Acknowledgments:

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About the cover: An aerial view of the Salkehatchie River in Hampton County illustrating the special conditions encountered during forestry operations on braided streams.
he bottomland hardwood stands in the Coastal Plain of South Carolina have experienced harvesting once or more since the European colonization of the state. With the introduction of steam locomotives and rehaul skidding in the early 1900’s, intensive harvesting occurred throughout much of the coastal plain bottomland forests. The stands regenerated after these harvesting operations are again reaching commercial maturity. Because large areas are being harvested in a relatively short time span, public awareness of bottomland forestry activities has been heightened.

Braided stream systems have multiple interconnected channels (Figure 1), resembling the strands of a braid, with very low stream gradient (<0.5% channel slope). These systems generally have broad valleys with well-defined floodplains. High water tables for much of the year result in soils with high organic content. Overland flows generally occur during the winter and spring. These characteristics create unique conditions for harvesting operations; therefore, additional BMPs are necessary.

Figure 1. Braided streams have multiple channels that interconnect like the strands of a braid.
Most braided streams are located in jurisdictional wetlands (as defined by the federal Clean Water Act) and some portions of these systems are considered navigable by the Department of Health and Environmental Control (DHEC) or the U.S. Army Corps of Engineers (COE). A permit is required to cross any navigable stream, and landowners and forestry operators should carefully evaluate their proposed forest management activities in these systems to determine if a consultation with DHEC or the COE is required. South Carolina Forestry Commission foresters are available to assist landowners and forestry operators to determine if a consultation is necessary.

Table 1: Representative segments of braided and non-braided streams.

<table>
<thead>
<tr>
<th>County</th>
<th>Water Body</th>
<th>Location</th>
<th>Braided (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colleton</td>
<td>Little Salkehatchie River</td>
<td>Between Highway 64 and Highway 63</td>
<td>Yes</td>
</tr>
<tr>
<td>Colleton &amp; Hampton</td>
<td>Salkehatchie River</td>
<td>From the junction with the Little Salkehatchie River northwest for 2 miles.</td>
<td>Yes</td>
</tr>
<tr>
<td>Dorchester</td>
<td>Four Hole Swamp</td>
<td>Between Highway 15 and Highway 453</td>
<td>No</td>
</tr>
<tr>
<td>Williamsburg</td>
<td>Santee Swamp</td>
<td>Between Suttons and Gourdin</td>
<td>No</td>
</tr>
</tbody>
</table>

South Carolina’s Best Management Practices for Forestry, published in 1994, do not specifically address some important considerations for protecting braided streams. The following supplemental BMPs for braided stream systems provide additional protection for their chemical, physical, and biological attributes. These BMPs also address navigation, and impacts from harvesting operations should be minimized if all BMPs are followed.
Streamside Management Zones for Braided Streams

Braided stream channels or runs should be identified before harvesting in order to prescribe adequate streamside protection. Protection needs vary depending on the size of the run.

- Major runs, which require more protection, have an average maximum depth of 3 feet at bankfull discharge as measured in Figure 2.
- Oxbow lakes that meet this depth requirement should be treated as if they are major runs.
- All other well-defined channels are considered minor runs.

The SMZ on major runs is divided into two parts: the primary and the secondary. The primary SMZ is 40-feet wide on each side of the stream. The width of the secondary SMZ is an additional 40-feet on each side of the stream adjacent to the primary SMZ. On minor runs, there is a 40-foot primary SMZ. When operating in braided stream systems, forest management activities within the primary and secondary SMZs should be carried out following the recommendations listed below.

Figure 2. (A) Bankfull discharge is determined using maximum stream depth, measured from the level where the stream just fills the channel to the bottom of the channel. Stream segments that average 3 feet or more at bankfull depth are major runs and require a primary and secondary SMZ. (B) Recommended cross-section locations for bankfull stage measurements.
All SMZs should be marked during periods when the streams are running within their channels and are easily identified.

Leave all trees in the primary SMZ on major runs and lakes. The primary intent is to lessen the probability of windthrow.

On major runs, the secondary SMZ may be selectively harvested, removing windthrow-prone species (such as oak, maple, and sweetgum), and retaining smaller-sized trees.

Remove all trees along minor runs when adjacent areas are clearcut, unless primary and secondary SMZs, meeting the requirements for major runs, are preferred.

Stream channels and lakes should be kept free of logging debris as harvesting operations progress.

Follow other applicable Streamside Management Zone BMPs on pages 5-13 in the BMP Manual.
Surface soil disturbance in the primary SMZ except where necessary for stream crossings.

Excessive disturbance of the surface soil in the secondary SMZ.

Logging debris in any stream channel and lakes.

Road construction in the primary or secondary SMZ, except where necessary for stream crossings.

Leaving individual or widely scattered trees adjacent to minor runs.

Locating log decks in the primary or secondary SMZs.

Excessive rutting, especially where ruts run perpendicular to major and minor runs.
BRAIDED STREAM SYSTEMS

ROAD STREAM CROSSINGS

Braided stream systems often require additional stream crossings for access, depending on the number of major and minor runs. Major runs are generally considered to be navigable, therefore anyone considering crossing a major run with a road should contact DHEC (843-448-1902) for guidance.

BMPs

- Minimize the number of stream crossings.
- Locate and install road crossings during non-flooded conditions.
- On major runs, road crossings should follow DHEC approved guidelines.
- Use bridges or culverts on minor runs, where stream crossings are necessary. Culverts should be sized to handle bankfull discharge (Table 2).
- Install culverts and hardened road dips as specified in Figure 3.
- Remove temporary crossings as soon as harvest is complete.
- Restore original channel width and depth when removing bridges and culverts.
- Follow other applicable Stream Crossing BMPs on pages 14-19 in the BMP manual.
Avoid

- Altering the flow of the stream.
- Using soil as fill material except when installing culverts.
- Using woody debris as fill material.
- Crossing lakes with roads.

