Operations Resource Committee

1.0 Purpose

This Resource Committee Report is the bridge document by which Catawba-Wateree Relicensing study results are delivered to the relicensing stakeholder teams (State Relicensing Teams and Advisory Groups) for their use and consideration as they negotiate to develop the Agreement-In-Principle (AIP). This report has been prepared under the oversight of the Catawba-Wateree Relicensing Operations Resource Committee and supplements the eight detailed study reports that are available at:

www.catawbahydrolicensing.com.

The purpose of this Resource Committee Report is to:

1) Consolidate and summarize key study findings,

2) merge the findings of hydroelectric operations / water quantity resource-related studies into a coordinated resource assessment,

3) identify relationships with other resource areas (e.g., aquatics, water quality and terrestrial), and

4) provide the Operations Resource Committee's assessment of potential resource protection, mitigation and enhancement opportunities supported by study findings.

Catawba-Wateree Resource Committees

- Aquatics
- Cultural
- SMP / Recreation
- Terrestrial
- Operations
- Water Quality

2.0 Contents

2.1 Study Purpose

The purpose of each study, including the basic relationship of the study to the operation of the Catawba-Wateree Project is provided in Section 3. The eight studies within the Operations Resource Committee are listed below. These studies are linked by their nexus to hydroelectric operations and water quantity issues.

Operations 01 - Hydrologic / Hydraulic Operations Model
Operations 02 - Reservoir Level Study
Operations 03 - Trash Management Plan
Operations 04 - Water Supply Study
Operations 05 - Low Inflow Protocol Study
Operations 06 - Hydro Project Maintenance and Emergency Protocol
Operations 07 - Recreation Flow Communication Study
Operations 08 - Wateree High Water Management Study

2.2 Methodology

The procedures and methods utilized in the execution of the studies are provided in Section 3 of this report. Where the procedures and outcomes are linked to other studies, that connection is described.

2.3 Key Findings

Key findings for each study are summarized. These are the study results that have the most direct correlation to the condition of the resource.

2.4 Resource Assessment

From the perspective of hydroelectric operations and water quantity, the key descriptive parameter in defining the resource condition is that available water quantity is finite. Studies to define historic lake levels, future water withdrawals and to model potential future operating scenarios provide valuable insight into water quantity issues. The Low Inflow and Hydro Project Maintenance and Emergency Protocols will help assure the stability of the water quantity resource long term. Enhanced communications of reservoir levels and flow releases will facilitate use of the water quantity asset.

3.0 Study Summary – Purpose, Methods and Findings

3.1 Hydrologic / Hydraulic Operations Model (Operations 01)

3.1.1 Study Purpose

The study purpose was to develop an enhanced version of the existing CHEOPS® PC based computer simulation model that incorporates the operating characteristics of the 11 developments that make up the Catawba-Wateree Hydro Project (FERC No. 2232). The model is capable of simulating the development's operations using specific hydraulic relationships based on an average daily inflow series to each of the individual development incremental drainages beginning upstream of Lake James and ending downstream of Lake Wateree above the confluence with the Congaree River. The model is capable of analyzing the effect of the integrated operation of all project developments on the flow and lake level regimen under proposed operational alternatives. The model provides a tool to evaluate various operational scenarios simulating changes in flows, lake levels and other operational constraints. The resulting data can be readily analyzed to assist stakeholders in evaluating the impact of the scenarios on specific water quantity interests.

3.1.2 Methodology

The scope of work that was performed to upgrade and enhance the existing Catawba-Wateree CHEOPS® model included several additional capabilities. The revised model code includes enhancements that have been developed since the original Catawba-Wateree CHEOPS® model was completed. These items included some new or revised subroutines, more robust error checking and other enhancements.

A significant element of the study work included the development of annual inflow hydrology for each of the developments in the Project. The inflow was generated from 75 years of archived hourly reservoir elevations, generation, spillage and tailwater elevation data.

