



FISK LAND SURVEYING & CONSULTING ENGINEERS, INC.
 1022 Main Street • PO Box 8154 • Rapid City, SD 57709
 Phone (605) 348-1538 • Fax (605) 341-1112 • E-mail fiskls@midconetwork.com

March 12, 2010

Growth Management Department
 City of Rapid City
 300 Sixth Street
 Rapid City, SD 57701

RE: Drainage Report
 Lot 14 of Feay Reder Subdivision

This lot is on the upper fringes of the Spring Creek Drainage Basin. The discharge enters Spring Creek some 3 miles away via minor stream flow.

The northern half of the lot receives flow in a vee swale from a 4 acre mountain hillside that is Forest Service land.

Additional flow is directed to the south half from the west from a 12.5 acre mountain hillside. There is no defined channel for this flow and it appears to be spread over a 300' wide area.

Discharge from the north

$$A = 4 \text{ ac.}$$

The upper 400' of this area is overland flow at:

$$s = 30/400 = .075 \quad 7.5\%$$

$$\text{Fig 2-4 } v = .68 \text{ fps}$$

$$t_1 = 400/.68 = 588 \text{ sec} = 9.8'$$

The lower 460' is more concentrated in a vee channel with:

$$s = 8.7\%$$

$$\text{velocities will increase to } 1 \text{ fps}$$

$$t_2 = 460 \text{ sec or } 7.7 \text{ min}$$

$$T_c = 9.8 + 7.7 = 17.5 \text{ min}$$

$$i_{100} = 6.9''/\text{hr}$$

$$c \text{ (forest - 100 year)} = 0.37$$

$$Q = 0.37 \times 6.9 \times 4 = 10.2 \text{ cfs}$$

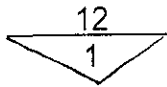
RECEIVED

MAR 12 2010

Rapid City Growth
 Management Department

Check flow at 1' deep vee channel – 12' wide.

$$\text{Mean } s = 22/190 = .1158 \quad s^{1/2} = 0.34$$



$$\begin{aligned} A &= 6 \\ P &= 12.2 \\ R &= .49 \\ R^{2/3} &= 0.62 \\ \text{Let } n &= 0.05 \end{aligned}$$

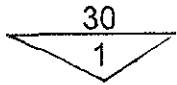
$$v = \frac{1.48 \times 0.62 \times 0.34}{.05} = 6.23 \quad Q = 37 \text{ cfs } \gg 10.2$$

Use 20' easement width, centered on mean alignment of channel to allow for variations.

Through the center portion of the site (before flow from the west is received) the channel widens and flattens.

Vee is 1' deep in 30' width.

$$s = 10/70 = .143 \quad s^{1/2} = 0.38$$



$$\begin{aligned} A &= 15 \\ P &= 30.1 \\ R &= .50 \\ R^{2/3} &= 0.63 \\ n &= 0.05 \end{aligned}$$

$$v = \frac{1.48 \times 0.63 \times 0.38}{0.05} = 7.08 \quad Q = 106 \gg 10.2$$

Try 20' wide 0.7' deep

$$\begin{aligned} A &= 7 \\ P &= 20.1 \\ R &= 0.35 \\ R^{2/3} &= 0.50 \end{aligned}$$

$$v = \frac{1.48 \times 0.50 \times .38}{.05} = 5.6 \text{ fps} \quad Q = 39 \gg 10.2$$

20' wide still ok for central

West Side Runoff Contribution

12.5 ac total channel length 1150'

Upper 500' $s = 60/500$ 11.8%
 $v = 0.8$ fps
 $t_1 = 10.4$ M

Next 560' $s = 70/560$ 12.5%
 $v = 1.2$ fps
 $t_2 = 7.8$
 $t_c = 18$
 $i_{100} = 5.75$ "/hr
 $c = 0.37$
 $Q = .37 \times 5.75 \times 12.5 = 27.3$ cfs

This flow appears to be uniformly spread across the lower 200 feet of the west side.

At the downstream end of the site, there is a combined discharge of $10.2 + 27.3 = 37.5$ cfs. The channel at that point is very broad, being only 1' deep and 90' across.

The mean slope is $8/120 = 0.66\%$ $s^{1/2} = 0.26$

Capacity at 1' depth:

$$A = \frac{30.1}{2} = 15$$

$$P = 90$$

$$R = .167$$

$$R^{2/3} = 0.30$$

$$V = \frac{1.48 \times .30 \times .26}{.05} = 2.31 \text{ fps}$$

$$Q = 2.31 \times 15 = 34.6 \quad 37.5, \text{ but close.}$$

Use 100' wide easement @ south end of site.

Taper easement width to 20' in 220' length.

Sincerely,
 FISK LAND SURVEYING & CONSULTING ENGINEERS, INC.

Warren L. Fisk

Warren L. Fisk, PE, LS
 Senior Engineer

