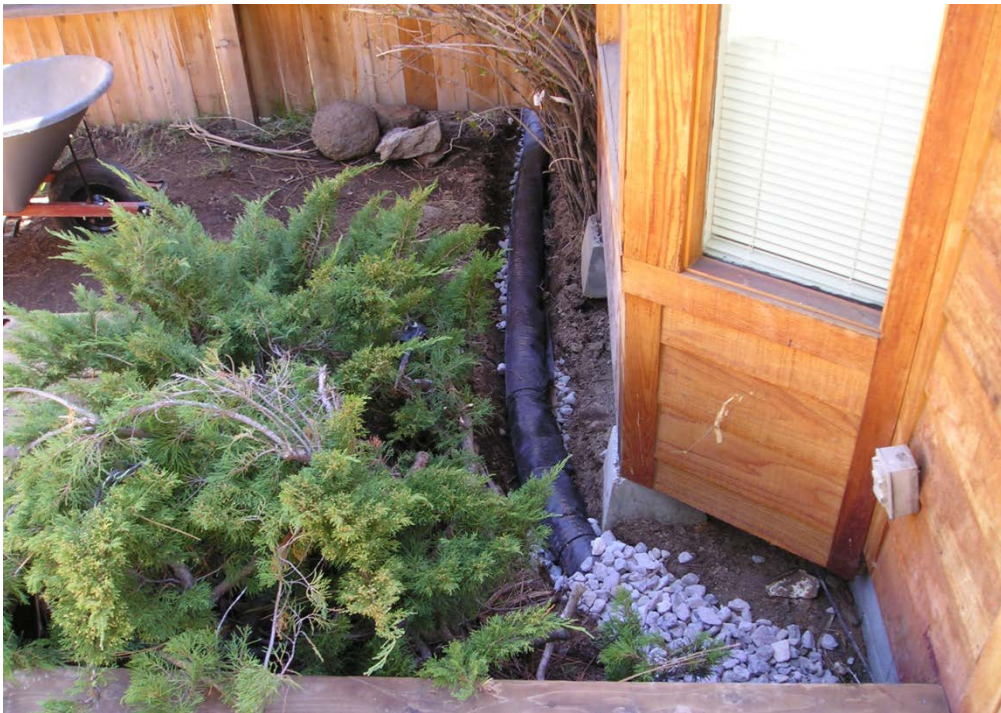


4.3-i SUBSURFACE DRAIN

Alternate Names: French Drain, Subsurface Perforated Drain, Subsurface Conveyance System

DESCRIPTION

A subsurface drain is a trench or system of trenches containing a perforated pipe surrounded by gravel. It is designed to collect stormwater runoff or groundwater and convey it from undesirable locations to a stable discharge point or hydrologic source control such as an infiltration basin or rain garden. While a perforated pipe may permit some infiltration, credit is typically not given because it is negligible and the primary purpose of a subsurface drain is conveying stormwater to a separate treatment and/or infiltration BMP in a more appropriate location.



Subsurface drain around a residential structure is conveying stormwater to an area on-site where there is more room for infiltration.

APPLICABILITY

Subsurface drains are suitable where local site conditions, such as slow infiltrating soils, steep slopes, sensitive areas, or limited space constrain or prevent natural infiltration in the direct vicinity.

Advantages

- Conveys stormwater runoff or groundwater away from foundations, roads, and other sensitive areas to an area that is more appropriate for infiltration or discharge.
- Prevents property damage, slope failure, and slumping.

BMP DESIGN APPROACH

- Pollutant Source Control
- Hydrologic Source Control
- Stormwater Treatment

SCALE OF APPLICATION

- All SFR and MFR < 1 acre
- MFR 1-5 Acre and CICU < 5 acres
- MFR and CICU > 5 acres and all WQIPs

TYPE OF APPLICATION

- Temporary
- Permanent

Disadvantages

- Accumulates sediment and debris over time, requiring periodic inspection and maintenance.

DESIGN CONSIDERATIONS

- Subsurface drains should be designed in conjunction with an infiltration system so that there is no direct discharge to surface waters or groundwater. The discharge and infiltration of stormwater should be installed within the property boundaries and should not harm adjacent properties. Stormwater should not be discharged into the right of way or municipal storm drain system unless approval is obtained from the local governing authority.
- Maintain a pipe slope greater than 1 percent to promote constant flow and to prevent freezing.
- Surround perforated pipe with additional gravel for insulation.

