Example Problem 2

SPEAKER Charles Berenbrock: In this section, we'll be looking at another example. This example comes from your book. Basically, in this example, they want us to determine what the alpha, the energy coefficient, is and what the friction slope is, and you see that it's denoted as S sub-f (S_f). All the information that is given in red or orange on your--is given. For example, the discharge is 2,600 cubic feet per second. Also, all the A's, areas, perimeters and many n roughness values are also given for each of the subsections--for the right subsection, the main subsection and also the left subsection. If you--in the left--in the right-most column is the hydraulic radius. Again, hydraulic radius is denoted by R, and it's A divided by P, area divided by the perimeter. If we do that for each subsection, we get it's appropriate value, okay?

If we continue on, we want to determine what the conveyance is, so we use our conveyance equation determine what the conveyance is for each subsection. And you can see, for example, the left subsection, the conveyance is 10,744 cubic feet per second or cfs. And we do that for each of the subsections and then we add all those values, the conveyances, for all the subsections together and we get a total of 85,874 cfs. Because we want to determine what the energy coefficient is, we also need to determine what it is--the conveyance to the third power and A to the second power for each subsection. And so we do that and you'll see that those values displayed in the third column of this sheet.

Now we take those values and we put it into the equation for the energy coefficient, alpha. Remember again that the numerator of the equation is the summation of all the conveyances to the third power divided by the areas to the second power. So, for this example, the numerator is 2.2391 times 10 to the ninth power. It is divided by the total conveyance to the third power, which is divided by the total area to the second power.

Now, if we carry those calculations out, we see that the energy coefficient or alpha is 1.54. We can calculate what the friction slope is. The equation for friction slope is the quantity of Q divided by K to the--and it's squared. Remember that Q is discharge. K is conveyance. So the value for this problem is 9.17 times 10 to the minus fourth value.

We can also determine what the average velocity is. The equation for average velocity is total conveyance times friction slope to the one-half power or square root divided by the total area, and

you can see what the values are. So K times the friction slope to the one-half power equals 2,600 divided by 661, and the resulting average velocity is 3.39 feet per second.

Because we know what the friction value is, we can go back up and we can determine what the velocity in each subsection is. So we can use that equation that we have for velocity is equal to conveyance times friction slope to the one-half power divided by area. We can use that equation to determine what each individual velocity is in each subsection. And when we do that, we get a velocity of about two feet per second for the left subsection, 5.4 feet for the main subsection and 1.7 feet per second for the right subsection. So that can help us maybe in subsequent calculations. And that concludes this section.