Goode & Associates

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Septic System Design / Installation

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SOIL EVALUATION FOR WEYERHAEUSER REAL ESTATE DEVELOPMENT COMPANY—SILVER LAKE FOREST RESERVE IN TOUTLE, WASHINGTON

DATE:	March 17, 2006 *(Revised 4-29-06)*
APPLICANT:	Weyerhaeuser Real Estate Development Company Carol Beck Mail Stop PH2 32820 Weyerhaeuser Way South Federal Way, WA 98063-9777
SITE ADDRESS:	Silver Lake Forest Reserve 855 Sightly Road, Toutle
PREPARED BY:	Jeannie Yackley, Licensed Designer Goode & Associates 1421 Harrison Avenue Centralia, WA 98531 360-736-5218

PURPOSE: The purpose of a soil evaluation is to determine the type, structure, and depth of suitable soil. It is these three key factors, plus slope, available area, daily design flow, and waste strength that determine what type of wastewater treatment system to install and where. In order for a site to receive a permit, Washington state code requires the presence of at least 12 inches of suitable soil; this 12 inches is soil above the restrictive layer, that layer either being either a seasonal high water table as evidenced by soil mottling, a clay hard pan, bedrock or any other impervious layer that would restrict the downward, unsaturated flow of effluent through the soil profile.

SCOPE: This soil evaluation was conducted for Weyerhaeuser Real Estate Development Company for the Silver Lake Forest Reserve in Toutle, Washington. Soil test pits were excavated on each lot in order to evaluate the site soils for septic systems. Test pits are staked in the field with four foot stakes with pink ribbons and a unique identifier. The numbering scheme for each pit was G/A Lot #/ Pit #. Test pits were backfilled after evaluation. Paths were cleared to each testing area. *Due to changes in lot numbers, the lot number on the stake may not correspond to the final lot number.* A map is attached showing the approximate test hole location. Further evaluation on each lot will be required in order to prepare preliminary and final septic system designs.

SOIL ANALYSIS: The Soil Survey of Cowlitz County, 1974 maps the area soils as an Olympic Silt Loam. The site soil appears to be consistent with the Olympic Silt Loam Series and the Coweeman Silty Clay Loam Series. An Olympic Silt Loam soil is described as very deep well drained soil located on hillslopes and mountainslopes. In a representative profile, the surface layer is covered with an organic mat about 2 inches thick. The subsurface layer is a dark reddish brown silt loam extending about 4 inches for the upper part. The lower part of the subsurface is dark reddish brown silt loam extending to a depth of 14 inches. The next layer is a dark reddish brown and yellowish red silty clay loam and silty clay extending to a depth of 38 inches. The last layer is yellowish red silty clay extending to a depth of 60 inches or more. The Coweeman Silty Clay Loam is described as a poorly drained soil on concave terraces formed in old sediments from basaltic and andesitic rocks. In a representative profile, the upper nine inches is very dark gray silty clay loam while the subsoil is mottled dark grayish-brown clay.

METHOD OF EVALUATION: Goode & Associates conducted soil and site evaluations at the Silver Lake Forest Reserve during March of 2006. Drainfield testing sites were chosen based on available land area, setbacks to site features such as property lines, wetlands, cuts/banks, steepness of slope, and probable home site locations. A minimum of three soil test pits were excavated on each lot. Soil test pits were evaluated for color, texture, structure, and probable seasonal high water table. Septic system recommendations were based on the best two out of three test results.

RESULTS: Soil test pit results and recommended system type for each area tested is included in Table 2. The identified system type for each lot is based on the best two out of three test pit evaluations. Given the highly variable suitable soil depths seen during the initial testing it may be possible to test a different area of the lot and find better soil depth capable of supporting a simpler and less costly septic system.

TYPES OF SEPTIC SYSTEMS:
Prior to installing a septic system, a design must be prepared by a Licensed Designer. This design matches the homeowner's needs with the technology available to provide affordable, efficient, reliable wastewater treatment. The Licensed Designer interviews the homeowner to determine the number of bedrooms in the proposed home, the footprint of all structures to be built, proposed landscaping plans, and then works to incorporate the septic system into the overall site plan. Typically, the site plan prepared by the Designer is also used as the site plan for the building permit. Once designs have been prepared by the Designer, they are then submitted to Cowlitz County Department of Building and Planning for review and approval. A permit is then issued for construction of the system. During construction, the Designer consults with the Installer and inspects the construction to ensure that the system is installed according to the approved plan. The Designer is also responsible for providing operation and maintenance instructions to the homeowner. Several different types are available to meet specific site conditions, user's needs, and permitting requirements. A general description of each system type is included. The estimated installation cost based on system type is summarized in Table 1.

