



YEN DESIGN INC.

Memorandum



May 26, 2016

Subject: 4950 NE 184th St. Drainage Memorandum
4950 NE 184th St.
Lake Forest Park, WA, 98155

To: City of Lake Forest Park

Drainage Memorandum

The enclosed drainage plan was designed in accordance with the 2009 King County Surface Water Design Manual and is subject to Small Site Drainage Review.

Applicant: Alex Schofield

Project Site: 4950 NE 184th Place Lake Forest Park, WA 98155

Project Description: Small Site Drainage Plan for a New Single Family Residence

- Project Proposes 2,445 SF of new impervious surfaces on a 14,329 SF lot.
- Existing surface water flow control is natural growth and vegetation.
- Limited Infiltration was selected for Flow Control BMP based on soil type.
- Project generates '...more than 2000 SF of new and/or replaced impervious surfaces... and results in less than 10,000 SF of total impervious surfaces added since 01/08/01...' and therefore requires Small Site Drainage Review per (KCSWDM Figure 1.1.2.A)

New Impervious Surface Details:

House/Roof: 1696 SF

Porch/Drive: 629 SF

North Patio: 120 SF

Total: 2,445 SF

Erosion & Sediment Control Plan

NGA recommends that water shall not be allowed to flow over or concentrate on the site slopes. The following items will be used to control erosion and sediment:

- Diversion of surface water away from disturbed areas
- Silt/Filter fences
- Ground cover- mulching/straw
- Hydroseeding or planting vegetation on disturbed area



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Erosion Hazard & Slope Stability

The sensitive, sloped area near the project site shall not be disturbed during installation of the drainage system. A proposed 40 ft construction buffer and diversion of surface water away from the sensitive area should mitigate any landslide hazards. NGA has evaluated the sloped area as low risk: "We believe onsite soils should have a low hazard for erosion in areas that are not disturbed and where the vegetation cover is not removed."

Earth Exploration & Soils Log

Nelson Geotechnical Associates (NGA) conducted a Geotechnical Engineering Evaluation on the subject parcel on May 4th, 2015. Subsurface conditions within the site were explored by excavating two test pits. Those approximate locations are shown in Figure 2 of the attached evaluation. The submitted soils log classifies the on-site soils as 'silty, fine sand' which would require BMP sizing for limited infiltration as follows: For every 1,000 SF of impervious surface; 75 feet (or 225 cubic feet of gravel filled trenches) if the soil is a fine sand or loamy sand (KCSWDM C.2.3.3)

Drainage Plan Details

BMP sizing for 2445 SF requires 550 cubic feet of trenching

- Trenches to be installed to the standards set in Figure C.2.2.A (KCSWDM)
- Roof runoff to be directed through downspouts and tight lined to trench
- Yard catch basins also to be tight lined to trench
- Footing drains are to be connected downstream to prevent backup
- Driveway runoff to pass through catch basin fitted with downward turned elbow
- Trenches to be placed 5' minimum from property lines
- Gravel material to be washed drain rock with a 0.30 void ratio
- Trench to be covered with filter fabric before backfill

Infiltration Trench 1: To accommodate runoff from House/Roof/Patio: 1816 SF of Impervious Area requires 408 cubic feet of trench.

- Located along the southern property line.
- Trench Dimension: 34'L x 4'W x 3'D

Infiltration Trench 2: To accommodate runoff from Porch/Driveway: 629 SF of Impervious Area requires 141 cubic feet of trench.

- Located in the southwest corner of the property.



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- Trench Dimensions: 12'L x 4'W x 3'D

Operation & Maintenance

Infiltration components; including gutters, downspouts, catch basins, etc. should be kept clean and inspected annually and also after a heavy storm to ensure proper drainage and longevity of materials.