INSTALLATION

- Excavate a trench at least 10 inches deep and 10 inches wide.
- Line the trench with an 8 milliliter plastic liner if no water is to infiltrate before the designed infiltration system (i.e. if you want to move water away from the foundation of a house). If some infiltration is desired as water is conveyed through the trench, line with geotextile filter fabric.
- Add a two inch layer of $\frac{3}{4}$ to 1 $\frac{1}{2}$ inch washed, clean drain rock at the bottom of the trench.
- Install the perforated pipe (typically 4 inch diameter) in the trench with at least 1 percent slope in the direction of flow.
- Install a clean-out port at the lower and upper end of the trench as well as at bends. Clean-outs can be constructed of an elbow or "T" extended above the surface and capped. A sediment trap may be installed at these locations for additional sediment capture.
- Backfill the trench with washed, clean drainrock.
- Adding a sand layer in between the layers of gravel may also add an additional treatment benefit.

INSPECTION AND MAINTENANCE

Refer to the Subsurface Drain Inspection and Maintenance Table.

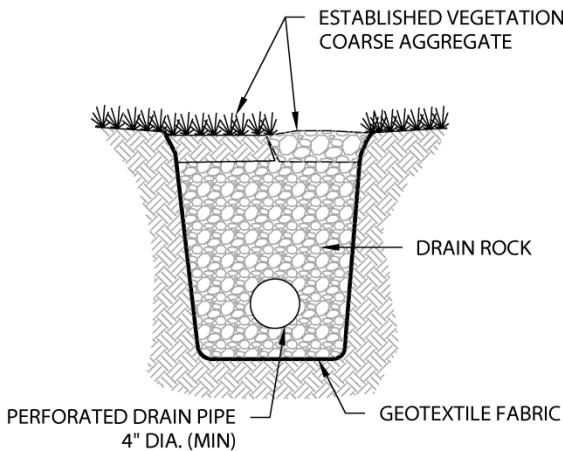
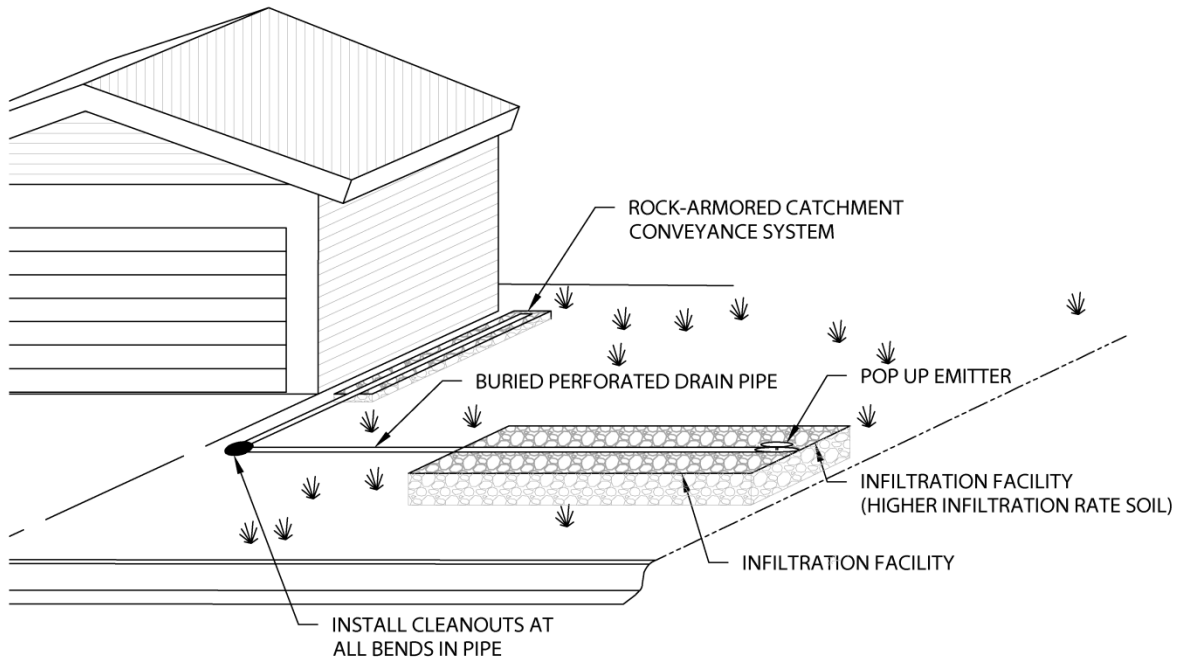
EFFECTIVENESS CONSIDERATIONS

Subsurface drains are an effective conveyance when designed and installed properly. Effectiveness is lost if the system gets clogged with sediment and debris so maintenance is critical.

