Georgia’s Best Management Practices For Mining

Soil and Water Conservation Measures for Mining Operations

1st Edition
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Glossary of Terms

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Foreword

Georgia’s Best Management Practices For Mining

Purpose - The purpose of this Manual is to provide a resource to all stakeholders involved in mining and mineral processing operations regarding economical and effective practices to minimize soil erosion, thermal pollution, and sediment entering Georgia’s streams from primarily non-point sources. A significant portion of the sediment and other pollutants entering Georgia’s streams comes from non-point sources such as sheet run-off associated with unprotected land disturbing activities. These stream pollution sources can be effectively minimized by using appropriate Best Management Practices (BMPs) for erosion control.

The Federal Water Pollution Control Act, The Federal Clean Water Act, and Georgia’s Water Quality Control Act require Georgia’s Department of Natural Resources to develop a program to protect and improve the physical, chemical, and biological integrity of the state’s waters so they remain “fish-able” and “swim-able” for today’s generation as well as tomorrow’s. All of Georgia’s citizens and businesses, including those involved in any aspect of mining, can have a significant impact in reducing non-point pollution to our streams by designing, operating, and maintaining their projects and other activities using appropriate BMPs.
Scope – Georgia’s mineral industry can be broadly divided into four (4) categories of mining:

- **Open-pit Operations** (e.g., kaolin clay, mica, attapulgite, etc.)
- **Hard Rock Operations** (e.g., marble, granite, dimension stone, etc.)
- **Dredging Operations** (e.g., sand, gravel, etc.)
- **Underground Operations** (e.g., limestone, etc.)

This manual contains BMPs that may be applicable to all four categories of mining, but focuses on BMPs that are specific to open-pit operations, i.e., kaolin clay mining and processing. BMPs appropriate for kaolin clay operations are illustrative of the BMPs that may be appropriate for the other types of mining in Georgia. Of course, every site/project will differ and thus BMPs specific to each site/project must be designed by qualified professionals.

**Features**

Note: Words in *italics* are defined in the glossary.

√ A “check mark” indicates a **Best Management Practice (BMPs)**.

X An “x” mark indicates **practices to avoid**.

📖 A “book” indicates a **mandatory rule, regulation or law**.

**Acknowledgments**

The Manual was created with the support of the Georgia Environmental Protection Division (GA EPD). Financial support and industry-specific mining practices were provided by the China Clay Producers Association (CCPA), the Georgia Mining Association (GMA), and the Georgia Construction Aggregate Association (GCAA). These three associations represent well over 90% of the mineral extraction and processing operations in Georgia.
The Manual was assembled from numerous reference sources, but primarily from the Georgia Forestry Commission BMP Manual and the Georgia Soil and Water Conservation Manual (the Green Book). The mining community especially acknowledges the outstanding work of the Georgia Forestry Commission (GFC) and the Georgia Forestry Association (GFA) in preparing the Forestry BMP Manual. With their permission the preparers of this Manual have borrowed heavily in both facts and format from the Forestry Manual.
Disclaimer

THIS MANUAL IS INTENDED TO BE USED AS A GENERAL GUIDE TO ASSIST THE REGULATED COMMUNITY IN DESIGNING AND IMPLEMENTING EFFECTIVE SOIL AND WATER CONSERVATION MEASURES IN CONJUNCTION WITH MINING OPERATIONS. IT IS NOT INTENDED TO BE A SOLE SOURCE FOR SUCH INFORMATION, NOR IS IT INTENDED TO PROVIDE LEGAL ADVICE OF ANY NATURE. USERS OF THIS MANUAL ARE EXPRESSLY CAUTIONED NOT TO RELY SOLELY ON THIS MANUAL FOR TECHNICAL OR LEGAL INFORMATION, BUT ARE ENCOURAGED TO SEEK LEGAL, TECHNICAL, AND ENGINEERING ADVICE FROM QUALIFIED PROFESSIONALS WHO ARE FAMILIAR WITH THE RELEVANT PROJECT. THE ORGANIZATIONS CONTRIBUTING TO THE PREPARATION OF THIS MANUAL EXPRESSLY DISCLAIM ANY RESPONSIBILITY OR LIABILITY FOR ANY ACTS OR OMISSIONS TAKEN BY ANY PARTY AS A RESULT OF THE USE OF THIS MANUAL.
1.0  Introduction to Georgia’s Mining Industry

Georgia’s mining industry is comprised of approximately 40 major mining companies with a mineral production value of $1.6 billion per year. The industry employs approximately 7,200 workers with a payroll exceeding $300 million. The industry extracts 17 industrial minerals from 96,594 acres of permitted mines, spread among 117 of the Georgia's 159 counties. According to GA EPD records, there were 756 permitted mining facilities in Georgia in 2006. This included 266 borrow pits, 328 open mining pits, 86 rock quarries, and 76 sand dredging operations.

Table 1-A: 2006 Georgia Mining Statistics

<table>
<thead>
<tr>
<th>Type</th>
<th>Number Facilities</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarries</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>Borrow Pits</td>
<td>280</td>
<td></td>
</tr>
<tr>
<td>Pits</td>
<td>334</td>
<td></td>
</tr>
<tr>
<td>Dredges</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>775</td>
<td>97,724</td>
</tr>
</tbody>
</table>

Kaolin clay mining and production is associated with the majority of the land permitted by GA EPD for mining in Georgia. In addition, making a finished kaolin product requires considerable mechanical and chemical processing and typically requires numerous
environmental permits such as air permits (Title V, PSD, Synthetic Minor, etc.), NPDES wastewater, NPDES storm water, water withdrawal, and others. In the early 1970’s, the major kaolin clay producers formed a trade association, the China Clay Producers Association (CCPA), in part to facilitate compliance with environmental regulations, particularly those dealing with clean water and clean air. The CCPA is a non-profit trade association and founding member of the broader Georgia Mining Association (GMA). The CCPA represents BASF Catalysts LLC, IMERYS, J. M. Huber Corp., and Thiele Kaolin Co., the four largest kaolin clay producers in Georgia and in the world. Kaolin economic impact and production is felt throughout the State of Georgia. From the Port of Savannah to rural middle Georgia, the kaolin industry provides employment, is a major part of the tax base, and is instrumental in conservation and environmental efforts within the State.

Kaolin clay is found primarily in 13 counties in middle Georgia: Glascock, Jefferson, Richmond, Twiggs, Warren, Washington, Wilkinson, McDuffie, Hancock, Baldwin, Houston, Macon, and Sumter. The industry paid $47 million in federal, state, local and county taxes in 1996. There are approximately 4,200 employees at the kaolin companies and 3,000 to 4,000 contractors work exclusively for the industry. The average salary paid to an employee in the industry is in excess of $46,000, not including fringe benefits. Wage payments to Georgia kaolin industry employees contributed $196 million in economic impact to the state in 1996, with $150 million of the impact occurring in the “kaolin belt” counties.

Over 7.5 million tons of clay products are produced each year in Georgia and shipped around the world. The total economic impact on Georgia from these sales is approximately $900 million. The industry invests $3 million per year in employee safety education and accident prevention. This has resulted in the kaolin industry having one of the best mine safety records in
the country, according to the U. S. Mine, Safety & Health Administration – a low 1.5 accidents per 100 employees in 1996.

The kaolin industry in Georgia spends about $7.2 million annually on operational expenses for environmental protection. A significant portion of that is spent protecting the quality of the State’s waters by returning disturbed land to productive use. The average it cost to control erosion and fully reclaim mined land is $1,900 per acre.

Georgia has over 44,000 miles of perennial streams. Approximately 4,000 miles are designated as mountain trout waters. An additional 24,000 miles of intermittent streams and 600 miles of ditches and canals total 70,150 stream miles. The state also has over 425,000 acres of public lakes and reservoirs, 4.8 million acres of wetlands (9% tidally affected), 850 square miles of estuaries, and 100 miles of coastline. These water resources are under ever increasing pressure to serve more and more users for a quickly growing population. It is in the State’s best interest that these resources be protected and conserved so that they can continue to serve Georgia’s needs forever.

This Manual addresses mining operations and specifically suggests BMPs to minimize soil erosion and stream sedimentation. Mining BMPs are the most appropriate or applicable techniques to employ while extracting the state’s mineral resources while at the same time protecting the physical, chemical, and biological integrity of the state’s waters.
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For more information about Mining BMPs, contact:

Georgia Mining Association / China Clay Producers Association,
113 Arkwright Landing, Macon, Ga. 31210, 478-757-1211
or visit their websites at www.georgiamining.org or www.kaolin.com

Georgia Construction Aggregate Association
9810 A Medlock Bridge Road, Suite 202, Duluth, GA 30097, 678-473-0012
or visit their website at www.gcaa.org

Georgia Environmental Protection Division,
Land Protection Branch at 404-362-2537
or visit their website at www.georgiaepd.org
2.0 Comprehensive Mine Planning & Water Quality

2.1 Discussion

Any land disturbing or mining activity, regardless of its potential impact on water quality, should be thoroughly planned in advance. The planning process should consider the objectives of the proposed activity as well as the potential environmental impacts of all actions that disturb the soil surface or impact water quality. The planning process should help identify sensitive areas and applicable BMPs to be used during: land clearing, timber sales, road construction, stream crossings, timber harvesting, site preparation, mining, site grading, reforestation, and herbicide applications. The planning process should help the mine planner to identify necessary terms and conditions in the state-required Mined Land Use Plans (MLUP) as well as in any local ordinances or permits that will conserve soil and protect water quality.

2.2 General Mining Objectives

2.2.1 Extract the useable ore in the most cost effective manner, while minimizing soil erosion and the negative impacts on water quality.

2.2.2 Comply with applicable requirements in the landowners lease, the MLUP and state, federal and local regulations governing surface mining.

2.2.3 Return the reclaimed mined land to productive uses such as: farming; wildlife habitat; hunting and fishing; or residential, commercial or industrial building sites.
2.3 Comprehensive Mine Planning Considerations

Thorough planning prior to permitting a new mine site can minimize delays and make the project an economic as well as environmental success. There are many stakeholders in a prospective mining project: land owners; mining company stockholders and employees; local citizens and governments; the environmental community; and state and federal regulatory agencies, to name a few. Carefully examine each of the items below to minimize project delays and potential impacts on wetlands and water quality.

2.3.1 Special Site Characteristics

- **Topography of the Site** – United States Geologic Survey (USGS) topographic maps, aerial photos, Natural Resource Conservation Service (NRCS) county soil survey maps, mine surveys, water well drilling logs; the Georgia Forestry Commission maintains all of these documents, except mine surveys and water well drilling logs, at all district offices; the NRCS maintains soil and topographic maps at local field offices.

- **History of the site including past land uses** – past land owners, deed records, etc.

- **Evidence of Soil or Water Contamination** – Phase I Environmental Site Assessment.

- **Special Site Conditions** – endangered species, wetlands, trout streams, historic sites, archeological sites, cemeteries, sensitive areas such as perennial and intermittent streams, ephemeral areas, lakes, ponds, wetlands, steep slopes, highly erosive or hydric soils, active gully systems.

2.3.2 Community Affairs

- **Community Impacts** – traffic safety, noise and dust, economic growth, increased employment and business activity.

- **Mine Safety** – blasting, highwalls, soil stability, roof falls, trespass, water hazards, rotating equipment, conveyors, chemicals, haul trucks, pedestrian and community traffic, Mine Safety and Health Regulations.
2.3.3 Special Permit Requirements

- Zoning Ordinances
- Local Site Projects Construction
- Mining Setbacks
- Wetlands Preservation
- Streamside Management Zones (SMZs)
- Storm Water/ Wastewater Discharges
- Groundwater Use
- Surface Water Use
- Air Permits

2.3.4 Water Management

- Managing Potential Impacts on Lakes or Streams – streamside buffer zones; low-flow streams and no-flow streams.
- Groundwater and Surface Water Use Management
- Managing Storm Water and Mine Pit Pump-out Water – erosion and sediment control, in-stream water quality standards
- Managing Industrial Wastewater Discharges – permit limits, in-stream water quality standards, conditions listed in receiving stream TMDLs
- Preservation of Top Soil & General Soil Erosion and Sedimentation Controls – minimizing land disturbance, minimizing impervious surfaces

2.3.5 Timber Harvesting & Site Clearing

2.3.6 Earth Moving Activities

- Road Building
- Stream Crossings
• Soil (Overburden) Removal and Storage

• Mineral Ore Extraction and Transport

• Mine Pit - Filling, Grading, and Final Cover

2.3.7 Land Reclamation – re-vegetation, landowner constraints, topographic constraints, forestation, fish and wildlife, and techniques for managing reclaimed land

2.3.8 Applicable Federal, State & Local Rules, Regulations and Laws - See Section 10 for a list of potentially applicable rules.
3.0 Kaolin Prospecting & Exploration

Nature has given Georgia an abundance of minerals such as kaolin, barite, feldspar, mica, sand, gravel, granite, limestone, and marble. Unlike some minerals, kaolin clay must be beneficiated extensively in order to become a useful product. Turning raw kaolin into products for industrial applications requires large capital investments in equipment and technology. The journey from the mines of middle Georgia to the paper, rubber, paint, or other industrial consumers involves finding the ore, mining it, processing it to a variety of specifications, and then shipping it to users all over the world.

The mining and processing of kaolin begins with exploration. Geologists study the earth’s surface, research literature and other data to identify areas with potential kaolin deposits. Deposits of kaolin are located by drilling holes in the earth, which can range up to 200 feet in depth. When kaolin deposits are encountered, core samples of the deposits are extracted and sent to a laboratory for testing. Kaolin companies drill 50 to 100 holes per every 100 acres to get a reasonable indication of the quality and size of the deposit. Thousands of acres are drilled and thousands of feet of samples are tested to yield a handful of acceptable mining sites.
BMPs for Prospecting and Exploration

Drill holes are sealed in the field naturally or with mechanical means to prevent groundwater contamination.

- Seal drill holes to prevent groundwater contamination.
- Protect streams and wetlands from any waste water resulting from prospecting or exploration activities.
- See BMPs for Temporary Access Trails for prospecting activities.
4.0 Timber Removal & Land Clearing

Before most mining operations can commence, timber is removed and land is cleared. Land clearing and timber harvesting encompass several operations. In addition to bush hogging, soil grubbing and cutting trees, the process typically includes the layout, construction, and stabilization of access roads, log staging areas, and dump sites. Land clearing and timber harvesting can be accomplished while protecting water quality, site productivity and future land use alternatives.

Potential water quality impacts can be avoided or minimized if the mine plan considers seasonal weather conditions, tree type, soil type, soil moisture, topography, and types of equipment used. It is important to avoid streams and to maintain the integrity of their banks, water flow, and stream biology. Specific BMPs for log staging areas, and dump areas are provided in this section.

4.1 Log Staging Areas And Dump Sites

Log staging areas and dump sites are areas of concentrated equipment and traffic flow resulting in a high degree of soil disturbance, soil compaction, and rutting. Storm water runoff and surface erosion may increase on these exposed areas and, depending on their locations, could impact water quality. Runoff may contain constituents from fuels and lubricants. The following BMPs should be implemented to prevent runoff from reaching nearby watercourses.
4.1.1 BMPs For Log Staging Areas and Dump Sites

√ Locate log decks and dump sites when planning the road system.

√ Minimize the size and number of log staging areas and dump sites necessary for the operation.

√ Locate log staging areas and dump sites uphill. Skid trees uphill to staging areas. If trees must be skidded, downhill erosion can be minimized by using several smaller staging areas. Install water bars with water turnouts in access trails prior to final approach to the staging area to disperse water.

√ Locate dump sites and log staging areas in a stable, well-drained area away from gullies when possible.

√ Stabilize as needed when the harvest is completed using water bars, logging slash, or vegetative cover. (See Section 8.6 for seeding recommendations.)

4.1.2 Practices to Avoid for Dump Sites & Log Staging Areas

X Avoid locating log staging areas and dump sites within the SMZ.

X Do not allow log staging areas and dump sites to discharge storm runoff directly onto roads or ditches that lead to a watercourse.

4.2 Temporary Access Trails

Temporary access trails are used during prospecting, exploration, and timber harvesting. When constructing and using these trails, minimize site-damaging effects to soil stability and water quality, such as rutting, puddling, and soil compaction. If trails will remain for vehicular access, upgrade them to road building standards.

4.2.1 BMPs for Temporary Access Trails

√ Skid logs uphill to log staging areas on ridges or hills.

√ Have periodic breaks in grade to help disperse surface flow.
Use temporary closure techniques, such as water bars or covering with logging slash, if significant erosion occurs before permanent closure techniques are installed.

When grades exceed 15%, use water bars with water turnouts.

Retire trails as soon as possible with properly installed water control structures. See Table 4-A for proper spacing of water bars.

### Table 4-A: Spacing of Water Bars on Skid Trails and Firebreaks

<table>
<thead>
<tr>
<th>Grade of Skid Trail or Firebreak</th>
<th>Distance Between Water Bars</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 %</td>
<td>250 ft</td>
</tr>
<tr>
<td>5%</td>
<td>135 ft</td>
</tr>
<tr>
<td>10%</td>
<td>80 ft</td>
</tr>
<tr>
<td>15%</td>
<td>60 ft</td>
</tr>
<tr>
<td>20%</td>
<td>45 ft</td>
</tr>
<tr>
<td>30%</td>
<td>35 ft</td>
</tr>
<tr>
<td>40%*</td>
<td>30 ft</td>
</tr>
</tbody>
</table>

* Use grades of 40% and steeper only for short stretches.

### 4.2.2 Practices to Avoid with Temporary Access Trails

- X Trails over 40% grade, except for short stretches.
- X Bladed trails, unless required on side slopes to maintain safe grades.
- X Using streams or ditches with defined channels as access trails.
- X Locating access trails within SMZs.

### 4.3 Temporary Stream Crossings

In certain situations, crossing a stream with a temporary structure may be preferable to a permanent road crossing. Factors to consider include: the temporary lifespan of the crossing; the value of the timber or mining ore reserves to be accessed relative to the cost of a permanent crossing; topographic features limiting construction of permanent crossings; and the size of the...
stream and/or the upstream watershed. To protect water quality during the life of the temporary stream crossing, it is important to:

- maintain the integrity of the stream bank,
- use water-permeable fill materials that are easy to later remove, and
- minimize the amount of fill dirt entering the stream.

4.3.1 BMPs for Temporary Stream Crossings

√ Minimize the number of crossings.

√ Cross stream at right angles.

√ Maintain stream bank integrity.

√ Approach streams at gentle grades of slope, ideally at < 3%.

√ Use temporary bridges or spans rather than temporary culverts.

√ If temporary culverts are used, make sure they are properly sized for the watershed.

√ Stabilize culvert fill during and after construction using a combination of: hay bales; seed and mulch; silt fence; rock; excelsior blankets; geotextiles; etc.

√ Use logs or rock as fill over temporary culverts instead of fill dirt whenever possible.

√ Remove all temporary fills and restore the channel to its original elevation.

√ Stabilize approaches during and after construction.

4.3.2 Practices to Avoid for Temporary Stream Crossings

X Building an avoidable stream crossing.

X Use of fords.

X Blocking stream flow.
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X Blocking the migration of aquatic organisms.
X Random crossings with mechanized equipment.
X Leaving logs or brush in stream crossing.

4.4 Rutting

During every stage of mechanized mining or tree harvesting, some soil disturbance and rutting is inevitable. Excessive or inappropriate rutting can impact water quality when it causes sediment or silt-laden runoff to enter a stream or when it interrupts or changes the natural flow of water to the stream. Rutting that results in the discharge of sediment to a stream may violate federal and state water-quality laws.