Possible Problem	Probable Cause	Desired Results
Sediment accumulation	Filling 20% or more of pipe	Pipes clear
Clogged debris	Debris and yard waste	Pipes clear
Leaking	Cracks wider than 1/2"	New piping



GEOTECHNICAL

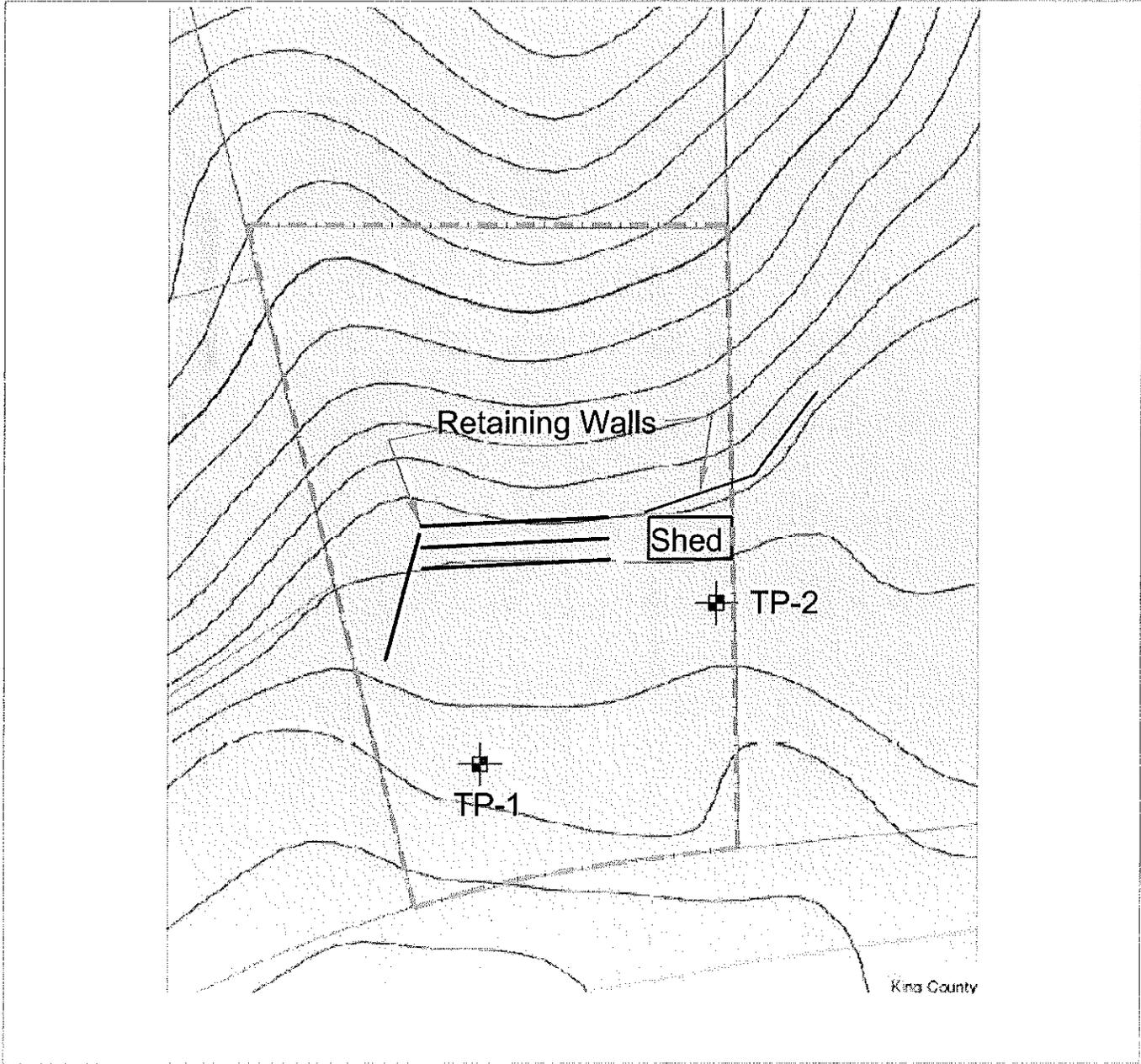
TEST PIT SITE PLAN

UNIFIED SOIL CLASSIFICATION SYSTEM

TEST PIT EXPLORATIONS

SCHEMATIC SITE PLAN

Not to Scale



Symbol for: Property line

Property line

TP-1



Number and approximate location of test pit

Project Number
924515

Scofield Retaining Wall
Lake Forest Park
Schematic Site Plan



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No.	Date	Revision	By	CK
1	5/20/15	Original	TDH	KMS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
		GRAVEL	GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FLAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

