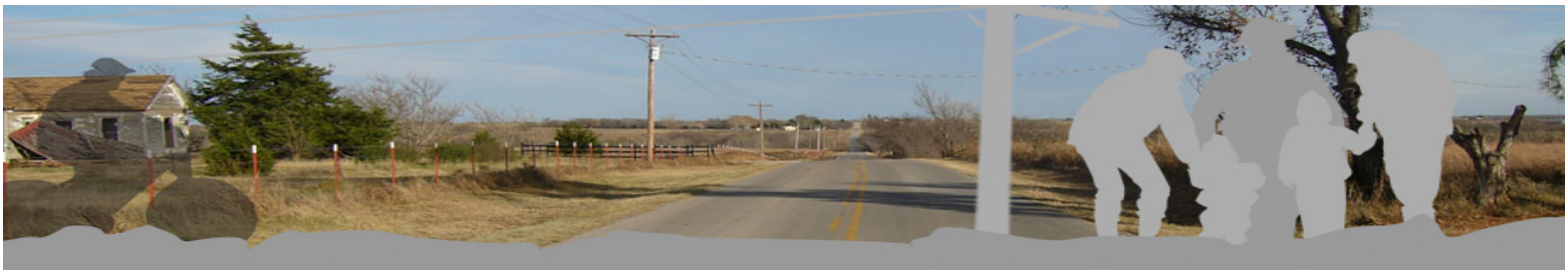

Hazard Resilience Index (HRI)

Geological Hazards (related to soil and earth)

Dust and Sand Storms
Erosion, Accretion and Desertification
Expansive Soils
Landslides
Land Subsidence and Sinkholes
Submarine Slides

Geological Hazards

Please refer to the *Hazard Resilience Index Instructions (HRI)* document for more information on using this document.

In order to avoid repetition, resiliency factors which only apply to human-caused hazards are in italics.

Dust and Sand storms [1 2 3]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check regularly with weather and air quality monitoring agencies such as Environment Canada to anticipate dust and sand storms generated locally or generated elsewhere that may blow into the community.	☐
☐	☐	☐	☐	Community-based dust and sand storm exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises).	☐

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☐	☐	☐	☐	Farmers minimize deep tillage in areas susceptible to dust and sand storms.	☐
☐	☐	☐	☐	If the dust and sand storms are severe or persist for an extended period, the community has plans to evacuate residents (especially those with respiratory diseases) to a designated shelter with dust-free air.	☐
☐	☐	☐	☐	*In order to prevent dust and sand storms communities have implemented appropriate strategies to reduce erosion, accretion (collection of dirt deposits)and desertification including: - re-vegetation of eroded areas with trees, shrubs or grasses; stabilization of dunes and slopes with branches or other materials pushed into the sand in a grid pattern; and establishment of wind breaks to control wind erosion*.	☐
☐	☐	☐	☐	*In order to prevent dust and sand storms communities limit businesses that use significant amounts of water (such as agricultural irrigation and houses with gardens that require large inputs of water) in areas susceptible to drought and desertification*.	☐
☐	☐	☐	☐	*In order to prevent local dust and sand storms communities have regulations that require farmers to, and limit land uses that, remove or alter vegetation (e.g., over-cultivation of agriculture, livestock over-grazing) or that require planting of vegetation on lands susceptible to wind erosion and desertification*.	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of potential dust and sand storms.	☐
☐	☐	☐	☐	There is a warning system in place to notify residents and farmers of dust and sand storms and to advise them to seek stable shelter for all family members and to shelter domesticated animals.	☐
☐	☐	☐	☐	When dust and sand storms are forecast, the community has plans in place to shut off community electrical power to avoid electrical fires.	☐

Erosion, Accretion (collection of dirt deposits) and Desertification [Natural and Human-Caused 4 5 6]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada to anticipate dry weather and wind storms that may cause wind erosion and dust and sand storms.	☐
☐	☐	☐	☐	Community-based discussions have taken place in the community-at-large (e.g., table-top or full-scale exercises) regarding erosion, accretion (collection of dirt deposits)and desertification.	☐
☐	☐	☐	☐	*In order to prevent local erosion, accretion (collection of dirt deposits)and desertification communities have regulations that require farmers to, and limit land uses that remove or alter vegetation (e.g., over-cultivation of agriculture, livestock over-grazing) or that require planting of vegetation on lands susceptible to wind erosion and desertification.*	☐
☐	☐	☐	☐	*In order to prevent local erosion, accretion (collection of dirt deposits)and desertification communities limit businesses that use significant amounts of water (such as agricultural irrigation and houses with gardens that require large inputs of water) in areas susceptible to drought and desertification.*	☐
☐	☐	☐	☐	*In order to prevent local erosion, accretion (collection of dirt deposits)and desertification communities implement appropriate strategies to reduce erosion, accretion (collection of dirt deposits)and desertification including: - re-vegetation of eroded areas with trees, shrubs or grasses; stabilization of dunes and slopes with branches or other materials pushed into the sand in a grid pattern; and establishment of wind breaks to control wind erosion.*	☐