Gravity Distribution Trench:
The simplest of all system types, this system relies on gravity flow to move wastewater from the septic tank to the drainfield. The septic tank is a two compartment, usually concrete, vessel which captures all of the household sewage and gray water from the residence and allows for settling of solids. The liquid moves from this tank by gravity to the drainfield which is constructed of trenches filled with drainrock or a plastic gravelless chamber product. Gravity systems are do not equally distribute wastewater to the drainfield trenches and require better soil conditions to finish treatment of the wastewater. Gravity systems can be used when suitable soil depth exceeds 48 inches[1]. Estimated cost: $7,000

Pressure Distribution Trench:
All systems other than gravity distribution systems use pressure distribution of the wastewater. A pressure distribution trench system is identical in size to those using gravity distribution. The difference in the two methods is the amount of suitable soil present. In the case of a pressure distribution trench system, a second single-compartment chamber is installed downstream from the septic tank. The second tank works as a pump chamber, allowing for storage of the wastewater and the installation of a pump to pressure dose the drainfield. Pressure distribution of wastewater is equal, meaning the entire drainfield is used during a dose which allows for better treatment of the wastewater, mitigating the shallow soil depth. A pressure distribution trench system can be designed when suitable soil depth exceeds 30 inches. Estimated system cost: $11,000

Pressure Distribution Trench w/ Treatment:
When soil depth is not deep enough to support a pressure distribution trench system, treatment of the wastewater must be made up by installing a treatment system. Several options are available for treatment including intermittent sandfilters or proprietary treatment systems. The system is the same as a regular pressure distribution trench system except the wastewater passes through a treatment system after leaving the pump chamber. The wastewater is then pumped from the treatment system to the drainfield for final treatment and disposal. Pressure distribution trenches with treatment can be installed when soil is deeper than 18 inches. An alternative to this system would be a mound which is discussed below. Estimated system cost: $18,000.

Mound:
Mound systems do not include trench drainfields. Instead, wastewater is pumped from the pump chamber to a "mound" of manufactured coarse sand and drainrock which allows for filtration and treatment of the wastewater prior to final treatment and disposal in the site soils. Mounds can be constructed so that they are backfilled on the upslope side and blend into the landscape in order to minimize their appearance. Estimated system cost: $17,000

Mound w/ Treatment:
A mound system with treatment is used when soils are marginally suitable. The same as a pressure distribution trench system with treatment, the additional treatment is necessary to clean up the wastewater before final treatment in the mound and disposal in the native soils. These systems are used when suitable soil depths are between 12 and 18 inches. An alternative to this system would be the proprietary Glendon system. Estimated system cost: $25,000

Glendon:
A Glendon is a proprietary septic system which incorporates a mound and a sandfilter into one system. This system includes a two-compartment septic tank, a single-compartment pump chamber, but the effluent is dosed to the system in small, frequent doses throughout the day. Estimated system cost: $14,000

ESTIMATED SYSTEM COSTS:
Estimated costs for each system type are included for general reference. These costs were proposed for three bedroom systems and are not a guarantee of actual system cost. System cost can be determined after site and project specific designs have been prepared.

[1] System type and soil depth is for flat sites. Sloping sites require deeper soil depth determined by percent slope.

Table 1—Estimated installation cost by system type

System Type	Estimated Cost*
Gravity Trench	$7,000
Pressure Distribution Trench	$11,000
Pressure Distribution Trench w/ Treatment	$18,000
Mound	$17,000
Mound w/ Treatment	$25,000
Glendon	$14,000

*Estimated system cost does not include septic system design or permit fees.

Figure 1—Typical trench construction (gravity or pressure distribution) using gravelless chamber

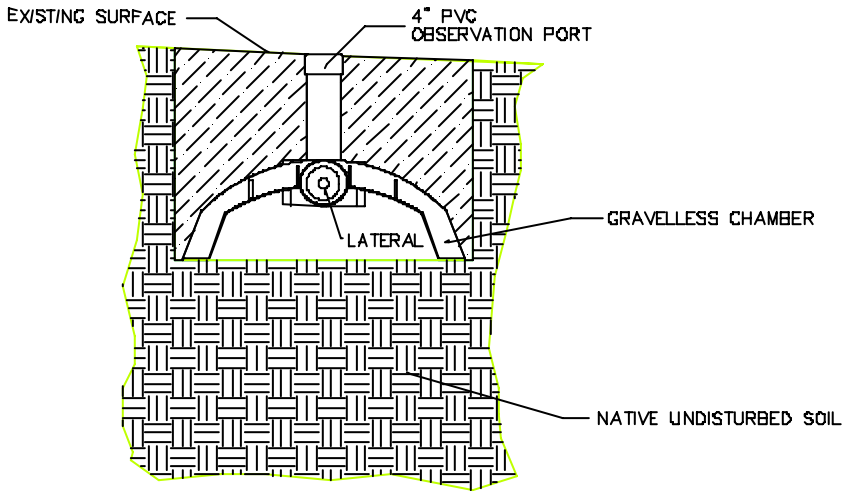


Figure 2—Typical trench construction (gravity or pressure distribution) using drainrock