- 1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.
- 2) Soil classification using laboratory tests is based on ASTM D 2488-93.
- 3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

- Dry - Absence of moisture, dusty, dry to the touch
- Moist - Damp, but no visible water.
- Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number 924515	Scofield Retaining Wall Lake Forest Park Soil Classification Chart	 NELSON GEOTECHNICAL ASSOCIATES, INC. GEOTECHNICAL ENGINEERS & GEOLOGISTS <small>17311-135th Ave. NE, A-501 Woodinville, WA 98072 (425) 498-1658 / Fax 481-2510</small> <small>Snohomish County (425) 337-1669 Wenatchee-Chelan (509) 665-7656 www.nelsongeotech.com</small>	No.	Date	Revision	By	CK
Figure 3			1	5/20/15	Original	TDH	KMS

Test Pit TP-1

Depth (feet)	USCS	Description	Sample No./Depth (feet)
0 – ¼		Dark gray to black, silty fine SAND with roots and organic matter, loose, wet (Topsoil Fill)	
¼ – 1¼		Brown, mottled orange and light gray, silty fine SAND with trace gravel, loose to medium dense, moist to wet (Fill)	
1¼ – 4		Gray, silty fine SAND with trace gravel and small cobbles, and woody roots, medium dense, moist to wet (Fill)	
4 – 5		Brown mottled with orange and gray, silty fine to medium SAND with gravel, very loose, wet (Fill)	
5 – 5½	SM	Black, silty SAND with roots and organic matter, loose, wet (Topsoil)	
5½ - 6½	SM	Gray, silty fine SAND with gravel, medium dense to dense, wet	

Test pit completed to a depth of about 6½ feet on May 8, 2015.

Samples were collected at 1.0 and 2.0 feet

Minor groundwater seepage observed at 3 feet. Two perforated black plastic pipes surrounded by gravel with moderate water flow encountered at 5½ feet.

Sidewall caving observed above 5 feet.

Test Pit TP-2

Depth (feet)	USCS	Description	Sample No./Depth (feet)
0 – ¼		Dark brown, silty fine SAND with grass roots and organic matter, loose, moist (Topsoil Fill)	
¼ – 5		Brown mottled with tan, silty fine SAND with scattered gravel, roots and charcoal to 1¼ feet, loose to medium dense, moist, (Fill)	
5 – 5½		Dark gray to black silty fine SAND with wood and organic matter, loose/soft, wet (Topsoil Fill)	
5½ – 7		Gray to blue-gray, silty fine to medium SAND, loose, wet (Fill)	
7 – 7½		Dark brown to black silty fine SAND with organic matter loose, wet (Topsoil Fill)	
7½ – 8½	SM	Brown, silty fine SAND with gravel, loose, wet	
8½ – 9	SM	Brown and orange-brown, silty SAND with gravel, loose to medium dense, moist to wet	

Test pit completed to a depth of about 9 feet on May 8, 2015.

Samples were collected at 2.0, 8.0, and 9.0 feet

Steel pipe pushed with excavator bucket to a depth of about 12 feet.