4.4.1 BMPs to Minimize Rutting

√ Use low ground pressure equipment, logging mats, or other techniques on saturated soils where practical.

√ Minimize the grade of roads and trails and follow the BMPs recommended for access roads.

4.4.2 Practices to Avoid Excessive Rutting

X Accessing sensitive areas during wet weather when soils are most subject to rutting.

X Damaging the integrity of a stream bank.

4.5 Equipment Washing/Servicing

Improper equipment washing and servicing can introduce hazardous or toxic materials to the site, which can adversely affect water quality.
4.5.1 BMPs for Washing/Servicing Equipment

√ Wash and service equipment away from any area that may create a water quality hazard, especially within SMZs and along ephemeral areas.

√ Dispose of oils, lubrications, their containers and other wastes according to local, state and federal regulations.

√ Remove all used tires, batteries, oil cans, and trash from operations before leaving the site. Clean up and/or contain fuel and oil spills immediately.

√ Clean up and/or contain fuel, oil and other regulated material spills immediately. Comply with state and federal regulations when reporting spills. Report as required appropriate fuel, oil or chemical spills to the DNR GA EPD HAZARDOUS SUBSTANCES OFFICE. (1-800-241-4113) and to the NATIONAL RESPONSE CENTER (1-800-424-8802) and other agencies as required.

√ Install oil/water separators on drains from equipment service areas.

4.5.2 Practices to Avoid When Washing & Servicing Equipment

✗ Avoid washing or servicing equipment where it could adversely affect water quality.

4.6 Protecting SMZs During Exploration & Harvesting

√ Use BMPs from Section 7.2.

4.6.1 BMPs for Exploration & Harvesting within SMZs

√ Use low ground pressure equipment and equipment with booms or cable winches to minimize soil disturbance.

√ Maintain the integrity of stream banks.

√ Drive on top of spread logging brush to minimize soil disturbance.

4.6.2 Practices to Avoid when Exploring or Harvesting within SMZs

✗ Using trees or de-limbing gates in the SMZs.

✗ Leaving tree tops in stream channels.

✗ Leaving drill mud pits in SMZs.
4.7 Protecting Wetlands During Mining Operations

Once federal and state permits have been obtained, follow forestry BMPs in Section 4.0 of this Manual for timber removal.

4.7.1 BMPs for Exploring & Harvesting Forested Wetlands

- Follow BMPs in Section 8.2.
- Plan the timber harvest for the dry season of the year when possible.
- Use site-specific equipment and methods to minimize water quality impacts, including high-flotation, low-pressure harvesting equipment, shovel logging or cable yarding.
- Concentrate skid trails and use logging slash, mats or other techniques to minimize soil compaction and rutting.
- Use practices conducive to rapid regeneration.
- Follow federally mandated stream and wetland crossing guidelines in Section 8.2.
5.0 Earth Moving Activities

5.1 Road Building - Location, Construction Techniques, Stream Crossings, Maintenance & Retirement

Access roads are an essential part of any mining or forest management operation. With proper planning, location, construction, and maintenance techniques, well-constructed access roads allow for productive operations and cause minimal soil and water quality impacts.

Poorly located, poorly constructed, or poorly maintained access roads, especially at stream crossings, can result in sediment reaching streams, changing stream-flow patterns, degrading fish and aquatic organism habitat, and adversely affecting aesthetics.
There are two types of access roads typically constructed in the state.

1. In mountainous and hilly terrain, the broad-based dip road is used.

**Figure 5-A: Broad-Based Dip Road**
(Source: Georgia Soil and Water Conservation Commission website
www.gaswcc.georgia.gov)

Stable outlets shall be provided for each diversion.

2. In the flat woods and along major flood plains, the crown and ditch road is commonly used.

5.1.1 BMPs for Road Location

- Identify federal, state and local laws, regulations or ordinances that apply to road purpose, construction, and maintenance prior to construction and operation.

- Use soil surveys and topographic maps to identify soils, stream locations and other natural features (rocky areas, steep slopes, wet areas, etc.) on the property that might pose problems.

- Locate potential control points i.e. log decks and stream crossings on topographic maps prior to designing access roads in the field.

- New permanent access roads should follow the contour as much as possible with grades ideally kept below 10%. An engineer’s divider can be used to lay roads out with the desired grade on a topographic map. Grades can run up to 12% for short distances. If soil is highly erosive, reduce grades. Plan to install water control structures.
Temporary access roads should follow the contour as much as possible. Grades can run up to 25% for short distances provided that water control structures are properly installed.

Except for planned stream crossings, locate new roads outside of SMZs.

Minimize stream crossings. Where crossings are necessary, see Chapter 6 of the Soil and Water Conservation Manual for design criteria.

Minimize the number, length, and width of access roads.

Locate new access roads on high ground, preferably on the sides of ridges, for proper surface drainage.

Locate new access roads on southern or western sides (aspect) of ridges if possible to expose the roadbed to more sunlight.

Conduct site reconnaissance to verify road layout with potential soil problems, stream locations, sensitive areas and watershed conditions.

Evaluate the condition of existing roads and potential water quality impacts. If necessary, plan for improvements or replace with new routes.

5.1.2 BMPs for Road Construction

Construct access roads only wide enough (usually 12-16 feet) to safely handle equipment that will use the road.

Schedule construction during favorable weather.

Maximize sunlight exposure along roadsides where surface drainage is a problem.

On permanent access roads with 3% or more grade, broad-based dips should be installed at proper intervals; at 30-degree angles across road surfaces; have reverse grades of 3%; and the bottom of the dips should be out sloped about 3 percent. If necessary, install sediment barriers such as rock, hay bales, or silt fence at the outfall of dips.

On temporary access or spur roads that have little traffic at low speeds, rolling dips can be installed. They resemble “stretched out” water bars.
Table 5-A: Recommended Spacing for Broad Based Dips in Permanent Access Roads and Rolling Dips in Temporary Access Roads

<table>
<thead>
<tr>
<th>Road grade (percent)</th>
<th>Distance between dips and turnouts (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 %</td>
<td>235 ft</td>
</tr>
<tr>
<td>4 %</td>
<td>200 ft</td>
</tr>
<tr>
<td>5 %</td>
<td>180 ft</td>
</tr>
<tr>
<td>6 %</td>
<td>165 ft</td>
</tr>
<tr>
<td>7 %</td>
<td>155 ft</td>
</tr>
<tr>
<td>8 %</td>
<td>150 ft</td>
</tr>
<tr>
<td>9 %</td>
<td>145 ft</td>
</tr>
<tr>
<td>10 %</td>
<td>140 ft</td>
</tr>
<tr>
<td>12 %</td>
<td>135 ft</td>
</tr>
</tbody>
</table>

√ On crown and ditched roads, install water turnouts at proper intervals.

Table 5-B

<table>
<thead>
<tr>
<th>Road Grade (%)</th>
<th>Spacing (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 – 5</td>
<td>500 – 300</td>
</tr>
<tr>
<td>6 – 10</td>
<td>300 – 200</td>
</tr>
<tr>
<td>11 – 15</td>
<td>200 – 100</td>
</tr>
<tr>
<td>16 – 20</td>
<td>100</td>
</tr>
</tbody>
</table>

√ Turnouts should never tie directly into streams or water bodies.

√ Install sediment barriers such as rock, hay bales, or silt fence on the outfall of turnouts.

√ Place riprap at culvert outfall to prevent washing.

√ Keep roads free from obstructions like logging debris, rocks or chunks of ore.

√ Roadbeds on erosive soils should be stabilized with rock, clay or other appropriate measures.
√ Stabilize exposed soil on shoulders of permanent or temporary access roads located within SMZs, wetlands or at stream crossings as soon as possible with any one or combination of the following: seed and mulch; silt fence; hay bales; excelsior blankets; geotextiles.

√ See Section 8.11.3 for grassing recommendations.

√ Type A (36 inch) or Type B (22 inch) silt fence can be used. Wooden stakes should be fastened to the fence every 6-ft on the down slope side. The bottom edge of the fence should be installed in a 4-inch deep trench with the bottom two inches of the fence facing upslope in the trench. See Figure 5-B.

√ Place hay bales on sides in 4-inch deep trenches and staked down.

√ For more information refer to Georgia Soil and Water Conservation Commission’s Field Manual for Erosion and Sediment Control in Georgia, Chapter 6.

**Figure 5-B: Silt Fence Installation**

(Source: Georgia Soil and Water Conservation Commission website [www.gaswcc.georgia.gov](http://www.gaswcc.georgia.gov))
5.1.3 Practices to Avoid During Road Construction:

- Avoid any road construction inside SMZs, except at planned stream crossings.

- Avoid in-sloping of roads. Where unavoidable, use *cross-drain culverts* positioned under the road at a 30° angle and spacing for proper inside road drainage.

- Avoid using *ditches* on steep roads. Some *ditches* may have to be lined with rock to prevent gullying and sedimentation.

- Do not tie turnouts directly into *perennial* and *intermittent streams* or *ephemeral areas*. 
5.1.4 BMPs for the Maintenance & Retirement of Roads

- Maintain existing roads in accordance with BMPs.
- Maintain points of ingress from county roads or highways to prevent mud and debris being brought onto these roads.
- Periodically inspect retired roads to assure stabilization techniques are still effective and permanent stream crossings are clear and operating properly.
- Minimize road grading and reshaping on hilly or mountainous terrain unless required to repair damaged road sections.
- Keep outfall of broad-based dips, water bars, and water turnouts open at all times during logging operations. If necessary, install sediment barriers such as rock, hay bales, or silt fence just below outfall.
- Retire temporary access roads by re-shaping and/or constructing water bars at recommended intervals. Stabilize as necessary by seeding and mulching or scattering gravel or logging debris over the road surface. (See Figure 3-I and Table 3-D for spacing recommendations.)
Table 5-C:  Recommended Maximum Spacing for Water Bars When Retiring Temporary Access Roads

<table>
<thead>
<tr>
<th>Road Grade (Percent)</th>
<th>Distance Between Water Bars (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 %</td>
<td>245 ft</td>
</tr>
<tr>
<td>5 %</td>
<td>125 ft</td>
</tr>
<tr>
<td>10 %</td>
<td>80 ft</td>
</tr>
<tr>
<td>15 %</td>
<td>60 ft</td>
</tr>
<tr>
<td>20 %</td>
<td>50 ft</td>
</tr>
<tr>
<td>25 %</td>
<td>40 ft</td>
</tr>
</tbody>
</table>

5.1.5 Practices to Avoid During Road Maintenance & Retirement

- Excessive traffic on wet roads.
- Removing safety berms.
- Blocking storm water turnouts.

5.2 Stream Crossings For Roads

Stream crossings are often necessary for access roads. From a water quality standpoint, stream crossings are the most critical aspect of the road system. Failure of a stream crossing due to improper planning, improper construction or inadequate maintenance can result in erosion and introduction of sediment into a stream. Stream crossings should be avoided if possible. This should be an objective of the site planning phase of a mining project.

Where crossings are necessary, planning should address the type of road and road-use pattern, stream channel characteristics, stream flow levels and the aquatic organisms in the stream. Minimizing impacts is critical. Permanent and temporary stream crossings should be based on expected applicable storm-flow return intervals and watershed acreage above the crossing.

There are three types of stream crossings to consider during mining or forest management operations: bridges, culverts, and fords.
**Georgia BMP Manual – 2008**

**Bridges**, whether permanent or temporary, typically create the least disruption to stream flow and have less effect on fisheries and other biota than other stream-crossing methods.

**Culverts** can be either temporary or permanent. *Culvert* sizing is critical to minimizing problems. Consider both the purpose of the crossing and the duration of use. Sizing may increase if the need is permanent.

**Fords** can be used for haul roads only where the streambed is firm, banks are low and stable, and the stream is shallow.
Figure 5-D: Temporary Bridge Crossing
(Source: Georgia Soil and Water Conservation Commission website
www.gaswcc.georgia.gov)
Figure 5-E: Temporary Bridge Crossing
(Source: Georgia Soil and Water Conservation Commission website
www.gaswcc.georgia.gov)

GENERAL NOTES:
1. Not to scale.
2. This type of crossing can be installed in both a wet or dry weather stream condition where the drainage area exceeds 10 acres.
3. Remove during cleanup.
5.2.1 Clean Water Act Requirements for Stream Crossings

The Federal Clean Water Act, Section 404 (40 CFR Part 232.3) exempts normal, established, ongoing mining activities from the permitting process for discharges of dredged or fill material in jurisdictional wetlands. An operation ceases to be established when the area has been converted to another use, i.e. forestland to mining. Federal 404 permits and state Surface Mining Act permits must be obtained. Once obtained, construction or maintenance of temporary roads for moving mining equipment must follow the BMPs. However, fifteen (15) baseline provisions for forest road construction and maintenance in and across waters of the U.S. (lakes, rivers, perennial and intermittent streams, wetlands, sloughs and natural ponds) are mandated to qualify for the forest road exemption:

- Permanent roads, temporary access roads for mining, forestry, or farm purposes in waters of the U.S. shall be held to the minimum feasible number, width and total length consistent with the purpose of specific farming, silvicultural, or mining operations, and local topographic and climatic conditions;

- All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads that must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;

- The road fill shall be bridged, culverted or otherwise designed to prevent the restriction of expected flood flows;

- The fill shall be properly stabilized and maintained during and following construction to prevent erosion;

- Discharges of dredged or fill material into waters of the U.S. to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers or other heavy equipment within waters of the U.S. (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;

- In designing, constructing and maintaining roads, vegetative disturbances in the waters of the U.S. shall be kept to a minimum;
The design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body;

Borrow material shall be taken from upland sources wherever feasible;

The discharges shall not take or jeopardize the continued existence of a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;

Discharges into breeding and nesting areas for waterfowl, spawning and wetlands shall be avoided if less harmful alternatives exist;

The discharge shall not be located in the proximity of a public water supply intake;

The discharge shall not occur in areas of concentrated shellfish production;

The discharge shall not occur in a component of the National Wild and Scenic River System;

The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts; and,

All temporary fills shall be removed in their entirety and the area restored to its original elevation.

5.2.2 General BMPs for Stream Crossings

In addition to the 15 CWA mandated provisions:

✓ Approaches to all permanent or temporary stream crossings should be made at gentle grades of slope (3% or less) wherever possible.

✓ Approaches should be made at right angles to stream flow where practical.

✓ Approaches should have water control structures, such as water turnouts or broad-based dips, on both sides of a crossing to prevent road runoff from entering the stream.

✓ Stabilize approaches, if necessary, with rock extending at least 50 feet from both sides of the stream bank during the operation.
For temporary access roads, temporary bridges or spans are favored over culverts or fords.

Build wetlands fill roads outside the SMZs, except when crossing the channel. Cross-drainage structures (culverts, bridges, portable spans, etc.) may be necessary in the fill road to allow for surface water movement across the site.

Stabilize exposed soil around permanent or temporary stream and wetlands crossings with any one or a combination of the following: seed and mulch; hay bales; rock; silt fence; geotextiles; and/or excelsior blankets.
5.2.3 BMPs for Bridges

- Use bridges to cross streams with 300+ acre or larger watersheds if other alternatives are not suitable for containing storm flows.

- Remove temporary bridges and stabilize approaches and stream bank when operations are completed. Temporary bridges (timber of otherwise) that can be moved to additional sites as needed are an effective BMP.

5.2.4 BMPs for Fords

- Use fords only for haul roads (not skid trails).

- Locate fords where stream banks are low and the bottoms are relatively hard and level.
Where necessary, establish a smooth, hard-surface, low water crossing. For a permanent ford use gravel or rock filled geoweb, or concrete pads. For temporary fords use dragline mats or logs to armor (protect) the stream bottom.

Material should not significantly impound stream flow, impede fish passage or cause erosive currents. Remove temporary crossings from the channel when operations are completed.

5.2.5 BMPs for Culverts

Bridges are preferred over culverts, especially for permanent crossings.

Where fords or bridges are not appropriate, use culverts to cross streams with usually 300-acre or less watersheds, depending on physiographic region, including braided streams in broad flats. See Figure 5-E.

One large culvert is generally preferred on most stream crossings, but may not be the best choice on a stream with a wide range of stream flows. Single large culverts aid in reducing debris blockage, provide for better fish and wildlife passage, and reduce flow velocities for better fish passage.

Carefully consider the time and duration of culvert installation or repair. Schedule projects so that they don’t coincide with fish migrations, spawning, and egg incubation periods avoid installation problems associated with high-water seasons.

When fish and wildlife are major concerns use open-bottom culverts to preserve the natural creek substrate. Common shapes include semicircular arch, elliptical arch, and concrete box culverts.

When crossing streams with a watershed larger than 300 acres, consult a qualified professional.
Table 5-D: Recommended Culvert Diameters Based on Drainage Area & Storm Events
(Source: Georgia Soil and Water Conservation Commission website www.gaswcc.georgia.gov)

<table>
<thead>
<tr>
<th>DRAINAGE AREA (acres)</th>
<th>LOWER COASTAL PLAIN (inches)</th>
<th>UPPER COASTAL PLAIN (inches)</th>
<th>PIEDMONT (inches)</th>
<th>MOUNTAINS AND RIDGE &amp; VALLEY (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMANENT (Based on 25-year, 24-hour storm flows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>24</td>
<td>15</td>
<td>30</td>
<td>24</td>
</tr>
<tr>
<td>50</td>
<td>36 or 2 (30)</td>
<td>18</td>
<td>48 or 2 (36)</td>
<td>48</td>
</tr>
<tr>
<td>100</td>
<td>48</td>
<td>24</td>
<td>54 or 2 (42)</td>
<td>60 or 2 (48)</td>
</tr>
<tr>
<td>200</td>
<td>60</td>
<td>36</td>
<td>72 or 2 (54)</td>
<td>72</td>
</tr>
<tr>
<td>300</td>
<td>2 (48)</td>
<td>54</td>
<td>84 or 2 (60)</td>
<td>78 or 2 (60)</td>
</tr>
<tr>
<td>TEMPORARY (Based on 2-year, 24-hour storm flows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>15</td>
<td>15</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>50</td>
<td>18</td>
<td>15</td>
<td>30</td>
<td>24</td>
</tr>
<tr>
<td>100</td>
<td>24</td>
<td>18</td>
<td>36</td>
<td>30</td>
</tr>
<tr>
<td>200</td>
<td>30</td>
<td>24</td>
<td>42 or 2 (30)</td>
<td>36</td>
</tr>
<tr>
<td>300</td>
<td>48</td>
<td>30</td>
<td>48</td>
<td>42</td>
</tr>
</tbody>
</table>

√ Size permanent culverts so that the cross-sectional area will accommodate expected 25-year, 24-hour storm flows.

√ Size temporary culverts so that the cross sectional area will accommodate the 2-year, 24-hour storm flows.

√ Multiple culverts should be discouraged where design criteria can be met with a single culvert. A multi-barreled box culvert is preferred over multiple individual culverts.

Under normal conditions, two alternative methods are acceptable:

1. Smaller multiple culverts can be substituted to provide for the same cross-sectional area of pipe required as shown in the above table.

2. A combination of a smaller culvert(s) with rock surfaced road dips constructed in the roadbed to handle the run-around flow from larger storm events.
√ **Culverts** less than 15 inches in diameter are not recommended.

√ Multiple **culverts** should be spaced a distance of at least 1/2 the culvert’s diameter apart.

√ Place the **culvert** in a straight section of the stream and free of obstructions.

