

Description

Water management is an important part of the design and construction of the home. A complete water management strategy will deflect water that comes in contact with the building envelope, and also divert the water down and away from the house where it can harmlessly flow away. Keeping water from entering the house is critical to ensure the long-term structural integrity of the building as well as to reduce the chances of mold issues and poor indoor air quality.

A well-sealed foundation or crawlspace will keep the water from entering the home, but to finish the task of water management, you must also create a path for water to flow away from the home and be discharged a safe distance away. Allowing water to collect around the foundation will eventually lead to unacceptable levels of soil saturation and ultimately could overcome any water sealing practices used to protect the foundation.

To ensure that water collecting around the foundation has an easily accessible path away from the home, you should:

1. Install protected drain tile at the footings of the basement and crawlspace walls that will discharge to outside grade (daylight), or
2. Install protected drain tile at the footings of the basement and crawlspace walls that will discharge to the home's sump pump.



Figure 1 - Drain Tile with Protective Cover. Drain tile is not tile at all but actually corrugated pipe with small perforations. This image shows drain tile with a protective filter cover that keeps silt and sand from clogging the system. 

Installing Protected Drain Tile that Discharges to Daylight

Drain tile is corrugated plastic pipe placed along side the footing. The pipe is perforated to allow water to flow into the drain tile, which helps divert water away from the bottom of foundations. When installed correctly, the drain tile can capture liquid water and transport it away from the foundation where it can be discharged. The discharge point is often called “to daylight,” which is at least 10 feet away from the foundation or a suitable alternative. (See [Patio Slabs, Porch Slabs, Walks, and Driveways](#)—for more information about discharging water away from the foundation.) Any water that finds its way to the footing area will be carried away by the system. Poor installation of the pipe system often prevents it from accomplishing this drainage function.

