SINGLE FAMILY RESIDENTIAL
INFILTRATION SYSTEM

APPLICATION WORK SHEETS

Site Address: _____ Application No.: _____

Applicant: _____

Instructions

This application worksheet package is designed to aid you in designing a single family residential infiltration system. Table 5.2 of the *Stormwater Management and Site Development Manual* has been simplified in this design guide to make the calculations easier. Using the simplified method may slightly increase the length of a trench. In most cases the difference is only several feet. As an alternative, you may use Table 5.2 of the Stormwater Management Manual.

Provide 3 copies of sheets 1-10. Incomplete submittals will not be accepted:

- **Calculation Sheets** – Pages 2-3. Complete all calculations for the roof and driveway.
- **Sizing Table** – Page 4. Designate multiplier used.
- **Sediment Control Structure Detail** – Page 5. Attach with any proposed changes.
- **Plan View of Infiltration Trench** – Page 6. Show length, width, and pipe sizes.
- **Profile** – Page 7. Show length of trench(s).
- **Trench Section** – Page 8. Show trench(s) width, depth, and pipe size.
- **Soils Evaluation Report Form** – Page 9. Complete all sections (See Page 16 for instructions).
- **Site Plan** – Draw to scale (1"=20'), show north arrow, date, parcel number, site address, property lines and dimensions, adjoining street names, driveway with flow direction toward catch basin, existing and proposed structures and other impervious surfaces such as patios, garages, barns, etc., easements, buffer areas, 2-foot contours (spot elevations are not acceptable), and on-site sewage disposal systems and reserve areas. Include the name, address, and telephone number of the contractor, if known, and the person preparing the site plan. Show the location and log number of the soil logs, legend (if symbols are used), natural drainage channels, wetlands, gullies, water bodies, etc., and areas to be graded or otherwise disturbed. Indicate the location of wells and underground storage tanks. Draw a line offset 10 feet inside the property line and the structure outline. Use the easement line if your lot fronts a private road. If you have a slope on or adjacent to your lot that is steeper than 25% (that's a slope that has a vertical rise of 1 foot in a run of 4 feet) draw another line located 25 feet from the top or toe of the 25% slope. In addition, show all catch basins, sediment control structures, and tight lines.

CALCULATION SHEET

DESCRIPTION OF PROJECT:

_____

_____

_____

_____

DESIGN:

Step 1. Determine the roof and driveway areas and enter the saturated percolation rate the design is based on.

Building Area: _____ sq. ft.
Roof Area: _____ sq. ft.
Driveway: _____ sq. ft.
Roof Overhang: _____ feet

Sat. Perc. Rate: _____ min./inch

Step 2. Select a trench depth between 1 and 4 feet.

Roof Trench Depth: _____ feet
Drvway Trnch Depth: _____ feet

Step 3. Select the correct trench bottom multiplier using the Sizing Table.

Roof Multiplier: _____
Drvway Multiplier: _____

Step 4. Select a trench width, the wider the trench (4 ft. max), the shorter the trench length.

Roof Trench Width: _____ feet (2' min.- 4' max)
Drvway Trnch Width: _____ feet (2' min.- 4' max)

Step 5. Calculate the required trench length.

Trench length of the roof = roof area (Step 1) times the trench bottom multiplier (Step 3) divided by the trench width (Step 4).

_____ sq. ft. X _____ (multiplier)/ _____ feet = _____ feet

Trench length of the driveway = driveway area (Step 1) times the trench bottom multiplier (Step 3) divided by the trench width (Step 4).

_____ sq. ft. X _____ (multiplier)/ _____ feet = _____ feet

Step 6. Summarize the trench dimensions:

Roof: _____ ft. deep X _____ ft. wide X _____ ft. long
Driveway: _____ ft. deep X _____ ft. wide X _____ ft. long

Step 7. (optional). For a combined roof and driveway trench, summarize the trench dimensions:

R & D: _____ ft. deep X _____ ft. wide X _____ ft. long

The above design meets the minimum requirements for stormwater control in accordance with Ordinance 99-24S, Chapter 5, Stormwater Management and Site Development Manual.

