Memorandum

To: *South Carolina Department of Natural Resources (DNR)*
South Carolina Department of Health and Environmental Control (DHEC)

From: *CDM Smith*

Date: *June 3, 2016*

Subject: *Salkehatchie River Basin SWAM Model Framework*

This memorandum presents the Simplified Water Allocation Model (SWAM) framework for the Salkehatchie River Basin. Several tables and figures are provided to help understand how the tributaries, water users, and discharges are being represented in the SWAM modeling environment. The tables and figures include:

Table 1 **Permitted and registered water users included in the Salkehatchie River Basin model framework.**

Table 2 **NPDES discharges included in the Salkehatchie Basin model framework.**

Table 3 **Interbasin transfers in the Salkehatchie Basin.**

Figure 1 **Overview Map**
This map consolidates and presents all active permitted and registered water users; significant discharge locations; USGS stream gage locations; and tributaries (the "higher order tributaries" are not represented explicitly in the model, but their contributions to flow are included in the flows of larger, modeled tributaries). Significant discharge locations generally include NPDES discharges that average over 3 million gallons per month (Mg/m).

Figure 2 **Model Tributaries and USGS Streamflow Gages**
This map presents the Salkehatchie River Basin hydrography. Also represented are major branches, primary tributaries and several secondary tributaries. The contributions of many of the secondary and higher order tributaries are accounted for in the aggregate flow in the larger tributaries that are modeled explicitly. Both active and inactive USGS streamflow gages are displayed as are tidally and non-tidally influenced gages. Not all streams which have a former USGS streamflow gage

will be explicitly included in the model due to the influence of tides on the gage records.

Compared to most other South Carolina basins, streamflow data in the Salkehatchie basin are limited both spatially and temporally. There are only two active, non-tidally influenced USGS streamflow gages with daily flow records. These are supplemented by three inactive, non-tidally influenced gages. The active and inactive gages are located on the Coosawhatchie River, the Salkehatchie River, the Combahee River, and Savannah Creek. The earliest daily flow records date to February 1951.

Figure 3 Permitted Surface Water Users and Registered Agriculture
This map presents the location of permitted surface water users and registered agricultural surface water users.

Figure 4 Dischargers
This map presents the location of all significant NPDES discharge locations, including several discharges that originate from withdrawals in the Savannah Basin. Significant discharge locations generally include NPDES discharges that average over 3 Mg/m; however, certain discharges that average less than 3 Mg/m, but with some months greater than 3 Mg/m are also included.

Figure 5 Salkehatchie Basin SWAM Model Framework
This figure represents the proposed SWAM model schematic, including tributaries, water users, and dischargers. Note that the permitted surface water withdrawals (golf courses) and one agricultural withdrawal that are near the coast are not included. This is because they are located on small streams that are tidally influenced and drain directly to the ocean. These small streams are not included in the model. The only other surface water withdrawals in the basin are registered agricultural withdrawals – most of which are located in the headwaters of the basin.

The Ashepoo River is not included in the model due to the lack of USGS flow records (i.e., no active or inactive gages) and the fact that there are no permitted or registered withdrawals.

The SWAM schematic includes a stretch of the Coosawhatchie River below the inactive USGS gage (0217**6517**) near Early Branch, up to the formation of the Broad River. Streamflow in this section can only be estimated, given the lack of a downstream gage to support calibration. Similarly, the schematic also extends the Combahee River beyond the inactive USGS gage (0217**6000**); however, streamflow estimates in this stretch cannot be confirmed through calibration.

Similar to the other basins already completed or in development, the guiding principles in determining what elements of the Salkehatchie River Basin to simulate explicitly were:

1. Begin with a simple representation, with the understanding that it is easier to add additional details in the future than to remove unnecessary detail to make the model more efficient.