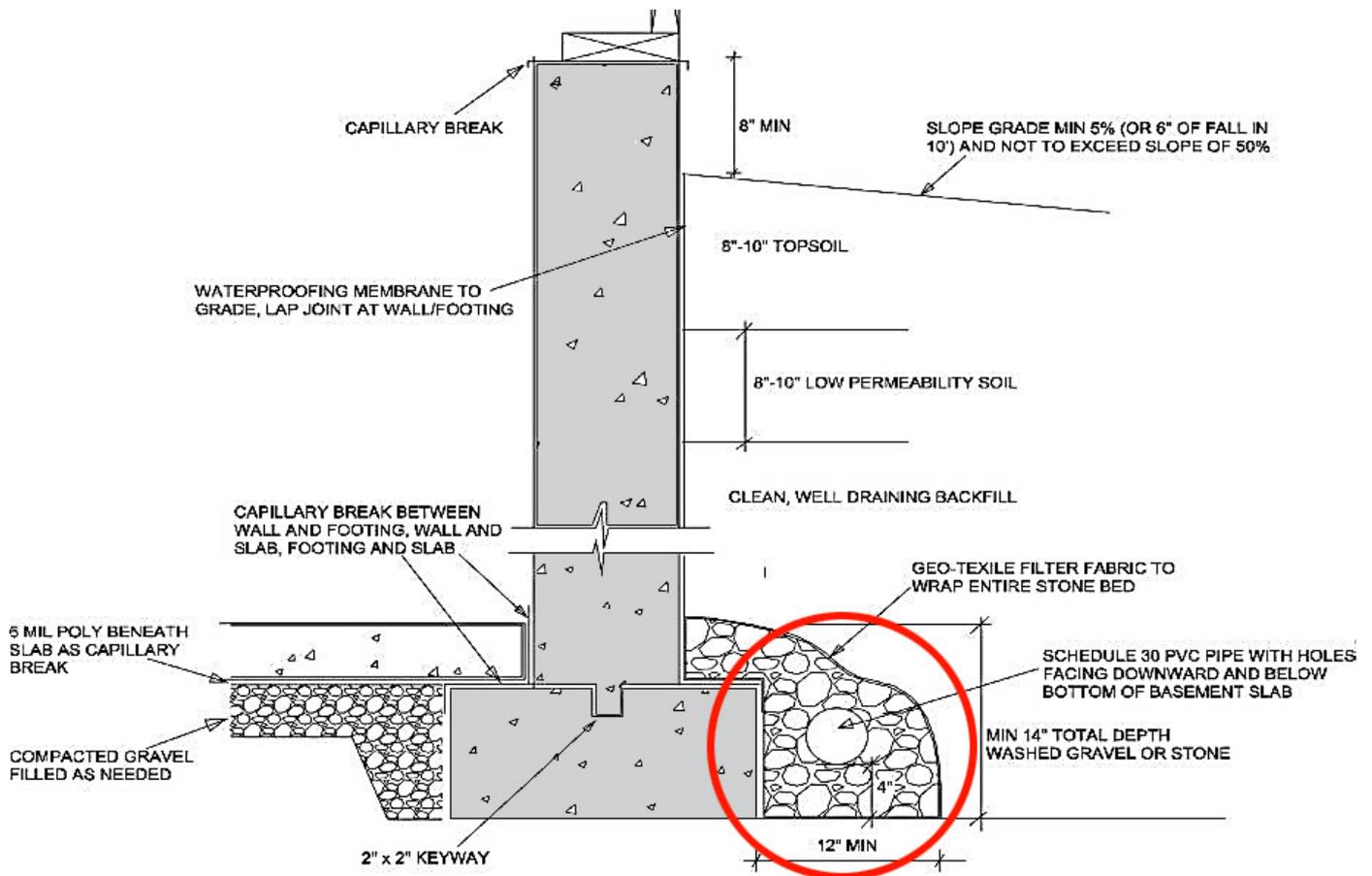


Figure 2 - Drain Tile Cross-Section. This image shows the relative placement of the drain tile to the foundation wall. Note that the geo-textile filter fabric must be installed to cover the entire bed of gravel in the trench. ⓘ

To ensure that this measure is successfully accomplished, you must:

1. Dig a trench large enough to accommodate the filter fabric, drainage tile, and gravel. The trench should allow 6 inches of space around the pipe, which means it will usually have to be at least 16 inches deep and 16 inches wide to fit a standard 4-inch pipe with protective cover. Because the drain tile will be installed at a height that is lower than the bottom of the concrete slab or crawlspace floor, the trench must be at least 10 inches deeper than the top of the footing or slab.
2. Slope or level the trench so that when the drainage tile is installed, water will readily flow to the lowest point (i.e., the discharge pipe).
3. Lay the filter fabric, usually called geo-textile fabric, on the bottom of the trench. When complete, the entire drainage tile and gravel bed will be surrounded by filter fabric, so leave ample surplus to ensure there is enough fabric to cover the area.
4. Lay a 6-inch layer of ½- to ¾-inch washed or clean gravel in the trench. It is important that the gravel be free of fines (i.e., clean) because silt and sand in the gravel will eventually clog the drain tile perforations or build up in the bottom of the pipe and reduce the effectiveness of the drainage system.
5. Install the drainage tile. Secure all the connections to make a complete drainage system around the entire foundation, including a non-perforated pipe that leads to the discharge location. (See [Patio Slabs, Porch Slabs, Walks, and Driveways](#)—for more information about discharging water away from the foundation.)
6. Once the drainage tile is connected, cover the system with a 6-inch layer of ½- to ¾-inch washed or clean gravel.
7. Wrap the drainage tile and gravel in the filter fabric to further protect the system from silt and sand.