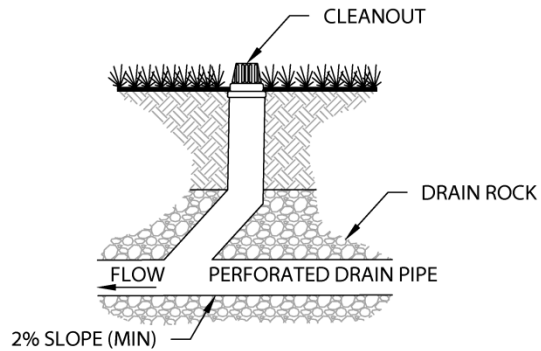
Subsurface Drain Inspection and Maintenance Table

INSPECTION AND MAINTENANCE ACTIVITIES	SUGGESTED FREQUENCY	INSPECTION EQUIPMENT	MAINTENANCE EQUIPMENT
<p>Inspect that the drain properly captures runoff from the impervious surface and conveys it to the treatment system. Verify performance by pouring water, via a hose or large water container, on the surface and/or observing the system during a storm event.</p> <ul style="list-style-type: none"> ▪ Repair any blocked or diverted conveyances. ▪ Clean Subsurface Drain via the clean out ports if piping is suspected of being clogged. 	Annually in spring and during major storms		Tools as needed to repair
<p>Inspect for trash and litter (especially pine needles) on the surface of gravel entry drains.</p> <ul style="list-style-type: none"> ▪ Remove trash and litter from gravel entry drains with leaf rake. 	Twice annually in spring and fall		Leaf rake Trash bag
<p>Inspect for upslope or adjacent erosion and contributing sediment sources.</p> <ul style="list-style-type: none"> ▪ Stabilize contributing eroding areas and/or bare soil to prevent sediment entry into drain system. 	Annually in spring		Soil Amendment, Seeds/Plants, Irrigation, Mulch, Erosion Control Blanket, Riprap, Coir Logs
<p>For gravel entry Subsurface Drains, inspect for sediment and debris accumulation in the gravel.</p> <ul style="list-style-type: none"> ▪ If there is evidence of runoff or pooling after 20 seconds, rehabilitation is needed. ▪ When top layer of gravel becomes clogged with sediment or debris or if accumulated material impedes runoff entry to drain, remove accumulated material. ▪ When dry, remove gravel, sieve gravel to remove sediment, clean or replace the underlying fabric, replace cleaned gravel and dispose of sediment in a TRPA approved stable on-site location or out of the Lake Tahoe Region. 	Semi-annually (spring and fall) and after major storms	Shovel	Shovel or Backhoe Sieving Screen Trash Bag Pickup or Dump Truck
<p>For Subsurface Drains with sediment traps, measure depth of sediment to determine accumulated depth.</p> <ul style="list-style-type: none"> ▪ If accumulated material has decreased sediment trap capacity by 50%, remove accumulated material. If frequently full of sediment, consider retrofitting with a larger sump. Investigate higher in the drainage area for possible contributing sediment sources. ▪ Remove grate or cover from trap, remove sediment with a vactor truck or by hand and dispose of sediment in a TRPA approved stable on-site location or out of the Lake Tahoe Region. 	Annually in spring and after major storms	Ruler	Grate removal tools Vactor Truck Shovel or Scoop Trash Bag
<p>Inspect site for unusual or unsafe conditions (snowplow damage, structural damage, dumping, vandalism, etc.).</p> <ul style="list-style-type: none"> ▪ Repair structural components as necessary. 	Annually in spring		Tools as needed
<p>Inspect for signs that animals are using the pipes as homes and burrows.</p> <ul style="list-style-type: none"> ▪ Install animal guards on the pipe ends if rodents are entering the pipes. 	Annually in spring		Tools as needed to correct
<p>Monitor ongoing effectiveness and determine whether another BMP type or additional BMPs could improve long-term effectiveness and improve benefits to costs versus the existing Subsurface Drain.</p> <ul style="list-style-type: none"> ▪ Analyze Inspection and Maintenance Log for trends or recurring issues ▪ Prepare a plan that more effectively addresses conveyance and infiltration needs, reduces long term maintenance costs and improves overall effectiveness and safety of the BMP. 	Every 5 years	Qualified Inspector or Consultant	Qualified Inspector or Consultant

Subsurface Drain Figure



**ROCK ARMORED
CATCHMENT
CONVEYANCE SYSTEM**



CLEANOUT

NOTES:

1. THE TRENCH SHALL BE CONSTRUCTED ON A CONTINUOUS GRADE WITH NO REVERSE GRADES OR LOW SPOTS.
2. SOILS UNDER THE DRAIN SHALL BE STABILIZED WITH GRAVEL OR OTHER SUITABLE MATERIAL.
3. DRAIN ROCK SHALL BE PLACED AS SPECIFIED WITH AT LEAST 3 INCHES OF ROCK ON ALL SIDES OF THE PIPE.
4. BACKFILL MATERIAL SHALL BE PLACED IN THE TRENCH IN SUCH A MANNER THAT THE DRAIN PIPE IS NOT DISPLACED OR DAMAGED.

THE TAHOE REGIONAL PLANNING AGENCY (TRPA) SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS DETAIL.