3.1.2.1 Upgrades to the existing CHEOPS® model

- Updated model code to current code/error checking and added subsequently developed standard features.
- Enhanced water withdrawal options to permit monthly adjustment of withdrawals.
- Inclusion of relative Multi-Year pricing capability.
- Developed code necessary to include annual hydrology input.
- Confirmation QA/QC on code changes.
- Added river routing reaches and nodes for the each of the three (3) river routing reaches; Bridgewater tailrace to Lake Rhodhiss, Wylie tailrace to Fishing Creek Lake and downstream of Wateree dam. For the reaches below the Wylie tailrace and downstream of the Wateree dam, a node location was selected near a critical

cross section for navigability in South Carolina as determined by the Aquatics 04 study.

- Data from the water supply study (Operations 04) will be utilized to evaluate groundwater recharge.
- Evaporation option features were modified for natural and forced evaporation based on review of available empirical data for the basin.
- Reservoir sedimentation features were added to allow the user to reduce the available reservoir storage due to future sedimentation of each of the 11 reservoirs.

3.1.2.2 Upgrading CHEOPS® Input Hydrology for Years 1929 to 2003

Electronic files containing daily reservoir elevations, generation, auxiliaries consumed (power) or net generation, and spilled discharge for the Catawba River hydro developments from Bridgewater to Wateree for the years 1929 to 2003 were used to develop the inflow hydrology. Evaporation and historic water withdrawals were accounted for to produce unregulated inflow. This allows the evaporation and withdrawals to be defined in the CHEOPS model for future scenarios. The development of the inflow data set included quality assurance procedures and benchmarking to available stream gage records.

3.1.3 Key Findings

- The CHEOPS model provides all stakeholders a tool to examine the impacts of changes to operational scenarios. These impacts can be quantified utilizing criteria and measures that align with specific interests. A performance measures spreadsheet (PMS) was developed to assist in interpreting the CHEOPS output data from scenario evaluations. The PMS delineates a series of criteria and performance measures and is populated by the results of stakeholder proposed scenarios. It is particularly useful for performing comparisons between results of multiple scenarios

3.2 Reservoir Level Study (Operations 02)

3.2.1 Study Purpose

The study purpose is to evaluate potential seasonal target elevations along with maximum and minimum elevations based on historical operation. The study provides data to assist in evaluating potential alternative target elevations for Bridgewater (Lake James), Cowans Ford (Lake Norman), Wylie (Lake Wylie), and Wateree (Lake Wateree) in order to assist in the balancing of the interests of lakeside homeowners, municipal and industrial water users, environmental interests, and power production capabilities. The study also evaluated the application of target and minimum elevations at the remaining

Catawba-Wateree reservoirs: Rhodhiss (Lake Rhodhiss), Oxford (Lake Hickory), Lookout Shoals (Lookout Shoals Lake), Mountain Island (Mountain Island Lake), Fishing Creek (Fishing Creek Lake), Great Falls/Dearborn (Great Falls Lake), and Rocky Creek/Cedar Creek (Rocky Creek Lake). This study was principally a data gathering and presentation activity.

3.2.2 Methodology

The historical lake level data (daily mid-night to mid-night) was assembled in an MSACCESS database. Much of this data (prior to 1990) was transferred from hand-recorded log sheets. The data was analyzed to determine both the frequency and time duration that each lake level was within a particular lake level band. These bands and the frequency time duration results are available to assist the stakeholders in developing criteria for lake levels.

3.2.3 Key Findings

- Historic lake levels were influenced over the life of the Catawba-Wateree hydroelectric facilities by hydrologic conditions, maintenance needs and operational philosophy (power generation needs). The magnitude of lake level variation has been reduced in recent years. This data is presented graphically in the Study Report. Basic lake level statistics are provided in the table below.