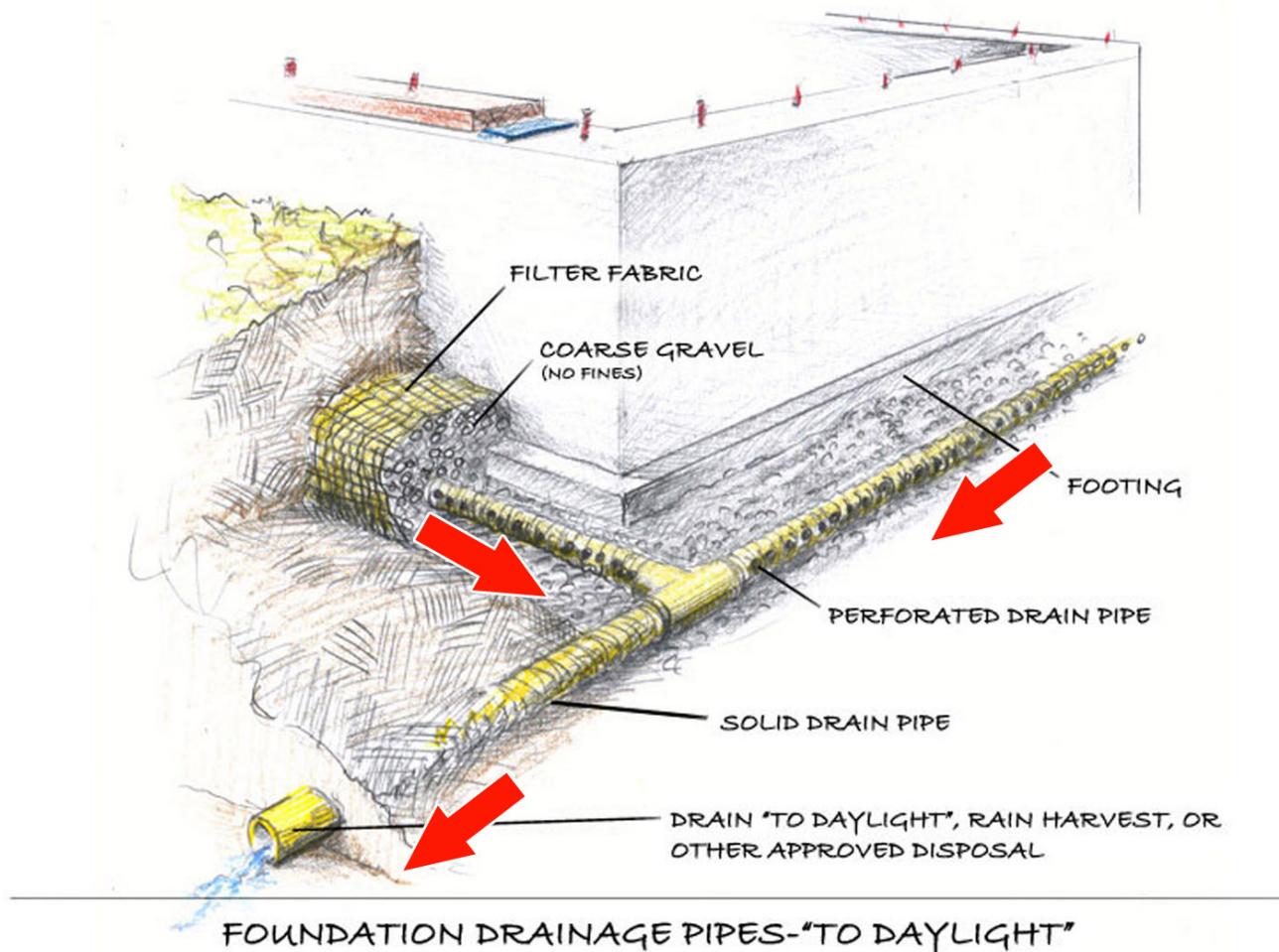
