Appendix A

Ditch Comps

Ditch Comp Sample Problems:

1) Calculate the runoff velocity (V) for a trapezoidal channel using Manning's Equation given the following channel information:

Bottom Width = 4 ft
Side Slopes = 2:1
Channel Slope = 0.03 ft/ft
Depth = 2 ft
n = 0.05 (grass-lined channel)

2) Find the peak discharge (Q) for the channel described in Problem 1.

3) The channel identified in Question 1 is grass-lined, Bermudagrass. Is the channel lining adequate to handle the velocity determined in Question 1?

4) The channel identified in Question 1 is a manmade channel. The Q(10) from the site is 80 cfs. Does the channel meet adequacy requirements as defined by Minimum Standard 19?

5) Calculate the runoff velocity (V) for a vee-shaped channel using Manning's Equation given the following channel information:

Side Slopes = 2:1
Channel Slope = 0.03 ft/ft
Depth = 2 ft
N = 0.05 (grass-lined channel)

6) Find the peak discharge (Q) for the channel described in Problem 5.

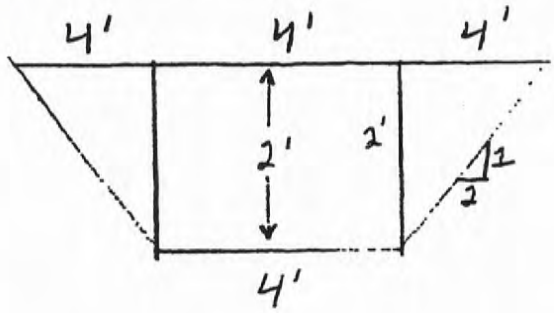
7) The channel identified in Question 5 is grass-lined, Bermudagrass. Is the channel lining adequate to handle the velocity determined in Question 5?

8) The channel identified in Question 5 is a manmade channel. The Q(10) from the site is 45 cfs. Does the channel meet adequacy requirements as defined by Minimum Standard 19?

Answers to Ditch Comp Sample Problems:

1) Calculate the runoff velocity (V) for a trapezoidal channel using Manning's Equation given the following channel information:

Bottom Width = 4 ft
Side Slopes = 2:1
Channel Slope = 0.03 ft/ft
Depth = 2 ft
n = 0.05 (grass-lined channel)