Historic Lake Level Statistics

Reservoir	Drainage Area (mi^2)	Full Pond 100 ft =	Historical [1] Minimum	Historical [1] Maximum
Lake James	380	1200	5.93 [2]	106.1 [3]
Lake Rhodhiss	710	995.1	76.90	110.1
Lake Hickory	220	935	80.80	104.7
Lake Lookout	140	838.1	76.60	114.4
Lake Norman	340	760	88.00	100.7
Mtn. Island Lake	70	647.5	88.73	109.6
Lake Wylie	1160	569.4	81.60	100.11
Fishing Creek Lake	790	417.2	69.33	100.32
Dearborn Reservoir	290	355.8	74.50	102.9
Cedar Creek Lake	260	284.4	76.60	109.6
Lake Wateree	390	225.5	81.84	109.6

[1] Local datum
[2] Maintenance drawdown in 1954
[3] Lake James reached 107.3 in 2004

- Beginning in 1976, Duke began a voluntary lake level stabilization program. Under this program, Duke endeavors to stabilize lake levels for three weeks during spring spawning. The goal is to control lake level variability within plus two feet, minus one foot of the trigger elevation. The Study Report provides comprehensive statistical data on the compliance history of the program. In general, the results demonstrate that lake stabilization goals were achieved the majority of the time.

3.3 Trash Management Plan (Operations 03)

3.3.1 Study Purpose

Develop a trash management plan for non-biodegradable and biodegradeable trash removed from project trashrack(s).

3.3.2 Methodology

Phase One:
- Reviewed Duke Power's current debris management practices. A summary document, describing current state practices was developed.

Phase Two:
- Evaluated safe, cost effective, and environmentally responsible options for non-biodegradable trash management.

Phase Three:
- State Relicensing Teams and Regional Advisory Groups reviewed and commented on the draft management plan.
- Comments were incorporated and the non-biodegradable trash management plan was finalized.

3.3.3 Key Findings

- Trash (debris) entering the Catawba-Wateree basin consists of both biodegradable (woody debris) material and non-biodegradable (household items, plastic bottles, etc.) material.

- If large volumes of trash accumulate at a hydroelectric projects intake it can reduce power generation by as much as 10-12 percent. Historically, this problem has been most pronounced at Rhodhiss, Fishing Creek and Rocky Creek-Cedar Creek Rocky Creek Powerhouse) developments.

- Debris typically enters the system and moves through it slowly. However, during high water events debris can accumulate rapidly. This debris can move over uncontrolled spillways or be released through gated spillways.

3.4 Water Supply Study (Operations 04)

3.4.1 Study Purpose

The objective of this study was to document the current water withdrawals and discharges in those portions of the Catawba-Wateree basin that affect the operation of the Project and to produce an estimate of future water withdrawals and discharges based on reasonable growth projections. The projected water withdrawals developed in this study will be included in the long-term evaluation of proposed changes to hydroelectric operations. The projections will also be included in the development of a Low Inflow Protocol (LIP; Study Plan: Operations 05) that will be the basis for future operation of the Project during periods of low inflow. The study allows for the evaluation of future water withdrawal demands on future proposed project operation scenarios as well as the effect of project operations on the safe yield of the Project's reservoirs for public water supply, especially during low inflow periods.

The study specifically produced:

- Water user input into long-term (e.g. 50-year) projections of water withdrawals and discharges on the Project and a comparative tool that can be used to evaluate the impact of project operation changes on the safe yield of the Project's reservoirs.
- Water user input into the method of loading projected withdrawals and returns in Duke Power's reservoir operations model.
- Water user input into development of a set of consistent actions to implement for use in the LIP. This input was a prerequisite to the final development of the LIP.
- A review of options for impact fee structures used by other hydro project licensees and a listing of the pros and cons of the identified fee structures.

3.4.2 Methodology

The Water Supply Study Team selected an independent consultant with experience in basin-wide water supply planning and with local water utilities to conduct the detailed water withdrawal and discharge research and prepare the existing and future water withdrawal estimates. The data developed on existing and future water withdrawal estimates will be used in Duke Power's reservoir operations model (CHEOPS™) to estimate the impact of existing and future water withdrawals on reservoir operations and the impacts of reservoir operations on water withdrawals under various stakeholder derived scenarios. The consultant also conducted a water supply safe yield analysis of the reservoirs so that impacts of future operating scenarios on water supplies can be evaluated.

