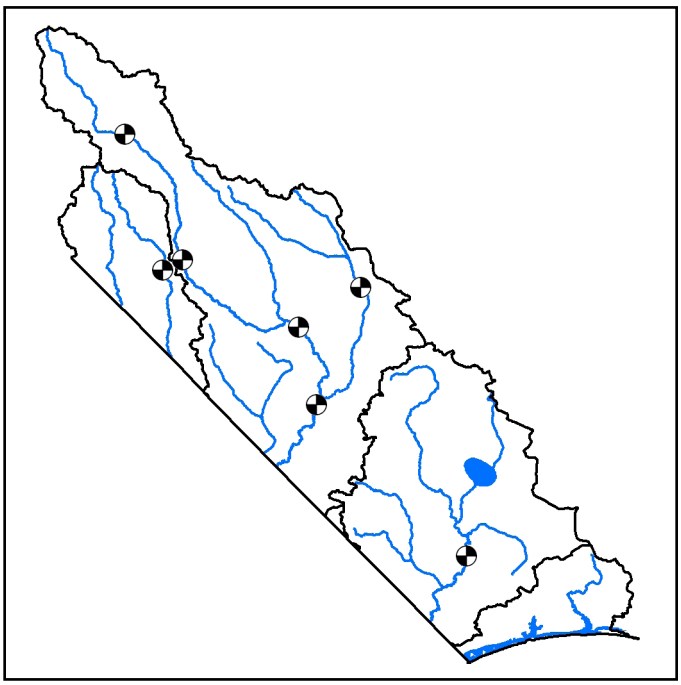
Chapter 8
Managing Water Quality & Quantity

Understanding Stream Flow

Stream flow is monitored by U.S. Geological Survey gaging stations (Figure 8-1) and the 7-day 10-year low flow (7Q10) statistic is calculated to determine minimum flow requirements appropriate for water use activities. Examples of these activities include point source discharger effluent assimilation, water withdrawals, protection of aquatic life, navigation, wetland maintenance, recreation, hydropower and TMDL development. Flows less than the 7Q10 may be the result of drought, but also can be caused by water withdrawals or impoundments. When stream flow falls below the 7Q10, water quality violations may occur. Flow requirements are often thought of as minimum flows or releases, but they can also include maximum flow limits for peaking hydropower dams, seasonal releases for fish spawning, or weekend releases for recreation. Flow, often abbreviated as "Q", is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs). For more information about instream flow see DWR website: ***http://www.ncwater.org/About_DWR/Water_Projects_Section/Instream_Flow/welcome.html .***

Figure 8-1: USGS Gaging Stations in the Lumber Basin



Managing Flow from Impoundments

Many of the larger waterbodies in the relatively flat Coastal Plain often meander and are lined with swamps consisting of bottomland forest. Coastal Plain soils are deep sands that have a high groundwater storage capacity. This abundance of groundwater and lack of good sites for dams means there are few reservoirs in the basin. Eighty-one miles of the Lumber River are classified as Natural and Scenic, limiting dam construction on the river which contributes to the low number of reservoirs.

Table 8-1: Minimum Releases from Impoundments in the Lumber Basin

Name of Dam	Waterbody	Drainage Area	Minimum Release
Holly Course Dam	Sandy Run Creek	0.9 mi^2	0.4 cfs
Lake Auman Dam	UT of Jackson Creek	4.2 mi^2	2.0 cfs
Lake Pinehurst Dam	Horse Creek	4.3 mi^2	2.5 cfs
Watson Lake Dam #2	Aberdeen Creek	8.75 mi^2	0.3 cfs
Pinehurst National Golf Course # 1	Aberdeen Creek UT	1.7 mi^2	0.2 cfs
Pinehurst National Golf Course # 2	Aberdeen Creek UT	1.7 mi^2	0.3 cfs
Pages Lake	Aberdeen Creek	14.1 mi^2	4.3 cfs
Town of Southern Pines Offstream Storage Dam (Proposed)	Horse Creek UT	0.3 mi^2	0.3 cfs

Note: Although every attempt has been made to include all flow requirements in the basin, omission from the list does not negate those with flow requirements from fulfilling their obligations.

Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water downstream of the impoundment. One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. The ***Division of Water Resources*** (DWR), in conjunction with the ***Wildlife Resources Commission*** (WRC), recommends conditions related to release of flows to satisfy minimum instream flow requirements. The ***Division of Land Resources*** (DLR) issues the permits and is responsible for enforcement. Calculated minimum streamflows for impoundments in the Lumber River Basin are listed in Table 8-1. If the inflow is less than the minimum release the minimum release becomes that inflow rate.

