UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Alcoa Power Generating Inc.	)	Project No. 2197-073

CONSOLIDATED ANSWER OF ALCOA POWER GENERATING INC. TO PETITIONS TO INTERVENE AND COMMENTS IN RESPONSE TO SCOPING DOCUMENT 1

I. Background and Purpose

Alcoa Power Generating Inc. ("APGI") filed an application to relicense the Yadkin Hydroelectric Project (FERC Project No. 2197) ("Yadkin Project" or "the project") on April 25, 2006. APGI filed the relicensing application after a multi-year pre-filing period during which APGI conducted a series of project impacts studies and communicated extensively with stakeholders about potential relicensing issues, using a communications-enhanced approach to the traditional licensing process set forth in Part 4 of the Commission's regulations, 18 C.F.R. Part 4.

As a result of intensive negotiations with stakeholders over the past several years, APGI and 27 stakeholder entities entered into an Agreement in Principle, which APGI submitted to the Commission on August 28, 2006. Continued communications with stakeholders have resulted in the development of a Relicensing Settlement Agreement ("RSA") which, as of the date of this filing, has been adopted by twenty-one parties. APGI intends to submit the RSA to the Commission as an Offer of Settlement in this relicensing proceeding by April 23, 2007.

On December 21, 2006, the Commission issued Scoping Document 1 ("SD-1") as part of its National Environmental Policy Act (“NEPA”) process in the above-referenced Yadkin Project relicensing docket, stating that the Commission Staff intend to prepare an environmental impact statement ("EIS") for the Yadkin Project, as well as for Progress Energy's ("PE's") Yadkin-Pee

Dee Hydroelectric Project (FERC Project No. 2206) ("Yadkin-Pee Dee"). Through the SD-1, the Commission announced that it would hold four scoping meetings, the last of which occurred on January 25, 2006. The Commission solicited scoping comments on the SD-1 to assist the Commission Staff in analyzing site-specific and cumulative effects of the Yadkin and Yadkin-Pee Dee Projects. The deadline for submission of comments was February 26 (30 days from the date of the scoping meetings).

The Commission received numerous timely filed comments, as well as requests to intervene in this proceeding, in response to the SD-1 and scoping meetings. Many of the requests to intervene and comments received in response to the SD-1 and scoping meetings were submitted by signatories to the AIP or the RSA.[1] Other requests to intervene and comments were submitted by a variety of stakeholder individuals, organizations, municipal and state entities, and resource agencies. While many of the comments submitted responded to the SD-1 and/or the scoping meetings, many commenters also provided general information for the Commission's consideration or reiterated positions previously stated in other submissions or communications during this relicensing process.

APGI herein provides its consolidated answer to the requests to intervene and comments received in response to the SD-1 and the scoping meetings. APGI has limited its answer, to the extent possible, to address only those comments that are relevant to the NEPA scoping process and reserves its rights to respond at the appropriate time to comments not otherwise addressed herein.

[1] As of this date, the signatories to the RSA are: American Rivers, APGI, Badin Historic Museum, Badin Lake Association, Catawba Indian Nation, City of Albemarle, High Rock Business Owners Group, High Rock Lake Association, Land Trust for Central NC, NC Dept. of Environment and Natural Resources, NC Wildlife Resources Commission, Pee Dee River Coalition, Piedmont Boat Club, Rowan County, Salisbury/Rowan Association of Realtors, SC Coastal Conservation League, SC Dept. of Natural Resources, The Nature Conservancy – SC, Town of Badin, US Forest Service, and Uwharrie Point Community Association.

II. Answer to Comments and Requests to Intervene

A. *RSA Signatories*

Numerous comments and requests to intervene were submitted by entities that have entered – or have stated their intent to enter – into the RSA. APGI welcomes the continued participation of these entities in this proceeding and recognizes the ongoing interest that RSA signatories have in the outcome of the Yadkin Project relicensing process. Of the RSA signatories or potential RSA signatories, scoping comments and/or requests to intervene were submitted by: American Rivers and SC Coastal Conservation League (Feb. 26, 2007); High Rock Lake Association (Jan. 10, 2007); NC Wildlife Resources Commission (Feb. 23, 2007); NC Department of Environment and Natural Resources (Feb. 23, 2007); NC Wildlife Resources Commission (Feb. 20, 2007); Pee Dee River Coalition (Feb. 19, 2007); SC Department of Natural Resources (Jan. 11 and Feb. 23, 2007); and The Land Trust for Central NC (Feb. 23, 2007).

B. *Federal Resource Agencies*

On February 23, 2007, the U.S. Forest Service filed comments on the SD-1 ("FS Comments") indicating its intent to enter into the RSA for the Yadkin Project "that will adequately protect and utilize National Forest System lands and resources." FS Comments at 1. The Forest Service also filed a request to intervene in this proceeding on February 22, 2007. APGI welcomes the Forest Service's continued participation in this relicensing process and intends to ensure, through the RSA, that Yadkin Project operations remain consistent with the Uwharrie National Forest Land and Resource Management Plan.

Section 10(j) of the FPA requires the FERC to include in licenses conditions to protect, mitigate damages to, and enhance fish and wildlife resources based on recommendations received from federal and state fish and wildlife agencies unless it finds that they are inconsistent with Part I of the FPA or other applicable law and that alternative conditions will adequately address fish and wildlife issues. The Commission will thus take into consideration the recommendations set forth in the comments submitted by the agencies under section 10(j) of the FPA.

The U.S. Department of Commerce's National Marine Fisheries Service ("NMFS") provided comments dated February 26, 2007 ("NMFS Comments") in response to the SD-1. In its comments, NMFS noted that the Winyah Bay-Yadkin-Pee Dee River Basin is "presently the focus of promising interagency efforts for restoration of migratory diadromous fishery resources." NMFS Comments at 3. NFMS also provided a summary of existing fisheries and diadromous fish populations in the river basin and observed that the "AIPs have addressed fish passage in general terms; however specific fish passage alternatives have not yet been fully identified." NMFS Comments at 6. With respect to EIS development, NMFS recommended a separate Draft EIS sub-section that includes a preliminary assessment of potential project effects on essential fish habitats, pursuant to the consultation requirements of Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act. NFMS Comments at 8. NMFS and the U.S. Fish and Wildlife Service ("USFWS") are performing a fish passage conceptual design analysis together with APGI and PE, and will present the analysis in their preliminary prescriptions for fishways. NMFS Comments at 6.

USFWS submitted a request to intervene in this proceeding on February 2, 2007, followed by comments on the SD-1 on February 23, 2007 ("USFWS Comments"). USFWS

described its ongoing cooperation with NMFS, APGI and PE, and state agencies to develop plans which will be part of the basis of the section 18 fishway prescriptions for American shad and American eel. USFWS Comments at 6. In addition to fish passage, USFWS stated its concerns about potential entrainment of fish at the Yadkin developments, a study of which was reported in the Fish Entrainment Assessment Report attached to APGI's Final License Application. USFWS Comments at 7. The results of that study indicated that "the potential for impact to fishes due to entrainment and turbine passage at the four Yadkin Project Developments…is low." USFWS Comments at 8. With respect to flows to protect aquatic riverine resources, USFWS noted that APGI's proposed flow release schedule for the Yadkin Project on an average daily basis "appears to be sufficient, provided that these flows can be adequately reregulated" by the downstream PE developments. USFWS Comments at 3.

As noted in the agencies' comments, APGI is working with the downstream licensee, PE, and the relevant fish and wildlife agencies to reach an agreement regarding fish passage independently of the RSA process.[2] It is APGI's hope that such an agreement will be reached and will be used by USFWS and NMFS as the basis for mandatory fishway prescriptions for the Yadkin Project under section 18 of the FPA. In particular, APGI and PE have been discussing with NMFS, USFWS and state fish and wildlife agencies fish passage needs, grounded in the relicensing record, for American shad and American eel.

As currently envisioned, such an agreement would focus upstream and downstream fish passage efforts for shad, and upstream passage efforts for eel, initially at the first dam on the river, PE's Blewett Falls development; later, in 2025, there would be a comprehensive review of the shad and eel restoration efforts. At that point, a decision would be made regarding the need

[2] As USFWS noted, its withdrawal from settlement negotiations was due only to the fact that APGI has requested a 50-year license term which conflicts with the USFWS's policy of recommending only 30 or 40-year license terms. USFWS Comments at 2.

for additional fish passage facilities and measures for both species. Under the terms of an agreement built around this concept, APGI would share the cost with PE of constructing and operating upstream and downstream fish passage facilities at Blewett Falls through 2025.

APGI believes that this approach is appropriate for the Yadkin-Pee Dee River for a number of reasons. Particularly with respect to American shad, there are still many outstanding questions about what steps are needed to restore shad to their historic spawning grounds without adversely impacting the existing American shad population in the lower river. Currently unknown or poorly understood issues regarding shad that could be better addressed in 2025 include:

- How much suitable spawning habitat is above the Yadkin Project's dams, and how many spawning adult shad could this habitat actually support?
- How likely is it that juvenile shad produced above High Rock dam will actually be able to successfully navigate downstream through six large reservoirs that support large populations of bass and other predatory fish species?
- Is the transfer of thousands of adult spawning shad above the Yadkin Project dams likely to help or harm the existing shad fishery in the lower river?
- Is access to potential spawning habitat above the Yadkin Project dams necessary, as there is currently hundreds of miles of mainstem and tributary spawning habitat in the lower river and tributaries that supports a robust population of American shad in the Yadkin-Pee Dee River and that is sizeable enough to support a commercial shad fishery in South Carolina?

While still hopeful that an agreement can be reached, it is becoming increasingly clear to APGI that the fish passage negotiations are likely to continue for some time. As in many locales, fish passage issues on the Yadkin-Pee Dee River are complex, involving two species of primary interest, two agencies with Section 18 prescription authority, two states and, in this instance, two licensees. For these reasons, it seems probable that negotiations will not result in a final agreement by the time that the agencies need to file their preliminary terms and conditions (FERC's Ready for Environmental Analysis notice requires any such preliminary terms and conditions by May 14). The federal resource agencies have indicated that in the event that a fish passage agreement has not been reached, they will file preliminary terms and conditions for the Yadkin Project that generally reflect the restoration and fish passage concepts that are being discussed in the agreement negotiations, as outlined above. If, however, no agreement is reached between the licensees and the agencies and the federal resource agencies propose fish passage facilities at Yadkin Project that are not merited by the record, APGI will, by necessity, consider all of its options, including the possibility of reaching an independent agreement with the fish and wildlife agencies or an appeal of any preliminary terms and conditions.

Addressing its Endangered Species Act responsibilities, USFWS stated that "the FERC should require the licensees to develop plans to ensure protection and enhancement for federally protected species, candidate species, and species of concern at federally licensed hydroelectric developments." USFWS Comments at 10. Specifically, USFWS asserted that a management plan should be developed to protect the endangered Schweinetz's sunflower and a federal candidate plant species, the Yadkin River Goldenrod. USFWS Comments at 2. USFWS also anticipated recommending that the Commission require a bald eagle management plan as a part of APGI's license for the Yadkin Project. USFWS Comments at 2.

USFWS recommended that FERC incorporate the shoreline management plan developed by APGI as a requirement in the Yadkin Project license. USFWS Comments at 10. As for access to the project area, USFWS recommended that tailwater access site be maintained under Yadkin's new license and that the Commission should consider requiring APGI to comply with the Americans with Disabilities Act for access to the Yadkin site. USFWS Comments at 11.

C. *Comments/Interventions Submitted by Individuals*

Several individuals[3] submitted comments to the Commission concerning High Rock Lake, some of which supported relicensing outright while others expressed concerns related to the impacts of water level fluctuations on recreation and aquatic life, and the length of the proposed license. APGI does not oppose these individual's interventions and welcomes their participation in the relicensing process. However, with the exception of Ms. Linda Bell's comments addressed below, the issues that concern these individuals were raised by other intervenors and are addressed by APGI throughout this consolidated response.

In her January 27, 2007 letter, Ms. Linda Bell expressed concerns on High Rock water levels, specifically referring to, and submitting photos of, a drawdown at High Rock Lake of 20 feet below full pool in January, 2004. This drawdown, however, was part of a one-time relicensing study to determine the quantity and quality of aquatic habitat and was requested by state and federal agencies. Prior to the drawdown, APGI notified adjoining property owners, FERC, and the general public that this unique drawdown would be conducted in order to engage in further analysis on habitat. APGI chose January because fish naturally seek lower depths in

[3] Individuals who have submitted comments include: Bridget Huckabee, Janet Morrow, Patricia Shaver, Robert Podgaysky, Tony Garitta, Jennifer and James Farmer, Michel Benham, David and Hazel Frick, Maynard Stickney, Herbert Osmon and Linda Bell.

reservoirs during colder months, and there were fewer recreational users of the reservoir at that time.

Moreover, to address Ms. Bell's concerns on water level at High Rock in the future, the RSA includes provisions to ensure higher water levels for High Rock Lake. In addition, a drought management plan will ensure that High Rock is treated equitably even in the most extreme drought situations.

D. *City of Salisbury*

On February 23, 2007, the City of Salisbury ("Salisbury") filed its "Scoping Comments and Response to Commission Request for Additional Study Results"("Salisbury Comments"). Salisbury's submission was accompanied by a compact disc containing files that purported to be a number of studies that Salisbury apparently commissioned regarding its claims that APGI's High Rock development has caused and continues to cause damage to Salisbury's water utility intake equipment and its wastewater treatment facility. Some of these studies had been submitted in previous filings by Salisbury in this docket and others were included for the first time in Salisbury's February 23, 2007 submission.

The gravamen of Salisbury's concerns is sedimentation that occurs at the points that its facilities intersect High Rock Reservoir. Salisbury claims that High Rock Reservoir causes the sedimentation that it experiences, and that this sedimentation over time has increased the frequency and severity of flooding in the vicinity of Salisbury's facilities located on the upper end of High Rock Reservoir. *See* Salisbury Comments at 8, 10. Salisbury claims that the experiences of recent years have demonstrated the danger that sedimentation and resultant flooding present to Salisbury's facilities (Salisbury Comments at 11), and that its studies

demonstrate that the city must spend amounts that would represent a "substantial burden on taxpayers" to protect its facilities from the increased risk of floods and damage to the city's water system between now and the year 2058. Salisbury Comments at 5, 9-11.

Salisbury requests that the Commission incorporate into the new project license conditions that would mitigate sedimentation and flooding effects that Salisbury alleges will occur over the term of the new license. Salisbury Comments at 16-21. Salisbury also requests inclusion of terms in the license to mitigate alleged "project mismanagement," and states its preferred alternative for mitigation of the environmental – and non-environmental – effects of the Yadkin Project that it alleges.

As demonstrated below, there are a number of reasons why Salisbury's claims and requests for mitigation must be rejected. Briefly summarized these reasons are:

(1) Even if substantiated – which they could not be on the basis of what Salisbury has presented – Salisbury's claims do not present valid issues under the FPA, are not supported by either FPA or Commission precedent, and thus do not fall within the scope of relicensing.

(2) Even if they fell within the FPA – which they do not – whatever real property rights Salisbury may have had for compensation were voluntarily relinquished by Salisbury when it (a) sold APGI flooding rights over its property; and (b) when it entered into a 1969 agreement with APGI's predecessor.

(3) Even if they proved what they set out to prove – which they do not – the "studies" offered by Salisbury are untimely, offered at the end of the relicensing process despite the fact that Salisbury has been an active participant since APGI initiated its relicensing process more than 4 years ago.