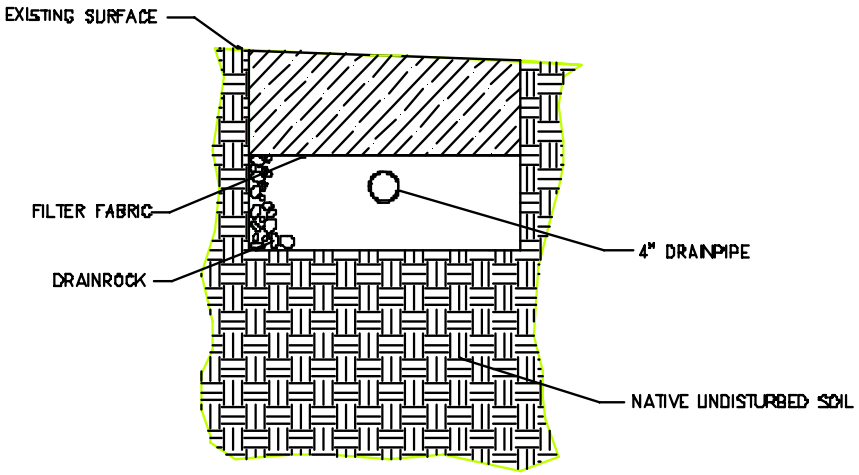


Figure 3—Typical cross-section of mound system

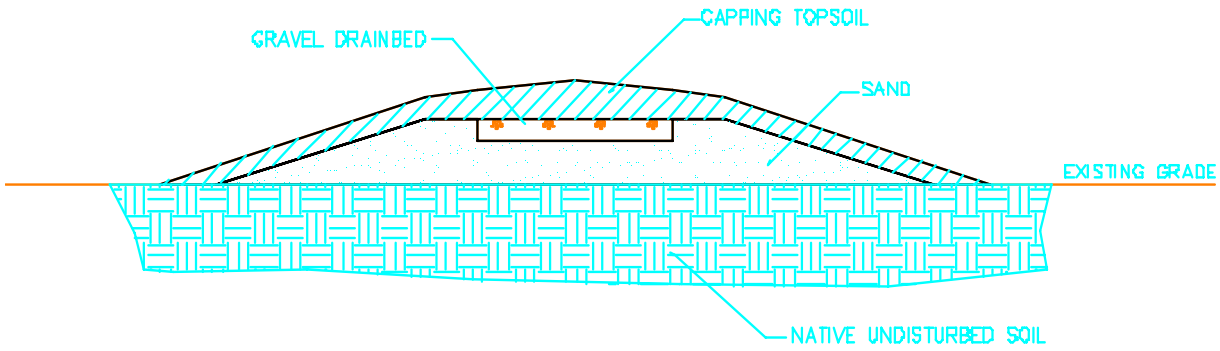


Figure 4—Typical cross-section of proprietary Glendon system

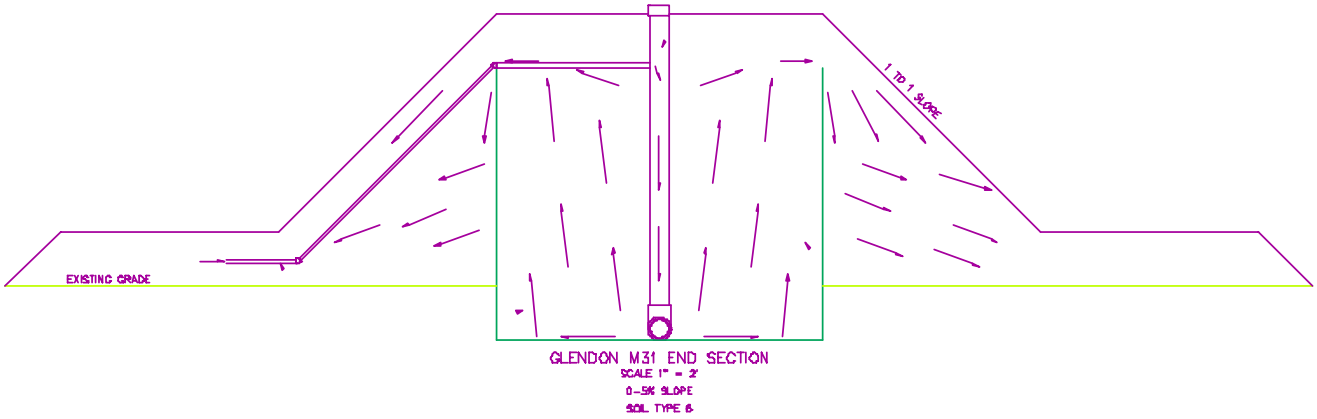


Figure 5—Typical layout of trench drainfield system (gravity or pressure distribution)

