TVA

Tennessee Valley Authority, 1101 Market Street, LP 5A, Chattanooga, Tennessee 37402-2801

August 22, 2008

10 CFR 52.80

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

In the Matter of)
Tennessee Valley Authority) Docket Numbers 52-014 and 52-015

BELLEFONTE COMBINED LICENSE APPLICATION – RESPONSE TO ENVIRONMENTAL REPORT REQUEST FOR ADDITIONAL INFORMATION – CORMIX-RELATED HYDROLOGY INFORMATION

References:

1. Letter from Mallecia Hood (NRC) to Ashok S. Bhatnaker (TVA), Request for Additional Information Regarding the Environmental Review of the Combined License Application for Bellefonte Nuclear Plant, Units 3 and 4, dated July 11, 2008 [ML081840493].
2. Letter from Jack A. Bailey (TVA) to Document Control Desk (NRC), Bellefonte Combined License Application – Response To Request For Additional Information – Cormix Related Hydrology Information, dated August 11, 2008

This letter provides a corrected set of attachments to Reference 2. Electronic processing of the PDF document inadvertently truncated the attachments included with the response. This letter provides the complete set of attachments.

The Tennessee Valley Authority's (TVA) response to the Nuclear Regulatory Commission's (NRC) request for additional information (RAI) items included in the Reference 1 has not changed from the original response dated August 11, 2008

This letter provides the Tennessee Valley Authority's (TVA) response to five of the Nuclear Regulatory Commission's (NRC) request for additional information (RAI) items included in the Reference 1 letter.

The status of the NRC requests related to Hydrology is provided in the enclosure. The enclosure also provides the complete response to four of these requests and three subparts of an additional request, as well as identifying any associated changes that will be made in a future revision of the BLN application.

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NRO

As discussed with the NRC's environmental project manager responsible for the review of the BLN ER, the data provided on the attached CD-ROM (Attachment 5.3-3(3)) is of a nature that it is not easily converted to PDF output files. Furthermore, it is TVA's understanding that converting the information to PDF output files would not serve the underlying purpose of this submittal; i.e., providing the raw, unprocessed data to enable the reviewers to independently validate the applicant's simulations and analyses. Those needing to review graphical representations of the data are directed to view the appropriate figures in Attachments 5.3-5A, 5.3-5B, and 5.3-5C of the enclosure to this letter.

If you should have any questions, please contact Thomas Spink at 1101 Market Street, LP5A, Chattanooga, Tennessee 37402-2801, by telephone at (423) 751-7062, or via email at tespink@tva.gov.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 22nd day of Aug, 2008.

Andrea L. Sterdis
Manager, New Nuclear Licensing and Industry Affairs
Nuclear Generation Development & Construction

Enclosure and Attachments:
See Page 3

Enclosure:

Responses to Environmental Report Requests for Additional Information – CORMIX-Related Hydrology Information

Attachments:

5.3-3(1)A. Flow Frequency Percentage for Flow Past the BLN. (Entire document)

5.3-3(1)B. Typical BLN Flow Rate Response During Reversal. (Entire document)

5.3-3(1)C. Reverse Flow Occurrence and Duration at the BLN (1978 - 2007). (Entire document)

5.3-3(1)D. Typical BLN Low Flow Rate Response During Reversal. (Entire document)

5.3-3(1)E. BLN Flow Rate Response (June 29 - 30, 2002), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)F. BLN Flow Rate Response (May 2 - 3, 1983), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)G. BLN Flow Rate Response (August 16 - 17, 1988), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)H. BLN Flow Rate Response (September 3 - 4, 1998), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)I. BLN Flow Rate Response (June 20 - 21, 2006), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)J. BLN Flow Rate Response (January 2 - 3, 2007), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)K. BLN Flow Rate Response (June 25 - 26, 2007), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)L. BLN Flow Rate Response (October 25 - 26, 2007), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)M. BLN ER Figure 2.3-5, Flow Frequency Percentage for Flow past the BLN, Rev. 1 (Entire document)

5.3-3(1)N. BLN ER Figure 2.3-6, Reverse Flow Occurrence and Duration at the BLN (1978-2007), Rev. 1. (Entire document)

5.3-3(3). Tennessee Valley Authority, CORMIX Input Files (run date 08-01-2008). (CD-ROM)

5.3-5A. Tennessee Valley Authority, ER Figure 5.3-3, 100% Effluent Flow through Both Diffusers – 7Q10 River Flow (39.2°F), Rev. 1. (Entire document)

5.3-5B. Tennessee Valley Authority, ER Figure 5.3-4, 100% Effluent Flow through Both Diffusers – 7Q10 River Flow (90°F), Rev. 1. (Entire document)

5.3-5C. Tennessee Valley Authority, ER Figure 5.3-5, 100% Effluent Flow through Both Diffusers – Maximum Reverse River Flow (39.2°F), Rev. 1. (Entire document)

cc (Enclosure and Attachments):
M. A. Hood, NRC/HQ

cc (w/o Enclosure and Attachments):
S.P. Frantz, Morgan Lewis
M.W. Gettler, FP&L
R.C. Grumbir, NuStart
P.S. Hastings, NuStart
P. Hinnenkamp, Entergy
R.H. Kitchen, PGN
M.C. Kray, NuStart
A.M. Monroe, SCE&G
C.R. Pierce, SNC
L. Reyes, NRC/RII
R.F. Smith-Kevern, DOE/HQ
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cc (w/o Enclosure and Attachments):

G.P. Arent, EQB 1A-WBN
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A. L. Sterdis, LP 5A-C
S. A. Vance, WT 6A-K
E. J. Vigluicci, WT 6A-K
EDMS, WT CA-K

RESPONSE TO ENVIRONMENTAL REPORT REQUESTS FOR ADDITIONAL INFORMATION

CORMIX-RELATED HYDROLOGY INFORMATION

This enclosure provides the status of the 22 requests for additional information (RAI) related to Hydrology and provides the BLN responses to four of these requests and three subparts to one request (RAI 5.3-3, Subparts 1, 2, and 3) specifically related to the CORMIX analyses.

Status of Requests for Additional Information Related to Hydrology

RAI Number	Date of TVA Response
• 2.3-1	August 4, 2008. (Reference 1)
• 2.3-2	August 4, 2008. (Reference 1)
• 2.3-3	August 8, 2008. (Reference 2)
• 2.3-4	August 8, 2008. (Reference 2)
• 2.3-5	August 4, 2008. (Reference 1)
• 3.3-1	August 4, 2008. (Reference 1)
• 3.6-1	August 4, 2008. (Reference 1)
• 3.6-2	August 4, 2008. (Reference 1)
• 5.2-1	August 4, 2008. (Reference 1)
• 5.2-2	August 8, 2008. (Reference 2)
• 5.2-3	August 4, 2008. (Reference 1)
• 5.2-4	August 8, 2008. (Reference 2)
• 5.2-5	This letter – see following pages.
• 5.3-1	August 4, 2008. (Reference 1)
• 5.3-2	This letter – see following pages.
• 5.3-3 (4)	August 8, 2008. (Reference 2)
• 5.3-3 (1), (2), (3)	This letter – see following pages.
• 5.3-4	August 8, 2008. (Reference 2)
• 5.3-5	This letter – see following pages.
• 5.3-6	August 8, 2008. (Reference 2)
• 5.3-7	August 8, 2008. (Reference 2)
• 5.3-8	This letter – see following pages.
• 6.6-1	August 4, 2008. (Reference 1)

References:

1. Letter from Jack A. Bailey (TVA) to NRC Document Control Desk, "Bellefonte Combined License Application – Response to Environmental Report Request for Additional Information – Hydrology," dated August 4, 2008.
2. Letter from Andrea L. Sterdis (TVA) to NRC Document Control Desk, "Bellefonte Combined License Application – Response to Environmental Report Request for Additional Information – Hydrology," dated August 8, 2008.

NRC Review of the BLN Environmental Report

NRC Environmental Category: HYDROLOGY

NRC RAI NUMBER: 5.2-5, 5.3-3(2), 5.3-3(3), 5.3-5, and 5.3-8

5.2-5: Provide a description of all nine CORMIX cases analyzed to understand the potential impact of discharge on the Tennessee River.

5.3-3: (2) If results of the flow reversal warrant them, provide revised descriptions of the CORMIX runs that characterize the operation of the diffusers.

(3) If additional CORMIX simulations are conducted, provide their input and output files.

5.3-5: (1) Review and revise Figures 5.3-3 through 5.3-11; for clarity, draw them all to scale or none to scale.

(2) For these figures, use a consistent unit convention (English or Metric).

5.3-8: Provide a referenceable, consistent, and complete discussion of the analysis and assumptions leading to the single pipe simulation (including the results of such simulation(s) appearing in the ER) for diffuser operation.

BLN RESPONSE:

Based on a discussion with the NRC reviewers on July 14, 2008 (Reference 1), it is TVA's understanding that the information requested by RAIs 5.2-5 and 5.3-3 has been fundamentally, but not fully, addressed to the reviewer's satisfaction by the BLN response to NRC Information Needs H-45B in the TVA letter dated June 12, 2008 (Reference 2). Consequently, a clarification to these RAIs was provided by the reviewer, requesting the following supplemental information:

5.2-5: *"During the discussion Charley confirmed that the RAI summary is correct and that we need the description and data associated with an improved or clarified definition of the three flow regimes that are key to understanding the reservoir response to the proposed discharge. We need the CORMIX input files and output summaries as described in RAI 5.3-3 item (3), and they need to be docketed in response to RAI 5.2-5 or 5.3-3 as these are related requests."*

5.3-3: *"The discussion of RAI 5.2-5 and 5.3-2 during the conference call are related to this RAI as well and that relationship is indicated in the conference call summary included in those portions of the table."*

The requested clarification is addressed as follows:

CORMIX software simulations were conducted on August 1, 2008, as depicted in the updated ER Tables 5.3-1 and 5.3-2 provided below. Eight CORMIX simulation cases were run for this new suite of simulations, including high river temperature and low river temperature conditions for 7Q10 downstream flow, reversing river flow, maximum reverse river flow, and maximum downstream flow. As noted in response to RAI 5.3-6 in the TVA letter dated August 8, 2008, (Reference 3), average river temperature cases were not considered in the new CORMIX simulations because it was determined that the results of such simulations would be bounded by the high and low river temperature cases, and no meaningful conclusions were drawn from previous simulation runs that assumed average river temperature.

The simulations show that the plume through the 120-foot diffuser simulations closely bounds the plumes for the smaller (75-foot and 45-foot) diffusers. Input files for the CORMIX simulations are provided electronically on CD-ROM as Attachment 5.3-3(3). The outputs for the CORMIX simulations are presented in the changes to Tables 5.3-1 and 5.3-2 provided on the following pages.

It is unlikely that only one diffuser would be placed in service during normal plant operation, but data is provided in the updated tables that supports this discharge. Cleaning and inspection of the diffusers would normally be performed during outages when only half of the discharge flow is present and one diffuser leg is in service.

The information provided in Table 5.3-2 for the reversing flow simulations meets the acceptance criteria (i.e., plume length is less than 10 times the river width); however, it could not be simulated due to the short occurrence of this transition flow. Consequently, figures are not provided for the reversing flows.

Also, the response to NRC Information Need H-45B also identified an inconsistency between the 14,450 gpm blowdown flow value for two cooling towers in ER Subsection 5.2.2.8 and the 15,828 gpm value presented throughout Chapter 5. Based on the confirmation of the accuracy of the 15,828 gpm value, the value in Subsection 5.2.2.8 was corrected to reflect this 15,828 gpm value.

References:

1. NRC Communication Summary, "Summary of Telecommunication with Tennessee Valley Authority to Discuss Clarification on Request for Additional Information (RAI) for Bellefonte Units 3 and 4." Contact: Mallecia Hood (DSER/NRO), dated July 28, 2008 [ML082070062].
2. Letter from Andrea L. Sterdis (TVA) to NRC Document Control Desk, "Nuclear Regulatory Commission (NRC) – Bellefonte Nuclear Plant (BLN) Response to NRC Information Needs Related to Hydrology," dated June 12, 2008 [ML081280468].
3. Letter from Andrea L. Sterdis (TVA) to NRC Document Control Desk, "Bellefonte Combined License Application – Response to Environmental Report Request for Additional Information – Hydrology," dated August 8, 2008.

This response is PLANT-SPECIFIC.

ASSOCIATED BLN COL APPLICATION TEXT CHANGES:

1. Change COLA Part 3, ER Chapter 5, Subsection 5.2.2.2.2, first paragraph, third sentence, as follows:

   A computer program, CORMIX2 (Version ~~4.3~~ 5.0), was used to simulate the thermal plume that is anticipated in the river by the discharge of the BLN cooling tower blowdown.

2. Change COLA Part 3, ER Chapter 5, Subsection 5.2.2.8, first paragraph, to update the ER changes provided in response to NRC Information Need H-45B in the June 12, 2008, TVA letter (Reference 2 above), as follows:

   An analysis of thermal plumes resulting from the BLN effluent discharges was done for ~~conditions of (1) low river temperature at maximum downstream flow, (2) mean river temperature at maximum downstream flow, (3) high river temperature at maximum downstream flow, (4) low river temperature at maximum reverse river flow, (5) mean~~

river temperature at maximum reverse river flow and (6) high river temperature at maximum reverse river flow (Subsection 5.3.1.2). these conditions:

- Low river temperature, 7Q10 downstream flow (Figure 5.3-3)
- High river temperature, 7Q10 downstream flow (Figure 5.3-4)
- Low river temperature, reversing river flow *
- High river temperature, reversing river flow *
- Low river temperature, maximum reverse river flow (Figure 5.3- 5)
- High river temperature, maximum reverse river flow *
- Low river temperature, maximum downstream flow *
- High river temperature, maximum downstream flow *

* No figures are provided for simulations without measureable plumes. In addition, no figures were provided for the transitional reversing river flow. The reversing condition is of such a short duration (less than 2 min.), that a fully developed plume could not be created.

The circulating water systems blowdown flow rate was assumed constant at approximately 14,450 15,828 gpm. However, a conservative rate of 16,000 gpm was used for the CORMIX2 runs. This 16,000 gpm flow rate represents the total of maximum blowdown, plus other miscellaneous effluents, from the new facility. For the maximum river flow, low river flow, and maximum reverse river flow case and the high, median, and low river temperatures, a A plume model was developed for each case to determine the plume characteristics. Summaries of the predicted plume analysis data are provided in Table 5.3-2, and additional information is presented in Subsection 5.3.2.1.

3. Change COLA Part 3, ER Chapter 5, Subsection 5.2.2.9, second paragraph, third sentence, as follows:

   Allowing for 430 375 ft. between the river bank and the first discharge port diffuser and adding the maximum cross-stream extent of 104 ft., less than 25 percent of the river width is impacted by the mixing zone and discharge structure. See Subsection 5.3.2 for further details regarding the thermal plumes mixing zone.

4. Change COLA Part 3, ER Chapter 5, Subsection 5.3.2.1, first paragraph, fourth sentence, as follows:

   The station discharge has been analyzed using CORMIX2, version 4.3 5.0 as discussed in the next paragraphs.

5. Change COLA Part 3, ER Chapter 5, Subsection 5.3.2.1, fourth paragraph, last sentence, as follows:

   The diffuser system consists of two diffuser sections with a combined a combined length of 120 ft. situated approximately 375 ft. from the right bank. Simulation runs for the 45 ft. and the 75 ft. diffusers were also made and were found to be bounded by the 120 ft. diffuser. Results of all simulations can be found in Table 5.3-2.

