

## Hydrologic Projections under Climate Change

A consultant has developed three scenarios of future water supply projections for Lake Ontario under climate change. First, the consultant selected global climate model (GCM) projections from the recently released CMIP6 climate model projection database. Projections of precipitation and mean temperature were taken from three GCMs (AWI, UKESM, and MRI-ESM) across the entire Great Lakes basin. The AWI model was run under the SSP2-4.5 emission scenario, while the UKESM and MRI-ESM climate models were run under the SSP5-8.5 emission scenario. The climate projections were then downscaled and bias corrected for the Great Lakes basin. Ultimately, time series of quarter-monthly precipitation and mean temperature were generated for the time period spanning the years 2022-2090 across the entire Great Lakes basin.

These projections of future climate were then forced through hydrologic models calibrated for each of the five Great Lakes to predict future series of net basin supplies (NBS) into each of the lakes. NBS projections for the Upper Great Lakes (i.e., Lakes Superior, Michigan-Huron, and Erie) were routed through the Upper Lakes and converted into Lake Erie outflows using the Great Lakes Routing and Regulation Model (CGLRRM) from the US Army Corps of Engineers. Projections of net total supply to Lake Ontario were derived by combining projections of Lake Erie outflows and NBS into Lake Ontario. Separate statistical models were used to convert climate projections into future projections of Ottawa River (SLON) flows and ice conditions on the St. Lawrence River.

Note that temperature increases in the climate model projections lead to higher off-lake evaporation and lower tributary inflows that reduce NBS across the lakes. Temperature changes can also alter the timing of streamflow into the lakes during the snow accumulation and melt season. Conversely, in scenarios where precipitation increases in the climate model projections, over-lake precipitation and tributary runoff can increase, which can counteract the effects of increasing temperatures and higher evapotranspiration. Unfortunately, the consultant did not provide the raw precipitation and temperature data from the climate projections. They only provided projections of NBS, NTS, Ottawa River (SLON) flow, and ice projections.