(4) Even if there were no questions as to their respective methodologies – which there are – the studies presented by Salisbury rest upon unsubstantiated assumptions, questionable data, proprietary (and thus unverifiable) computation methods and questionable input values.

(5) All of the studies are conceptually defective because they proceed from the false assumption that APGI is completely responsible for the sedimentation that had occurred to date and is expected to occur over the next 50 years. APGI has no control over and no responsibility for the fact that suspended sediment is carried in the waters of the Yadkin River as it enters the project; and none of Salisbury's studies even account for the fact that accumulated sediment existed in what is now the upper reaches of High Rock Reservoir before the dam was built and that additional sediment accumulation most

likely would have occurred in the intervening years even if High Rock Dam never had been constructed.

Each of these issues will be discussed in turn.

(1) Salisbury's Claims Do Not Present FPA Issues

Salisbury is attempting to use this proceeding in order to bring about resolution of claims that are beyond the scope of the decisions that the Commission must make in determining whether and under what conditions it should issue a new license for the project. Salisbury's proposals for "mitigation" of purported Yadkin Project effects would entail the Commission making a determination that APGI is liable for damage to Salisbury's property and setting the relief for that alleged damage (e.g., requiring APGI to pay for the relocation of Salisbury's pump station). However, Salisbury's propositions for "mitigation" clearly run afoul of the FPA. Claims for property damage caused by the existence or operation of the project are not within the scope of relicensing and are not within the scope of Part I of the FPA.

Property damage issues are addressed directly in Section 10(c) of the FPA, 16 U.S.C. § 803(c), which provides:

> Sec. 803. Conditions of license generally
>
> All licenses issued under this subchapter shall be on the following conditions:
>
> * * *
>
> (c) Maintenance and repair of project works; liability of licensee for damages
>
> … Each licensee hereunder shall be liable for all damages occasioned to the property of others by the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto, constructed under the license and in no event shall the United States be liable therefor.

Salisbury's essential claim is that it has been and continues to be damaged by sedimentation caused by APGI's impoundment behind High Rock Dam. Simply put, that is a claim for "…damages occasioned to the property of [another]…by the construction, maintenance, or operation…" of High Rock Dam. As has been determined in other cases, the right to such damages does not arise under the FPA. *See South Carolina Public Service Authority v. FERC*, 850 F.2d 788, 795 (D.C. Cir. 1988) ("Congress intended for 10(c) merely to preserve existing state laws governing the damage liability of licenses" and, accordingly, "it follows that the Commission may not encroach upon this state domain by engrafting its own rules of liability."); *Skokomish Indian Tribe, et al. v. United States, et al.*, 410 F.3d 506, 519 (9th Cir. 2005). Thus, any rights that Salisbury may have to such damages arise, if at all, under state law. Salisbury may not use this proceeding to essentially litigate its allegations of property damage that it attributes to the existence and operation of the Yadkin Project.

(2) Salisbury Previously Relinquished Any Property Rights At Issue

Notwithstanding the fact that Salisbury's claims of damage to its property are outside of the scope of this proceeding, Salisbury has given up its rights to raise claims with respect to sedimentation and flooding that may affect Salisbury's water system. As Salisbury notes,"[i]n 1927 (recorded October 25, 1927), the City granted Tallassee Power Company (APGI's predecessor) the right to flood the pump station tract up to an elevation of 623.9 NGVD29. *See* Rowan County Deed Book 199 Page 43." Salisbury Comments, Exhibit 7 at 3. Salisbury further limited its property rights through an agreement dated July 31, 1969 ("1969 Agreement") under which APGI's predecessor granted an easement to enable Salisbury's addition of certain water intake facilities. The 1969 Agreement specifies that Salisbury must hold APGI harmless for any damage to its facilities to which the 1969 Agreement applies:

> 5. Salisbury shall defend, indemnify, and save harmless Yadkin, its successors and assigns, from all liabilities, losses, damages, expenses, claims, demands, actions, or causes of actions by reason of any injury or damage to any person or to the property of any person, firm or corporation, including the property of Salisbury, and including officers, employees and citizens of Salisbury, which injury or damage may in any manner whatsoever arise out of or be connected with the construction, location, operation, maintenance, flooding, clogging, or obstruction of said raw water intake pipe and/or water mains. . .
>
> * * *
>
> 7. It is expressly understood and agreed by Salisbury that the easement granted is partially within Yadkin's High Rock Reservoir, and that the water in said reservoir will be subject to the natural variations caused by the rise and fall in the Yadkin River, and subject further to such rise and fall as the operation of all of Yadkin's water power developments . . . may make necessary or desirable; and Salisbury hereby covenants to and with Yadkin, its successors and assigns, and it hereby does absolve, acquit and release Yadkin, its successors and assigns, from any and all liability for injury or damage to persons or property of Salisbury…arising from such rise and fall or from flooding to any elevation of the lands in which the above-mentioned rights are granted.
>
> Salisbury Comments, Exhibit 18 at 3-4.

Thus, even if Salisbury could establish that it had a right to assert property damage claims that could be recognized and/or litigated under the FPA, it has relinquished that right pursuant to a private agreement with APGI. Nothing in the FPA alters the contractual terms of the agreements discussed herein, which limit Salisbury's rights to bring forth a claim of property damage caused by the Yadkin Project developments.

(3) The Studies Submitted by Salisbury are Untimely

Attached to its comments, Salisbury submitted the results of sedimentation studies performed by its contractors. The submission of those studies comes ten months after APGI submitted its formal application to relicense the Yadkin Project. Salisbury's submission of the

studies in February of 2007 is not merely belated, but represents a flagrant departure from the communications-enhanced traditional licensing process that APGI has conducted. The studies performed by Salisbury and its contractors are essentially responses to APGI's studies on sedimentation and flooding (which were performed at the request of Salisbury), intended to dispute or discredit the information in APGI's studies. As such, Salisbury's study results should have been filed in accordance with the pre- and post-filing processes set forth in Part 4 of the Commission's regulations, 18 C.F.R. Part 4.

Sections 4.38(b) and (c) of the Commission's regulations, 18 C.F.R. §§ 4.38(b) and (c), provide for pre-filing consultation study requests and responses to those studies. Salisbury had an opportunity to (and did)[4] provide its own study data in response to APGI's "Sediment Fate and Transport Study Report," submitted to the Commission during the pre-filing consultation process in November of 2005. Salisbury had another opportunity to discuss potential studies and submit information related thereto during the 60-day period following APGI's filing of the Yadkin relicensing application. *See* 18 C.F.R. § 4.32(g). However, Salisbury waited until now, when the license application is ready for environmental analysis, to submit its most detailed studies, at a point in the process in which neither the applicant, the other parties nor the Commission Staff have time or resources to evaluate them on their merits.[5]

Now, far past the point in the relicensing process when Salisbury's studies would be timely and appropriate, Salisbury presents these studies that directly conflict with analyses performed by both APGI and the Commission staff. Given Salisbury's ample opportunity to perform and present the results of its own studies at multiple points in the relicensing process,

---

[4] *See Technical Report: High Rock Dam and High Rock Lake Sedimentation Flooding Effects as Estimated Using HEC-RAS Modeling*, Docket No. P-2197-073 (January 26, 2006).

[5] In the short time since it received this latest Salisbury submission, APGI has only had the opportunity for limited review of the submission by its experts. APGI reserves the right to respond more fully to this material to the extent necessary at an appropriate time.

the Commission should not allow Salisbury's untimely studies to alter or impede the course of this proceeding.

(4) Salisbury's Studies Are Based on Technically Unsound and Unverifiable Data

Among other exhibits, Salisbury filed study reports entitled "Numerical Sedimentation Investigation, Yadkin River, North Carolina," written by Dr. Ronald Copeland (Salisbury Comments, Exhibit 1 ("Copeland Report")), and "High Rock Dam and Sediment Delta Flooding and Sedimentation Effect (1927-2058)," written by Dr. Martin Doyle (Salisbury Comments, Exhibit 2 ("Doyle Report")). As stated above, these study reports present data and conclusions that conflict with the information provided in studies previously conducted by APGI and the Commission Staff. *See* Yadkin Sediment Fate and Transport Report, prepared by Normandeau Associates, Inc. and PB Power (November 2005) ("Yadkin Sediment Report"); Letter from Mark Robinson, Director of FERC Office of Energy Projects, to Mr. Qualkenbush, et al. (June 18, 2003) ("June 18, 2003 Letter").

Salisbury's study reports are lacking in technical merit and rest upon information which cannot be verified because it is not publicly available.[6] The technical inadequacy and resultant inaccurate conclusions in Salisbury's study reports are examined in more detail in the attached affidavits of APGI's technical consultants.

Among APGI's highly qualified consulting team is David Williams, Ph.D., P.E., National Technical Director of Water resources for PBS&J, a national engineering firm. Dr. Williams is a former President of the International Erosion Control Association (IECA), chair of the ASCE Task Committee on Analysis of Laboratory and Field Sediment Data Accuracy and Availability, and chair of the ASCE Sedimentation Committee. Dr. Williams is an acknowledged expert on

[6] Dr. Copeland's Report states that some of its calculations were done using a proprietary model. Copeland Report at 8.

hydraulics and sedimentation and a prolific author in the field. In fact, Dr. Williams recently authored the new HEC-6 Users' Manual for the United States Corps of Engineers' Hydrologic Engineering Center and previously wrote the Reservoir Sedimentation Chapter in the U.S. Corps of Engineering Manual on Sedimentation Investigations. Dr. William's affidavit, which is attached as Exhibit A, discusses three major areas of error in the Copeland Report, namely that: (1) the base condition has not been modeled, (2) there are numerical instabilities in the model that invalidate its results, and (3) Dr. Copeland's study finds an unusual pattern of bed elevation changes, which raises other questions about the validity of the model.

As further discussed in Dr. Williams' affidavit, Dr. Copeland's report comparing current flow data and sedimentation deposits at current levels to historical levels begins with the assumption, based on a single reading from a gage that no longer exists, that the Yadkin River experienced a flow of 121,000 cfs at Salisbury in 1916. The sedimentation model to which the flow data is applied is highly sensitive to the composition of the sediment that has and continues to flow down the Yadkin River. Yet, as Dr. Copeland notes, little historical or future data exists as to sediment composition. Copeland Report at 18-21. To compensate for this lack of data, Dr. Copeland has used averages and extrapolation to arrive at projected sediment accumulations. *Id.*

These averages and extrapolations, upon which Dr. Copeland's conclusions are based, do not account for the amount of sedimentation that may have existed before the High Rock dam was constructed in 1927 or that would have occurred at Salisbury's facilities had the High Rock dam not been constructed. Nonetheless, Dr. Copeland essentially concludes that the High Rock Reservoir has operated to create a "delta" at the confluence of the Yadkin and South Yadkin Rivers, resulting in the accumulation of sediment that has interfered with Salisbury's water system operations. Copeland Report at 62-63. While the information underlying Dr. Copeland's

conclusion is in some places lacking and in others potentially distorted through extrapolation, his study suggests that potential error should be accounted for by increasing the margin of safety of the remedial steps undertaken. This, in turn, results in Dr. Copeland's suggestion of remediation measures that are beyond that which could be supported by the data underlying his analysis.

Dr. Doyle's report also contains serious flaws, as discussed in the affidavit of Paul F. Shiers, P.E., Vice President/Water Resources Group for PB Power Inc., a unit of the national construction and engineering firm of Parsons Brinkerhoff. *See* Exhibit B. Dr. Doyle's report is not, however, intended to present new information relevant to this proceeding, but rather "…summarizes several years of studies conducted by Salisbury, [and] is intended to provide background information and a synthesis of the studies that have been conducted to date." Doyle Report at 2. In reviewing this "synthesis," in addition to its heavy reliance on data assumptions interpolated from a topographic map with a resolution inadequate to justify the report's findings, Mr Shiers identified several areas of concern regarding Dr. Doyle's report.

First, the Doyle Report erroneously identifies the 121,000 cfs number it develops and uses as the design flood criterion.[7] In Section 3.3 of his Report, Dr. Doyle incorrectly states the location of the gage reading for the 1916 design flood as River Mile 19.4, not River Mile 15.2 which is where the USGS gage that made the reading was actually located. Being further downstream of where the SRU pump station is located, this gauge measured, in addition to Yadkin River flows, the outflow from the Grant's Creek drainage area which intersects below the confluence of the Yadkin and South Yadkin Rivers. This disparity materially affects Dr. Doyle's analysis. Moreover, as reported by USGS, the 121,000 cfs flow in 1916 represented a peak hourly flow. The average daily flow for this 1916 storm event, as reported by USGS, is

[7] Because this number was also used by other Salisbury consultants, the fact that it is erroneous likewise infects and invalidates those other work efforts.

103,000 cfs. As discussed in Mr. Shiers' affidavit, using USGS peak flow data from Yadkin College and the correlation factor determined by SRU, the value would be 116,000 cfs. Also, presenting data in Table 3.1 which was apparently prepared from Yadkin College data for the 1928 to 2004 period, and inserting the recorded Salisbury USGS flow value is misleading.

Contrary to Dr. Doyle's assertion (Doyle Report, Section 8), APGI did not suggest that the sediment accumulation was not caused by the reservoir. Rather, APGI posited that the flood elevations in the riverine section of the Yadkin River at the Salisbury pump station, as defined by Salisbury, are caused at least in part by the natural constrictions created by channel geometry and bends in the river, conditions which pre-dated construction of High Rock Dam. APGI has also presented evidence that other manmade impediments in the river, including railroad and interstate bridges, are contributing to flooding in the vicinity of the pump station. Furthermore, Dr. Doyle's analysis fails to provide substantiation for its assumption that in the late 1800's and early 1920's, when sediment was determined to be a problem and subsequently reached its peak, the Yadkin River, one of most heavily sediment laden rivers in the eastern United States (USGS Robert Meade, 1982), was in approximate geomorphic equilibrium (Doyle Report, Section 3) before High Rock was constructed, or to provide any data demonstrating that it would have remained so.

Finally, although Section 3.4 of Dr. Doyle's report indicates that the Grants Creek Waste Treatment Facility plant, which was constructed long after High Rock Dam was built, suffers flood damage at El. 634 USGS datum when concrete structures at the plant are overtopped, it fails to note that APGI retains flood rights at the facility location to El. 638.9 USGS datum. It is apparent that Salisbury failed to give adequate consideration to flood design criteria when the facility was constructed.

Once again, the study reports submitted by Salisbury also conflict with earlier studies by both APGI and FERC Staff. These earlier studies demonstrate that the operation of High Rock Reservoir has only a *de minimis* effect on flooding at the confluence of the Yadkin and South Yadkin Rivers. *See* June 18, 2003 Letter ("The hydraulic model study conducted by staff indicated that during the high flood events of March 18-22, 2003, High Rock Reservoir operation would not have had a significant influence on the water surface elevation at the confluence of the Yadkin and South Yadkin Rivers"); Yadkin Sediment Report at iv and Appendix E-3. Salisbury's reports do not establish how or why they are more credible than the studies performed by both APGI and the Commission Staff. Further, they are based in part on information that is not publicly available and so cannot be evaluated upon all of the supporting information. Finally, none of the characterizations of information set forth in Salisbury's study reports have been made publicly available for scrutiny or comment. Thus, Salisbury's studies should not be accorded credibility at this late date in the proceeding.

