss of identity, or sense of place)	15%-25% of the patients and staff affected	15%-25% of the patients and staff affected	Major harm, leading to long term incapacity or disability. Several individuals impacted	Major erosion of public trust in health authority	Negative community complaints, major loss of credibility, national short-term media interest	Consequences would threaten continued effective provision of services and require top-level management intervention	Major disruption in business operation with significant loss of revenue and market reputation (weeks-long disruption)	Extensive damage to hospital assets with wide spread impacts	$1M-$10M
Catastrophic [5]	Widespread and severe dis[illegible]rbance resulting in lo[illegible]	>25% of the [illegible] staff affected	>25% of the [illegible]ents a[illegible] affected	Death or major harm, leading to permanent incapa[illegible]y, large [illegible] individual[illegible]	Complete erosion of public [illegible]in h[illegible] authority	Parliamentary questions, national long-[illegible]	Consequences would threaten provision of key services causing major problems for [illegible]	Significant disruption in business operation (virtually [illegible]	Hospital assets are completely damaged with irreversible loss	>$10M

2

OUTCOME

Post-Workshop

- Analysis of results
- Probability assessment
- Risk assessment
- Define risk thresholds
- Develop climate risk adaptation and mitigation action table
  - Show how design considerations address high risks
- Document residual risk and third-party supplier risks
- Develop Climate Risk brief for review with CoV and Panel

QUESTIONS

You will have time in breakout groups for questions also

- **Introduction + Overview** **8:05-9:05am**
  - Process
  - Site Context
  - Climate Stress Tests
  - Demonstration + Questions
- BREAKOUT GROUPS 9:05-9:15am
- **Sample Exercise** **9:15-9:40am**
  - Group Introductions
  - Overview of Stress Tests & Exposure Units
  - Exposure Unit Vulnerability Validation + Consequence Scoring
- **Vulnerability Validation** **9:40-10:15am**
  - Climate Hazard A
  - Climate Hazard B
- BIG BREAK 10:15-11:00am
- **Consequence Scoring** **11:00-1:00pm**
  - Climate Hazard A
- SMALL BREAK
  - Climate Hazard B

Breakout Rooms

Shane O'Hanlon will support across breakout groups

Group 1	**Group 2**	**Group 3**	**Group 4**
Wendy Macdonald (lead)	***Lourette Swanepoel (lead)***	***Bernadette Middleton (lead)***	***Norman Shippee (lead)***
Guy Felio (support)			
Paul Watton- PCL	Adam Sabo - PCL M&E	Jackie Trach - PCL	Brent Frayne - PCL Electrical
Stuart Elgie - PCL Architectural shell & core	Troy Ransdell - PCL clinical	Sean Simpson - PCL	Rene Horn - PCL
Krystle Lim - PHC Technical	Clayton Wong - PHC Technical	Brian Postlethwaite-PHC Technical	Marc Dagneau - PHC Technical
Laarnie St-Laurent -PHC Clinical	Dimple Prakash - PHC Clinical	Claire MacEwing - PHC Clinical	Miriam Stewart - PHC Clinical
Alex Hutton- LMFM EES	Ghazal Ebrahimi - LMFM EES	Dan St. Onge - B.C. Hydro	Jennifer Coulthard - Fortis
Joe Stano - Compliance Passive House Cslt. (Kane)	Zlatko Puljic - Compliance Mech. Cslt. (AME)	Lex Webster- Compliance Elec. Cslt. (AES)	Compliance Architectural Cslt. (IBI)
Sebastian Huang, CoV Engineering	Brad Roberts - CoV Sewer	Samuel Li - CoV Water	Alex Charpentier - CoV NEU
Darren Lee - CoV Development	Lisa Brideau - CoV Sustainablity	Elizabeth Stanger - Indigenous / DTES	Camille Ciarinello - PHC Risk Management
	Darren Burns - PCL Architectural shell & core		Keith Der - CoV Sewer