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Computer system requirements:

- Windows 95 or higher
- Minimum 486 or higher (the faster the better)
- Minimum 8 megs of Ram (the more the better)
- Minimum of 12 megs of hard disk space.

History of SWMHYMO v4.02

1983 - Based on the research work of several contributors, the first version of OTTHYMO was developed within the frame of the IMPSWM Program directed by Dr. P. Wisner at the University of Ottawa. OTTHYMO-83 was essentially an extension of the HYMO model developed by Williams and Hann in 1973 and introduced a new subroutine (URBHYD) for the simulation of urban runoff and another (NASHYD) for the simulation of runoff from small to intermediate rural areas. A pipe routing subroutine (KINROUTE) and a dual drainage subroutine (DUHYD) were also introduced at that time.

1989 - Within the scope of a Master's Project, the 1989 version of OTTHYMO was developed by Mr. J.F. Sabourin at the University of Ottawa under the direction of Dr. P. Wisner and with the assistance of Mr. L. Alperin. The improvements which were incorporated were largely based on "User" experience gained from the application of the OTTHYMO-83 model and from the additional research and calibration studies conducted by the IMPSWM group. For this new version, the source code was rewritten to increase computational efficiency and the model's output formats and error checking capabilities were greatly improved to help the review and interpretation of results. The use of DEFAULT parameter values were introduced to simplify data entry. The new STANDHYD command (an improved version of URBHYD) was shown to produce better results when compared to field measurements and was less sensitive to the computational time step. Several new utility commands such as READ STORM, CHICAGO STORM, MASS STORM, MODIFY STORM, SAVE HYD, READ HYD, and PLOT HYD were created to simplify and expand the applicability of the model. New routing commands such as ROUTE CHANNEL, ROUTE PIPE, and SHIFT HYD were made available to simplify this modeling task. A flow diversion command (DIVERT HYD) was introduced to split hydrographs and a simplified detention pond command (COMPUTE VOLUME) was developed for reservoir storage volume estimations.

1995-00 Following many more years of experience with OTTHYMO-89 and in order to respond to increasing needs in stormwater management combined with the presence of improved computer systems, a significant expansion of the model was created and called **SWMHYMO**. Under the direction of Mr. J.F. Sabourin and as main author this new version introduced many operational, computational and practical improvements, all of which are described on pages 3 and 4 of this brochure.

The future - JFSA is committed to actively continue the development of SWMHYMO as the needs for stormwater management continue to evolve. Examples of future improvements will include subroutines for the analysis of BMPs such as grass swales, perforated pipes, horizontal trenches, etc. and infiltration and inflow modeling in sanitary sewer systems. Research needs are currently being addressed through cooperation with Canadian universities.

For More Information

Visit our web site at www.JFSA.com or you may direct your inquiries to Mr. Jean-François Sabourin at **J.F. Sabourin and Associates Inc.**, 52 Springbrook Drive, Ottawa, Ontario, K2S 1B9
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SWMHYMO

StormWater Management

HYdrologic MOdel

A single event and continuous simulation model
 based on the principles of HYMO and
 its many successors.

100% upward compatible with input files
 from OTTHYMO-83 and OTTHYMO-89

distributed by:



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WATER RESOURCES AND ENVIRONMENTAL
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Introduction

SWMHYMO, as with many HYMO successors, is a complex hydrologic model used for the simulation and management of stormwater runoff in either small or large rural and urban areas. (See page 5 for the history of **SWMHYMO**)

Based on easily acquired watershed or sewersheds information, **SWMHYMO** can use single rainfall events (observed or synthetic) or continuous rainfall records to simulate the transformation of rainfall into surface runoff. Computed hydrographs can be routed through pipes, channels or stormwater control ponds and reservoirs. In urban areas, the effective capture rates of catchbasin and the effects of street storage in low points can also be simulated.

The hydrologic and hydraulic principles which are incorporated in **SWMHYMO** have been applied, tested and calibrated over many years. It is the amalgamation of these principles which makes **SWMHYMO** such a useful and flexible tool.

The application of **SWMHYMO** is not limited to any type of hydrological analysis but typically the model will be used in studies which include the following:

- Master Drainage Plans for entire watersheds,
- Floodplain Mapping Studies,
- SWM Studies for new developments,
- Design of dual drainage systems,
- Design and analysis of storm sewer systems,
- Design of stormwater control facilities,
- Erosion and flood control studies,
- Evaluation of SWM pond operations,
- Evaluation of Combined Sewer Overflows,
- System failure analysis and evaluation of alternatives.

Who should use **SWMHYMO**?

Users of **SWMHYMO** may include hydrologists, engineers and technicians within engineering firms, municipalities and various reviewing agencies. **SWMHYMO** and its predecessors are currently applied in Canada, Switzerland, Spain, Argentina, Tunisia, and Senegal. The model has also been adopted as an educational software by several universities and colleges.