(5) Salisbury's Studies Are Based on a False Assumption of APGI's Liability

None of the sedimentation studies relied upon in Salisbury's reports account for the amount of sedimentation that would have occurred in the absence of the High Rock Dam. The studies rely upon incomplete, unverifiable, and sometimes publicly unavailable information to predict a relatively exact calculation of potential flooding effects on Salisbury's facilities within the year 2058. At bottom, it is apparent that Salisbury's studies begin with the false conception that the sedimentation they purport to investigate was all caused by the presence of the High Rock Dam. The studies thus set out to establish the degree of projected accumulations of sediment that Salisbury assumes were and will be attributable to the Yadkin Project.

The fact remains that none of the studies that Salisbury has commissioned account for the fact that accumulated sediment existed in what is now the upper reaches of High Rock Reservoir before the High Rock Dam was constructed. Nor do the studies account for the likelihood that some additional sediment accumulation may have occurred in the intervening years, even if High Rock Dam never had been constructed. Moreover, APGI has no control over and no responsibility for the fact that suspended sediment is carried in the waters of the Yadkin River as it enters the project. It is known that sedimentation transport, as well as flooding at the confluence of the Yadkin and South Yadkin Rivers, are natural features of this watershed. These facts are recognized in the separately conducted reports of the Commission Staff and APGI. *See* June 18, 2003 Letter (referencing report on Yadkin River flooding events performed by Commission Staff); Yadkin Sediment Report. Yet they are continually ignored in the outcomes predicted in Salisbury's studies and technical reports. Thus, Salisbury's studies do not provide a reliable basis for the development of environmental reviews related to potential sedimentation and flooding impacts.

E. *Duke Energy*

On February 16, 2007, Duke Energy Carolinas, LLC ("Duke") submitted a motion to intervene in the relicensing proceeding followed by a February 22, 2007 letter commenting on SD-1. Duke was a party to the consultation meetings and negotiations Protocol of the Yadkin Project relicensing proceeding since December 2004 and was an active participant in settlement discussions related to the Yadkin Project relicensing until it declined to join APGI's AIP. Duke's interest in this proceeding relates to its ownership and operation of the four-unit, coal-fired, 369 MW Buck Steam Station ("Buck") located on the reservoir of the High Rock

Development, which uses the water from the High Rock Reservoir for condenser cooling and other processes.

In its February submissions, Duke stated, as it has in previous filings, that its ability to operate Buck is directly affected by APGI's operation of the High Rock Development, including the decisions APGI makes concerning the release of minimum flows and reservoir drawdowns. Duke Intervention at 2; Duke Comments at 1. Specifically, Duke asserts that when the reservoir is drawn down 10 feet or more, Buck begins to experience operational problems. Duke Comments at 2. In its August 25, 2006 letter to FERC, Duke explained:

> The National Pollutant Discharge Elimination system ("NPDES") permit for Buck explicitly states that when High Rock Lake is drawn down 10 feet or greater, as measured at the Buck site, Buck shall use no more than two-thirds (2/3) of the stream flow for condenser cooling and Buck shall ensure that the minimum unheated daily average stream flow does not fall below one-third (1/3) of the 7-day, 10-year low flow (7q10). During periods of low inflow to the High Rock Development, this requirement can restrict or shut down the output of Buck.

Letter from John A. Whittaker, IV, Docket No P-2197-073, at 2 (August 25, 2006).

However, the NPDES permits are issued by the North Carolina Department of the Environment and Natural Resources ("NC DENR") under the NPDES permitting program.[8] The temperature sensitivity and streamflow limits of the NPDES permit appear to be linked to the fact that Duke's Buck Steam facility operates without cooling towers, which is increasingly unusual in this day and age.[9] Thus, although Duke has not installed cooling towers at its facility, it seeks consideration of drawdown limitations to accommodate a less efficient[10] water usage associated with its once-through cooling system. To the extent that Duke seeks to limit

[8] NC DENR is the Section 401 permitting agency as well.

[9] During the drought of 2002, Duke did temporarily install cooling towers at the Buck Steam facility, but removed them once the drought was over.

[10] Efficient as measured by the quantity of the water withdrawn from the reservoir.

reservoir drawdowns to accommodate a questionable environmental use of the Yadkin waters through this process, it is asking the Commission to act inconsistent with the FPA.

Moreover, it is not clear that Duke's problems are of a major order. The impact that Duke is describing is when High Rock Reservoir is down 10 feet or more, and under the terms proposed for the new license, that would only occur either (1) in the winter (i.e. November through March); or (2) in a major drought such as that of 2002. Streamflow during November through March is generally fairly good because that is when most of the precipitation and resultant streamflow occurs, and moreover, the demand for electricity is generally lower during that period. Major droughts are at their worst in the summer, which is when demand for electricity is at its peak, and it is understandable that Duke would be concerned under drought conditions that the Low Inflow Protocol ("LIP") might not rank the needs of the Buck Steam facility as high as the needs of municipal water and sewer utilities, for example. But, fortunately, extreme droughts are rare. In any event, outside of its own parochial needs, Duke has offered no basis for rejecting the careful, balanced decision making reflected in the LIP.

Additionally, in its February 22, 2007 submission, Duke specifically commented on both SD-1 and APGI's response to AIR #10. In reference to the scoping document, Duke requested that the impact of the High Rock Lake development on Buck be thoroughly assessed in the EIS as outlined in Sections 5.2.2 and 5.2.8. Duke Comments, at 2.

As to Duke's comments on APGI's response to AIR #10, Duke raised three issues. First, Duke noted that the modeling results submitted by APGI show that with the 30-year sediment and water withdrawal projections included in the analysis, the total number of days that the water elevations in High Rock Lake are more than 10 feet below full pond elevation increases significantly compared to the modeling results without the growth in sediment fill and water

withdrawal use. Thus, Duke states that the new license conditions should be designed to keep the number of day that High Rock Lake is drawn down 10 feet or more below full pond elevation to a minimum under the most extreme drought conditions. Duke requested that the Commission evaluate the means to accomplish this in the EIS. However, consideration of such issues in the context of environmental analysis would be inappropriate since, in effect, Duke is arguing the terms of its existing NPDES permit should control the Commission's decision making under the Federal Power Act, a contention for which there is no legal basis.

Second, Duke stated that as the modeling results filed by APGI do not account for additional growth in sediment fill and water withdrawals for periods beyond 30 years in the new license term, the Commission, in preparing the EIS, should ensure that the water quantity modeling is revised to account for the potential of a 50 year license term and reflect 50 years of hydrology, future sediment fill, and water withdrawals. APGI clarifies that in its AIR #10, the Commission only required APGI to do a thirty year model. Further, Duke has provided no evidence that the 30 year model is insufficient for the Commission to make appropriate determinations.

Finally, Duke commented that the Commission should not include any model run results in the EIS that do not include projected water withdrawals associated with power plant cooling. Duke asserts that as the Yadkin River is a major water source in the Carolinas and is projected to be used by Duke as a source of future power plant cooling water during the next 50 years, any model runs that do not include projected power plant cooling water use is not conservative. Duke believes the geographic scope of the EIS (SD-1 5.1.1) encompasses such upstream uses.

However, the purpose of the EIS is to consider the range of reasonable outcomes from an environmental perspective. Over the next 50 years, water withdrawals associated with power

plant cooling may significantly decrease in the event, for example, Duke constructs water cooling towers at Buck to make more efficient use of Yadkin waters. Further, studies that consider the possibility that Duke will not receive future permits to make large water withdrawals provide a more complete picture. As stated in APGI's response to AIR # 10,

> … the total of all projected increases in net withdrawals upstream of High Rock Dam is 138 cfs. Most of the projected net withdrawals are in the range of 3 cfs to 25 cfs, volumes that are small relative to the Yadkin River flows for all but the most severe of drought conditions such as those experienced during the 2001 through 2002 drought. The single future withdrawal that stands out, however, is an incremental 120 cfs consumptive withdrawal projected by Duke Power Company (Duke), between 2008 and 2038. With regard to the "reasonableness" of this projected consumptive withdrawal, it appears to be a very large withdrawal even for a large thermal electric power generation facility with closed loop evaporative condenser cooling, perhaps representing several thousand megawatts. APGI cannot predict whether Duke actually would be granted the right to operate plants that withdraw that volume of water upstream of the Yadkin Project during drought periods in which the inflows into High Rock Reservoir are on the order of only a few hundred cfs (which was the case in the summer of 2002). Given that, APGI has provided the depth, frequency, and duration data requested to illustrate the incremental effects of sedimentation and withdrawals, with and without the Duke 120 cfs projection.

Responses to Federal Energy Regulatory Commission's September 14, 2006 and November 22, 2006 Additional Information Requests, at 11, Docket No. P-2197-073 (December 13, 2006).

F. *SaveHighRockLake.org*

In its letter dated February 26, 2007, SaveHighRockLake.org ("SaveHighRock") submitted comments asking FERC to consider the following modifications to the RSA: (1) the license term be limited to 30 years; (2) APGI should be required to improve safety signage at High Rock Lake as recommended in *Safety Signage at Hydropower Projects* on the hydroelectric page of FERC's website and provide lighted hazard buoys at all bridges as well as anywhere a marked hazard exists more than 200 feet from the nearest shoreline; and (3) the operating guide

for High Rock Lake be modified to limit drawdowns to no more than 6 feet below full pond. SaveHighRock Comments at 5-6.

SaveHighRock believes that the license term should be limited to 30 years because APGI's 44% projected population increase by 2030, which was provided in Section 5.5 of the Recreational Use Survey, indicates the need to reevaluate the impact of the operation of the project much sooner than the year 2058. SaveHighRock Comments at 5-6. However, beyond that bare assertion, SaveHighRock provides no specifics or evidence that the present relicensing process is inadequate to permit a license longer than 30 years.

SaveHighRock's proposed modification to improve signage and provide buoys has no apparent connection to the contents of the SD-1. Under the terms of the Yadkin Project license, APGI must allow public access for recreational purposes to project waters and adjacent lands and may restrict access as necessary to protect the public and property. The courts of North Carolina have found that the Yadkin Project license itself does not, however, create a duty of care to those who would use it for recreational purposes. *See Croker v. Yadkin, Inc.*, 130 N.C. App. 64, 69, 502 S.E.2d 404, 408 (1998). APGI has been and will continue to be in compliance with Part 12 of the Commission's regulations on project safety. Those regulations, particularly 18 C.F.R. § 12.4, delegate to the Regional Engineer the responsibility to oversee the protection of life, health and property in the operation of hydroelectric projects. To the extent that SaveHighRock is advocating that the company do more than Part 12 requires, it is beyond the scope of this relicensing proceeding.[11]

SaveHighRock also wants the Commission to modify the operating guide for High Rock Lake to limit drawdowns to no more than 6 feet below full pond during the period from Nov. 1 to

[11] APGI does note that, as part of the RSA process, it agreed to provide $2,500 annually to the NCWRC to enhance NCWRC's ability to improve signage and provide buoys.

March 1 and to remove the provisions that allow withdrawals from High Rock Lake at a rate as high as 30% above the project discharges. SaveHighRock Comments at 6-7. In support of this proposal SaveHighRock asserts there is no scientific study data generated as part of the relicensing process to document the need or recreational or environmental benefit of a 10 foot winter drawdown. SaveHighRock Comments at 7

However, there is ample evidence in the record that APGI's water level proposal will provide significant environmental, recreational and aesthetic resource enhancement. *See* Application for License, Yadkin Hydroelectric Project (FERC No. 2197) at, e.g., E.3.6.1, E.3.6.2, Exhibit B.2, Exhibit B.6, Exhibit E.2.7, and Appendix E-4 (April 25, 2006). Maintaining reservoir water levels within 4 ft of full April 1 – October 31 enhances fish and wildlife access to a portion of the high quality habitat located within the upper 6 ft of the reservoir during a three month longer period each year. The operating curve calls for raising the water levels in High Rock six weeks earlier in the spring than under the existing license to provide spawning fish with earlier and better access to high quality spawning habitats. Maintaining the reservoir within 4 ft of full for six weeks longer than under the existing license in the late summer and fall will enable juvenile fish to remain in the high quality habitats for much longer, allowing them to grow larger and making them less vulnerable to predation. Maintaining the reservoir within 4 ft of full between April 1 and October 31 also extends the potential growing season for submerged and emergent wetland vegetation, allowing more vegetation to become established and to be maintained in the reservoir, and enhancing aquatic habitat availability.

Maintaining the reservoir within 4 ft of full also enhances conditions for recreational boating during the peak of the recreation season and significantly improves the opportunity for

recreation on the reservoir by three additional months each year. It also improves reservoir area availability for use by fishermen and boaters in the early spring and fall, along with opportunities for recreation on the reservoir during the fall foliage season.

Further, limiting the winter drawdown to a maximum of 10 ft below full will also provide significant enhancements. Limiting the drawdown to 10 ft will protect a greater portion of the reservoir littoral zone from the effects of desiccation and freezing and will enable more organisms and plants to establish themselves in the reservoir. Limiting the winter drawdown will enhance the ability for reservoir refill each spring in time for fish spawning season and the prime spring fishing season. Limiting the winter drawdown to 10 ft will also prevent dewatering of significant areas of the reservoir bottom and so should help to reduce related problems such as sediment re-suspension. The limited winter drawdown will also help to improve the scenic quality of the reservoir during the late fall and winter.

SaveHighRock also states that with an average depth of 16 feet drawdowns in excess of 6 feet present significant hazards to recreational boating and effectively make all of the nearly 2800 piers unusable and dangerous. SaveHighRock Comments at 7. Since historic Shoreline Management Plan provisions required an eight foot depth at full pond in order to qualify for a permit to construct a pier, thereby assuring at least 2 feet of water during a 6 foot drawdown, the assertion regarding existing piers is patently false. There are boating hazards during draw down periods, as is true of any storage reservoir of any size that is also used for recreational boating, which is why the primary responsibility for boating safety has to fall on the boat operator. But the major point is that the 10-foot draw downs are being proposed for the winter, November through March, when there are far fewer boaters in any event. Finally, the record shows that in the more than 75-year history of High Rock Reservoir, during most of which winter draw downs

exceeded 10 feet, hazards to recreational boaters during November through March have not been a pressing issue.

SaveHighRock also attempts to support its recommendation to limit drawdowns by asserting that modeling runs performed as part of relicensing negotiations documented that operating High Rock Lake at 3-6 ft drawdown would result in only minor generation losses to APGI. SaveHighRock Comments at 7. The characterization of these losses as "minor" reflects the narrow point of view of SaveHighRock. APGI, recognizing the project purpose for hydroelectric generation and considering the generation losses it will already be experiencing under the new license, does not agree with this characterization as minor.

Finally, SaveHighRock argues that the High Rock Development contributes nothing economically to the surrounding communities, SaveHighRock Comments at 7, an argument at odds with the various apparent recreation businesses located around the reservoir and the property values that depend on the reservoir's proximity. *See* Application for License, Yadkin Hydroelectric Project (FERC No. 2197) at Appendix E-20 and Appendix H-1 (April 25, 2006).

G. *City of Rockingham*

The City of Rockingham ("Rockingham") submitted a Motion to Intervene and Scoping Comments ("Rockingham Comments") on February 26, 2007. Rockingham has been a participant throughout the Yadkin relicensing process as a member of the Pee Dee River Coalition, and as such, has a continuing interest in these proceedings. Accordingly, APGI does not oppose Rockingham's intervention. Rockingham notes that its primary interest is in the operations of the Yadkin-Pee Dee project, but asserts that it has an interest in the Yadkin

relicensing with respect to the Yadkin Project's cumulative impacts on the recreation and fish and wildlife resources of the Pee Dee River. Rockingham Comments at 3.

