Any building has the potential to have challenges from subsurface water and soil moisture simply because the building has direct contact with the soil. However, the building practices to protect a given building depend upon the site soil characteristics and seasonal and permanent water table depths, along with the building foundation type. Types of building foundations to be addressed include concrete wall and foundations for shallow crawl spaces, deep basements, partial or walkout basements as well as slab-on-grade and post-frame construction foundations.

Three different strategies are typically implemented to control subsurface water and soil moisture. These strategies include the following:

1. **Control or Minimize Subsurface Water** – Use foundation or footing drainage to remove subsurface water from contacting the building foundation and footings.

   Foundation and footing drainage provides the base control of subsurface water by removing the water from the soil next to the building. Keeping water away from a building foundation protects the building from frost-heave problems and minimizes any unwanted water leakage into a building’s basement. Two publications provide detailed discussions about foundation drain systems for slab-on-grade construction, crawl space foundation construction and basement wall foundation construction. The first one is “Moisture Control Guidance for Building Design, Construction and Maintenance” (available from the U.S. Environmental Protection Agency at www.epa.gov/sites/production/files/2014-08/documents/moisture-control.pdf). The second one is “Build a Better Home: Foundations” (available from APA – The Engineered Wood Association at www.apawood.org). The APA publication focuses on home construction but the foundation information is applicable for any building that uses wood frame construction on top of a concrete foundation system.

   Either a seasonal or permanent high water table can adversely impact a building’s foundation. A properly designed and installed foundation drainage system can lower the elevation of a water table. The water table can be lowered because the foundation drains allow subsurface water to drain out of the soil around the building foundation. The resulting subsurface water-free zone provides a place for a building foundation to exist without being impacted by subsurface water in contact with the building foundation. The ability of a foundation drainage system to lower a water table is discussed in more detail and shown in Figure 1 from the APA “Build a Better Home: Foundations” publication.

   A post-frame building foundation can be protected from subsurface water using a foundation drainage system if a high water table is found on a post-frame building site. The drainage system must be placed outside (typically two feet or more) of the post foundations and at a lower elevation than the bottom of the post foundation pads. The installation of a foundation drainage system must not impact the post foundations, which must be free of subsurface water to minimize frost-heave issues.

2. **Minimize Surface Water Infiltration** – Implement building foundation construction practices and surface water drainage practices to minimize surface water infiltrating close to building.

   A post-frame building foundation can be protected from subsurface water using a foundation drainage system if a high water table is found on a post-frame building site. The drainage system must be placed outside (typically two feet or more) of the post foundations and at a lower elevation than the bottom of the post foundation pads. The installation of a foundation drainage system must not impact the post foundations, which must be free of subsurface water to minimize frost-heave issues.
Surface water that infiltrates into the soil becomes subsurface water. The key is to minimize surface water infiltration near a building. As discussed in part two of this series, good site drainage must be established so surface water drains away from building. However, foundation drain systems need to be protected from surface water infiltration flooding. Many foundation resources will show the need for granular backfill or gravel to be placed against a basement foundation wall, especially on building sites with clay and/or highly expansive soils. The granular or gravel backfill helps protect the foundation wall from high soil pressures when soils expand during wet periods. A low permeability soil needs to be placed at least six to eight inches thick to minimize surface water infiltration directly into the granular or gravel backfill. If the granular backfill is installed from the drainage system to the top of the finish grade around a building, rainwater is likely to drain directly into the gravel backfill especially during heavy and extended rainfall events. When rainfall directly enters a foundation drainage system, the drainage system typically becomes flooded because the typical 4-inch perforated drainage pipe is not nearly large enough to serve as a storm water drainage system. If a building basement with a basement foundation often becomes wet during heavy or extended rainfall periods, check to see if rainwater can easily enter the foundation drainage system.

3. Protect from Soil Moisture
   – Install vapor barriers and capillary breaks to protect the building from soil moisture penetration

Soil moisture exists in soil even when all subsurface water has been drained out of the soil. Capillary water in the soil can often cause moisture problems inside building spaces that are in contact with the soil when building foundation components are not protected from soil moisture. The specific details for protecting a building foundation from soil moisture varies depending upon the building foundation construction system. The two publications mentioned earlier provide detailed discussions and diagrams on how to protect different foundations from soil moisture. In general, gravel (often 3/4 inch diameter) or damp proofing methods provide a capillary break protecting the foundation from capillary moisture movement. A vapor barrier, often polyethylene film, minimizes moisture vapor movement from the soil into the building space.

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