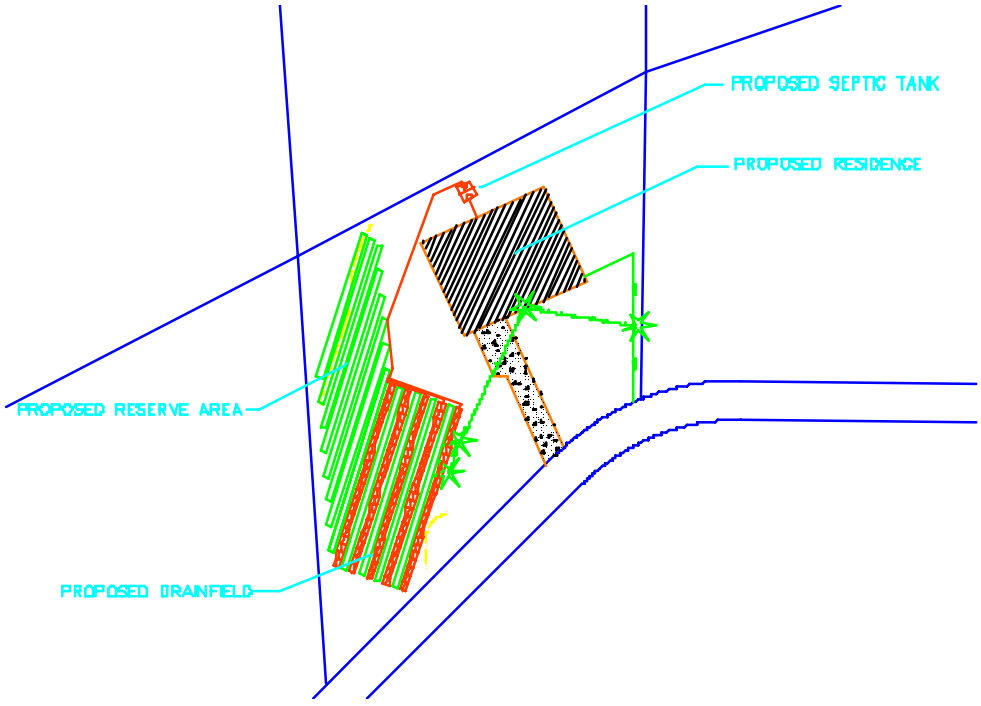


Figure 6—Typical layout of mound drainfield system

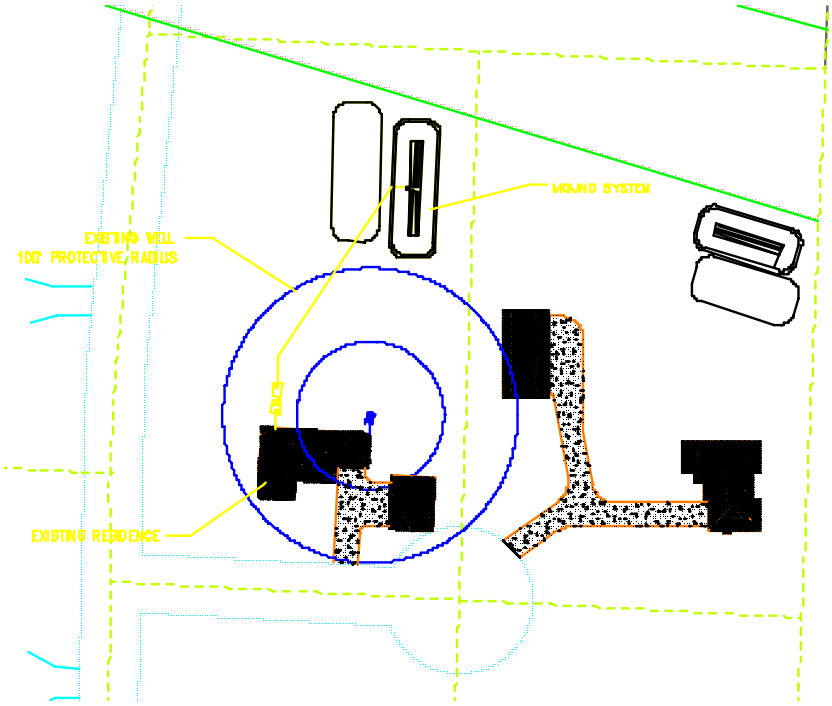


Figure 7—Typical layout of Glendon drainfield system

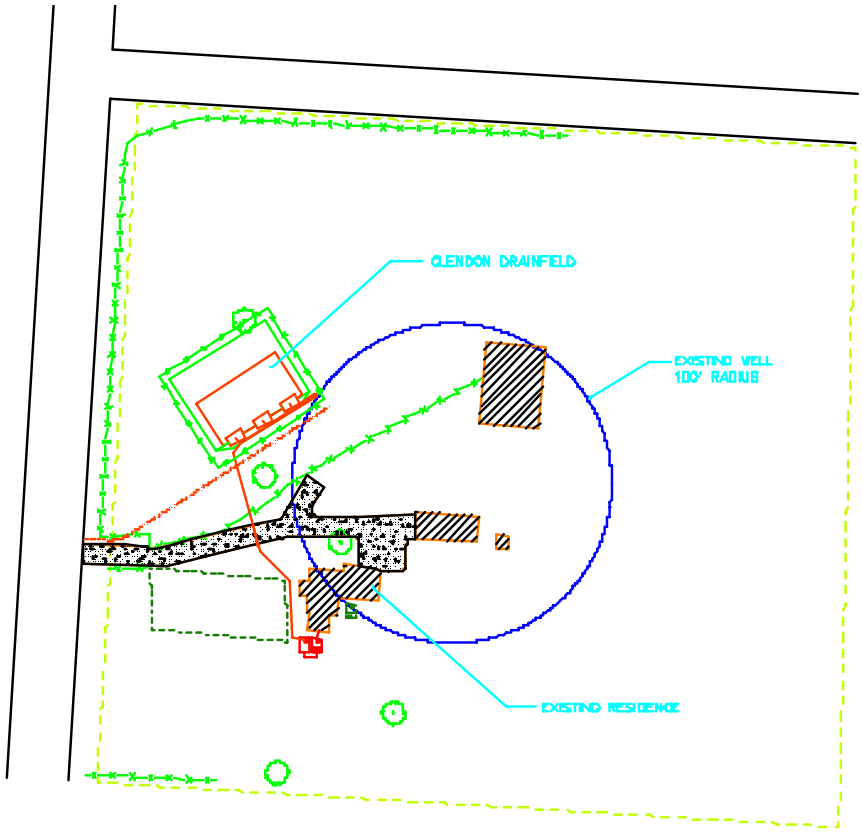


Table 2—Recommended system type per lot (where tested)

LOT NUMBER	*SOIL TYPE*	*PIT #1*	*PIT #2*	*PIT #3*	*PIT #4*	*PRIMARY RESTRICTIVE*	*RESERVE RESTRICTIVE*	*RECOMMENDED SYSTEM TYPE*
1	6	45"	32"	32"		TEXTURE CHANGE	PARENT MATERIAL	PD TRENCH
*2**	6	36"	45"	50"		TEXTURE CHANGE	TEXTURE CHANGE	PD TRENCH
3	6	33"	40"	30"	8"	FRACTURED BEDROCK	TEXTURE CHANGE	PD TRENCH
*4**	6	26"	26"	28"		TEXTURE CHANGE	TEXTURE CHANGE	MOUND
*5**	6	26"	35"	32"		TEXTURE CHANGE	TEXTURE CHANGE	PD W/ TREATMENT
6	5	41"	44"	35"		WATER SEEPS @ 41"	WATER SEEPS @ 35"	PD TRENCH
7	5	38"	40"	37"		TEXTURE CHANGE	TEXTURE CHANGE	PD TRENCH
*8**	5	46"	40"	40"		FRACTURED BEDROCK	TEXTURE CHANGE	PD TRENCH
9	6	44"	33"	32"		FRACTURED BEDROCK	PARENT MATERIAL	PD TRENCH
10	6	45"	46"	35"		TEXTURE CHANGE	PARENT MATERIAL	PD TRENCH
