

VEAL EXHIBIT 10

REDWOOD MANOR
REVISED DRAINAGE CALCS 12/11/95
KEITH A. LITCHFIELD, PE

LITCHFIELD, P.E.
CONSULTANT & TECHNICAL SERVICES

128 West Marilyn Avenue, Everett, Washington 98204
(206) 290-5458

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ED. HILL
EH 106

REVISED DRAINAGE CALCULATIONS

PROJECT SITE:

REDWOOD MANOR
N.E. 101ST PLACE
REDMOND, WASHINGTON

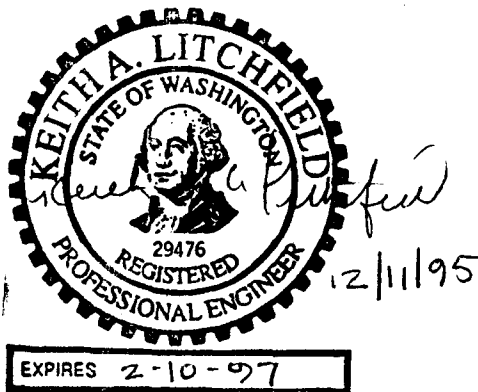
FILE NO. PPL90-06

PREPARED FOR:

RON KLUGER
23004 N.E. 64TH
REDMOND, WASHINGTON
(206) 868-2086

PREPARED BY:

KEITH A. LITCHFIELD, P.E.
DECEMBER 11, 1995



DRAINAGE CALCULATION REVISIONS:

The attached revised drainage calculations are in response to the City of Redmond consultant's November 7, 1995 review of the project. During Otak's review of the calculations and plans, two comments were brought up in regards to the hydrologic analysis and interceptor swale sizing. In response to these comments the detention pipe and orifices and interceptor swale were resized as detailed in the following calculation sheets. The earlier calculations are also attached for reference purposes.

12/11/95

REVISED

- BASED ON OTAK 10/22/95 REVIEW REWORK
COEFFICIENT OF DISCHARGE TO REFLECT
WOOD & FOREST AREA ($C = 0.10$)
- RESIZE SYSTEM

R/D BASIN DESIGNCOEF. OF DISCHARGE

$$C_1 = 0.90 \quad (\text{from } 1/6/94 \text{ CALCS})$$

$$A_2 = 0.22 \quad (\quad " \quad " \quad " \quad)$$

REVISED

$$C_{2A} = 0.10$$

$$A_{2A} = 1.33 \text{ ACRE}$$

$$C_{2B} = 0.15$$

$$A_{2B} = 1.32 \text{ ACRE}$$

$$C_3 = 0.90 \quad (\text{from } 1/6/94 \text{ CALCS})$$

$$A_3 = 0.067 \text{ A} \quad (\quad " \quad " \quad " \quad)$$

$$C_4 = 0.15 \quad (\quad " \quad " \quad " \quad)$$

$$A_4 = 0.067 \text{ A} \quad (\quad " \quad " \quad " \quad)$$

$$C_E = \frac{(0.90)(0.22) + (0.10)(1.33) + (0.15)(1.32) + (0.9)(0.067) + (0.15)(0.067)}{3.00}$$

$$= 0.20$$

$$I_{10} = 1.35 \quad (\text{from } 1/6/95 \text{ CALCS})$$

$$Q_E = C_E I_{10} A = (0.20)(1.35)(3.00)$$

$$= 0.81 \text{ CFS}$$

SIZE R/D BASIN FOR 10 YR. STORM

$$Q_0 = \frac{\text{ALLOWABLE OUTFLOW}}{(\text{ACREAGE}) \text{ FUTURE "C"}}$$

↖ ↗
SEE 11/6/94 CALCS

$$Q_0 = \frac{0.81}{(3.0)(0.52)} = 0.52 \frac{\text{CFS}}{\text{ACRE} \cdot \text{C}}$$

$$T_{10\text{YR}} = -25 + \sqrt{\frac{70500}{26.4 Q_0}} = -25 + \sqrt{\frac{70500}{(26.4)(0.52)}}$$
$$= 46.7 \text{ MIN (PEAK STORAGE TIME)}$$

$$\text{VOLUME}_{\text{MAX}} = \sqrt{s} = \frac{2820T}{T+25} - 26.4 Q_0 T$$
$$= \frac{2820(46.7)}{46.7 + 25} - 26.4(0.52)(46.7)$$
$$= 1,196 \text{ ft}^3$$

$$\text{VOLUME}_{\text{TOTAL}} = \sqrt{s} A C_F = (1196)(3.0)(0.52)$$
$$= 1866 \text{ ft}^3$$