The study was divided into two phases as follows:

<u>Phase I</u>:
Phase I of the study relied upon currently available data and provided an initial understanding of the magnitude of current and future water demands that affect Project operations. Tasks completed in Phase I included:

- Compilation of current permitted withdrawals and discharges greater than 100,000 gallons per day, including interbasin transfers.
- Clarification and reconciliation of the information presented in the Local Water Supply Plans of North Carolina communities and in the Water Plan of South Carolina.
- Development of a basin-wide database, utilizing Geographic Information System (GIS) technology, based on state government standards as appropriate, that links water withdrawals and associated water return (effluent discharge) locations and volumes.
- Examination of the impacts of the 1998-2002 drought on groundwater recharge and evapotranspiration for future scenario modeling purposes.
- Development of a set of 50-year future water demand projections using a methodology that is recommended by the consultant and adopted by the Water Supply Study Team. The projections should include estimates based on expected growth in the basin, with sensitivities provided for low growth and high growth. Estimates of future interbasin transfers need to be included also. In addition, the Project safe yield will be developed in order to determine the impact on water supplies under various proposed operating conditions.

Phase II:
Phase II of the study focused on building support for a long-term, basin-wide water supply planning and drought management structure and gathered information regarding impact fees for water withdrawals, including the pros and cons of options identified. Tasks in Phase II are:

- Evaluate options for the long-term maintenance of the database developed in Phase I, including what entity should maintain it once relicensing is over.
- Recommend a consistent drought contingency plan policy that all water users can utilize along with Duke Power to responsibly manage the limited water supply during low inflow periods. The plan will recommend the trigger levels for water withdrawers to start implementing their individual conservation programs as appropriate. The plan considers the needs of relicensing stakeholders that do not withdraw water. The plan also considers impacts to natural resources including aquatic organisms.
- Identified impact fee structures used by other hydro project licensees and list the pros and cons of the identified fee structures. Provide estimates of the potential magnitude of fees under each option.
- Identified opportunities for improved water quantity and/or quality management that could be at least partially supported with funds from future impact fees.

3.4.3 Key Findings

- Fifty year projections (to the year 2058) for water withdrawals were developed and are summarized in the study report. Projections for the year 2058 are provided in the table below.

Projected Water Withdrawals (mgd) Current / 2058

Reservoir	Withdrawals	Returns	Net Outflows
Lake James	11 / 36	10 / 17	1 / 19
Lake Rhodhiss	26 / 44	13 / 24	113 / 20
Lake Hickory	19 / 44	5 / 16	14 / 28
Lookout Shoals Lake	1 / 12	1 / 1	0 / 11
Lake Norman	60 / 179	2 / 4	58 / 175
Mountain Island Lake	101 / 224	6 / 18	95 / 206
Lake Wylie	92 / 155	45 / 89	47 / 66
Fishing Creek Reservoir	109 / 185	164 / 291	-55 / -106
Great Falls-Dearborn	1 / 2	1 / 5	0 / -3
Cedar Creek Reservoir	1 / 1	1 / 1	0 / 0
Lake Wateree	6 / 56	0 / 0	6 / 56

Note: 1 mgd = 1.57 cfs

- Safe yield withdrawal estimates were calculated and are presented in the study report. The safe yield evaluation concludes that, "under extreme drought conditions, the water supply available to the region from the Catawba River is not unlimited, and therefore, appropriate planning and management could help preserve and extend water supply availability during these conditions."

- Future hydroelectric operations requirements (i.e. flow releases) can further impact the water supply available to the region.

- Several methods are being used by other hydro operators to assess water withdrawal fees. Duke Power is the only hydroelectric operator in the Carolinas that currently does not charge for water withdrawals (there is one exception on Lake Keowee in which fees were ordered by the FERC). Some methods are based on the loss of hydroelectric generation and capacity, some are based on the cost of maintaining the dam and reservoir that provides storage and reliability and some are based on the cost to the water withdrawer to provide its own equivalent storage and reliability. The different methods yield different fee amounts when applied to Catawba-Wateree water withdrawers.