11	5	31"	36"	26"		WATER SEEPS @ 36-58"	WATER SEEPS @ 20"	PD TRENCH W/ TREATMENT
*12**	5	32"	31"	37"		TEXTURE CHANGE	FRACTURED BEDROCK	PD TRENCH W/ TREATMENT
13	5	50"	56"	45"		DEPTH OF EXCAVATION	TEXTURE CHANGE	GRAVITY TRENCH
14	6	65"	57"	55"		DEPTH OF EXCAVATION	DEPTH OF EXCAVATION	GRAVITY TRENCH
15	6	66"	58"	58"		DEPTH OF EXCAVATION	PARENT MATERIAL	GRAVITY TRENCH
16	6	57"	60"	34"		DEPTH OF EXCAVATION	TEXTURE CHANGE	GRAVITY TRENCH
17	5	68"	38"	34"		PARENT MATERIAL	PARENT MATERIAL	PD TRENCH
18	6	37"	42"	8"	0"	SHW/PARENT MATERIAL	HYDRIC SOIL	PD TRENCH
*19**	6	30”	42”	36”		TEXTURE CHANGE	TEXTURE CHANGE	PD TRENCH
20	6	38"	38"	28"		TEXTURE CHANGE	TEXTURE CHANGE	PD TRENCH
*21**	6	39"	51"	38"		TEXTURE CHANGE	TEXTURE CHANGE	PD TRENCH
*22**	6	15"	22”	39"		TEXTURE CHANGE	WATER SEEPS @15"	PD TRENCH W/ TREATMENT
*23**	6	25"	26"	24”		TEXTURE CHANGE	WATER SEEPS @ 12"	MOUND
24	5	45"	43"	32"		TEXTURE CHANGE	TEXTURE CHANGE	PD TRENCH
25	6	22"	28"	17"		TEXTURE CHANGE	WATER SEEPS @ 17"	MOUND
26	6	45"	35"	54"		TEXTURE CHANGE	SHW	PD TRENCH