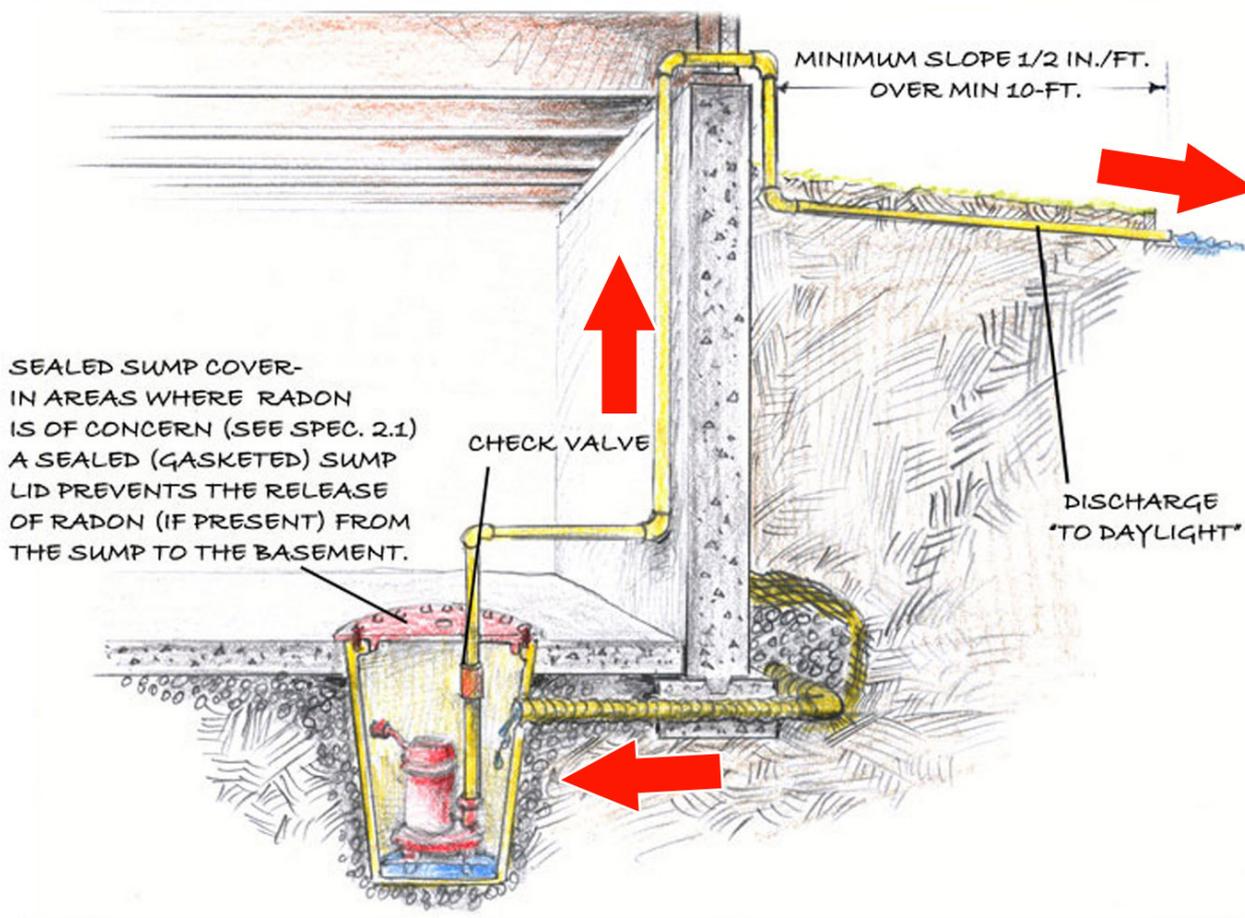