3.5 Low Inflow Protocol Study (Operations 05)

3.5.1 Study Purpose

This study developed a low inflow protocol (LIP) that will provide trigger points and procedures for how the Catawba-Wateree Project will be operated by the Licensee during periods of low inflow (i.e. periods when there is not enough water flowing into the Project reservoirs to meet the normal needs for power generation, recreation flows, minimum flows, any on-reservoir water withdrawals and designated lake levels). The protocol was developed on the basis that all parties with interests in water quantity will share the impact of low inflow. This includes consideration of impacts to natural resources. The study also evaluates the potential of using forecasting approaches (developed in the Water Supply Study-Operations 04) to determine the probabilities of shortfalls in water availability before they occur.

3.5.2 Methodology

The study proposes reductions and adjustments to reservoir levels, downstream minimum flows, water withdrawals, and generation amounts during periods of low inflow when certain trigger points in overall cumulative storage are reached. This study, in conjunction with others determined the adjustments on a staged basis until the inflow increases sufficiently to allow all water users to return to normal operations. The study also used results from Phase II of the Water Supply Study (Operation 02) to see if predictive measures provide additional benefit during low inflow periods.

3.5.3 Key Findings

- Trigger points were established for the LIP that defines four stages. An initial low inflow watch stage would initiate the first actions under the LIP. Three sources of data will be monitored with the potential to trigger the LIP; the Storage Index for the Catawba Reservoirs, The U.S. Drought Monitor and four USGS gages. To enter a stage, the Storage Index Trigger plus either of the two additional triggers must be met.

LIP Trigger Points

Stage	Storage Index[1]	Drought Monitor[2]	USGS Gages[3]
0	90% < SI ≤ TSI	0 ≤ DM	AVG ≤ 75%
1	75% < SI ≤ 90%TSI	1 ≤ DM	AVG ≤ 70%
2	60% < SI ≤ 75%TSI	2 ≤ DM	AVG ≤ 55%
3	50% < SI ≤ 60%TSI	3 ≤ DM	AVG ≤ 40%
4	SI ≤ 50%TSI	DM = 4	AVG ≤ 30%

[1] The ratio of Remaining Useable Storage (RUS) to Target Storage (TSI) at any given point in time. This Index is a mandatory trigger requirement for Stages 1-4. TSI is the storage available at the target lake elevations. RUS is the storage available at the actual lake elevations.

[2] Three month numeric average. Either this trigger or the stream gage trigger in addition to the storage index trigger must be met to initiate stages 1-4.

[3] The sum of the rolling six-month average for the selected gages as a percentage of the long term six-month rolling average for the selected gages. Either this trigger or the drought monitor trigger in addition to the storage index trigger must be met to initiate stages 1-4.

- Critical flows will established (as part of Aquatics 04: IFIM) for each hydro electric development that prevent irreversible damage to aquatic communities, that provide a basic level of operability for downstream water intakes and that provide some basic level of water quality maintenance in stream reaches.

3.6 Hydro Project Maintenance and Emergency Protocol (Operations 06)

3.6.1 Study Purpose

Under some emergency, equipment failure, or maintenance situations, certain license conditions may be impractical to meet or may need to be suspended or modified to avoid taking unnecessary risks. The purpose of this study was to develop a protocol (called the Hydro Project Maintenance and Emergency Protocol-HPMEP) that defines the most likely situations of this type, identifies the potentially impacted license conditions and outlines the general approach that the Licensee will take to mitigate the impacts to Project-related resources and to communicate with the resource agencies and affected parties.

3.6.2 Methodology

The study evaluated the most likely license requirements and evaluated the method of meeting the requirements. After consultation with resource agency personnel, threshold values for flow, lake levels, and other pertinent items were established and the HPMEP specifies in general terms what actions and communications the Licensee needs to take in response to the situation.

3.6.3 Key Findings

- The following situations were identified that could potentially impact license compliance. The HPMEP defines potentially impacted license conditions and mitigating actions.

  - Hydro Unit Maintenance
  - Maintenance of Minimum Flow Devices
  - Dam Safety Emergency
  - Voltage or Capacity Emergency
  - Lake Drawdown
  - High Flow Event

3.7 Recreation Flow Communication Study (Operations 07)

3.7.1 Study Purpose

This study reviewed the recreation communication needs as they pertain to the operation of the Catawba-Wateree project (FERC# 2232). A communication protocol was developed to provide communications to the general public addressing selected locations along the Catawba-Wateree project.