LOT NUMBER	*SOIL TYPE*	*PIT #1*	*PIT #2*	*PIT #3*	*PIT #4*	*PRIMARY RESTRICTIVE*	*RESERVE RESTRICTIVE*	*RECOMMENDED SYSTEM TYPE*
27	6	29"	12"	8"		WATER SEEPS @ 12 & 28"	WATER SEEPS @ 8'	MND W/ TRMNT OR GLENDON
*28**	6	24"	25"	20"		TEXTURE CHANGE	TEXTURE CHANGE	PD W/ TREATMENT
29	5	36"	28"	12"		WATER SEEPS @ 28"	SHW/MOTTLING	PD W/ TREATMENT
30	5	34"	30"	19"		TEXTURE CHANGE	TEXTURE CHANGE	PD W/ TREATMENT
31	6	40"	15"	14"		WATER SEEPS @ 18"	WATER SEEPS @ 16"	MND W/ TRMNT OR GLENDON
*32**	6	36”	24”	24”		SHW/TEXTURE CHANGE	SHW/ TEXTURE CHANGE	PD W/ TREATMENT
*33**	6	28"	21”	24”		TEXTURE CHANGE	TEXTURE CHANGE	PD W/ TREATMENT
*34**	6	18”	18”	19”		TEXTURE CHANGE	TEXTURE CHANGE	MOUND
35	6	24"	36"	17"	12"	SHW/TEXTURE CHANGE	SHW/TEXTURE CHANGE	MOUND
36	6	31"	39"	19"		TEXTURE CHANGE	SHW/TEXTURE CHANGE	PD W/ TREATMENT
*37**	6	37"	36”	35”		TEXTURE CHANGE	TEXTURE CHANGE	PD TRENCH
38	6	36"	38"	30"		TEXTURE CHANGE	WATER SEEPS @ 30"	PD TRENCH
*39**	6	30"	55"	33"		PARENT MATERIAL	TEXTURE CHANGE	PD TRENCH
40	6	41"	40"	35"		TEXTURE CHANGE	SHW/TEXTURE CHANGE	PD TRENCH
41	5	48"		40"		DEPTH OF EXCAVATION	PARENT MATERIAL	PD TRENCH
*42**	5	30"	26"	23"		PARENT MATERIAL	SHW	PD TRENCH W/ TREATMENT
43	5	36"		30"		PARENT MATERIAL	PARENT MATERIAL	PD TRENCH
44	5	84"	36"	12"		TEXTURE CHANGE	WATER SEEPS @ 18"	PD TRENCH
45	5	41"		36"		TEXTURE CHANGE	PARENT MATERIAL	PD TRENCH
46	6	35"		17"		TEXTURE CHANGE	SHW/MOTTLING	PD TRENCH
47	6	41"		32"		TEXTURE CHANGE	TEXTURE CHANGE	PD TRENCH
48	5	63"	38"	16"		SHW/MOTTLING	SHW/MOTTLING	PD TRENCH
*49**	5	50”	60”	55”		TEXTURE CHANGE	TEXTURE CHANGE	GRAVITY TRENCH

*Those lot numbers followed by an asterisk were re-evaluated on 4-20-06 and found to have more suitable soils in a different area than previously tested. The preferred drainfield area for these sites will be denoted by a stake in the field labeled with the date of evaluation. The format is similar to G/A 4-XX-06 Lot # -X.

**PD Trench systems with treatment are installed mostly below grade and can be more easily landscaped and therefore were chosen as the preferred system for the lot. If a mound system was specified, it was felt that the design and installation of the mound would be easier than trying to maintain a shallow trench depth along the contour.

***Soil type is classified as Type 1A through 6 with Type 1A soils being the coarsest and Type 6 the finest textured soil. Each soil type has a specific loading rate for septic system drainfields.

Type 1A-coarse gravelly sands, extremely gravelly soils
Type 5-silty loam
Type 6-silty clay loam, clay loam
SHW= estimated seasonal high water

