APPENDIX C –

Provisional Inflow Data Development

The current methodology for developing model inflow data does not lend itself well to frequent updates that will be necessary for real-time position analysis. The current methodology requires a large amount of input gage data (using 11 gages); impairments from reservoir operations, water supply, wastewater returns, and agricultural withdrawals; correction to negative inflows that could otherwise cause model infeasibility; and scaling of gains to ensure that filled-in data for gages with missing data preserves the known volume of flow at downstream gages. Obtaining impairment data alone (which are necessary to unimpair the gage flows) is the most time-intensive part of the updating process.

HydroLogics has developed a simplified, *provisional* procedure that will enable weekly or monthly updates to be made, later overridden by periodic annual updates using the current methodology. It is meant to provide a representative inflow to key points in the basin, most notably Tar River Reservoir, which is central to real-time management of the basin. The calculations for the provisional update are handled automatically within the GUI upon entry of data as shown on the Update Record tab.

To simplify the update as much as possible, the procedure eliminates the need for most impairments and the concern over negative inflows that could lead to model infeasibility. The assumption is that most of the net impairments (withdrawals less discharges) in the basin are small and occur within a reach and therefore are not likely to have much effect on the natural inflow.

As an example, the Tar River gages below Tar River Reservoir (e.g., Tarboro and Greenville) are significantly affected by the operation of the reservoir during low flow conditions. However, by computing the gains between the reservoir (using measured releases) and Tarboro, and between Tarboro and Greenville, the effect of the reservoir operation is removed. Only the net impairments within those reaches affects the natural inflow, and as long as the net impairments are small, it can be assumed that the difference in gaged flows in these reaches is the natural inflow.

Negative inflows can occur at Tar River Reservoir since they are back-calculated from the historic releases. They can also occur when the downstream gage flow is less than the upstream gage flow (which is usually due to time of travel issues or, in the case of Greenville, tidal influence). In either case, these only pose a modeling problem if there is not enough water in the river or reservoir to handle them, which is rare. As a precaution, when gains are negative, the model's OCL is used to filter them to maintain model feasibility.

The simplified procedure is detailed below in the following steps. As noted, all calculations are automatically done within the model.

Step 1: Obtain from the USGS web site the daily gage data (in cfs) for the following gages: Tar River near Tar River (Tarr), Tar River at Louisburg (Loui), Swift Creek at Hilliardston (Swif), Little Fishing Creek near White Oak (Lfsh) Fishing Creek near Enfield (Fish), Tar River at Tarboro (Tarb), and Tar River at Greenville (Gree).

Step 2: Obtain the following data for Rocky Mount:

Daily elevation for the Tar River Reservoir, expressed as inches above (+) or below (-) the spillway, daily precipitation at Rocky Mount (in inches), daily release (in cfs) from the reservoir, and daily net withdrawal (in mgd) from the reservoir.

Step 3: Compute the net evaporation for all reservoirs in the basin using the precipitation data collected above and a monthly evaporation pattern.

Step 4: Back-calculate the (impaired) total inflow to Tar River Reservoir by adding the reservoir release, net withdrawal, net evaporation on the lake, and the change in storage.

Step 5: Set the Tar River near Tar River flow equal to the Tarr river gage flow. Set the Louisburg gain to be the difference between the Louisburg gage flow and Tarr flow (lagged by 1 day).

Step 6: Compute the Cedar and Taylor Creek inflows using a drainage area adjustment of the Swift Creek gage (Swif).

Step 7: Compute the Tar Reservoir gain by subtracting the Louisburg and Cedar and Taylor Creek flows from the total reservoir inflow. To better reflect the unimpaired inflow in this reach, an average of 10 cfs is added to this gain to account for the estimated agricultural withdrawal. The remaining net impairment in this reach is small and thus ignored.

Step 8: Set the flows for Swift and Little Fishing Creeks

to the gage flows (Swif and Lfsh). Set the gain to Fishing Creek as the Fishing Creek flow (Fish) minus the Lfsh flow. Compute Conetoe Creek flow based on a drainage area adjustment of the Swift Creek gage.

Step 9: Compute the Tarboro gain by subtracting the Tar River Reservoir release (lagged 1 day) and the flows for the Swift and Fishing Creeks from the Tarboro gage flow (Tarb). Compute the Greenville gain by subtracting the Tarboro gage flow (lagged 1 day) and Conetoe Creek flow from the Greenville gage flow (Gree).