Expansive Soils [7] [8]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Community-based discussions have taken place in the community-at-large regarding the potential for expansive soils.	☐
☐	☐	☐	☐	*Most residents living in areas with expansive soils have been educated about these hazards and know that structures built on expansive soils can be better protected if water does not infiltrate soils next to the foundation. This can be prevented by: maintaining soil sloping away from the building; placing gardens, grasses and trees requiring watering away from the building; and ensuring swimming pools and pipes do not leak moisture into soils near the foundation*.	☐
☐	☐	☐	☐	The community has geo-technical experts (experts in soil behavior and earth materials) regularly inspect and monitor areas susceptible to expansive soils.	☐
☐	☐	☐	☐	*The community requires new developments to have land checked by geotechnical professionals for expansive soils and if present the community has regulations that require engineering techniques to prevent building foundation damage, such as building foundations beneath the zone of water content fluctuation and adding non expansive materials to the soil*.	☐

Landslides – Natural and Human-Caused [9] [10] [11] [12] [13]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Communities have regulations that prohibit development, limit land use, or require hillside development practices for buildings located in landslide hazard areas, such as grading slopes to reduce steepness, using structural systems to increase slope resistance, or dewatering and redirecting drainage.	☐
☐	☐	☐	☐	*Communities work with utility companies to ensure that underground wiring or culverts do not lead to an increased risk of landslides down slope*.	☐
☐	☐	☐	☐	Community officials check frequently with weather forecasting agencies such as Environment Canada regarding major events that may trigger landslides, such as heavy precipitation or earthquakes.	☐
☐	☐	☐	☐	Community-based landslide exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐

☐	☐	☐	☐	*In developed areas subject to slope instability, communities and landowners have implemented appropriate strategies to reduce landslide hazards by: directing surface and ground water away from landslide areas; keeping or planting vegetation on slopes to stabilize soils; installing retaining walls to stabilize slopes.*	☐
☐	☐	☐	☐	In developed areas subject to slope instability, communities have used structural measures to redirect, or retain landslides away from roads and developments such as retention basins, deflection structures, or tunnels.	☐
☐	☐	☐	☐	Most residents living in high risk landslide areas check frequently with weather forecasting agencies such as Environment Canada or with seismic agencies such as Natural Resources Canada regarding major events that may trigger landslides, such as heavy precipitation or earthquakes.	☐
☐	☐	☐	☐	*Most residents living in high-risk landslide areas have been educated about landslide hazards and high risk areas and know to refrain from performing activities that can trigger landslide, such as blasting or slope alteration; maintaining soil sloping downhill; placing gardens, grasses and trees requiring watering away from slopes; and ensuring swimming pools and pipes do not leak moisture into slope soils.*	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of potential landslides	☐
☐	☐	☐	☐	There is a warning system in place to notify residents of potential landslides.	☐
☐	☐	☐	☐	There is a warning system in place to notify Search and Rescue (SAR) volunteers of potential landslides	☐

Land Subsidence and Sinkholes – Natural and Human-Caused 14 15

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Communities have regulations that prohibit development, limit land use, or require development buffers in areas susceptible for land subsidence or sinkholes.	☐
☐	☐	☐	☐	Community members have been educated about subsidence and sinkhole hazards and high risk areas to encourage voluntary land use restrictions and support for hazard mitigation planning.	☐
☐	☐	☐	☐	Community officials check regularly with geologists and monitor areas at risk of land subsidence and sinkholes.	☐
☐	☐	☐	☐	Community-based land subsidence and sinkhole exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	*In areas subject to subsidence and sinkhole risk, communities require or appropriate strategies to reduce hazards by: limiting rainwater infiltration by directing runoff and/or making ground surfaces impermeable; using flexible pipes; and preventing the decline of the water table.*	☐

☐	☐	☐	☐	*In areas subject to subsidence and sinkhole risk, communities require or appropriate strategies for erosion and sedimentation control such as using special building foundations; reinforcing road and railway infrastructure; and limiting further development through covenants, easements or land purchase*.	☐
☐	☐	☐	☐	Prior to issuing building or road permits, communities require experts to identify existing and potential subsidence and sinkhole areas.	☐
☐	☐	☐	☐	There is a warning system in place to notify police, fire and ambulance personnel of potential submarine slides	☐
☐	☐	☐	☐	There is a warning system in place to notify residents of potential submarine slides.	☐

Submarine Slides – Natural and Human-Caused [16 1718 19 20 21]

Hazard Resilience Rating	High Resilience ☐	Low Resilience ☐	Need More Info ☐	Not Applicable ☐

Yes	No	Need More Info	Not Applicable	FACTORS	This factor is important to my community
☐	☐	☐	☐	Communities have completed underwater mapping of areas susceptible to submarine slides and shared the maps with community and fishers.	☐
☐	☐	☐	☐	Community-based submarine slide exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)	☐
☐	☐	☐	☐	Development regulations in areas susceptible to submarine slides limit land use, prohibit development or require wind and flood resilient building features including elevated buildings and concrete walls.	☐
☐	☐	☐	☐	Dredging has taken place to avert potential submarine slides and/or *dredging activities are monitored and assessed for their potential to cause submarine slides.*	☐
☐	☐	☐	☐	Evacuation routes for a potential submarine slide are marked with visible signage.	☐
☐	☐	☐	☐	Plans are in place to develop and preserve coastal forests which act as protection against submarine slides.	☐
☐	☐	☐	☐	Residents are educated about submarine slides and know how and where to evacuate	☐

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