6. Change COLA Part 3, ER Chapter 5, Subsection 5.3.2.1, sixth and seven paragraph, as follows:

   - Low river temperature, 7Q10 downstream flow (Figure 5.3-3)
   - ~~Mean river temperature,7Q10 downstream flow (Figure 5.3-4)~~
   - High river temperature, 7Q10 downstream flow (Figure ~~5.3-5~~ 5.3-4)
   - Low river temperature, reversing river flow ~~(Figure 5.3-6)~~ *
   - ~~Mean river temperature , reversing river flow (Figure 5.3-7)~~
   - High river temperature, reversing river flow ~~(Figure 5.3-8)~~ *
   - Low river temperature, maximum reverse river flow (Figure ~~5.3-9~~ 5.3-5)
   - ~~Mean river temperature , maximum reverse river flow (Figure 5.3-10)~~
   - High river temperature, maximum reverse river flow ~~(Figure 5.3-11)~~ *
   - Low river temperature, maximum downstream flow *
   - High river temperature, maximum downstream flow *

   * No figures are provided for simulations without measureable plumes. In addition, no figures were provided for the transitional reversing river flow. The reversing condition is of such a short duration (less than 2 min.), that a fully developed plume could not be created.

   The effluent blowdown flow rate of 16,000 gpm was conservatively used for the CORMIX2 runs, the actual blowdown flow for two cooling towers is approximately 15,828 gpm.

   Summaries of the predicted plume analysis data are provided in Table 5.3-2. For the maximum delta-T conditions, low river temperature 7Q10 downstream flow, ~~low river temperature maximum reverse river flow,~~ the surface area within a 5-°F temperature isotherm is estimated to be ~~8384~~ 25,213 sq ft. These isotherms extend approximately 36 ft. from the discharge diffuser. The maximum width of the 5-°F isotherm is ~~about~~ approximately ~~235~~379 ft., or about ~~0.14~~ 23 percent of the width of the river, which is approximately 1640 ft. at normal reservoir pool condition (Reference 9)~~,~~. Therefore, ~~hence~~ the formation of a thermal barrier is precluded. During a low temperature discharge, the diffusion of the low temperature plume is bounded by the conditions as seen in the diffusion of a high temperature plume.

7. Change COLA Part 3, ER Chapter 5, by **replacing existing** Figure 5.3-3, Rev. 0, **with Figure 5.3-3, Rev. 1**, 100% Effluent Flow through Both Diffusers – 7Q10 River Flow (39.2°F), provided as Attachment 5.3-5A.

8. Change COLA Part 3, ER Chapter 5, by **replacing existing** Figure 5.3-4, Rev. 0, **with Figure 5.3-4, Rev. 1**, 100% Effluent Flow through Both Diffusers – 7Q10 River Flow (90°F), provided as Attachment 5.3-5B.

9. Change COLA Part 3, ER Chapter 5, by **replacing existing** Figure 5.3-5, Rev. 0, **with Figure 5.3-5, Rev. 1**, 100% Effluent Flow through Both Diffusers – Maximum Reverse River Flow (39.2°F), provided as Attachment 5.3-5C.

10. Change COLA Part 3, ER Chapter 5, by **deleting existing** Figure 5.3-6, Rev. 0 through Figure 5.3-11, Rev. 0.

11. Change COLA Part 3, ER Chapter 5, Section 5.3, Table 5.3-1, as follows:

TABLE 5.3-1

SUMMARY OF FACILITY DISCHARGE PLUME CASES ANALYZED

Case	Ambient River Temperature (°F)	Discharge Rate[a] (gpm)	Discharge Temperature[b] (°F)
High River Temperature	90	16,000	95
~~Mean River Temperature~~	~~68.5~~	~~16,000~~	~~95~~
Low River Temperature	39.2	16,000	95

a) Actual plant discharge rates vary; maximum flows are shown. As discussed in Subsection 5.3.2, this discharge flow represents the total of the maximum expected blowdown from Units 3 and 4.

b) The analysis was done using a temperature of 95-°F ~~temperature~~ for all discharges.

12. Change COLA Part 3, ER Chapter 5, Section 5.3, by **replacing** the existing Table 5.3-2 with the following table:

Table 5.3-2

SUMMARY OF THERMAL PLUME ANALYSIS

120-Ft. Diffuser, 100% Discharge Flow

		Maximum Downstream Flow		Maximum Reverse Flow		7Q10 Flow		Reversing River Flow	
Case Studied	Isotherm Considered (°F)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)
High River Temperature	5	0.00	120.01	0.00	120.01	132.38	141.80	219.72	491.08
Low River Temperature	5	0.98	119.88	8.66	119.03	133.07	378.94	22.74	125.85

75-Ft. Diffuser, ½ Discharge Flow

Case Studied	Isotherm Considered (°F)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)
High River Temperature	5	0.00	75.00	0.00	75.00	91.99	92.19	132.94	255.97
Low River Temperature	5	0.85	74.93	4.95	74.61	76.05	195.08	24.74	81.04

45-Ft. Diffuser, ½ Discharge Flow

Case Studied	Isotherm Considered (°F)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)
High River Temperature	5	0.00	45.01	0.00	45.01	129.43	67.72	170.90	233.60
Low River Temperature	5	1.64	44.95	12.66	44.36	54.53	157.81	141.93	1122.70

TABLE 5.3-2 (Continued)

SUMMARY OF THERMAL PLUME ANALYSIS

75-Ft. Diffuser, 100% Discharge Flow

		Maximum Downstream Flow		Maximum Reverse Flow		7Q10 Flow		Reversing River Flow	
Case Studied	Isotherm Considered (ºF)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)
High River Temperature	5	0.00	75.00	0.00	75.00	138.25	102.95	223.20	442.78
Low River Temperature	5	0.89	74.93	19.88	73.56	98.95	335.24	294.69	2138.85

45-Ft. Diffuser, 100% Discharge Flow

Case Studied	Isotherm Considered (ºF)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)	Plume Length (ft.)	Max Plume Width (ft.)
High River Temperature	5	0.00	45.01	0.00	45.01	132.41	79.66	223.13	442.52
Low River Temperature	5	0.82	44.95	51.87	43.04	425.43	738.71	654.33	3046.00

ATTACHMENTS:

The following data file is provided on CD-ROM as Attachment 5.3-3 to this enclosure:

5.3-3(3). Tennessee Valley Authority, CORMIX Input Files (run date 08-01-2008). (CD-ROM)

The following figures are provided as Attachments 5.3-5A, 5.3-5B, and 5.3-5C to this enclosure:

5.3-5A. Tennessee Valley Authority, ER Figure 5.3-3, 100% Effluent Flow through Both Diffusers – 7Q10 River Flow (39.2°F), Rev. 1. (Entire document)

5.3-5B. Tennessee Valley Authority, ER Figure 5.3-4, 100% Effluent Flow through Both Diffusers – 7Q10 River Flow (90°F), Rev. 1. (Entire document)

5.3-5C. Tennessee Valley Authority, ER Figure 5.3-5, 100% Effluent Flow through Both Diffusers – Maximum Reverse River Flow (39.2°F), Rev. 1. (Entire document)

NRC Review of the BLN Environmental Report

NRC Environmental Category: HYDROLOGY

NRC RAI NUMBER: 5.3-2 and 5.3-3 (1)

5.3-2: (1) Provide the CORMIX output files for the ER Rev0 CORMIX analyses.

(2) Provide a description and data associated with definition of "reversing river flow", and "maximum reverse river flow", e.g., the river discharge values employed in the analyses.

5.3-3: (1) Provide data or an analysis of flow reversal at the Bellefonte site that better characterizes the flow reversal phenomena. Use the existing reservoir operation rules and any future anticipated changes to peaking strategy to evaluate these phenomena.

BLN RESPONSE:

Based on a discussion with the NRC reviewers on July 14, 2008 (Reference 1), a clarification to RAI 5.3-2 was provided by the reviewer, requesting the following supplemental information:

5.3-2: *PNNL explained that in response to this RAI they need the description and data associated with improved or clarified definition of the three flow regimes that are key to understanding the reservoir response to the proposed discharge. This request for CORMIX input files and output summaries is related to the request documented in RAI 5.3-3 item (3), and the response to these two RAIs can be tied together.*

The requested clarification is addressed as follows:

The CORMIX input files are provided on CD-ROM as Attachment 5.3-3(3) to this enclosure. The CORMIX output files (output summaries) are provided in the updated Table 5.3-1 and replacement Table 5.3-2 that are included in the response to RAI 5.3-3(3), which is included in this enclosure.

Original data were collected from the nearest long-term data source located on the Tennessee River, the U.S. Geological Survey stream flow gauge at South Pittsburg, Tennessee (Tennessee River mile [TRM] 418.1). Subsequent to the submission of the BLN COL application, TVA reassessed flow within the Guntersville Reservoir using TVA's ADYN flow instability model, based on hourly discharge records from Nickajack and Guntersville dams. ADYN is a one-dimensional, longitudinal, unsteady flow model that simulates time-varying flow rate and water surface elevation at multiple locations (nodes) along a river reach. It is a component of TVA's River Modeling System program and is used by TVA and several organizations to model hydrodynamic properties in river systems.

TVA's ADYN simulation reported hourly river flow rates from 1978 to 2007 past the BLN site (TRM 391.1). These hourly data points show both normal (towards Guntersville Dam) and reverse (towards Nickajack Dam) river flow rates past the BLN site. These data were analyzed in a Microsoft Excel® spreadsheet to determine maximum normal flow, maximum reverse flow, average daily flow, average monthly flow, flow rate frequency, frequency and duration of flow reversals, and assessment of "zero" flow durations. Graphical comparisons of dam discharges to flow past the BLN site were also analyzed and are discussed below.

Flow rate information at the BLN site for 1978 to 2007, based on the above analysis, is as follows:

1.	Maximum Normal Flow:	294,184 cfs	(May 8, 2003)
2.	Maximum Reverse Flow:	19,738 cfs	(August 16, 1988)
3.	Maximum Reverse Flow since 2004:	17,785 cfs	(June 21, 2006)
4.	Minimum Average Monthly Flow:	6985 cfs	(May 1988)
5.	Maximum Average Monthly Flow:	132,534 cfs	(February 1990)
6.	Percent of time Normal Flow > 0 cfs:	93.4 percent	
7.	Percent of time Reverse Flow > 0 cfs:	6.6 percent	

The percentage of time exceeding specific flow rates is shown in Attachment 5.3-3(1)A. Normal river flow direction was shown to occur approximately 93 percent of the time, with flow exceeding 10,000 cfs (normal) approximately 85 percent of the time. Reverse river flow direction was shown approximately 7 percent of the time, with flow exceeding 1000 cfs (reverse) approximately 6 percent of the time.

Typical flow reversals were assessed to determine the duration of low-flow conditions associated with the reversal phenomenon. As shown in Attachment 5.3-3(1)B (negative values are reverse flow), a typical flow reversal lasts less than 5 hours. From January 1, 1978 to December 31, 2007, 5025 reversals have occurred. The majority of the reversals (41 percent) lasted between 3 and 5 hours in duration (Attachment 5.3-3(1)C).

Lower flow conditions (less than 1000 cfs, normal or reverse) during the flow reversals are transient and last only a few minutes as the reversal is taking place (the flow value of 1000 cfs was used for ease of interpretation and as a conservative flow rate). The longest duration of lower flows occurs during the shorter duration (less than 1 hour) flow reversals. As depicted in Attachment 5.3-3(1)D (Attachment 5.3-3(1)B is limited to 1000 cfs), longer duration reverse flow occurrences result in lower flow conditions of only a few minutes as the reversal occurs, with short duration reverse flow occurrences (for less than 1000 cfs reverse flow) producing the maximum lower flow durations (approximately 1 hour at less than 1000 cfs flow, normal or reverse). Based on this analysis, very low flows (less than 100 cfs, normal or reverse), would occur only for several minutes during the flow reversal events with only transient zero flow occurrences. The minimum average daily flow depicted for the Tennessee River at the BLN is 23 cfs, which occurred on June 30, 2002. Although the average flow was 23 cfs on this date, hourly flows for June 30, 2002, ranged between 12,508 cfs normal flow and 15,534 reverse flow, with only momentary flows below 100 cfs as flow direction changed. This relationship is shown in Attachment 5.3-3(1)E, Julian date 180 on the graph.

Typical flow reversal scenarios were graphically compared to show the relationship of flow past the BLN site to the Nickajack and Guntersville Dam releases. Typical flow relationship curves are shown in Attachments 5.3-3(1)E through 5.3-3(1)L for various 2-day periods within the data set. Attachment 5.3-3(1)G depicts the flow relationship curves for the maximum flow reversal occurrence on August 16, 1988, and Attachment 5.3-3(1)I depicts the flow relationship curves for the maximum flow reversal occurrence since 2004 (change in reservoir operations) on June 21, 2006.

In general, flow past the BLN site seems to be most influenced by the releases from Nickajack Dam. Discharges from Guntersville Dam seem to have minimal effect on the flow rate past the BLN [Attachments 5.3-3(1)F and 5.3-3(1)H]. These curves show the flow reversals are generally a response to lowering or cessation of flow from Nickajack Dam and tend to show an oscillatory response during longer periods of zero dam discharges [Attachments 5.3-3(1)E and 5.3-3(1)I]. None of the oscillations produced extended periods of low flow, even during times where neither dam was discharging.

This response is PLANT-SPECIFIC.

ASSOCIATED BLN COL APPLICATION TEXT CHANGES:

1. Change COLA Part 3, ER Chapter 2, Subsection 2.3.1.2.2, first through third paragraphs, as follows:

   The estimated daily average flow rate of the Tennessee River (in the Guntersville Reservoir) at the BLN site is 38,850 cfs. The calculated 7Q10 flow is defined as the lowest average flow over a period of 7 consecutive days that occurs once every 10 years, on average. The conservative 7Q10 flow rate for the Tennessee River (in the Guntersville Reservoir) ~~at the South Pittsburg gauge station~~for the Nickajack Dam discharge was approximately ~~10,500~~ 5130 cfs. Average flows were significantly less than historical averages (drought of record) in 1986 for the Tennessee River (in the Guntersville Reservoir) as shown on Table 2.3-7. Low lake levels are documented for the Guntersville Reservoir in FSAR Subsection 2.4.11.3. Estimates of frequency and duration of water-supply shortages are presented in FSAR Subsection 2.4.11.

   Streamflow of the Tennessee River Basin has been altered since the 1930s by the construction of 49 dams either on the Tennessee River or on its major tributaries. Because a certain water depth must be maintained for river navigation, Guntersville Reservoir is one of the most stable TVA reservoirs, varying only 2 ft. between its normal minimum pool in winter and maximum pool in the summer. TVA no longer maintains a gauging station on the Tennessee River within the boundaries of the Guntersville Reservoir. Historical streamflow data were examined from two former gauging stations, which were located at South Pittsburg, Tennessee (USGS No. 03571850), ~~and~~ Guntersville, Alabama (USGS No. 03573500), and discharge flows from Nickajack and Guntersville Dams.

   Several statistics for flow rates from these two gauges and dam discharges are presented in this section to evaluate the water supply that is available for plant operations and to determine flood hazard characteristics of the site. These statistics include daily average streamflow, peak streamflow, and minimum daily streamflow. In addition, TVA records hourly flow discharges and predicts the discharge flows anticipated for the following two days at most of its dams (see Subsection 2.3.1.3).

