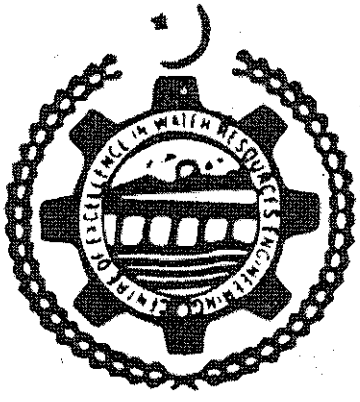
THESIS

ANALYSIS OF REVERSE SLOPE IN WATERCOURSE DESIGN



By

Muhammad Shahid Amin
(2006-PG-WRM-17)

For The Degree of

MASTER OF SCIENCE

IN

WATER RESORECES MANAGEMENT

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
University of Engineering & Technology, Lahore

2010

ABSTRACT

In the command area of an outlet, there exist variations in the elevation of the fields. Some of the command area that is at higher elevation than the normal fields would not be irrigated at designed FSL of watercourse; this is irrigated by submerging the outlet. Because of submergence, outlet discharge decreases and the flow velocity decreases as well, where as flow depth increases which ultimately cause siltation in the bed of watercourse. To create sufficient working head and to raise the bed of watercourse, field engineers incorporate reverse slope in watercourse without considering optimal limit of reverse slope. More or less, it affects the hydraulic performance of the outlets. This study was conducted to evaluate a suitable reverse slope to overcome above said problems.

This research was carried out in Model Tray Hall in the Center of Excellence in Water Resources Engineering UET, Lahore. Three different types of outlets (AOSM, Pipe and Open flume) each of one-cusec discharge were designed and constructed. Three watercourses were also designed and constructed to carry one-cusec discharge each. The outlet discharges were calculated by using authorized formulas and then measured by the sharp crested weir that was installed at the downstream of watercourse. The watercourses were used one by one for each type of outlet.

The reverse slopes were first incorporated in one-meter length of watercourse bed downstream of the outlet. Results were obtained at reverse slope values of -0.025, -0.050, -0.075, -0.10, -0.15 and -0.20 at constant value of FSL (9.95 m) of canal and

outlet discharge of 28.32 LPs (1 cusec). The same was repeated by reducing the discharge of outlets to 22.68 LPs and FSL of canal to 9.85 m. Later on above-mentioned reverse slopes were incorporated in two-meter length of watercourse bed just downstream of the outlet and results were obtained for each reverse slope value.

It was observed that -0.10 and -0.15 reverse slopes incorporated in a length of one meter are suitable for an outlet of one-cusec discharge. It was also found that the FSL of watercourse increases with increase in reverse slope value up to -0.15 and then starts decreasing gradually at -0.20. Whereas the outlet discharge decreases slightly from -0.10 to -0.15 reverse slopes and significantly decreases at -0.20 reverse slope by submerging the outlets.

This study concluded that reverse slope incorporated in one-meter length of channel bed is better than incorporated in two-meter length of channel bed. The results obtained for AOSM and pipe outlets were approximately the same. Open Flume outlets found not to be fit for reverse slope. It was also found that the best hydraulic section for reverse slope was found that starts from the width equal to the Bt of an outlet and then expands in the direction of flow to join the designed width of the channel.