Water Withdrawls

North Carolina General Statute G.S. 143-215.22H, originally passed in 1991, requires surface water and ground water withdrawers who meet conditions established by the General Assembly to register their water withdrawals and surface water transfers with the State and update those registrations at least every five years. Agricultural water users that withdraw one million gallons of water a day or more and non-agricultural water users that withdraw one hundred thousand gallons of water a day are required to register. Administrative rules that became effective in March 2007 (15A NCAC 02E.0600) stipulate that registrants must also report their water usage annually to the Department of Environment and Natural Resources. In its 2008 session, the General Assembly established civil penalties for failure to comply with these requirements.

Table 8-2: Current Surface Water Withdrawals by Local Water Supply Systems

County	Water System	Source	Withdrawal	HUC
Moore/Richmond	Town of Southern Pines	Drowning Creek	14 MGD max. 3.06 MGD avg.	03040203
Robeson	City of Lumberton	Lumber River	4 MGD avg.	03040203
Brunswick	Dea Trail Corp.	Onsite Pond	0.081 MGD avg.	03040208
Brunswick	Ocean Ridge Plantation Golf	Onsite Pond	0.246 MGD avg.	03040208
Brunswick	Brick Landing Plantation CC	Onsite Pond	0.081 MGD avg.	03040208
Brunswick	Brunswick Plantation Golf Resort	Onsite Pond	0.115 MGD avg.	03040208
Brunswick	Lockwoods Folly Country Club	Onsite Pond	0.11 MGD avg.	03040208
Brunswick	Meadowlands Golf Club	Onsite Pond	0.15 MGD avg.	03040208
Brunswick	Farmstead Golf Links	Onsite Pond	0.096 MGD avg.	03040208
Brunswick	Oak Island Golf Club	Onsite Pond	0.027 MGD avg.	03040208
Brunswick	Sandpiper Bay Golf Club	Onsite Pond/ Wastewater Effluent	0.112 MGD avg.	03040208
Hoke	Carolina Turf Farm	Onsite Pond	0.029 MGD avg.	03040203
Moore	Pinehurst, Inc.	Onsite Pond	0.667 MGD avg.	03040203
Moore	The Country Club of NC	Watson Lake	0.267 MGD avg.	03040203
Moore	The Pit Golf Links	Onsite Pond	0.096 MGD avg.	03040203
Moore	The Bluff Golf Links	Onsite Pond	0.085 MGD avg.	03040203
Moore	Pinewild CC of Pinehurst	Onsite Pond	0.112 MGD avg.	03040203
Moore	Beacon Ridge Golf and CC	Lake Auman	0.725 MGD avg.	03040203
Moore	National Golf Club	Onsite Pond	0.115 MGD avg.	03040203
Richmond	Unimin Corporation	Onsite Pond	1.352 MGD avg.	03040204
Robeson	Progress Energy Carolinas, Inc.	Lumber River	6.017 MGD avg.	03040203
Scotland	Scotch Meadows CC Inc.	Gum Swamp Creek	0.036 MGD avg.	03040204
Scotland	Deercroft Golf, LLC	Lake Sinclair	0.055 MGD avg.	03040204

Units of local government that supply or plan to supply water to the public are required to prepare a Local Water Supply Plan (LWSP). Like the withdrawal registrations, a LWSP must be updated at least every five years and systems required to prepare a LWSP must also report water usage annually to the Division of Water Resources. Preparing a LWSP and keeping it updated meets a local government's obligation to register their water withdrawals under General Statute 143-215.22H. Local Water Supply Plans and associated materials can be found at ***www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/***.

In the Lumber River Basin there are twenty-three registered users that withdraw surface water. Two of these are units of local government that have prepared a Local Water Supply Plan, the towns of Southern Pines and Lumberton. In addition to the 20 golf-related facilities that use surface water from the basin, Progress Energy operates the 173-megawatt Weatherspoon Steam Electric Plant near Lumberton which uses water from the Lumber River. The most recent withdrawal and use information available for these facilities are summarized in Table 8-2.