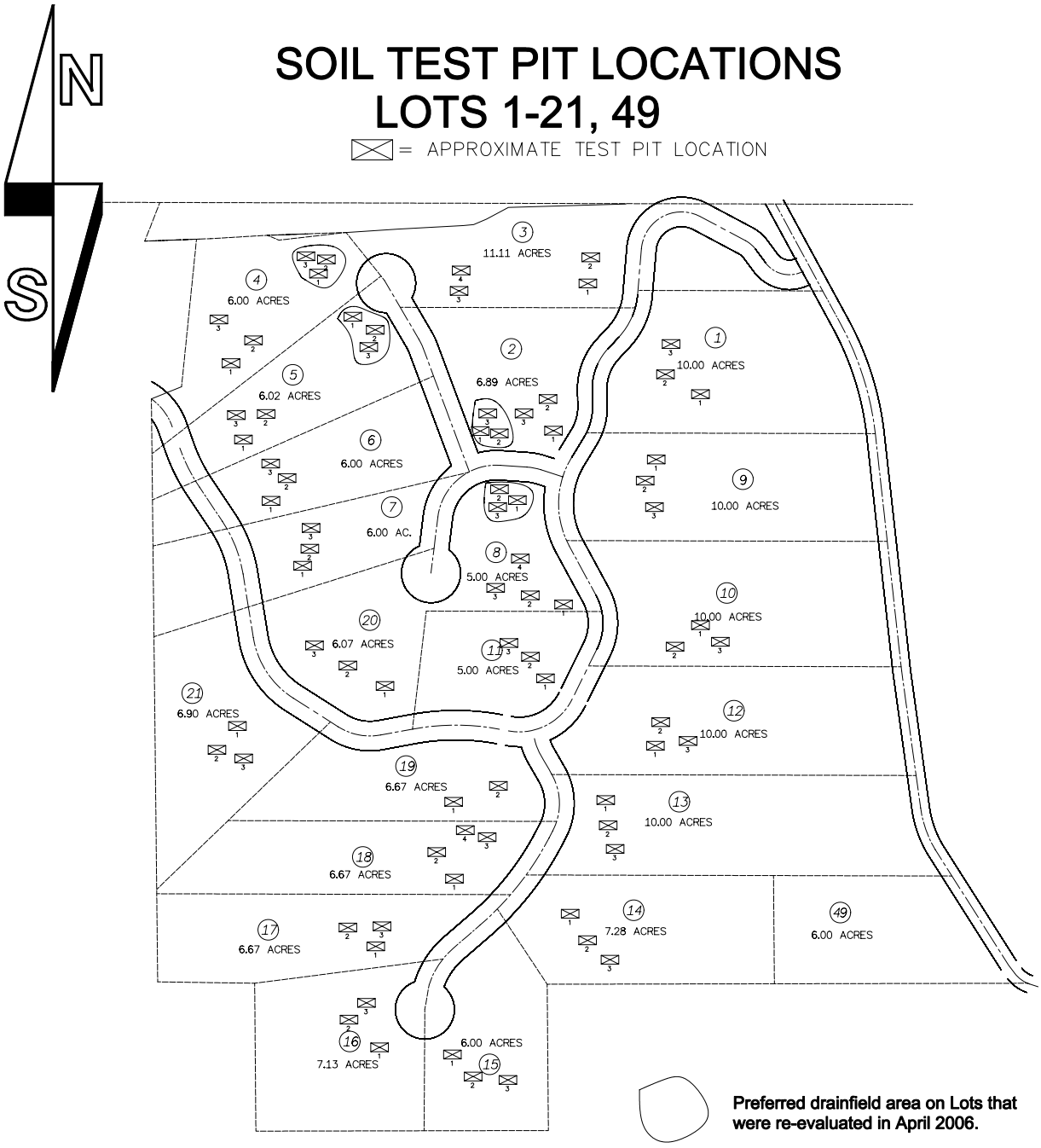
CONCLUSION:
Recommended system types are based on the analysis of three soil test pits in an area chosen as the best site for a drainfield. It is expected that the recommendations are a worst case scenario. It may be possible to test other areas on each lot in order to determine if more suitable soils (requiring less costly systems) are present. Septic systems are designed for site conditions and the user's needs. This evaluation is not a guarantee of permit approval by Cowlitz County. It is merely an opinion based on knowledge of the current rules and regulations regarding septic system design.

Respectfully Submitted,

Jeannie Yackley, Licensed Designer
Goode & Associates

SOIL TEST PIT LOCATIONS
LOTS 1-21, 49

⊠ = APPROXIMATE TEST PIT LOCATION



NOTE: Site plan is intended to be used as an aid in locating soil test pits in the field. This is not a design.

APPLICANT: Weyerhaeuser Real Estate Development Company
32820 Weyerhaeuser Way South, MS: PH2
Federal Way, WA 98063-9777

SITE ADDRESS: Silver Lake Forest Reserve
855 Sightly Road, Toutle

TAX PARCEL #:
DRAWING DATE: 4-3-06

SCALE: NTS
DRAWN BY: jy

ON-SITE WASTEWATER TREATMENT SYSTEM
STATE OF WASHINGTON
5100216
JEAN R. YACKLEY
LICENSED DESIGNER
EXPIRES 08/11/

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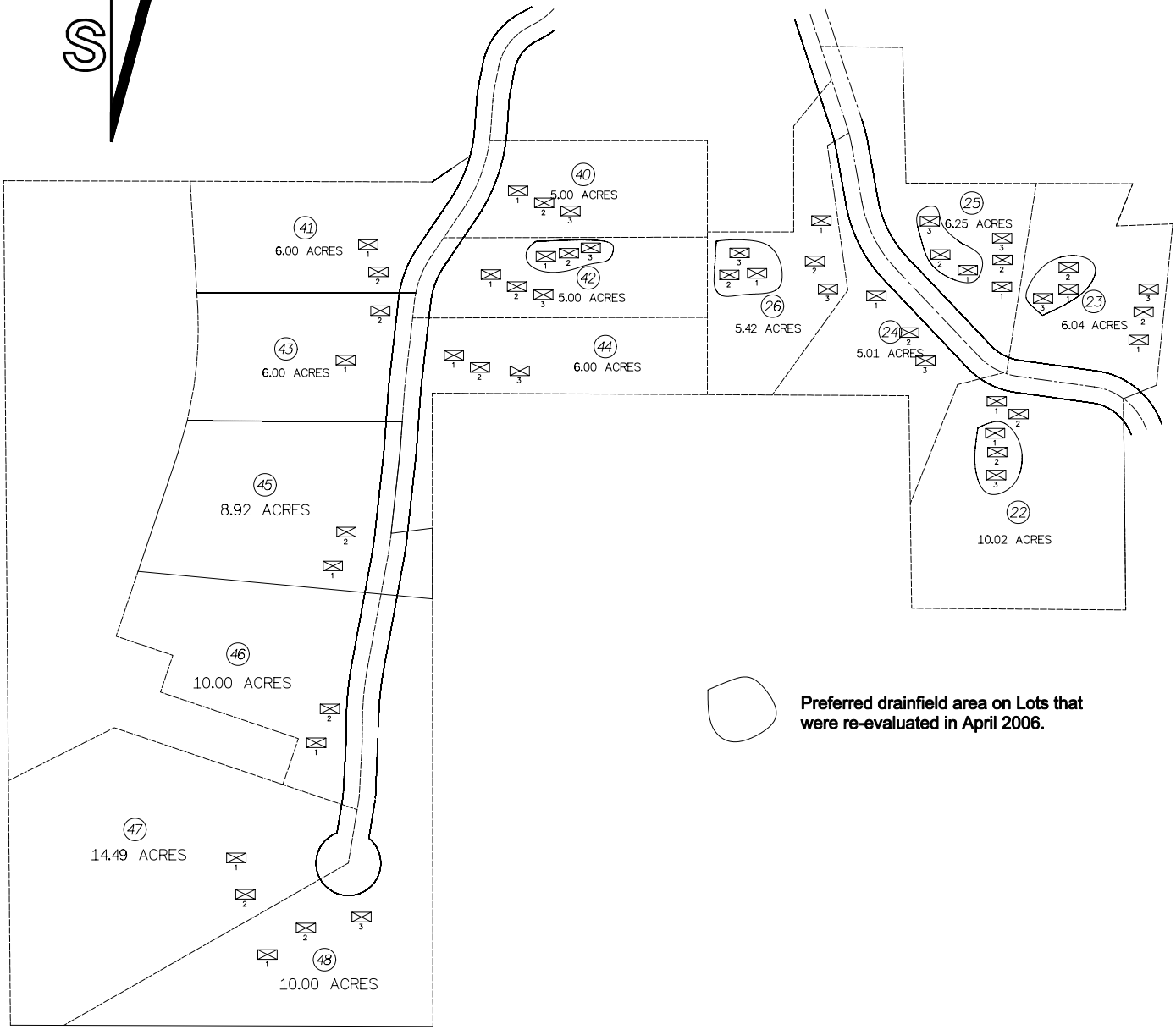
JOB NUMBER: 2006-14