Figure 3 - Properly Installed Drain Tile Discharging to Daylight. This image shows the position of the drain tile when properly installed. The drain tile is positioned next to the footing and is connected to solid drain pipe to discharge to daylight. ⓘ

Installing Protected Drain Tile that Discharges to a Sump Pit

If the home will use a sump pump to remove water from under the foundation slab, the drainage tile may use the sump crock or pit as the discharge point. The process for installing drainage tile that discharges to a sump pit is exactly the same as the process for installing drainage tile that discharges to daylight; however, as described below, the process for connecting to the discharge pipe is slightly different.

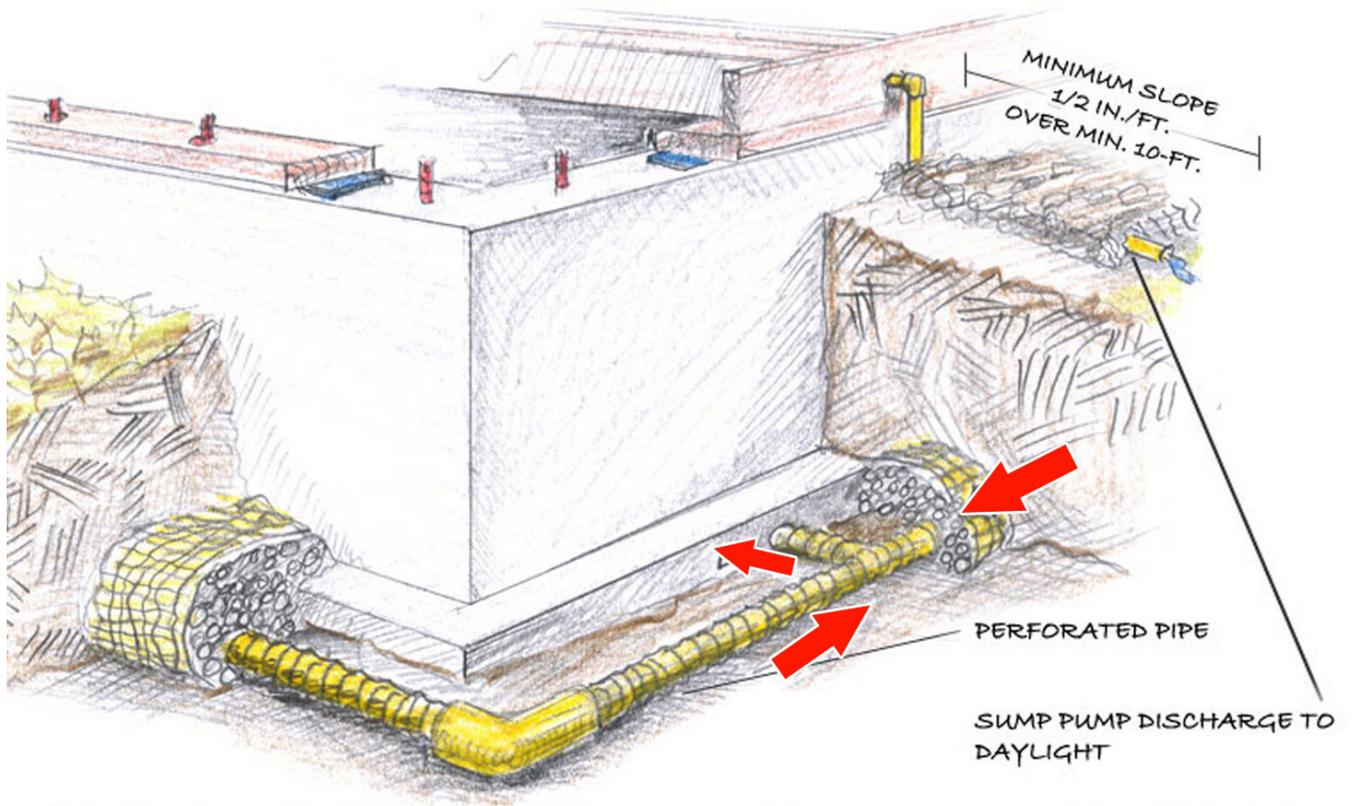


SUMP PUMP REMOVAL OF WATER

Figure 4 - Drain Tile with a Sump Pump System. This image shows the position of the drain tile that will discharge to the sump pit and be pumped out and away from the foundation. Note that the drainage tile and non-perforated drain pipe are both located below the foundation slab. 

The steps for installing drain tile that diverts water to a sump pump are as follows:

1. Prior to pouring the concrete slab or foundation, establish where the sump pit or crock will be located and extend a piece of 4-inch non-perforated pipe from the pit to the exterior of the house, leaving at least 12 inches of pipe to extend beyond the footing. The pipe should be imbedded in the gravel capillary break below the foundation or slab.
2. Pour the foundation, taking care to not damage the drainage pipe.
3. After the concrete has set, follow the same instructions as listed above with one exception:
 1. In step 5 above, install the non-perforated pipe to lead to the sump pit. As shown in the illustration above and below, the sump pump then discharges the water. The discharge point is often called "to daylight," which is at least 10 feet away from the foundation or a suitable alternative. (See [Patio Slabs, Porch Slabs, Walks, and Driveways](#)—for more information about discharging water away from the foundation.)



FOUNDATION DRAINAGE PIPES - TO SUMP

Figure 5 - Properly Installed Drain Tile Discharging to a Sump Pit. This image shows the exterior of the foundation and placement of the drainage tile that diverts water to the sump pit. 

Ensuring Success

In order to ensure the drainage system is installed properly, it is important that only clean gravel, free of fines, be used in the trench around the drain tile. Gravel that has sand or silt will foul the perforations in the drain tile and eventually diminish the system's ability to divert water away from the foundation.

Also, a properly installed drain tile works in combination with the discharge of the water away from the foundation. Therefore, see [Patio Slabs, Porch Slabs, Walks, and Driveways](#) for additional guidance in discharging water away from the foundation.

Climate

No climate specific information applies.

Training

Right and Wrong Images



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CAD

None Available

Compliance

The Compliance tab contains both program and code information. Code language is excerpted and summarized below. For exact code language, refer to the applicable code, which may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our [webmaster](#) if you find broken links.

[ENERGY STAR Certified Homes](#)

ENERGY STAR Certified Homes (Version 3/3.1, Revision 08), Water Management System Builder Requirements

1. Water-Managed Site and Foundation:

1.8 Drain tile installed at basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ? 6 in. of ½ to ¾ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump. If drain tile is on interior side of footing, then channel provided through footing to exterior side.⁸

Footnotes:

(8) Alternatively, either a drain tile that is pre-wrapped with a fabric filter or a Composite Foundation Drainage System (CFDS) that has been evaluated by ICC-ES per AC 243 are permitted to be used. Note that the CFDS must include a soil strip drain or another ICC-ES evaluated perimeter drainage system to be eligible for use. In an existing home (e.g., in a home undergoing a gut rehab.) a drain tile installed only on the interior side of the footing without a channel is permitted. Additionally, a drain tile is not required when a certified hydrologist, soil scientist, or engineer has determined that a crawlspace foundation, or an existing basement foundation (e.g., in a home undergoing a gut rehab.), is installed in Group I Soils (i.e. well-drained ground or sand-gravel mixtures), as defined by 2009 IRC Table R405.1.