Interbasin Transfers

In 1993, the North Carolina Legislature adopted the Regulation of Surface Water Transfers Act (G.S. §143-215.22I). The intent of the law is to regulate large surface water transfers between river basins. It does this by requiring a certificate from the Environmental Management Commission. The act has been modified several times since it was first adopted, most recently in 2007 when G.S. §143-215.22I was repealed and replaced with G.S. §143-215.22L. In general, transfer certificates are required for new transfers of 2 million gallons per day (MGD) or more and for increases in an existing transfer by 25 percent or more (if the total including the increase is over 2 MGD). Certificates are not required for facilities that existed or were under construction prior to July 1, 1993, up to the full capacity of that facility to transfer water, regardless of the transfer amount. More information on current interbasin transfers, the controlling regulations, and the approval process can be found on the Division of Water Resources website at ***www.ncwater.org/Permits_and_Registration/Interbasin_Transfer/***.

The Brunswick County Water system is the only system in the Lumber River Basin that needs an interbasin transfer certificate. Currently they are pursuing permission to increase their allowable transfer. The Brunswick County water system treats water from the Cape Fear River and distributes potable water to communities throughout the county. The coastal communities in the county, most of which are located in the Shallotte River watershed, depend on the county water system to meet their customer's needs. Filings and notices associated with Brunswick County's request for an increase in the transfer can be found on the Division of Water Resources website. Table 8-3 summarizes the systems that depend on this transfer and the volume of water involved.

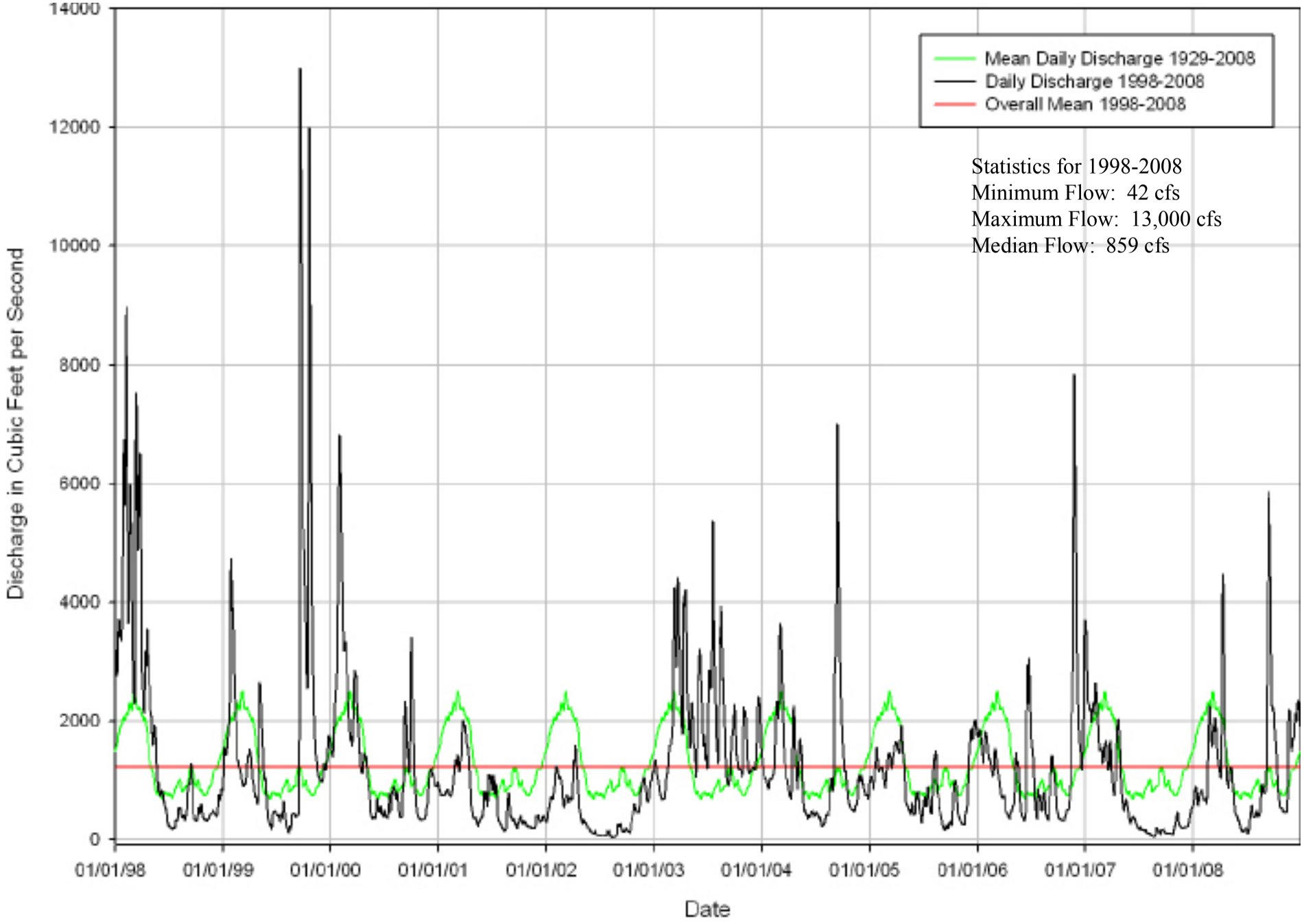
Table 8-3: Estimated Interbasin Transfer in the Lumber Basin