Using Table 5.2 in the Course book

$A = bd + zd^2$

$A = (4')(2') + (2')(2')^2$

$A = 8 + 8 = \boxed{16\ ft^2}$

or

$A = bd + 2(1/2\,bd)$

bd → Area of Square; $1/2\,bd$ → Area of Triangle

$A = (4')(2') + 2[1/2(4')(2')]$

$A = 8 + 2[4] = \boxed{16\ ft^2}$

Wetted Perimeter

Using Table 5.2 in the Course book

$$P = b + 2d\sqrt{z^2+1}$$

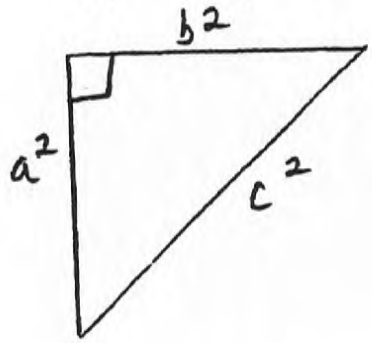
$$P = 4' + 2(2')\sqrt{2^2+1}$$

$$P = 4' + 4'\sqrt{5}$$

$$P = 4' + 8.9' = 12.9, \quad \boxed{13 \text{ feet}}$$

Or

$$a^2 + b^2 = c^2$$



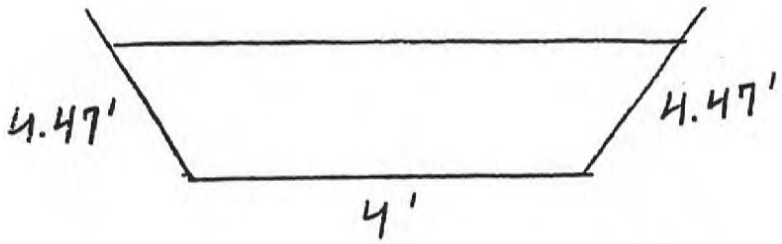
$$2^2 + 4^2 = c^2$$

$$4 + 16 = c^2$$

$$20 = c^2$$

$$c = \sqrt{20}$$

$$c = 4.47$$



$$4.47' + 4' + 4.47' = 12.9, \quad \boxed{13 \text{ feet}}$$

$$\boxed{R = A/P = 16/13 = 1.23}$$

$$V = \frac{1.49}{n} \cdot R^{2/3} S^{1/2}$$

$$v = \frac{1.49}{0.05} \cdot (1.23)^{2/3} \quad (0.03)^{1/2}$$

$$v = (29.8)\ (1.14)\ (0.17)$$

$$\boxed{v = 5.7 \text{ ft/second}}$$

2) **Find the peak discharge (Q) for the channel described in Problem 1.**

$Q = VA$

$Q = (5.7)(16)$

$Q = 91.2$ cfs

3) **The channel identified in Question 1 is grass-lined, Bermudagrass. Is the channel lining adequate to handle the velocity determined in Question 1?**

Yes, Permissible Velocity from Table 3.17-A (page III-135) of VESCH = 6 ft/second.
Channel Velocity = 5.7 ft/second.
$6 > 5.7$ ✓

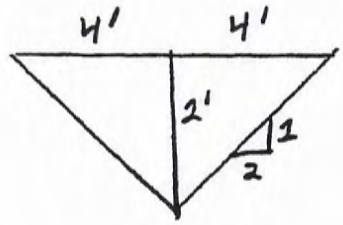
4) **The channel identified in Question 1 is a manmade channel. The Q(10) from the site is 80 cfs. Does the channel meet adequacy requirements as defined by Minimum Standard 19?**

Yes, Allowable Q for Channel is 91.2 cfs. Q from Site is 80 cfs.

$91.2 > 80$ ✓

5) Calculate the runoff velocity (V) for a vee-shaped channel using Manning's Equation given the following channel information:

Side Slopes = 2:1
Channel Slope = 0.03 ft/ft
Depth = 2 ft
N = 0.05 (grass-lined channel)



Using Table 5.2 in the course book

$A = zd^2$

$A = 2(2')^2$

$\boxed{A = 8}$

or $A = 2(1/2\, bd)$

Area of Triangle

$A = 2\left[1/2\,(4)(2)\right]$

$A = 2(4)$

$\boxed{A = 8}$

Wetted Perimeter:

Using Table 5.2 in the course book.

$$P = 2d\sqrt{z^2+1}$$

$$P = 2(2')\sqrt{(2)^2+1}$$

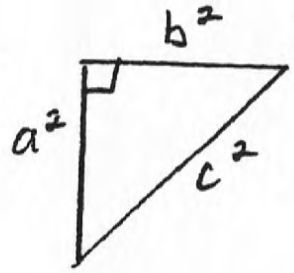
$$P = 4'\sqrt{4+1}$$

$$P = 4'\sqrt{5}$$

$$\boxed{P = 8.9}$$

or

$$a^2 + b^2 = c^2$$



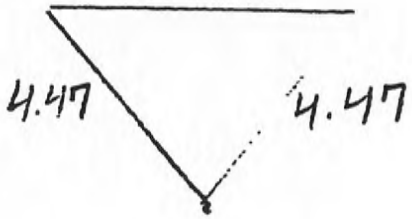
$$(2')^2 + (4')^2 = c^2$$

$$4 + 16 = c^2$$

$$20 = c^2$$

$$c = \sqrt{20}$$

$$c = 4.47$$



$$\boxed{P = 4.47 + 4.47 = 8.9}$$

$$\boxed{R = A/P = 8/8.9 = 0.89}$$

$$V = \frac{1.49}{n} \cdot R^{2/3} S^{1/2}$$

$$V = \frac{1.49}{0.05} \cdot (0.89)^{2/3} (0.03)^{1/2}$$

$$V = (29.8)(0.92)(0.17)$$

$$\boxed{V = 4.6}$$

6) **Find the peak discharge (Q) for the channel described in Problem 5.**

$Q = VA$

$Q = (4.6)(8)$

$\boxed{Q = 36.8 \text{ cfs}}$

7) **The channel identified in Question 5 is grass-lined, Bermudagrass. Is the channel lining adequate to handle the velocity determined in Question 5?**

Yes, Permissible Velocity from Table 3.17-A (page III-135) of VESCH = 6 ft/second.
Channel Velocity = 4.6 ft/second.

$6 > 4.6$ ✓

8) **The channel identified in Question 5 is a manmade channel. The Q(10) from the site is 45 cfs. Does the channel meet adequacy requirements as defined by Minimum Standard 19?**

No, Allowable Q for Channel is 36.8 cfs. Q from Site is 45 cfs.

$36.8 < 45$ ✓