Among other requests and comments primarily related to the Yadkin-Pee Dee project, Rockingham requests that the Commission convene a technical conference to "systematically discuss disputes about scientific data or method[s]" before publishing a Draft EIS. Rockingham Comments at 4. Further, Rockingham asserts that the Commission Staff should analyze whether APGI and PE coordinate operations under written agreements or standard practices; what the operating agreements with Duke Power require; and how the companies' new licenses may enhance coordination to benefit developmental and non-developmental uses. Rockingham Comments at 9.

APGI does not oppose Rockingham's request to convene a technical conference provided that doing so would not encumber the schedule or delay the orderly process that the Commission has outlined for this proceeding. To the extent that it relates to headwater benefits issues, Rockingham's request that the FERC Staff analyze project coordination is outside the scope of this relicensing proceeding. However, by law the new licenses will make provision for such arrangements and APGI and PE have already had preliminary discussions on the subject. Moreover, in fact, APGI and PE have coordinated operations on the watershed for many years under their respective existing licenses, including during the drought of 2002. Each has participated in the relicensing proceeding of the other with regard to common flow and environmental issues. APGI has addressed operating issues with respect to Duke Power in its response to Duke's comments, above.

H. *Sandhills Rod and Gun Club*

The Sandhills Rod and Gun Club ("Club") submitted a Motion to Intervene on February 26, 2007. While the Club noted that its primary interest is in the operations of the Yadkin-Pee Dee project, it intervened in the Yadkin River Project relicensing in order to address the cumulative impacts of both projects on the recreational and fish and wildlife resources of the Yadkin and Pee Dee Rivers. Club Intervention at 2. However, the Club's intervention does not address any specifics related to the APGI's project. Rather, the Club only addresses the impacts of drawdowns by PE's Tillery Plant on recreation and fish life. Club Intervention at 2.

Accordingly, APGI does not oppose the Club's intervention.

I. *Carolina Sand*

In a letter dated February 21, 2007 Carolina Sand, Inc., a business dealing with sedimentation, submitted comments concerning sediment problems in High Rock Lake. Carolina Sand asserted that the negative impacts of water depth and capacity on recreation and aquatic life is due to sedimentation. Carolina Sand Comments at 1. Specifically, Carolina Sand maintained, "sediment studies and modeling that has been done shows that the real problem is, hundreds of thousands of tons of sediments from up stream, have displaced much of the water[.]" *Id*.

On this basis, Carolina Sand asserted that APGI should be required to remove sediment to improve water depth and capacity. Carolina Sand Comments at 2. It proposed that the Shoreline Management Program be amended to provide that certain areas along the lake be designated specifically for sediment removal to help with the maintenance of the water levels in

the lake. *Id*. Carolina Sand, which currently conducts sand mining in the High Rock Reservoir, also noted that it has already recommended a few such sites to APGI. *Id*.

It appears that Carolina Sand's interest in this proceeding is purely pecuniary. By requiring APGI to remove sediment from High Rock Lake, Carolina Sand hopes to grow its business dealing with removal of sedimentation. However, it is uncontested that APGI does not cause sedimentary matter to flow into the project and there exists no simple or economic means to prevent that from occurring. Thus, there is no legal basis to saddle APGI with the expense of removing sediment it does not cause.[12] Moreover, the fact that any license condition requiring APGI to remove sediment in or around the project area could stand to financially benefit Carolina Sand undermines the credibility of its assertions regarding sedimentation.

J. *Stanly County and Individual County Residents*

On February 26, 2007, Stanly County filed comments on the SD-1 and scoping meetings, styled "Scoping Comments of Stanly County and Request for Additional Information from Licensee" ("Stanly County Comments"). Supporting Stanly County's positions taken in its comments and in its previous communications in this proceeding, a few of Stanly County residents signed and submitted a form letter ("Stanly County Resident Form Letters") urging the Commission to reject APGI's license application on the basis of purported environmental contamination and losses to the local economy.[13] In addition, North Carolina Senator William Purcell and Representative David Almond submitted letters, both dated February 20, 2007,

[12] A brief survey of Commission precedent revealed no cases of licensees being directed to remove sediment that they did not cause.

[13] Form letters were filed by: Alex Cousins, Ashley Hightower, Cody Myrick, Daniel Barringer, David Beaver, Donna Pleasant, Donnie Swaringen, Dustin Poplin, Elizabeth Hill, Joseph and Karen Korzelius, Kristen Laton, Lindsay Smith, Martha Hughes, Martha Sullivan, Michael Laton, Natalie Almond, Robbie Walters and Sarah Bivins.

requesting that the Commission delay these proceedings while the concerns raised by Stanly County are resolved.

Stanly County's comments, and the form letter submitted by a few county residents, urge the Commission to act to address allegations of environmental contamination in and around the project area that Stanly County and the form letter signatories attribute to past activities at the Badin Works aluminum smelter owned by APGI's corporate parent, Alcoa Inc. Stanly County Comments at 9-27; Stanly County Resident Form Letters. Stanly County and the residents that submitted form letters also urge the Commission to analyze, as part of the Yadkin relicensing, ways in which the Yadkin Project can be used to support local job creation to replace local job force reductions that resulted from the Badin Works curtailment. Stanly County Comments at 27-34; Stanly County Resident Form Letters. Stanly County suggests that the Commission consider federal takeover of the Yadkin Project, despite the Commission Staff's preliminary rejection or—and the lack of any basis for—that alternative. Stanly County Comments at 34-35.

The issues regarding contamination from Badin Works and workforce reductions raised in Stanly County's comments and the form letter deal with matters that, while important, are separate from the licensing of the Yadkin Project. This fact has been pointed out by APGI repeatedly during scoping meeting[s] and in response letters to Stanly County. *See* Letter from Gene Ellis to Tony Dennis, Chairman, Stanly County Commission, dated February 22, 2007 ("February 22 Letter"). Part I of the FPA empowers the Commission to issue licenses for hydroelectric projects for the development, transmission, and utilization of power. 18 U.S.C. § 797(e). The FPA does not, however, contemplate the Commission making determinations relating to the issuance of a new license that are based on the presence of industrial contamination not located within the hydroelectric project or employment at other non-project

industrial operations. These issues are fundamentally outside of the purview of this licensing proceeding.

To the extent that Stanly County may have raised environmental issues that are within the scope of this proceeding, APGI has already addressed those issues. In communications with APGI and at the January scoping meetings held by the Commission, Stanly County made statements about certain solid waste management sites related to Alcoa's Badin Works aluminum smelter and the need for Commission action with respect to those sites. Following the scoping meetings, APGI verified the location of known waste management sites in Stanly County, confirming that there are no such waste sites in Stanly County within the project boundary, nor do any sites outside of, but in proximity to, the project boundary have an adverse impact on Project lands or waters. APGI so informed Stanly County of this confirmation in the February 22 Letter.

As stated in its February 22 Letter to Stanly County, APGI remains willing to discuss with Stanly County matters related to the management of waste management sites outside of this relicensing process. Further, as communicated to Stanly County many times, APGI has been working with the appropriate state agencies, in accordance with applicable regulatory requirements, to address these waste management sites. However, this relicensing process should not be impeded, and the Commission's resources should not be unduly burdened, by the issues raised by Stanly County that are not within the scope of the proceeding to relicense the Yadkin Project.

K. *Ronnie Qualkenbush*

Mr. Ronnie Lee Qualkenbush submitted "Comments [on the] Scoping Meetings" and a "Protest [of] the Re-Licensing" ("Qualkenbush Comments") on February 18, 2007. Mr. Qualkenbush's filing did not explicitly discuss scoping issues pertaining to the SD-1 or the scoping meetings, but rather restated his concerns regarding flooding, APGI operating procedures, and sedimentation in the Yadkin River. These concerns have been raised by Mr. Qualkenbush previously in this docket and have likewise been addressed on numerous occasions by APGI. *See, e.g.*, Response of Alcoa Power Generating Inc. in Opposition to Additional Study Requests of Duke Power Company LLC, The City of Salisbury, North Carolina, SaveHighRockLake.org and Mr. Ronnie Lee Qualkenbush, Docket No. P-2197-073 (June 18, 2006); Response of Alcoa Power Generating Inc. to Pleading of Ronnie Lee Qualkenbush Captioned As "Complaint," Docket No. P-2197-000 (Aug. 26, 2003). The Commission has also expended considerable effort in responding to the concerns previously raised by Mr. Qualkenbush and reiterated in his February 18, 2007 filing. *See, e.g.*, Letter from Charles Cover, P.E., FERC Engineering and Jurisdiction Branch, to Mr. Qualkenbush, Docket No. P-2197-066 (Oct. 3, 2003); Letter from Mark Robinson, Director of FERC Office of Energy Projects, to Mr. Qualkenbush, et al. (June 18, 2003); *Alcoa Power Generating Inc.*, 92 FERC ¶ 62,029 (2000); *Alcoa Power Generating Inc.*, 93 FERC ¶ 61,152 (2000).

In support of the concerns raised in his filing, Mr. Qualkenbush makes numerous references to North Carolina law, common law, and the public trust doctrine. Whatever their validity in other contexts, which APGI does not concede, it is apparent that these references have no relevance to any legitimate issue with respect to the SD-1.

III. Conclusion

APGI appreciates the continued involvement of the participants that submitted comments and requests to intervene in this proceeding. It is APGI's hope and intention that the SD-1 and scoping meetings, together with the comments received in response, will enable the Commission Staff to engage in a meaningful and comprehensive environmental review of the Yadkin Project relicensing. APGI intends to address many of the environmental issues that have been raised earlier in the relicensing process through the submission of an RSA that could become the basis for a new Yadkin Project license. In addition, APGI will continue to work with federal and state agencies to address fish passage through an agreement that will fulfill the purposes of sections 10 and 18 of the FPA. APGI asks that, together with this Consolidated Answer, the Commission carefully evaluate the comments submitted in response to the SD-1 and scoping meetings to ensure that the issues identified therein are relevant and meaningfully aid in determining the scope of environmental review for the Yadkin Project relicensing.

Respectfully submitted,

/S/

David R. Poe (dpoe@llgm.com)
D. Randall Benn (dbenn@llgm.com)
Ahren S. Tryon (atryon@llgm.com
Shamai Elstein (selstein@llgm.com)
LeBoeuf, Lamb, Greene & MacRae LLP
1875 Connecticut Avenue, NW
Washington, DC 20009
(202) 986-8000

Counsel for Alcoa Power Generating Inc.

EXHIBIT A

AFFIDAVIT OF DAVID WILLIAMS, Ph.D., P.E.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Alcoa Power Generating Inc.	)	Project No. 2197-073

AFFIDAVIT OF DAVID T. WILLIAMS, Ph.D., P.E.

I am David T. Williams, Ph.D., P.E., CPESC, P.H., D.WRE, National Technical Director of Water Resources for PBS&J, a national engineering firm. My areas of professional expertise related to this affidavit are hydraulic modeling, sediment transport mechanics, sediment transport modeling, reservoir sedimentation analysis, and watershed sediment yield analysis. My curriculum vitae is attached as Exhibit 1 and my references that establish my expertise with regard to the issues addressed in this affidavit are attached as Exhibit 2.

I have read and begun a preliminary analysis of “Numerical Sedimentation Investigation, Yadkin River, North Carolina,” by Dr. Ronald R. Copeland, which is Exhibit 1 of the February 23, 2007 filing by the City of Salisbury entitled "City of Salisbury Scoping Comments and Response to Commission Request for Study Results." I have identified three major areas of concern in the analyses presented in this document. These concerns are fundamental, thus invalidating the results of the study which in turn directly invalidate the conclusions of the report. In addition, to the extent that conclusions of other reports in the Salisbury filing, in particular Exhibit 2 by Dr. Martin Doyle, are based upon flawed results of the Copeland study, those conclusions are likewise invalid, but I do not directly address the Doyle report here. My major concerns with the Copeland study are grouped under three captions: "Base Condition Has

Not Been Modeled"; "Numerical Instabilities in the Sediment Transport Model"; and "Unusual Bed Elevation Changes," and are as follows:

Base Condition Has Not Been Modeled

1. To evaluate the effects of a project such as the impoundment of High Rock Reservoir, a determination of what would have happened if the project had not been built is required. This is termed as a "base condition." A comparison of the “with the project” and “without the project" results, from 1928 to the present and beyond, would then give a true picture of the sediment impact of High Rock Reservoir.

2. This is a fundamental modeling procedure that should have been performed by Salisbury. This type of analysis is also recommended by the U.S Army Corps of Engineers (USCOE) document, “Sedimentation Investigations of Rivers and Reservoirs, EM 1110-2-4000” in Section 4.3, which is as follows:

> The impact of the project on stream system morphology should not be determined by comparing a static condition of the stream system, as depicted by either current or historical behavior, to a "future condition with the proposed project in operation". A more appropriate measure of impact is to compare the "stream system with project" to a "future base condition." The future base condition is determined by forecasting the stream system without the proposed project, i.e., a "no-action condition." The "with project forecase" is made for a period equal to the project life. The "no-action forecast" should be made for the same period of time and should contain all future changes in land use, water yield, sediment yield, stream hydraulics and basin hydrology except those associated with the project.

3. In addition, USCOE document, “River Hydraulics, EM 1110-2-1416” in Section 7.10, states:

> “The most appropriate use of a movable bed simulation is to compare an alternative plan of action with a base condition.

> a. The base test. In most cases the base conditions is the simulation behavior of a river under a "no action future." In a reservoir study, for example, the base test would calculate the behavior of the river, both upstream and downstream of the proposed dam site, without the dam in place."

4. Taken together, the USCOE documents clearly point out that a "no action forecast" should have been made; however, in this case, this would be a "hindcast" since the Yadkin project was in existence at the time of analysis.

5. Salisbury made projections into the year 2058 with High Rock Reservoir in place, but no predictions were made of what would have happened up to year 2058 if the Reservoir had not been in existence. The curriculum vitae of Salisbury's lead consultant, Dr. Copeland, indicates that he was a contributor to the development of EM 1110-2-400 (see item 2 above) and therefore is aware that a "no project" condition simulation is needed to fully assess the project effects.

Numerical Instabilities in the Sediment Transport Model

6. Sediment transport numerical simulations must be carefully examined to assure that the results are truly representative of the "real" world and not the result of computation errors. Computational errors commonly occur due to numerical instabilities. Indicators of numerical instabilities in a sedimentation model simulation are oscillations in the bed elevation changes at any cross section when plotted over time and oscillation in the bed elevation changes of cross sections of a river reach, at any given time, when plotted over channel distance. If any of these conditions exist in the simulation, the subsequent results are merely artifacts of the numerical instabilities and therefore most likely not representative of the "real world."

7. I began my analysis by trying to duplicate Dr. Copeland's model calculations. The HEC-6T model data sets that were submitted by Salisbury were executed using the HEC-6T version

that PBS&J purchased in 2006 from Mobile Boundary Hydraulics, Dr. Copeland's firm. The execution of this data produced essentially the same output for all runs (also submitted) with very minor differences that were in the order of 0.1 feet or less. The differences between my calculations and those of Dr. Copeland can be attributed to the slightly different versions of HEC-6T we used; therefore, the results of my analysis and Dr. Copeland's analysis should essentially be the same. The input data sets developed by Dr. Copeland were then modified to output the bed elevation changes at every computational time step. By contrast, the model submitted by Salisbury provided calculations of such bed changes on a much more infrequent basis.