√ Unless clearly demonstrated that it would not be practicable, the upstream and downstream invert of culverts (except bottomless culverts) installed in perennial streams will be buried/embedded to a depth of 20 percent of the
culvert diameter to allow natural substrate to colonize the structure’s bottom, encourage fish movement and maintain the existing channel slope. Culvert slope should not exceed 4 percent.

√ Place fill dirt around the lower half of the culvert and pack during installation.

√ Place at least 15 inches or at least 1/3 the culvert's diameter, whichever is greater, of fill dirt over the top of the culvert so that the fill over the culvert is the high spot in the stream crossing. This creates an emergency run-around for high flows.

√ The culvert’s ends should be long enough which should achieve no more than a 2:1 slope on the fill.

√ Stabilize fill at ends of a culvert with either riprap, geoweb, excelsior blankets, gabions, headwalls, grass seed and mulch, hay bales, etc.

√ Periodically inspect culverts and remove any debris inside.

√ Remove all temporary culverts and fill material used in stream or wetland crossings and stabilize streambanks when operations are completed.

5.2.6 Practices to Avoid when Constructing Stream Crossings

X Using steep approaches (> 3%) into the stream channel.

X Crossings at bends in the stream.

X Using fords in streams for skid trails.

X Constructing hard surface crossings on streams with muddy or unstable bottoms.

X Using asphalt materials for low-water crossings.

X Anything that impedes the free or expected flow of water.

X Temporary crossings of logs and brush “topped” with soil.

X Using undersized culverts.
5.3 Overburden And Ore Removal

Erosion and sediment control (E&S) measures recommended in this manual should be constructed and employed prior to, or concurrent with, all land disturbing activities. This normally occurs when the “first cut” is made.

5.3.1 BMPs for First-cut Top Soil Removal

√ Top soil should be re-used whenever possible in reclamation efforts.

√ Spread recovered top soil over the final grade to reduce reclamation cost and produce high quality, permanent vegetation.

√ If necessary, stockpile top soil for use in future reclamation.

√ Consider using stockpiled top soil to cover the “first cut dump” just prior to planting the dump with permanent vegetation.

5.3.2 BMPs for First-Cut Overburden Removal

Non-metallic minerals, such as kaolin clays, are typically mined using a “cut and fill” surface mining method. The “first cut” involves removal of undisturbed earth which must be stockpiled until a hole is available for future cuts. First cut overburden material is stockpiled at a dump site on the surface of the ground, unless there is a mined-out hole readily available from prior mining activity.

√ Locate the first cut dump site in an area where it can remain indefinitely, or where it will not have to be relocated until mining activities cease.

√ Design the contours of the dump site to blend with the natural topography.

√ Direct the surface water runoff from the “first cut dump” to an approved sediment basin using appropriate erosion control structures such as berms and down drains.

√ Construct the dump with a series of benches that allow for grading to a maximum slope of 3:1.
If the graded slopes on dumps exceed a length of 30 feet, consider the use of terraces and down drain structures.

Slope the terrace at a grade of no greater than 0.5%.

5.4 Ore Stockpiling, Hauling And Pumping

Direct accumulated storm water runoff from all stockpiled ores to an approved sediment basin. Monitor sediment basin volumes and clean out as necessary to prevent the release of turbid or other impacted waters that would negatively impact the quality of the receiving stream.

Where possible, surface water runoff from the surrounding reclaimed area should be directed away from the mine pit and into the mine water collection system. This will prevent erosion within the mine pit and reduce the amount of mine water that will need to be pumped.

Haul roads constructed in the mine area should be built with the best compacted soil available and topped with a material that will provide traction in rainy conditions. The road surface should be crowned to prevent water from collecting on the road, and the road runoff should be diverted and contained using ditches, turn-outs and down drain structures.

In many applications in the mine site the water can simply be directed to the approved erosion and sediment control system established in the mine permit. In other areas it may be necessary to establish additional sediment traps to control the runoff. In all cases, periodically monitor sediment basin and trap volumes and clean out when necessary. Discharges will require an NPDES permit.

Road maintenance will be required to provide safe and efficient hauling. The roads should be graded to maintain the crown and withstand wet conditions. The wet, graded soil should be spread back over the road as weather conditions allow. Use water trucks and other dust suppression techniques in dry weather.
Traffic patterns should be established and signage regulating traffic should be clearly posted.

Install earthen berms along edges of roads where required by MSHA standards.

Mine dewatering is generally accomplished by the installation of mine pumps to lift the accumulated water out of the pit. This mine water is pumped via discharge pipes or hoses to ditches or berms that then divert the flow to approved sediment basins.

5.4.1 BMPs For Ore Stockpiling, Hauling & Pumping

- Stockpile ore where it will not have to be moved until needed.
- Construct perimeter berms around stockpiles and soil dumps.
- Direct surface water runoff to sediment basins.
- Install diversion dikes and berms to direct surface water runoff from stockpile areas to sediment control basins.

- Berms - Grade at 0.5%.
- Slopes - Grade at 3:1.
√ Minimize disturbed land surface and ore handling.

√ Locate ore stockpiles in areas with no mine-able ore.

5.4.2. Hauling

√ Grade haul roads with crowns that direct surface water runoff to E&S controls.

√ Use storm water turn-outs and sediment traps on haul roads and haul ramps. This will minimize surface water entering pit and sediment loads on pit sump pumps.

√ Install earthen berms along edges of roads where required by safety regulations. Berms are typically 2-3 feet high (or mid-axle of tallest vehicles using the road).

√ Remove debris and sediment from turnouts, traps and down drain pipes regularly.

√ Grade and water roads as needed to reduce erosion and dust.
5.5 Mine Back-Filling, Grading And Final Cover

After the ore is removed, the open pit (hole) is typically filled with stockpiled overburden and other inert material from the mining activity. This mine pit filling process can be accomplished mechanically using haul trucks or hydraulically using dredges or pipelines. Pits may also be filled with reject material coming from the cleaning and sizing of the ore.

The shape of the final grading is dependant on the topography of the mine site. Flat or gentle rolling topography makes the final grading and reclamation easier. If the mine site has steep slopes with streams or wetlands at the base of the slopes, then establishing a final vegetative cover will only be possible if good erosion and sediment control techniques are employed. These include installing 3:1 slopes with terracing and properly designed storm water down drains.

5.5.1 BMPs For Mine Back-Filling, Grading & Final Cover

- First Cut - Backfill mined-out cut in 30-40 foot benches to desired elevation.
- Maintain 3:1 grades where possible or flatter.
Use terraces and down drains on slopes longer than 30 feet 0.5% grade.

Place top soil from the next (second) cut onto the final grade of the reclaimed first cut in preparation for grassing.

Final cut. If no backfill material is available, slope remaining highwalls to 3:1 grade to create a pond. Slopes should extend at last 8 feet below the pool level of the future pond.
5.6 Open-Pit Surface Mining Techniques For Kaolin & Other Non-Metallic Minerals

Kaolin is removed from the ground using a surface mining technique called open-pit cut and fill. In this technique, large blocks of overburden, the unusable overlying sand and red clay are cut from the earth using off-road trucks, excavators, draglines, scrapers, or other equipment. The kaolin ore is then removed and stockpiled or transported to a processing plant or milling facility.

The first cut of overburden is stockpiled on the surrounding land surface. The second adjacent cut of overburden is placed into the mined out hole created by the first cut. Each successive overburden cut is deposited, or filled, into the previously mined-out hole, maintaining the original topography as nearly as practicable. The last cut over an ore body has insufficient backfill material to completely fill the hole, so it is typically graded and developed into a pond or lake.

This mining technique minimizes the area of disturbed land by reducing stockpiled overburden. It also minimizes erosion and sedimentation because storm water runoff is confined within the open pit area. Silt removal is typically accomplished in large sediment basins where natural settling clears the water. The pH of pit pump-out water is adjusted by adding small amounts of acid or lime until the pH falls within NPDES permit limits.

Kaolin clay mining affects the largest surface area of any type of mining in Georgia. Since kaolin quality varies widely from deposit to deposit – and even within the same deposit – most companies operate more than one mine. Blending crude clays from different deposits allows companies to produce finished products suitable for a variety of applications while extending the life of this depletable resource. A typical kaolin mine is located in the Fall Line
region of central Georgia, a region about 60 miles wide and 250 miles long. The topography is generally rolling to flat land with slopes less than 20%. There are four major watershed basins in the Middle Georgia region, each containing numerous creeks, streams, ponds and lakes.

5.6.1 Site Planning: Mine Pits, Processing Plants & Wastewater Impoundments

Determine which of these permits are required:

- **Surface Mining Permit** – GA EPD Land Protection Branch
- **NPDES (wastewater discharge)** – GA EPD Water Branch
- **NPDES Industrial Storm Water General Permit** – GA EPD Watershed Protection Branch
- **404 wetlands (dredge or fill) permit** – U.S. Corps of Engineers

- Entrance roads – stay on top of ridges; design for storm water runoff.
- Streamside Management Zones.
- Sediment basins and erosion control structures – Take advantage of area topography. Locate sediment basins in strategic depressions.
- Contain all storm water run-off within the approved erosion control structures.

- Land Clearing – Create brush berms to filter surface run-off.
5.6.2 Overburden Removal

First Cut - Top soil removal

√ Stockpile top soil for reuse

√ Spread top soil over first cut dump and grass as soon as possible

First Cut - Overburden Removal and Placement

√ Minimize disturbed land surface and dirt handling.

√ Locate stockpile in an area with no mine-able ore.
5.7 Sediment Basins

Refer to the latest edition of the Georgia Soil and Water Conservation Manual for detailed design criteria for sediment basins. Design details and specific site requirements must be included in the Surface Mining Land Use Plan to be submitted as part of the application for the site’s Surface Mining Permit.
Figure 5-J: Principal Spillway Design
(Source: Georgia Soil and Water Conservation Commission website
www.gaswcc.georgia.gov)

PRINCIPAL SPILLWAY DESIGN

\[
T = \text{Top width of dam, ft.} \quad A = \text{Top of dam elevation}
\]

\[
Z_u = \text{Upstream side slope} \quad B = \text{Lowest elevation of pipe at riser}
\]

\[
Z_d = \text{Downstream side slope} \quad C = \text{Lowest elevation of pipe at outlet}
\]

\[
E = \text{Extended length of pipe beyond toe of dam}
\]

\[
L = \text{Total length of pipe, ft.}
\]

\[
L = \left[ A - \frac{B + C}{2} \right] \left[ Z_u + Z_d \right] + T + E
\]
Construct perimeter berms around stockpiles and soil dumps.

Direct surface water runoff to sediment basins.
FIGURE 5-K: DAM
(Source: Georgia Soil and Water Conservation Commission website www.gaswcc.georgia.gov)
Use down drains to carry storm water to lower elevations.

Berms - Grade at 0.5%.

Slopes - Grade at 3:1.

Figure 5-L: Downdrain Pipe and Inlet Detail
(Source: Georgia Soil and Water Conservation Commission website www.gaswcc.georgia.gov)

Make all pipe connections watertight and secure so that the joints will not separate in use.

DOWNDRAIN PIPE AND INLET DETAIL

Use terraces and down drains on slopes longer than 30 feet.
The pipe could also be buried in a trench.

**Figure 5-M: Fill Slope Treatment & Tracking**
(Source: Georgia Soil and Water Conservation Commission website
www.gaswcc.georgia.gov)

Each lift of the fill is compacted, but the outer face of the slope is allowed to remain loose so that the rocks, clods, etc. reach the natural angle of repose.

FILL SLOPE TREATMENT

Dozer treads create grooves perpendicular to the slope.

TRACKING
6.0 Mineral Processing Plants

The processing of raw minerals into useful products or into useful ingredients for other manufacturer’s products requires a wide variety of chemical and mechanical processes. For minerals such as sand and gravel the basic processing may be limited to crushing, conveying, water washing, and loading into trucks or railcars. For minerals like kaolin, barite, or titanium dioxide, the processing steps can include intense mechanical grinding, particle sizing down to the micron level, chemical leaching, and thermal drying. Water and energy are key ingredients in these processes. Both must be managed efficiently for the industry to meet its environmental obligations and to remain competitive in the world marketplace.
6.1 Discussion – Kaolin Processing & Manufacturing

The processing of kaolin varies from company to company. Each kaolin producer uses different equipment and methods. Companies that use identical methods may use them at different points during processing.

A good example of the extensive processing of kaolin is found in those products intended for the paper industry. The greatest demand for kaolin-based pigments comes from the paper industry, which uses them to coat and fill papers and boards. There are many ways to produce these pigments. One of the methods used is called the "water washed process." Generally, in the processing of water washed clays, water is used as a transport and process medium involving the following:

6.2 Blunging

The kaolin is mixed with water and chemical dispersants to create milk-shake-like slurry. Slurry is simply the water and dispersed clay mixture, which puts the clay particles in suspension.
6.3 De-Gritting & Particle Sizing

The slurried kaolin is usually transported through pipelines to degritting facilities, where sand, mica and other impurities are extracted with the help of gravity.

6.4 Filtering & Drying

Large rotary vacuum filters remove water from the slurried kaolin. Large gas-fired spray dryers remove and evaporate the remaining moisture.

6.5 Packaging & Shipping

Finished kaolin products can have the consistency of dry powder, like baby powder, or a wet slurry, like milk.

6.6 Managing Wastewater

Managing wastewater and collected storm water from kaolin processing facilities is an on-going activity. Many of the BMPs for kaolin processing facilities are similar to those associated with managing pit pumpout and storm water management at mining operations and include the following:

- Design the drainage for the milling and processing operation to ensure that wastewater and/or collected storm water is transferred to a wastewater treatment system which has an NPDES permit that includes storm water and industrial wastewater. Typical discharge parameters include the following:
  - Turbidity – monthly average of 50 NTU.
  - Turbidity – maximum value of 100 NTU.
• pH – 6.0 to 9.0

For any discharges which are intended to leave the kaolin processing site, ensure that the final destination for any process wastewater and mixed storm water is to a permitted NPDES outfall.

Determine if the receiving stream for discharge of wastewater and mixed storm water is listed on the current inventory of impaired waters (see Section 303(d) list) and, if so, identify and implement procedures to comply with the specific TMDL and TMDL requirements for that stream segment.

• The current Section 303(d) list and TMDLs are available in the technical guidance section of the GA EPD website under Watershed Protection Branch.

• [http://www.gadnr.org/epd/Documents/techguide_wpb.html#sw](http://www.gadnr.org/epd/Documents/techguide_wpb.html#sw)

√ When possible, install recycling systems in the wastewater process to minimize the use of groundwater and/or surface water and to minimize the need to discharge wastewater.

Develop and comply with a SPCC plan as required for petroleum storage for on-site storage greater than 1,320 gallons.

Provide suitable secondary containment for chemical and petroleum storage tanks where practical and where required.

6.7 Pipeline Installation and Repair

√ Use corrosion and wear resistant pipe materials such as poly pipe or heavy walled plastic coated steel pipe.

√ Use anode bags or cathodic protection to prevent corrosion failures.

√ Clean out pipeline periodically using a “pig”, which is a mechanical device pumped through the line to scrape the internal surfaces.

√ Inspect pipeline right-of-ways periodically to look for leaks.

√ Protect stream crossings and other sensitive areas such as wetlands by installing double-wall pipe, pipe casings and extra heavy wall pipe.

√ Mark the pipeline with signs or concrete markers to prevent mechanical damage from digging in the area.
√ Provide local spill responders and local emergency management agencies with emergency contact information and with a diagram locating all pipelines, including buried waste lines and slurry lines.

√ In the event of a pipeline leak: (1) Stop the flow as soon as possible; (2) Divert the spill away from streams by creating temporary earthen catch basins and ditches; and (3) Repair pipeline with appropriate equipment.

6.8 Spill Response BMPs

√ Prepare spill kits and supplies in advance.

√ If the spill leaves the mining property or threatens to enter a stream, lake, or pond, notify GA EPD and other agencies, if appropriate.
7.0 Water Management Activities During Mining

7.1 Identifying Regulated Waters

Water quality protection begins with recognizing regulated watercourses and water bodies. According to the federal Clean Water Act, “waters of the U.S.” include lakes, rivers, perennial and intermittent streams, wetlands, sloughs or natural ponds. Georgia law (O.C.G.A. § 12-7-3 (16)) defines “State waters” as “all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, and other bodies of surface or subsurface water, natural or artificial, lying within or forming part of the boundaries of the state, which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.”

Identifying stream types (perennial, intermittent, or ephemeral) is important in prescribing the level of protection through the implementation of BMPs listed in this manual. USGS topographic maps and NRCS county soil maps can be used as a reference to identify stream types. Where available they should be cross-referenced and field verified.

7.1.1 Perennial Streams

- Perennial streams flow in a well-defined channel throughout most of the year (under normal climatic conditions).
- Some may dry up during drought periods or due to excessive upstream uses.
- They are usually identified as solid blue lines on USGS topographic maps and as either solid black or black lines separated by one dot on NRCS soil maps.
- Aquatic organisms are normally present and easily found in these streams.
7.1.2 Intermittent Streams

- Intermittent streams flow in a well-defined channel during wet seasons, but not for the entire year.
- They generally exhibit signs of water velocity sufficient to move soil material, litter and fine debris.
- They are usually identified as blue lines separated by three dots on USGS topographic maps and as black lines separated by two or more dots on National Resources Conversation Service (NRCS) soil maps.
- Aquatic organisms often are difficult to find or not present at all in these streams.

7.1.3 Ephemeral Areas

- Ephemeral areas, commonly referred to as drains, draws, or dry washes, typically have no well-defined channels and flow only for short periods following precipitation.
- They typically flow into intermittent or perennial streams.
- Leaf, straw and other forest litter are typically present in ephemeral areas.
- They are usually not identified on topographic maps nor NRCS soil maps.
- Aquatic organisms are not present in these areas.

The landowner or land manager may be familiar with a stream’s flow characteristics and make the determination of stream type. In some cases there may be uncertainty. For example, ephemeral areas may be difficult to locate when they are not actively flowing. In such situations, consult a qualified professional.

Some water bodies and upland areas have particular characteristics or regulatory requirements that require different management approaches. These include, but are not limited to mountain trout streams, protected river corridors, water supply reservoirs / watersheds,
ditches, canals, sloughs, wetlands, braided streams, gullied areas and protected mountain tops. In such situations, consult a qualified professional.

Safety and health issues such as personnel safety, blasting safety, fire management, integrated pest management, or disease control may also require a qualified professional to prescribe appropriate actions.

Mine operators, mine managers, forest managers, landowners, site preparation, and independent mining contractors should clearly identify water bodies, sensitive areas and streamside buffer zones (SMZs) in the field. They should then decide which BMPs apply, and when and where to apply them to carefully design access roads, log decks, stream crossings and buffer zones. Managers should then supervise their operations to make sure BMPs are followed throughout the life of the mining activity so that top soil is conserved and water quality is not compromised.

The benefits of well written mine plans and lease contracts include better communications of expectations between the landowner and mining professionals; maximum return from the investment; higher productivity; better infrastructure; economic efficiency; minimal environmental impacts; compliance with federal, state and local laws; and avoidance of fines or penalties. Planning for the protection of water quality makes good sense for all stakeholders.

7.2 Streamside Management Zones (SMZs)

Streamside Management Zones (SMZs) are buffer strips adjacent to perennial or intermittent streams or other bodies of water (lakes, ponds, reservoirs, etc.) that should be managed with special considerations to protect water quality. Trees and other vegetation in the SMZs provide shade that buffers water temperatures, woody debris vital to the aquatic ecosystem, natural filtration of sediment and other pollutants (nutrients and pesticides), and
travel corridors and habitat for wildlife. SMZs also provide flood protection by dissipating the velocity of moving water.

