

SUBSIDENCE, SINKHOLE

DEFINITION – Subsidence is a natural geologic process that commonly occurs in areas with underlying limestone bedrock and other rock types that are soluble in water. Water passing through naturally occurring fractures dissolves these materials leaving underground voids. Eventually, overburden on top of the voids causes a collapse which can damage structures with low strain tolerances. This collapse can take place slowly over time or quickly in a single event, but in either case. Karst topography describes a landscape that contains characteristic structures such as sinkholes, linear depressions, and caves. In addition to natural processes, human activity such as water, natural gas, and oil extraction can cause subsidence and sinkhole formations. (FEMA, 1997).



MITIGATION ACTIONS FOR RESIDENTS

- ▶ **Personal Preparedness** – It is important to plan for disasters. Families may not be together or at home. Consider completing the following to be prepared.
 - **Family Emergency Communication Plan** (FEMA) serves as a comprehensive checklist for household disaster preparedness. [FEMA Family Emergency Communication Plan Checklist](#)
 - **Family Disaster Plan** (American Red Cross) – Communication networks and electricity could be disrupted. Planning in advance will help ensure that all the members of your household know how to reach each other and where to meet up in an emergency. [American Red Cross Family Disaster Plan Template](#)
 - **Emergency Kits** – It is always a good idea to have an emergency kit on hand. Consider basic items as well as special needs.
 Build a Kit (Ready.gov) [ready.gov Build-a-Kit](#)
 Survival Kit Supplies (American Red Cross) [American Red Cross Survival Kit Supplies Checklist](#)
- ▶ **Be Informed** – Research geological conditions and history of subsidence, sinkholes in your area.
- ▶ **Know the Signs** – In homes and buildings, look for:
 - Cracks in your exterior of your home, such as in the block or stucco;
 - Cracks in interior areas along joints, windows, or doors;
 - Doors and windows that don't close properly;
 - Floors sloping and becoming uneven;
 - Muddy or cloudy well water.
- ▶ **On the property, check for:**
 - Previously buried items, such as foundations, fence posts and trees becoming exposed as the ground sinks;
 - Gullies and areas of bare soil, which are formed as soil is carried towards the sinkhole;

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- A circular pattern of ground cracks around the sinking area. Sudden earth cracking should be interpreted as a very serious risk of sinkhole or earth collapse.
 - Localized, gradual ground settlement;
 - Formation of small ponds, as rainfall accumulates in new areas;
 - Interrupted plumbing or electrical service to a building or neighborhood due to damaged utility lines;
 - Vegetation that wilts and dies as essential water is drawn away by the sinkhole;
 - Slumping or falling trees or fence posts;
 - Sudden ground openings; and
 - Sudden ground settlement.
- ▶ **Sinkhole Development** – If a sinkhole develops, do the following:
- Mark the hole for safety but restrict access.
 - *If the hole is very large, contact local police, municipal officials, and emergency responders, especially if the hole is a hazard to the public, affects an occupied dwelling, near a utility line, in a roadway, or on a sidewalk or trail.
 - *Contact a reputable geotechnical consulting firm that is familiar with working in karst so that they may provide you with an assessment of your situation and how to correct the problem.



MITIGATION ACTIONS FOR MUNICIPALITIES

- ▶ **Adopt the York County Hazard Mitigation Plan** by resolution or develop and implement a municipal hazard mitigation plan. [York County Hazard Mitigation Plan](#)
- ▶ **Mapping** – Map and assess subsidence, sinkhole susceptibility in your municipality.
- ▶ **Coordination** – Develop pre-disaster Memorandums of Agreements or Memorandum of Understanding with adjacent jurisdictions. Build partnerships (neighborhoods, emergency management/first responders, businesses, utility service providers, and local government agencies to strengthen response and recovery.
- ▶ **Public Education and Outreach** – Educate residents regarding risk and impact of hazards, how to prepare and protect themselves and their property. Facilitate funding for mitigation measures and technical assistance programs that address measures that citizens can take.
- ▶ **Development Regulations** – Implement development regulations in areas considered to be at risk for subsidence or sinkholes. This can include restrictions on development, vegetated buffers, and planting of vegetation.

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- ▶ **Acquisition** – Remove existing structures from subsidence hazard areas.