Millcreek Superfund Site
Hydrologic Evaluation of Flood Retention Basin

Introduction

The primary purpose of this analysis is to determine the duration of stages in the Flood Retention Basin (FRB) due to various return interval floods from the upstream watershed. The methodology used in the analysis was to utilize the previously developed HEC1 rainfall/runoff model and the UNET hydraulic routing program to determine the duration of flood stages. The HEC1 model computes the inflow hydrographs using a kinematic wave rainfall to runoff transformation. The UNET model is a one-dimensional hydraulic routing model which uses the complete unsteady flow equations to route the flows through the hydraulic network of Marshall’s Run.

Model Setup

Design storms inflows were developed with HEC1 and inputted into the UNET model of Marshall’s Run. The HEC1 hydrographs generated were the area upstream of the railroad embankment, the FRB area, and at several locations along Marshall’s Run. These hydrographs were inputted at the appropriate cross-section location in the hydraulic UNET model. The UNET model incorporated the storage areas along Marshall’s Run of the upstream Railroad Embankment, the Trucking Company, the FRB, and the associated conduits connected the storage areas and natural creek channel. The elevation-capacity relationship of the FRB is shown in Figure 1. UNET models the flow through the conduits as unsteady flow, whereas the computed flow through each conduit is a function of the respective headwater and tailwater elevations, which in turn, varies as a function of time.

Model Results

The translation of the 100-year flood hydrograph is shown in Figure 2. Due to the urban nature of the upstream watershed, the flood hydrograph is relatively sharp peaked and quick-forming upstream of the railroad embankment. As the hydrograph flows through the conduits of the restrictive railroad embankment and FRB, the hydrographs get attenuated and drawn out over time. The stage hydrographs corresponding to the 10-year, 50-year, and 100-year flood events are shown in Figure 3. As shown by the stage-hydrographs, the FRB pool level would rise and fall within approximately a 24-hour time period.
Figure 1
Millcreek SFS
Flood Retention Basin - Elevation-Storage Relationship

Figure 2
Millcreek SFS
Flood Retention Basin 100-Year Flow Hydrographs
based on HEC1/UNET Modelling
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Flood Retention Basin - Elevation-Storage Relationship

Figure 2
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