USE 54" LMP FOR DETENTION TANK

R/D SIZING (CONT.)

$$\text{AREA}_{54''} = 15.9 \text{ ft}^2$$

- USE 72" M.H.'S w/ 4.7' OF STORAGE ABOVE MH SUMP & 3' OF 36" PIPE BETWEEN MH'S & D. PIPE.

$$\begin{aligned} V_{\text{EXTRA}} &= (28.2)(4.7)(2) + \left[\frac{(\pi)(3)^2}{4} \right] (3')(2) \\ &= 307 \text{ ft}^3 \end{aligned}$$

$$L_{\text{REQ'D}} = \frac{1866 - 307}{15.9} = 98.0 \text{ LF}$$

- 1/6/94 CALCS CALLED FOR 92 LF - 54" CMP
∴ CHANGE PLANS & CALL OUT 98 LF - 54" CMP w/ 72" MH'S

ORIFICE SIZING

CALCULATE 5 YR Q

$$Q_{5\text{YR}} = C_E I_S A = (0.20)(1.05)(3.0)$$

↑ 1/6/94 CALCS

$$= 0.63$$

CALCULATE 2 YR Q

$$Q_{2\text{YR}} = (0.20)(0.71)(3.0)$$

↑ 1/6/94 CALCS

$$= 0.42 \text{ CFS}$$

SIZE ORIFICES

24R DISCHARGE ORIFICE

$$Q_{\text{ALLOW}} = (0.62)(a) \sqrt{2gh}$$

- where TOTAL AVAILABLE HEAD, $H_{TA} = 4.25'$

- Assume $h_{24R} = H_{TA}/3$; $h_{54R} = H_{TA}/2$;
 $h_{104R} = H_{TA} \approx 1'$ BETWEEN EACH ORIFICE

$$a_{24R} = \frac{Q_A}{(0.62) \sqrt{2gh}} = \frac{0.42}{(0.62) \sqrt{(64.4) 1.42}} = 0.071 \text{ ft}^2$$

$$d_{24R} = \sqrt{\frac{4a}{\pi}} = \sqrt{\frac{4(0.071)}{\pi}} = 0.30' = 3.6''$$

