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GROUND WATER IN CRAWL SPACES

Steps to take to prevent water in crawl spaces.

During the process of designing a structure owners should carefully consider the site and ways to prevent water from accumulating in the crawl space. Prevention is always the best solution. Begin by identifying areas that may have a high water table. This can be difficult during the dry months. Talk to experienced people such as septic designers, excavation contractors, County Planning & Environmental Health staff, and owners of neighboring parcels. *Ask questions.*

If you believe there may be a high water table that could potentially flood the crawl space take action during the design and planning stages of your project. Below are recommended steps to take that will help reduce the risk of flooding in crawl spaces.

Prevention:

- 1) Find a location on your property that will meet all setback requirements, located on the highest ground possible. In addition, look for an area to direct drainage away from potential building site(s).
- 2) To compensate for any ground water that may enter under the structure, you may need to raise the height of foundation walls to so that you can increase the ground level inside the crawl space. See International Residential Code (IRC), Sections 408.5,408.6 #2 and International Building Code (IBC), Section 1807.1.2.
- 3) Outside the crawl space, make sure required footing depths are maintained and that the finished grade falls a minimum of 6-inches within the first 10-feet. See IRC Section R401.3 & IBC Section 1807.4.2.
- 4) In serious situations you may want to consider pouring a concrete slab inside the crawl space. Slabs should be sloped to accommodate a sump pump. See IRC section R405.2.3 & IBC1807.1.3.
- 5) Foundation drains shall be installed in accordance to IRC Section R405.1 & IBC Section 1807.4.2. Additional recommendations would include installing a **tight line** system for downspouts connected to a properly sized infiltration-drywell system. You may need to consult a soils engineer for assistance.
- 6) The following clearances must be maintained:
 - a) Wood joists or structural floor systems shall not be less than 18” and wood beams and girders shall not be less than 12” to the exposed ground. See IRC Section R319.1 #1
 - b) Mechanical clearances must be maintained in accordance to the International Mechanical Code Sections 301.13, 304.9, & 401.5.3. (Dryer vents, exhaust and heating ducts, etc.)

Clearances must be maintained during all times of the year. The owner/builder is responsible to make provisions during the design and building stages to make sure clearances can be maintained.

- 7) Moisture content greater than 19% can affect structural integrity of materials and may pose health concerns. It is the responsibility of the owner/contractor to take precautions to assure compliance. At no time after occupancy of the structure should design flaws allow building material moisture content to exceed 19% per IBC and NDS standards.

See code sections on reverse side

International Residential Code

R317.1 Location required. Protection from decay shall be provided in the following locations by the use of naturally durable wood or wood that is preservative treated in accordance with AWPA U1 for the species, product, preservative and end use. Preservatives shall be listed in Section 4 of AWPA U1.

1. Wood joists or the bottom of a wood structural floor when closer than 18 inches (457 mm) or wood girders when closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated area located within the periphery of the building foundation.

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection so as to not create a hazard. Lots shall be graded so as to drain surface water away from foundation walls. The grade away from foundation walls shall fall a minimum of 6 inches (152 mm) within the first 10 feet (3048 mm).

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), drains or swales shall be provided to ensure drainage away from the structure.

R405.1 Concrete or masonry foundations. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend at least 1 foot (305mm) beyond the outside edge of the footing and 6 inches (153 mm) above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper, and the drainage tiles or perforated pipe shall be placed on a minimum of 2 inches (51 mm) of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (153 mm) of the same material.

Exception: A drainage system is not required when the foundation is installed on well-drained ground or sand gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in Table R405.1.

R405.2.3 Drainage system. In other than Group I soils, a sump shall be provided to drain the porous layer and footings. The sump shall be at least 24 inches (610mm) in diameter or 20 inches square (0.0129 m²), shall extend at least 24 inches (610mm) below the bottom of the basement floor and shall be capable of positive gravity or mechanical drainage to remove any accumulated water. The drainage system shall discharge into an approved sewer system or to daylight.

R408.6 Finished grade. The finished grade of under-floor surface may be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches (152 mm) of the finished floor at the building perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the under floor space shall be as high as the outside finished grade, unless an approved drainage system is provided.

R408.7 Flood resistance. For buildings located in areas prone to flooding as established in Table R301.2(1):

1. Walls enclosing the underfloor space shall be provided with flood openings in accordance with Section R324.2.2.
2. The finished ground level of the underfloor space shall be equal to or higher than the outside finished ground level.

Exception: Underfloor spaces of Group R-3 buildings that meet the requirements of FEMA/FIA TB 11-1.

International Building Code (IBC)

1807.1.2.1 Flood hazard areas. For buildings and structures in flood hazard areas as established in Section 1612.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level.

1807.4.2 Foundation drain. A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-per cent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend a minimum of 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1807.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

1807.4.3 Drainage discharge. The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *International Plumbing Code*.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

International Mechanical Code (IMC)

301.13 Flood hazard. For structures located in flood hazard areas, mechanical systems, equipment and appliances shall be located at or above the design flood elevation.

Exception: Mechanical systems, equipment and appliances are permitted to be located below the design flood elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood-resistant construction requirements of the *International Building Code*.

304.9 Clearances from grade. Equipment and appliances installed at grade level shall be supported on a level concrete slab or other approved material extending above adjoining grade or shall be suspended a minimum of 6 inches (152 mm) above adjoining grade.

401.4.3 Flood hazard. For structures located in flood hazard areas, outdoor exhaust openings shall be at or above the design flood elevation.