2. Most tributaries with current uses (permitted or registered withdrawals or significant discharge) will be represented explicitly. In the Salkehatchie Basin, there are several exceptions to this. Many of the agricultural withdrawals are located on small tributaries to the Salkehatchie, Little Salkehatchie and Combahee rivers. Since these are very minor tributaries, the withdrawal location is typically close to the major river that they drain to, and there is a lack of available streamflow data to characterize flows in these minor tributaries with much precision, the withdrawal locations will be assigned to the adjacent major river. While this approach is limiting in that it may suggest that there is more water available to the user than is actually present, it still accounts for the withdrawal, and the impact on flow downstream.

3. Generally, tributaries that are unused are not included explicitly, but the hydrologic contributions from these tributaries is embedded in the unimpaired flows (or reach gains) in downstream locations. As UIFs are developed throughout the Salkehatchie, some additional tributaries may be added explicitly if warranted as candidates to support future use (or these can be easily added at any time in the future as permit applications are received).

The proposed framework is submitted with the understanding that it is malleable – that is, we may find that additional tributaries are warranted as explicit model objects (to support simulation of future withdrawals or discharges) rather than implicit flow additions, or that further simplifications are possible without compromising model utility.

The proposed model framework is a starting point based on discussions with DNR and DHEC, and on CDM Smith's initial estimate of an appropriate framework for planning and permitting in South Carolina. Feedback from water users, environmental organizations, and other stakeholders within the Salkehatchie River Basin will be important in refining the representation of the river system. The framework will be presented at the first planned stakeholder meeting for the Salkehatchie River Basin, and feedback will be used to refine the framework as appropriate.

Table 1. Permitted and registered surface water users included in the Salkehatchie Basin model

ID	Type	Facility Name	Withdrawal Tributary	Model Object ID
03IR002S02	IR	Chappell Farms	Coosawhatchie River	IR: Chappell Farms
03IR004S01	IR	Coosaw Farms	Coosawhatchie River	IR: Coosaw Farms
03IR006S01	IR	Sharp & Sharp Certified Seed	Coosawhatchie River	IR: Sharp Seed
03IR006S02	IR	Sharp & Sharp Certified Seed	Coosawhatchie River	IR: Sharp Seed
03IR006S03	IR	Sharp & Sharp Certified Seed	Coosawhatchie River	IR: Sharp Seed
03IR010S01	IR	JCO Farms	Coosawhatchie River	IR: JCO Farms
03IR011S01	IR	Connelly Farms	Salkehatchie River	IR: Connelly Farms
03IR011S02	IR	Connelly Farms	Miller Swamp	IR: Connelly Farms
03IR011S03	IR	Connelly Farms	Jackson Branch	IR: Connelly Farms
05IR007S01	IR	Brubaker Farms Inc	Salkehatchie River	IR: Brubaker Farms
05IR011S01	IR	Anilorac Farm	Little Salkehatchie River	IR: Anilorac Farm
05IR023S01	IR	Gary Hege Farm	Salkehatchie River	IR: Gary Hege Farm
05IR023S02	IR	Gary Hege Farm	Little Salkehatchie River	IR: Gary Hege Farm
05IR042S01	IR	Diem Aden Farm	Little Salkehatchie River	IR: Diem Aden Farm
06IR007S01	IR	Danny Hege Farm Barnwell	Salkehatchie River	IR: Danny Hege Farm
07GC012S04	GC	Dataw Island Club	Coast*	*NA*
07GC026S01	GC	Spring Island Club	Coast*	*NA*
07GC031S01	GC	Belfair Plantation LLC	Coast*	*NA*
07GC031S02	GC	Belfair Plantation LLC	Coast*	*NA*
07GC036S01	GC	Eagles Pointe Golf Club	Coast*	*NA*
07GC037S01	GC	Crescent Pointe Golf Club	Coast*	*NA*
07GC039S01	GC	Chechessee Creek Club	Coast*	*NA*
07IR054S01	IR	Kuzzens Inc Lobeco	Coast*	*NA*
15IR002S01	IR	Breland Farm	Little Salkehatchie River	IR: Breland Farm
15IR012S01	IR	Williams Farms Partnership	Little Salkehatchie River	IR: Williams Farms
15IR012S02	IR	Williams Farms Partnership	Willow Swamp	IR: Williams Farms
15IR012S03	IR	Williams Farms Partnership	Willow Swamp	IR: Williams Farms
15IR012S04	IR	Williams Farms Partnership	Willow Swamp	IR: Williams Farms
15IR012S05	IR	Williams Farms Partnership	Willow Swamp	IR: Williams Farms
25IR059S01	IR	Coosaw Land LLC	Coosawhatchie River	IR: Coosaw Land