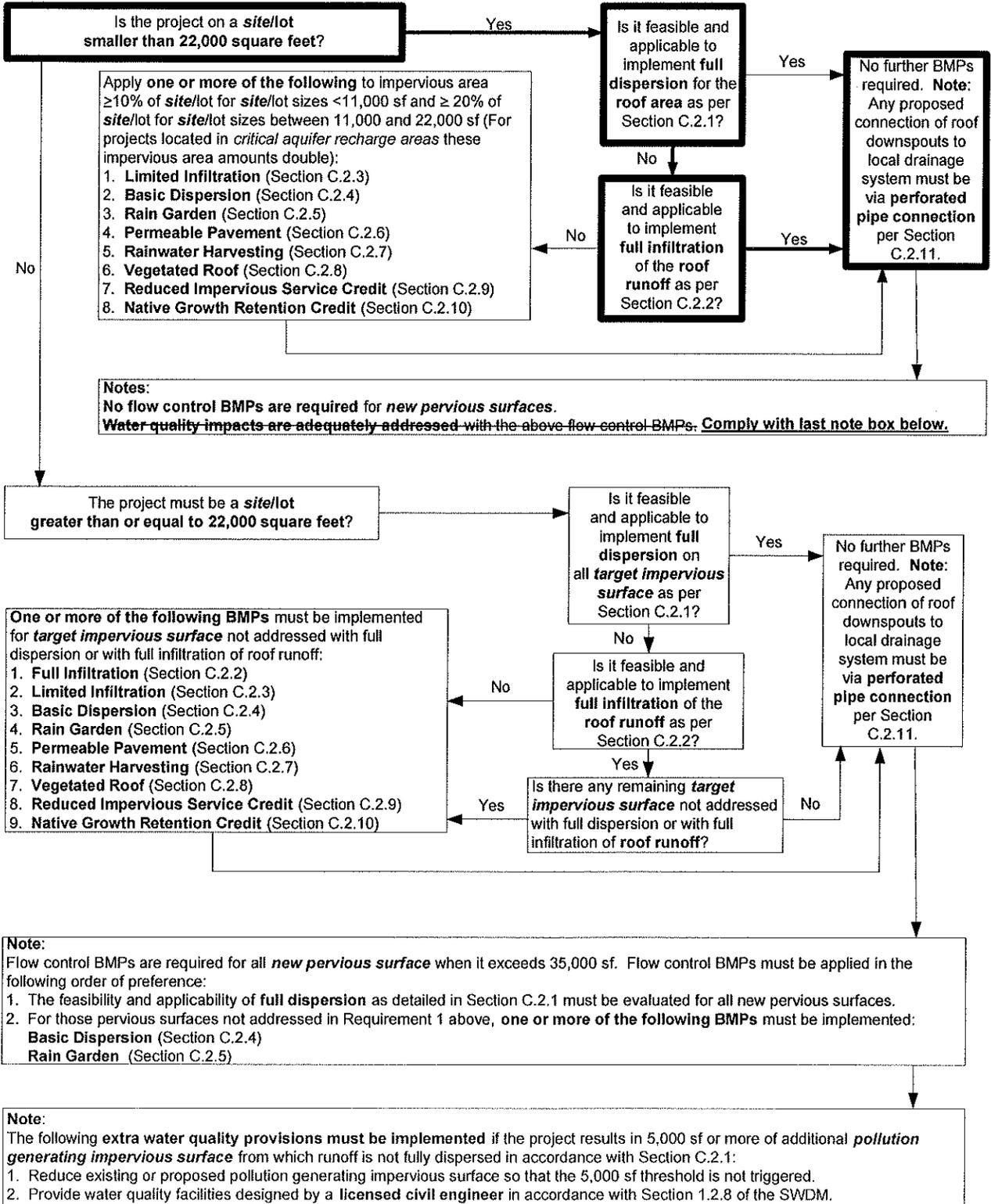
No groundwater seepage observed.

No sidewall caving observed.

Project Number 924515	Logs of Test Pits Scofield Residential Property 4900 Block NE 184th Street Lake Forest Park, Washington	 NELSON GEOTECHNICAL ASSOCIATES, INC. GEOTECHNICAL ENGINEERS & GEOLOGISTS	No.	Date	Revision	Bv	CK
Figure 4			1	5/20/15	Original	TDH	KMS