Features of **SWMHYMO** v4.02

Operational Features NEW

- True multitasking through the Windows Operating System.
- Integrated editor for input data files, default value files, output files, storm and hydrograph files.
- Online help for every input parameter and command.
- Integrated printing utility with options to include line numbers, page numbers, column printing, headers and footers.
- Integrated access to **STORMS**⁽¹⁾ and **PLOTHYD**⁽¹⁾ for the manipulation, analysis, and plotting of rainfall and flow data.
- Simple installation procedure and 100% upward compatible with input files from OTTHYMO-83 and OTTHYMO-89.

Computational Features NEW

- Continuous or single rainfall event simulation with up to 5000 time steps.
- As with its predecessors, **SWMHYMO** operates by executing a logical sequence of user entered commands. Commands available in **SWMHYMO** are described below.

STORM COMMANDS

- can be used to read storm files.

READ AES DATA

- can be used to read continuous AES hourly rainfall data files. The command also provides statistics on the rainfall which is read.

COMPUTE API

- can be used to calculate the Antecedent Precipitation Index (API) of a continuous rainfall record. The API is then used to update various hydrologic parameters during a continuous simulation.

MODIFY STORM

- can be used to account for the effects of aerial distribution of rainfall intensities and the movement of storm clouds.

CHICAGO STORM

- can be used to derive a Chicago type design storm.

MASS STORM

- can be used to derive synthetic design storms or the distribution of snowmelt runoff using mass curves.

STANDHYD (DESIGN⁽²⁾, CALIB⁽²⁾ or CONTINUOUS⁽²⁾) NEW

- uses two parallel standard instantaneous unit hydrographs to simulate the surface runoff hydrographs from urban catchments. Rainfall losses can be simulated with either the Horton's infiltration equations, a modified SCS procedure or a proportional coefficient.

NASHYD (DESIGN⁽²⁾, CALIB⁽²⁾ or CONTINUOUS⁽²⁾) NEW

- uses the Nash instantaneous unit hydrograph to simulate surface runoff hydrographs from small to medium size rural areas or very large urban areas. Rainfall losses can be simulated with a modified SCS procedure or a proportional coefficient.

WILHYD (CALIB⁽²⁾ or CONTINUOUS⁽²⁾) NEW

- uses the unit hydrograph developed by Williams and Hann to simulate surface runoff hydrographs from large rural areas with long recession periods. Rainfall losses can be simulated with a modified SCS procedure.

DESIGN SCSHYD

- uses the SCS Curve Number procedure to compute rainfall losses and the SCS unit hydrograph for the convolution.

HYDROGRAPH COMMANDS

ROUTING COMMANDS

ROUTE CHANNEL

- uses a Variable Storage Coefficient (VSC) method to route flows in prismatic or natural channel cross-sections. The detailed results of ROUTE CHANNEL now include a stage versus (flow depth x velocity) which can be used to identify potential safety hazards.

ROUTE PIPE

- uses the same algorithm as ROUTE CHANNEL but is tailored to route flows in circular or rectangular pipes. The command can also be used for pipe sizing.

SHIFT HYD

- can be used when peak flow attenuation through routing is negligible but the time translation is important.

ROUTE RESERVOIR

- uses the storage-indication method to route flows through ponds and reservoirs based on an outflow-storage relationship. The command was recently improved to allow overflows to be diverted to another location.

OPERATIONAL & UTILITY COMMANDS

ADD HYD

- can be used to add up to nine hydrographs together. Previously, this command could only add two hydrographs.

COMPUTE DUALHYD

- can be used to split the flow between the major and minor drainage systems. The command can also consider the effects of street low points with surface storage.

COMPUTE VOLUME

- can be used to provide an estimation of the storage volume that may be required to reduce the peak flow of a given hydrograph.

DIVERT HYD

- can be used to simulate the operation of a diversion channel or overflow structure. According to a given flow distribution, the command can split an inflow hydrograph into and up to 5 hydrographs.

EROSION INDEX

- can be used to compare the erosive potential of several simulated hydrographs.

PRINT HYD, SAVE HYD, READ HYD and STORE HYD

- are utility commands. PRINT HYD is used to print simulated hydrographs in table format while SAVE HYD can save hydrographs to ASCII files for later retrieval by the READ HYD command or for exportation to other software. The STORE HYD command can be used to directly enter a hydrograph into the input file.

Other Practical Features

- Improved error checking and warning messages.
- Improved Detailed and Summary output files.
- Three decimal place printing.
- Alphanumeric input for hydrograph numbers is allowed.
- Condensed easy to follow user's manual.
- Direct user support provided by professionals who have been involved in the development of **SWMHYMO** and its predecessor.

1) **STORMS** and **PLOTHYD** are separate utility programs which can be used jointly or independently of **SWMHYMO** or OTTHYMO-89 (see separate information brochures).

2) In the **DESIGN** mode these commands make use of various default hydrological parameters. In the **CALIB**rate and **CONTINUOUS** modes the user is required to enter all parameters.