Blue and gray shading identifies water users with multiple permitted withdrawal locations. These are represented by one model object.

** Will not be included in the model due to withdrawal location near the coast or non-modeled river*

NA = Not appplicable (no model object necessary)

Table 2. NPDES discharges included in the Salkehatchie Basin model framework.

NPDES Pipe ID	Facility Name	Discharge Tributary	Associated Surface Water Permit	Associated Groundwater Withdrawal ID	Model Object ID
SC0001830-001	Nevamar Company LLC	Coosawhatchie River	None	25IN001G	IN: Nevamar
SC0021318-001	Hampton, Town of	Coosawhatchie River	None	25WS001G	WS: Hampton
SC0025950-001	Yemassee, Town of	Combahee River	None	25WS004G	WS: Yemassee
SC0040215-001	Denmark, City of	Little Salkehatchie River	None	05WS002G	WS: Denmark
SC0040215-002	Denmark, City of	Little Salkehatchie River	None	05WS002G	WS: Denmark
SC0040436-001	Walterboro City of WWTP	Ashepoo River*	None	15WS001G	*NA*
SC0047872-001	Barnwell, City of WWTF (New)	Salkehatchie River	None	06WS003G	WS: Barnwell
SC0046191-001	Hilton Head No 1 PSD WWTP	Coast*	None	07WS017G	*NA*
SC0046191-002	Hilton Head No 1 PSD WWTP	Coast*	None	07WS017G	*NA*
SC0046191-003	Hilton Head No 1 PSD WWTP	Coast*	None	07WS017G	*NA*
SC0002577-003	US Marines/Parris Island Depot	Coast*	None	None	*NA*

Blue shading identifies dischargers that have a public water supply permit or registration to withdraw groundwater, but no surface water permit, and are represented by a Water User object.
Gray shading identifies dischargers that do not have a public water supply permit or active registration to withdrawal groundwater.
** Will not be included in the model due to discharge location near the coast or non-modeled river*
NA = Not appplicable (no model object necessary)

Table 3. Interbasin transfers in the Salkehatchie Basin.

NPDES Pipe ID	NPDES Facility Name	Associated Water Permit	Associated Water Permit Facility	Intake Basin	Discharge Basin	Location of Discharge in Salkehatchie	Model Object ID
SC0047279-003	BJW&SA/Cherry Point WWWTP	07WS005	Beaufort Jasper Water & Sewer Authority	Savannah	Salkehatchie	Coast*	*NA*
SC0048348-001	BJW&SA/Port Royal WTR Recl Fac	07WS005	Beaufort Jasper Water & Sewer Authority	Savannah	Salkehatchie	Beaufort River*	*NA*
SC0000825-001	US Marine Corps Air Station	07WS005	Beaufort Jasper Water & Sewer Authority	Savannah	Salkehatchie	Beaufort River*	*NA*
SC0000825-002	US Marine Corps Air Station	07WS005	Beaufort Jasper Water & Sewer Authority	Savannah	Salkehatchie	Broad River*	*NA*

** Will not be included in the model due to discharge location near the coast or non-modeled river*
NA = Not appplicable (no model object necessary)