_____ _____
Designer's Name (print name) **Date**

_____ _____
Signature **Registration No. (if applicable)**

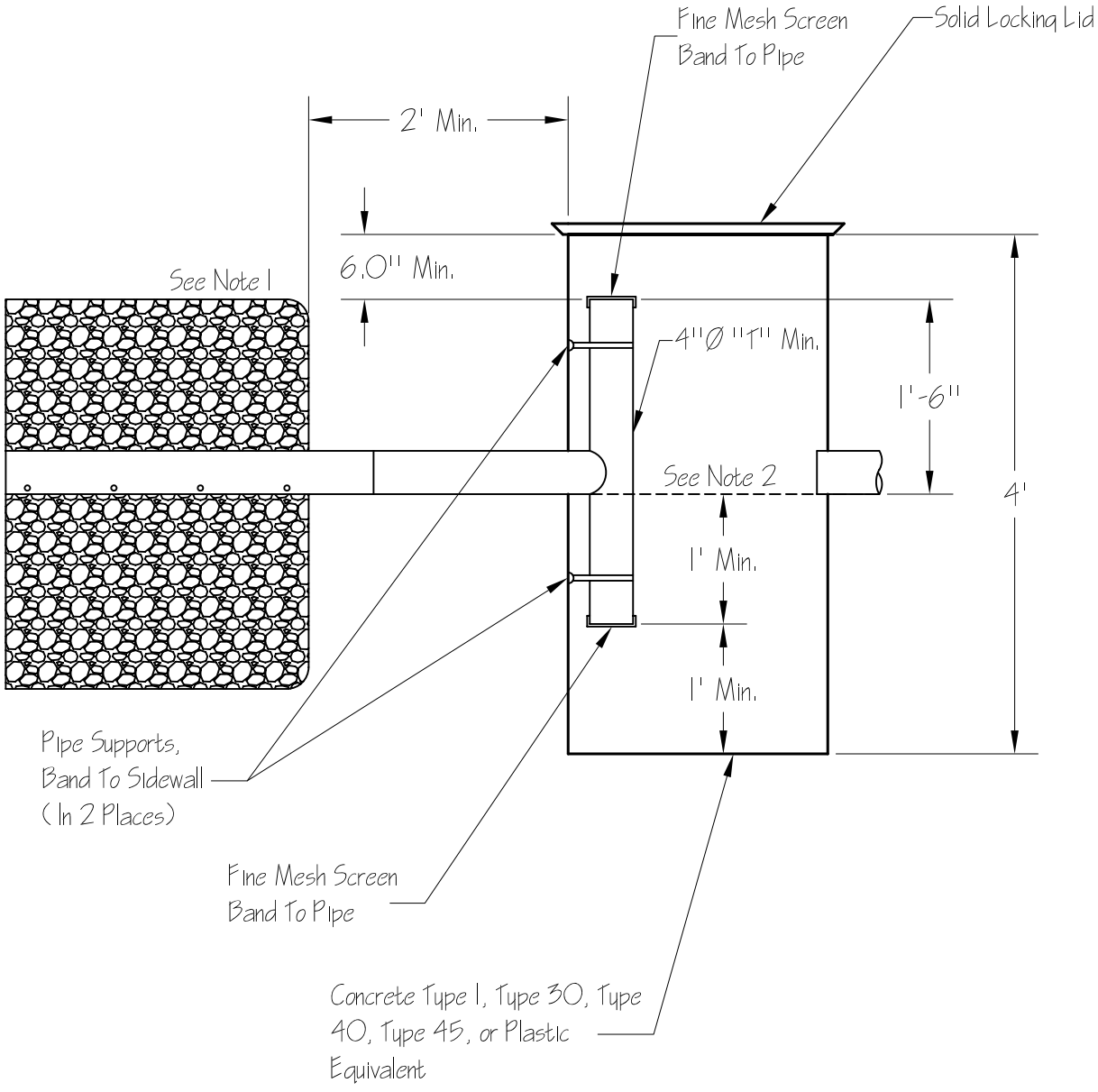
SIZING TABLE

Saturated Percolation Rate	Depth	Trench Bottom Multiplier
1 minute / inch	1'	0.033
	1.5'	0.031
	2'	0.030
	2.5'	0.028
	3'	0.027
	3.5'	0.025
	4'	0.024
5 minute / inch	1'	0.085
	1.5'	0.081
	2'	0.076
	2.5'	0.072
	3'	0.067
	3.5'	0.063
	4'	0.058
15 minute / inch	1'	0.145
	1.5'	0.138
	2'	0.130
	2.5'	0.123
	3'	0.115
	3.5'	0.108
	4'	0.100
30 minute / inch	1'	0.220
	1.5'	0.209
	2'	0.198
	2.5'	0.187
	3'	0.176
	3.5'	0.165
	4'	0.154
60 minute / inch	1'	0.438
	1.5'	0.417
	2'	0.396
	2.5'	0.375
	3'	0.354
	3.5'	0.333
	4'	0.312

Notes:

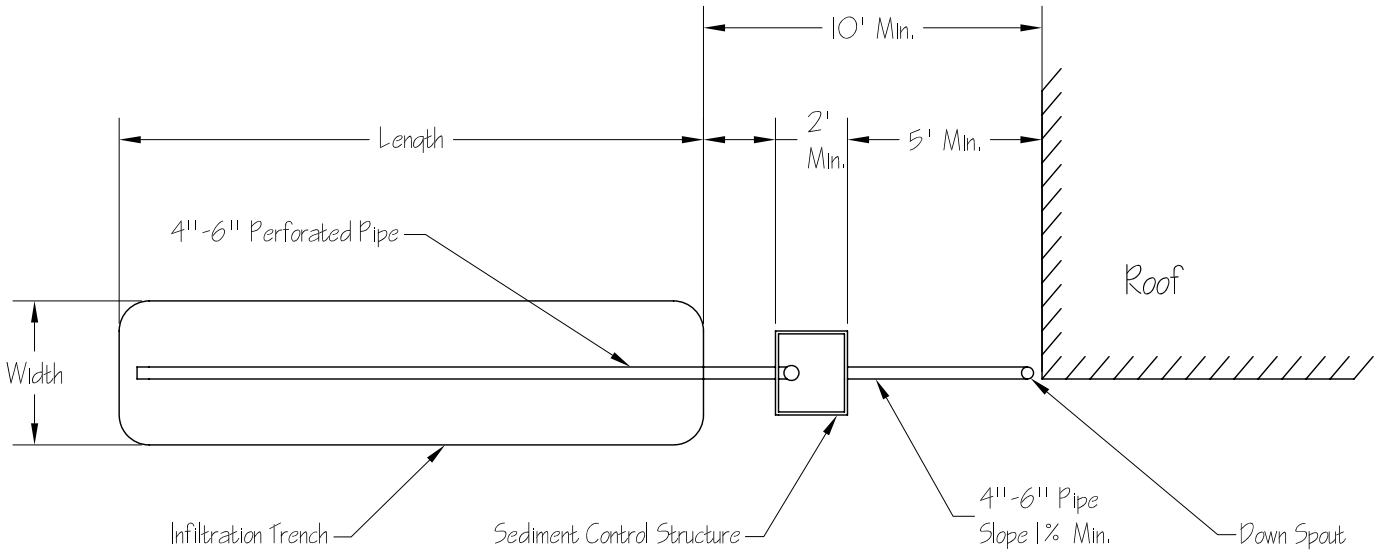
1. Set the top of the Tee Riser at or above the top elevation of the trench drain rock.