8. Figure 1 (attached as Exhibit 3) shows the bed elevation change over time for selected cross sections. Note that cross section 19.4 of river segment 1, which is near Salisbury's water intake structure, shows bed elevation change oscillations ranging from 0 feet to about 10 feet at approximate cyclic intervals. Small oscillations can be expected in numerical simulations, but note that in this instance, the oscillation range is as large as the overall change that is blamed for causing inundation of the water intake structure.

9. Figure 3 (attached as Exhibit 5) shows the bed elevation change over time for selected cross sections for segment 2. Note that cross section 19.42 at approximately day 22,000 of the simulation shows oscillations ranging from -2 feet to 5 feet on a cyclic basis also. Figure 4 shows this oscillation in detail. Note that the oscillations are fairly regular and have almost the same amplitude. Also note that these oscillations are not caused by high discharges but by numerical instability since they are not in phase with each other.

10. The characteristics of the bed elevation oscillations shown in Figures 1, 3, and 4 (attached as Exhibit 6) are evidence of numerical instabilities in the model and therefore invalidate the results. Since the results at these locations are not dependable, they also cast doubt on the validity of the results at other locations since all the locations, both upstream and downstream, are influenced by each other through hydraulics and sediment transport phenomenon.

Unusual Bed Elevation Changes

11. Figure 2 (attached as Exhibit 4) shows the bed elevation change for cross section 19.4 for the first 500 days of simulation. At approximately day 370, a large flood occurred (discharge is shown in blue with the scale on the right side), resulting in a very large increase in bed elevation of 4 feet (from bed elevation change 8 feet to 12 feet) and when the flood receded, the bed elevation went down 7 feet (from bed elevation change 12 feet to 5 feet). Such a dynamic bed response is highly unusual for a reservoir, especially in such a short timeframe as 50 days.

12. Figure 3 also shows scour at cross section 19.8 of almost 5 feet just a few days into the simulation. However, at cross section 19.42, which is only 0.38 miles downstream of 19.8, it shows deposition of almost 3 feet. This results in a bed elevation difference of almost 8 feet over a distance of only 2,000 feet. Such bed changes (both in magnitude and steepness over a short distance) at the beginning of a simulation are looked upon by modelers as suspicious and are indicative of numerical instabilities. Furthermore, it is hard to conceive that the High Rock Reservoir would cause 5 feet of scour at cross section 19.8 and then cause it to deposit at cross section 19.42.

13. Given the short time available for examination of the study, detailed descriptions of other concerns or questionable modeling practices are not discussed in full detail in this affidavit. Some of those concerns or practices which should be analyzed include:

(a) Sensitivity of deposition parameters for silt and clay;

(b) Sensitivity of the proportioning of silts and clays to both total inflowing load and between the two;

(c) The basis for using the 1980 inflowing sediment load for projection to the year 2058. Land management practices, which affect the inflowing load, should change for the better in the future; and

(d) Sensitivity of different assumptions for determining the model geometry in 1928. The 1929 geometry from the High Rock Dam to about 19.4 miles upstream is not detailed and is subject to considerable conjecture.

The inflowing load (items a, b and c above) has the greatest uncertainty in the model assumptions as pointed out in page 32, paragraph 2 of the report. This also greatly impacts the result and therefore must be examined very thoroughly.

14. In conclusion, three major concerns related to the results of the sediment transport modeling have been presented. These major concerns, in conjunction with other itemized concerns, completely invalidate the results of the modeling effort. Since the results are invalid, the conclusions in the Salisbury filing based upon the flawed results are also invalid.

FURTHER, Affiant Saith not.

I, David T. Williams, hereby declare that I am submitting the foregoing Affidavit on behalf of Alcoa Power Generating, Inc., that information in this Affidavit was prepared by me or under my direction, and that the contents hereof are true and correct to the best of my knowledge, information, and belief.

Dates: 26 March, 2007

David T. Williams

Sworn to and subscribed before me on this 26th day of March, 2007.

DANA S. WALKER
Commission # 1716610
Notary Public - California
Orange County
My Comm. Expires Jan 13, 2011

Notary Public
My commission expires: January 13, 2011

Resume of David T. Williams

Education

Ph.D., Civil Engineering, Colorado State University, 1995
M.S., Civil Engineering, University of California, Davis, 1977
B.S., Civil Engineering, University of California, Davis, 1972

Registrations

Professional Engineer (Civil)
- California 57020, 1997
- Arizona 24349, 1990
- Hawaii 7796, 1993
- Mississippi 8242, 1981
- New Mexico 12187, 1993
- Texas 80003, 1994
- Washington 23201, 1990

Professional Hydrologist (PH)
Certified Professional, Erosion and Sediment Control (CPESC)

Professional Affiliations

American Society of Civil Engineers (Fellow)
International Erosion Control Association (IECA)
American Society of Testing and Materials (ASTM)
American Institute of Hydrology

Professional Work History

Combat Engineer Unit Commander, U.S. Army, 7th Special Forces Group, Ft. Bragg, NC
Civil Engineer, Hydrologic Engineering Center, Davis, CA
Civil Engineer, U.S Army Corps of Engineers District, Nashville, TN
Research Hydraulic Engineer, Waterways Experiment Station (now ERDC), Vicksburg, MS
Chief, H&H Section, U.S Army Corps of Engineers District, Baltimore, MD
President, WEST Consultants, San Diego, CA
National Director, Hydrology and Hydraulics, HDR Engineering, San Diego, CA
National Director, Water Resources, PBS&J Engineering, San Diego, CA

Summary

Dr. David Williams is a registered Professional Civil Engineer in eight states, a Fellow of the American Society of Civil Engineers, a Professional Hydrologist and a Certified Professional in Erosion and Sediment Control (CPESC). He served as Principal-in-Charge for several flood insurance studies in San Diego and Orange counties. He has written the new HEC-6 User Manual for the U.S. Corps of Engineers Hydrologic Engineering Center, performed HEC-6 and local scour analysis of pipeline crossings in Arizona and New Mexico, headed the Keene Ranch groundwater modeling study and the Nile River sedimentation evaluations. He is well versed in the computer programs HEC-1, HEC-2, HEC-RAS, HEC-6, STORM, and WQRRS. Dr. Williams is a nationally recognized expert in sedimentation engineering and in developing innovative solutions to difficult hydraulic and hydrologic design problems in rivers and estuaries.
Dr. Williams previously served as a two time President of the International Erosion Control Association. He has served as chair of the ASCE Task Committee on Analysis of Laboratory and Field Sediment Data

Accuracy and Availability. He is also a past chair of the ASCE Sedimentation Committee as well as the Computational Hydraulics Committee and currently serves on the ASCE Stream Restoration Committee. While chair of the Federal Interagency Technical Committee on Sedimentation, he worked with hydraulic and sedimentation experts from the Federal Highway Administration, Bureau of Reclamation, U.S. Geological Survey, Bureau of Land Management, Forest Service, TVA, Bureau of Land Management and the Agricultural Research Service. His work with the Committee involved developing sediment sampling equipment and sediment data collection methods. He is the author of more than 100 technical papers and reports on hydraulics and sedimentation. Dr. Williams was formerly an Associate Editor of the ASCE Journal of Hydraulic Engineering, as well as a reviewer. He was selected the 1993 Small Business Person of the Year by the Carlsbad, California Chamber of Commerce, and served as chair of the Carlsbad Beach Erosion Committee.

His professional experience includes more than eighteen years as a hydraulic engineer with the U.S. Army Corps of Engineers at the Waterways Experiment Station (WES) in Vicksburg, Mississippi, both the Nashville and Baltimore Districts, and the Hydrologic Engineering Center in Davis, California. While at WES, Dr. Williams worked on research applications of sediment transport in rivers and reservoirs and the solution of unusual hydraulic and sediment related problems using computer models and other state-of-the-art techniques. He also worked on the development of the cohesive and network versions of the HEC-6 sediment transport computer model, and wrote the Reservoir Sedimentation Chapter in the U.S. Corps of Engineering Manual on Sedimentation Investigations. At the Nashville District, Dr. Williams performed erosion control and sedimentation studies for the Tennessee-Tombigbee Waterway Project and also conducted sedimentation and floodplain information studies of proposed flood control projects. He was acting Chief of the Hydrology and Hydraulics Section at the Baltimore District Corps of Engineers. During the mid 1970's, Dr. Williams worked at HEC, helping in the development of spatial data management techniques, evaluation of the economic benefits of flood control projects, and sedimentation in rivers and reservoirs.

Dr. Williams has been a frequent short course instructor for ASCE for computer training workshops on using HEC-2, HEC-RAS, and HEC-6. In addition, he has taught short courses on channel bed scour for toe protection design, sediment transport, bridge scour and streambank protection.

Selected Projects

Evaluation of Fluvial-12 Sedimentation Model on Pole Creek for Ventura County Watershed Protection District, California - The sediment transport model Fluvial-12 was used by Chang and Associates to model a sedimentation basin and exit conditions on Pole Creek in Ventura County. The model results were used to justify the location and dimensions of the sedimentation basin as well as the channel dimensions of its outlet to the Santa Clara River. The Ventura County Watershed Protection District required an outside expert, Dr. Williams, to evaluate the Fluvial-12 model results and make recommendations on improvements to the model, if needed.

Uncertainty Analyses Using Simplified Methods for the Flood Control District of Maricopa Co. – The study developed simplified methods to evaluate the uncertainty for flood control projects. This involved automated execution of hydrologic and hydraulic models with varying inputs to develop probability density functions for use in Monte Carlo simulations. The probability distributions of hydrologic and hydraulic inputs were developed. The results were the determination of the uncertainty in the outs so that decisions could be made such as the height of freeboard, operation schemes for reservoir operation, etc.

Santa Paula Creek Emergency Streambank Protection for Ventura County Watershed Protection District, California - As the lead technical advisor, Dr. Williams and his team identified potential alternatives to the streambank erosion problem along the Santa Paula Creek which included a No-Action plan, as well as non-structural and structural solutions. The consensus preferred alternative was the use of river training structures such as Bendway Weirs and Spur Dikes. This alternative involved design considerations using geomorphic and natural channel design procedures, determining the dimensions of the low flow channel, scour

analyses for preventing undermining of the spur dikes, and the orientation, spacing and dimensions of the spur dikes.

Evaluation of Sediment Transport and Scour Analyses of the Agua Fria River, Arizona, for the Flood Control District of Maricopa County - Dr. Williams headed this project in which the PSB&J team was asked to assess the validity of sediment transport and scour analyses that had been conducted on the Agua Fria River as well as conduct an independent study. The analyses included development of an HEC-6T sediment transport model, analyses of levee heights and determination of toe scour depths to protect the levees. The resulting report was use by the Flood Control District of Maricopa County to require the project owners to reconsider their design and use the techniques that were presented in the report.

Approximate Floodplain Study for Orange County, California - Dr. Williams prepared an approximate floodplain study for the Orange County Flood Control District to delineate 100-year floodplains for the East Garden Grove - Wintersburg Channel (C05), the Ocean View Channel (C06), and seven tributaries to the C05 channel. This project was undertaken by the District to facilitate lifting of the Santa Ana River floodplain (zone A99) after the completion of the Santa Ana River flood protection project by the U.S. Army Corps of Engineers (Corps). The Corps project has controlled breakout flows from the Santa Ana River (SAR), but the flooding from other sources underlying the SAR floodplain, needed to be delineated before the A99 zone was lifted by FEMA. The study area is located in the Cities of Huntington Beach, Fountain Valley, Westminster, Santa Ana, Garden Grove, Anaheim, and Orange, in Orange County, California.

The C05 and C06 channel system consists of a complex network of leveed channels, storm drains, and detention basins that convey stormwater runoff from highly urbanized low-lying interior areas to the Pacific Ocean. About 16 miles of flood control channels were analyzed using an approximate hydraulic analysis with the Corps HEC-RAS program. The C05 channel laterals were analyzed using various computer programs including the Corps HEC-RAS program and the HEC-2 program with the split-flow option, and the Los Angeles County Flood Control Districts WSPG program. To obtain a model for an approximate level of analysis, all levees, bridges, and culverts, were removed from the cross-sections.

Engineering judgment was used to interpret the model results based on output that appeared reasonable in accordance with field observations. Field observations were used to verify flow directions, track flow paths, and evaluate the effect of floodplain features such as elevated highway embankments. Approximate studies in urban environments can be especially challenging because of the need to make appropriate assumptions in order to simplify complex hydrologic and hydraulic phenomena. A Zone A approximate 100-year floodplain was delineated. The results of the study satisfied FEMA requirements and were subsequently published for the benefit of the community.

Cherokee Wash Hydraulic/Sediment Analysis, Paradise Valley, Arizona - Hydrologic, hydraulic, and sedimentation studies were performed for the Maricopa County Flood Control District to evaluate options to alleviate flooding and sediment problems. Existing HEC-1 models were evaluated and modified to reflect current and with-project (flow diversions) hydrologic conditions. The existing HEC-2 model was reviewed and found unsuitable; therefore a new model was created to evaluate current hydraulic conditions including controls and flow break-out points. An HEC-6 model was prepared for sedimentation studies of the wash; a sediment sampling program was designed by WEST, and the gradation results were used in the model. Channel sediment continuity and geomorphic analyses were also performed, and the study results were used to render opinions on the need for grade control, sedimentation basins, and maintenance of the project.

Cumulative Effects Study of Sedimentation Impact, Upper Mississippi River - Dr. Williams quantified the cumulative man-made and natural effects on sedimentation, stream morphology and ecology along the Upper Mississippi River (UMR) and IWW and predicted future conditions for the year 2050. The study area involves 5 states, 3 Army Corps of Engineer's Districts, and about 1,200 river miles. The geology and glacial history of the study area was analyzed to define the influences and controls on channel morphology. Hydrologic records were examined to identify changes in discharge and stage along the UMR. Available research was reviewed to

define potential impacts of global warming on basin hydrology. The history and extent of human influences on the fluvial system were characterized. Historic plan form and channel geometry data were analyzed to quantify changes in channel morphology. The sources and sinks of sediment along the UMR were quantified and a sediment budget developed to estimate backwater sedimentation rates in navigation pools. Historic changes in nine geomorphic categories were characterized throughout the study area. Predictions of geomorphic conditions along the UMR and IWW in the year 2050 were developed based on trends identified from historic geomorphic data and results of the sediment budget. Ecological conditions in the year 2050 were predicted based on ecological guilds and the trends established for aquatic habitat.

Eastern Arkansas Water Supply Study - Study included extensive model application and model calibration to analyze the effect of in-basin water transfers on surface water flow magnitude, frequency, and duration in the La Grue Bayou stream network using Corps of Engineers' programs HEC-1, HEC-2, HEC-DSS, and HEC-FFA. A unique feature to this study was the application of the Memphis District's program HUXRAIN to develop long term (50 years) synthetic discharge hydrographs using calibrated antecedent precipitation index coefficients, a long term rainfall data base, and computed unit hydrographs for the sub-basins. Another component of this work was an interior hydrology study for the city of Clarendon, Arkansas. Several scenarios were analyzed using HEC-IFH for continuous simulation with 50 years of data.