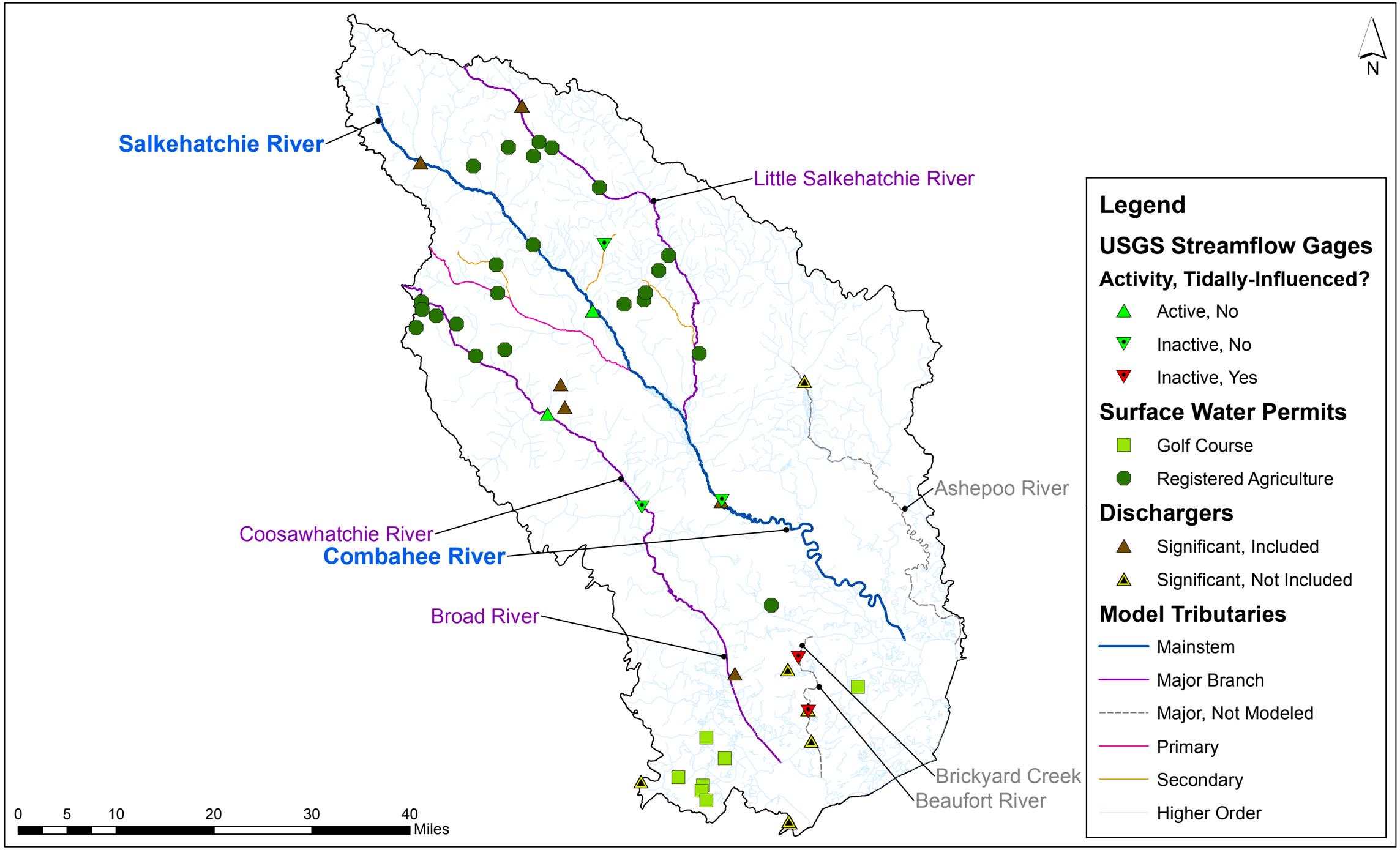

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Figure 1: Overview Map

