

Niagara Falls Case Study

Ch 7 Non- Uniform Flow and Hydraulic Jump

Introduction

Niagara Falls is the name of a group of three waterfalls on the U.S.-Canadian border between New York and Ontario. The falls- the Horseshoe Falls, the American Falls, and the Bridal Veil Falls- are located on Niagara River and drain Lake Erie into Lake Ontario. Combined, the falls have the highest flow rate in the world with an average of 64,750 cfs and can reach a peak flow of 202,000 cfs. In summer months, 10% of the flow is diverted to facilities for hydroelectric power production. Assume the Niagara River has a rectangular channel, a width of approximately 3,409 ft, a rocky natural streambed (a Manning's n value of 0.035), and a slope of 0.003 ft/ft.



Exercises:

1) For the peak flow of the Falls, calculate and plot the water surface profile where the Niagara River approaches free outfall at the Falls to the point where $y \leq 0.9y_n$.

Your Instructor may give you an Excel spreadsheet backwater calculator.

2) The International Niagara Control Works has 18 sluice gates that allow for changes in Falls flow, where water is diverted for hydroelectricity. If 10% of the peak flow is diverted through the 18 sluice gates (each 10 ft wide and opened 1.5 ft), determine the depth just downstream of the jump.

*State any assumptions made

Reference Example 7-4 and 7-5 in *Hydrology and Floodplain Analysis* 5th Edition