2. Set the bottom of the inlet pipe at the same elevation as the outlet pipe.



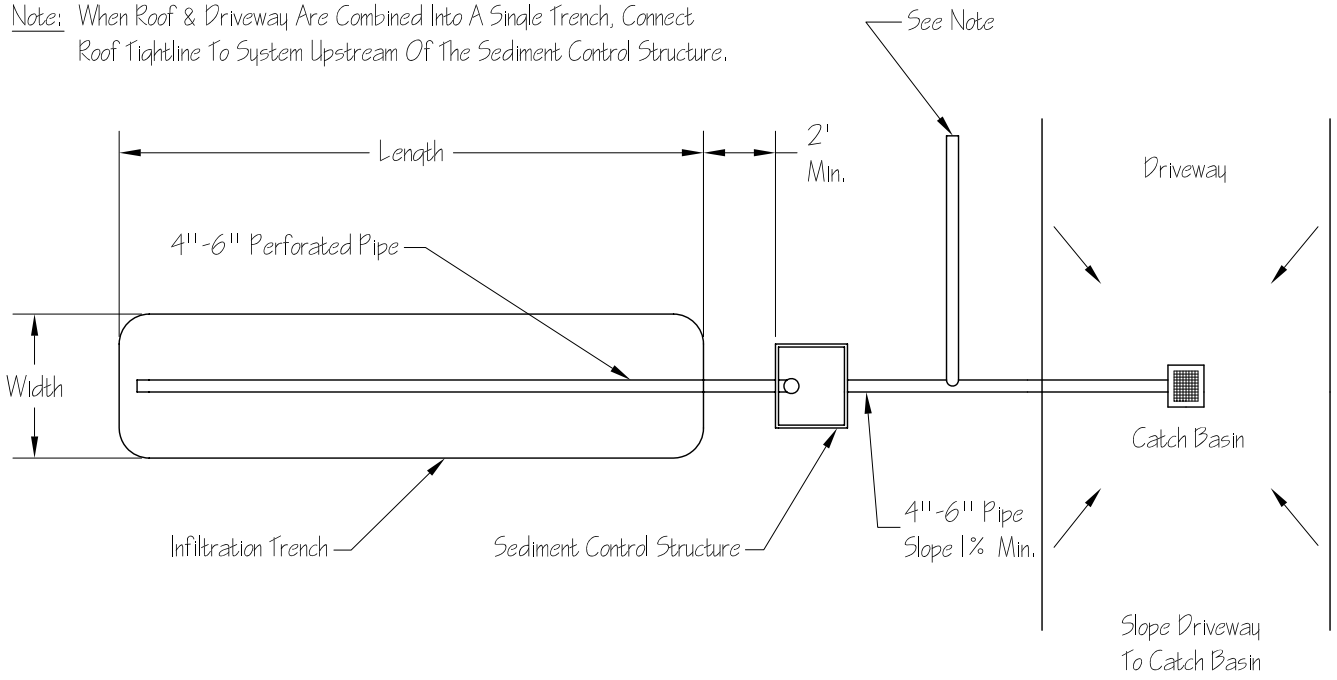
Residential Sediment Control Structure

Figure 1



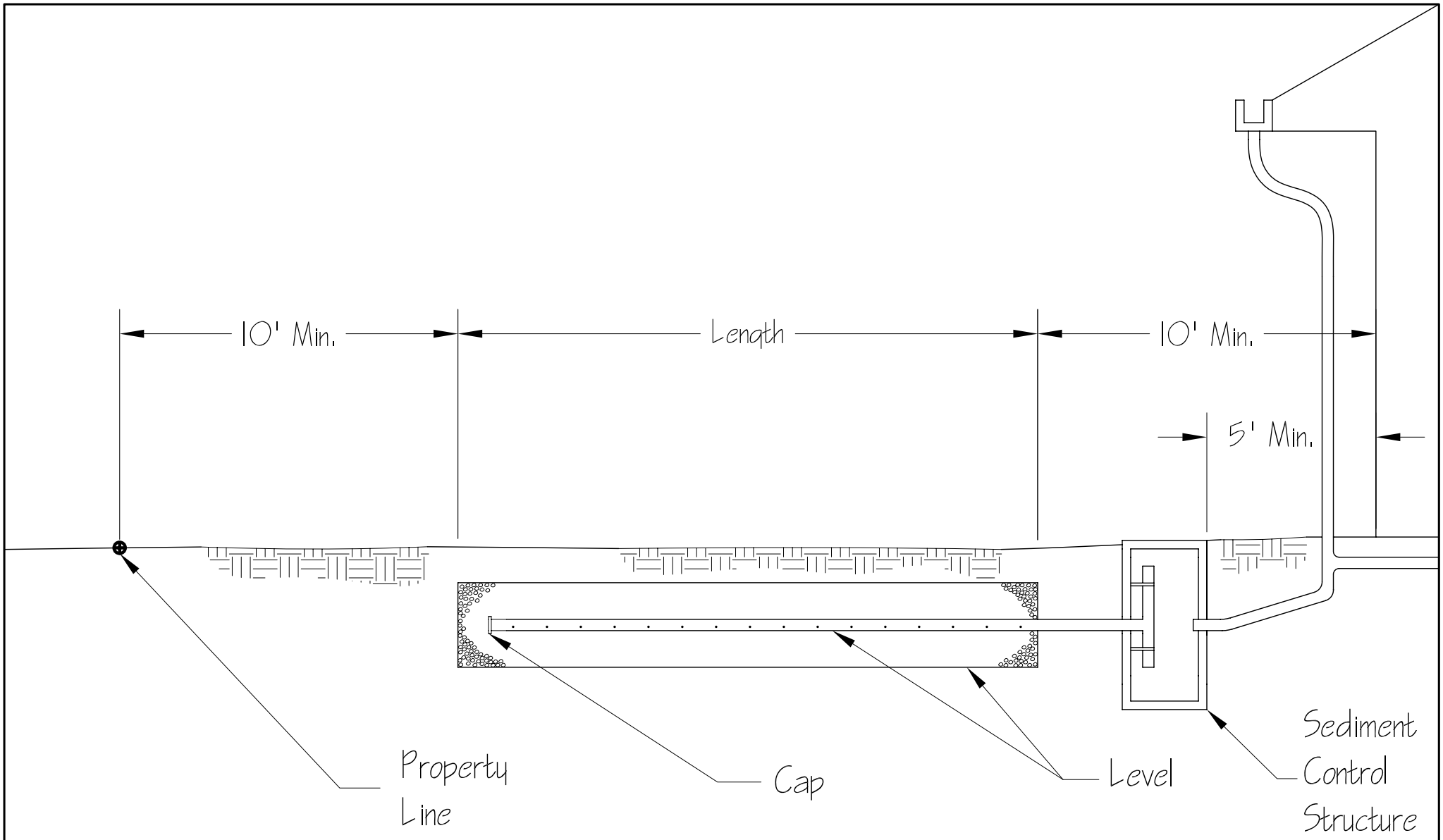
Roof System

Note: When Roof & Driveway Are Combined Into A Single Trench, Connect Roof Tightline To System Upstream Of The Sediment Control Structure.