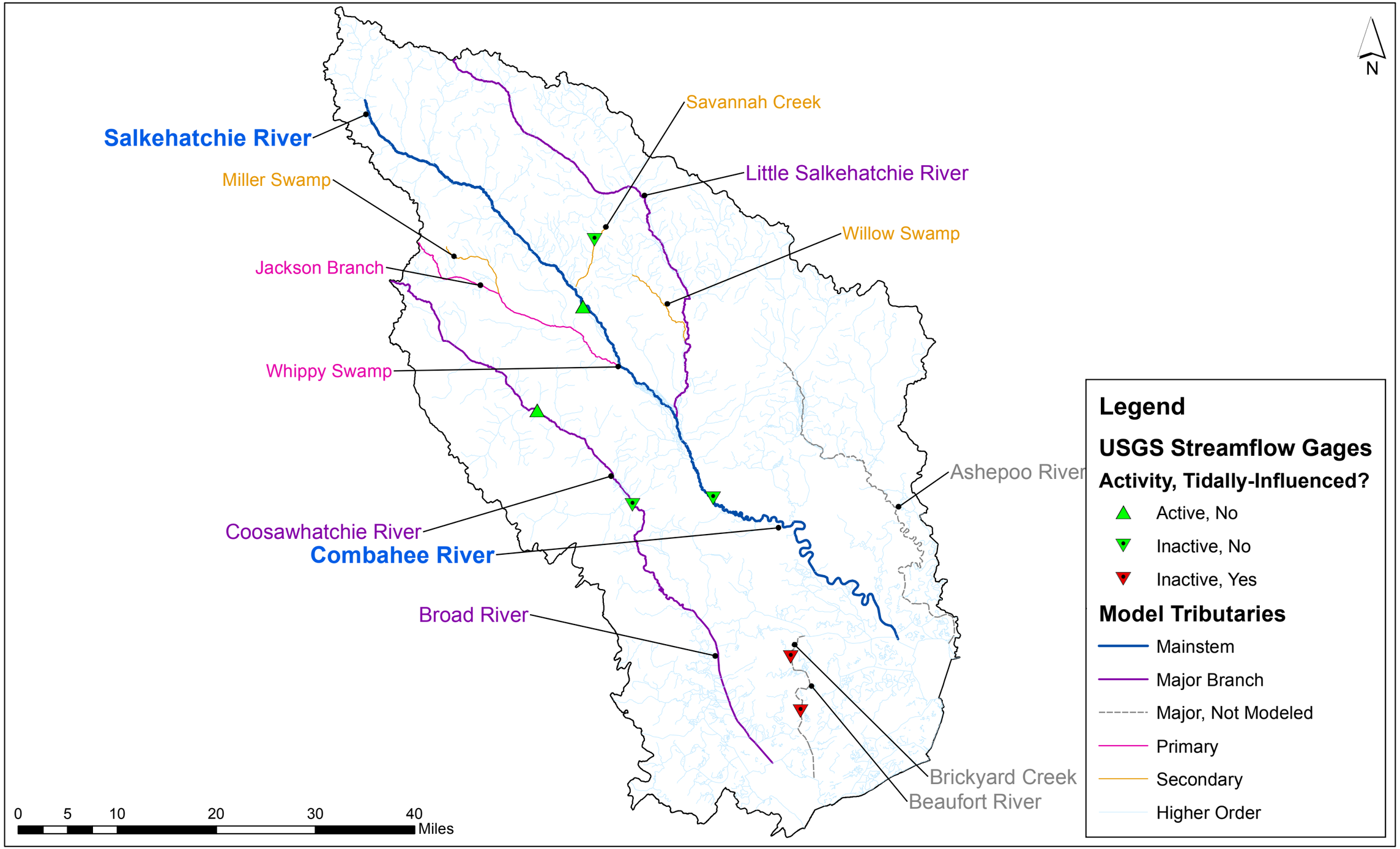

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Figure 2: Model Tributaries and USGS Streamflow Gages