3.7.2 Methodology

Phase One:

- Conducted Regional Discussion groups with members of each of the Catawba-Wateree Relicensing Advisory Groups and State Relicensing Teams, and reviewed current flow information practices, defined the communication needs, and made recommendations to meet those communication interests.

Phase Two:

- Duke Power developed an efficient, effective and appropriate communication protocol to provide public access to flow release information.

Phase Three:

- Tested communications protocol and reviewed with stakeholder groups.

3.7.3 Key Findings

- The study identified the following communications desires:

  - A yearly calendar (Recreation Flow Calendar) of the scheduled flows from generation (including amount in cfs) agreed upon through the Catawba-Wateree relicensing process or other processes (Available on the Internet)
  - Provide a three-day projection of flows that are on the Recreation Flow Calendar including the amount (cfs) and the time (duration) of flow (Available on the Internet and IVR)
  - Provide a three-day projection of flows from generation on days / times not on the Recreation Calendar including the amount (cfs) and the time (duration) of flow during daylight hours (Available on the Internet and IVR)
  - An approximate schedule of when flows from generation will arrive and recede at four locations downstream from Wylie (Available on the Internet and IVR)
  - Information that would help the recreationist determine if there is enough water flow in the Great Falls bypass sections for recreational paddling activities (Internet and IVR)
  - Special messages to inform the recreationist of any river situation that might affect the safety and quality of the recreational experience (Internet and IVR)

- A link from the website to all applicable USGS gages so that real time river flow can be obtained and historical patterns can be reviewed (Website)
- A graph showing annual minimum, maximum, and target elevations for each lake (Internet)
- Real time lake levels, the difference between full pond and current level, and whether the lake level is rising or falling as compared to the day prior (IVR)
- Graph and/or table showing lake levels for the current day, a 7-day and 3-month forecast, and a 7-day and 3-month history (Internet)
- Special messages to inform the recreationist of any lake situation that might affect the safety and quality of the recreational experience (Internet and IVR)

3.8 Wateree High Water Management Study (Operations 08)

3.8.1 Study Purpose

The study purpose was to review the management/operation of the Catawba-Wateree Project during periods of high intensity precipitation events, particularly the Lower Catawba, identify high-water concerns and evaluate alternatives and address the frequency and degree that Lake Wateree reservoir elevations rise above full reservoir elevation 225.5 ft msl.

3.8.2 Methodology

The study was comprised of three phases. The first phase reviewed historical lake levels and determined the frequency of Lake Wateree reservoir levels above elevation 225.5 ft msl using existing Duke lake elevation data processed in the Operations 02 study. The second phase was an inventory and prioritization of high-water concerns, including where they occur. This inventory included the distribution of written surveys by members of the Wateree Homeowners Association (WHOA). Recent topography was used to estimate the length of roadway below certain variable threshold elevations. The third phase was a review of operation and physical changes that could be implemented at the Wateree project. Water management through out the system is hydraulically and operationally linked, therefore, it was necessary to use an analytical tool to analyze the impact of various operational and physical alternatives associated with analyzing lake levels at Wateree. The study used existing hydrologic and hydraulic computer models and spreadsheets to analyze the complex interaction between inflows, outflows, and storage, for various alternatives. The scope of the study included analysis of the impacts to the downstream river corridor if physical or operational modifications to the existing structures are made.

3.8.3 Key Findings

- High Water Concerns Include:
    - Inundation of roads during high water restricting access

- Property damage (structures, docks, boats)
- Shoreline erosion
- Debris
- Septic tank damage

▪ Lake Wateree has never exceeded the flood easement of 10 vertical feet required on all property adjoining the lake. Since the construction of Cowan's Ford Dam in 1963, Lake Wateree has exceed full pond (100 feet) approximately 3% of the time, with a range of from 0 to 4 days per year. It has exceeded 103 feet less than one day per year on average.

▪ Operational changes (with the current physical configuration) including opening existing spill gates earlier and increased generating schedules will not significantly decrease high water levels because having a suitably accurate long-term forecast is not feasible.