2. Change COLA Part 3, ER Chapter 2, Subsection 2.3.1.2.2, last paragraph of the South Pittsburg subsection, and insert the **new** Nickajack Dam and TRM 391.06 subsections, as follows:

   The minimum daily streamflow at the South Pittsburg gauge station was 2900 cfs (approximately 3000 cfs at the BLN site) recorded on November 1 and 15, 1953, and was the result of flow-regulating activities at Chickamauga Lake. Table 2.3-9 presents the minimum daily streamflow observed on the Tennessee River at the South Pittsburg, Tennessee, gauge station from 1930 to 1987 (Reference 10). ~~The calculated 7Q10 flow rate for the Tennessee River at the South Pittsburg gauge station was approximately 10,500 cfs (FSAR Subsection 2.4.11). Table 2.3-10 presents low-flow volumes (in cfs) for 1, 7, and 30 days for selected return periods for the Tennessee River at South Pittsburg, Tennessee.~~

   Nickajack Dam

   Daily average flows, generated using discharge data recorded from 1976 to 2007 at Nickajack Dam, were examined and applied to the site as a conservative estimate for the 7Q10 flow rate. In application to the site, the Nickajack Dam flow releases are conservative in that they do not account for flow introduced to the Guntersville Reservoir from the Sequatchie River and several minor direct-flow watercourses. Therefore, the 7Q10 estimate is less than would be determined for a location downstream of the dam.

The minimum average daily flow is 0 cfs and has occurred 11 times over the period of record. On one occurrence in 2001, the zero flow spanned 2 days. The annual minimum daily flows for Nickajack Dam (1976 through 2007) are presented in Table 2.3-X1. The calculated 7Q10 flow rate for the Tennessee River at Nickajack Dam was approximately 5130 cfs (FSAR Subsection 2.4.11). Table 2.3-10 presents low-flow volumes (in cfs) for 7 and 30 days for selected return periods for the Tennessee River at Nickajack Dam.

TRM 391.06

Daily average flows, generated using discharge data from Nickajack Dam and Guntersville Dam and recorded from 1978 to the present, were determined for a location adjacent to the site at TRM 391.06. The mean monthly flows on the Tennessee River at TRM 391.06 (1976 through 2007) are presented in Table 2.3-X2. Table 2.3-X3 presents the annual minimum daily flows on the Tennessee River at TRM 391.06 (1978 through 2007). The minimum average daily flow is 23 cfs and occurred on June 30, 2002. Although the average flow was 23 cfs on this date, hourly flows for June 30, 2002, ranged between 12,508 cfs normal flow and 15,534 reverse-flow, with only momentary flows below 100 cfs as flow direction changed.

3. Change COLA Part 3, ER Chapter 2, Subsection 2.3.1.2.3, as follows:

Current flow patterns between the Nickajack and Guntersville dams can be reversed as part of TVA dam operations and flood control efforts. ~~No~~Reverse flow frequency and durations were analyzed based on hourly Nickajack and Guntersville release records from ~~1976 to 1995 (excluding the period 1993 – 1994 for which records were missing)~~ 1978 to 2007. Periods of normal flow (downstream) greater than 1 cfs occurred approximately ~~90~~93 percent of the time, while periods of reverse flow ~~less~~greater than 1 cfs occurred at the BLN site approximately ~~10~~7 percent of the time. Periods of zero-flow are transient in nature and usually occur during a flow reversal and last for a few minutes at most.

Figure 2.3-5 illustrates the flow frequency curve for the Guntersville Reservoir past the BLN. ~~However, t~~The majority of ~~zero or~~ reverse-flow occurrences do not last more than ~~about half a day (12 – 13 hrs.)~~ 4 hours with none exceeding 6 hours in duration, as shown in Figure 2.3-6. ~~Channel velocities~~Approximate channel flows at the BLN site average ~~0.9 fps~~51,125 cfs under normal winter flow conditions and ~~0.6 fps~~29,843 cfs under normal summer conditions. Based on the average stream flow past the BLN site and volume of the Guntersville Reservoir, the average retention time for water within the Guntersville Reservoir (Table 2.3-15) ranges from 11.51 days (normal pool storage volume) to 14.93 days (maximum pool storage volume) ~~(Table 2.3-15)~~.

4. Change COLA Part 3, ER Chapter 2, by **replacing existing** Figure 2.3-5, Rev. 0, **with Figure 2.3-5, Rev. 1**, Flow Frequency Percentage for Flow past the BLN, provided as Attachment 5.3-3(1)M.

5. Change COLA Part 3, ER Chapter 2, by **replacing existing** Figure 2.3-6, Rev. 0, **with Figure 2.3-6, Rev. 1**, Reverse Flow Occurrence and Duration at the BLN (1978-2007), provided as Attachment 5.3-3(1)N.

6. Change COLA Part 3, ER Chapter 2, Table 2.3-10, as follows:

Table 2.3-10
LOW-FLOW VALUES[(a)] FOR ~~1,~~ 7~~,~~ AND 30 DAYS FOR SELECTED RETURN PERIODS FOR THE TENNESSEE RIVER AT ~~SOUTH PITTSBURGH, TN~~NICKAJACK DAM

	Return Period (years)			
Duration (days)	5	10	100	~~1000~~
~~1~~	~~7,340~~	~~6,220~~	~~4,200~~	~~3,150~~
7	6,150~~12,100~~	5,130~~10,500~~	3,410~~7520~~	~~5870~~
30	8,630~~15,200~~	7,200~~13,000~~	4,740~~8,730~~	~~6370~~

a) Measured in cfs.

Notes:

Low flow based on statistical analysis of data for ~~USGS gauge on the Tennessee River at South Pittsburg, TN (USGS 03571850) from 1953 to 1987 and supplemented with interpolated data from USGS gauges on the Tennessee River at Chattanooga, TN (USGS 03568000) and Whitesburg, AL (USGS 03575500) from 1988 to 2005~~the daily average flows generated using discharge data from Nickajack Dam, recorded from 1976 to 2007.

7. Change COLA Part 3, ER Chapter 2, Table 2.3-32, to update values under the 7Q10 heading, as follows:

7Q10

5,130 ~~10,500~~	38,375 ~~78,545~~	3,315,605,397 ~~6,786,326,837~~	69,289,920	2.09 ~~1.02~~	71,021,664	2.14 ~~1.05~~	73,946,880	2.23 ~~1.09~~

8. Change COLA Part 3, ER Chapter 2, to update Table 2.3-15, as follows (gridlines shown for clarity; will be removed in final version):

Table 2.3-15

RESERVOIR RETENTION TIME CALCULATIONS FOR GUNTERSVILLE RESERVOIR

Storage Condition	Storage Volume (ac.-ft)	Storage Volume (ft^3)	Flow Condition	Flow Rate (cfs)	Flow Rate (ft^3/day)	Retention Time (days)
Normal Volume	886,000	3.86×10^{10}	Average	38,850	~~3.35×10^9~~ 3.36×10^9	11.50
			7Q10	5,130~~10,500~~	~~9.07×10^8~~ 4.43×10^8	87.07~~42.54~~
			Average Maximum	73,767~~83,502~~	~~7.21×10^9~~ 6.37×10^9	6.06~~5.35~~
			Average Minimum	17,889~~19,287~~	~~1.67×10^9~~ 1.55×10^9	24.97~~23.16~~
			Minimum	2900	2.51×10^8	154.03
Maximum Volume	1,149,000	5.01×10^{10}	Average	38,850	~~3.35×10^9~~ 3.36×10^9	14.91
			7Q10	5,130~~10,500~~	~~9.07×10^8~~ 4.43×10^8	87.07~~55.17~~
			Average Maximum	73,767~~83,502~~	~~7.21×10^9~~ 6.37×10^9	7.85~~6.94~~
			Average Minimum	17,889~~19,287~~	~~1.67×10^9~~ 1.55×10^9	32.38~~30.04~~
			Minimum	2900	2.51×10^8	199.75

Notes:

Conversion factors used: 1 day = 86,400 seconds; 1 ac.-ft =43,560 ft^3
Retention Time = Storage Volume / Flow Rate
Average Flow: Estimated average flow at BLN
7Q10: Lowest average flow over a seven consecutive day period that occurs once every 10 years, on average, conservatively estimated at Nickajack Dam.

Average Maximum:	Average monthly maximum streamflow from 1978 to 2007 at BLNflow at the USGS South Pittsburg, N, Gauge Station (see Table 2.3-7).
Average Minimum:	Average monthly minimum streamflow from 1978 to 2007 at BLNflow at the USGS South Pittsburg, N, Gauge Station (see Table 2.3-7).
Minimum:	Lowest flow rate recorded (that was not due to dam repair efforts) recorded at the USGS South Pittsburg, TN, Gauge Station (Table 2.3-9).

9. Change COLA Part 3, ER Chapter 2, by adding **new** Table 2.3-X1, as follows:

Table 2.3-X1

MINIMUM DAILY STREAMFLOW OBSERVED ON THE TENNESSEE RIVER AT NICKAJACK DAM, 1976 – 2007

Climatic Year[a]	Date	Minimum Daily Discharge, cfs
1976	5/1/1976	8471
1977	8/21/1977	11529
1978	11/5/1978	7983
1979	2/28/1980	8429
1980	3/28/1981	5521
1981	5/17/1981	1267
1982	4/23/1982	4321
1983	10/22/1983	5804
1984	3/31/1985	6196
1985	6/2/1985	779
1986	5/4/1986	1875
1987	10/25/1987	1350
1988	9/25/1988	0
1989	4/29/1989	2367
1990	4/14/1990	4733
1991	6/9/1991	7667
1992	4/18/1992	2583
1993	10/3/1993	4192
1994	6/5/1994	1300
1995	5/7/1995	2167
1996	5/5/1996	7300
1997	4/20/1997	4308
1998	10/25/1998	4846
1999	6/6/1999	421
2000	5/14/2000 & 1/7/2001	0
2001	4/28/2001, 4/29/2001, 5/26/2001 & 1/13/2002	0
2002	4/13/2002	609
2003	4/6/2003	0
2004	4/4/2004, 4/11/2004 & 4/17/2004	0
2005	8/7/2005	1295

a) Climatic Year – April 1 to March 31

10. Change COLA Part 3, ER Chapter 2, by adding **new** Table 2.3-X2, as follows:

Table 2.3-X2 (Sheet 1 of X)

MONTHLY MEAN STREAMFLOW OF THE TENNESSEE RIVER PAST THE BLN SITE

Tennessee River streamflow in cfs

Monthly Mean (calculation period from 1978 to 2007)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1978	75,693	51,650	44,673	21,733	28,311	26,369	25,373	34,143	28,315	17,406	17,059	35,502
1979	79,089	54,071	87,788	45,475	38,623	42,359	50,165	41,384	43,003	42,783	70,029	49,618
1980	59,951	38,034	86,421	52,097	36,182	29,402	31,829	26,599	23,762	19,596	22,166	20,145
1981	18,194	34,222	17,791	17,099	11,122	30,398	26,087	26,266	22,744	20,568	17,873	31,084
1982	80,178	88,999	57,135	19,458	14,101	20,817	27,418	36,452	30,720	28,832	35,924	83,720
1983	49,216	56,791	28,191	48,825	55,028	41,663	34,264	36,667	22,772	17,183	31,883	64,141
1984	44,025	43,438	47,998	32,664	99,055	31,106	38,755	42,719	36,323	24,103	29,574	32,040
1985	31,379	53,749	24,965	11,962	13,123	16,463	20,626	28,680	21,065	21,642	23,132	31,919
1986	19,580	31,666	24,323	7402	8271	9881	15,146	13,379	17,396	20,866	35,902	50,866
1987	45,958	51,528	53,146	26,553	24,370	22,327	28,216	26,799	18,510	21,698	17,941	15,956
1988	34,410	27,510	15,531	10,245	6985	11,082	12,759	14,627	15,165	14,392	25,435	23,504
1989	58,687	54,616	57,878	25,417	36,977	75,828	59,669	39,113	47,159	69,258	65,841	57,962
1990	78,213	132,534	84,567	19,379	36,324	29,784	29,045	37,170	26,846	27,740	31,148	66,713
1991	61,717	75,226	72,363	42,274	34,527	30,696	31,048	34,808	31,589	23,606	31,266	93,190
1992	58,610	31,564	44,256	13,438	18,135	34,640	34,176	29,229	33,097	34,137	53,656	77,872
1993	77,371	40,396	72,389	42,287	23,124	24,042	21,139	28,975	25,983	18,346	22,270	47,218
1994	67,685	108,570	95,014	120,055	24,685	31,609	40,138	42,466	40,989	43,807	39,022	42,371
1995	59,281	64,154	57,119	11,697	15,451	18,982	22,185	31,401	34,179	47,138	54,870	44,203
1996	79,742	85,315	55,933	26,663	30,587	39,945	25,441	36,778	34,796	39,148	49,394	74,119
1997	74,254	56,855	90,951	27,219	41,285	59,767	36,353	30,190	29,303	33,503	33,477	24,253
1998	59,252	78,020	55,084	79,209	53,296	48,659	26,577	30,506	25,205	21,447	21,669	32,223

Tennessee River streamflow in cfs

Monthly Mean (calculation period from 1978 to 2007)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1999	60,249	41,095	43,770	9116	25,546	17,357	43,626	28,129	21,238	21,421	24,727	22,807
2000	24,199	22,078	24,606	41,848	13,018	14,703	18,726	31,467	20,786	26,458	25,015	19,989
2001	26,542	46,304	32,015	12,526	9979	16,315	17,206	35,619	27,381	26,439	25,315	34,963
2002	58,220	30,883	42,584	23,377	26,485	16,117	18,904	24,385	24,610	26,352	51,269	73,480
2003	39,759	95,621	54,468	38,309	101,515	45,803	50,664	46,384	40,195	36,175	47,864	62,446
2004	52,907	61,427	41,698	10,996	10,761	32,970	31,400	29,998	67,499	42,534	65,451	111,653
2005	53,130	49,032	39,784	35,264	23,030	29,859	39,035	30,896	34,233	27,454	23,828	30,103
2006	44,164	35,325	19,504	23,099	18,057	16,864	18,423	25,768	26,788	29,878	53,375	26,840
2007	46,489	20,062	17,266	11,108	9808	18,802	16,109	25,281	10,329	12,032	11,079	9960
Mean of Monthly Flow	53,938	55,358	49,640	30,226	29,592	29,487	29,683	31,543	29,399	28,531	35,248	46,362
Maximum	80,178	132,534	95,014	120,055	101,515	75,828	59,669	46,384	67,499	69,258	70,029	111,653
Minimum	18,194	20,062	15,531	7402	6985	9881	12,759	13,379	10,329	12,032	11,079	9960

11. Change COLA Part 3, ER Chapter 2, by adding **new** Table 2.3-X3, as follows:

Table 2.3-X3

MINIMUM DAILY STREAMFLOW OBSERVED

ON THE TENNESSEE RIVER AT TVA TRM 391.06, 1978 – 2007

Climatic Year[a]	Date	Minimum Daily Discharge, cfs
1978	11/5/1978	9282
1979	6/24/1979	21,671
1980	9/27/1980	8847
1981	5/17/1981	3007
1982	4/23/1982	9191
1983	10/22/1983	6807
1984	11/18/1984	10,551
1985	6/2/1985	1946
1986	5/4/1986	2214
1987	9/5/1987	1305
1988	9/24/1988	1043
1989	4/29/1989	1973
1990	4/14/1990	6162
1991	6/9/1991	7682
1992	4/18/1992	4313
1993	7/4/1993	4811
1994	6/5/1994	1532
1995	5/7/1995	4059
1996	5/5/1996	8382
1997	4/20/1997	7183
1998	10/25/1998	5391
1999	4/18/1999	2628
2000	5/13/2000	1491
2001	4/28/2001	1286
2002	6/30/2002	23
2003	4/6/2003	2399
2004	5/18/2004	1602
2005	8/7/2005	5025
2006	3/31/2006	3087
2007	11/25/2007	1442

a) Climatic Year – April 1 to March 31

12. Change COLA Part 3, ER Chapter 5, Subsection 5.2.1.2, second paragraph, as follows:

The estimated daily average flow rate of the Tennessee River (in the Guntersville Reservoir) at the BLN site is 38,850 ~~cubic feet per second (~~cfs~~)~~. The calculated 7Q10 flow is defined as the lowest average flow over a period of 7 consecutive days~~period~~ that occurs once every 10 years, on average. The conservative 7Q10 flow rate for the Tennessee River (in the Guntersville Reservoir) ~~at the South Pittsburg gauge station~~for the Nickajack Dam discharge was approximately ~~10,500~~5130 cfs. Average flows were considerably less than historical averages (drought of record) in 1986 for the Tennessee River (in the Guntersville Reservoir) as shown on Table 2.3-7. Low lake levels are documented for the Guntersville Reservoir in the FSAR Subsection 2.4.11.3. Estimates of frequency and duration of water-supply shortages are presented in the FSAR Subsection 2.4.11. The data presented in Table 2.4.11-203 of the FSAR show that a shortage of water supply is not expected. Additional flow rates are discussed in Subsection 5.2.2.1.1. Further information regarding flow data in the Guntersville Reservoir can be found in Subsection 2.3.1.2.3.