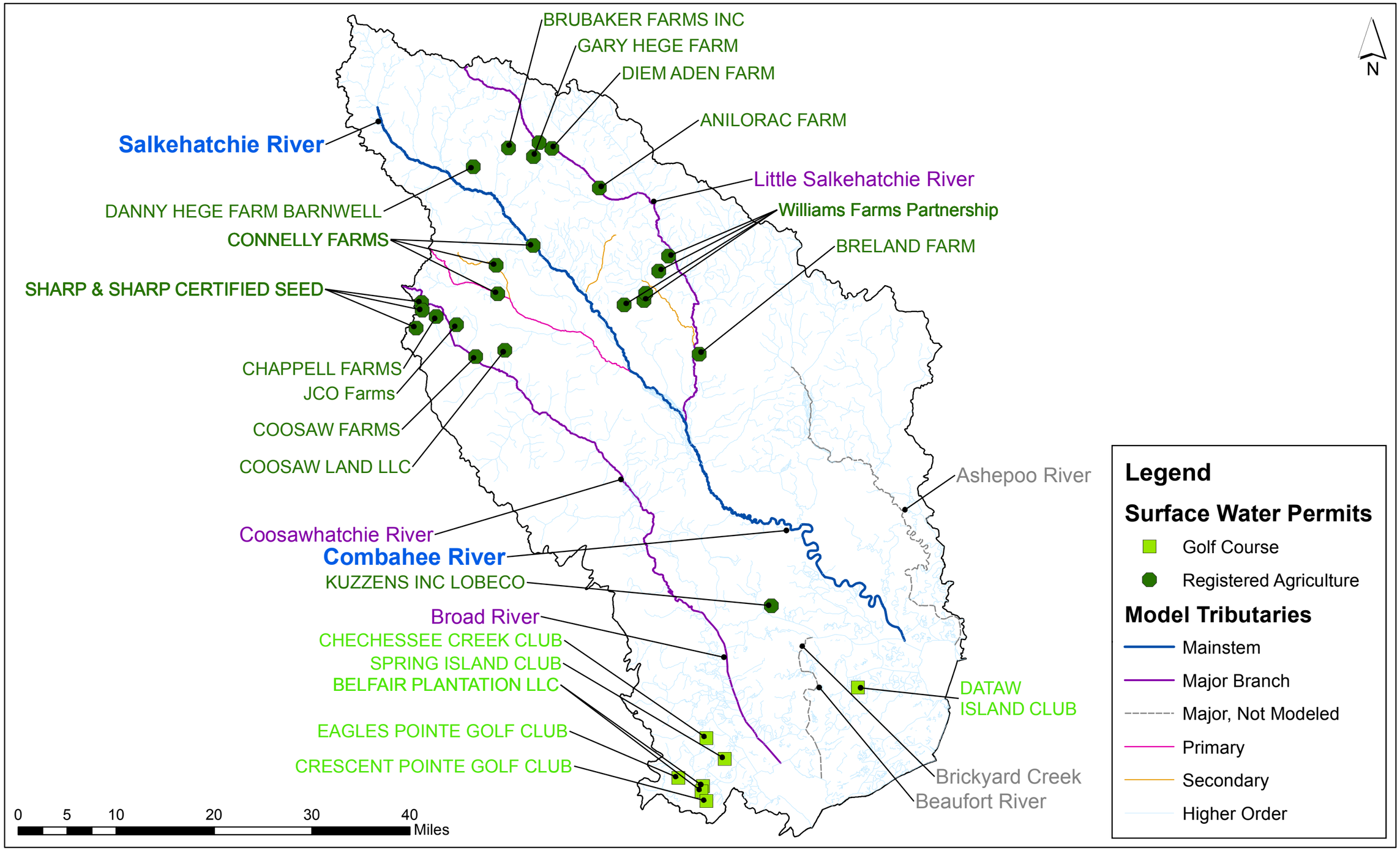

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Figure 3: Permitted Surface Water Users and Registered Agriculture