When planning and laying out mining or timber harvesting areas, SMZs should be identified on maps or aerial photos and clearly designated in the field with paint or flagging. Specially protected areas such as National Parks, water supply reservoirs / watersheds or protected river corridors may have specific rule requirements that supercede these BMPs. Consult local, state and federal regulations and a qualified professional when working near such areas. For guidance on identifying regulated streams that require SMZs, see “Field Guide for Determining the Presence of State Waters that Require a Buffer” provided by The Georgia Department of Natural Resources, Environmental Protection Division, Watershed Protection Branch, NonPoint Source Program.

7.2.1 SMZs Width Recommendations for Perennial, Intermittent & Trout Streams

There is no uniform formula to determine the appropriate width of an SMZs. In general, however, the steeper the slope and more erosive the soil, the wider the SMZs should be. Slope should be determined at 100-ft perpendicular to the stream bank. Therefore, SMZs widths may vary along a stream’s course and on opposite sides of the same stream. SMZs should be measured along the ground from the stream bank on each side of the stream and not from the centerline of the stream.

<table>
<thead>
<tr>
<th>Slope Class</th>
<th>Min. Width (ft) of SMZs on Each Side</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perennial</td>
</tr>
<tr>
<td>Slight (&lt; 20%)</td>
<td>40</td>
</tr>
<tr>
<td>Moderate (21 - 40%)</td>
<td>70</td>
</tr>
<tr>
<td>Steep (&gt; 40%)</td>
<td>100</td>
</tr>
</tbody>
</table>
Remember that these are recommended minimum widths and conditions such as unstable or erosive soils or lack of ground cover may warrant wider SMZs for adequate water quality protection. Also SMZs have a limited filtering capacity and are not intended to correct problems created by poor upslope or adjacent practices.

7.2.2 BMPs for SMZs Around Perennial & Intermittent Streams
(Does NOT include trout streams. Trout stream BMPs are discussed below)

Management activities may occur within an SMZs provided that the disturbance to soil or ground cover is minimized. Water quality objectives should prevent movement of soil or other potential pollutants from within the SMZs into the watercourse and protect streambank integrity. The BMPs associated with typical mining activities are listed below:

√ Identify any local, state, or federal regulations that may supercede these BMPs or mandate the use of special BMPs.

√ Determine and designate the appropriate SMZs widths on site prior to conducting any timber sale or forest practice.

√ Along perennial streams, leave an average of 50 square feet of basal area per acre evenly distributed throughout the zone or at least 50% canopy cover after a harvest to provide shade.

√ Along intermittent streams, leave an average of 25 square feet of basal area per acre evenly distributed throughout the zone or at least 25% canopy cover after a harvest to provide shade.

√ Minimize stream crossings.

√ Except at planned stream crossings, locate new access roads outside the SMZs.

√ Maintain existing roads within SMZs with adequate water control structures and stabilization measures as needed.

√ If adequate stabilization measures are not feasible, consider relocating the road.
Locate stockpiles, *log staging areas*, and *skid trails* outside the SMZs, preferably on well-drained, stable soils.

Where used, *firebreaks* should be installed parallel to streams and outside SMZs.

Minimize the intensity of a *prescribed fire* in the SMZs to maintain forest floor cover and protect the soil surface.

Periodically inspect the SMZs and evaluate the effectiveness of the BMPs, adjusting practices when necessary.

### 7.2.3 Practices to Avoid within Perennial & Intermittent SMZs:

- Cutting stream bank trees.
- Unnecessary *access roads* and main *skid trails*.
- *Log decks*
- Portable sawmills.
- Significant soil compaction and rutting by harvesting equipment.
- Removal of ground cover or under-story vegetation.
- *Felling* trees into the streambed or leaving *logging debris* in the stream.
- Servicing or refueling equipment.
- Mechanical *site preparation*, land clearing, and *site preparation* burning.
- Mechanical tree planting.
- Broadcast application of *pesticides* or *fertilizers*.
- Handling, mixing, storing or disposing of flammable, toxic or hazardous materials (fuels, lubricants, solvents, *pesticides*, or *fertilizers*).
7.2.4 Trout Streams

Trout require cool (less than 70°F), high-quality water. They, and the insects they eat, are extremely sensitive to sediment and thermal pollution (elevated water temperatures). Therefore, trout streams require additional protection. Streams designated as Primary Trout Waters are waters supporting a self-sustaining population of rainbow, brown or brook trout. Streams designated as Secondary Trout Streams are those where trout can survive but there is no evidence of natural trout reproduction. Refer to the GFC’s brochure, BMPs for Trout Streams for a listing of trout streams by county. The Georgia DNR Wildlife Resources Division also publishes a Trout Streams of Georgia brochure containing a map of Georgia’s trout streams. To obtain copies contact the DNR.

√ Establish 100 foot SMZs on both sides of designated streams and tributaries according to the following options:

Option A:
A minimum 100 foot SMZ that includes a no-harvest zone within the first 25 feet of primary or secondary trout streams. Timber harvests within the remaining 75 feet of the SMZ should leave an average of 50 square feet of basal area per acre or at least 50% canopy cover.

Option B:
Within the 100 foot SMZ, leave an average of 50 square feet of basal area per acre evenly distributed throughout the zone to provide shade. Option B may be selected if a qualified professional is consulted.

√ Follow all other BMPs for perennial and intermittent streams noting the 100 foot zone.

Practices to Avoid Around Trout Streams

X Any forest activity within 25 feet of the stream, unless using Option B above.

X Mechanical site preparation and high intensity burns on ephemeral areas above trout waters.
7.2.5 Ephemeral Areas

Ephemeral Areas can direct stormflow into surface waters. Avoid direct tie-in of storm water turnouts and the outfalls of water bars. Employ the following BMPs to minimize the amount of pollutants coming from such areas:

- Minimize soil disturbance, litter layer removal, and avoid high-intensity fire within ephemeral areas.
- Cover any exposed soils with logging debris, grass, or mulch.
- Minimize equipment traffic within and around ephemeral areas. If traffic is unavoidable due to site constraints, minimize soil disturbance and litter layer removal.
- Place logging debris, mats, or other soil protecting structures so that they do not interfere with the natural flow of water.
- Follow BMPs for herbicide application and for fertilizer application.

7.3 Special Management Areas

7.3.1 Braided Streams

Treat each channel individually, depending upon whether the stream is perennial, intermittent or ephemeral. These unique streams require highly site-specific management planning and recommendations. In some cases, the potential for wind throw of trees left in the SMZs will dictate variances in the removal of the canopy cover. Seek the assistance of a qualified professional.

X Avoid any mining or forestry activity within 25 feet of a trout stream, (unless using Option B for trout streams shown above).

X In ephemeral areas, avoid direct tie-in of storm water turnouts and the outfalls of water bars.
7.3.2 Canals & Ditches (C&Ds)

Minor drainage to temporarily lower the water level on a wetland site during road construction, timber harvesting, and site preparation is considered normal and exempt from 404 permitting if it does not result in the immediate or gradual conversion of a wetland to an upland or other land use. Minor drainage does not include the construction of a canal, dike or any other structure which continuously drains or significantly modifies a wetland or other waterbody.

Provide appropriate water quality protection if the ditches could potentially move sediment or other pollutants off site. Ditches should not empty directly into streams. Do not locate new drainage ditches in the SMZs.

C&Ds are included in the definition of “waters of the state”. Most canals were established for flood control purposes prior to Section 404 guidance. Today, the construction of canals would most likely be considered major drainage and require Section 404 permits.

Construction of minor drainage ditches in wetlands is exempt from Section 404 permitting provided it does not:

- result in the immediate or gradual conversion of a wetland to a non-wetland;
- facilitate the conversion from one wetland use to another; and,
- significantly modify a stream, lake, swamp, bog, or any other wetland or aquatic area constituting waters of the U.S.

Maintenance of existing C&Ds is allowed provided the original dimensions are not exceeded. In order to conduct maintenance dredging there must be unobstructed access along one or both canal banks for equipment and placement of spoil materials (side-casting). Therefore, there may not be a tree canopy on one or both sides immediately adjacent to the C&Ds.
SMZs are probably not appropriate for C&Ds but this should be evaluated on a case by case basis. There should be no water temperature violations, especially in ditches, since many ditches dry completely out if they are constructed through non-wetland areas and are not associated with natural stream channels. For these reasons, no SMZ with basal area requirements are considered practical. However, where C&Ds were established in old perennial and intermittent stream channels that are now acting as the stream, SMZs with basal area requirements would be appropriate.

Turbidity could be an issue during maintenance dredging, especially in flowing water. Therefore, maintenance should occur during the dry season. If sediment is likely to move from C&Ds into a stream, consideration should be given to “appropriate water protection” such as sloping and grassing of ditch banks and spoil piles. The need for sediment control will be determined by soil type, the distance to a stream and the amount of vegetated filter between the ditch and the stream.

BMPs for Canals and Ditches (C&Ds)

√ Keep logging and site preparation debris out of C&Ds.
√ Minimize C&Ds crossings and where necessary the fill over culverts should be stabilized.
√ Avoid applying chemicals that are not labeled for aquatic applications directly to C&Ds with standing or flowing water.
√ Prevent bedding that tends to channel surface runoff into C&Ds.
√ If sediment transport is occurring, slope and grass the ditch banks and dredge spoil piles.
√ If the current ditch or canal replaced an old perennial or intermittent stream than establish an SMZ.

7.3.3 Gullies
Gullies directly connected to greater than 0.2 acres of ephemeral areas, intermittent or perennial streams, or a watershed above the gully, require special attention since they can be eroded by mining or forestry operations. Consider local soil conditions, slopes, and other topographic characteristics when choosing the proper BMPs.

√ Protect soil and litter layers within a gully and along its banks during mining and forestry operations. Low impact operational methods should be used for harvesting and site preparation in and around a gully.

√ Leave some trees and shrubs on the banks and inside of gullies as a marker for subsequent harvesting, site preparation, planting, herbicide application, and other activities.

√ Place logging debris and slash in a gully to provide hydraulic resistance to flow and thus promote sediment deposition.

√ Follow BMPs for herbicide application and for fertilizer application.

**Practices to Avoid Around Gullies**

X Avoid high-intensity prescribed burning in a gully to protect decomposed litter layers from burning and minimize exposure of mineral soils.

X Avoid creating an impoundment behind logging debris or slash placed in a gully.

X Minimize traffic within and around gullies, especially within and around severely eroded areas.

X Avoid direct tie-in of storm water turnouts and the outfalls of water bars/breaks into gullies.
Table 7-B: Headwater stream types and hydrological and biological characteristics.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Perennial</th>
<th>Intermittent</th>
<th>Ephemeral Area</th>
<th>Ephemeral Wetland</th>
<th>Gully</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroperiod</td>
<td>Year-round (&gt;90% of the time)</td>
<td>During the wet season</td>
<td>Short period after a rain event</td>
<td>Moist year-round, wet during the wet season</td>
<td>Immediately after a rain event</td>
</tr>
<tr>
<td>Channel definition</td>
<td>Well defined</td>
<td>Somewhat defined</td>
<td>Somewhat-not defined</td>
<td>Not defined</td>
<td>Clear</td>
</tr>
<tr>
<td>Sediment and litter movement</td>
<td>Clearly observable</td>
<td>Partially observable</td>
<td>Minimum</td>
<td>Minimum</td>
<td>Clearly observable</td>
</tr>
<tr>
<td>Streambed scouring</td>
<td>Evident</td>
<td>Somewhat evident</td>
<td>Not evident</td>
<td>Not evident</td>
<td>N/A</td>
</tr>
<tr>
<td>Water pools</td>
<td>Present</td>
<td>Transition</td>
<td>Absent</td>
<td>Mostly absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Stream shape</td>
<td>Sinuous</td>
<td>Less sinuous</td>
<td>Mostly straight</td>
<td>Not observable</td>
<td>Straight</td>
</tr>
<tr>
<td>High water marks</td>
<td>Present</td>
<td>Transition</td>
<td>Absent</td>
<td>Transition</td>
<td>Absent</td>
</tr>
<tr>
<td>USGS topographic map marker</td>
<td>Solid or dotted blue-line</td>
<td>Dotted blue-line or concave contour line</td>
<td>Concave contour line</td>
<td>Concave contour line</td>
<td>N/A</td>
</tr>
<tr>
<td>Energy level</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Very Low</td>
<td>High-Low</td>
</tr>
<tr>
<td>Erosion potential</td>
<td>Low-Medium</td>
<td>Low-Medium</td>
<td>Medium-Low</td>
<td>Non</td>
<td>High</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Wetland plants at edge or in a stream</td>
<td>Wetland and mesic plants at edge or in a stream</td>
<td>Mesic plants around and in a area</td>
<td>Wetland and mesic plants in and around a area</td>
<td>No vegetation in an active gully</td>
</tr>
<tr>
<td>Aquatic insects</td>
<td>Present</td>
<td>Present</td>
<td>Transition</td>
<td>Transition</td>
<td>Absent</td>
</tr>
<tr>
<td>Fish</td>
<td>Present</td>
<td>Transition</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
</tr>
</tbody>
</table>
7.3.4 Lakes, Ponds, & Other Bodies of Flowing Water

Follow the BMPs recommended for perennial streams if they could potentially move sediments or other pollutants off site.

7.3.5 Protected Mountain Tops

Land disturbing activities on mountain tops above 2,200-ft elevation with slopes greater than 25% including the reforestation requirement shall comply with BMPs. Local governments may allow mining activity on protected mountains, if such activity is permitted by DNR. (Rules of Georgia Department of Natural Resources, Environmental Protection Division; Chapter 391-3-16-.05).

7.3.6 Protected River Corridors

Land disturbing activities within the 100-foot buffers along those rivers at a point and below where the flow is 400 cubic feet per second (cfs) shall comply with BMPs. Local governments may exempt mining activities if permitted by DNR pursuant to the Georgia Surface Mining Act of 1968, as amended.

7.3.7 Seeps & Springs

Treat as perennial streams if they flow all year long or intermittent otherwise.

7.3.8 Sinkhole

A geologic feature, typically found in Karst geology, that might provide a direct connection between land surface and groundwater. Treat as perennial streams.

7.3.9 Sloughs and Other Floodplain Features

Sloughs and other floodplain features perform diverse hydrologic, biological, and ecological functions. Over-bank main-stem flows, main-stem backwater flow, floodplain groundwater drainage, and tributary inflows create many different features in floodplains. Such
features include the main river channel, upland tributaries, springs and seeps, continuous side channels, braided streams, drainage channels, floodway, river bottom flats, discontinuous side channels, backwater channels, backwater swamps, isolated depressions, oxbows, ponds, front bars, natural levees, and ridges. Although many of these features are broadly described as “sloughs”, there is obviously great variation in their origin and form.

Mining and forestry activities near these features can adversely impact these important functions. The water quality effects of mining and forestry activities along sloughs depend on the flood frequency, durations and energy. All of these factors should be considered when selecting the correct BMPs for a particular slough or floodplain. For example, if a discontinuous side channel is rarely connected to perennial streams, then it may serve as breeding habitat for amphibians but is unlikely to serve as fish habitat. In this case, maintaining a stringer of bank trees to protect the stability of the feature and to provide some woody debris input is desired, but a larger streamside management zone (SMZ) for shade or for chemical adsorption and filtration is not necessary. The proper BMPs should:

- Prevent the movement of soil, fertilizer, and herbicide into the surface water system.
- Maintain water temperatures and dissolved oxygen levels adequate for biotic survival.
- Maintain inputs of organic matter and coarse woody debris into water bodies.
- Maintain structural integrity of the floodplain features.

If the following conditions exist, these general BMPs should be considered:
If the area has:

- Perennial or intermittent water flows, establish SMZs.
- Potential surface runoff inputs from adjacent lands (exception of flooding), establish SMZs.
- Steep, unstable, and/or well defined banks, protect banks by bank trees or undisturbed zone.
- Wet or ponded depression areas, shade water by bank trees.
- Prolonged flooding areas, treat as a wetland and apply wetland BMPs.
- Surface water, do not spray any chemicals.

**Note:** Assumes normal flow conditions. Appropriate BMP adjustments should be required during excessively dry or wet conditions.

In an effort to simplify slough management decisions, BMPs are recommended in the following Table for each of the most prevalent floodplain water types. Those water types are described below:

1. **Tributaries that originate in uplands and flow across floodplain:** These usually well-defined channels with sandy substrate originate in the uplands and flow across the floodplain to the main river in continuous channel features.

2. **Springs and Seeps:** Water emerges from these features within the floodplain and flows all or part of year in most years. Channel structure and substrate of springs are usually well defined and sandy, but those of seeps are less defined and mixed.

3. **Continuous side channels and Braided streams:** These less distinct channels and banks flow intermittently and are connected to the main channel network at both ends. The channels often contain mixed substrates (sand, organics, fine sediments).

4. **Drainage channels:** These less distinct channels begin on the floodplain and usually flow intermittently during periods of high water tables via a continuous linear drainage system to the main river. The channels often contain mixed substrates (sand, organics, fine sediments).
5. **Floodway and River bottom flats**: Area of floodplain with significant water velocities during frequent overbank flows (flows less than the 2-year low flow). Evidence of scour and debris movement can be found. The floodway is usually identified on FEMA floodplain maps. Smaller floodway or riparian areas in minor streams are also called river bottom flats.

6. **Discontinuous side channels**: Channel features that may or may not be connected on medium or higher flow energy channels at least one end. May have distinct or indistinct channel features, but the channel features disappear and reappear.

7. **Backwater paleo channels**: Usually well-defined deep channel features that are remnants of earlier river and side channel configurations. Mixed channel substrates (sand, organics, fine sediments). Flow usually backs into these features from the main river. Organic debris is often found piled against the “wrong” side of obstructions.

8. **Backwater swamps**: Backwater swamps are wetland areas formed in old overflow channels on the margins of floodplains at the base of the adjacent slopes. They feature wetland vegetation, hydric soils, and fine and organic substrates, but they may show evidence of scour and debris movement.

9. **Isolated depressions**: Feature wetland vegetation, hydric soils, fine and organic substrates, no evidence of fluvial scour.