DRAINAGE/ ESC PLANS & DETAILS

FIGURE C.1.3.A FLOWCHART FOR DETERMINING APPLICATION OF FLOW CONTROL BMPS





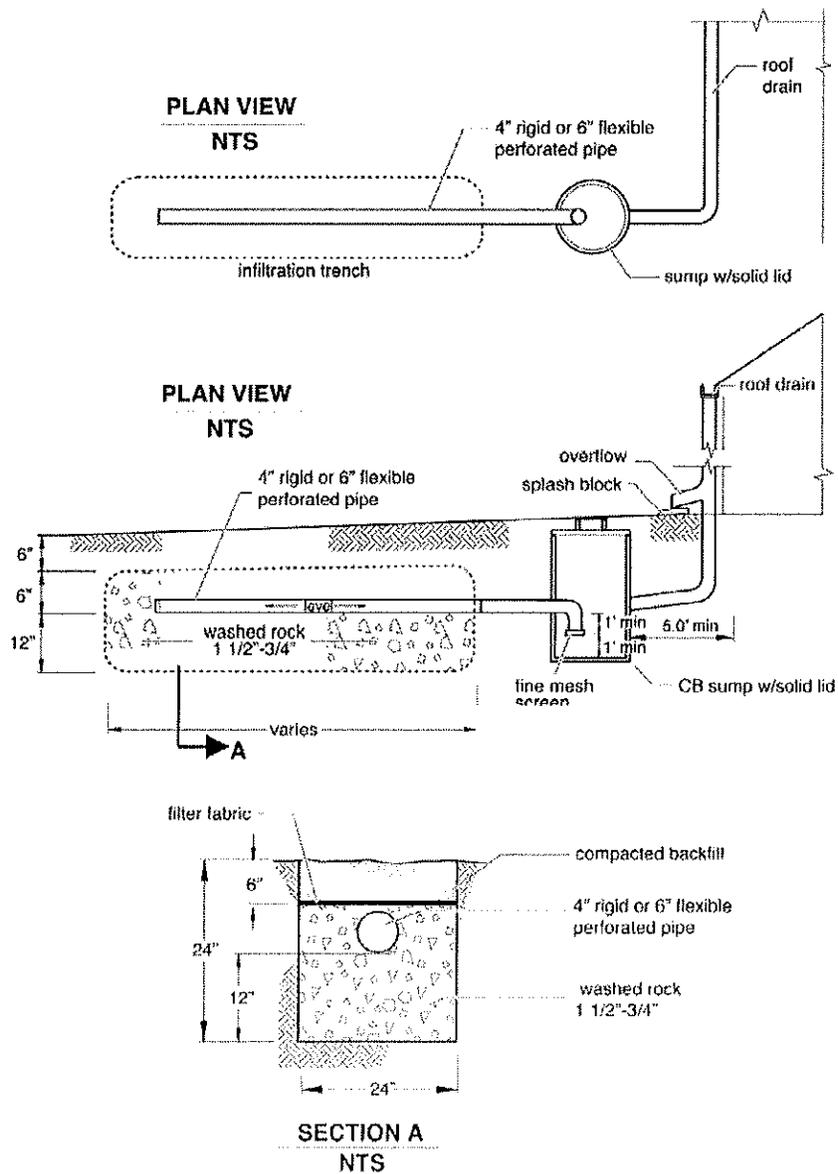
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C.2.2 FULL INFILTRATIO

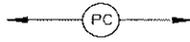
FIGURE C.2.2.A TYPICAL TRENCH INFILTRATION SYSTEM



D.3.2.4 PLASTIC COVERING

Code: PC

Symbol:



Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

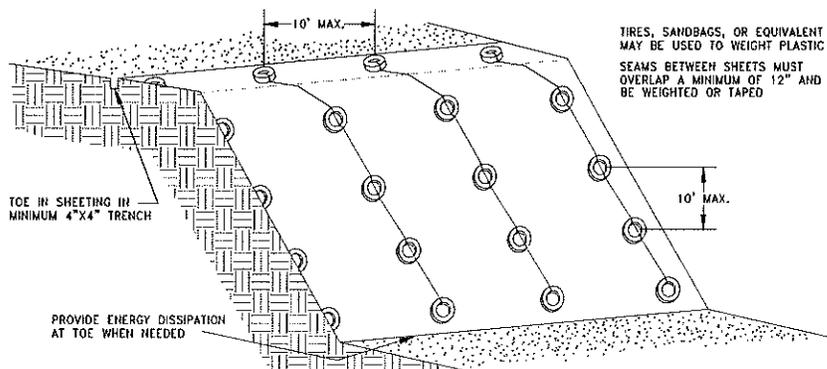
1. Plastic covering may be used on disturbed areas that require cover measures for less than 30 days.
2. Plastic is particularly useful for protecting cut and fill slopes and stockpiles. *Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term applications.*
3. Clear plastic sheeting may be used over newly-seeded areas to create a greenhouse effect and encourage grass growth. Clear plastic should not be used for this purpose during the summer months because the resulting high temperatures can kill the grass.
4. Due to rapid runoff caused by plastic sheeting, this method shall not be used upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.

Note: There have been many problems with plastic, usually attributable to poor installation and maintenance. However, the material itself can cause problems, even when correctly installed and maintained, because it generates high-velocity runoff and breaks down quickly due to ultraviolet radiation. In addition, if the plastic is not completely removed, it can clog drainage system inlets and outlets. It is highly recommended that alternatives to plastic sheeting be used whenever possible and that its use be limited.

Design and Installation Specifications

1. See Figure D.3.2.D for details.
2. Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
3. If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

FIGURE D.3.2.D PLASTIC COVERING



D.3.3 PERIMETER PROTECTION

Perimeter protection to filter sediment from sheetwash shall be located downslope of all disturbed areas and shall be installed prior to upslope grading. Perimeter protection includes the use of vegetated strips as well as, constructed measures, such as silt fences, fiber rolls, sand/gravel barriers, brush or rock filters, triangular silt dikes and other methods. During the wet season, 50 linear feet of silt fence (and the necessary stakes) per acre of disturbed area must be stockpiled on site.

Purpose: The purpose of perimeter protection is to reduce the amount of sediment transported beyond the disturbed areas of the construction site. Perimeter protection is primarily a backup means of sediment control. Most, if not all, sediment-laden water is to be treated in a sediment trap or pond. The only circumstances in which perimeter control is to be used as a primary means of sediment removal is when the catchment is very small (see below).

When to Install: Perimeter protection is to be installed prior to any upslope clearing and grading.

Measures to Use: The above measures may be used interchangeably and are not the only perimeter protection measures available. If surface water is collected by an interceptor dike or swale and routed to a sediment pond or trap, there may be no need for the perimeter protection measures specified in this section.

Criteria for Use as Primary Treatment: At the boundary of a site, perimeter protection may be used as the sole form of treatment when the flowpath meets the criteria listed below. If these criteria are not met, perimeter protection shall only be used as a backup to a sediment trap or pond.

Average Slope	Slope Percent	Flowpath Length
1.5H:1V or less	67% or less	100 feet
2H:1V or less	50% or less	115 feet
4H:1V or less	25% or less	150 feet
6H:1V or less	16.7% or less	200 feet
10H:1V or less	10% or less	250 feet

D.3.3.1 SILT FENCE

Code: SF

Symbol: 

Purpose

Use of a silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

1. Silt fence may be used downslope of all disturbed areas.
2. Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment trap or pond. The only circumstance in which overland flow may be treated solely by a silt fence, rather than by a sediment trap or pond, is when the area draining to the fence is small (see "Criteria for Use as Primary Treatment" on page D-30).