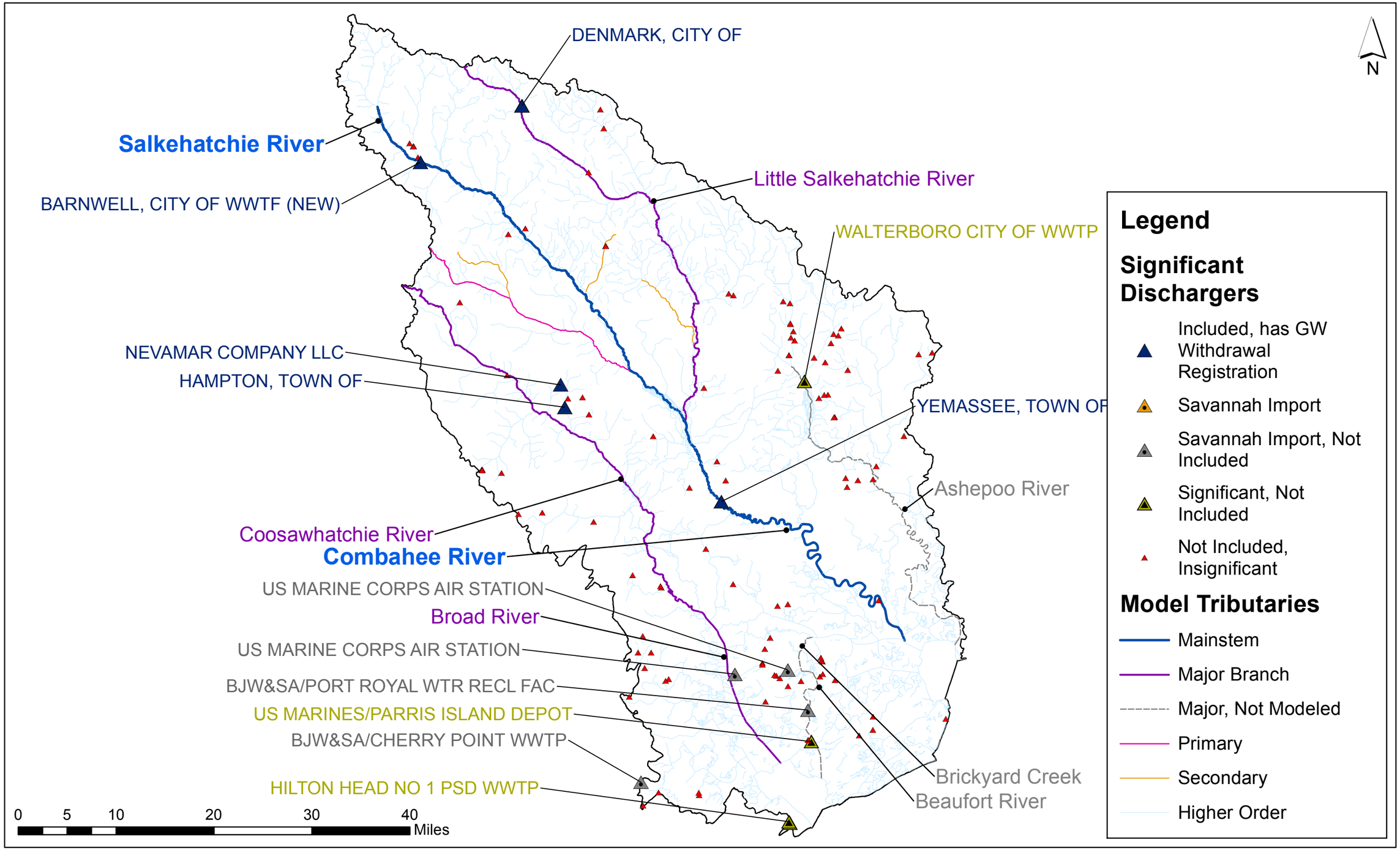

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Figure 4: Dischargers

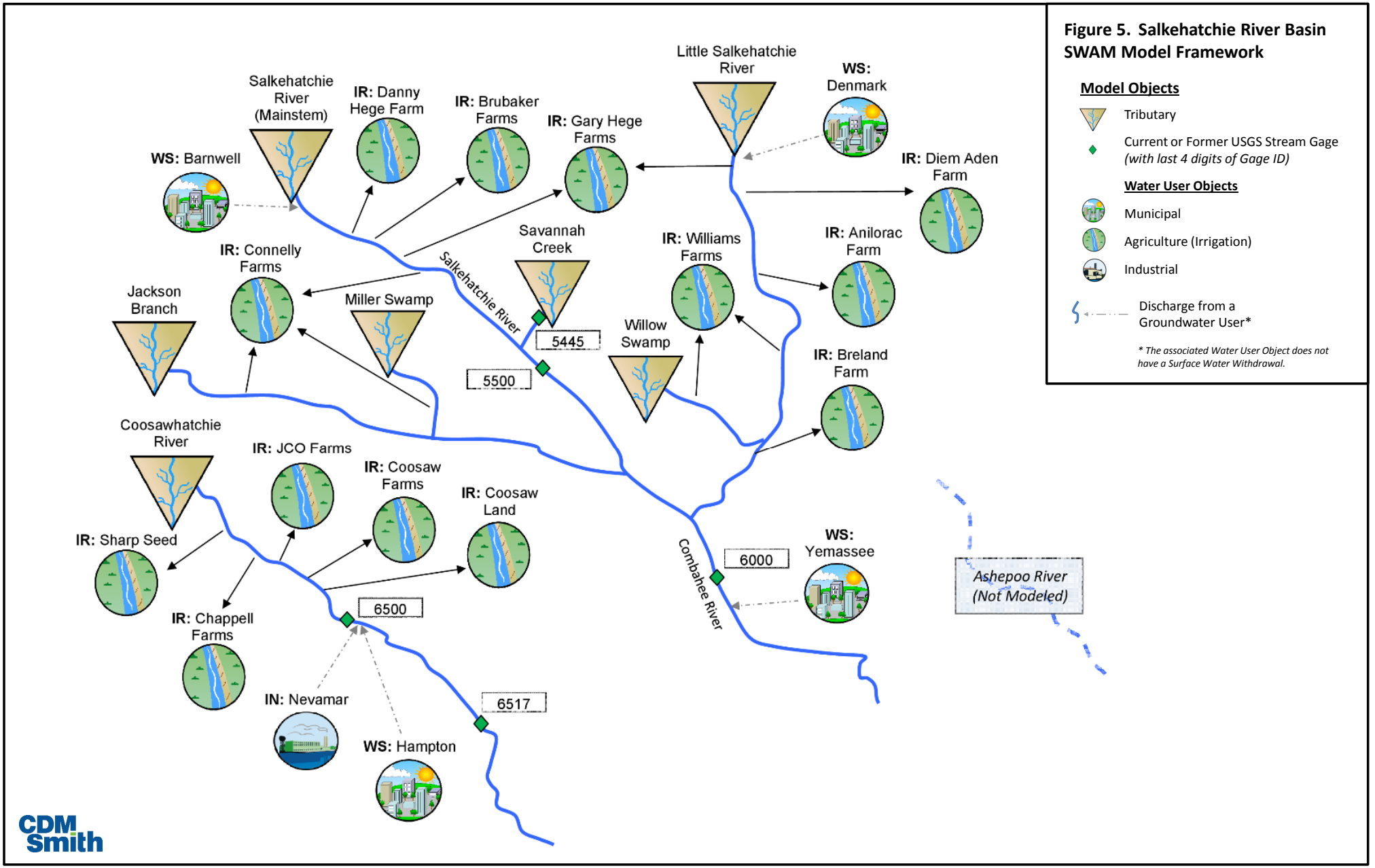

Figure 5. Salkehatchie River Basin SWAM Model Framework

Model Objects

- Tributary
- Current or Former USGS Stream Gage *(with last 4 digits of Gage ID)*

Water User Objects

- Municipal
- Agriculture (Irrigation)
- Industrial
- Discharge from a Groundwater User*

** The associated Water User Object does not have a Surface Water Withdrawal.*