13. Change COLA Part 3, ER Chapter 5, Subsection 5.2.1.7, second paragraph, as follows:

    The average withdrawal consumption is approximately 0.28 percent of the flow past the site, while at the low-flow rate (7Q10) of ~~10,500~~5130 cfs average withdrawal creates a consumption rate of approximately ~~1~~2 percent (See Table 2.3-32). Detailed information on water use for the area and the BLN is presented in Subsection 2.3.2 and Section 3.3.

14. Change COLA Part 3, ER Chapter 5, Subsection 5.2.2.1.1, third paragraph, third sentence, as follows:

    Using the average withdrawal rate of approximately 48,118 gpm (or 107 cfs for comparison purposes) for the two units and the monthly 7Q10 low-flow rate of ~~10,500~~5130 cfs, the net water lost from the river is approximately ~~1~~2 percent.

15. Change COLA Part 3, ER Chapter 5, Subsection 5.2.2.2.1, 5th paragraph, 1st sentence, as follows:

    Based on an estimated average daily stream flow of 38,850 cfs, blowdown as percentage of average flow is approximately 0.1 percent of the average flow and ~~0.33~~0.69 percent of the average 7Q10 flow calculated for the BLN site (two units).

16. Change COLA Part 3, ER Chapter 5, Subsection 5.2.2.2.2, second paragraph, as follows:

    (Changes to this paragraph are included in the response for ER RAI 5.2-4, provided in TVA's August 8, 2008 letter.)

17. Change COLA Part 3, ER Chapter 5, Subsection 5.3.1.1.1, third paragraph, second and third sentences, as follows:

    The 7Q10 flow rate for the Tennessee River (in the Guntersville Reservoir) ~~at the South Pittsburg gauge station~~based on the Nickajack Dam discharges was approximately ~~10,500~~5130 cfs~~.~~ (Subsection 5.2.1.2). Based on the maximum intake flow for both units in operation, the intake withdraws less than ~~5~~3 percent of the minimum low flow, as shown in FSAR Subsection 2.4.11.5.

18. Change COLA Part 3, ER Chapter 5, Subsection 5.3.1.2.1, second paragraph, first sentence, as follows:

    Based on review of literature and operational monitoring reports, Subsection 5.3.1.1.1 concludes that less than ~~5~~3 percent of the Guntersville Reservoir water is removed under both mean and 7Q10 low-flow conditions.

19. Change COLA Part 3, ER Chapter 2, Table 5.2-1, as follows (gridlines shown for clarity; will be removed in final version):

Table 5.2-1

COMPARISON OF GUNTERSVILLE RESERVOIR FLOWS AND BLN COOLING WATER FLOWS

Month[a]	Average Flow (cfs)	7Q10 Flow[a] (cfs)	Maximum Withdrawal for CT Makeup (2 Units) (cfs)	Maximum Evaporation Rate (2 Units) (cfs)	Percent of Average Flow Lost to Evaporation	Percent of 7Q10 Flow Lost to Evaporation	Blowdown Flow (cfs)	Blowdown as Percent of Average Flow	Blowdown as Percent of 7Q10 Flow
~~Oct-86~~ Jan-07	~~24,690~~ 46,489	~~10,500~~ 5,130	107.2	71.5	~~0.29~~ 0.15	~~0.68~~ 1.39	35.27	~~0.14~~ 0.08	~~0.33~~ 0.69
~~Nov-86~~ Feb-07	~~37,990~~ 20,062	~~10,500~~ 5,130	107.2	71.5	~~0.19~~ 0.36	~~0.68~~ 1.39	35.27	~~0.09~~ 0.18	~~0.33~~ 0.69
~~Dec-86~~ Mar-07	~~53,370~~ 17,266	~~10,500~~ 5,130	107.2	71.5	~~0.13~~ 0.41	~~0.68~~ 1.39	35.27	~~0.07~~ 0.20	~~0.33~~ 0.69
~~Jan-87~~ Apr-07	~~46,110~~ 11,108	~~10,500~~ 5,130	107.2	71.5	~~0.16~~ 0.64	~~0.68~~ 1.39	35.27	~~0.08~~ 0.32	~~0.33~~ 0.69
~~Feb-87~~ May-07	~~53,300~~ 9,808	~~10,500~~ 5,130	107.2	71.5	~~0.13~~ 0.73	~~0.68~~ 1.39	35.27	~~0.07~~ 0.36	~~0.33~~ 0.69
~~Mar-87~~ Jun-07	~~53,270~~ 18,802	~~10,500~~ 5,130	107.2	71.5	~~0.13~~ 0.38	~~0.68~~ 1.39	35.27	~~0.07~~ 0.19	~~0.33~~ 0.69
~~Apr-87~~ Jul-07	~~30,340~~ 16,109	~~10,500~~ 5,130	107.2	71.5	~~0.24~~ 0.44	~~0.68~~ 1.39	35.27	~~0.12~~ 0.22	~~0.33~~ 0.69
~~May-87~~ Aug-07	~~29,050~~ 25,281	~~10,500~~ 5,130	107.2	71.5	~~0.25~~ 0.28	~~0.68~~ 1.39	35.27	~~0.12~~ 0.14	~~0.33~~ 0.69
~~Jun-87~~ Sep-07	~~26,400~~ 10,329	~~10,500~~ 5,130	107.2	71.5	~~0.27~~ 0.69	~~0.68~~ 1.39	35.27	~~0.13~~ 0.34	~~0.33~~ 0.69
~~Jul-87~~ Oct-07	~~32,590~~ 12,032	~~10,500~~ 5,130	107.2	71.5	~~0.22~~ 0.59	~~0.68~~ 1.39	35.27	~~0.11~~ 0.29	~~0.33~~ 0.69
~~Aug-87~~ Nov-07	~~31,590~~ 11,079	~~10,500~~ 5,130	107.2	71.5	~~0.23~~ 0.65	~~0.68~~ 1.39	35.27	~~0.11~~ 0.32	~~0.33~~ 0.69
~~Sep-87~~ Dec-07	~~24,050~~ 9,960	~~10,500~~ 5,130	107.2	71.5	~~0.30~~ 0.72	~~0.68~~ 1.39	35.27	~~0.15~~ 0.35	~~0.33~~ 0.69

Notes: cfs - cubic feet per second

a) ~~The USGS South Pittsburg Gauge Station was discontinued in September 1987; the most recent 12 mo. average flow data are presented for October through December 1986 and January through September 1987.~~ The 7Q10 flow is conservatively derived from the Nickajack Dam discharges from 1976 to 2007.

ATTACHMENTS:

The following figures are provided as Attachments 5.3-3A through 5.3-3N to this enclosure:

5.3-3(1)A. Flow Frequency Percentage for Flow Past the BLN. (Entire document)

5.3-3(1)B. Typical BLN Flow Rate Response During Reversal. (Entire document)

5.3-3(1)C. Reverse Flow Occurrence and Duration at the BLN (1978 - 2007). (Entire document)

5.3-3(1)D. Typical BLN Low Flow Rate Response During Reversal. (Entire document)

5.3-3(1)E. BLN Flow Rate Response (June 29 - 30, 2002), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)F. BLN Flow Rate Response (May 2 - 3, 1983), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)G. BLN Flow Rate Response (August 16 - 17, 1988), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)H. BLN Flow Rate Response (September 3 - 4, 1998), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)I. BLN Flow Rate Response (June 20 - 21, 2006), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)J. BLN Flow Rate Response (January 2 - 3, 2007), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)K. BLN Flow Rate Response (June 25 - 26, 2007), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)L. BLN Flow Rate Response (October 25 - 26, 2007), Compared to Guntersville and Nickajack Dam Releases. (Entire document)

5.3-3(1)M. BLN ER Figure 2.3-5, Flow Frequency Percentage for Flow past the BLN, Rev. 1. (Entire document)

5.3-3(1)N. BLN ER Figure 2.3-6, Reverse Flow Occurrence and Duration at the BLN (1978-2007), Rev. 1. (Entire document)

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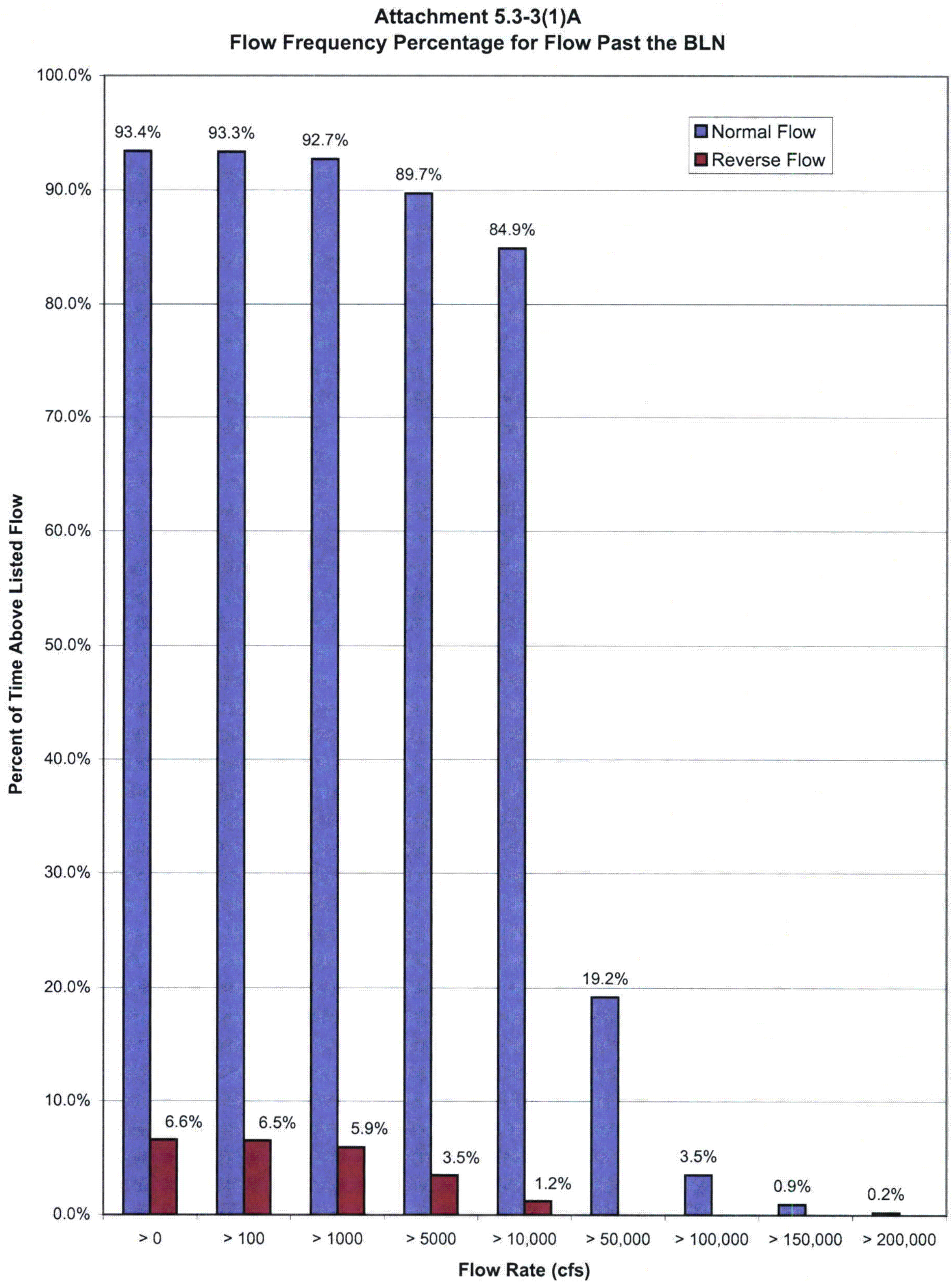
Flow Frequency Percentage for Flow Past the BLN (1 page)

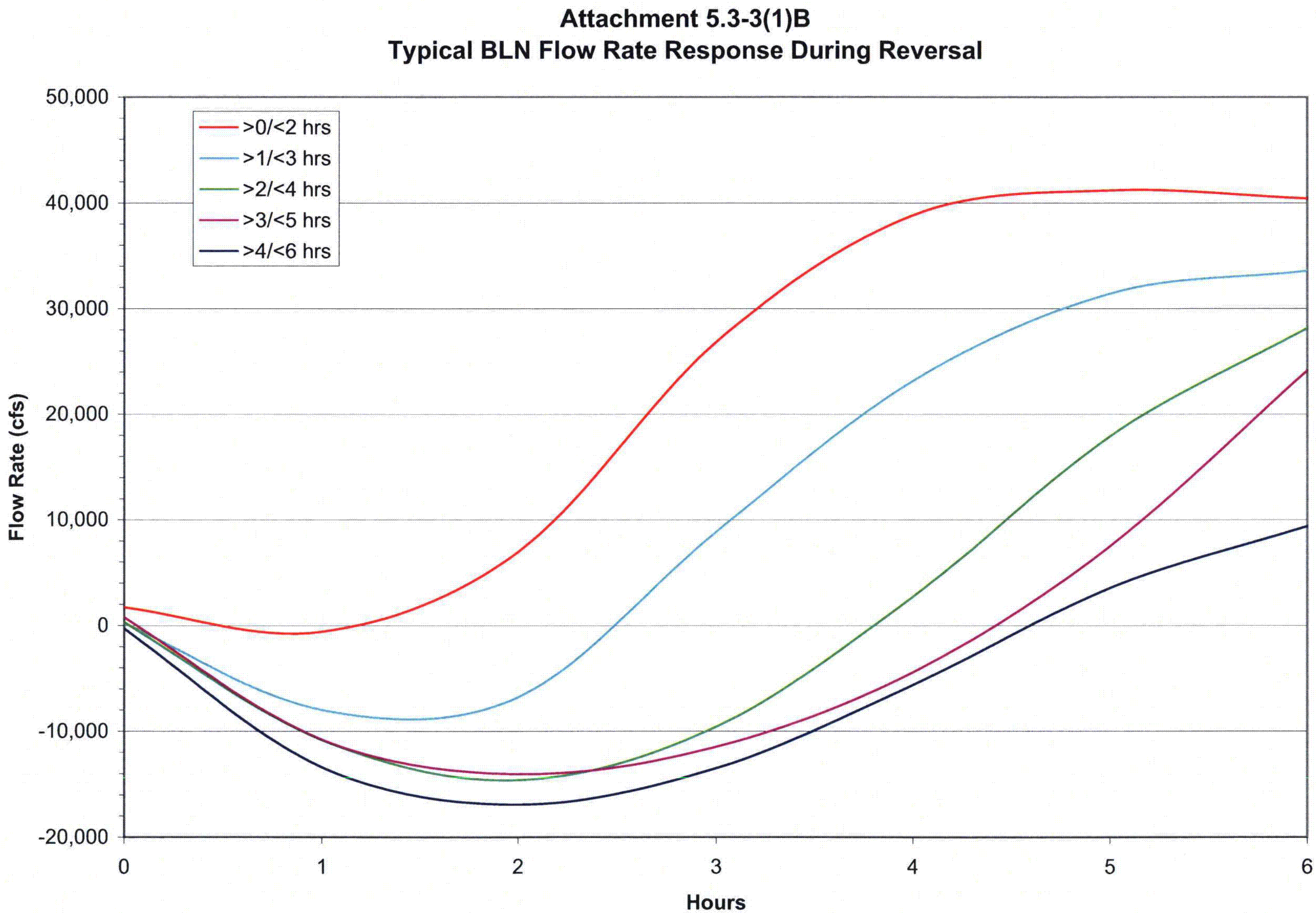
ATTACHMENT 5.3-3(1)A



Tennessee Valley Authority

Typical BLN Flow Rate Response During Reversal
(1 page)

