Drainage
FACTSHEET

BRITISH COLUMBIA

Ministry of Agriculture and Food

Backhoe Excavation of Ditches on Grade Using Hub Stakes

To ensure that a drainage ditch will be capable of carrying the design flow rate, effective grade control is required during construction. A backhoe machine does not have accurate grade control therefore, control points or **hub stakes** should be considered. Hub stakes are especially useful when shallow grades are required. (Hub stakes are 2" x 2"wooden pegs set into the ground adjacent to the ditch bank). Hub stakes can be used in various ways depending on the situation.

Setting Hub Stakes During Ditch Survey

As the survey of the ditch profile is conducted, hub stakes are usually set every 25 m or less. The elevation of the top of the stakes is also recorded. Once the ditch profile has been drawn and the new ditch bottom calculated, the **depth to dig** can be established for each hub stake location. The **depth to dig** will be the elevation difference between the top of the stake to the bottom of the new ditch. The **depth to dig** can then be used during excavation to assure a uniform ditch bottom grade. See **Figure A**.
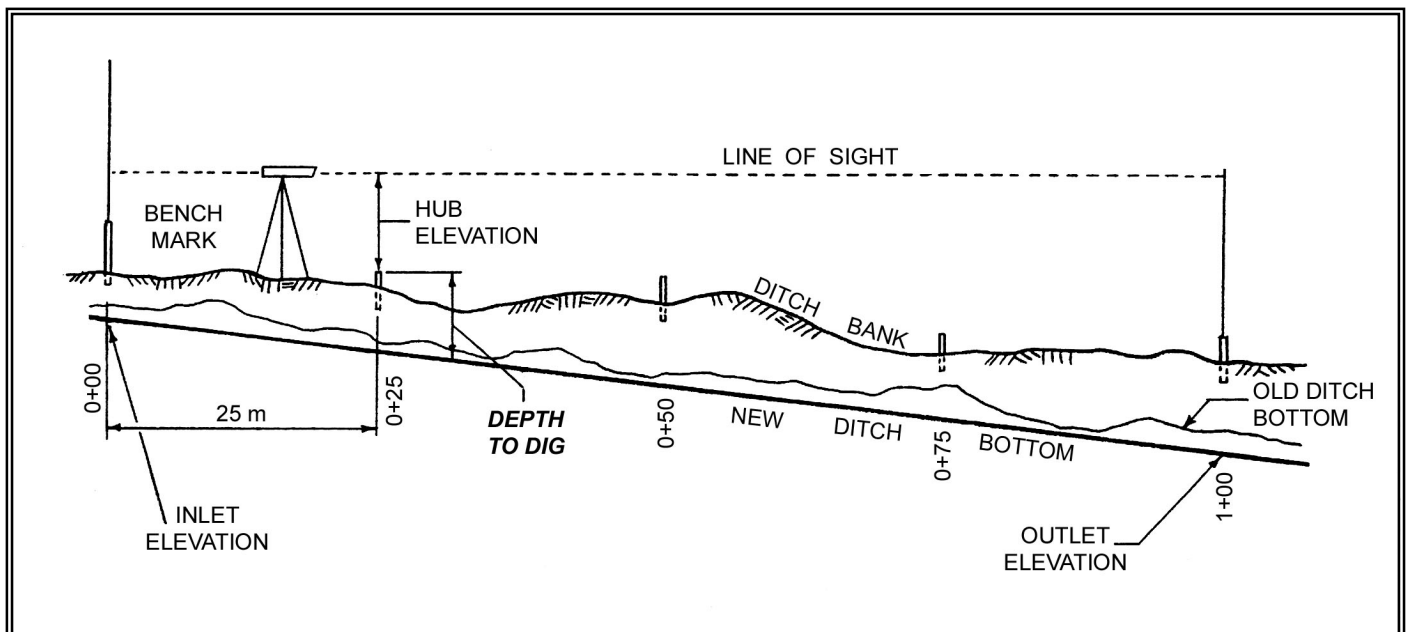

Figure A

Setting Hub Stakes After the Ditch Survey

Hub stakes can also be set after the ditch survey and ditch profile drawings have been done. Using the ditch profile drawing as a guide, measure along the ditch and set hubs as required (at least every 25 m or less). The *depth to dig* will be calculated from the profile drawing for each hub stake location. Since the hub stakes were set after the survey, the *depth to dig* will be the depth from the top of the existing bank to the bottom of the new ditch. This method is not as accurate as setting hub stakes during the survey but may still be very useful.

Hub stakes could also be set after the original survey with a level and then used in a manner similar to the first example.

Using Hub Stakes on New Ditch Construction

If a new ditch is to constructed on very flat land, the hub stake method can be useful. If the upstream and downstream elevations are known as well as the length of the ditch, the grade can be calculated by dividing the elevation difference by the ditch length. The grade would be considered uniform over the entire length and be marked on each hub stake.

Example

A ditch 200 m in length is to be dug in a flat field. The difference in elevation between the upstream and downstream elevation will be 0.2 m. The ditch is to be 1 m in depth at the upstream end. What will be the depth to dig at each hub location along the ditch?

$$\text{Grade} = \frac{0.2 \text{ m}}{200 \text{ m}} = 0.001 \frac{\text{m}}{\text{m}}$$

Depth to dig for each 25 m will be:

$$25 \text{ m x } 0.001 \frac{\text{m}}{\text{m}} = 0.025 \text{ m}$$

Hub Location	Depth to Dig
0 m	1.0 m in depth
25 m	1.025 m in depth
50 m	1.050 m in depth
100 m	1.075 m in depth
125 m	1.100 m in depth
150 m	1.125 m in depth
175 m	1.150 m in depth
200 m	1.175 m in depth

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