MONTGOMERY WATSON

SPIDA - TRICKS AND TIPS

by

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Conversion of WALLRUS Models

Existing WALLRUS SSD files can be read into the SPIDA editor and converted automatically to SPIDA DSD files. WALLRUS holds a pipe and its associated upstream manhole as a single entity. During conversion SPIDA splits them using the upstream manhole to create a NODE and the pipe to form a LINK. The cover level, dry weather flow and all contributing area details are held against the node whilst all details of the pipe are held against the link. If a global DWF was defined in the SSD file this is not converted and will have to be added by the user. In SPIDA the global DWF is defined in terms of $m^3/s/km^2$ whilst in WALLRUS it is terms of $m^3/s/m$. Before SPIDA will read an applied DWF hydrograph file a Land Use Index has got to be defined, this can be done globally.

When converting WALLRUS models containing pumping stations the details of the wet well are defined against the node and the details of the pumps are defined as control links. During conversion the invert level of the wet well is set to the invert level of the lowest incoming sewer. In order to get the model to run in SPIDA this invert level might need editing to set it below the lowest switch off level of the pumps.

Case Study 1

A model of a looped system had been built in WALLRUS. Some of the bifurcations had been represented using on-line tanks but it had not been possible to configure the WALLRUS model to represent all the interconnections. The WALLRUS model was therefore converted to SPIDA so that the unmodelled interconnections could be added. The on-line tanks which had been used to represent bifurcations in the WALLRUS model were converted as on-line tanks in the SPIDA model. When the model was run in the Simulation Method it was noted that it ran slowly and the pipes being flagged as creating most difficulty were those associated with bifurcations represented as on-line tanks.

The model was edited to reconfigure the bifurcations simply as two links going from a single node rather than as on-line tanks. In doing this one of the nodes associated with the outgoing pipes from the on-line tank became redundant and was removed but any contributing area or DWF associated with this node was reassigned to some other node in the model. Having amended the bifurcations in this way it was found that the model ran more smoothly and quickly.

Case Study 2

In carrying out the verification of a particular model good agreement in flow had been achieved at the monitor on the main outlet pipe from the catchment but the model significantly under predicted the depths. This pipe was defined as a broad egg in the model. However it had been noted during site visits that this pipe was not a standard egg shape, in particular a reinforced invert, approximately 50 mm thick, had been applied to the lower third of the pipe. The width/height measurements for the pipe were obtained from the flow survey contractor. These were used to create a User Defined Shape (.SHP) file so that the cross-sectional shape was defined correctly in SPIDA.

Case Study 3

A SPIDA model containing a number of pumping stations was being used to simulate extended periods of dry weather flow. The pumping stations were large, containing several pumps, and did not have a wet well. The pumping regime was controlled by operatives and not by automatic switches. It was originally attempted to model them as conventional wet well stations with a number of pumps which were controlled by individual on/off levels. The model ran very slowly and it was observed that the links SPIDA had most difficulty finding a solution for were those associated with the pumping stations. In order to try to get the model to run more quickly it was decided to re-specify the pumps using the Archimedes Screw pump option in SPIDA. This option allows the user to specify a depth/flow relationship to represent the pump. For each pumping station the depth/flow relationship for the incoming sewer was calculated and this was then used to specify a single Archimedes Screw pump for each pumping station. With the pumps specified in this way the simulation time was reduced to less than 10% of the time required for conventionally specified pumping stations. It was believed that this was probably the best way of modelling this particular type of pumping station as a head/discharge curve could be defined to represent the way the station was controlled by the operatives.

Case Study 4

During verification of a particular model there was difficulty reconciling the predicted and measured depth plots in one area for one storm. The area involved was just upstream of a pumping station and it was observed that the velocity plots for the monitors in the area had reduced to zero for a period just prior to the peak of the storm. One explanation for the mismatch in depth plots was therefore the possibility of pump shutdown for this period. In order to demonstrate that this explanation could produce the right depth plots it was decided to make use of one of SPIDA's interactive features. A sluice gate was introduced just upstream of the pumping station. At the start of the simulation this was set to be fully open. The simulation was paused at the point when it was thought the pump shut down and the setting of the sluice gate was altered to fully closed. The simulation was then continued to the point at which it was thought the pump started again and the sluice gate setting was changed to fully open again and the simulation was then left to continue to the end of the event. Comparison of the predicted depths from this simulation and the measured depths demonstrated that pump shutdown could account for the depth data recorded.

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Question

Jim Allen, Severn Trent Water

In case study 3 are you saying that pumping stations will not run in SPIDA without being modelled as an archimedean screw?

Answer

No, in the specific case the standard pumping station caused extended run times, long periods of DWF were being simulated and the archimedean screw method, significantly reduced run times.

The runs are extended due to SPIDA iteratively solving, in detail, what happens at the sump as pumps switch on and off, as it is getting all the volumes right.

Comment, I.A. Noble, Montgomery Watson Ltd

It is important to look at how pumping stations operate. Variable speed pumps or those at large pumping stations are controlled, with partly closed valves etc., to avoid switching on and off and to match incoming flows, in these cases their performance is very close to that of a screw pump.

Question

Dave Walters, MW Barber Group

Would you say that SPIDA is value for money and is it a complete alternative to WALLRUS?

Answer

The more I work with it the more impressed I get with it. There is no reason why it cannot model all the things WALLRUS can.