ATTACHMENT 5.3-3(1)B



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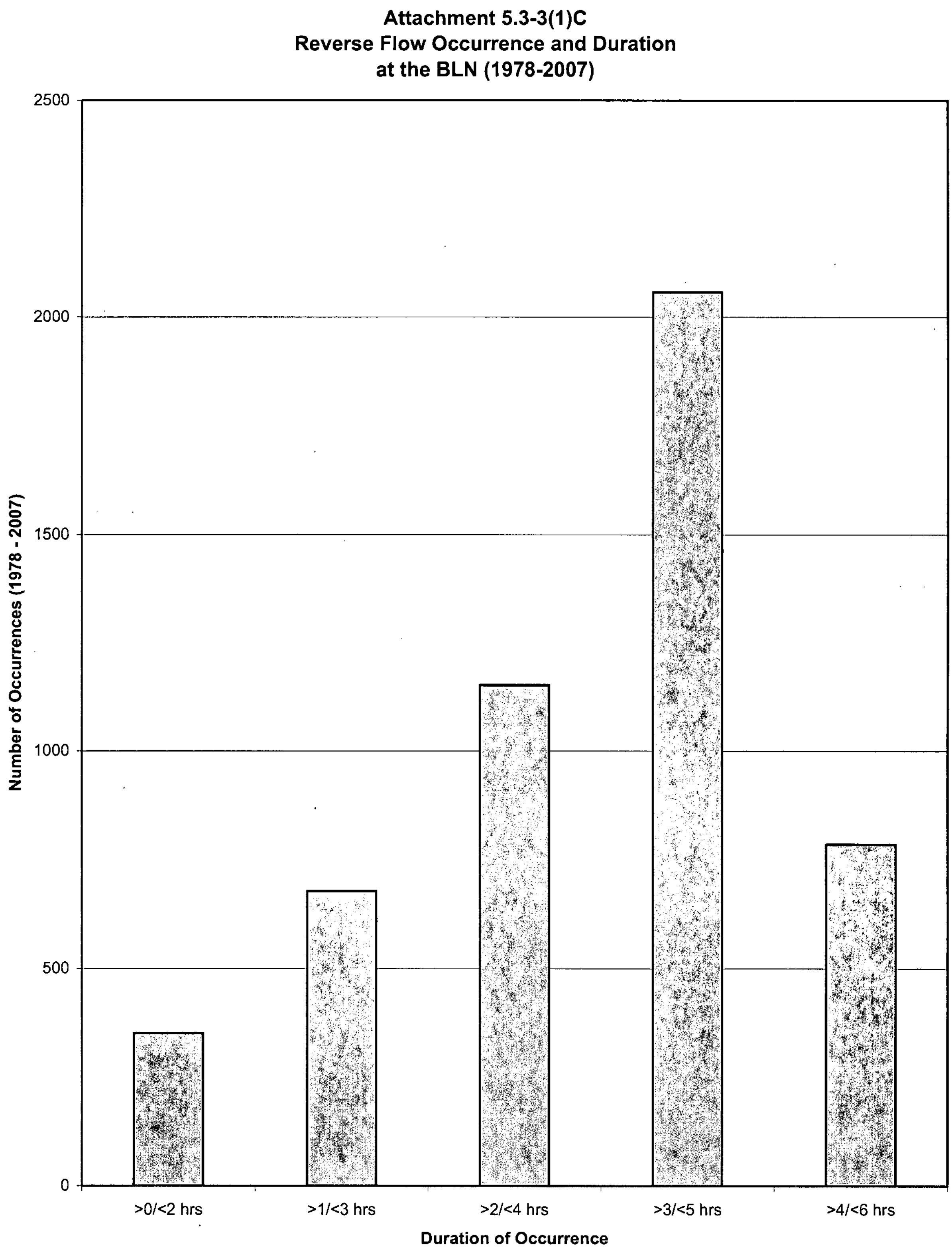
Reverse Flow Occurrence and Duration at the BLN (1978 - 2007)

(1 page)

ATTACHMENT 5.3-3(1)C

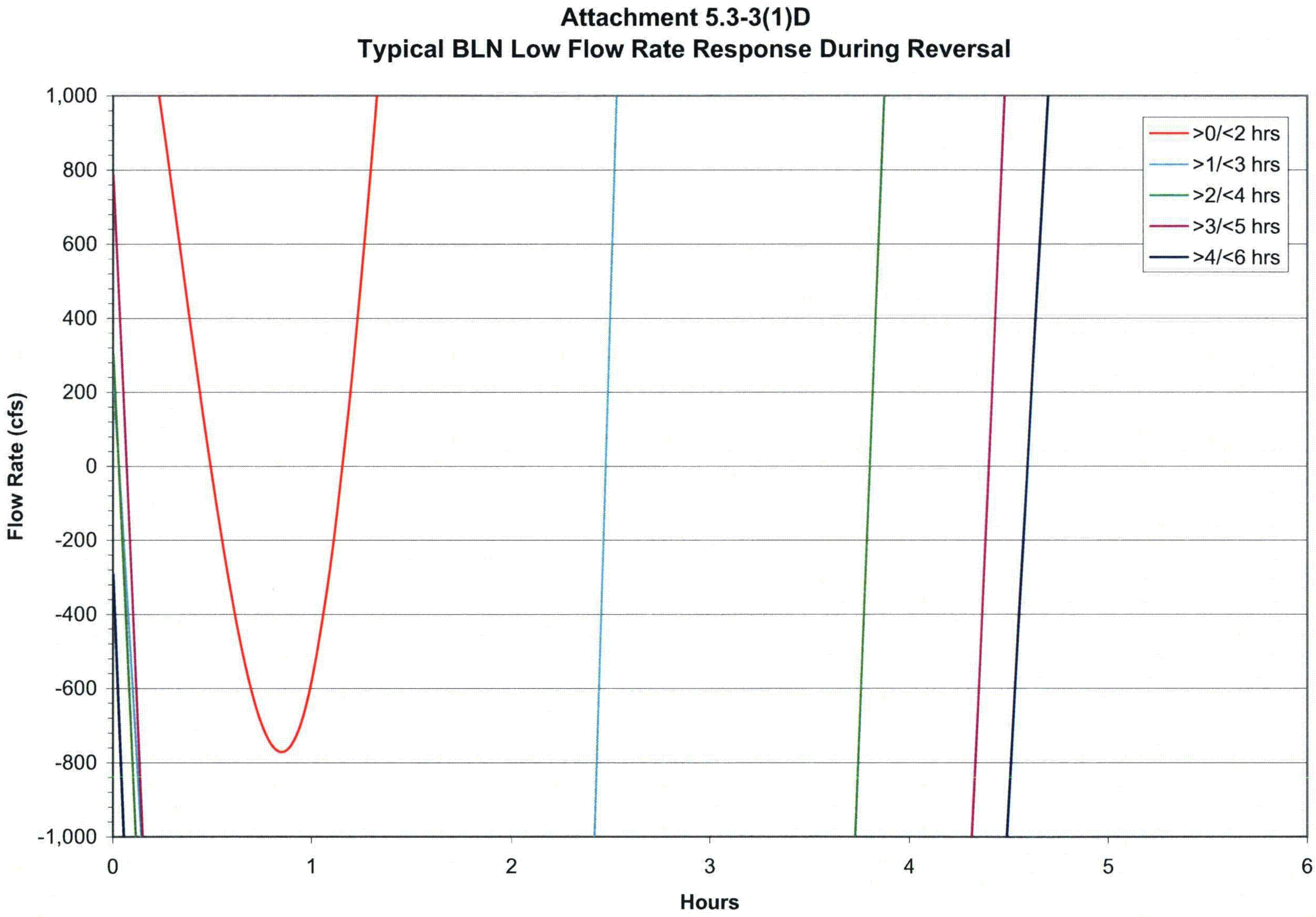


Tennessee Valley Authority

Typical BLN Low Flow Rate Response During Reversal

(1 page)

ATTACHMENT 5.3-3(1)D



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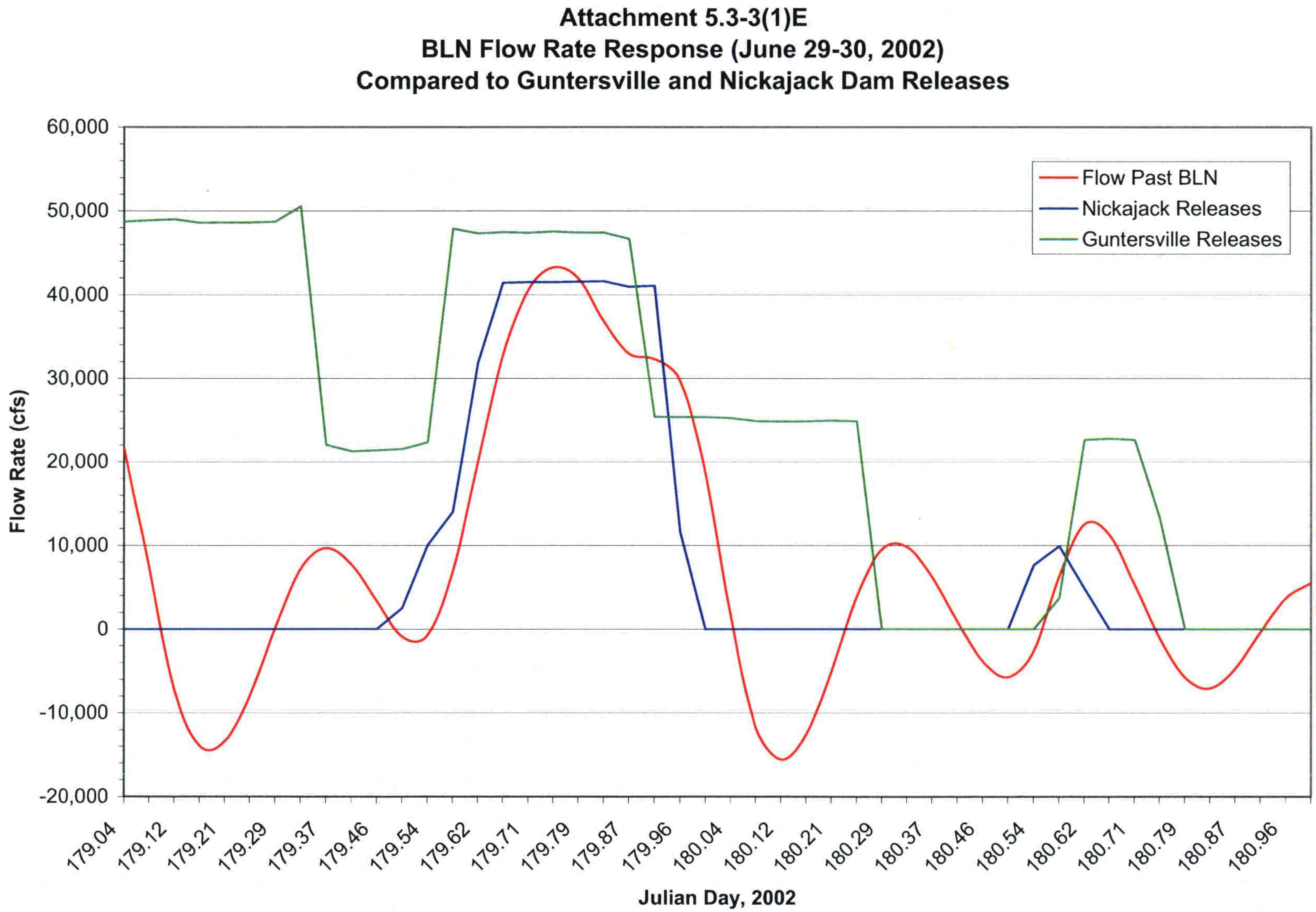
BLN Flow Rate Response (June 29 - 30, 2002) Compared to Guntersville and Nickajack Dam Releases

(1 page)