10. **Oxbows and Ponds**: Ponded deep water (>2 feet deep), fine and organic substrates, no evidence of fluvial scour.
Table 7-C: Summary characteristics of floodplain features and the corresponding BMPs. (Source: Georgia Forestry Commission BMP Manual)

<table>
<thead>
<tr>
<th>Hydroperiod</th>
<th>Floodplain Feature</th>
<th>Flow Energy¹</th>
<th>Channel Characteristics (Bank Structures, Substrate Materials, and Other Features)</th>
<th>Biological Values</th>
<th>Floodplain Protection Measures / SMZs²</th>
<th>Mechanical Site Prep. w/in SMZs³</th>
<th>Herbicide, Fertilizer, and Burning w/in SMZs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Perennial</td>
<td>•Tributaries originating in uplands and flowing across floodplain •Springs</td>
<td>High-Medium</td>
<td>Well defined channel, sandy substrate.</td>
<td>Aquatic fauna</td>
<td>Perennial stream BMPs</td>
<td>No</td>
<td>Not allowed</td>
<td></td>
</tr>
<tr>
<td>Intermittent</td>
<td>•Tributaries originating in uplands and flowing across floodplain •Seeps, •Continuous side channels, •Braided stream, or •Drainage channels</td>
<td>Medium -Low</td>
<td>Less distinct channel, mixed substrate (sand, organics, fines). These may be connected to the mainstem directly or indirectly.</td>
<td>Aquatic and terrestrial fauna, Off channel rearing habitat, High-flow refugia</td>
<td>For tributaries, intermittent stream BMPs. For other floodplain features, at minimum, leave 50% canopy cover within banks and leave bank trees.</td>
<td>No</td>
<td>Not allowed</td>
<td></td>
</tr>
<tr>
<td>Ephemeral</td>
<td>•Tributaries originating in uplands and flowing across floodplain •Seeps, •Continuous side channels, •Braided stream, or •Drainage channels</td>
<td>Medium -Low</td>
<td>Area of floodplain. Occasional evidence of scour and debris movement. Chances appear and disappear, and may or may not be connected on at least one end.</td>
<td>Terrestrial fauna</td>
<td>N/A</td>
<td>Low impact</td>
<td>Avoid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>•Discontinuous side channels</td>
<td>High-Medium</td>
<td>Terrestrial fauna</td>
<td>Leave bank trees if one end is connected and/or has a clearly defined bank.</td>
<td></td>
<td></td>
<td>Avoid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>•Backwater paleo channels</td>
<td>Medium -Low</td>
<td>Well defined, deep channel. Mixed substrate (sand, organics, fines). Debris piled on “wrong” side of obstructions.</td>
<td>Terrestrial fauna, High-flow refugia</td>
<td>Maintain trees on banks, maintain channel stability</td>
<td>No</td>
<td>Avoid</td>
<td></td>
</tr>
<tr>
<td>Ponded</td>
<td>•Backwater swamps</td>
<td>Medium -Low</td>
<td>Located on floodplain margins. Usually no channel. Wetland vegetation. Hydric soils. Organic and fine substrate. Sometimes evience of debris movement.</td>
<td>Aquatic and terrestrial fauna, Off channel rearing habitat, High-flow refugia</td>
<td>Treat as wetlands. Leave stringer trees if defined banks apparent</td>
<td>N/A⁴</td>
<td>Only wetland approved herbicides</td>
<td></td>
</tr>
<tr>
<td></td>
<td>•Isolated depressions</td>
<td>Low</td>
<td>No channel. Wetland vegetation. Hydric soils. Organic and fine substrate.</td>
<td>Aquatic and terrestrial fauna, Off channel rearing habitat, High-flow refugia</td>
<td>Treat as wetlands. Leave stringer trees if defined banks apparent.</td>
<td>N/A⁴</td>
<td>Only wetland approved herbicides</td>
<td></td>
</tr>
<tr>
<td></td>
<td>•Oxbows</td>
<td>Low</td>
<td>Deep (&gt;2 feet) standing water. Wetland vegetation. Hydric soils. Organic and fine substrate.</td>
<td>Aquatic and terrestrial fauna, Off channel rearing habitat, High-flow refugia</td>
<td>Treat as lakes or ponds. Leave stringer trees on banks.</td>
<td>N/A⁴</td>
<td>Only wetland approved herbicides</td>
<td></td>
</tr>
<tr>
<td></td>
<td>•Ponds</td>
<td>Low</td>
<td>No channel. Wetland vegetation. Hydric soils. Organic and fine substrate.</td>
<td>Aquatic and terrestrial fauna, Off channel rearing habitat, High-flow refugia</td>
<td>Treat as wetlands. Leave stringer trees if defined banks apparent.</td>
<td>N/A⁴</td>
<td>Only wetland approved herbicides</td>
<td></td>
</tr>
</tbody>
</table>

¹ Flow energy under normal flow conditions.
² Floodplain protection measure includes SMZs (GA Forestry BMP manual Pg. 8, 63) and special management areas (GA Forestry BMP manual Pg. 12).
³ Follow EPA/COE memorandum to field (GA Forestry BMP manual Pg. 34)
⁴ See wetlands section of GA Forestry BMP manual.
7.3.10 Water Supply Reservoir / Watershed

The rule (Ga. Rule 391-3-16-.01) states that local governments may exempt mining activities permitted by the DNR under the Surface Mining Act from the provisions of the Water Supply / Watershed Protection plans.

- For governmentally-owned intakes or impoundments occurring within a 100-square mile or larger watershed, land disturbing activities within a 150-ft buffer adjacent to all reservoirs and 100-ft buffer adjacent to all perennial streams within a seven-mile radius above intakes shall comply with BMPs.

- For governmentally-owned intakes or impoundments or intakes within a watershed of less than 100-square miles, land disturbing activities within a 150-ft buffer adjacent to the reservoir, a 100-ft buffer adjacent to perennial streams within a seven-mile radius, and a 50-ft buffer adjacent to all perennial streams above the seven-mile radius shall comply with BMPs.

7.3.11 Wetlands

For regulatory purposes, wetlands are defined by the presence or absence of specific plant communities, hydric soils and hydrologic conditions. Because of the generally wet soil conditions associated with forested wetlands, these areas are sensitive to forestry and mining activities. For instance, bottomland hardwood sites, Carolina bays, cypress domes, other swamps, and some pine savannas differ from upland forest types because their soils are wet most of the year. They frequently are connected directly to a larger aquatic system, often have over-bank flow from nearby stream flooding, and may accumulate sediments and nutrients from upstream erosion and runoff.

To properly manage forested wetlands: plan for regeneration; consider the areas beyond the actual harvest site; and remember that special harvesting techniques may be necessary to protect water quality. Any stream channels should be identified and the appropriate SMZs established. The BMPs that apply to any other forest type generally apply to forested wetlands.
7.3.12 Criteria for Protection of Groundwater Recharge Areas

See Ga. Rule 391-3-16-.02 for provisions applicable to these areas.

7.4 Managing Storm Water & Mine Pit Pumpout Water At Kaolin Mines & Similar Non-Metallic Mineral Operations

Managing collected storm water and accumulated pit water is an on-going activity throughout the mining process. Storm water which falls onto the mine site will accumulate in the mine and therefore will need to be pumped out to allow the mining work to continue. Collected storm water and pit pumpout water are then pumped to another location before final discharge.

![Photo 7-A: Arrows indicate the direction of water flow from active mining areas to intermediate sediment ponds and to a final sediment pond.](image)

7.4.1 BMPs for Chemical Treatment of Mine Discharge Water

- Place permanent chemical tanks inside secondary containment system designed to capture 110% of the contents of the largest tanks.

- If treatment chemicals are corrosive, provide emergency shower and eyewash stations for operators, maintenance personnel and delivery drivers.
√ Label tanks and piping systems to identify the contents and hazards.

√ Install lockable valves, ladders and gates to prevent unauthorized individuals from accessing chemical treatment systems.

7.4.2 BMPs For Storm Water & Mine Pit Pumpout Ponds

√ Ensure that any chemically treated pit pumpout water, including that mixed with storm water, is discharged via a permitted NPDES outfall.
When feasible, divert all pit pumpout water and mixed storm water from the entire mine permit boundary area to a final collection pond. This will provide surge capacity for the discharge water during storm events and allow for settling of solids and chemical treatment if necessary.

Install diversion dikes and berms to direct surface water runoff from affected areas into sediment control structures.
√ Size the sediment pond and overflow based on local terrain and soil conditions.

√ Provide an emergency overflow structure for storm water / pit pumpout basins. Ensure that the overflow is stabilized with concrete, riprap, etc.
To minimize silt/sediment loads to the final sediment pond, install upstream sediment basins, barriers and silt traps.
After construction of a sediment pond, provide temporary vegetation as soon as possible to provide erosion control until permanent vegetation is established.

Install riprap at the discharge of the final outfall to prevent secondary erosion.

Ensure that water is discharged at a non-erosive velocity to prevent secondary erosion.
√ Ensure that any hose from a pit pumpout does not cause secondary erosion as it enters a final sediment/collection pond. Rip-rap or letdown structures can be used to minimize erosion and stabilize slopes.

√ Routinely inspect the storm water, pit pumpout pond area with emphasis on correction of the following:

- Identify and correct any areas where vegetative cover is not complete.
- Identify and correct any gullies or washing in the water handling system or structures.
- Ensure that secondary erosion is not occurring from piping discharges into the final sediment pond.
- Remove accumulated sediment from intermediate sediment control structures (i.e. silt traps, sediment basins, etc).
- Inspect chemical storage tanks and containment systems.
- Ensure that an adequate volume of treatment chemical is maintained to anticipate large storm events.
- Remove collected rain water from chemical storage spill containment systems.
- Determine if the receiving stream for discharged pit pumpout water and mixed storm water is listed on the inventory of impaired waters (see Section 303(d) list).
If the receiving stream is on the Section 303 (d) list, comply with the specific TMDL requirements for that stream segment.

Note: The current Section 303(d) list and TMDLs are available in the technical guidance section of the Georgia EPD website under Watershed Protection Branch (http://www.gadnr.org/epd/Documents/techguide_wpb.html#sw).

7.4.3 Practices to Avoid When Discharging Mine Waste Water

- Do not discharge collected mine storm water into:
  - Areas not identified in the facility’s NPDES waste water discharge permit
  - Areas not covered by an industrial storm water Storm Water Pollution Prevention Plan (SWP3) as defined by General Storm water Permit GAR0000000.

- Do not discharge water which would degrade the receiving stream.

- Do not discharge mine storm water/pit pump-out water that would cause a violation of:
  - The Georgia State water quality standards for the receiving stream.
  - Any NPDES permit condition.
  - Any TMDL for the receiving stream.

- Do not discharge industrial wastewater (from milling/processing operations) that is mixed with storm water/mine pit water unless specifically authorized by an NPDES permit for that point discharge.

7.4.4 Potentially Applicable Regulations Associated With Pit Pumpout / Storm Water Collection Ponds

Georgia - NPDES Industrial Wastewater Discharge Permits (O.C.G.A. § 12-5-20, et seq.; Ga. Rule 310-3-6)

- Required for discharges of pit-pumpout water and mixed storm water.
- Required for discharges of any mixture of process wastewater and pit-pumpout water and/or mixed storm water.
• Required for discharges of “storm water associated with industrial activity” from areas such as manufacturing, processing or raw materials storage areas at an industrial plant.

Georgia Erosion and Sedimentation Control (O.C.G.A. § 12-7-1, et seq.; Ga. Rule 391-3-7)

• Required for disturbance of land equal to or greater than 1.0 acre which can discharge to waters of the State if the locations are not covered by an existing mine land use plan or NPDES discharge permit.

NPDES Permit GAR00000 – Authorization to Discharge Storm Water Associated With Industrial Activity

• Required for discharges of storm water associated with industrial activity from processing areas, stockpiles, overburden and other land disturbances to waters of the State...

Georgia Safe Dams (O.C.G.A. § 12-5-370, et. seq.; Ga. Rule 391-3-8)

• Applicable to dams which are greater than 25 feet high from the lowest point; or for dams which impound more than 100 acre feet of liquid.

Georgia Surface Mining Act (O.C.G.A. § 12-4-70, et. seq.; Ga. Rule 391-3-3)

7.5 Managing Wastewater Discharges From Mine Milling & Processing Operations

The primary differences between the wastewater from mine milling and processing areas and wastewater from general mine pit areas is the potential for having materials from on-site chemicals, petroleum fuels and mobile equipment servicing. At some mine sites, the ore undergoes mechanical & chemical processing to reduce particle size or convert it into a slurry form. Chemicals are defined as manmade organic and inorganic chemical substances or formulations that perform important functions in mining, mineral processing, wastewater treatment and the refining of mineral products. These substances may be found in the wastewater or storm water associated with mining activities. They may be added intentionally or
unintentionally from such practices as forest management (fertilizers, herbicides, insecticides, fungicides and repellents) or mineral refining (acids, bases, dispersants, flocculants, surfactants, tall oils and biocides), or related industrial processes (heavy metals from corrosion of pipes, oils, greases, soaps, petroleum products, and fecal coliform from septic tank systems).

7.5.1 Kaolin Mine Milling & Processing Operations

Kaolin milling and process operations involve a multiple stage process. Typically, the ore is mixed with water and dispersant chemicals to remove large particles and impurities such as sand and mica. Kaolin slurry is then stored in tanks at the mining location before being piped to a processing plant. After being received at the processing plants, the slurry is further processed through a variety of methods that include centrifuge, magnetic separation, bleaching, milling, flotation, filtration, drying, calcination, and packaging.
7.5.2 BMPs For Milling & Processing Operations

√ Follow the BMPs for storm water and mine pit pump-out water identified in Section 7.4.

√ Conduct and report any wastewater and/or storm water monitoring required by the facility’s NPDES permit(s).

√ Typical kaolin clay wastewater discharge parameters include the following:
  - Turbidity – Monthly Average of 50 NTU.
  - Turbidity – Maximum value 100 NTU.
  - pH – 6.0 to 9.0

√ All wastewater discharges that are intended to leave the mining site should pass through a permitted NPDES outfall.
√ Locate ore stockpiles so storm water runoff drains into a sediment control pond, or install ditches to direct the storm water into a sediment control pond.

√ When feasible, install water recycling systems in the wastewater process. This will reduce ground water use and reduce the amount of wastewater discharged.

√ Develop and comply with a Spill Prevention Control & Countermeasures Plan (SPCC Plan) to prevent petroleum related materials from entering the wastewater.

√ An SPCC Plan is required if on-site storage of petroleum exceeds 1,320 gallons. Provide secondary containment for chemical and petroleum storage tanks.

√ Conduct and report any wastewater monitoring required by the site’s NPDES permit.

√ Verify (by observation or testing) that the discharge of storm water/pit pump-out water does not cause a violation of the Georgia State water quality standards of the receiving stream, any specific condition in the site’s discharge permit or any State TMDL.

√ Routinely inspect the storm water, pit pump-out pond areas for erosion problems.

√ Identify and correct any areas where vegetative cover is not complete.

√ Identify and correct any gullies or washing in the water handling system or structures.

√ Ensure that secondary erosion is not occurring at piping discharges into the final sediment pond.
√ Remove accumulated sediment from intermediate sediment control structures (i.e. silt traps, sediment basins, etc).

√ Inspect chemical storage tanks and containment systems which are typically used for pH and turbidity adjustment of wastewater.

√ Ensure that an adequate volume of treatment chemical is maintained to anticipate large storm events.

√ Remove collected rain water from chemical storage spill containment systems.

√ Routinely inspect all chemical storage locations for leaks, spills and poor housekeeping practices. These can contribute contaminants to the wastewater during storm events.

√ Clean-up any oil spillage around oil service areas.

√ Collect plant waste water in properly designed sediment basins having a permitted NPDES outfall (if required).

√ Design pond discharge structures so that flow can be regulated or stopped completely if necessary.

√ Install floating collars around discharge structures if petroleum spills can potentially enter the sediment pond.

√ Locate chemical tanks and treatment systems so that accidental leaks flow back into containment areas, and not into the receiving stream.

√ Install riprap at the discharge of the final outfall to prevent secondary erosion.

📖 Verify that the quality of any water discharged from NPDES sediment basin meets all standards specified in the site’s discharge permit.

📖 Secure NPDES Permit for every wastewater point discharge.

📖 Post a sign at each NPDES discharge identifying the owner and contact info.

📖 Apply for General Storm water Permit coverage for regulated sheet run-off and other storm water discharges, if not otherwise covered by an individual NPDES permit.

📖 Test storm water during rain events if required.
Prepare Storm Water Pollution Prevention Plan (SWP3) if required.

Any construction project in the mine mill or processing plants which disturbs a land area greater than or equal to 1.0 acres (which is not already identified on a SMLUP mine plan) must comply with the GA EPD erosion and sedimentation control rules and Georgia’s General Storm water permit (GAR000000).

Determine if the receiving stream for discharge of wastewater and mixed storm water is listed on the current inventory of impaired waters (see Section 303(d) list).

If the receiving stream is on the Section 303(d) list, then comply with the specific TMDL requirements for that stream segment.

Note: The current 303(d) list and TMDLs are available in the technical guidance section of the Georgia EPD website under Watershed Protection Branch. (http://www.gadnr.org/epd/Documents/techguide_wpb.html#sw)

7.5.3 Practices To Avoid for Milling & Processing Operations

X Do not discharge collected storm water from mining, milling or processing areas into an area unless it is identified in the facility’s NPDES waste water permit or designated in the Storm Water Pollution Prevention Plan (SWP3).

X Do not discharge water which would degrade the receiving stream.

X Do not allow industrial wastewater to enter sediment ponds that discharge to the environment unless an NPDES waste water permit has been obtained authorizing the specific discharge.

7.5.4 Applicable Regulations Associated With Pit Pumpout / Storm Water Collection Ponds

- Georgia - NPDES Industrial Wastewater Discharge Permits (Ga. Rule 310-3-6)
  - Required for discharges of pit-pumpout water and mixed storm water.
  - Required for discharges of any mixture of process wastewater and pit-pumpout water and/or mixed storm water.
  - NPDES discharge points must be identified with the appropriate signage.
Georgia BMP Manual - 2007

- Georgia Erosion and Sedimentation Control (Ga. Rule 391-3-7)
  - Required for disturbance of land equal to or greater than 1.0 acre which can discharge to waters of the State at locations which are not covered by an existing mine land use plan or another NPDES discharge permit.

- NPDES Permit GAR00000 – Authorization to Discharge Storm Water Associated With Industrial Activity
  - Required for discharges of “storm water associated with industrial activity” from areas such as manufacturing, processing or raw materials storage areas at an industrial plant.

- Georgia Safe Dams (Ga. Rule 391-3-8)
  - Applicable to constructed dams which are greater than 25 feet high from the lowest point or for dams which impound more than 100 acre feet of liquid.

- Georgia Surface Mining Act (Ga. Rule 391-3-3)

- SPCC Regulations – 40 CFR Part 112
8.0 Reclamation

8.1 Reclaiming Kaolin And Other Mined Lands

The state of Georgia has one of the most comprehensive reclamation acts in the nation, requiring that an acre of land be reclaimed for every acre mined. As mining is completed, the mining industry begins reshaping the land and restoring it to its natural state. Kaolin companies, for example, spend approximately $1,900 per acre to reclaim mined land.

Lake Franklin Reclamation Site

Companies prepare the land for mining by removing earth (overburden) to reach the kaolin deposits. Because kaolin can vary widely in quality from deposit to deposit and even within the same deposit, most companies operate more than one mine. Heavy machinery is used to remove the kaolin for processing.

Once the kaolin deposit is extracted, kaolin companies begin one of the most important parts of the job – reclamation. The companies backfill the overburden into the mined areas to form a land contour compatible with the surrounding topography. Long slopes are broken at regular intervals by bench basins or terraced catch basins.

Fertilization and reseeding of the land often returns it to a state that is more productive than it was before mining. Kaolin and other mining companies plant commercial forest tree species and other vegetative covers (grass and shrubbery) to stabilize the land. The vegetation
also acts as erosion control, protecting the earth from wind and rain. The trees and plants are selected (from both native and native varieties) to be compatible with the natural environment and to be suitable for wildlife, forest production and agriculture.

The kaolin industry, for example, transforms mined land into forests and pasture lands, recreational areas, lakes, parks and other recreational areas. Middle Georgia will benefit from these improved areas for many years to come.
Reforestation can be accomplished artificially or naturally. Natural regeneration and hand planting generally pose less of a threat to water quality as opposed to mechanical methods. Complete artificial regeneration projects as quickly as practical. The use of native vegetation and voluntary regeneration techniques are encouraged particularly in disturbed silvicultural and wetland areas because of the benefits to wildlife and ecological functionality. A qualified professional can provide advice on reforestation choices.