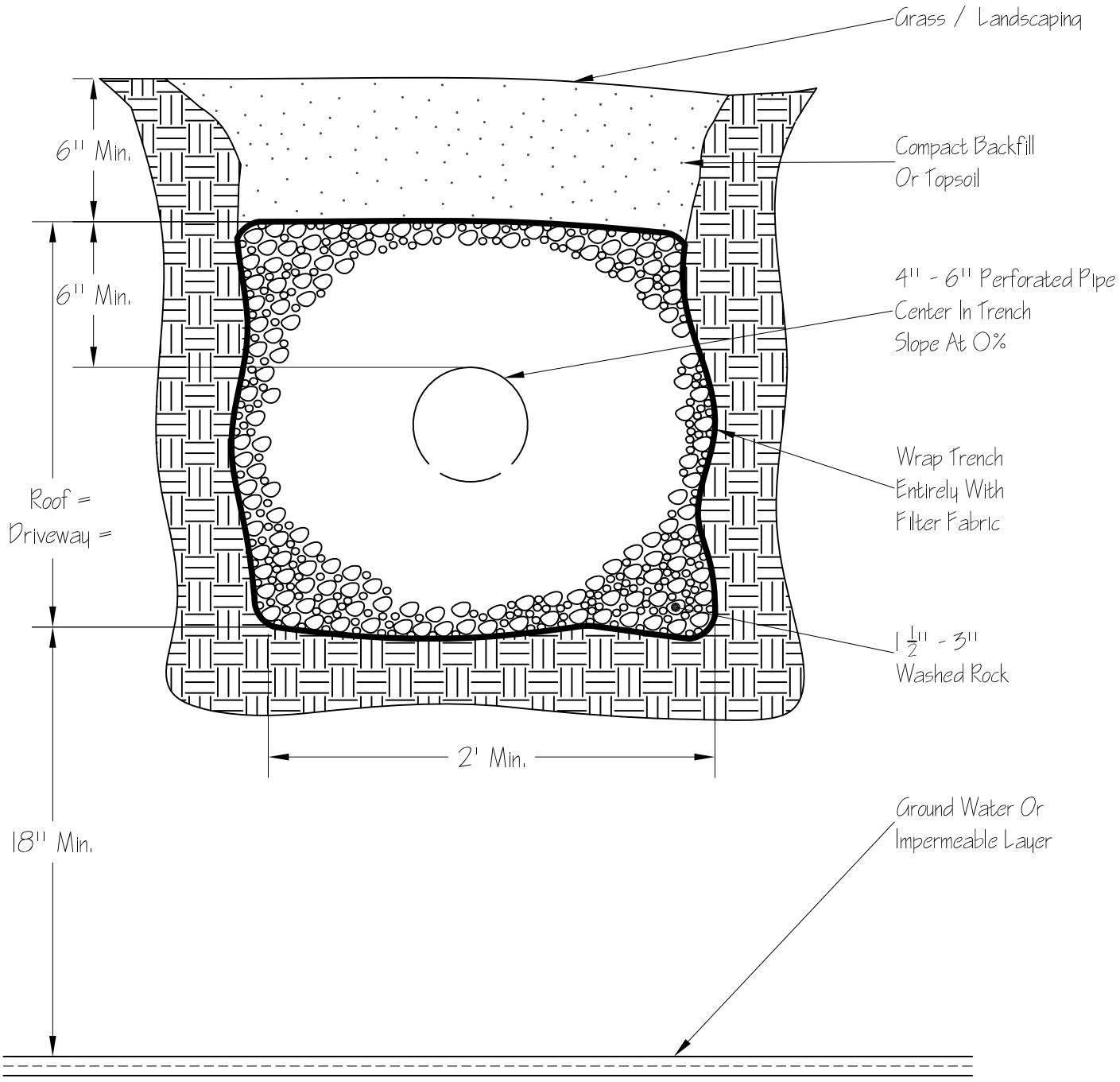
Driveway / Combination System

Figure 2



Profile

Figure 3



Trench Section

Figure 4

SFR INFILTRATION SYSTEM
SOIL LOG EVALUATION REPORT

SOIL LOG NUMBER
(Number shall match site plan) **Sheet ___ of ___**

1. SITE ADDRESS:

2. PARCEL NUMBER:
___ ___ ___ ___ ___ ___ - ___ ___ ___ ___

3. SITE DESCRIPTION:

4. LIST METHODS USED TO EXPOSE, SAMPLE, AND TEST SOILS:

5. NUMBER OF TEST HOLES LOGGED:
_____

6. SATURATED PERCOLATION RATE	**7. HAS FILL MATERIAL BEEN PLACED OVER THE PROPOSED INFILTRATION TRENCH AREA?**
MINUTES / INCH	**NO YES**

8. SCS SOIL SERIES	**9. HYDROLOGIC SOIL GROUP (circle one)**	**10. DEPTH TO SEASONAL HIGH WATER:**
	A B C D	

11. CURRENT WATER DEPTH:	**12. DEPTH TO IMPERVIOUS LAYER:**	**13. SOIL PROFILE DESCRIPTION:**

HORIZON	DEPTH	TETURAL CLASS	MOTTLING	INDURATION

I hereby state that I prepared this report, and conducted or supervised the performance of related work. I state that I am qualified to do this work. I represent my work to be complete and accurate within the bounds of uncertainty inherent to the practice of soil science, and to be suitable for its intended use.