ATTACHMENT 5.3-3(1)E



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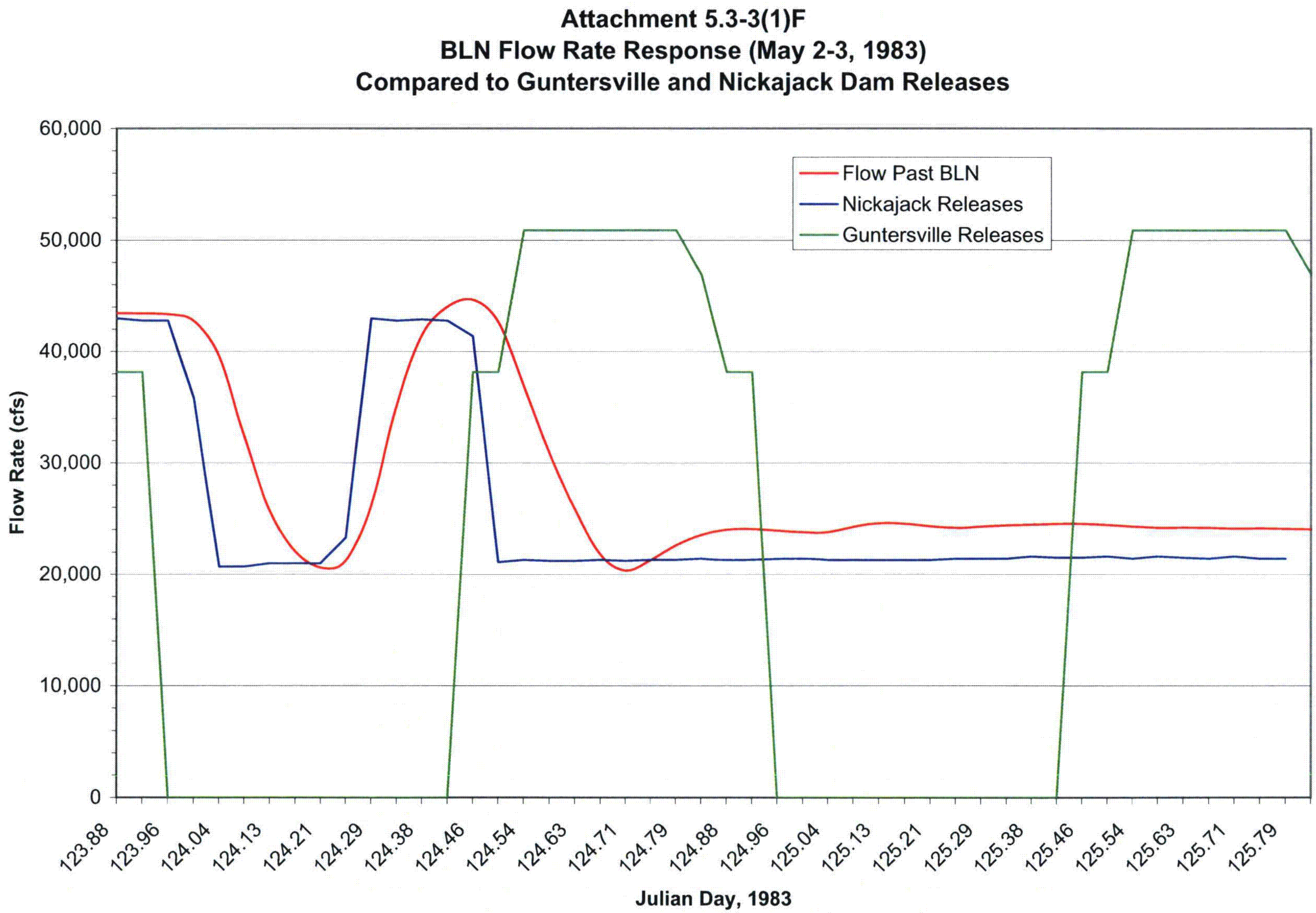
BLN Flow Rate Response (May 2 - 3, 1983) Compared to Guntersville and Nickajack Dam Releases (1 page)

ATTACHMENT 5.3-3(1)F



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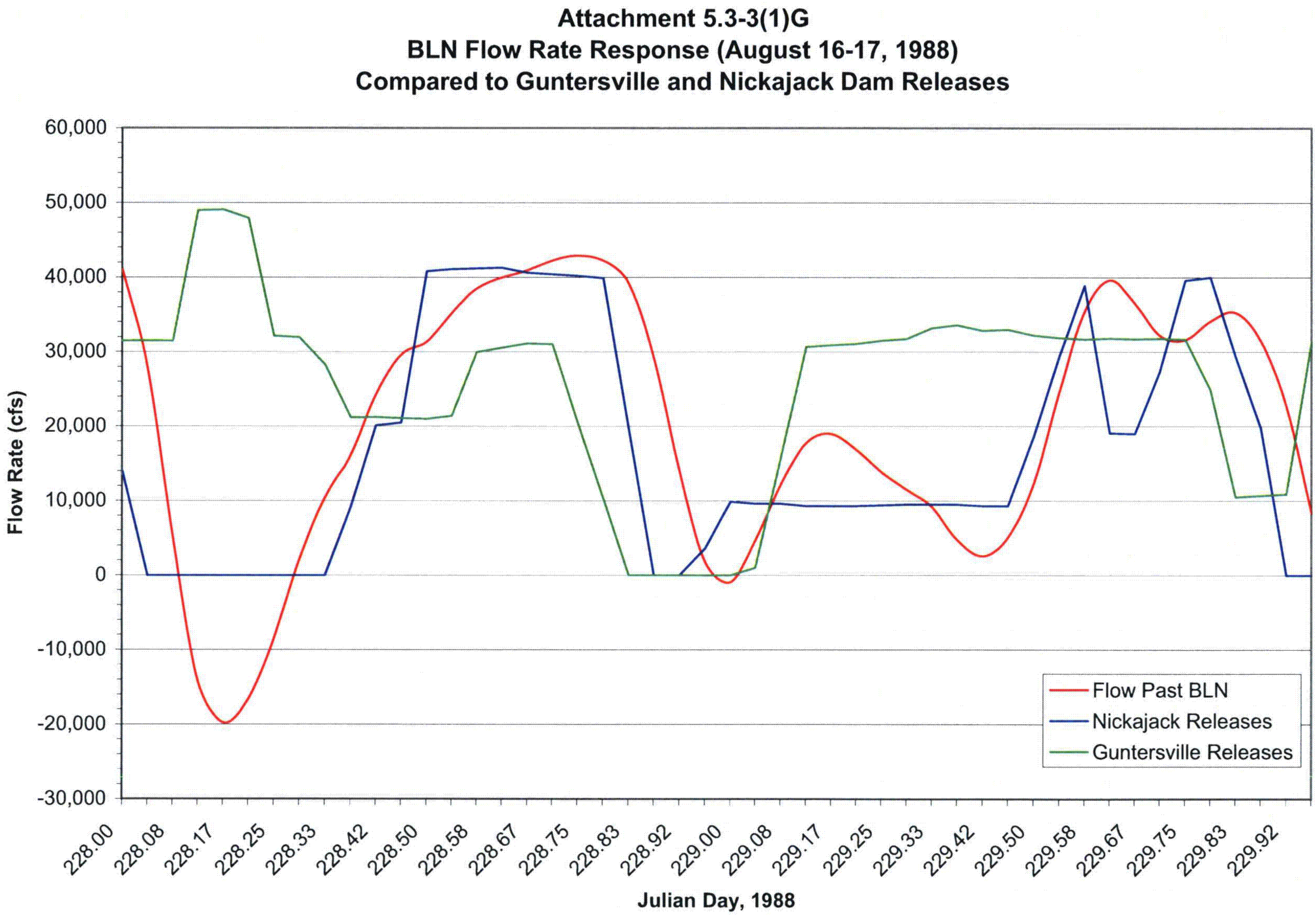
BLN Flow Rate Response (August 16 - 17, 1988) Compared to Guntersville and Nickajack Dam Releases (1 page)

ATTACHMENT 5.3-3(1)G



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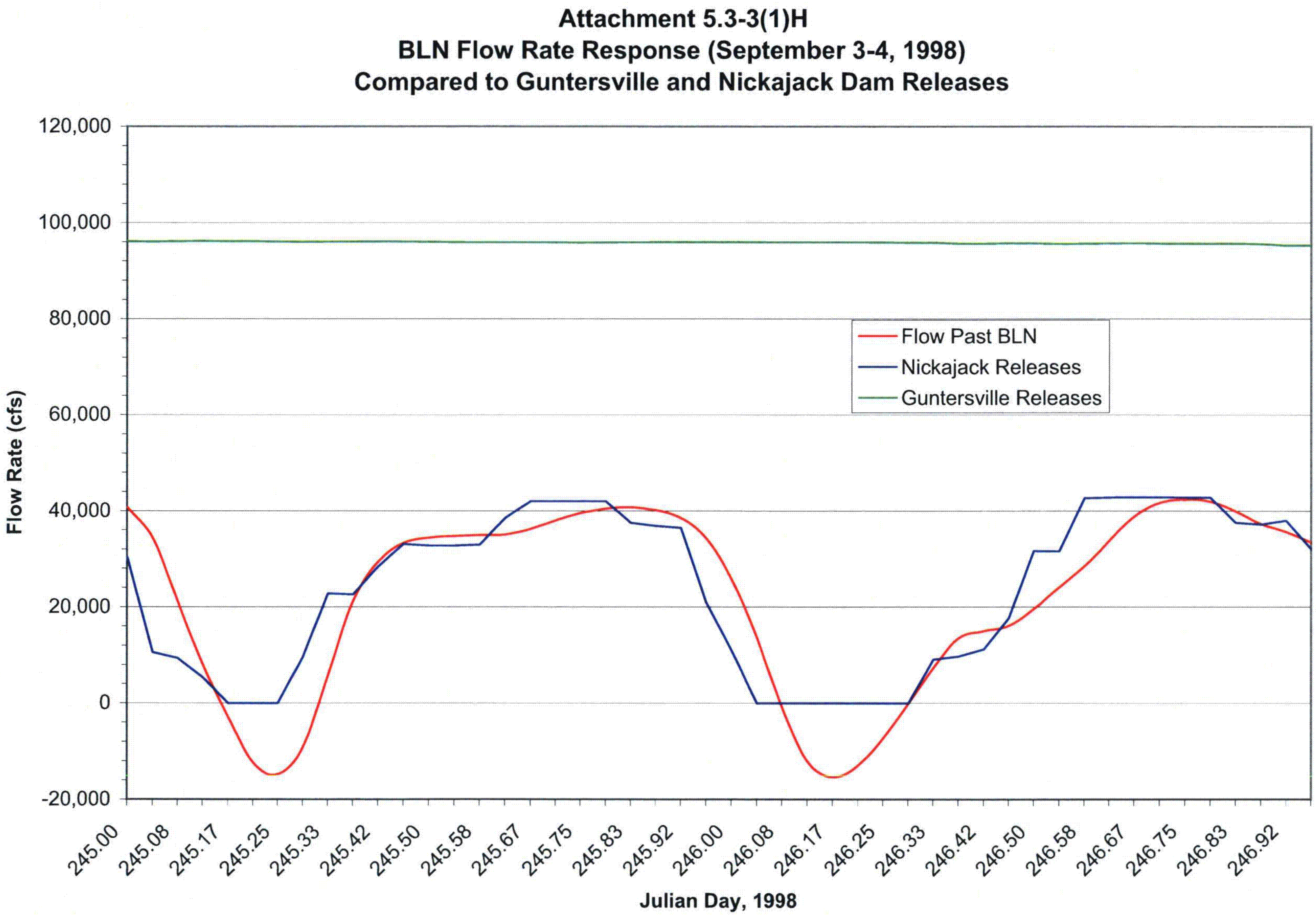
BLN Flow Rate Response (September 3 - 4, 1998)
Compared to
Guntersville and Nickajack Dam Releases
(1 page)

ATTACHMENT 5.3-3(1)H



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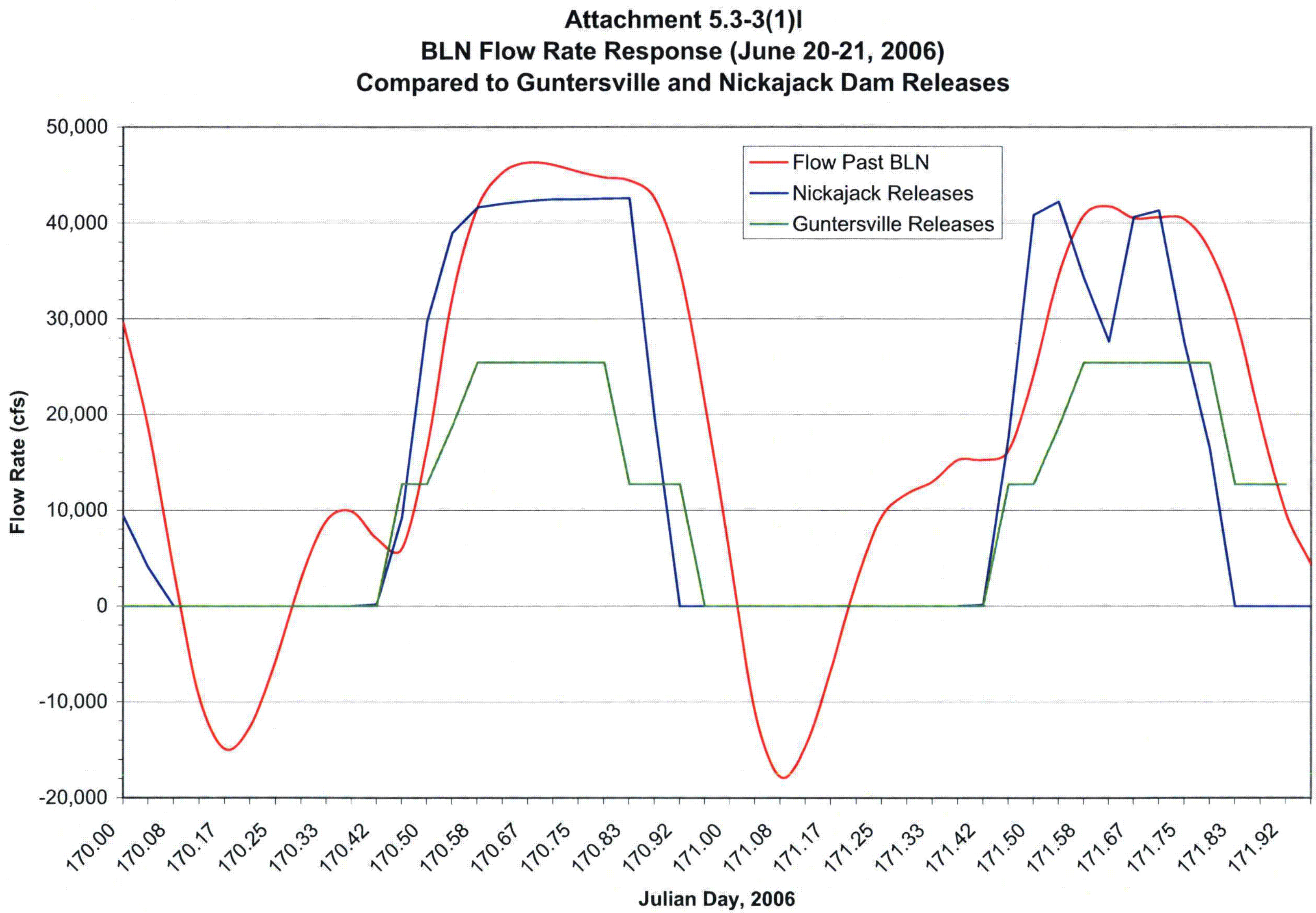
BLN Flow Rate Response (June 20 - 21, 2006) Compared to Guntersville and Nickajack Dam Releases (1 page)