Supplying System	Receiving System	Source	Destination	Est. Transfer (MGD)
Brunswick County	All Municipalities	Cape Fear River	Shallotte River	8.37
Brunswick County	Brunswick County	Cape Fear River	Waccamaw River	0.65

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. Factors used to determine whether a certificate should be issued include:

- the necessity, reasonableness and beneficial effects of the transfer;
- the detrimental effects on the source and receiving basins, including effects on water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, hydroelectric power generation, navigation and recreation;
- the cumulative effect of existing transfers or water uses in the source basin;
- reasonable alternatives to the proposed transfer; and
- any other facts and circumstances necessary to evaluate the transfer request.

Figure 8-2: Discharge Measured by USGS Gaging Station 02134500 Lumber River at Boardman 1998-2008



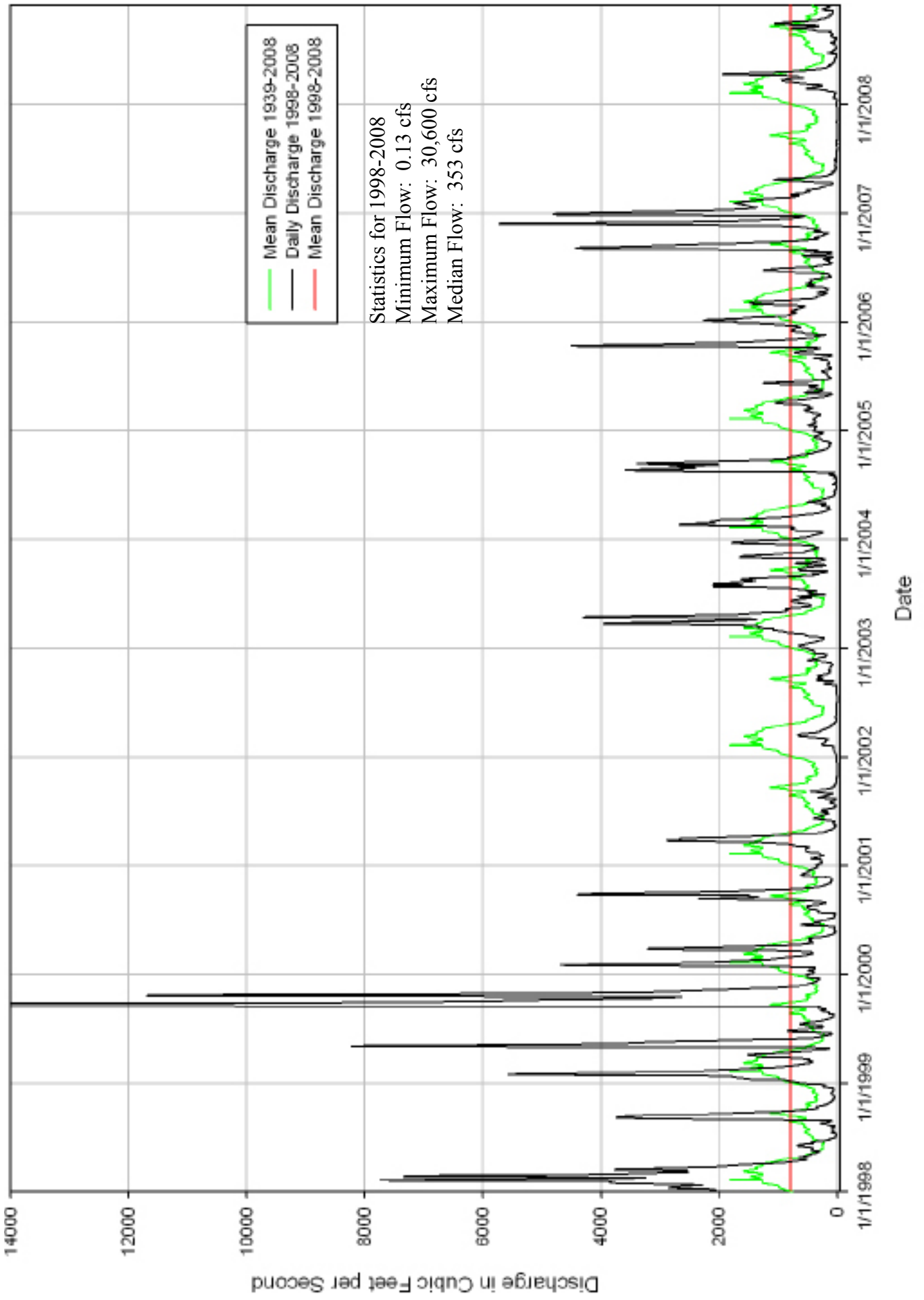


FIGURE 8-3: DISCHARGE MEASURED BY USGS GAGING STATION 02109500 WACCAMAW RIVER AT FREELAND 1998-2008

A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition. For more information on water withdrawals, visit ***http://www.ncwater.org*** or call DWR at (919) 733-4064.

Observed Flow

Figures 8-2 and 8-3 depicts the flow pattern for the Lumber and Waccamaw Rivers from between 1998 and 2008. Also shown is the daily flow averages for the past 80 and 70 years, respectively. Notice that flow is usually at its highest levels in the late winter and early spring. The lowest flows can be seen in the summer and fall with the occasional spike in discharge due to tropical systems that frequent the area in late summer and early fall.

Water Quality Issues Related to Drought

The recent drought in North Carolina has highlighted natural resource management and the importance of the relationship between water quantity and quality. Droughts and floods are natural processes and their impacts are often amplified by land use activities. Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because high flows may carry increased loadings of substances (e.g., metals, oils, herbicides, pesticides, sand, clay, organic material, bacteria and nutrients). These substances can be toxic to aquatic life (fish and insects) or may result in oxygen depletion or sedimentation. During drought conditions, these pollutants become more concentrated in streams due to reduced flow. Summer months are generally the most critical months for water quality. Dissolved oxygen is naturally lower due to higher temperatures, algae growth increases due to longer periods of sunlight, and stream flows are reduced. In a long-term drought, these problems can be greatly exacerbated and the potential for water quality problems to become catastrophic is increased. This section discusses water quality problems that can be expected during low flow conditions.

