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Farm dam and licenced diversions under climate change

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Abstract: Historically, when developing catchment inflows for hydrological models, Melbourne Water has attempted to generate natural inflows by modelling the influence of farm dam impacts and licenced diversions in the waterways. The modelling of farm dam impacts is completed in the STEDI (spatial tool for estimating dam impacts) modelling program. The modelling of licenced diversion depends on the licence type. The largest users (by volume) are irrigation licences and their demands are developed based on recorded annual usage and the seasonal patterns modelled using the PRIDE (program for regional irrigation demands estimation) program. Outputs from the PRIDE and STEDI modelling are then used to generate a timeseries of waterways diversions which are used as an input in the Melbourne Water Resource Planning Model (henceforth referred to as WRPM). The WRPM is modelled in the eWater Source modelling platform and projects forward in time using projected urban demands and recycling historical streamflow replicates. The PRIDE and STEDI modelling platforms are both dependent on climate (rainfall and evaporation) data, with streamflow data also required for STEDI. This means the waterway diversions timeseries are necessarily tied to a particular climate sequence. Hence these timeseries are also cycled through the model with the streamflow data. There was concern about the unknown and untested extent of the influence of climate change on these waterway diversions. It was expected that irrigation demands would increase in a hotter drier climate and that farm dam impacts would be greater as there would be more empty space in farm dams with less frequent rainfall, resulting in a greater impact in terms of water impounded by the farm dams within the catchment.

It was elected to test the sensitivity of the waterway diversions to climate change by completing the PRIDE and STEDI modelling with streamflow and climate data that has been transformed as per the Victoria Government's Climate Change Guidelines (DEWLP, 2020). This would be a significant undertaking of manual labour due to having the run PRIDE and STEDI models for 12 separate sub-catchments and for the 14 separate climate scenarios prescribed in the guidelines. Fortunately, there was a concurrent project for the Victorian Environmental Water Holder assessing reduction to environmental water availability under climate change. This was viewed as a good opportunity to test the sensitivity of environmental flow outcome modelling to these changes in the waterway diversions. Instead of generating the demands under all climate change scenarios, a subset could be selected and generated. Then two equivalent scenarios could be run in the Source model with and without the climate change impact on the waterway diversions. This would inform if the modelling results, of interest to environmental water managers, were sensitive to the changes in demand modelled by PRIDE and STEDI. If they were, then there would be justification for the expense and effort of producing them across all climate change scenarios.

After producing the climate change waterway diversions, there were interesting learnings from the demand timeseries before adopting them in any Source modelling. The climate change STEDI modelling revealed the reduction in streamflow from the climate transformation had greater influence on the farm dam impacts rather than any changes due to extra capacity to impound water between sparser rainfall events. Initial timeseries for the licenced diversions exhibited unexpected behaviour which was subsequently attributed to how PRIDE modelling results were used to generate the final timeseries for the licenced diversions. Source modelling showed that the results of interest to the environmental water managers were likely insensitive to the changes in the modelled demand from using the climate change adjusted PRIDE and STEDI model runs. The major conclusion being time would be better spent improving and calibrating PRIDE and STEDI models as opposed to generating the time series under all climate scenarios.

REFERENCES

DELWP (2020) Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria. Final, November 2020, Department of Environment, Land, Water and Planning, State Government of Victoria.

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