SIGNED:_____

DATE:_____ **REGISTRATION NO.:**_____

REPLACE THIS PAGE WITH YOUR SITE PLAN

SINGLE FAMILY RESIDENTIAL
INFILTRATION SYSTEM

DESIGN GUIDE

Introduction

This guide is designed to aid you in designing a single family residence infiltration system. A number of the most commonly asked questions are included. Table 5.2 of the *Stormwater Management and Site Development Manual* has been simplified, in this design guide, to make the calculations easier. Using the simplified method may slightly increase the length of a trench. In most cases, the difference is only several feet. As an alternative, you may use Table 5.2 of the Stormwater Management Manual. For a complete reference of the ordinance, refer to Chapter 5, Ordinance 99-24S, *Stormwater Management and Site Development Manual.*

What is an infiltration system? Infiltration is the soaking of surface water into the ground. An infiltration system is similar to the septic tanks and drain fields that are used to dispose of wastewater from your house. The system is composed of several elements that convey runoff (gutters and downspouts) to a sediment control structure (similar to a septic tank, but much smaller) which filters out debris and finally to a gravel-filled trench where the runoff percolates into the soil.

Why is an infiltration system required? Single family residential construction often has a negative effect on the environment. Typical construction practice consists of stripping the building site of all vegetation and, in many cases, the topsoil. This practice reduces the amount of vegetation and topsoil that is available on a site to absorb rainfall. The construction project adds impervious surfaces, such as roofs and driveways, which prevents natural infiltration.

It is necessary to control this extra runoff to prevent flooding and erosion, and to recharge groundwaters that supply water to wetlands, streams and wells. A properly designed, constructed, and maintained infiltration system is one of the most effective ways of managing runoff from single family construction projects.

Who can design an infiltration system? A homeowner or contractor may use this design packet to design an infiltration system with help from a Soils Professional. A Soils Professional is required to verify the soil type and determine the appropriate infiltration rate. The infiltration rate is determined using the falling head test method, per Appendix M of the *Stormwater Management and Site Development Manual*. For sites with proposed on-site sewage disposal systems, the same Soils Professional designing that system can provide the on-site soil type(s) and design the infiltration system.

What is a Soils Professional? A licensed professional in the State of Washington (geologist, civil engineer, geotechnical engineer, septic designer) who demonstrates proficiency in the practice of the science of soils, including their origin, character, and utilization for stormwater treatment and disposal. This proficiency shall be demonstrated through the soils professional's ability to complete the Soils Evaluation Report form in a precise and accurate manner.

I cannot design a system per the regulations. What do I do? Contact a professional engineer licensed in the State of Washington. They can design alternative systems that meet the requirements of the Pierce County Site Development and Storm Drainage Manual.

Requesting an inspection: All inspections should be requested at least 24 hours in advance through the City of Bonney Lake Permit Center at (253) 862-8602.

When to call for an inspection: The drainage system must be completely constructed but not yet backfilled at the time of inspection. All pipe connections must be in place, properly coupled or glued, and exposed. A clean, smooth stake (preferably PVC) shall be placed in every trench prior to filling with washed rock. The inspector will remove this stake to check the depth of washed rock. All accessory structures such as driveway basins, residential sump structures, clean outs, and/or inspection wells, depicted on the approved plan, must be in place.

What is required to get a final inspection on my building permit? Prior to final inspection approval of construction, the contractor or applicant needs to have the infiltration system inspected by the City of Bonney Lake.

Design Procedure and Tips

1. The first step in designing an infiltration trench is to determine what you are trying to fit on your site. If you have a small lot and are trying to squeeze a house, driveway, septic system with reserve area and an infiltration trench(s), you might be in for a challenge. Reducing the footprint of the house and driveway can reduce infiltration trench system sizes.

2. Start by preparing an accurate, to scale site plan (see Figure 5, Page 17). Include the name, address, and telephone number of the contractor, if known, and the person preparing the site plan. Draw the site plan at a scale of 1" = 20'. Show north arrow, date, parcel number, site address, property lines and dimensions, legend (if symbols are used), natural drainage channels, wetlands, gullies, water bodies, areas to be graded or otherwise disturbed, wells and underground storage tanks, and driveway with flow direction toward catch basin. Show all easements, buffer areas and/or other areas where building activity is restricted. Show contour lines at 2-foot intervals. Draw a line offset 10 feet inside the property line. Use the easement line if your lot fronts a private road. If you have a slope on or adjacent to your lot that is steeper than 25% (that's a slope that has a vertical rise of 1 foot in a run of 4 feet) draw another line located 25 feet from the top or toe of the 25% slope. Infiltration systems must be 25 feet minimum from any slope steeper than 25% and 10 feet minimum from any property line.

3. Draw a preliminary location of the house foot print on the site plan, including other existing and proposed structures and other impervious surfaces such as patios. Draw a line offset 10 feet from the house outline. Infiltration systems must be 10 feet minimum from any structure. In addition, show adjoining street names, location and log number of soil logs (a minimum of one soil log shall be obtained for each proposed infiltration system location), on-site sewage disposal systems and reserve areas, sediment control structures, catch basins, and tight lines.

4. The remaining area is available, minus the area needed for on-site sewage disposal systems and reserve areas, for the infiltration system. If you are utilizing an on-site sewage system (septic system) you will have to coordinate the location of both systems. Infiltration systems must be located at least 10 feet from a septic drain field, reserve area, septic tank or pump chamber.

5. Locate an area for the infiltration system on the site plan. It needs to be located down slope from the driveway and house so the water drains to it. The trench needs to be oriented parallel to the site's contour lines. Have a Soils Professional determine the soil type and infiltration rate in minutes per inch. See the following section on soil evaluation reports. The soils determination must be consistent with the Sizing Table, see page 4.