Humboldt Bay Highway Seismic Retrofit Scour Evaluation Study - Caltrans planned to seismically retrofit the highway bridge crossing Humboldt Bay near Eureka in Northern California. The bridge is approximately 8,000 feet long, and crosses the bay in three sections with two islands. The proposed retrofit would substantially increase the number of piles at each pier and the size of the pile caps. Dr. Williams studied the seismically retrofit using a 2-dimensional hydrodynamic model (using RMA-2) and a 2-dimentional sediment transport model (using SED2D) study was conducted to: (1) determine if the larger bridge foundation might alter circulation patterns in the northern part of the bay, (2) to evaluate the scour at the modified individual bridge piers, and (3) determine if sediment transport processes in the bay might change sufficiently to cause increased sedimentation in sensitive areas, such as a nearby marina. The study included a detailed survey within 2,000 feet of the bridge, development of a detailed finite-element grid in the vicinity of the bridge, model calibration, and model application. A 14-day tide, including neap and spring cycles, was used to analyze the bay's circulation and sediment transport response to normal conditions. A 100-year storm surge was used to evaluate pier scour at the modified bridge.

IDIQ for Los Angeles District Corps of Engineers - During this IDIQ contract for hydrology and hydraulics with the Los Angeles District, Dr. Williams completed multiple work orders. A spillway inundation study was conducted for Carbon Canyon using HEC-RAS. A two-dimensional link node model was applied to Mission Creek in Santa Barbara to evaluate flooding. In the Santa Margarita river watershed study HEC-1, HEC-2 and HEC-6 were used to evaluate flooding and sedimentation problems in the river. Two channel restoration and environmental enhancement plans were developed in Phoenix for the Tres Rios and Rio Salado projects. Tres Rios involved HEC-6 modeling, and Rio Salado had both HEC-RAS and HEC-6 models developed for the Salt River. We conducted a flood map revision study and levee analysis report for the Los Angeles River and Compton Creek. During this study numerous HEC-2 models were modified to reflect levee system changes made by the Los Angeles District. Overbank models were also modified to analyze split flow conditions.

Lead Instructor and Course Notes Author - Developed short course notes and taught HEC-RAS, HEC-6, Bridge Scour and Streambank Protection short courses. The courses were very technically oriented and geared to immediate implementation of the subjects taught. Certain subjects were enhanced according to the location of the course - local problems and situations. The courses ran from 2 to 3 days.

Lindo Lake Park Water Quality Study, Lakeside, California - Dr. Williams conducted detailed study of water quality conditions, to evaluate lake rehabilitation alternatives, and to develop a restoration plan to improve water quality conditions and to support a wide array of beneficial uses, including active recreation for Lindo Lake Park. Lindo Lake Park Water Quality Study

The Lindo Lake Park Water Quality Study was comprised of five major tasks: 1) public meetings; 2) report on inventory, bibliography and proposed methodology; 3) Quality Assurance Project Plan according to EPA guidelines; 4) Water quality study and associated technical report; and 5) Implementation plan.

Minnesota and Red River CWMS Watershed Modeling - To establish a flood forecasting system and reduce future flood damage in the Red River of the North basin (4,010 square miles) and Minnesota River basin (1,770 square miles), Dr. Williams along with the U.S. Army Corps of Engineers, St. Paul District (the Corps), developed a Corps Water Management System (CWMS) model to assist in real time operation of the reservoirs to regulate reservoir outflows.
Dr. Williams developed snow process, hydrologic, water control, and hydraulic models that will be incorporated by the Corps into CWMS as model components. The modeling work included development, calibration, and verification of the Distributed Snow Process Model (DSPM), HEC-HMS, HEC-ResSim, and HEC-RAS models.

Pipeline Crossings over Desert Rivers and Washes, Arizona - Dr. Williams was Project Manager and Project Engineer for numerous Pipeline Crossings over Desert Rivers and Washes in Arizona. These efforts required the understanding of fluvial geomorphology, alluvial fan flooding, sediment transport and short duration/high peak discharge as related to desert hydrology.

Potrero Creek In-Channel Sedimentation Basin Alternative Study, Ventura, California -Ventura County Flood Control District (VCFCD) proposed building one or more in-channel sedimentation basins to reduce the incoming sediment load from Potrero Creek from reaching the homes located in Lake Dr. Williamslake in Ventura, California. Dr. Williams evaluated the effectiveness of their various sedimentation basin plans.
Dr. Williams formulated a plan to first estimate the average annual sediment yield from Potrero Creek and then model the system using HEC-6T, the sediment transport software package developed by the U.S. Army Corps of Engineers. Dr. Williams estimated average annual sediment yield using two different methods. The first method involved numerical integration of sediment yield-frequency curves for four contributing sub-watersheds provided by the VCFCD. The second method applied U.S. Geological Survey methodology based on a curve of long-term sediment yield in nearby mountain watersheds in Los Angeles and Ventura Counties to the VCFCD data. The sediment yield-frequency curve and U.S.G.S. methods provided two cases for input into sediment transport model.

QA/QC, 50 Bridge Scour Analyses, Caltrans, California - Principal in Charge and Senior Project Manager. Responsible for quality control and assurance for over 50 bridge scour analyses that were required under CalTrans seismic retrofit program. The projects ranged state-wide but were concentrated mostly in desert environments in southern California. Dr. Williams also acted as project manager for complicated situations that involved innovative channel designs or scour protection requirements to minimize the impacts of the bridge retrofit on channel scour. Several of these projects involved fluvial geomorphic analyses.

Restoration/Environmental Enhancement Plans, Tres Rios and Rio Salado Projects, Phoenix, Arizona - Principal in charge and Senior Project Manager: Two channel restoration and environmental enhancement plans were developed in Phoenix for the Tres Rios and Rio Salado projects. Tres Rios involved HEC-6 modeling, and Rio Salado had both HEC-RAS and HEC-6 models developed for the Salt River through Phoenix, AZ. The work involved the use of fluvial geomorphology principles and took into consideration the effects of san/gravel mining activities. The project also required coordination with biologists and botanists to establish a well-balanced environmentally sound project and still meet the flood control requirements.

Wellhead Protection Plan for the Los Angeles Corps of Engineers, San Luis, Arizona - The components included the delineation of wellhead protection areas, the compilation of a contaminant source inventory, the development of management tools to protect the groundwater and the formulation of a contingency plan for both short and long term losses of one or more wells. Dr Williams was also the Principal-incharge of several sediment transport studies (Agua Fria, Salt, and Gila Rivers) for the Flood Control District of Maricopa County in Arizona. The purposes of these studies were to develop sediment models that could be used as

predictive and management tools. The developed sediment transport models served to evaluate potential effects on channel stability of bank protection measures, floodplain encroachments and sand and gravel mining operations along the rivers.

U.S. Army Corps of Engineers, New Orleans District, New Orleans, Louisiana - Mr. Williams developed a conceptual flood management plan for St. Tammany Parish in southeast Louisiana. Flood management in St. Tammany Parish was a unique challenge, with 100 square miles drained by a complex network of natural bayous and man-made canals. Hydrologic and hydraulic models were needed to evaluate existing conditions and compare flood management alternatives. The results of the hydrologic models provided the input for hydraulic modeling to the New Orleans District with useful answers about their proposed flood management plan, allowing the District and the citizens of St. Tammany Parish to make informed decisions about their watershed.

Ventura County Flood Control District, Calleguas Creek Sediment Transport Study, Ventura, California - An HEC-6T sediment transport model was prepared for Calleguas Creek, Arroyo Las Posas, and Arroyo Simi in Ventura County to establish baseline conditions and to evaluate proposed channel improvements. The model extends 25 miles from State Highway 1 near the mouth at Mugu Lagoon to upstream of Hitch Boulevard in the vicinity of Moorpark. Inflowing sediment loads and sediment discharge to Mugu Lagoon were calibrated to records of historical sediment deposition in the lagoon, historical bed changes in the channel, and records of maintenance sediment removals. A long term hydrological simulation (50 years) was used in HEC-6T to evaluate proposed grade control structures, sediment basins, and other channel improvement options in Calleguas Creek and to determine their effectiveness in reducing sediment inflow to the lagoon.

West Tennessee Tributaries Project Limited Evaluation Study, Tennessee - A reconnaissance level analysis was conducted to evaluate the proposed restoration of old river meanders that were cut off from the Middle Fork Forked Deer River by historical channelization projects. This study included an extensive combination of hydrological, hydraulic, and sediment transport simulations, using historical rainfall and runoff records, current field data, and calibration to 1960 and 1979 channel geometry survey data. In addition to Corps of Engineers' programs HEC-1, HEC-2, HEC-DSS, HEC-FFA, and HUXRAIN for surface water flow modeling and standard computer program HEC-6 for sediment transport analysis, the newer HEC-6T, "Sedimentation in Stream Networks", developed by William A. (Tony) Thomas, was used to evaluate the sediment transport of flow converging and diverging at the junctions of the main channel and the old meanders. A sediment-weighted histogram generator modified by WEST Consultants was used to generate the hydrology input for the HEC-6 programs. Designs for rock riprap diversion weirs and bridge protection, and an in-line sediment trap were developed in this study.

White River Unsteady Flow Model, Arkansas - An unsteady flow model using the computer program UNET was developed for 70 miles of the White River in eastern Arkansas. Model parameters were calibrated to historical stage and flow records before executing two 47 year simulations. Simulations were run for existing conditions and conditions after installation of an inlet canal and pumping station for an irrigation scheme. Results were provided to the District to help them evaluate effects of the irrigation project on the river. A second part of this project involved evaluation of the irrigation canals for sediment transport and scour/deposition. The computer program SAM was used to help determine stable channel parameters and the amount of scour/deposition that could be expected with the District's design geometry and slope.

Wolf River Reconnaissance Study, Tennessee - Included a hydraulic and sedimentation analysis for approximately 75 miles of the Wolf River in western Tennessee. An HEC-2 model for the lower reaches was extended with new survey data into the upper watershed. A HEC-6 model was then developed to evaluate the effect of grade stabilization weirs, environmental enhancement weirs with permanent pools, and reductions in inflowing sediment loads from 9 tributaries in the upper watershed. HEC-1 was used to compute unit hydrographs for calibration to stream gage data. The sediment-weighted histogram generator program was used to construct the HEC-6 input hydrology. The results of a 25-year future simulation were evaluated in

terms of vertical bed elevation changes over time and volumetric changes in sediment deposited and scoured on a reach by reach basis.

Expert Testimony and Support

Expert Consultant, Scour Evaluation of Grading Plan Changes for Cyrus Wash, Kern Co., CA
Expert Consultant, Blackfoot and Clark Fork River Restoration Plan, Montana
Expert Consultant, Agua Fria River Streambank Scour Analyses, Phoenix, AZ
Expert Consultant: Erosion and Drainage, Newport Beach, Califonia
Expert Consultant: Subdivision Flooding Problems and Floodplain Mapping Procedures, Dayton, Ohio
Expert Consultant: Flooding Problems, Unnamed creek, Los Angeles, California
Expert Testimony: Murrietta Creek Flooding, Riverside County, California
Expert Testimony: Flooding Potential and Analysis of Coconut Grove, Kailua, Oahu, Hawaii
Expert Consultant: Subdivision Flooding Problems, Waialae Iki V, Oahu, Hawaii
Expert Testimony: Flood Problems at Carlton Oaks Country Club, Santee, California
Expert Consultant: Alpine Mobile Home Park Flooding, Alpine, California
Expert Consultant: River Effects of Sand Mining Operations, San Luis Rey River, California
Expert Consultant: Pecos Road Pipeline Scour, Phoenix, Arizona
Expert Consultant: San Diego Creek Revetment Failure, Irvine, California
Expert Consultant: San Luis Obispo Creek Flooding, San Luis Obispo, California

Floodplain Hydraulics

FEMA Studies of River System near Huntington Beach, Orange County, California
River System Studies near Huntington Beach for Orange County for Submittal to FEMA, Orange County, California
FEMA Studies of 27 Streams in the Unincorporated Areas of San Diego County, California
Hydraulic Analysis and Levee Elevation Design of West Williamson, West Virginia, Flood Control Project
Flood Information Study of Pineville, Kentucky
Hydraulic Design of Supercritical and Subcritical Flood Control Channels for the Rio Puerto Nuevo Flood Control Project, San Juan, Puerto Rico
Flood Control Channel Design, Buena Vista Creek, Vista, California, City of Vista

Sedimentation and Scour Evaluations

Harrow Debris Basin Overtopping Analysis, Los Angeles County, California
Bridge Scour Analyses, Various locations, California Department of Transportation
Ashtabula River Hazardous Waste Project, Ohio
Tia Juana River Valley Surface and Groundwater Water Budget Analysis, San Diego, CA
Sedimentation Investigations of Boeuf River and Tributaries, Louisiana
Sedimentation Analysis of a Cutoff for the Barbourville, Kentucky, Flood Control Project
Analysis of the Effects of Strip Mining on Project Life of Martin's Fork Reservoir, Kentucky
Sedimentation Surveys and Analyses of J. Percy Priest Reservoir, Tennessee
Sedimentation Surveys and Analyses of Laurel River Reservoir, Tennessee
Sedimentation Surveys and Analyses of Martin's Fork Reservoir, Kentucky
Sedimentation Study of the St. Lucie River and Estuary, Florida
Sedimentation Analysis and Debris Basin Design for the Rio Puerto Nuevo Flood Control Project, San Juan, Puerto Rico
Determination of Sediment Yields after the Mt. St. Helens Eruption, Washington
Modeling the Sedimentation Effects of the Removal of the Washington Water Power Dam, Lewiston, Idaho
Sedimentation and Dredging Maintenance Requirement Study for the Rochester, Minnesota, Flood Control Project

Sedimentation Study of Tuttle Creek Reservoir, Kansas
Sediment Yield and Debris Basin Evaluation of Goleta, California, Flood Control Project
Sedimentation and Sediment Yield Study of the Harding Ditch, East St. Louis, Missouri, Flood Control Project
Analysis of Sediment Exclusion and Ejection System of the Igdir Irrigation Project, Turkey, for the World Bank
Reservoir Sedimentation Study of Shoccoe Dam, Jackson, Mississippi
Evaluation and Assessment of Sedimentation in the White Nile River and Irrigation Schemes, Sudan, for the World Bank
Zink Dam Sedimentation Study, Arkansas River, Tulsa, OK
Erosion and Sedimentation Analysis of South Coast Materials Mine Reclamation Plan, Buena Vista Creek, Carlsbad, California
Incipient Motion Analysis of Spawning Gravel, Cedar River, Renton, Washington

Stable Channel Analysis

San Luis Rey Levee Design and Sediment Transport Analysis
Sediment and Stable Channel Analysis of Pipeline Crossings for El Paso Natural Gas Company, Northern New Mexico and Arizona
Channel Stability Study of the Salt/Gila River Project, Arizona
Sediment and Channel Stability Study of the Gallup, New Mexico, Flood Control Project
Keene Ranch Stable Channel Assessment, Bakersfield, California
Stability Assessment of Sewer Pipeline, Tia Juana River, San Diego, California
Channel Stability Analysis, East Memphis, Arkansas
Development of Channel Design using Gabions Computer Program
Development of Channel Design using Geosynthetics Computer Program
Development of Riprap Design Program using Corps of Engineers Criteria

Water Quality and Groundwater

Caltrans NPDES Permit Project, Los Angeles County, CA
Keene Ranch Groundwater Quality and Quantity Modeling, Bakersfield, California
Turbidity Plume Analysis of Open Ocean Disposal for the Tampa Bay Deepening Project, Florida
Predictions of the Effects of Structural Alternatives on Turbidity in the St. Lucie Canal at Port Mayaca, Florida
Determination of Light Extinction Coefficients for Lakes and Reservoirs for use in Water Quality Mathematical Models
Analysis of the Behavior of Fine Sediments in Reservoirs for Environmental and Water Quality Operation Systems (EWQOS) Program
PCB Transport Study for the Hudson River, New York

Other

Analysis of Proposed Hydraulic Dredging for Construction of Gallipolis Lock and Dam, West Virginia
Design of Sedimentation Basins and Erosion Control Measures, Tennessee- Tombigbee Waterway Project
Dredged Material Disposal Site Analysis in an Ocean Environment for the Tampa Bay Deepening Project, Florida
Assisted in the Development of the Cohesive and Network Versions of the Computer Program, "HEC'6, Scour and Deposition in Rivers and Reservoirs"
Evaluation of Structural Alternatives of a Sediment Retention Dam on the Toutle River For Hyper concentration Sediment Conditions from Eruption of Mt. St. Helens, Washington
Debris Analysis of a Proposed Tunnel Cutoff for the Harlan, Kentucky, Flood Control Project
Preparation of the new HEC-6 Manual (Scour and Deposition in Rivers and Reservoirs) for the Hydrologic Engineering Center, Davis, California
Kern River Ordinary Highwater Litigation, Bakersfield, California

Erosion Control Plan, Rancho Verde Development, Escondido, California
Development of Forest Sedimentation Management Plan, Tongass National Forest, Alaska, U.S. Forest Service
Development of Water Resources/Geomorphology Small Stream Classification System, State of Washington, Department of Natural Resources
Development of Computer Based Design Program for Gabion Lined Channels
Development of Computer Based Design Program for Riprap Channels

Publications

Conference Papers

Williams, David T., and Kreymborg, Leo R., "Are You Double Counting, Over Conservative, or Misapplying Safety Factors for Stream Scour Analyses?" Floodplain Management Association Annual Conference, Coronado, CA, September 5-8, 2006

Kreymborg, Leo R., and Williams, David T., "Rapid Floodplain Delineation Using GIS," Floodplain Management Association Annual Conference, Coronado, CA, September 5-8, 2006

Williams, David T., and Doeing, Brian J., "Variation in Depth of Toe Scour Computations For Stream Restoration Bank Protection Design," *Proceedings*, International Erosion Control Annual Conference and Exposition, Las Vegas, NV, February 24-28, 2003.