Builders Responsibilities: It is the exclusive responsibility of builders to ensure that each certified home is constructed to meet these requirements. While builders are not required to maintain documentation demonstrating compliance for each individual certified home, builders are required to develop a process to ensure compliance for each certified home (e.g., incorporate these requirements into the Scope of Work for relevant sub-contractors, require the site supervisor to inspect each home for these requirements, and / or sub-contract the verification of these requirements to a Rater). In the event that the EPA determines that a certified home was constructed without meeting these requirements, the home may be decertified.

ENERGY STAR Revision 08 requirements are required for homes permitted starting 07/01/2016.

[DOE Zero Energy Ready Home](#)

Exhibit 1: Mandatory Requirements. Certified under ENERGY STAR Qualified Homes Version 3.

[2009 IRC](#)

Section R405.1 Concrete or masonry foundations. Drains must be provided around all enclosed concrete or masonry foundations that enclose habitable or usable spaces and retain earth. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved means must be installed at or below the area to be protected and must discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains to extent at least 1 foot beyond the outside edge of the footing and 6 inches above the top of the footing and covered with an approved filter membrane material. The top of drain tile open joints must be protected with strips of building paper, and the drainage tiles or perforate pipe must be placed on a minimum of 2 inches of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with at least 6 inches of the same material. Exception: a drainage system isn't required when the foundation is 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.*

[2012 IRC](#)

Section R405.1 Concrete or masonry foundations. Drains must be provided around all enclosed concrete or masonry foundations that enclose habitable or usable spaces and retain earth. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved means must be installed at or below the area to be protected and must discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains to extent at least 1 foot beyond the outside edge of the footing and 6 inches above the top of the footing and covered with an approved filter membrane material. The top of drain tile open joints must be protected with strips of building paper, and perforate drains must be surrounded with an approved filter membrane or the filter membrane must cover the washed gravel or crushed rock covering the drain. Drainage tiles or perforated pipe must be placed on a minimum of 2 inches of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with at least 6 inches of the same material. Exception: a drainage system isn't required when the foundation is 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.*

*Due to copyright restrictions, exact code text is not provided. For specific code text, refer to the applicable code.

[IRC 2015](#)

More Info.

Access to some references may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our [webmaster](#) if you find broken links.

Case Studies

None Available

References and Resources*

1. [DOE Zero Energy Ready Home National Program Requirements](#)
Author(s): DOE
Organization(s): DOE
Publication Date: April, 2017
Standard requirements for DOE's Zero Energy Ready Home national program certification.
2. [ENERGY STAR Certified Homes, Version 3 \(Rev. 08\) National Program Requirements](#)
Author(s): EPA
Organization(s): EPA
Publication Date: December, 2015
Document outlining the program requirements for ENERGY STAR Certified Homes, Version 3 (Rev. 08).
3. [Multi-Year Advanced Residential Building Systems Research - Revisions to Quality Management Products](#)
Author(s): NAHB Research Center
Organization(s): NAHB Research Center, NREL
Publication Date: December, 2008
Report discussing development of scopes of work and quality management for builders in mixed-humid climates.
4. [Technical Guidance to the Indoor airPLUS Specifications](#)
Author(s): EPA
Organization(s): EPA
Publication Date: October, 2015
Website providing technical guidance to help home builders and their subcontractors, architects, and other housing professionals understand the intent and implementation of the specification requirements of the IAQ labeling program.
5. [Water Management System Builder Checklist Guide](#)
Author(s): EPA
Organization(s): EPA
Publication Date: February, 2011
Guide describing details that serve as a visual reference for each of the line items in the Water Management System Builder Checklist.

*Publication dates are shown for formal documents. Dates are not shown for non-dated media. Access dates for referenced, non-dated media, such as web sites, are shown in the measure guide text.

Contributors to this Guide

The following authors and organizations contributed to the content in this Guide.

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