6. Size the infiltration trench per the following steps.

Step 1. Determine the number of square feet of the roof and driveway. You do not have to worry about the pitch of the roof. Use the roof area and not the floor area. They will be different on a multi-story house. Be sure to include the roof overhang in your calculations. Note the soil type that is consistent with the Sizing Table (i.e. Fine- Loamy sand (15min./in.)).

Step 2. Select a trench depth between 1 and 4 feet. A deeper trench will result in a shorter trench. This could be an issue in a design where space is limited. A deep trench may not be possible in soils with a high ground water elevation. The bottom of the trench must be located at least 18 inches above the seasonal high groundwater or impermeable layer. You will also need at least 6 inches of topsoil over the top of the trench. As an example, if your site has an impermeable layer at 5 feet below the surface, the maximum trench depth possible is 3 feet (6 inches cover + 3 foot trench + 18 inches separation = 5 feet). Your Soils Professional can help with the trench depth selection.

Step 3. Determine the correct trench bottom multiplier using the Sizing Table, see page 4. The table is divided into 5 infiltration rates ranging from 1 minute per inch to 60 minutes per inch. After you have selected the correct portion of the table, locate the multiplier that applies to your site. As an example, if your site has a Fine – Loamy sand (15 min./1 in.) and a trench depth of 2 feet, the correct multiplier is 0.130.

Step 4. Select a trench width. The wider the trench the shorter it will be. Selection of the trench is one of personal choice. The amount of room available and ease of construction may be used in determining the best width for your site. The width of the trench should be between 2 feet and 4 feet.

Step 5. Calculate the length of the trench by multiplying the area (Step 1) by the multiplier (Step 3) and dividing by the trench width (Step 4). The resulting number is the length of the trench in feet. For example, if we used a 2,000 square foot roof times a 0.130 multiplier divided by a 4-foot wide trench, the length would be 65 feet.

Step 6. Summarize the trench dimensions from steps 2, 4 and 5.

Step 7. If you are combining the roof runoff and the driveway runoff into a single trench, summarize dimensions from (step 6) by adding the trench lengths. The combined length must be less than 100 feet. See the following section **The Trench** below, for more information.

7. Complete the final site plan incorporating the infiltration system (length(s), width(s), and location(s) on site) and accompanying sediment control structures and tight lines. Sediment control structures cannot be located within 5 feet of any structure.

Driveway Runoff

The designer must consider runoff from the proposed driveway. The designer may choose to grade the proposed driveway towards a natural and/or landscape area in lieu of a separate infiltration trench. A fairly flat area (sloped at less than two percent) and good soils (Group A) are required. Sufficient detail must be shown to demonstrate to the satisfaction of the City of Bonney Lake that no runoff will leave the site. The City must pre-approve discharge of driveway runoff to an off-site system.

Sediment Control Structures

(See Figure 1, Page 5) Sediment control structures are important for keeping debris out of the infiltration trench. The "T" with its screens keeps leaves, needles, twigs, roofing gravel, etc., from clogging the perforated pipe and/or the washed rock. Several different types of structures can be used. Generally, a concrete catch basin that has a depth of at least 4 feet is used. Some installations utilize a plastic structure. When choosing a concrete structure, consider using a Type 1, Type 30, Type 40 or a 24 inch diameter Type 45 catch basin. Plastic equivalents are acceptable. The inlet pipe (from the house) should be set at the same elevation as the outlet pipe. If the inlet is set above the outlet pipe, the in-flowing water will splash and cause turbulence. This may suspend sediment and cause the suspended sediment to be deposited in the perforated pipe or washed rock.

The Trench

(See figures 2, 3, and 4, Pages 6, 7, and 8 respectively) Infiltration systems cannot be constructed in fill or severely compacted soils (an area that has been driven over repeatedly). Infiltration systems shall be a minimum of 25 feet from any slope steeper than 25%. Trench bottoms shall be a minimum of 18 inches above seasonal high groundwater or impermeable layer (hard pan). The end of the trench must be located within 100 feet of the sediment control structure. If your calculations show a trench longer than 100 feet, you will need to split it into two separate trenches. There is no minimum spacing between trench center lines; however flow distribution lines shall be installed at a minimum spacing of 10 feet or less between pipes. The elevation of both trenches must be the same to ensure equal distribution of flows. All infiltration trenches must be located downstream of the sediment control structure. The trench shall be wrapped entirely with filter fabric. Geotextile fabric or roofing felt shall be placed on top of the drain rock prior to back filling.

Soil Evaluation Reports

A Soils Professional (engineer, soil scientist or septic designer) must be utilized to verify if on-site soils are adequate. A minimum of one soil log shall be obtained for each proposed infiltration system location. It shall extend a minimum of 18 inches below the bottom of the trench. Each soil log shall be shown on a separate Soil Evaluation Form. Soil log locations need to be shown on the site plan. You must hire a civil engineer to design systems in areas with a hydrologic group D soil.

THE CARE AND FEEDING OF AN INFILTRATION SYSTEM

If an infiltration system is not properly maintained, it can fail after a few short years. When properly maintained, they can function for 20 to 50 years. The most important factor is to prevent anything other than clean water from entering the trench portion of the system. Leaves, fir needles, grass clippings, plastic bags, toys, oil/grease, mud, roofing gravel, etc. can clog a system and necessitate costly repairs or replacement of the system. The following is a list of hints to keep your system in good working order:

- Inspect the sediment control structure several times a year. The most important time is in the fall before the heavy rains of winter begin. If there is less than 6 inches of clearance between the debris and the bottom of the outlet tee, clean the sump. A wet/dry shop vacuum may be useful as a cleaning devise (See Figure 6, Page 18).

- Clean and inspect both screens. Replace corroded and/or damaged screens as necessary.

- Clean gutters several times a year. Do not flush debris into the system with a hose. Clean out gutters with a plastic scoop or shop vacuum.

- Sweep driveways with a broom several times a year. Do not flush debris into the system with a hose.