8.1.1 BMPs for Reforestation

√ Hand plant on >21% slopes with severely erosive soils.
√ Machine plant on the contour on slopes between 2% and 20%.

8.1.2 Practices to Avoid During Mechanical Reforestation

X Machine planting up and down slopes greater than 5%.
X Machine planting within SMZs.

8.1.3 General Grading Specifications

Grading involves earth moving, reducing high walls, creating graded slopes, constructing berms and bench basins, and smoothing finished slopes. The topography of disturbed land should be graded in a way that:

- Creates ponds, roads, farm land, building sites or other topographic structures approved in the Mined Land Use Plan.
- Promotes plant and wildlife growth.
- Controls the movement of soil and water onto or off of the mined site.
  √ Slopes should not exceed 3 feet horizontal run per 1 foot of vertical drop (3 to 1).
  √ The maximum length of any slope should not exceed 100 lineal feet.
  √ Waterways and bench basins should be installed on zero grade.
Construct bench basins at intervals not to exceed 100 lineal feet (slope distance)

Size bench basins to contain all runoff water from the slope surface above the basin for a six inch rainfall within 24 hours.

Grade all other areas so they can be easily traversed with farm-type planting and harvesting equipment.

All areas should have a neat, clean appearance with no un-graded piles, slopes, ditches, or soft spots.

8.1.4 Installing a Permanent Vegetative Cover

Although Bermuda Grass and Sericea Lespedeza are not native species, they are used to install a permanent vegetative cover. Permanent cover is defined as a stand of Bermuda Grass and Sericea Lespedeza requiring no maintenance for continued growth two years after planting. The vegetative cover should be free of bare areas, gullies, rill or sheet erosion. A successful plan for vegetative cover requires proper soil conditioning, seeding and mulching.

8.1.4.1 Soil Conditioning Guidelines

Liming and Fertilizing: Except when soil tests indicate different requirements, apply lime and fertilizer at the following rates:

Agricultural Lime: 1 ton per acre (46 pounds / 1000 square feet) or equivalent.

Fertilizer: 800 pounds per acre (18 pounds / 1000 square feet) of 10-10-10 analysis fertilizer or equivalent analysis at planting. Apply nitrogen (33% N) as a top dressing on all plantings within six to eight weeks following planting.

Harrowing/Disking: Incorporate lime and fertilizer into the soil before planting using a conventional agricultural type disk harrow. Lime and fertilizer should be disked into the soil to a depth not to exceed six inches.

8.1.4.2 Seeding Requirements
Georgia BMP Manual - 2007

Seeding and Planting: Grasses and Legumes shall be planted uniformly at the rates guidelines set out in the schedule below. Drill or broadcasting methods may be used. Seed planted by broadcasting shall be lightly covered by rolling or lightly harrowing planted areas.

Seeding Rates: Permanent grasses and broadcast rate are as follows:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>REMARKS</th>
<th>PLANTING DATES</th>
<th>RATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Bermuda</td>
<td>Hulled</td>
<td>March -June</td>
<td>20 lbs/acre Scarified</td>
</tr>
<tr>
<td>Sericea Lespedeza</td>
<td>Hulled</td>
<td>March -June</td>
<td>40 lbs/acre Scarified</td>
</tr>
<tr>
<td>*Rye Grain</td>
<td>None</td>
<td>Sept. -Dec.</td>
<td>2 bu./acre</td>
</tr>
</tbody>
</table>

8.1.4.3 Planting Plan and Schedule

<table>
<thead>
<tr>
<th>Species of Vegetative Cover to be Planted</th>
<th>Pounds of Seed per Acre</th>
<th>Planting Season (Month &amp; Year)</th>
<th>Type Fertilizer and Amount per Acre</th>
<th>Seedbed Preparation for Planting</th>
<th>Type Mulch &amp; Amount per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sericea Lespedeza</td>
<td>50 lbs.</td>
<td>February thru July</td>
<td>800 lbs or equivalent 10-10-10</td>
<td>Disked &amp; Seeded with Brillion</td>
<td>1.5-2.0 tons bermuda</td>
</tr>
<tr>
<td>Bermuda Grass</td>
<td>25 lbs.</td>
<td>February thru July</td>
<td>1.5-2.0 tons of Lime</td>
<td>Seeder</td>
<td></td>
</tr>
<tr>
<td>Abruzzi Rye</td>
<td>150 lbs.</td>
<td>September thru December</td>
<td>100 lbs. Actual Nitrogen- 800 lbs. 10-10-10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.1.4.4 Mulching Requirements

Immediately following planting, the seed bed should be mulched with Coastal Bermuda Grass hay or other effective ground cover that will protect the seed bed from erosion and retain moisture. Apply hay uniformly over the entire seeded area at the rate of 1 1/2 tons per acre.

If rye grain is planted as the initial cover crop, over-seed the rye grain cover crop early the following spring with Common Bermuda Grass and Sericea Lespedeza at the per acre rates shown above.
8.2 Other Land Use Objectives

The Best Management Practices recommendations in this publication are directed at maintaining water quality, which is critical for the conservation of all natural resources. Mining management practices such as timber harvesting, site preparation, ore removal and land reclamation can be conducted in ways that enhance fish and wildlife habitat, aesthetics and recreational opportunities, while accommodating sensitive sites and endangered species. Landowners may have other resource objectives that can be achieved only through the use of practices that vary but are consistent with the protection of water quality. The following comments describe additional management options that landowners may wish to consider.

8.3 Wildlife Management

√ Compare your current habitat conditions, along with those on adjacent lands, to your wildlife management objectives before making land management decisions.

√ Some fish and wildlife species benefit from SMZs wider than the minimum widths specified for water quality BMPs.

√ Manage for a diversity of forest types and age classes to enhance wildlife habitat quality.

√ Maintain mature mast producing hardwoods in groups or stands.

√ Leave corridors of trees connecting mature forest stands to provide food, cover and travel avenues for wildlife while adjacent stands are regenerated.

√ Leave snags, dead and down woody debris, brush piles or windrows throughout timber harvest areas.

√ Use prescribed fire, which is one of the most cost-effective forest and wildlife management practices.

√ Use wildlife-friendly plantings for log decks, roads and skid trails following logging operations.

√ For more information on any of the above recommendations, contact the Georgia DNR Wildlife Resources Division.
8.4 Protected Species

The University of Georgia Cooperative Extension Service, the College of Agricultural and Environmental Sciences, or the Georgia Department of Natural Resources Wildlife Resources Division have publications with listings of protected plant and animal species.

If you suspect the presence of an endangered species, contact the Georgia Department of Natural Resources Wildlife Resources Division or the U.S. Fish and Wildlife Service for verification and management considerations.

8.5 Forest Regeneration

This Section provides more detailed information to be used if the mined land is to reclaimed for use as timberland.

The site preparation technique used depends on soils, slope, condition of the site, vegetation, crop tree species, cost, location and landowner goals. Analyze the erosion potential of the site prior to any site preparation. Topography, soil type and residual ground cover determine erosion potential.

- Topography - The steepness and length of the slope are major considerations when determining the treatment intensity. Intensive treatments that are acceptable in areas of little or no slope may be unacceptable in areas of steep slope.

- Soil Type - Soil types or mapping units differ in texture, slope, stoniness, erodibility, wetness or other characteristics that affect the use of the soils by man. Soil surveys describe these limitations as slight, moderate, or severe. Any limitations should receive extra care to prevent soil degradation.

- Residual Ground Cover - The amount, species and size of ground vegetation, debris and other organic matter should be a consideration in prescribing the type and intensity of the treatment.

Site preparation techniques can be grouped into three categories: mechanical, chemical, and controlled burning. Combinations of these techniques are common.
8.6 Mechanical Site Preparation

Mechanical site preparation includes shearing, raking, subsoiling, chopping, windrowing, piling, bedding and other physical methods to cut, break apart or move logging debris, or improve soil conditions following harvest. This category is often described by its impact on the soil. Methods vary from low intensity to high intensity.

High-intensity methods such as disking and bedding expose the soil on more than 50% of the site. Chopping is a low-intensity method. Erosion potential usually increases with higher-intensity methods, especially in areas with steep slope. Therefore, high-intensity methods are appropriate for flat and gentle slopes, used with caution on moderate slopes, and avoided on steep slopes. Low-intensity methods are preferred on steep slopes.

8.6.1 BMPs for Mechanical Site Preparation

- Plan the site preparation job before starting to ensure that the best treatment is implemented.
- Use the minimum intensity of site preparation required.
- On slopes of 6%-10%, intensive mechanical methods should follow the contour of the land.
√ On slopes of 11%-20%, mechanical methods other than chopping should follow the contours of the land. On soils with moderate to severe erosion potential, strips of untreated areas or windrows should be left to slow water and soil movement.

√ On slopes of 21%-30% with severely erosive soils, use only low-intensity mechanical methods that follow the contour. Drum chopping should be perpendicular to the slope.

√ On slopes greater than 30%, use only hand tools (chain saw felling).

√ Where accelerated erosion is likely, use methods that leave logging debris and other litter scattered evenly over the site.

√ When constructing beds on slopes greater than 5%, follow land contours. Protect forest floor and limit soil disturbance in stabilized gullies that are not eroding.

8.6.2 Practices to Avoid During Mechanical Site Preparation

X Any mechanical methods except drum roller chopping or spot cultivation on slopes greater than 30%. Drum chopping should not follow the contour.

X Intensive mechanical methods on slopes greater than 20% with severe erosion potential.

X Windrow construction that could direct runoff into waterways.

X Mechanically preparing sites when soils are saturated.

X Mechanical site preparation within SMZs.

X Blocking any drainage with beds, windrows, or similar structures.

X Bedding that channels surface runoff into waterways and roadbeds.

X Moving soil into windrows and piles.

X Re-activating stabilized gullies.

8.7 Mechanical Site Preparation In Wetlands

Forested wetlands offer unique challenges for site preparation. The EPA and Army Corps of Engineers have determined that, except for specifically exempted activities, draining or filling in jurisdictional wetlands will require a Section 404 permit from the Army Corps of
Engineers. Also a 404 permit may be required for mechanical site preparation for pine establishment in the following forested wetland types, unless they no longer exhibit their unique distinguishing wetland characteristics due to past practices:

- **Permanently flooded, intermittently exposed and semi-permanently flooded wetlands**: Examples include Cypress-Gum Swamps, Muck and Peat Swamps, and Cypress Strands / Domes.

- **Riverine Bottomland Hardwood wetlands**: Seasonally flooded or wetter bottomland hardwood sites within the first or second bottoms where overbank flooding has resulted in alluvial features such as natural levees. Soils are listed in NRCS surveys as poorly or very poorly drained. Bottomland hardwoods do not include sites in which greater than 25% of the canopy is pine.

- **White Cedar Swamps**: Wetlands greater than one acre in headwaters and greater than five acres elsewhere, underlain by peat of greater than 40 inches, where natural white cedar represents more than 50% of the basal area and where the total basal area for all tree species is 60 square feet or greater.

- **Carolina Bay wetlands**: Oriented, elliptical depressions with a sand rim, either underlain by (a) clay-based soils and vegetated by cypress or (b) peat of greater than 20 inches and typically vegetated with an overstory of Red, Sweet, and Loblolly Bays.

- **Non-riverine Forest wetlands**: Rare, high quality (undisturbed) wet forests, with mature vegetation, located on the Southeastern coastal plain, whose hydrology is dominated by high water tables. Two forest community types fall into this group:
  - **Wet Hardwood Forests** - interstream flats comprising 10 or more contiguous acres typically found on the margins of large peatland areas that are seasonally flooded or saturated by high water tables. Soils are listed as poorly drained mineral soils. Vegetation is dominated (greater than 50% of basal area) by mature swamp chestnut oak, cherrybark oak, or laurel oak alone or in combination.
  - **Swamp Forests** - flats comprising 5 or more contiguous acres found on sites that are seasonally to frequently flooded or saturated by high water tables. Soils are listed as very poorly drained. Vegetation is dominated by mature bald cypress, pond cypress, swamp tupelo, water tupelo, or Atlantic white cedar alone or in combination.

Note: Sites dominated by red maple, sweetgum, or loblolly pine alone or in combination are not considered to be of high quality, and therefore do not require a permit.
- **Low Pocossin wetlands**: Central, deepest parts of domed peatlands on poorly drained interstream flats, underlain by peat soils greater than 40 inches, typically vegetated by a dense layer of short shrubs.

- **Wet Marl Forest**: Hardwood forest wetlands underlain with poorly drained marl-derived, high pH soils.

- **Tidal Freshwater Marshes**: Wetlands with dense herbaceous vegetation located on the margins of estuaries or drowned rivers and creeks regularly or irregularly flooded by freshwater.

- **Maritime Grasslands, Shrub Swamps, and Swamp Forests**: Barrier island wetlands in dune swales and flats, underlain by wet mucky or sandy soils vegetated by wetland herbs, shrubs, and trees.

These forested wetland areas are more precisely described in an EPA and Corps November 1995 memorandum concerning Application of Best Management Practices to Mechanical Silvicultural Site Preparation Activities for the Establishment of Pine Plantations in the Southeast. Consult a qualified professional for additional information to determine if one of these wetland types is on a site.

### 8.7.1 Other Wetlands

Other jurisdictional forested wetlands do not require a Section 404 permit if the mining or silvicultural activities are conducted according to the following federally mandated minimum BMPs.

### 8.7.2 Federally Mandated BMPs for Mechanical Site Preparation in Wetlands

- Position shear blades or rakes at or near the soil surface. *Windrow*, pile and move logs and *logging debris* by methods that reduce dragging or pushing through the soil.

- Minimize soil disturbance associated with *shearing, raking* and moving trees, stumps, brush and other unwanted vegetation.

- Activities should avoid excessive soil compaction and maintain soil tilth. Arrange *windrows* to limit *erosion*, overland flow and runoff.
√ Prevent disposal or storage of logs or logging debris in SMZs.
√ Maintain the site’s natural contour and ensure that activities do not immediately or gradually convert the wetland to a non-wetland.
√ Conduct activities with appropriate water management mechanisms to minimize off-site water quality impacts.

8.8 Chemical Site Preparation

*Herbicides* are a valuable tool in forest management and are used to control competing vegetation in the establishment and management of natural and planted pine stands. *Herbicide* treatments are acceptable site preparation methods on all slopes if conducted properly.

Proper planning and execution are key to safe *herbicide* use. Follow label directions and applicable state and federal laws in the storage, transportation, handling and application of all *herbicides*. Apply *restricted-use herbicides* only under the supervision of a certified *pesticide* applicator.

8.8.1 BMPs for Chemical Applications

√ Establish appropriate buffer along *perennial* and *intermittent streams* and flowing bodies of water.
√ Consider weather conditions such as temperature, wind speed and *precipitation*, equipment capabilities and *pesticide* formulations to avoid *pesticide* drift into the SMZs.
√ Conduct all on-site *pesticide* handling, such as tank mixing, loading and rinsing equipment, away from streams, ponds, wells and roadside *ditches*.
√ Dispose of *pesticide* containers and/or excess *pesticides* according to local, state and federal regulations and label requirements.
√ Clean up and/or contain all *pesticide* spills immediately and comply with local, state and federal regulations for reporting hazardous materials spills. Report spills to the DNR GA EPD Hazardous Substance Office (1-800-241-4113) and to other agencies as required.
8.8.2 Practices to Avoid During Chemical Applications

- Applying a *pesticide* directly to water bodies (streams, lakes, and swamps) unless it is specifically prescribed and labeled for aquatic management.
- Broadcast applications of *pesticides* within SMZs.

8.9 Controlled Burning

Controlled fire is often used alone or in conjunction with chemical or mechanical *site preparation* to prepare sites for *regeneration*. A properly executed site prep burn only slightly increases the chance for *erosion*. Fires that expose significant mineral soil on steep slopes, however, may increase *erosion* potential. Other factors also must be taken into consideration. If in doubt about appropriate *site preparation* treatment, consult a *qualified professional*.

8.9.1 BMPs for Controlled Burning

- Unless protected by natural barriers, the area to be burned should be protected by *firebreaks* installed following BMP recommendations. (See Section 5.5)
- Moisture levels within the soil, forest fuels and the air should be sufficient to prevent major exposure or damage to the mineral soil, especially on moderate to severely erosive soils.
- Exclude high-intensity *site preparation* fires from the SMZs. Cool, low-intensity, hazard-reduction fires that do not consume the *duff* layer are allowed.

8.10 Firebreaks

Pre-suppression *firebreaks* aid in *site preparation* (controlled) burning, *prescribed burning* and in controlling wildfires. Proper planning and BMP implementation for pre-suppression *firebreaks* can minimize sediment delivery to surface water. Aerial photographs, topographic maps, or county soil survey maps should be used to locate tract boundaries, streams, *wetlands*, rock outcrops, gullies, cemeteries, etc. that require extra precautions.
8.10.1 BMPs for Firebreaks

√ Where possible, use natural barriers such as roads, streams, and fields as firebreaks.

√ Install firebreaks on the contour as much as possible.

√ When firebreaks cannot be installed on the contour, use a gradual grade.

√ Use bladed or harrowed firebreaks instead of plowed firebreaks whenever possible.

√ On slopes exceeding 3%, install water bars with water turnouts in firebreaks according to the BMP recommendations for skid trail retirement.

√ Use hand tools or back blade firebreaks away from the edge of streams, roads, or gullies.

√ Install water bars and water turnouts at approaches to streams, roads, and gullies to prevent channeling water from firebreaks into these areas.

√ Treat active gullies the same as streams, using appropriate buffers and plowing practices.

8.10.2 Practices to Avoid During Firebreak Construction

X Firebreaks that channel surface runoff into streams, roads, or gullies.

X Plowing inside the SMZs.

8.11 Re-Vegetation & Stabilization Of Sites

Mining activities often disturb the surface soils and vegetative cover. Establishing a vegetative cover in these disturbed areas as soon as possible reduces erosion and prevents sedimentation. In addition to protecting the soil, vegetative cover can enhance wildlife habitat. Establishing a vegetative cover may include selecting the proper plant species, preparing the site, liming, fertilizing, seeding and mulching. This section provides managers with a variety of seeding mixtures that stabilize sites quickly and also provide benefits to wildlife. The table below provides a quick reference to help with the selection and establishment of seeding
mixtures. Selection of plant species, establishment methods and maintenance procedures should be based on site characteristics, including climate, soils, topography and future land-use objectives.

8.11.1 Land Preparation

*Site preparation*, such as smoothing or reshaping rutted roads and landings, may be necessary before conventional equipment can prepare seed beds, which are important for vegetation establishment. Disc *harrowing* and dragging will firm and smooth soil and promote good germination. Heavily compacted areas may require *sub-soiling*, ripping or *disking* to allow water infiltration and to provide a suitable seedbed for root growth.

8.11.2 Fertilizer and Lime

A soil test can determine fertility and pH. If a soil test is not available and lime has not been applied in the past three years, apply it at the rate shown in the following table. Lime and fertilizer are most efficient when incorporated into the soil. Spread them uniformly over the site prior to land preparation and mix them completely with the soil. Lime takes several months to react with the soil and become fully effective.

Forest soils are typically low in phosphorous and/or potassium and usually require lime. Clovers are not productive in acid sites (below pH 6.0) with low fertility unless fertilizer and lime are added.
Table 8-A: Rate of Lime to Use When a Soil Test is Unavailable

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>Tons/Acre</th>
<th>Pounds/1000 sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sands and loams</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Clayey, acidic</td>
<td>3</td>
<td>150</td>
</tr>
<tr>
<td>Clayey, alkaline</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Base additional applications of lime on soil test recommendations.