Williams, David T., Gusman, A. Jake., and Teal, Martin J., "Proposed Methodology for Floodway Determination Using Unsteady Flow in HEC-RAS," *Proceedings*, ASFPM Conference, Biloxi, MS, June 23-28, 2003.

Williams, David T., "Headcut Analysis Due to Overbank Sand and Gravel Mining," *Proceedings*, ASFPM Conference, Phoenix, Arizona, June 24-28, 2002.

Williams, David T., Hu, Henry H., and Stefanovic, Dragoslav, "Sediment Flushing From a Flood Control Channel Outlet Into the Pacific Ocean", *Proceedings*, EWRI 2002 Conference on Water Resources Planning and Management, Symposium on Managing the Extremes: Floods and Droughts, First Symposium on Environmental and Water Resources Systems Analysis, Roanoke, Virginia, May 19-22, 2002.

Williams, David T., and Doeing, Brian J., "Predicting Bed Scour for Toe Protection Design in Bank Stabilization Projects" *Short Course*, International Erosion Control Association 33rd Annual Conference and Expo, Orlando, Florida, February 25, 2002.

Williams, David T., Hu, Henry H., Doeing, Brian J., and Phillips, Craig, "Headcut Analysis Due to Overbank Sand and Gravel Mining." *Proceedings*, Floodplain Management Association 21st Semi-Annual Conference, Lake Tahoe, NV, September 23-26, 2001.

Doeing, Brian J., M. ASCE, and Williams, David T., F. ASCE, "Development, Calibration, Confirmation, Project Production Runs and Sensitivity Analyses of One Dimensional Sediment Transport Models", *Proceedings*, World Water and Environmental Resources Congress Conference, Orlando, Florida, May 20-24, 2001.

Stefanovic, Dragoslav, Williams, David T., *Proceedings*, "Two-Dimensional-Vertical Numerical Modeling of Stratified Environments", Proceedings, World Water and Environmental Resources Congress Conference, Orlando, Florida, May 20-24, 2001.

Forman, S.M., Williams, D.T., and Remus II, J.I., "Development of Sampling Design Methodology to Reduce Suspended Sediment Data Collection on the Missouri River", *Proceedings*, Seventh Federal Interagency Sedimentation Conference, Reno NV, March 25-29, 2001

Williams, David T., Teal, Martin J., and Bradley, Jeffrey B., "Use of GIS and Regional Relationships to Determine Subbasin Sediment Yields for Input to a Sediment Transport Model", Invited paper, *Proceedings*, ASAE International Symposium, Honolulu, Hawaii, January 3-5, 2001

Williams, David T., and Teal, Martin J., "Between A Rock And A Soft Place: Which Riprap Method Should I Use for My Project?" *Proceedings,* ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Teal, Martin J., Schulte, Marc A., Williams, David T. and Remus, John I., "Sediment Modeling of Big Bend Reservoir, South Dakota", *Proceedings*, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Schulte, Marc A., Forman, Selena M., Williams, David T., Mashburn, Glenn, and Vermeeren, Rene, "A Stable Channel Design Approach for the Rio Salado, Salt River, Arizona", *Proceedings*, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Forman, Selena M., Williams, David T., and Remus, John I., "Development of Methodology to Reduce Suspended Sediment Sample Collection on the Missouri River at Sioux City, Iowa", *Proceedings*, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Chintala, Ramesh S., Williams, David T., Allen, Peter M., "Channel Response and Sediment Yields in Brookeen Creek, Central Texas", Proceedings of the International Erosion Control Association (IECA) Conference, Palm Springs, California, 2000

Doeing, Brian J. and Williams, David T., "Development, Calibration, Confirmation, Project Production Runs and Sensitivity Analyses of One Dimensional Sediment Transport Models", *Proceedings*, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Williams, David T., Smith, David S., and Schulte, Marc A., "What Caused the Palm Canyon Drop Structure Problem? Solving a Mystery and Finding Solutions in Palm Springs, California", *Proceedings*, Association of State Floodplain Managers, Arizona Floodplain Management Association (AFMA), Arid Regions Floodplain Management 8th Biennial Conference, Las Vegas, NV, January 20-22, 1999.

Teal, Martin J., Powell, Nancy; Gomez, Erika; and Williams, David T., "A Conceptual Flood Control Plan for a Complex Channel System Using UNET", *Proceedings*, ASCE Water Resources Engineering Conference, Memphis, Tennessee, August 2-7, 1998.

Mohammed, Ejaz; Williams, David T.; Crossett-Avila, Catherine; and McBride, Dennis, "HEC-RAS Hydraulic and Scour Analysis of Ten Mile River Bridge Under the Caltrans Seismic Retrofit Program", *Proceedings*, ASCE Water Resources Engineering Conference, Memphis, Tennessee, August 2-7, 1998.

Williams, David T., Teal, Martin J., and Kumar, Sree, "Overtopping Prevention of the Harrow Debris Basin in Los Angeles County", *Proceedings*, ASCE Water Resources Engineering Conference, Memphis, Tennessee, August 2-7, 1998.

Williams, David T., and Teal, Martin J., "Design Consideration and Recommendations for Seven Commonly Used Riprap Design Methods", Management of Landscapes Disturbed by Channel Incision, edited by Sam S. Y. Yang, Eddy J. Langendoen, and F. Douglas Shields, Jr., The University of Mississippi, May 19-23, 1997.

Williams, David T., "Commonly Used Computer Programs For Management of Stormwater," Invited Paper, Soil and Water Management for Urban Development Conference, Sydney, New South Wales, Australia, September 9 - 13, 1996.

Teal, Martin J., and Williams, David T., "Selection of Sediment Transport Relations: Part I, Review of Sediment Transport Comparisons," *Proceedings*, ASCE North American Water and Environmental Congress, Anaheim, California, June 22-28, 1996.

Smith, David S., and Williams, David T., "Selection of Sediment Transport Relations: Part II, Ranges of Dimensional Numbers," *Proceedings*, ASCE North American Water and Environmental Congress, Anaheim, California, June 22-28, 1996.

Williams, David T., and Julien, Pierre Y., "Selection of Sediment Transport Relations: Part III, Numerical Ranking of Sediment Transport Relations," *Proceedings*, ASCE North American Water and Environmental Congress, Anaheim, California, June 22-28, 1996.

Williams, David T., "Industry Standards for Erosion Control Products - Future Tools for Civil Engineers," *Proceedings*, ASCE North American Water and Environmental Congress, Anaheim, California, June 22-28, 1996.

Doeing, Brian J., and Williams, David T., "Site Selection for Pipeline Waterway Crossings," *Proceedings*, ASCE Pipeline Crossings, 1996, Burlington, Vermont, June 16-19, 1996.

Williams, David T., Austin, Deron N., and Thiesen, Marc S., "Erosion Protection of Using Permanent Geosynthetic Reinforcement Mattings," *Proceedings*, Sixth Federal Interagency Sedimentation Conference, Las Vegas, Nevada, March 10-14, 1996.

Williams, David T., "Selection and Predictability of Sand Transport Relations Based upon a Numerical Index," Ph.D. dissertation, Colorado State University, Fort Collins, CO, 1995.

Williams, David T., "River Restoration: Reverse Engineering of the Environment," invited paper for Third Annual Conference on the Management for Urban Development, Sydney, Australia, September 12-15, 1995.

Williams, David T., "The International Erosion Control Association's Committee on Erosion Control Standards," invited paper for Third Annual Conference on the Management for Urban Development, Sydney, Australia, September 12-15, 1995.

Williams, David T. and Austin, Deron N., "PC-Based Design of Channel Protection Using Permanent Geosynthetic Reinforcement Mattings," *Proceedings*, ASCE First International Conference on Water Resources, San Antonio, Texas, August 14-18, 1995.

Bradley, Jeffrey B., and Williams, David T., "Limitations and Applicability of Sediment Transport Modeling in Gravel Bed Streams," *Proceedings*, ASCE First International Conference on Water Resources, San Antonio, Texas, August 14-18, 1995.

Williams, David T. and Passarelli, Peter, "Equivalencing Rock Riprap and Gabions for Stream Channel Protection," *Proceedings*, ASCE First International Conference on Water Resources, San Antonio, Texas, August 14-18, 1995.

Teal, Martin J. and Williams, David T., and Grant, Gordon E., "A New Version of XSPRO: A Stream Hydraulic Analysis Computer Program," *Proceedings*, ASCE First International Conference on Water Resources, San Antonio, Texas, August 14-18, 1995.

Teal, Martin J. and Williams, David T., "Computer Aided Design of Riprap Revetments," *Proceedings*, ASCE First International Conference on Water Resources, San Antonio, Texas, August 14-18, 1995.

Williams, David T. and Cozakos, David, "Use of HEC-2 and HEC-6 to Determine Levee Heights and Revetment Toe Scour Depths," *Proceedings*, ASCE Hydraulic Engineering Conference, Buffalo, New York, 1994.

Williams, David T. and Osendorf, Gary R., "Computer Aided Design and Cost Estimation of Gabion Lined Channel," *Proceedings*, ASCE National Conference on Hydraulic Engineering, July 1993.

Bradley, Jeffrey B. and Williams, David T., "Sediment Budgets in Gravel-Bed Streams," *Proceedings*, ASCE National Conference on Hydraulic Engineering, July 1993.

Williams, David T., Carreon, Jr., Samuel, Hamilton, Douglas J., and Bradley, Jeffrey B., "Erosion Potential and Scour Depth Assessment of Pipeline Crossings," *Proceedings*, Arid West Flood Conference, Association of State Floodplain Managers, Las Vegas, Nevada, December 2-4, 1992.

Williams, David T., Carreon, Jr., Samuel and Bradley, Jeffrey B., "Evaluation of Erosion Potential at Pipeline Crossings," *Proceedings*, ASCE Water Forum, 1992.

Williams, David T., "Sedimentation Problems and Solutions; Roseires Dam and Reservoir, Sudan," *Proceedings*, ASCE National Conference on Hydraulic Engineering, Nashville, Tennessee, July 1991.

Bradley, Jeffrey B., Williams, David T. and Barclay, Michael, "Incipient Motion Criteria Defining 'Safe' Zones for Salmon Spawning Habitat," *Proceedings*, ASCE National Conference on Hydraulic Engineering, Nashville, Tennessee, July 1991.

Stoker, Bruce and Williams, David T., "Dam Removal Methods for Lake Mills and Lake Aldwell Dams, Elwha River, Washington," *Proceedings*, ASCE National Conference on Hydraulic Engineering, Nashville, Tennessee, July 1991.

Williams, David T., and Bradley, Jeffrey B., "Use of 2-D Hydrodynamic and 1-D Sediment Models to Estimate Dredging Requirements," presented at the Western Dredging Association (WEDA) Annual Conference, Las Vegas, Nevada, May 1991.

Williams, David T., "Ocean Disposal of Dredged Material: Plume Analysis," *Proceedings*, Fifth Federal Interagency Sedimentation Conference, Las Vegas, Nevada, March 1991.

Thompson, James C., Williams, David T. and Bradley, Jeffrey B., "Integration of 2-D Hydrodynamic and 1-D Sediment Transport Models," *Proceedings*, Fifth Federal Interagency Sedimentation Conference, Las Vegas, Nevada, March 1991.

MacArthur, Robert C., Williams, David T., and Thomas, W.A., "Status and New Capabilities of Computer Program HEC-6: Scour and Deposition in Rivers and Reservoirs," *Proceedings*, ASCE National Hydraulics Conference, San Diego, Calif., August 1990.

Williams, David T. and Bradley, Jeffrey B., "The Sediment Histogram Generator and Estimation of Sediment Transport Trends," *Proceedings*, ASCE National Hydraulics Conference, San Diego, California, August 1990.

Williams, David T., "The Relationship of Milligrams per Liter to Parts per Million," *Proceedings*, ASCE Hydraulics Conference, New Orleans, Louisiana, August 1989.

Williams, David T., "Purpose and Activities of the Task Committee on Analysis of Laboratory and Field Sediment Data Accuracy and Availability," *Proceedings*, ASCE Hydraulics Conference, New Orleans, Louisiana, August 1989.

Williams, David T. "U.S. Army Corps of Engineers Sedimentation Engineering, D. Reservoir Sedimentation," *Proceedings*, ASCE Hydraulics Conference, Colorado Springs, Colorado, August 1988.

Mulvihill, Michael E., Hashtak, John M., Williams, David T. and Holand, Eric, "Computer Aided Hydraulic Design of Open Channels," *Proceedings*, ASCE Hydraulics Conference, Colorado Springs, Colorado, August 1988.

Williams, David T. and Julien, Pierre Y., "On the Selection of Sediment Transport Equations," *Proceedings*, ASCE National Conference on Hydraulic Engineering, Williamsburg, Virginia, August 3-7, 1987.

Williams, David T. "Sedimentation Study for Rochester, Minnesota, Flood Control Project," *Proceedings*, ASCE Hydraulics Specialty Conference, Coeur d'Alene, Idaho, August 14-17, 1984.

Williams, David T., et. al., "Determination of Light Extinction Coefficients in Lakes and Reservoirs," *Proceedings*, ASCE Symposium on Surface Water Impoundments, Minnesota, June 2-5, 1980.

Dyhouse, Gary R. and Williams, David T., "Case Study of Stream Deposition and Changing Land Use," *Proceedings*, ASCE Symposium on Watershed Management, Idaho, 1980

Selected Reports, Manuals, Journal Papers and Articles

Forman, S.M., Teal, M.J., Williams, D.T., Kreymborg, L.R., and Burnett, C.M., "Use of GIS Geo-Based Programs and Computer Models for Watershed and Site Analyses", *Erosion Control Magazine*, September/October, 2000.