▪ Approximately 18,400 feet of roadway is below elevation 104.5 feet and is subject to flooding during extreme high water events.

▪ Adding additional discharge capacity of 40,000 cfs at the Wateree spillway coupled with proactive operational actions in advance of storm events theoretically significantly lowers the peak elevation during high water events. For the event modeled, March 2003, the peak lake level at Wateree Dam was calculated to be approximately 4 feet lower, and the duration of days above 100 feet would be reduced from 6 to 2 days. Several options for providing additional discharge capacity were evaluated, developing advantages and disadvantages as well as estimated costs. The two central categories of options considered were increase generation capacity and increased spillway capacity.

4.0 Resource Assessment

4.1 Overall Condition of the Resource

The group of studies under the technical oversight of the Operations Resource Committee are linked by their nexus to Hydroelectric Station operations. All eight studies have some relation to water quantity issues. There are numerous secondary relationships between this group of studies and all resource areas (aquatics, recreation, SMP/terrestrial, cultural and water quality). Resource impacts for these areas are addressed directly in their respective Resource Committee Report. Specific findings about resource status linked to the Operations Studies are delineated in Section 4.2.

From the perspective of hydroelectric operations and water quantity, the key element in defining the resource condition is that available water quantity is finite. Studies to define historic lake levels, future water withdrawals and to model future operating scenarios provide valuable insight into water quantity issues. The Low Inflow and Hydro Project Maintenance and Emergency Protocols will help assure the stability of the water quantity resource long term.

4.2 Resource Problems, Causes, and Needs

4.2.1 Debris and Trash

A significant volume of debris enters the Catawba reservoirs and regulated river reaches. Both naturally occurring materials, woody debris, and manmade trash enters the reservoirs and river reaches and is transported through the Catawba basin, particularly during periods of high rainfall and high reservoir levels. Often, the debris accumulates in “rafts” of significant size. Woody debris, particularly near the shoreline is an important source of habitat for aquatic organisms. Manmade trash is a detriment to the resource. Impacts include negative aesthetic impacts and potential navigation hazards. In addition, plastic and metal containers can contain polluting chemicals.

4.2.2 Periods of Low Inflow

Water entering and moving within the Catawba-Wateree basin is finite resource, dependent on the hydrologic cycle. During sustained periods of low precipitation, water quantities are insufficient to meet all normal needs and uses. These needs include power generation, water supply, water quality and aquatic resources. The new Catawba-Wateree operating license will provide additional definition concerning how water quantities are utilized. Without appropriate planning, resource impacts will occur during periods of low inflow. The Low Inflow Protocol is needed to guide actions by water users during sustained low inflow periods.

4.2.3 Hydro Station Emergencies

Hydroelectric operations will be adjusted as need to support the requirements of the FERC license. Certain transient emergency occurrences can restrict the ability to comply with flow releases and other actions. A Hydro Project Maintenance and Emergency Protocol is needed to define appropriate actions and communication needs during these infrequent occurrences.

4.2.4 Informational Needs

Recreational use of the project reservoirs and regulated river reaches is an important resource. Communication of lake levels, flow release's and other special information would enhance this project resource. The planned communications program will provide information that is desired by recreationists and other stakeholders.

4.2.5 Wateree High Water

During periods of extremely high rainfall, levels in Lake Wateree can exceed full pond. These high water levels can result in damage to homeowner assets (i.e. buildings, landscaping, docks) and can block emergency egress along low-lying roads adjacent to Lake Wateree.

4.3 Assessment of Resource Improvement Options

4.3.1 Debris and Trash

Duke Power proposes to support an annual voluntary trash clean-up program on the project reservoirs. Duke's Lake Management will continue to remove select trash as part of the source reduction component of its mosquito control program.

Duke proposes to install a trash handling system at the Fishing Creek Development. Debris that accumulates at the powerhouse will be removed, segregated and disposed of properly. This represents a resource enhancement and will remove trash at an important location within the Catawba Project. Removal of debris at this location would significantly reduce quantities of debris downstream. The estimated installation cost of this system, planned for two of the five intakes is $200,000. Operations and maintenance of the removal system would be in addition to the initial expenditure.