ATTACHMENT 5.3-3(1)I



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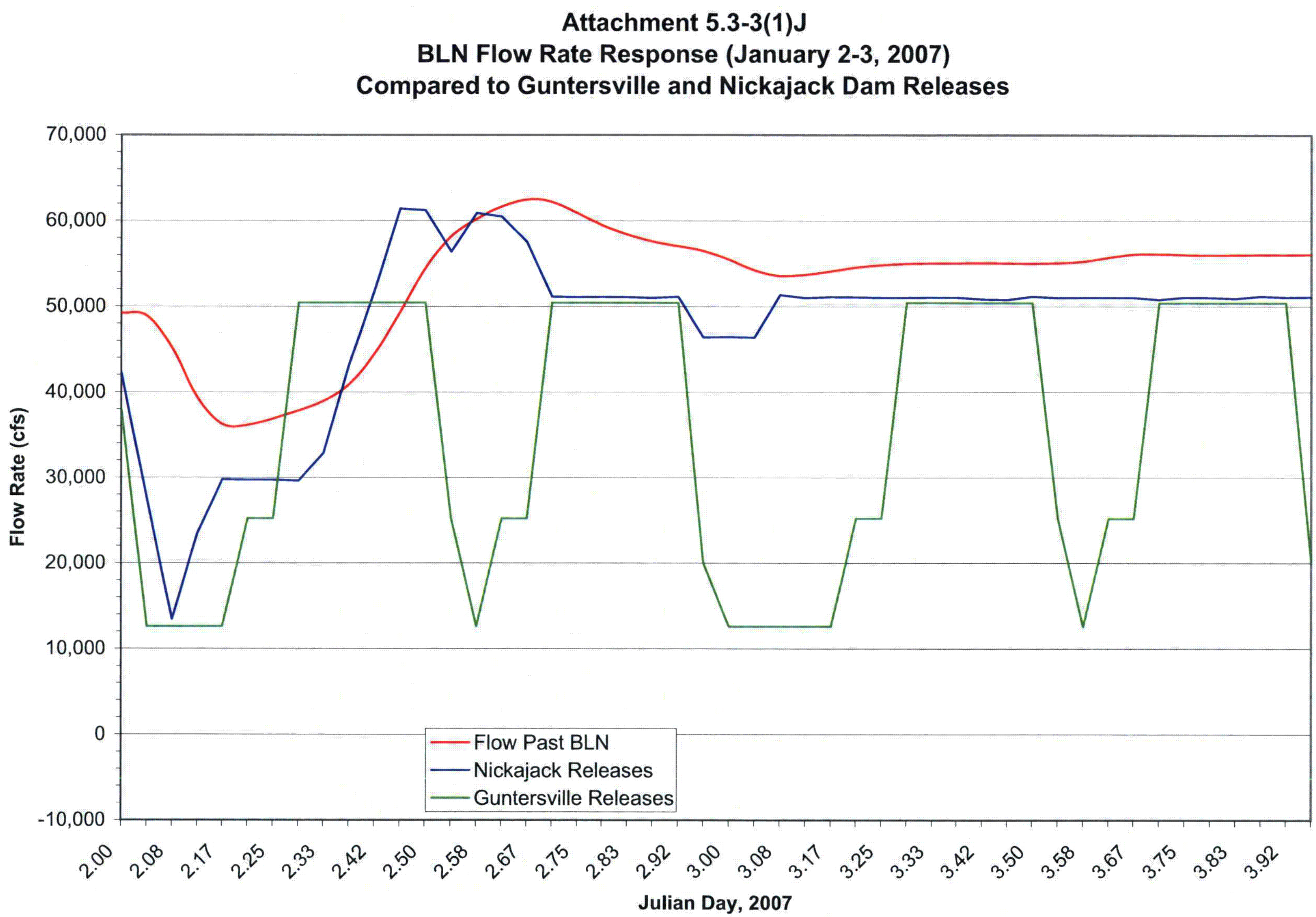
BLN Flow Rate Response (January 2 - 3, 2007) Compared to Guntersville and Nickajack Dam Releases (1 page)

ATTACHMENT 5.3-3(1)J



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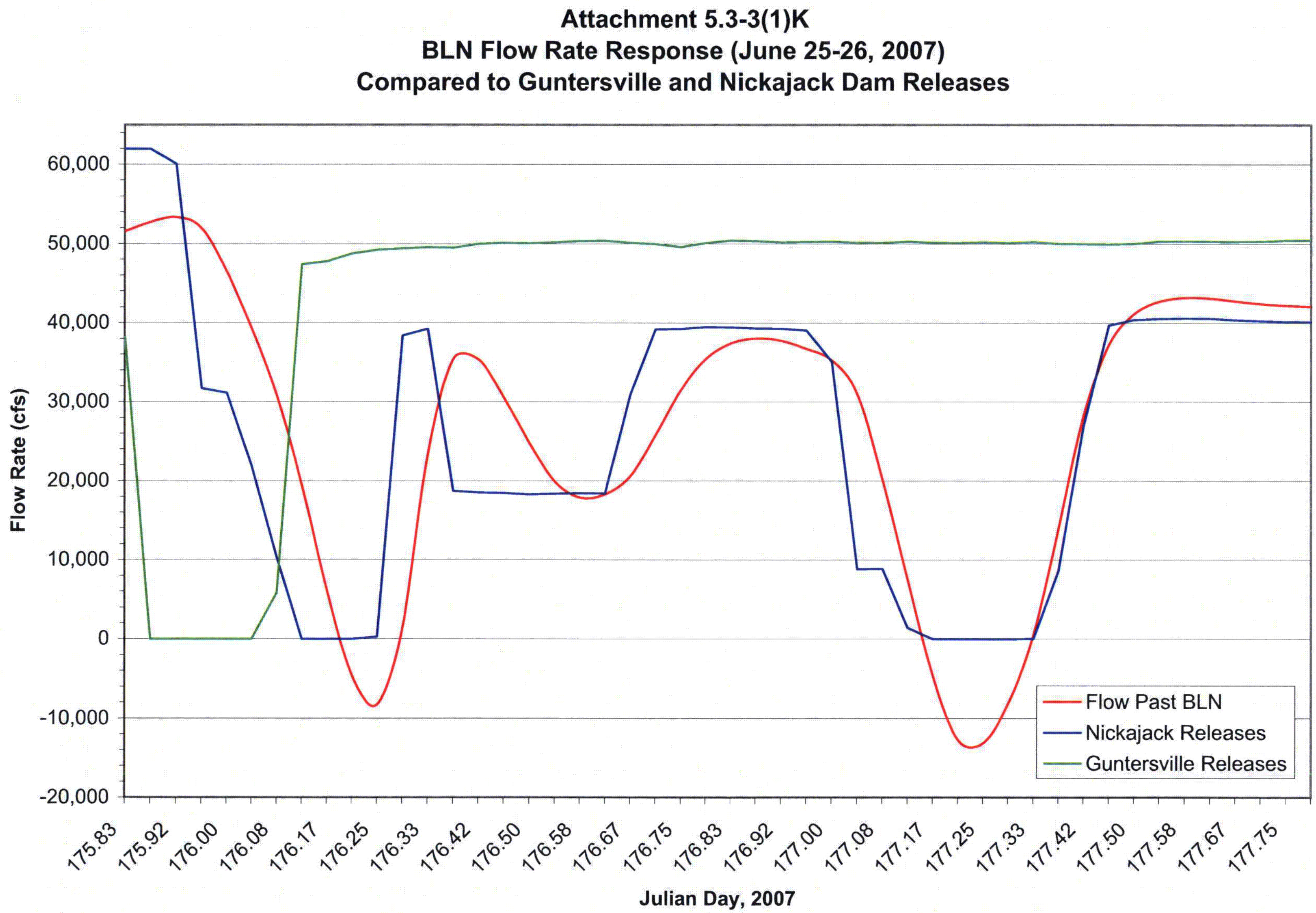
BLN Flow Rate Response (June 25 - 26, 2007)
Compared to
Guntersville and Nickajack Dam Releases
(1 page)

ATTACHMENT 5.3-3(1)K



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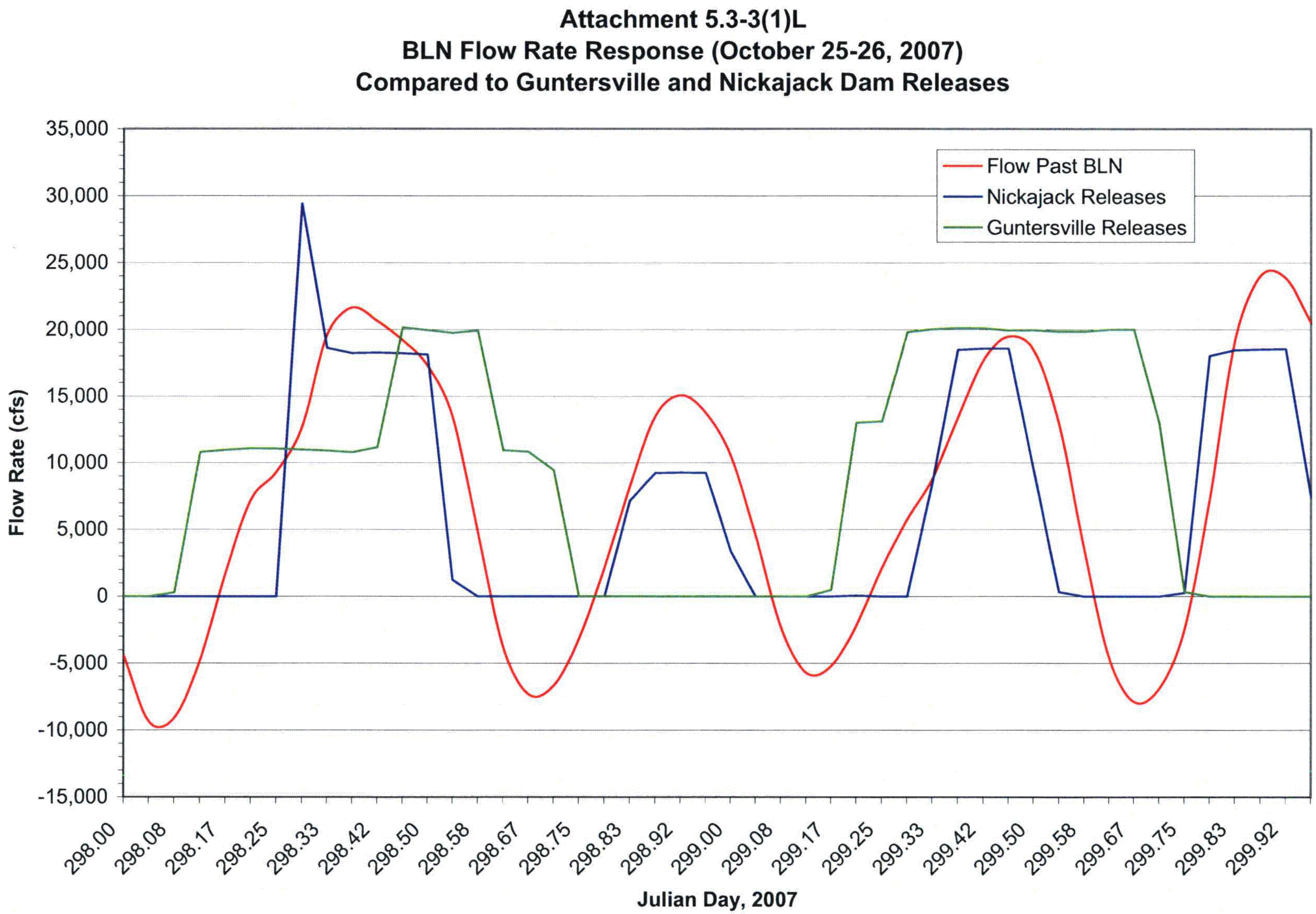
BLN Flow Rate Response (October 25 - 26, 2007)
Compared to
Guntersville and Nickajack Dam Releases
(1 page)

ATTACHMENT 5.3-3(1)L



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BLN ER Figure 2.3-5
Flow Frequency Percentage
for Flow past the BLN
(1 page)

Rev. 1

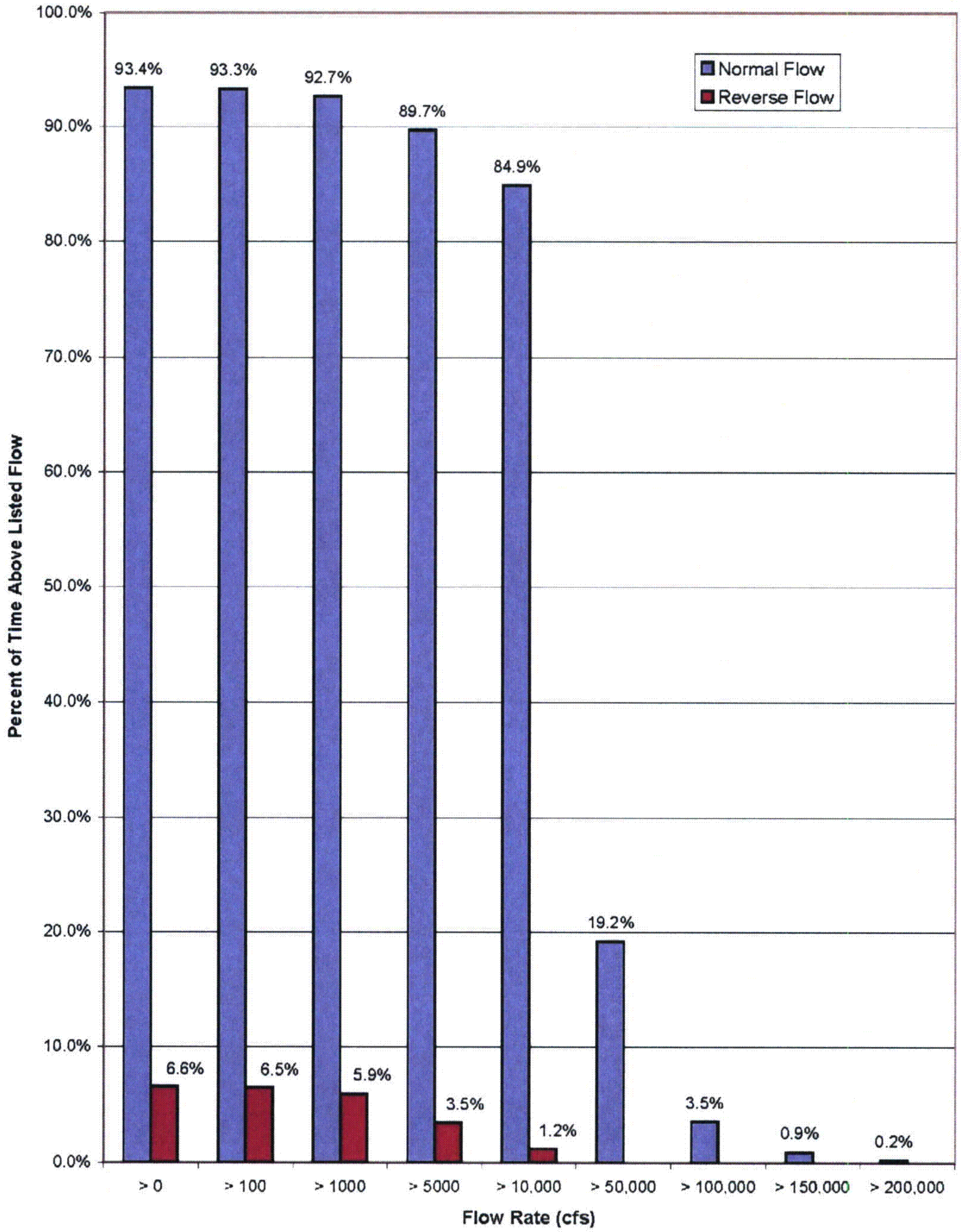

FIGURE 2.3-5
Flow Frequency Percentage for Flow past the BLN

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BLN ER Figure 2.3-6
Reverse Flow Occurrence and Duration at the BLN (1978 - 2007)
(1 page)