HOW TO TELL IF YOUR SYSTEM IS WORKING PROPERLY

The simple answer is if you put water in, and it goes away, it's probably working. For the most part, the first statement is correct; however, listed below are several ways to troubleshoot the system if it is not working properly:

- Is water bubbling out of the connection where the downspout connects to the drain line? If it is, the screens may be clogged, the infiltration trench may be clogged, or a pipe may be plugged or broken. Check and clean the screens if necessary. If the screens are clean, check to see that the pipes from the downspout to the sediment control structure are clear. A plumber's "snake" or garden hose may be helpful to check and/or clean out the pipe.

- If you have a catch basin located in the driveway, is it backed up? Check to make sure the catch basin outlet is not clogged. Also check to make sure that the pipe from the catch basin to the sediment control structure is clear.

- Are the screens and pipe leading to the sediment control structure clean and clear? Check the perforated pipe in the infiltration trench. Is it clogged?

- So far nothing is clogged, but the system will not drain. Try digging a hole about 1 or 2 feet away from the edge of the trench, at about the midpoint. Dig it as deep as the infiltration trench. If it is full of water as you dig, you may have a high groundwater problem. Contact an engineer for further advice.

Soil Evaluation Report Instruction:

The following instructions should give you the guidance to complete the Soil Log Evaluation Report:

1. Provide the site address, including house number and street name.

2. Provide the 10 digit parcel number.

3. Describe site topography and natural cover.

4. List methods used to expose, sample, and test soils, including the required falling head test method.

5. Note number of test holes logged (a minimum of one soil log shall be obtained for each proposed infiltration system location).

6. Describe the saturation percolation rate for the infiltration trench.

7. Indicate whether fill material has been placed over the infiltration trench area. Circle the correct response.

8. Indicate the Soil Conservation Service (SCS) soils series observed as a result of the soils testing done. Example: "Alderwood."

9. Circle to appropriate DOE hydrological soil group. A civil engineer must design systems in a hydrologic Group D soil (silty clay loam, clay loam, or a percolation rate slower than 60 min/in).

10. Indicate seasonal high water table depth base upon the presence of mottling, gleying, or other evidence. If information available is inadequate, state value to be "greater than" the bottom of the hole depth.

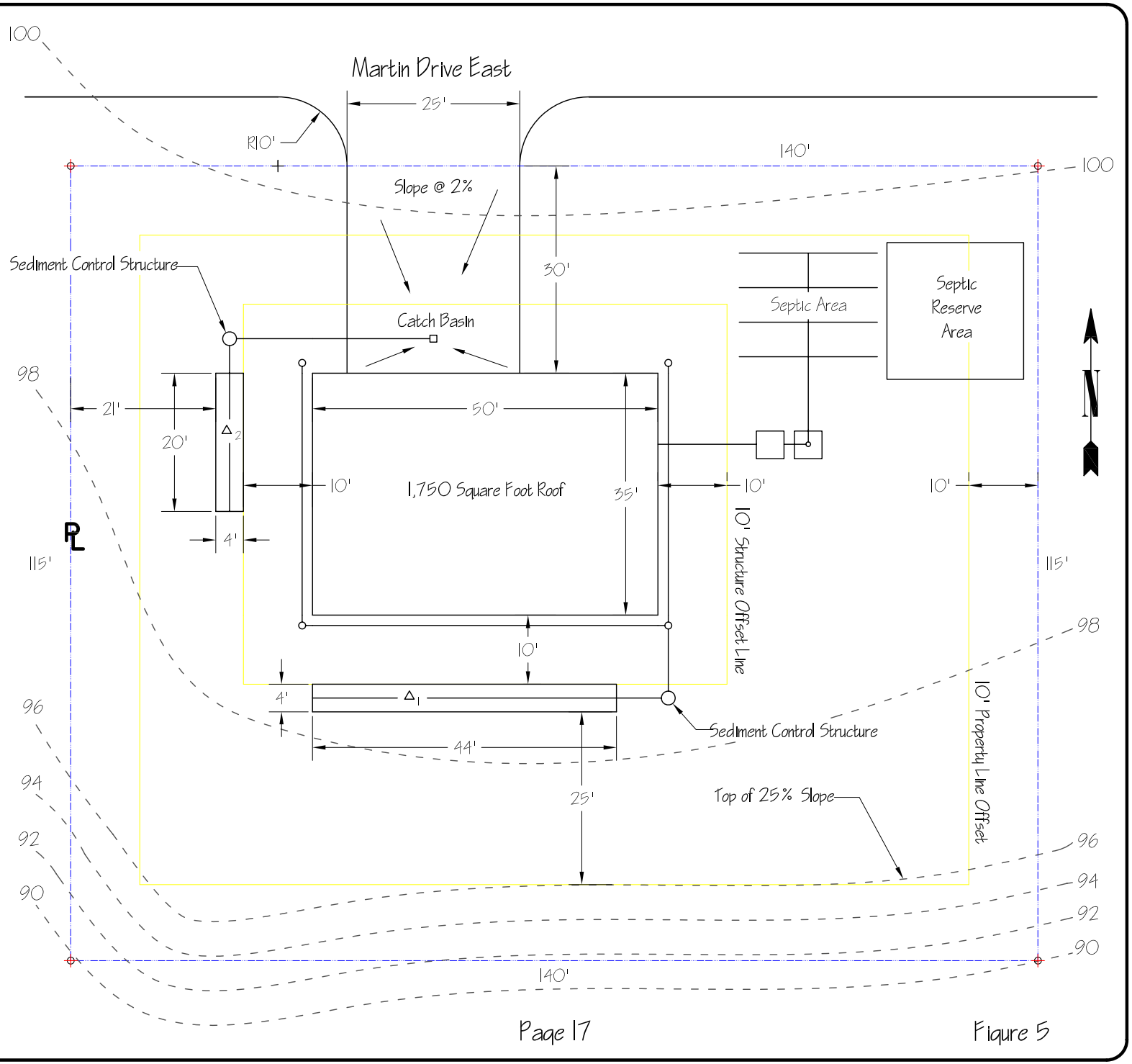
11. Indicate current water table depth based upon observation. If saturation conditions are not observed, state value to be "greater than" bottom of hole depth.

