

HYDROLOGY MODEL SELECTION

Criteria for Model Selection

During the original study, it was essential for the hydrologic model for this watershed-wide stormwater management plan to have the capability to represent variable land use throughout the watershed, and to produce a full hydrograph response from each sub-area. The objective of model development was to provide a hydrologic analysis tool that could: (1) establish baseline runoff conditions under present land use in the Combined Watershed; (2) quantify the impact of future land use conditions on runoff peaks, volumes, and sub-area timing relationships; and (3) evaluate alternative stormwater runoff management techniques.

The following criteria were used to select a hydrologic computer model for the Combined Watershed:

1. The model should produce a full hydrograph, and must be capable of evaluating variable soils and land use conditions. The model should be able to route hydrographs through different stream reaches, and identify principal runoff source areas at selected points-of-interest. The model should also compute sub-area release rates, or provide travel time and peak flow information from which these release rates may be developed.
2. The model must be able to evaluate the hydrologic effects of land use change, channel modification, and stormwater management practices.
3. The selected model must be computationally efficient, and its data input requirements must be compatible with data readily obtained for the Combined Watershed.

Models Considered for the Fishing Creek/Cedar Run Watershed {tc “ ***Models Considered for Fishing Creek/Cedar Run Watershed***” V 2}

There were a number of hydrologic models and methods that satisfied the criteria described above. The following list includes the most prominent hydrology models and methods that were available at the time of the original study:

1. The HEC-1 computer program developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, is a comprehensive rainfall-runoff computer model for simulating runoff hydrographs from multiple storm events. It was developed originally for large natural watersheds, but has been modified recently to accommodate small,

urbanizing basins. This program has the capability to model flow diversions, and provides output regarding travel times and peak flows that can be used to compute sub-area release rates. HEC-1 is appropriate for use on the Combined Watershed.

2. PSRM (Aron, 1992) is a single-event, rainfall-runoff computer model that was developed to simulate small urban and suburban watersheds having simple storm drainage networks. PSRM assumes that all runoff occurs as sheet flow on an overland surface. The “peak flow presentation table” is a feature of PSRM output that identifies sub-areas that contribute a substantial amount of runoff to the total hydrograph peak at a downstream point-of-interest. This feature can be used to locate possible sites for regional stormwater management facilities. The channel routing capability of PSRM is adequate for short reaches of channel or storm sewer. The channel routing technique is capable of modeling storm sewer surcharge and out-of-bank channel flow. PSRM is appropriate for use on the Combined Watershed.
3. The SCS computer model TR-20 (1969), revised in 1983, has been an important tool for stormwater and flood protection project formulation in undeveloped watersheds for many years. TR-20 is based on the SCS soil-cover-complex or runoff curve number (CN) for rainfall losses, a dimensionless unit hydrograph for sub-area runoff, and an attenuated kinematic wave routing method for channels. Reservoir routing is accomplished using the Modified Plus or Storage Indication Method. TR-20 was developed for the purpose of evaluating hydraulic structures and their impacts on watershed hydrology. TR-20 can model flow diversions, and provides travel time and peak flow output that can be used to develop release rates. TR-20 is appropriate for use on the Combined Watershed.
4. The SCS TR-55 procedure (1986) is a design storm method for analyzing small, developing watersheds. It has full hydrograph capability, based on the tabular hydrograph application to a 24-hour design storm, and is able to determine local impacts and downstream effects of land use change on the hydrology of an area. It was developed as a simple approximation to TR-20 by SCS in 1975, and was revised in 1986. TR-55 does not have the capability to model diversion or reservoir flows; therefore, it was not considered appropriate for use on the Combined Watershed.

Summary of the Hydrology Model Used for Fishing Creek/Cedar Run

The model that was selected for the original Combined Watershed study was the SCS computer model TR-20. From a practical perspective, it is likely that the majority of hydrologic computations for future land development projects within the Combined Watershed will be completed using a desktop hydrologic procedure, such as TR-55 which is a simplification of the TR-20 methodology. The 24-hour storm was selected because there are no provisions in the TR-55 procedure to compute runoff for storm duration's other than the 24-hour storm. It was expected that the use of the 24-hour storm in the hydrologic model selected for the combined watershed, and in all future hydrologic computations using a procedure such as TR-55, would result in consistent peak flow results.