Design and Installation Specifications

1. See Figure D.3.3.A and Figure D.3.3.B for details.

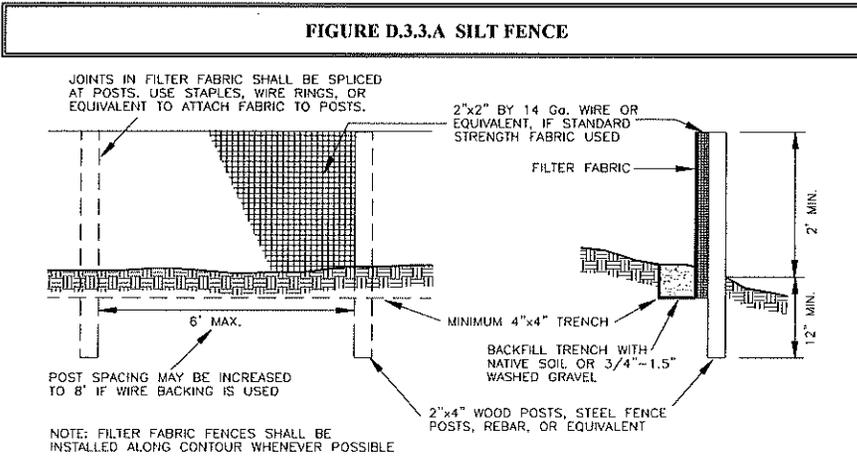
- The geotextile used must meet the standards listed below. A copy of the manufacturer's fabric specifications must be available on site.

AOS (ASTM D4751)	30-100 sieve size (0.60-0.15 mm) for slit film 50-100 sieve size (0.30-0.15 mm) for other fabrics
Water Permittivity (ASTM D4491)	0.02 sec ⁻¹ minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. min. for extra strength fabric 100 lbs. min. for standard strength fabric
Grab Tensile Elongation (ASTM D4632)	30% max.
Ultraviolet Resistance (ASTM D4355)	70% min.

- Standard strength fabric requires wire backing to increase the strength of the fence. Wire backing or closer post spacing may be required for extra strength fabric if field performance warrants a stronger fence.
- Where the fence is installed, the slope shall be no steeper than 2H:1V.
- If a typical silt fence (per Figure D.3.3.A) is used, the standard 4 x 4 trench may not be reduced as long as the bottom 8 inches of the silt fence is well buried and secured in a trench that stabilizes the fence and does not allow water to bypass or undermine the silt fence.

Maintenance Standards

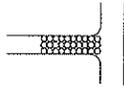
- Any damage shall be repaired immediately.
- If concentrated flows are evident uphill of the fence, they must be intercepted and conveyed to a sediment trap or pond.
- It is important to check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.
- Sediment must be removed when the sediment is 6 inches high.
- If the filter fabric (geotextile) has deteriorated due to ultraviolet breakdown, it shall be replaced.



D.3.4.1 STABILIZED CONSTRUCTION ENTRANCE

Code: CE

Symbol:

**Purpose**

Construction entrances are stabilized to reduce the amount of sediment transported onto paved roads by motor vehicles or runoff by constructing a stabilized pad of quarry spalls at entrances to construction sites.

Conditions of Use

Construction entrances shall be stabilized wherever traffic will be leaving a construction site and traveling on paved roads or other paved areas within 1,000 feet of the site. Access and exits shall be limited to one route if possible, or two for linear projects such as roadway where more than one access/exit is necessary for maneuvering large equipment.

Design and Installation Specifications

1. See Figure D.3.4.A for details.
2. A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the following standards:

Grab Tensile Strength (ASTM D4751)	200 psi min.
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

3. Hog fuel (wood based mulch) may be substituted for or combined with quarry spalls in areas that will not be used for permanent roads. The effectiveness of hog fuel is highly variable, but it has been used successfully on many sites. It generally requires more maintenance than quarry spalls. Hog fuel is not recommended for entrance stabilization in urban areas. The inspector may at any time require the use of quarry spalls if the hog fuel is not preventing sediment from being tracked onto pavement or if the hog fuel is being carried onto pavement. Hog fuel is prohibited in permanent roadbeds because organics in the subgrade soils cause difficulties with compaction.
4. Fencing (see Section D.3.1) shall be installed as necessary to restrict traffic to the construction entrance.
5. Whenever possible, the entrance shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.

Maintenance Standards

1. Quarry spalls (or hog fuel) shall be added if the pad is no longer in accordance with the specifications.
2. If the entrance is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include street sweeping, an increase in the dimensions of the entrance, or the installation of a wheel wash. If washing is used, it shall be done on an area covered with crushed rock, and wash water shall drain to a sediment trap or pond.