SOIL TEST PIT LOCATIONS
LOTS 22-26, 40-48

⊠ = APPROXIMATE TEST PIT LOCATION



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TAX PARCEL #:	
DRAWING DATE:	4-3-06
SCALE:	NTS
DRAWN BY:	jy

ON-SITE WASTEWATER TREATMENT SYSTEM
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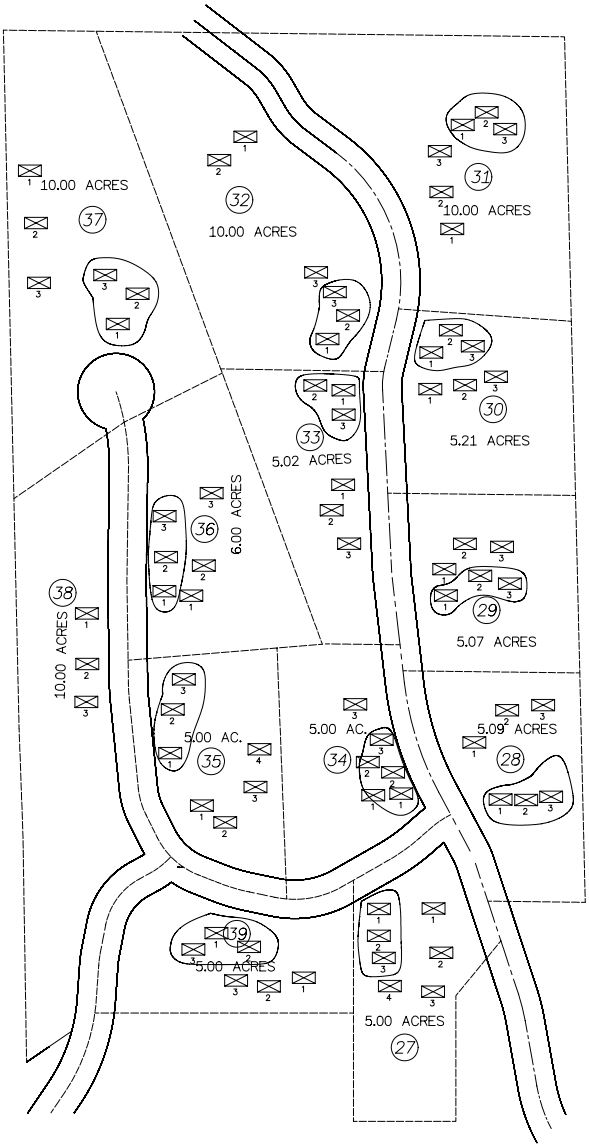
JOB NUMBER: 2006-14

SOIL TEST PIT LOCATIONS
LOTS 27-39

⊠ = APPROXIMATE TEST PIT LOCATION



Preferred drainfield area on Lots that were re-evaluated in April 2006.

NOTE: Site plan is intended to be used as an aid in locating soil test pits in the field. This is not a design.

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Federal Way, WA 98063-9777

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855 Sightly Road, Toutle

TAX PARCEL #:
DRAWING DATE: 4-3-06

SCALE: NTS
DRAWN BY: jy

ON-SITE WASTEWATER TREATMENT SYSTEM
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JOB NUMBER: 2006-14