



Hazard Resilience Strategies

Geological Hazards

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

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

Dust and Sand storms ^{1 2 3}

- Ensure 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.
- Ensure community-based dust and sand storm exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises).
- Ensure 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, ensure 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 ensure 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 be sure to 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 ensure 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.*

- Ensure there is a warning system in place to notify police, fire and ambulance personnel of potential dust and sand storms.
- Ensure 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, ensure 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

- Ensure 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.
- Ensure 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 ensure 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 ensure 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 ensure 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

- Ensure community-based discussions have taken place in the community-at-large regarding the potential for expansive soils.
- *Ensure 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.*
- Ensure the community has geo-technical experts (experts in soil behavior and earth materials) regularly inspect and monitor areas susceptible to expansive soils

- *Ensure 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

- Ensure 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.
- *Ensure communities work with utility companies to ensure that underground wiring or culverts do not lead to an increased risk of landslides down slope.*
- Ensure 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.
- Ensure 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, ensure 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, ensure communities have used structural measures to redirect, or retain landslides away from roads and developments such as retention basins, deflection structures, or tunnels.
- Ensure 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.
- *Ensure 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.*
- Ensure there is a warning system in place to notify police, fire and ambulance personnel of potential landslides
- Ensure there is a warning system in place to notify residents of potential landslides.
- Ensure 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

- Ensure communities have regulations that prohibit development, limit land use, or require development buffers in areas susceptible for land subsidence or sinkholes.
- Ensure 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.
- Ensure community officials check regularly with geologists and monitor areas at risk of land subsidence and sinkholes.
- Ensure 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, ensure 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, ensure 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, ensure communities require experts to identify existing and potential subsidence and sinkhole areas.
- Ensure there is a warning system in place to notify police, fire and ambulance personnel of potential submarine slides
- Ensure there is a warning system in place to notify residents of potential submarine slides.

Submarine Slides – Natural and Human-Caused 16 17 18 19 20 21

- Ensure communities have completed underwater mapping of areas susceptible to submarine slides and shared the maps with community and fishers.
- Ensure community-based submarine slide exercises have taken place in the community-at-large (e.g., table-top or full-scale exercises)
- Ensure 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.
- Ensure dredging has taken place to avert potential submarine slides and/or *dredging activities are monitored and assessed for their potential to cause submarine slides.*
- Ensure evacuation routes for a potential submarine slide are marked with visible signage.
- Ensure plans are in place to develop and preserve coastal forests which act as protection against submarine slides.
- Ensure residents are educated about submarine slides and know how and where to evacuate
- Ensure there is a warning system in place to notify police, fire and ambulance personnel of potential submarine slides
- Ensure there is a warning system in place to notify residents of potential submarine slides.

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