Rev. 1

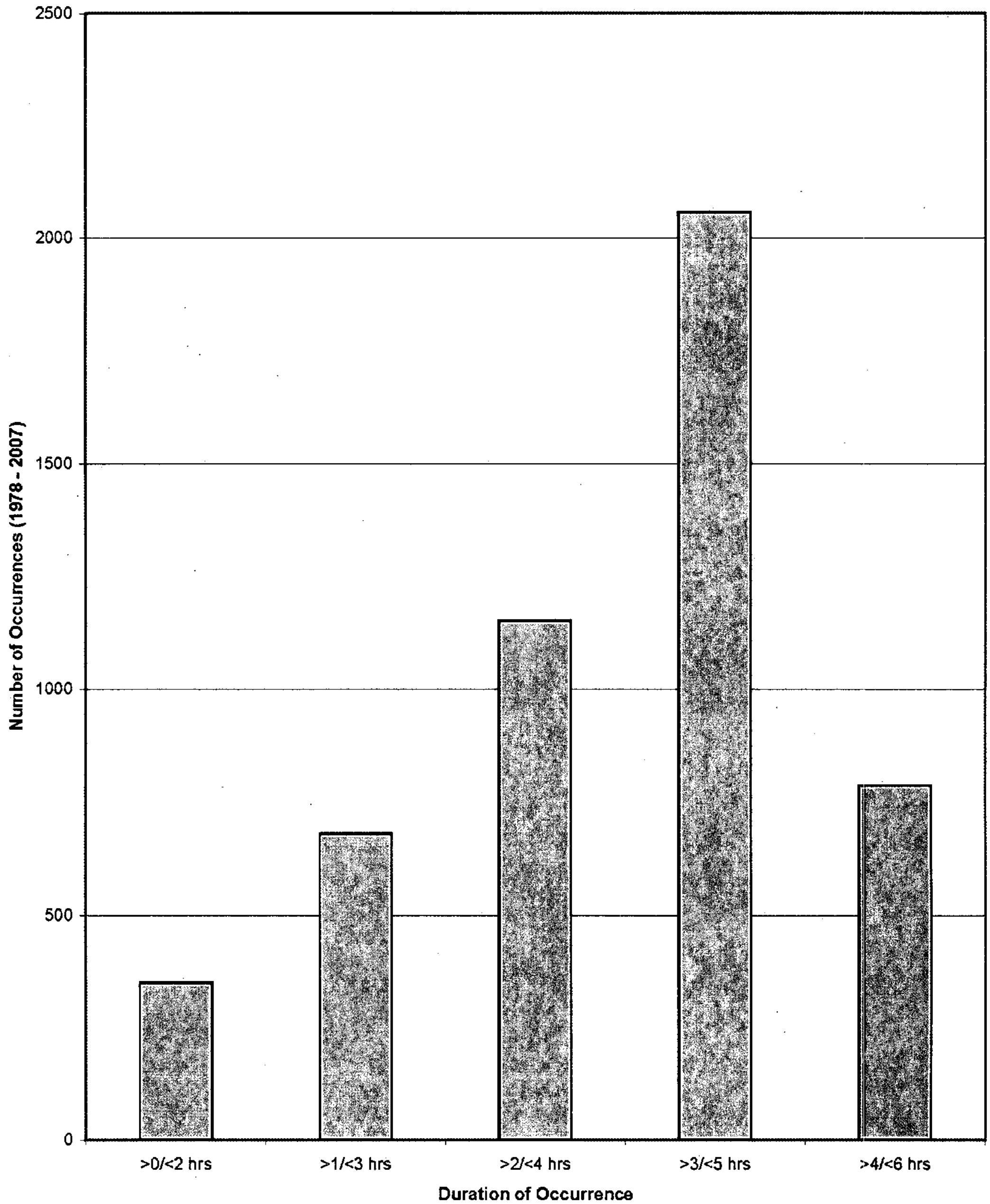

FIGURE 2.3-6
Reverse Flow Occurrence and Duration at the BLN (1978-2007)

ATTACHMENT 5.3-3(3)
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CORMIX Input Files
(CD-ROM, run date 08-01-2008)

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ER Figure 5.3-3
100% Effluent Flow through Both Diffusers
7Q10 River Flow (39.2°F)
(1 page)

Rev. 1

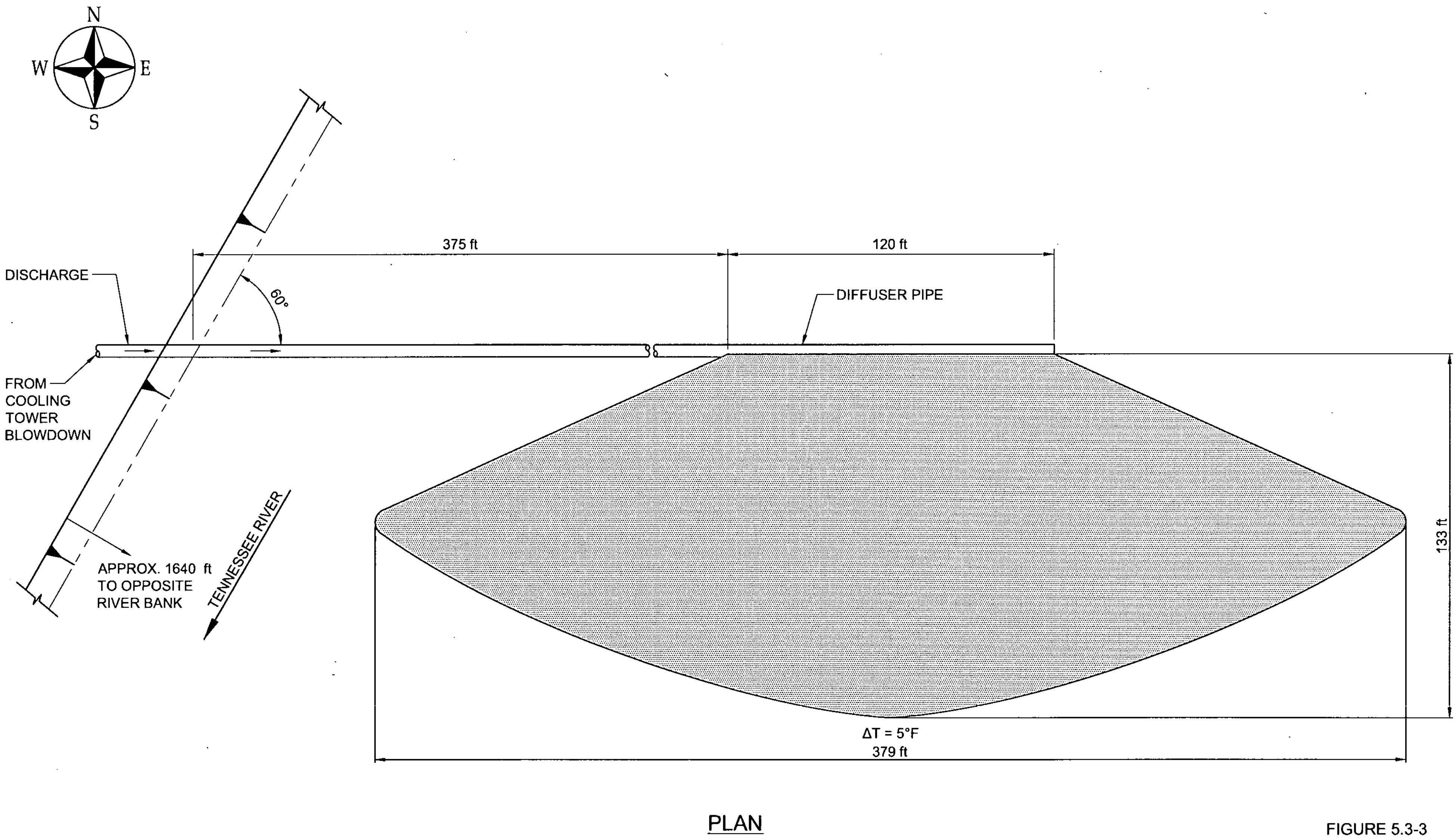

FIGURE 5.3-3
100% EFFLUENT FLOW THROUGH BOTH DIFFUSERS - 7Q10 RIVER FLOW (39.2°F)

Tennessee Valley Authority

ER Figure 5.3-4
100% Effluent Flow through Both Diffusers 7Q10 River Flow (90°F)
(1 page)

Rev. 1

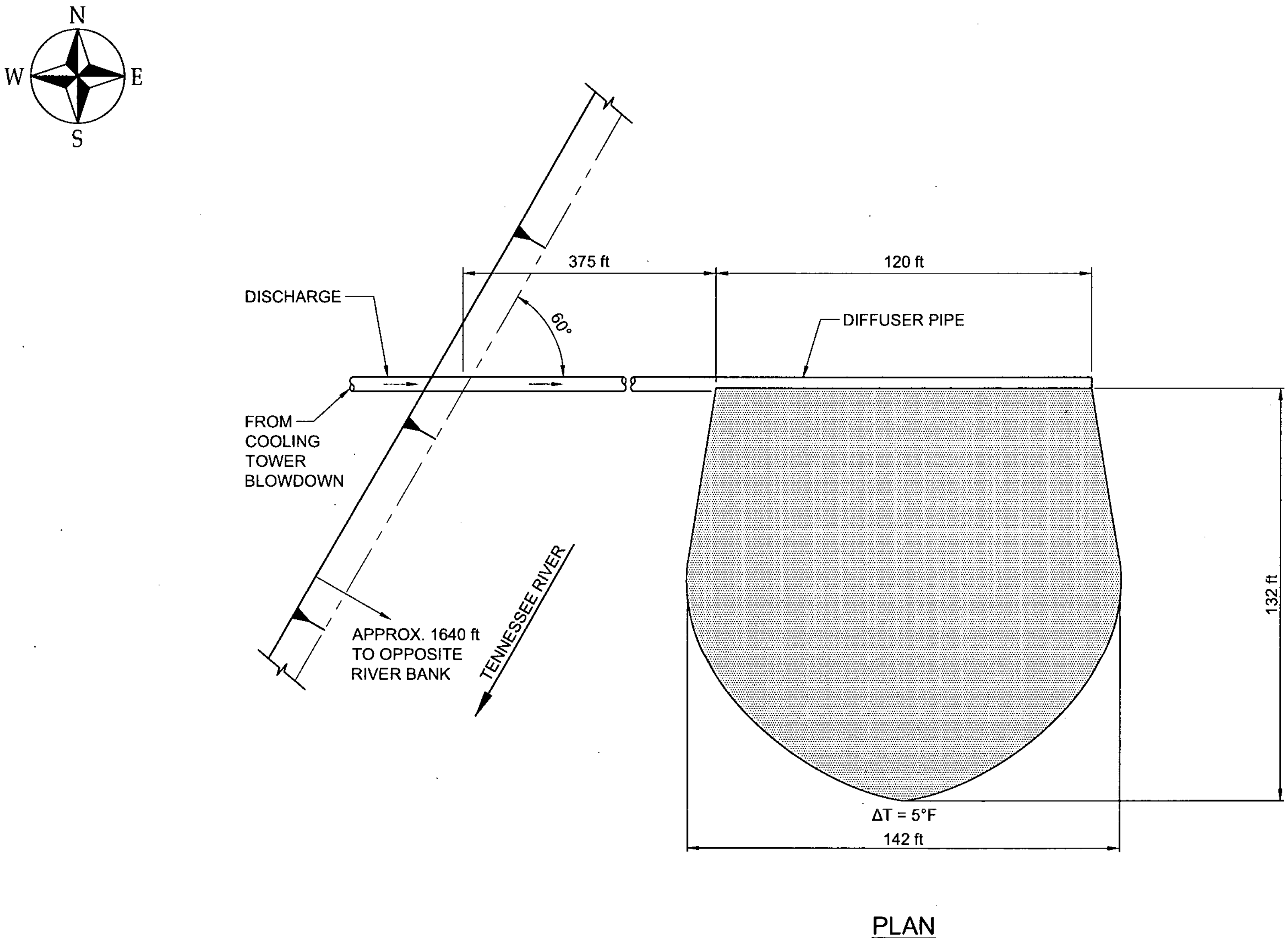

FIGURE 5.3-4
100% EFFLUENT FLOW THROUGH BOTH DIFFUSERS - 7Q10 RIVER FLOW (90°F)

Rev 1

Tennessee Valley Authority

ER Figure 5.3-5

100% Effluent Flow through Both Diffusers Maximum Reverse River Flow (39.2°F)

(1 page)

Rev. 1

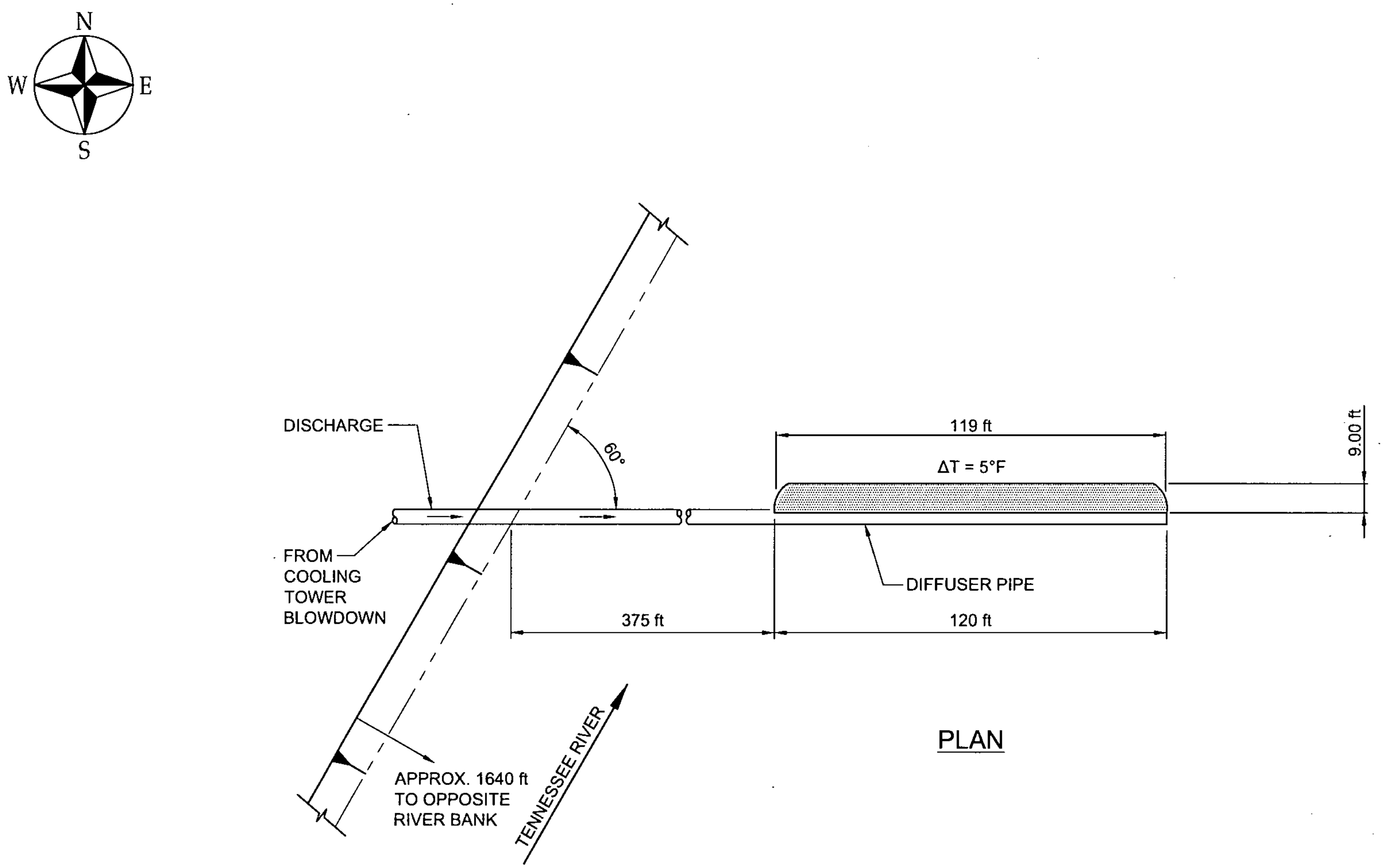

FIGURE 5.3-5
100% EFFLUENT FLOW THROUGH BOTH DIFFUSERS - MAXIMUM REVERSE RIVER FLOW (39.2°F)