54R DISCHARGE ORIFICE

$$Q_{24R} = (0.62)(0.071) \sqrt{(64.4) 2.84} = 0.59 \text{ CFS}$$

$$Q_{54R} = 0.63 - 0.59 = 0.04 \text{ CFS}$$

$$a_{54R} = \frac{0.04}{(0.62) \sqrt{(64.4) (1.84)}} = 0.0059 \text{ ft}^2$$

$$d_{54R} = \sqrt{\frac{4(0.0059)}{\pi}} = 0.087' = 1.0''$$

10 YR DISCHARGE ORIFICE

$$Q_{24R} = (0.62)(0.071) \sqrt{(64.4)(4.25)} = 0.73 \text{ CFS}$$

$$Q_{54R} = (0.62)(0.0059) \sqrt{(64.4) 3.25} = 0.053 \text{ CFS}$$

$$Q_{104R} = 0.81 - 0.73 - 0.053 = 0.027 \text{ CFS.}$$

$$a = \frac{0.027}{0.62 \sqrt{(64.4)(2.25)}} = 0.0036 \text{ ft}^2$$

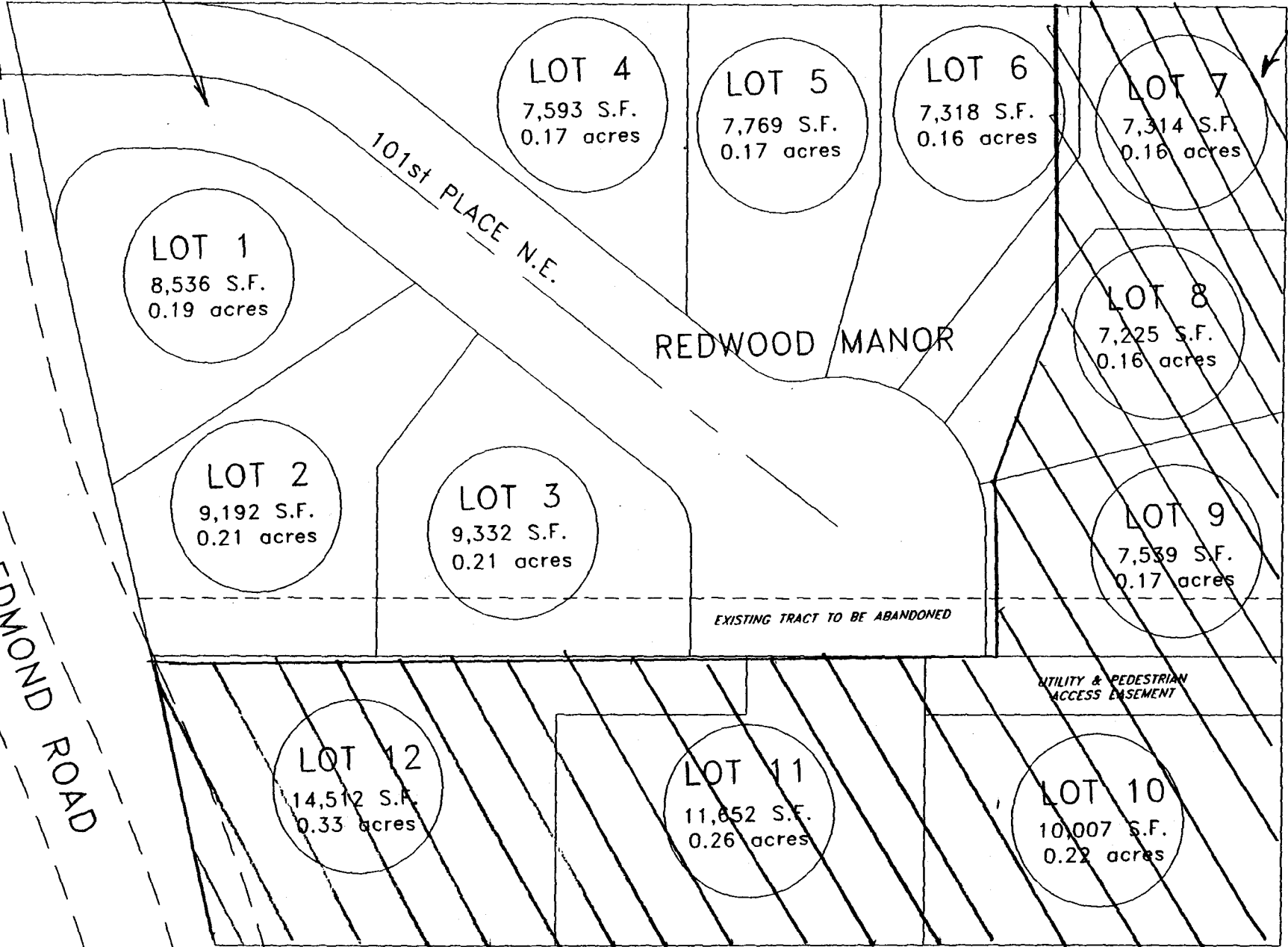
$$d = \sqrt{\frac{(4)(0.0036)}{\pi}} = 0.068' = 0.82''$$

↑
N
1" = 50'

SPARSE TREES w/ GROUND COVER
AREA = 57,500 SF = 1.32 ACRE
C = 0.15

WOOD & FOREST AREA
AREA = 57,900 SF = 1.33 ACRE
C = 0.10

WOODINVILLE-REDMOND ROAD



Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: REDWOOD MANOR

Comment: INTERCEPTOR DITCH - EAST PROPERTY LINE

Solve For Depth

Given Input Data:

Left Side Slope..	3.00:1 (H:V)
Right Side Slope.	3.00:1 (H:V)
Manning's n.....	0.030
Channel Slope....	0.0400 ft/ft
Discharge.....	3.05 cfs

Computed Results:

Depth.....	0.51 ft
Velocity.....	3.86 fps
Flow Area.....	0.79 sf
Flow Top Width...	3.08 ft
Wetted Perimeter.	3.25 ft
Critical Depth...	0.58 ft
Critical Slope...	0.0213 ft/ft
Froude Number....	1.34 (flow is Supercritical)