Table 2: Recommended Diameters & Spacing for Culverted Crossing on Minor Runs. (For example, a 2-foot deep channel that is 12-feet wide would require three 24-inch culverts)

<table>
<thead>
<tr>
<th>Depth of Channel (feet)</th>
<th>Pipe Size (inches)</th>
<th>Channel Width per Pipe (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>2-3</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>2-3</td>
<td>30</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 3.
Culvert Installation.
The culvert should be placed at the grade of the stream channel. Hardened road dips should be constructed on each side of the culvert to handle overflow. If flexible PVC pipe is used, extra care should be taken to ensure that it is installed properly.
Forest Road Construction

Forest road construction in braided stream systems is subject to state and federal wetland/water quality regulations. Road construction for silvicultural purposes in jurisdictional wetlands does not require a permit because of the silvicultural exemption under Section 404 of the Clean Water Act. However, to qualify for the silvicultural exemption, the road construction must comply with the federally-mandated BMPs listed on pages 26-27 in the BMP Manual. The silvicultural exemption from permitting only applies to roads built specifically for forest management purposes. Roads built primarily for non-silvicultural activities, such as for access to a house or hunting camp, require a permit from the U.S. Army Corps of Engineers. The following BMPs are listed for additional interpretation of subjective areas covered by the 15 federally-mandated BMPs.

BMPs

- Design roads to parallel the drainage system where practical, except where necessary for stream crossings.

- Design and construct roads generally with less than three feet of fill above the forest floor. Road height may be higher in low areas.

- Provide and maintain adequate cross-drainage under roads by installing 24-inch or larger culverts at discernible low points in the topography and additional culverts regularly spaced in-between. Sufficient hardened road dips or culverts should be installed in road segments that are perpendicular to the water flow. Consider installing the first culvert at the base of the hill.
BMPs (continued)

- Use culverts of sufficient design specification for the load and life requirements of the crossing.

- Design roads to keep water moving as if no road was present.

- Mound soil on the road surface on both sides of road breaks for safety purposes.

- Construct appropriate water diversion structures listed on page 24 in the BMP manual.

- Follow all federally-mandated BMPs as listed on pages 26-27 in the BMP manual.

- Follow other applicable Forest Road Construction BMPs on pages 20-29 in the BMP manual.

Avoid

- Constructing forest access roads that are wider or longer than necessary for normal forestry activities.

- Constructing roads within 80 feet of a major run or 40 feet of a minor run, except where necessary for stream crossings.

- Altering the reach or flow of either the base-flow within braided channels or flood-flows over the floodplain.

- Connecting roadside ditches to major runs.
Timber Harvesting

The planning phase of a timber harvesting operation in a braided stream system is especially important due to seasonal access problems during flooded conditions. The location and construction of roads, stream crossings, streamside management zones, and log decks are best performed under non-flooded conditions. The harvesting operation should utilize appropriate equipment and techniques to minimize both on-site and off-site impacts. Plan and execute timber harvests under the supervision of a licensed forester.

BMPs

- Locate log decks at least 80 feet from major runs and 40 feet from minor runs.
- Minimize the number of skid trail stream crossings on major and minor runs.
- Establish appropriate SMZs adjacent to all major runs and minor runs.
- Use appropriate techniques to minimize rutting, such as: (1) debris or mats on skid trails, (2) high flotation equipment, (3) concentrating logs in felling and forwarding operations, and (4) other low-impact techniques.
- Cease harvesting operations when overland water flow impairs beneficial uses of water bodies downstream from the harvesting operation. Increased turbidity downstream from a logging operation should not be of a duration or magnitude to impair the beneficial uses of the water body. Isolated episodes of turbidity, related to distinct events such as culvert installation, are not considered to be violations of these BMPs.
Upon completion of the logging operation, block all channels that were created by skidding or sledding logs across major or minor runs.

Remove any logging debris occurring in major and minor runs as harvesting operations progress.

Follow other appropriate Timber Harvesting BMPs on pages 30-37 in the BMP Manual.

Avoid

- Locating log decks within 80 feet of a major run and 40 feet of minor runs.
- Skidding within a stream channel or primary SMZ, except at adequately designed stream crossings.
- Skidding across major runs, except over an adequately designed stream crossings (see Stream Crossing BMPs).
- Using soil fill, either alone or in combination with woody debris fill, for skid trail stream crossings.
- Generating turbid conditions downstream that result from the routine, daily operation of harvesting equipment.
- Using woody debris for skid trail stream crossings on major runs.
Additional Management Considerations

When planning and conducting a harvesting operation in braided stream systems, some additional factors may need to be considered. Although not considered BMPs, suggestions from the following list may be incorporated into sales contracts or harvesting plans where appropriate:

- When planning to harvest in areas that have historically been or are currently fishing areas, harvests should be scheduled during periods of low fishing activity. The main fishing season in braided stream systems generally occurs from April to August.

- Contract periods for sales contracts may need to be extended longer than normal. Braided stream systems may be inundated for long periods, and additional time is often necessary to complete the harvest.

- SMZs should be connected when possible. Some stretches of an individual run may meet the criteria to require an SMZ, and shallower stretches may not. Connecting the SMZ across the sale area provides extra protection for the stream and can act as a wildlife travel corridor.

- Consider widening the primary SMZ to at least 80 feet on stream segments that are identified as navigable under Section 10 of the federal Rivers and Harbor Act to provide a wider aesthetic buffer.

- When wildlife management is an objective, snags and den trees should be retained where practical, and where windthrow is not a factor.