4.3.2 Water Supply / Water Quantity

The Water Supply Study (Operations 04) results provide significant information including future projections for water withdrawals and returns within the Catawba-Wateree Basin to the year 2058. In addition to being available in the study report, this withdrawal and return data will be archived in a GIS database to include ownership information, physical descriptions, historical water use and future projections. This information has been transferred to the CHEOPS simulation model to assist in the evaluation of future operational scenarios.

4.3.3 Periods of Low Inflow

Duke desires to participate in a Low Inflow Protocol that defines actions to be taken by all water users during periods of low inflow. The goal of the protocol is the develop a balanced reduction in water use such that the burden resulting from reduced water supply is shared by all users of this resource, including natural resources such as aquatic habitat.

4.3.4 Hydro Project Emergency Situations

A protocol is needed to define the basic approach to be taken when license conditions can not be met due to some emergency, equipment failure and maintenance situations. The HPMEP will define the most likely situations where license conditions could not be met and the approach to be taken to mitigate the impact of this transient condition. The protocol would include requirements for consultation and communication.

4.3.5 Informational Needs

An information communication system will be tested and implemented by Duke to provide relevant information on flows and lake levels. This system will incorporate as many of the information desires delineated in the study report (see section 3.7.3) as practical. Information will be accessible via the internet and by phone.

4.3.6 Wateree High Water

Approximately 18,400 feet of roadway (13,200 feet paved & 5,300 feet unpaved) adjacent to Lake Wateree is below elevation 104.5 feet and is subject to flooding during extreme high water events. Physically increasing the elevation of all or a portion of these roads would provide increased assurance they were available to support emergency access and egress during flood events. The estimated for the materials cost to raise these roads is $ 1,840,000.

Adding additional discharge capacity at the Wateree Dam can mitigate the peak water surface elevations if advance actions are taken prior to high-flow events based on accurate forecasts. Adding spillway capacity that provides an additional 40,000 cfs of discharge can significantly reduce peak reservoir elevations and durations of peak reservoir levels for the high rainfall events analyzed. Options for providing this additional capacity include pneumatic gates (rubber dam) and conventional steel radial gates with an estimated cost of $10,000,000 and $21,800,000 respectively. Releasing this volume of water via a gate structure changes the flow regime downstream from what would have occurred with the current spillway configuration. These flows would have potential impacts on aquatic and terrestrial resource downstream of Lake Wateree.

4.4 Other Resource Opinions and Alternative Resource Improvement Options

4.4.1 Debris and Trash

Trash removal systems could be installed at additional hydroelectric development intakes. These systems effectiveness would be limited by the accumulation of trash at these specific locations. Approximate cost of trash removal systems is $200,000 per location. As noted in the study (Operations 03), adding a trash removal system at Fishing Creek aligns this capability with a key location that receives a significant quantity of floating debris and where removal of the debris benefits downstream locations through Lake Wateree.

A trash skimmer barge system is available commercially and has been utilized to remove trash on large southeastern reservoirs. It allows floating trash to be removed at locations accessible to the barge. Cost for this device is approximately $500,000 with an annual operations and maintenance cost of $300,000. In addition to cost, these barges have complex hydraulic systems and are subject to hydraulic fluid leaks. Additionally, these devices can only effectively cover a limited surface area of reservoir(s).

4.4.2 Water Withdrawal Fees

Currently these options are available:

1. Duke Power does not implement fees.
2. Duke Power reserves the right to implement fees in the future.
3. Duke Power begins phasing in fees on all new water withdrawals or water withdrawal expansions.
4. In conjunction with Option 3, determine constructive watershed enhancements that could be achieved with the fees collected.

4.4.3 Lake Wateree High Water

Additional spill capacity could be added at Wateree Dam. The cost would be comparable to what is discussed in section 4.3.3. The effectiveness of this option depends on taking proactive reservoir management actions prior to high water events based on accurate forecasts. Additional spill volume increases the likelihood of impacts to aquatic communities, shoreline and terrestrial ecology downstream.