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Flow Resistance of Submerged Vegetated Dikes in the Flood Plane

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In many flood plains summer dikes, access roads and spur dikes (groins) are present and these obstacles are generally submerged during floods (high water stages). Often these elevated parts are covered with vegetation. The same holds for the groins, which are perpendicular to the main channel and mostly vegetated. These vegetated dikes and groins produce high resistance to flow, so it causes flood level rise in the rivers. Hydraulic roughness of these features is difficult to estimate. Computer models (1D and 2D flow models) should be improved with respect to representation of vegetation resistance. The resistance to flow due to vegetation has been studied extensively, but the combined effect of submerged vegetated dikes and groins has not yet been studied in depth. Moreover proper description and interpretation of the combined losses is lacking, so the objective of this study is to estimate and parameterize the form drag due to vegetated weir- like obstacles. Experimental study has been carried out in the Laboratory of Environmental Fluid Mechanics of Delft University of Technology. The prototype dike and groin have been modeled as weir with various down stream slopes (1:4, 1:7,1:15) and vegetation has been represented in various shapes (such as cylinders , cones and gyre with different mesh sizes) on the crest of weir with 25% blockage area inside the vegetated region. Measurements for energy head losses were carried out for a range of discharges and down stream water levels covering submerged and subcritical flow conditions. Head loss due to submerged vegetated dikes and groins has been modeled by expansion loss form drag model (Energy and momentum balance principles). Expansion loss form drag models has been derived from one dimensional momentum conservation equation and accounts for the energy loss associated with a deceleration of the flow downstream of a sudden flow expansion. It has been compared with experimental data. Predicted results by expansion loss form drag model show some deviation from experimental results due to the downstream slope effects and non- uniform velocity distribution at vegetated cross section on the crest of weir.