The frequency of acute impacts due to nonpoint source pollution (runoff) is actually minimized during drought conditions. However, when rain events do occur, pollutants that have been collecting on the land surface are quickly delivered to streams. When stream flows are well below normal, this polluted runoff becomes a larger percentage of the water flowing in the stream. Point sources may also have water quality impacts during drought conditions even though permit limits are being met. Facilities that discharge wastewater have permit limits that are based on the historic low flow conditions. During droughts these wastewater discharges make up a larger percentage of the water flowing in streams than normal and might contribute to lowered dissolved oxygen concentrations and increased levels of other pollutants.

As stream flows decrease, less habitat is available for aquatic insects and fish, particularly around lake shorelines. Less water is also available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increases strain on the resource. With less habitat, naturally lower dissolved oxygen levels and higher water temperatures, the potential for large kills of fish and aquatic organisms is very high. These conditions may stress the fish to the point where they become more susceptible to disease and where stresses that normally would not harm them result in mortality.

These are also areas where longer retention times due to decreased flows allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount dissolved oxygen in the water, but at night algal respiration and die off can cause dissolved oxygen levels to drop low enough to cause fish kills. Besides increasing the frequency of fish kills, algae blooms can also cause problems for recreation and difficulty in water treatment resulting in taste and odor problems in finished drinking water.

Effects of Artificial Drainage

Artificially draining wetlands, as is the case in much of the Waccamaw and Long Bay Subbasins, can have impacts on water quality. It increases both the severity of flooding and drought. Wetlands reduce the risk and

severity of flooding by retaining water and allowing it to slowly seep into the ground and recharge the aquifers. The surfical and Pee Dee aquifers feeds into the Waccamaw River, supplying it with a more consistent baseflow. Without discharge from the aquifers to the river the water will be dominated by swamp water and could result in decreased pH. Recharge of the aquifers is important to the Long Bay Subbasin because it prevents saline water from intruding into the aquifer and up the coastal rivers. Figure 8-4 shows the extent of artificial drainage of the wetlands along the Columbus and Brunswick County border.

Figure 8-4: Artificial Drainage in the Waccamaw and Long Bay Subasins through time From Riggs, et al.