8.11.3 Seeding and Mulching

Seeding can be done in a number of ways. The most common method is with a farm tractor and a broadcast seeder. On steep or severely erosive sites, use a hydro-seeder. Seed should be covered by pulling a section harrow, culti-packer, or brush.

Mulch should be used on slopes over 5%, on sites where vegetation will establish slowly, or on deep sands or heavy clay soils. Mulch helps prevent erosion and allows vegetation to become established. Structural measures such as a diversion, which moves concentrated runoff, usually require mulch. Where there is a danger of mulch being blown or washed off-site, anchor it by running over the mulched area with a disk harrow with the discs set to run straight. On steep slopes, anchor mulch with netting and tack-down staples or spray it with a tackifier.
### Table 8-B: Seeding Mixtures for Erosion Control Plantings
(Source: Georgia Forestry Commission BMP Manual)

#### Fall Plantings

<table>
<thead>
<tr>
<th>Recommended Planting</th>
<th>Seeding Rate (lb/acre)</th>
<th>Planting Date</th>
<th>Fertilizer (lb/acre)</th>
<th>Wildlife Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ladino Clover</td>
<td>5</td>
<td>September 15</td>
<td>500</td>
<td>Excellent</td>
<td>Well drained clayey or loamy soils. Perennial clover can persist for several years. Inoculate clover seed. Maintaining pH above 6.0 is critical.</td>
</tr>
<tr>
<td>Red Clover</td>
<td>10</td>
<td>September 1</td>
<td>10-10-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryegrass</td>
<td>15</td>
<td>to November 15</td>
<td>to October 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rye</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crimson Clover</td>
<td>15</td>
<td>September 15</td>
<td>500</td>
<td>Excellent</td>
<td>Well drained clayey or loamy soils. Tolerates lower soil pH. Disk lightly in September to encourage re-seeding and overseed with wheat.</td>
</tr>
<tr>
<td>Hairy Vetch</td>
<td>15</td>
<td>September 1</td>
<td>10-10-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>60</td>
<td>to November 15</td>
<td>to November 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrowleaf Clover or Crimson Clover</td>
<td>15</td>
<td>September 15</td>
<td>500</td>
<td>Good</td>
<td>Well drained sandy or loamy soils. Tolerates lower soil pH. Disk lightly in September to encourage re-seeding of clover and overseed with wheat and rye.</td>
</tr>
<tr>
<td>Ryegrass</td>
<td>15</td>
<td>September 15</td>
<td>10-10-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>40</td>
<td>September 1</td>
<td>to October 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat or Rye Unhulled bermuda in sandy soil or Fescue in clayey soil</td>
<td>50</td>
<td>September 15</td>
<td>500</td>
<td>Poor</td>
<td>Cool season annuals provide value for wildlife during fall and winter of first year. Maintain by mowing for weed control and fall fertilization.</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>September 1</td>
<td>to November 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>to December 15</td>
<td>to December 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Spring Plantings

<table>
<thead>
<tr>
<th>Recommended Planting</th>
<th>Seeding Rate (lb/acre)</th>
<th>Coastal</th>
<th>Piedmont</th>
<th>Mountains</th>
<th>Fertilizer (lb/acre)</th>
<th>Wildlife Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryegrass</td>
<td>20</td>
<td>Feb. 15 to April 1</td>
<td>Feb. 15 to April 1</td>
<td>March 1 to April 15</td>
<td>500</td>
<td>10-10-10</td>
<td>Excellent</td>
</tr>
<tr>
<td>Kobe Lespedeza</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bahia grass Brown Top Millet</td>
<td>25</td>
<td>March 25 to July 1</td>
<td>April 15 to July 1</td>
<td>May 1 to July 1</td>
<td>500</td>
<td>10-10-10</td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bermuda grass Brown Top Millet</td>
<td>10</td>
<td>March 15 to July 1</td>
<td>March 15 to July 1</td>
<td>April 15 to July 1</td>
<td>500</td>
<td>10-10-10</td>
<td>Fair</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Footnotes for Erosion Control Plantings Table:

- To maximize wildlife value, avoid plantings with Fescue, weeping love grass, and Bermuda grass.

- Seeding depths should be 1/4 inch unless otherwise noted.

- For mixtures including Ladino clover, lime at the rate indicated by soil test or at the rate of 2 tons per acre.
8.12 Aesthetics

√ Consider aesthetics during forest management activities and be aware that appearance may influence public opinion.

√ Use forest management methods that can minimize visual impacts such as single tree and group selection, seed tree and shelterwood regeneration, and small patch clearcuts.

√ Leave corridors of trees along well-traveled public roads to enhance visual quality.

√ Shape harvest areas with natural features of the landscape.

√ Re-seed bare soil areas promptly.

√ Maintain a mixed tree species composition.

√ During artificial regeneration, establish tree rows parallel to the road and avoid 90-degree angles.

√ Minimize the "skylining" of residual snags and cull trees.

√ For more information, see the American Pulpwood Association’s Forestry Aesthetics Guide, Image and Opportunity.

8.13 Sensitive Sites

Consider protective management prescriptions for unique cultural (Native American sites), ecological (protected species), archeological (civil war breastworks), geological (rock formations), or historical (old forts and cemeteries) sites. They may need special consideration to manage their values. Contact the DNR.

Proper site (land & soil) preparation facilitates the regeneration process and is the first step toward successful regeneration. Site preparation methods prepare harvested and non-forested areas for desired tree species and stocking. Site preparation may be used for both natural and artificial forest regeneration. Methods chosen should reduce debris, control competing vegetation, and enhance seedling survival.
9.0 Managing and Protecting Reclaimed Land

9.1 Prescribed Burning / Hazard Reduction

*Prescribed burning* is used to reduce hazardous accumulations of forest fuels, manage competing plant vegetation, improve wildlife habitat and perpetuate certain endangered plant and animal ecosystems. When properly planned and conducted, *prescribed burning* has minimal impacts on water quality. These burns should follow federal, state, county and local regulations.

9.1.1 BMPs for Prescribed Burning

✓ Follow same BMPs as in 8.4 and 8.5.

9.2 Wildfire Suppression

Wildfires are suppressed aggressively with the safety of personnel and equipment a primary concern. After suppression, when safety allows, BMPs should be installed during mop up or as soon as possible.

9.2.1 BMPs for Wildfire Suppression Firebreaks

✓ Locate camps and *staging areas* on upland sites.

✓ Stabilize areas designated for *water supply points* and dip sites for helicopters to prevent excessive rutting from support equipment.

✓ Mix and/or handle fire retardants, lubricants, etc. away from streams, ponds, wells and roadside *ditches*. 
9.3 Periodic Fertilization

Forest fertilization is a valuable mining practice that enhances tree survival and growth. The primary nutrients applied are nitrogen and phosphorus. Plan any forest fertilization to prevent direct applications and runoff into water bodies. When conducted properly, forest fertilization poses little threat to water quality. Fertilizer applications should not result in exceedence of state water quality standards for nitrates and phosphorus for lakes. For more information, contact the DNR GA EPD Water Protection Branch for those standards.

9.3.1 BMPs for Periodic Fertilization

- Consider weather conditions (such as temperature, wind speed and precipitation) and equipment capabilities to avoid fertilizer drift into the SMZs.
- Conduct all on-site fertilizer handling, such as mixing and loading, away from streams, ponds, wells and roadside ditches.
- Clean up and/or contain all fertilizer spills immediately and comply with any local, state and federal regulations for reporting spills of hazardous materials.
- Dispose of fertilizer containers and/or excess fertilizer according to local, state and federal regulations and label requirements. In case of accidental spills, call the GA EPD at 1-800-241-4113. Other agency notifications may be required.

9.3.2 Practices to Avoid when Applying Fertilizers

- Applying fertilizer directly to water bodies (streams, lakes, and swamps) unless specifically prescribed and approved for aquatic management.
- Applications of fertilizer within SMZs.
10.0 Applicable Federal, State & Local Laws & Regulations

In addition to reviewing applicable Federal and State rules, landowners and mining operators should always check with local authorities before undertaking mining or forestry activities.

10.1 The Federal Clean Water Act, Section 404, 40 CFR Part 232

- Exempts from permitting the construction and maintenance of temporary roads for moving mining equipment where such roads are constructed and maintained in accordance with BMPs.

- Exempts normal, established, on-going, mining operations from permitting.

- Requires mining operations to adhere to BMPs and 15 baseline provisions for forest road construction and maintenance in and across waters of the U.S. (lakes, rivers, perennial and intermittent streams, wetlands, sloughs and natural ponds) in order to qualify for the mining exemption from the permitting process. See Section 3.3.1 for list.

- Requires Army Corps of Engineers permit for the conversion of forested wetlands to other uses such as agriculture or development or mining.

- Memorandum of Understanding dated November 28, 1995, between the Army Corps of Engineers and the U.S. Environmental Protection Agency - requires permit for the conversion of specific high-quality bottom land hardwood wetlands to pine plantations by mechanical site preparation methods. Mandates use of 6 BMPs in other jurisdictional wetlands. See Section 5.2.1.1 for the list.

- Provides for civil and criminal penalties up to $125,000 per day.

10.2 USDA Programs

Participation by landowner in various loan, price support, agriculture, forestry incentive and assistance programs subject landowners to rules and regulations regarding the Federal Farm Bill (Swampbuster and Sodbuster Provisions).

- Prohibits landowners from converting forested wetlands to agricultural uses.
• Provides for penalties including program payments plus interest to be paid back from the time of the conversion, loss of benefits and loss of eligibility in future programs.

10.3 The Georgia Water Quality Control Act (O.C.G.A. § 12-5-20, et seq.)

• Makes it unlawful to discharge excessive pollutants (sediment, nutrients, pesticides, animal waste, etc.) into waters of the State in amounts harmful to public health, safety, or welfare, or to animals, birds or aquatic life or the physical destruction of stream habitats. See Section 1 or glossary for definition of waters of the State.

• Provides for civil and criminal penalties up to $100,000.00 per day.

10.4 Georgia Rules & Regulations For Water Quality Control Chapter 391-3-6-.03 – Water Use Classifications & Water Use Quality Standards

General Criteria for All Waters. The following criteria are deemed to be necessary and applicable to all waters of the State:

• **Turbidity.** All waters shall be free from turbidity, which results in a substantial visual contrast in a water body due to a man-made activity. The upstream appearance of a body of water shall be as observed at a point immediately upstream of a turbidity-causing man-made activity. That upstream appearance shall be compared to a point, which is located sufficiently downstream from the activity so as to provide an appropriate mixing zone.

• For land disturbing activities, proper design, installation, and maintenance of best management practices and compliance with issued permits shall constitute compliance with Paragraph 391-3-6-.03(5)(d).

• **Temperature:** Not to exceed 90°F. At no time is the temperature of the receiving waters to be increased more than 5°F above intake temperature except that in estuarine waters the increase will not be more than 1.5°F. In streams designated as primary trout or smallmouth bass waters by the Wildlife Resources Division, there shall be no elevation of natural stream temperatures. Streams designated as primary trout waters are waters supporting a self-sustaining population of rainbow, brown or brook trout. In streams designated as secondary trout waters, there shall be no elevation exceeding 2°F natural stream temperatures. Streams designated as secondary trout streams are those with no evidence of natural trout reproduction, but are capable of supporting trout throughout the year.
10.5 The Georgia Planning Act of 1989 (O.C.G.A. § 12-2-8)

Authorized the Georgia Department of Natural Resources to develop minimum planning standards and procedures that local city and county planning and zoning jurisdictions could adopt and enforce pertaining to the protection of river corridors, mountain tops, water supply reservoirs/watersheds and wetlands.

- Requires local governments to use these minimum standards in developing and implementing local comprehensive growth development plans.

- Mining practices are exempt from permitting requirements according to the guidelines, but the activity must comply with BMPs within these sensitive areas. The rules for environmental planning for each of these sensitive areas, are as follows:

10.6 Water Supply Reservoir / Watershed (Ga. Rule 391-3-16-.01)

Provides local governments criteria to allow development of a water supply reservoir or watershed without contaminating the water source to a point where it cannot be treated to meet drinking water standards.

- The criteria establishes buffer zones and requirements for land disturbing activities along perennial streams and lakes and applies to existing and future water supply reservoirs and watersheds.

- Under certain circumstances, local governments may allow specific mining and forestry activities without the stream and lake corridor buffers provided the activity complies with the state’s Surface Mining Act Permit.

10.7 Wetlands Protection (Ga. Rule 391-3-16-.03)

- Requires local governments and regional development centers to acknowledge the importance of wetlands for the public good in the land-use planning process.

- Where wetlands exceed 5 acres, local governments are encouraged to protect them.

- Mining activities must obtain 404 and 401 permits, where applicable.

- Timber production and harvesting are considered acceptable uses.
10.8 River Corridor Protection (Ga. Rule 391-3-16-.04)

- Requires local governments and regional development centers to use standards for the protection of river corridors in developing and implementing local comprehensive development plans.

- Applies to any *perennial* river or watercourse, at that point and below, where the average annual flow is at least 400 cubic feet per second (cfs) as determined by appropriate U.S. Geological Survey documents.

- Protected buffers include all land within 100-ft horizontally on both sides of the river as measured from the riverbanks.

- Plans shall provide for timber production and harvesting provided the activity complies with *Best Management Practices*.

10.9 Coastal Marshlands Protection Act of 1970 (O.C.G.A. § 12-5-280, et seq.)

- Requires existing authorities in the 11-county coastal area to execute the full range of policies and management techniques identified as necessary for coastal management purposes.

10.10 Metropolitan River Protection Act (O.C.G.A. § 12-5-440)

- Requires the Atlanta Regional Commission (ARC) to adopt a Plan that would protect the land and water resources of the Chattahoochee River Corridor from Buford Dam to SW edge of Fulton County.

- Establishes a 2,000-ft buffer in which land disturbing activities are regulated.

- Requires a 50-ft buffer of natural vegetation be left in its natural state along the banks of the river and 35-ft along the banks of other tributaries.

- Forestry practices are exempt from permitting outside of these buffers and in areas zoned for agriculture. However in residential or commercial areas, a plan must be submitted and approved by the ARC when removing healthy trees over two inches in diameter at breast height.

- Establishes civil penalties of $1,000.00 per acre per day or part thereof on which such violation occurs.
10.11 Georgia Forest Fire Protection Act (O.C.G.A. § 12-6-80, et seq.)

- Requires any person, firm, corporation, or association entitled to burn any woods, lands, marshes, or any other flammable vegetation, whether in cultivated or uncultivated areas, shall prior to such burning notify and/or obtain a permit from the county office of the GFC wherein such burning is to be made.

- Any person who makes a burn and fails to give notice and/or obtain required permit shall be guilty of a misdemeanor.

10.12 Erosion & Sediment Control Act (O.C.G.A. § 12-7-1, et seq.)

- Provides permitting by local issuing authorities for land disturbing activities.

- Exempts surface mining and granite quarrying from permitting.

- Exempts commercial forestry activities, including harvesting, from permitting

- Harvesting inconsistent with BMPs may be interpreted as being in association with land conversion activities and trigger E & SC permits and requirements.

10.13 Oil Or Hazardous Material Spills Or Releases Act (O.C.G.A. § 12-14-1, et seq.)

- Requires any person owning or having control over any oil or hazardous substance who has of any spill or release exceeding the reportable quantity is to immediately notify the Department of Natural Resources.

10.14 Georgia Surface Mining Act of 1968 - (O.C.G.A. § 12-4-1, et seq.)

- Provides for the preparation of Surface Mined Land Use Plans and the issuance of a permit for the mining and extraction of minerals in the State.

- Provides for the bonding of disturbed acres until such land is properly reclaimed.

10.15 BMPs & Tips For Submitting SMLUP Amendments & Permit

1. Application & Surface Mining Land Use Plan (SMLUP) – the “blue forms”:

   - Signed by Applicant – all 3 copies.

   - Notarize or Attach Corporate Seal.

   - Company names must match on application and SMLUP.
• Give the mine a common name.

• Affected Acres = Acres to be Permitted.

• Latitude & Longitude are needed.

• General road directions to mine site from a recognizable intersection.

• Fill in all anticipated dates.

• Show Property boundaries and Type of boundary markers.

• Show List of Attachments.

2. SMLUP Plans Must Include:

• Direction and sequence of mining.

• Topographic Map.

• Permit Boundaries.

• Erosion and Sedimentation Controls with details.

• Reclamation Plan.

• Recommend owner keep a set of Plans at site.

3. Common Problems that Delay Permits:

• Allow enough time to have permits & amendments processed.

• Submit 3 copies of forms and plans.

• Need adequate Erosion and Sedimentation controls.

• Dashed blueline creeks must be shown.

• Reclamation plan must be submitted/updated with amendments.

• Bonding must be submitted within 60 days.

• Change of ownership must be submitted with appropriate bonding within 60 days.
10.16 Road Protection

Some counties require permits and/or bonds before activity can begin. The Georgia Forestry Association, the Georgia Forestry Commission and the University of Georgia School of Forest Resources Extension Service maintains current list of those counties.

10.17 Zoning/Mining Ordinances

Some local jurisdictions have ordinances that regulate mining and require local permits.

10.18 Local Land Use Plans

See Comprehensive Growth Planning Act under State Laws.

10.19 Mountain Protection (Ga. Rule 391-3-16-.05)

- Requires local governments and regional development centers to use planning standards for the protection of mountain areas in developing and implementing local comprehensive plans.

- Applies to all land area 2,200-feet or more above mean sea level that has a percentage slope of 25 percent or greater for at least 500-feet horizontally, and shall include the crests, summits, and ridge tops that lie at elevations higher than any such area.

- Certain mining and forestry practices are allowed on protected mountains provided the activity complies with the Best Management Practices. Mining may be exempt under the Surface Mining Act.

10.20 NPDES Industrial Storm Water General Permit GAR000000

- Obtain permit coverage for your facility by submitting a Notice of Intent – Version 2006 (NOI) form at least one week prior to beginning industrial activity at the site.

- Develop and implement a Storm Water Pollution Prevention Plan (SWP3) for your facility on or before the date of commencement of industrial activity at the site. The SWP3 should identify all industrial materials and activities that may be exposed to storm water at your facility and establish a system of storm water Best Management Practices (BMPSs) designed to control pollution in storm water discharges from your site.

- Properly implement and maintain all BMPs established in the SWP3. Update the SWP3 as needed in accordance with the permit.
• Conduct quarterly inspections and an Annual Comprehensive Site Evaluation.

• Provide employee training on the SWP3.
Glossary

**ACRONYMS**

**EPA** – U.S. Environmental Protection Agency  
**GA EPD** – GA Environmental Protection Division  
**DNR** – GA Department of Natural Resources  
**NPDES** - National Pollution Discharge Elimination System (wastewater discharge)  
**TMDL** – Total Maximum Daily Loads (lb/day or TSS)  
**SMZ** – Streamside Management Zones  
**SMLUP** – Surface Mined Land Use Plan  
**SWP3** – Storm water Pollution Prevention Plan  
**SPCC** – Spill Prevention Control and Countermeasures Plan (Spill Plan)  
**TSS** – Total Suspended Solids  
**GMA** – GA Mining Association  
**CCPA** – China Clay Producers Association  
**GCAA** - GA Construction Aggregates Association

**Access Roads or Trails** - A permanent or temporary road or trail used for prospecting & exploration, and for transporting timber and ore from a mine site to a public road. Also known as a haul road.