12. Indicate depth to impervious layer (e.g., basal till). If information is inadequate, state value to be "greater than" bottom of hole depth.

13. The profile description provides the ***minimum*** information on the physical attributes of the soil. All information provided for the profile shall utilize standard SCS nomenclature and abbreviations. The following are the factors to be addressed, with brief examples of the acceptable responses. Further information on most of these is provided in the SCS *Soil Survey of Pierce County*. Use additional sheets if necessary.

- **a.** Horizon: A layer of soil with distinct characteristics, labeled A, AB, B, C, Ccw, etc.
- **b.** Depth: Starting at 0" (surface), depth and interval of horizon.
- **c.** Textural class: Class that best describes relative percentages of sand, silt, and clay in horizon, such as sandy loam (SL).
- **d.** Mottling: Where present, describe using three-letter abbreviation to indicate abundance, size, and contrast, such as CFD (common, fine, distinct).
- **e.** Induration: Physical compaction of a layer such as a glacial till. Where present, describe as weak, mod(erate), or str(ong).

Sign the form and affix the relevant professional seal (e.g. P.E., Licensed Geologist, or Onsite Wastewater Treatment System Licensed Designer).



Page 17

Figure 5

Legend:
Δ_1 - Soil Log 1
Δ_2 - Soil Log 2

Contractor:
Percolation Infiltration
8118 Morgan Avenue East
Barney Lake, WA 98391
253-123-4567

Site Address:
12119 Martin Drive East
Bonney Lake, WA 98391
Parcel No. 2925111323

Prepared By: John Doe
4511 Murray Way
Murphy, WA 98003
253-867-5309

Date: 12-27-05
Drawn By: ALF
Scale: 1" = 20'

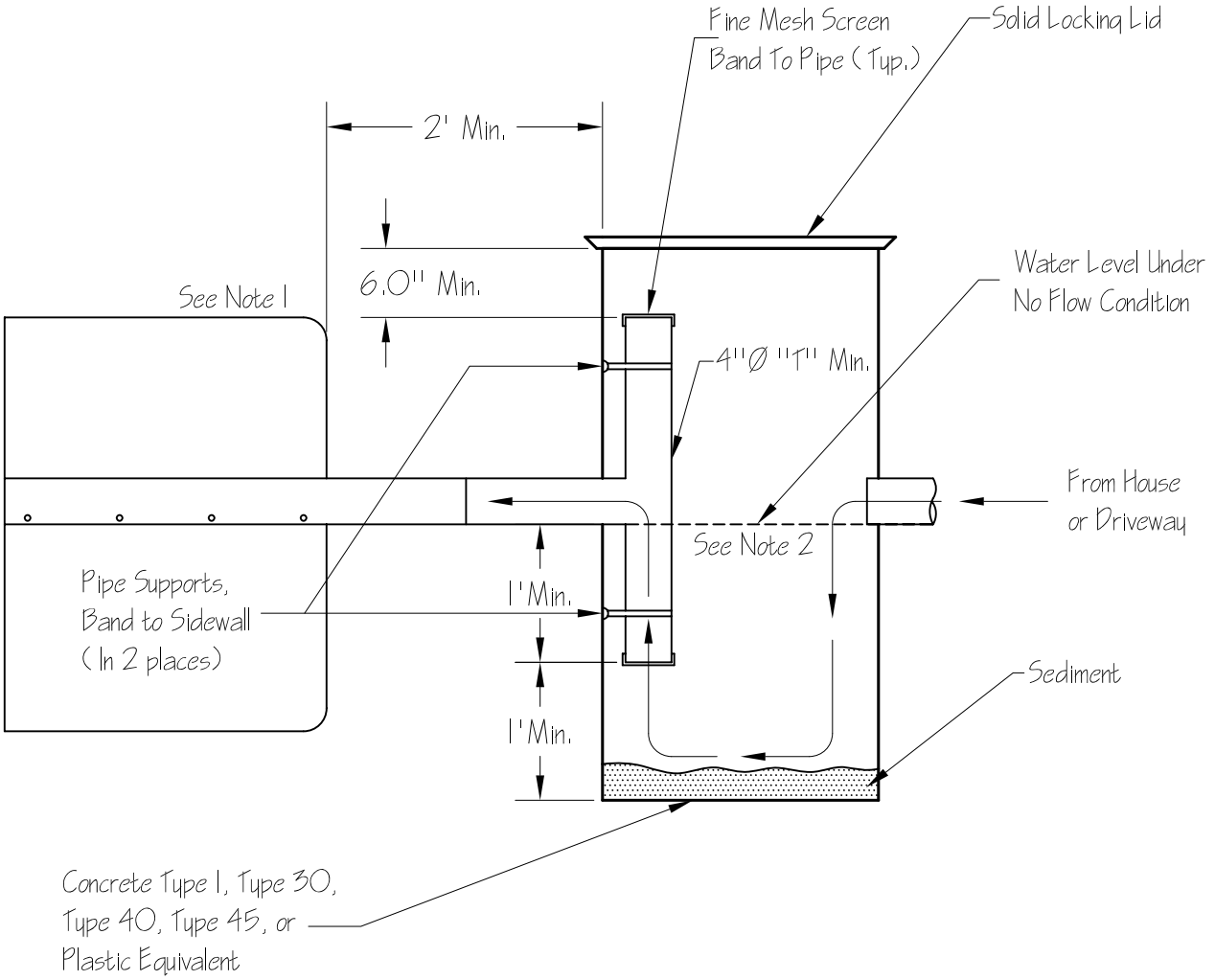
Example Residence
Infiltration System

Dwg. 1 of 1

Notes:

1. Set the top of the Tee Riser at or above the top elevation of the trench drain rock.

2. Set the bottom of the inlet pipe at the same elevation as the outlet pipe.



Residential Sediment Control Structure Inspection