**Aesthetics** - Practices designed to restore the natural beauty or human appeal of a mine site.

**Aggregates** – Primarily granite, silica, marble and limestone-based mineral particles (rocks, stones and sands) that have been sized for specific industrial uses.

**Aspect** - The compass direction that the slope of the land faces (north, northwest, south, etc.)

**Back blading** - The practice of laying the bulldozer blade on the ground while operating a crawler tractor or other dozer equipment in reverse. This practice is commonly used for smoothing rough soil or for pulling soil or debris away from an area when pushing is not practical.

**Bedding** - A site preparation technique in which a small ridge of surface soil is formed to provide an elevated planting or seedbed. It is used primarily in wet areas to improve drainage and aeration for seedlings.

**Best Management Practices (BMPs)** - Methods, measures or practices to prevent or reduce water pollution, including but not limited to, structural and non-structural controls, operation and maintenance procedures, and other requirements, scheduling, and distribution of activities. Usually BMPs are applied as a system of practices rather than a single practice.
Blunging – Mechanical process in which a mixer is used to produce a wet slurry blend from the basic ingredients of a mineral ore and water.

Braided stream - A stream flowing in several dividing and reuniting channels resembling the strands of a braid. The divisions are commonly caused by the obstructions from sediment deposited by the stream.

Broad-Based Dip - A surface drainage diversion built into the bed of a permanent haul road that consists of a long approach section, a low, out-sloped middle section, and a short terminal section with a reverse grade. They are specifically designed to intercept and divert surface water flow out of a dirt road while allowing vehicles to maintain normal haul speeds. Also called a rolling dip.

Broadcast Burn - A controlled fire within well-defined boundaries to reduce forest fuel hazards.

Brush Barrier - A linear pile of limbs, tops, logs, and other forest debris which is arranged along the lower edge of a road, field, or other disturbed land area for the purpose of filtering sediments and debris from storm water runoff.

Buffer Zones- A transitional area between two different land uses which mitigates the effects of one land use on another. For water quality purposes this might be a strip of undisturbed woodlands along a stream which will help filter surface runoff and trap sediment coming from adjacent land disturbing activities. Some state and local regulations require buffer zones within mining areas.

Canopy cover – The percent of ground surface shaded by a combination of overstory and midstory trees.

Channel - A natural water-bearing trough cut vertically into low areas of the land surface by the erosive action of concentrated flowing water. See also “Ditch”.

Chemicals – Manmade organic and inorganic chemical substances or formulations that perform important functions in mining, mineral processing, wastewater treatment and the refining of mineral products. These substances may be found in the wastewater or storm water associated with mining activities. They may be added intentionally or unintentionally from such practices as forest management (fertilizers, herbicides, insecticides, fungicides and repellents) or mineral refining (acids, bases, dispersants, flocculants, surfactants, tall oils and biocides), or related industrial processes (heavy metals from corrosion of pipes, oils, greases, soaps, petroleum products, and fecal coliform from septic tank systems).

Chopping - A mechanical treatment in which vegetation is concentrated near the ground and incorporated in the soil. Chopping may be used to facilitate burning.

Clear cutting - A mining practice in which all merchantable trees are harvested over a specified area in one operation.
Commercial Forest land – Forest land bearing or capable of bearing timber of commercial character, currently or prospectively available, and not withdrawn from such use.

Contour - An imaginary line on the surface of the earth connecting points of the same elevation. Also a line drawn on a map connecting points of the same elevation.

Controlled burning (fire) – See “prescribed burning”.

Cross-Drain Culvert - A buried metal, wooden, plastic or concrete conduit through which water from one ditch alongside a road is directed underneath the road surface to the opposite side of the road.

Culvert - A metal, concrete or plastic pipe, or a constructed box-type conduit through which water is carried under roads or trails.

Ditches and Canals - Manmade water courses.

Down Drain - A metal, concrete or plastic pipe installed in a road turn-out, sediment trap or other diversion structure to transport storm water to a lower elevation. Also known as a “down spout” or “down pipe”.

Dragline - A machine for removing overburden and mineral ore that use a cable-suspended bucket to scrape, hold, transport and dump the extracted mineral materials.

Dry Wash - A stream bed that carries water only during and immediately following a rain event. Sometimes referred to as a “gully” or “ephemeral stream”.

Duff - Partially decayed organic matter on the forest floor.

Ephemeral stream area – Depressions or swales, sometimes called drains, draws, or dry washes, that have no defined continuous channel and that are well-connected to intermittent or perennial streams. Ephemeral areas are characterized by water tables that often rise to the surface during high water table months, and these areas produce surface flow for short periods during and following rainfall. Forest floors in ephemeral areas are intact, and hydrophytic vegetation may or may not be present. Aquatic insects are usually not present in these areas. Soils in these areas may quickly become saturated during rainy or thawing periods. Soils in ephemeral areas feature finer textures and higher organic contents than soils in adjacent uplands. Fluvial power is generally low, but there may be evidence of small debris jams of leaf litter and other small organic matter deposited after surface flows. These areas are usually not identified on USGS or NRCS maps. Water from ephemeral areas may carry sediment and other contaminants directly into streams. Ephemeral Wetlands are a part of Ephemeral Areas, which exhibit partial or full wetland characteristics.

Erosion - The process by which soil particles are detached and transported by water, wind and gravity to a point downslope or downstream.
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**Estuary** - An inlet or arm of the sea where the tide meets the current at the mouth of a river.

**Excelsior blanket** - A machine produced mat of curled wood excelsior bonded with polymer netting.

**Fauna** - The animals of a specified region or time.

**Felling** - Cutting down standing trees.

**Fertilizers** - Any substance or combination of substances used primarily as a source of plant nutrition or soil amendments.

**Firebreaks (Fire Lines)** - Artificial barriers that contain fires within an area that typically are established by plowing and/or harrowing.

**Flora** - The plants of a specified region or time.

**Gabion** – Large, multi-celled, welded wire or rectangular wire mesh boxes, used in stream channel revetments, retaining walls, abutments, check dams, etc to stabilize steep or highly erosive slopes.

**Geotextiles** - Fabrics used to improve the load bearing capacity of roads with weak base material.

**Geowebb** - A heavy-duty polyethylene cellular confinement system used to improve and stabilize structural fill in roads and embankments.

**Grading** - The process of changing the disturbed land's topography in such a way as to control the movement of water onto or from the mined site. Grading includes but is not limited to earth moving, reducing high walls, grading slopes, constructing berms and bench basins and back-blading finished slopes.

**Gully** - Narrow ravines, often caused by past land cultivation. They are typically V- or U-shaped channel that may or may not have exposed soil surfaces within the channel. They carry water only during and immediately following rainstorms or thawing event. Dry wash, draw, swale, arroyo, and gulch are other common names for gullies. Old agricultural gullies often have mature trees growing within their banks. Gullies often occur in uplands, relatively steep stream-sideslopes, upper slopes of ephemeral areas, or on exposed erodible soils. Gullies may or may not be directly connected to ephemeral areas, intermittent, or perennial streams. Because of their short hydroperiod, gullies do not generally provide suitable habitat for aquatic flora and fauna.

**Groundwater Recharge Areas** – Any portion of the Earth’s surface where water infiltrates into the ground to replenish an aquifer.
Harrowing (Disking) - A mechanical method of scarifying the soil to reduce competing vegetation and to prepare a site for seeding or planting.

Herbicide - Any chemical or mixture of chemicals intended to prevent the growth of or promote the removal of targeted trees, bushes, and/or herbaceous vegetation.

Humus layer - The organic layer of the soil formed by the decay of organic matter.

Hydric Soils - Soils exhibiting a considerably wet nature, typically characterized by dark or gray mottled colors and associated with wetlands.

Hydrology - The scientific study of the properties, distribution and effects of water on the earth’s surface, in the soil and underlying rocks and in the atmosphere.

In-slope – The feature of a road surface, established during construction or maintenance, that slants the roadbed towards the inner or uphill side. This diverts storm water into the uphill side ditch where it can be concentrated and released downhill via cross-ditch culverts or down-drains.

Integrated Pest Management - The maintenance of destructive agents, including insects, at tolerable levels by the planned use of a variety of preventive, suppressive, or regulatory tactics and strategies that are ecologically and economically effective and socially acceptable.

Intermittent stream - A watercourse that flows in a well-defined channel during wet seasons of the year but not the entire year. They generally exhibit signs of water velocity sufficient to move soil material, litter and fine debris. Aquatic insects often are difficult to find or not present at all.

Kaolin Clay – An aluminosilicate clay mineral. Also known as China clay.

Mulching - Any loose covering of forest soil with organic residues such as grass, straw or wood fibers that controls erosion and stabilizes exposed soil.

Non-point source (NPS) pollution - Water pollution that is (1) induced by natural processes including precipitation, seepage, percolation and sheet runoff; (2) not identifiable as coming from a discrete discharge point such as a pipe or ditch; not readily traceable to any discrete facility; and (3) better controlled by using BMPs.

Ore - The raw merchantable mineral(s) sought by the mining extraction process.

Out-slope - The feature of a road surface, established during construction or maintenance, that slants the roadbed to the outer or downhill side to facilitate drainage of storm runoff from the road in more diffuse flow than occurs at dips and water bars. Out-sloping is a contrasting road design to the crowned roadbed or to an in-slope toward a ditch line.

Overburden – Minerals, rocks and soils which lay on top of the desired ore and must be removed prior to ore extraction.
Perennial Stream - A watercourse that flows in a well-defined channel throughout most of the year under normal climatic conditions. Perennial streams may have no flow or dry up completely during periods of drought or times of excessive withdrawals by upstream users. Aquatic insects are normally present and easily found.

Pesticide - Any chemical substance used to control undesirable insects, diseases, vegetation, animals or other life forms. Herbicides, insecticides, fungicides, biocides and nematicides are considered pesticides.

Pollutants - Natural or manmade waste material that contaminates air, soil or water.

Precipitation - Any form of water that falls to the ground from the atmosphere, including drizzle, rain, snow, snow pellets, ice crystals, etc.

Prescribed Burning (fire) - The use of planned fire that is deliberately set under specific fuel and weather conditions to accomplish any variety of management objectives and is under control until it burns out or is extinguished.

Protected Mountain Top - Mountain tops above 2,200-ft. elevation and greater than 25% slope.

Protected River Corridors – One hundred-foot buffers along those rivers at a point and below where the flow is at 400 cubic feet per second (cfs).

Qualified Professional - A person whose training and experience qualifies him/her to make mining, geological, forestry and water quality recommendations. Examples include engineers, geologists, chemists, foresters, hydrologists, soil scientists, forest engineers, fishery and wildlife biologists, or other technically trained individuals who have similar levels of expertise.

Raking - A mechanical site preparation method to remove trees and shrubs by raking and piling debris. Raking usually moves less soil into windrows than bulldozing.

Reclamation – The process by which land areas disturbed by mining and forest activities are returned to desired elevations (topography); ponds, lakes and wetlands are created; vegetation is re-introduced; and desired land uses are restored.

Regeneration - A young tree crop that replaces older trees removed by harvest or disaster; also the process of replacing old trees with young ones.

Registered Professional Engineer, Forester or Geologist - A person who is registered and licensed to engage in professional practices as determined by the Georgia State Board of Registration for that discipline.

Restricted Use Pesticide - A pesticide that is applied only by certified persons for specific uses.
**Retirement of Roads** - Preparing a road for a long period of non-use by methods including mulching, seeding and installing water bars.

**Riprap** - Rock or other large aggregate that is placed to protect streambanks, bridge abutments or other erodible sites from runoff or wave action.

**Rotation Period** - The period of time needed to establish, grow and harvest a crop of trees at a specified condition of maturity.

**Sediment** - Soil particles that have been detached and transported into water during erosion.

**Seed Tree Cut** - A timber harvesting method that provides for the natural regeneration of a site by leaving single trees, or small groups of seed-bearing trees, evenly distributed throughout the harvest area. Generally results in an even-aged stand.

**Seep or spring** - A place where groundwater flows slowly to the surface and often forms a pool; a small spring.

**Selection cut** - Removal of select trees in a forest stand based on some economic or physiological criteria. Generally results in an uneven-aged stand.

**Shearing** - A mechanical site preparation method of removing large numbers of stems too large for disking or drum chopping. Shear blades, mounted on crawler tractors, are angled or V-shaped, have straight or serrated edges and have a “stinger” for splitting larger trees and stumps.

**Side cast** - The act of moving excavated material to the side and depositing it.

**Silt fence** - A lofty web of mechanically or melt bonded polymer netting, monofilament or fibers that are entangled to form a strong and dimensionally stable matrix to catch storm runoff and soil particles.

**Silviculture** - The science and art of growing forest crops. More particularly, the principles, theories and practices for protecting and enhancing the regeneration, growth, development and use of forests for multiple benefits.

**Sinkhole** - A geologic feature that may provide a direct connection between land surface and groundwater.

**Site preparation** - A forest activity to remove unwanted vegetation and other material, and to cultivate or prepare soil for reforestation.

**Skid** - The short-distance moving of logs or felled trees along the surface of the ground from the stump to the point of loading.

**Skid Trail** - A temporary, non-structural pathway over forest soil for dragging felled trees or logs to a log deck.
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**Slurry** - A wet blend of mineral ore and water.

**Slough** - A poorly defined *channel* in a swamp, bog, marsh, or riverine system, often without a clearly defined inlet or outlet.

**Staging area** - An area designated for the concentration of vehicles and equipment for a specific activity.

**Streamside Management Zone (SBZ)** - A designated area of varying width adjacent to the banks of streams and bodies of water where management practices that might affect water quality, fish, or other aquatic resources are modified.

**Sub-soiling** - A mechanical site preparation method for ripping apart compact soils or soils with plow pans, hard pans, or fragi-pans under the soil surface.

**Thermal Pollution** - A temperature rise in a body of water sufficient to harm aquatic life.

**Trout stream** - A perennial stream and its tributaries inhabited by trout. Streams designated as Primary Trout Waters are waters supporting a self-sustaining population of rainbow, brown or brook trout. Streams designated as Secondary Trout Streams are those with no evidence of natural trout reproduction, but are capable of supporting trout throughout the year.

**Turbidity** - An optical measurement of water clarity commonly expressed in NTU’s.

**Water bar** - A hump or small dam-type surface drainage structure used to close abandoned roads, skid trails, and fire lines.

**Water Control Structure** - Any structure used to regulate surface or subsurface water flows.

**Watershed** - All land and water within a drainage divide.

**Waters of the State** - Any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells and other bodies of surface or subsurface water, natural or artificial, lying within or forming part of the boundaries of the state, which are not entirely confined and retained completely upon the property of a single individual, partnership or corporation.

**Waters of the U.S.** - Lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, including some that are entirely confined and retained completely upon the property of a single individual, partnership or corporation if they can be used in Interstate Commerce (fish & shellfish production or migratory bird habitat).

**Water Supply Point** - An easily accessible location used to pump water into fire-suppression vehicles.
**Water Supply Reservoir / Watersheds** - Governmentally owned impoundments of water and the watersheds above such impoundments used primarily to provide water to one or more governmentally owned public drinking-water systems.

**Water Turnout** - The extension of an access road’s drainage ditch or a skid trail’s water bar into a vegetated area to divert, disperse and filter storm water runoff.

**Wetlands** - Areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands possess three essential characteristics: hydrophytic vegetation, hydric soils and hydrology. Wetlands generally include swamps, marshes, bogs, river floodplains, Carolina bays, cypress domes and stringers, pine hammocks and similar areas.

**Windrow** - Logging debris and woody vegetation that is piled into rows to decompose or be burned.
REFERENCE LIST

For other natural resource information, contact any of the following organizations:

State and Local Agencies:

Georgia Forestry Commission
P.O. Box 819
Macon, Georgia  31201
1-800-GA-TREES

University of Georgia
School of Forest Resources
Athens, Georgia  30602
706-542-2686

University of Georgia
Forest Resources Cooperative
Extension Service
School of Forest Resources
Athens, Georgia  30602
706-542-3446

Georgia Department of Natural Resources
Environmental Protection Division
NonPoint Source Pollution Program
205 Butler Street, S.E.
East Floyd Towers, Suite 1070
Atlanta, Georgia  30334
404-656-4887

Georgia Department of Natural Resources
Wildlife Resources Division
2070 US Highway 278 S.E.
Social Circle, Georgia  30279
770-918-6401

Georgia Soil and Water Conservation Commission
P.O. Box 8024
Athens, Georgia  30603
706-542-3065
Federal Agencies:

U.S. Department of Agriculture Forest Service
Southern Region
1720 Peachtree Street, N.W.
Atlanta, Georgia 30367
404-347-4178
706-546-2272

U.S. Department of Agriculture Forest Service
Chattahoochee-Oconee National Forest
1755 Cleveland Hwy
Gainesville, Georgia 30501
770-536-0541

U.S. Environmental Protection Agency
Wetlands, Coastal and Water Quality
Atlanta Federal Center
61 Forsyth Street
Atlanta, Georgia 30303
404-562-9355

Natural Resources Conservation Service
State Office
Federal Building, Box 13
355 E. Hancock Street
Athens, Georgia 30601

United States Department of the Interior
Fish and Wildlife Service
Region 4
1875 Century Boulevard, Suite 200
Atlanta, Georgia 30345

U.S. Army Corps of Engineers
Savannah District
P.O. Box 889
Savannah, Georgia 31402
912-652-5822

Private Organizations:

The Conservation Fund
880 W. Wesley Road, N.W.
Atlanta, Georgia 30327
404-355-7246
The Georgia Conservancy
1776 Peachtree Street, N.W.
Suite 400, South
Atlanta, Georgia 30309
404-876-2900

The Georgia Farm Bureau
P.O. Box 18002
Macon, Georgia 31298
912-746-5263

The Georgia Forestry Association
505 Pinnacle Court
Norcross, Georgia 30071
770-416-7621

The Georgia Wildlife Federation
1930 Iris Drive
Conyers, Georgia 30207
770-929-3350
The Nature Conservancy of Georgia
1330 W. Peachtree Street, Suite 410
Atlanta, Georgia 30309
404-873-6946

The Society of American Foresters
Georgia Division
912-751-3553

The Southeastern Wood Producers Association
P.O. Box 9
Hilliard, Florida 32046
904-845-7133

Websites:

Idaho Department of Lands
Best Management Practices for Mining in Idaho
Chapter 5, Colorado Mining Nonpoint Source Management Program
including BMPs by the Colorado Department of Public Health and Environment,
Water Quality Control Division


EPA and Hardrock Mining: A Source Book for Industry in the Northwest and Alaska,
Appendix H, Erosion and Sedimentation
State of Nevada, Division of Environmental Protection
BMP – Best Management Practices Handbook, Chapter 9 – Mining
http://ndep.nv.gov/bwqp/bmp05.htm

Atlanta Regional Commission
Georgia Storm Water Management Manual
Volumes 1 & 2

Natural Resources and Conservation Service Technical Guide
(http://www.nrcs.usda.gov/Technical/efotg/)


http://clean-water.uwex.edu/pubs/pdf/shore.fishfriendlyculverts.pdf

http://sas.usace.army.mil/permit.htm

http://www.nr.nps.gov/

http://www.athens.fws.gov/endangered/counties_endangered.html

http://www.gaswee.org

http://www.fema.gov

http://crd.dnr.state.ga.us/

http://www.epa.gov

http://www.dnr.state.ga.us

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Georgia Wildlife Resources Division
Georgia-Pacific Corporation
The Nature Conservancy of Georgia
Weyerhaeuser Corporation