Forman, Selena M., Williams, David T., and Thomas, Iwan M., "Use of GIS, Geo-Based Programs and Computer Models for Watershed and Site Analyses", *Erosion Control Magazine*, July/August 2000.

Doeing, Brian J., Jeffrey B. Bradley, and David T. Williams, "Gas Pipeline Erosion Failures: January 1993 Floods, Gila River Basin, Arizona," in *Reviews in Engineering Geology*, Vol. XI, "Storm-Induced Geologic Hazards: Case Histories from the 1992-1993 Winter in Southern California and Arizona", ed. R. A. Larson and J. E. Slosson, 1997.

Williams, David T., "EC-Design, Erosion Control Design Package," prepared for Synthetic Industries, Chattanooga, Tennessee, 1995.

Williams, David T. and Teal, Martin J., *"Riprap Design System, User's Manual,"* WEST Consultants, Inc., Carlsbad, California, 1994.

Williams, David T., "Computer Program for Gabion Designers is a Keeper," *Civil Engineering News*, Volume 4, No. 10, November 1992.

"Hydraulic and Erosion Potential Analysis of Berry Homes Property Near the Santa Ana River," prepared for Berry Homes, Santa Ana, California, January 1992.

"Erosion Potential and Evaluation of the Salt River Stream Crossing Near 93rd Avenue, Phoenix, Arizona," prepared for El Paso Natural Gas Company, El Paso, Texas, July 29, 1992.

"Erosion Potential and Evaluation of the Salt River Stream Crossing Near Cotton Lane, Phoenix, Arizona, prepared for El Paso Natural Gas Company, El Paso, Texas, July 24, 1992.

"Tia Juana River Valley Surface and Groundwater Budget Analysis," prepared for the California Coastal Conservancy, Oakland, California, 1992.

Williams, David T., and Julien, Pierre Y., "Examination of Stage-Discharge Relationships of Compound/Composite Channels," *Channel Flow Resistance: Centennial of Manning's Formula*, Water Resources Publications, Colorado, 1991.

"Erosion Potential Evaluation of Gila River Stream Crossing Below Gillespie Dam", El Paso Natural Gas Co., El Paso, Texas, November 1991.

"Phase I and II - Detailed Analysis Evaluation of Erosion Potential of Stream Crossings, San Juan Mainline and San Juan Triangle Pipeline Expansion", El Paso Natural Gas Co., El Paso, Texas, July 1991.

Williams, David T., and MacArthur, Robert C., "*HEC-6 Users Manual*," Hydrologic Engineering Center, Davis, California, July 1991.

"Hydrologic and Hydraulic Report, Buena Vista Creek Enhancement Design", prepared for the City of Vista, California, August 1990.

"Report on Zink Dam Sedimentation Problems", Tulsa River Parks Authority, January 1990.

Beverage, Joseph, and Williams, David T., "Comparison: US P-61 and Delft Bottle Sediment," *Journal of Hydraulic Engineering*, ASCE, Vol. 115, No. 12, 1989.

Williams, David T. and Julien, Pierre Y., "Applicability Index for Sand Transport Equations," *Journal of Hydraulic Engineering*, ASCE, Vol. 115, No. 11, Nov., 1989.

Williams, David T., "Levee Design Profiles for the Williamson, West Virginia, Flood Protection Project," *Miscellaneous Paper HL-88-4*, USAE Waterways Experiment Station, Vicksburg, Mississippi, June 1988.

"Report on Sedimentation Problems in Sudan", Ministry of Irrigation, Government of Sudan, December 1988.

U.S. Army Corps of Engineers. "Chapter 5, Reservoir Sedimentation," *Sedimentation Manual, EM 1110-2-4000*, Office of the Chief of Engineers, Washington, D.C., 1988.

Williams, David T. "Examination of Sediment Exclusion and Ejection Aspects of the Igdir, Turkey Irrigation Project," Prepared for the World Bank, USAE Waterways Experiment Station, Vicksburg, Mississippi, 1987.

Williams, David T., Ingram, John J., and Thomas, William A., "St. Lucie Canal and Estuary Sedimentation Study; Mathematical Model Investigation," *Miscellaneous Paper HL-86-4*, USAE Waterways Experiment Station, Vicksburg, Mississippi, 1986.

Williams, David T. "Considerations in the Selection of Transport Equations in Sediment Modeling," *Essays on River Mechanics*, Report CER 85-86, PYJ28, Civil Engineering Department, Colorado State University, Fort Collins, 1986.

"Assessment of the Sedimentation Characteristics of a Sediment Retention Structure at the Green River Site, North Fork Toutle River, Washington", Letter Report, USAE Waterways Experiment Station, Vicksburg, Mississippi, 1985.

Williams, David T. "Tampa Bay Dredged Material Disposal Site Analysis," *Miscellaneous Paper HL-83-8*, USAE Waterways Experiment Station, Vicksburg, Mississippi, October 1983.
Williams, David T. "Sedimentation Study for Rochester, Minnesota, Flood Control Project," *Miscellaneous Paper HL-83-7*, USAE Waterways Experiment Station, Vicksburg, Mississippi, October 1983.

Williams, David T. "Effects of Dam Removal: An Approach to Sedimentation," Technical Paper 50, Hydrologic Engineering Center, October 1977

Honors and Awards

Small Business Person of the Year, Chamber of Commerce, Carlsbad, California, 1993
Fellow, American Society of Civil Engineers
Diplomate, American Academy of Water Resources Engineers

References

Doeing, Brian J., M. ASCE, and Williams, David T., F. ASCE, "Development, Calibration, Confirmation, Project Production Runs and Sensitivity Analyses of One Dimensional Sediment Transport Models", Proceedings, World Water and Environmental Resources Congress Conference, Orlando, Florida, May 20-24, 2001.

Williams, David T., Teal, Martin J., and Bradley, Jeffrey B., "Use of GIS and Regional Relationships to Determine Subbasin Sediment Yields for Input to a Sediment Transport Model", Invited paper, Proceedings, ASAE International Symposium, Honolulu, Hawaii, January 3-5, 2001

Teal, Martin J., Schulte, Marc A., Williams, David T. and Remus, John I., "Sediment Modeling of Big Bend Reservoir, South Dakota", Proceedings, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Williams, David T., and Julien, Pierre Y., "Selection of Sediment Transport Relations: Part III, Numerical Ranking of Sediment Transport Relations," Proceedings, ASCE North American Water and Environmental Congress, Anaheim, California, June 22-28, 1996.

Stoker, Bruce and Williams, David T., "Dam Removal Methods for Lake Mills and Lake Aldwell Dams, Elwha River, Washington," Proceedings, ASCE National Conference on Hydraulic Engineering, Nashville, Tennessee, July 1991.

Williams, David T., and MacArthur, Robert C., "HEC-6 Users Manual," Hydrologic Engineering Center, Davis, California, July 1991.

MacArthur, Robert C., Williams, David T., and Thomas, W.A., "Status and New Capabilities of Computer Program HEC-6: Scour and Deposition in Rivers and Reservoirs," Proceedings, ASCE National Hydraulics Conference, San Diego, Calif., August 1990.

"Report on Zink Dam Sedimentation Problems", Tulsa River Parks Authority, January 1990.

"Report on Sedimentation Problems in Sudan", Ministry of Irrigation, Government of Sudan, December 1988.

U.S. Army Corps of Engineers, "Chapter 5, Reservoir Sedimentation," Sedimentation Manual, EM 1110 2 4000, Office of the Chief of Engineers, Washington, D.C., 1988.

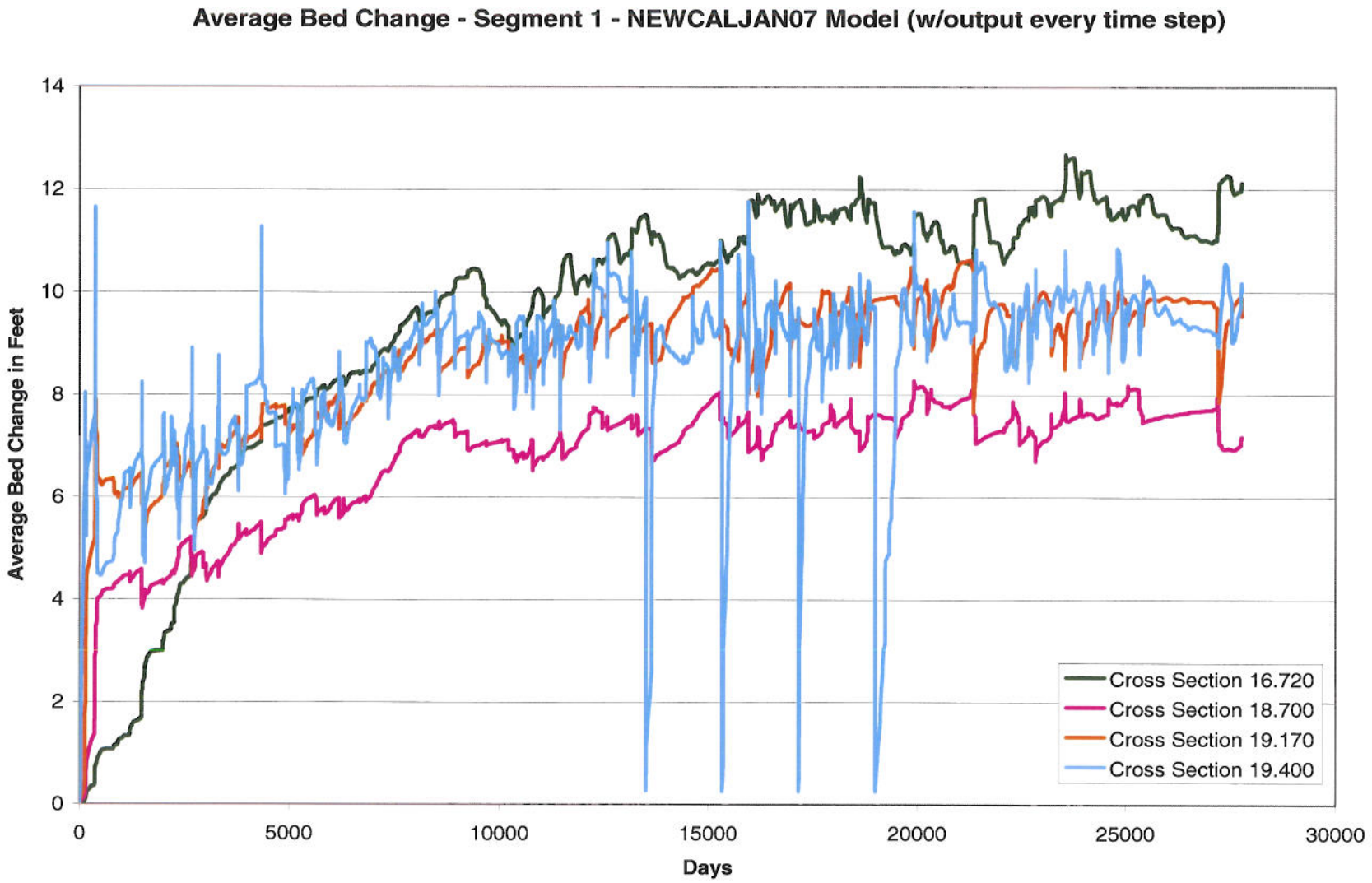

Figure 1. Average Bed Elevation Change for Selected Cross Sections, Total Simulation Period, Segment 1

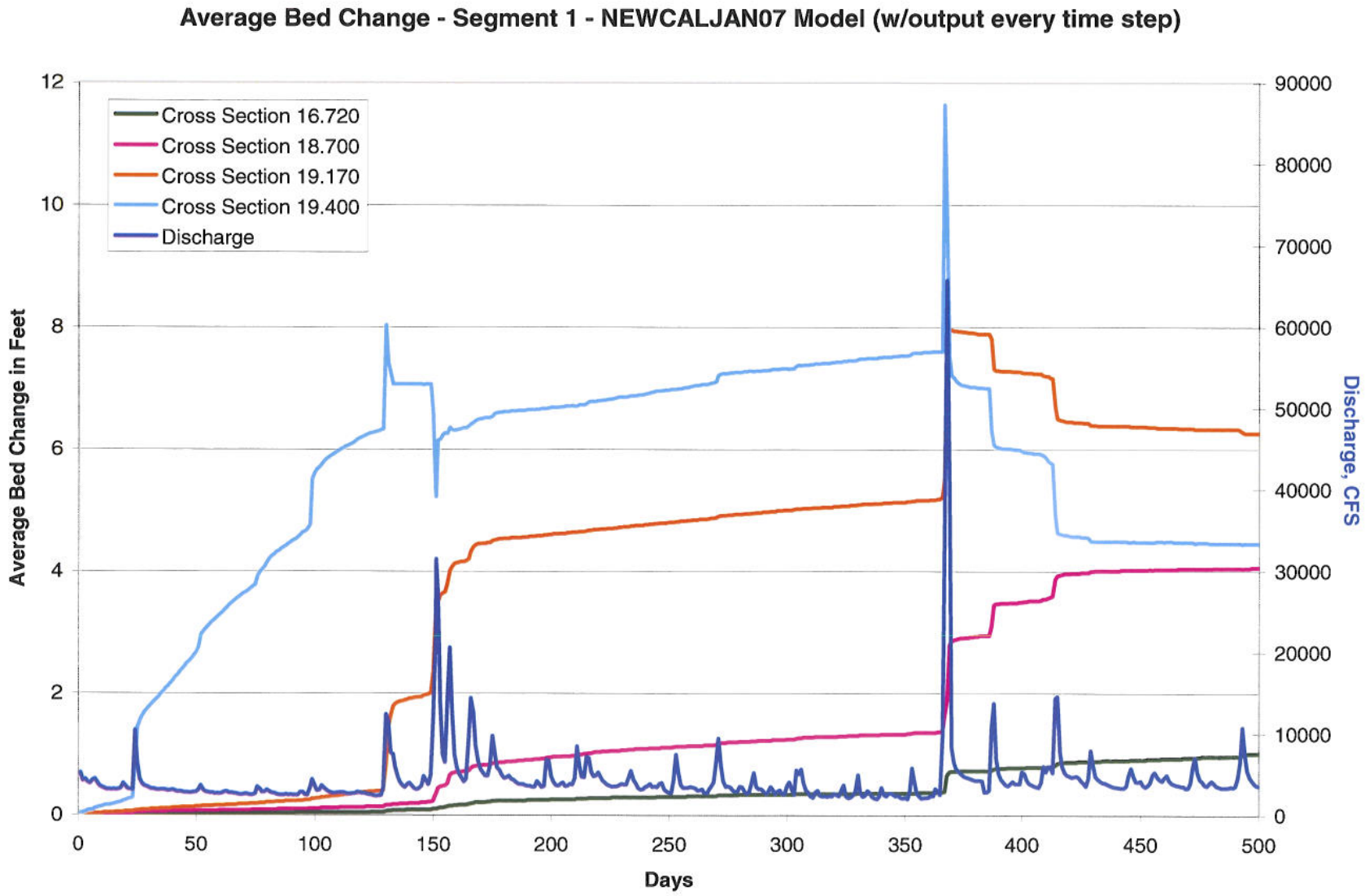

Figure 2. Average Bed Elevation Change for Selected Cross Sections, First 500 Days of Simulation, Segment 1

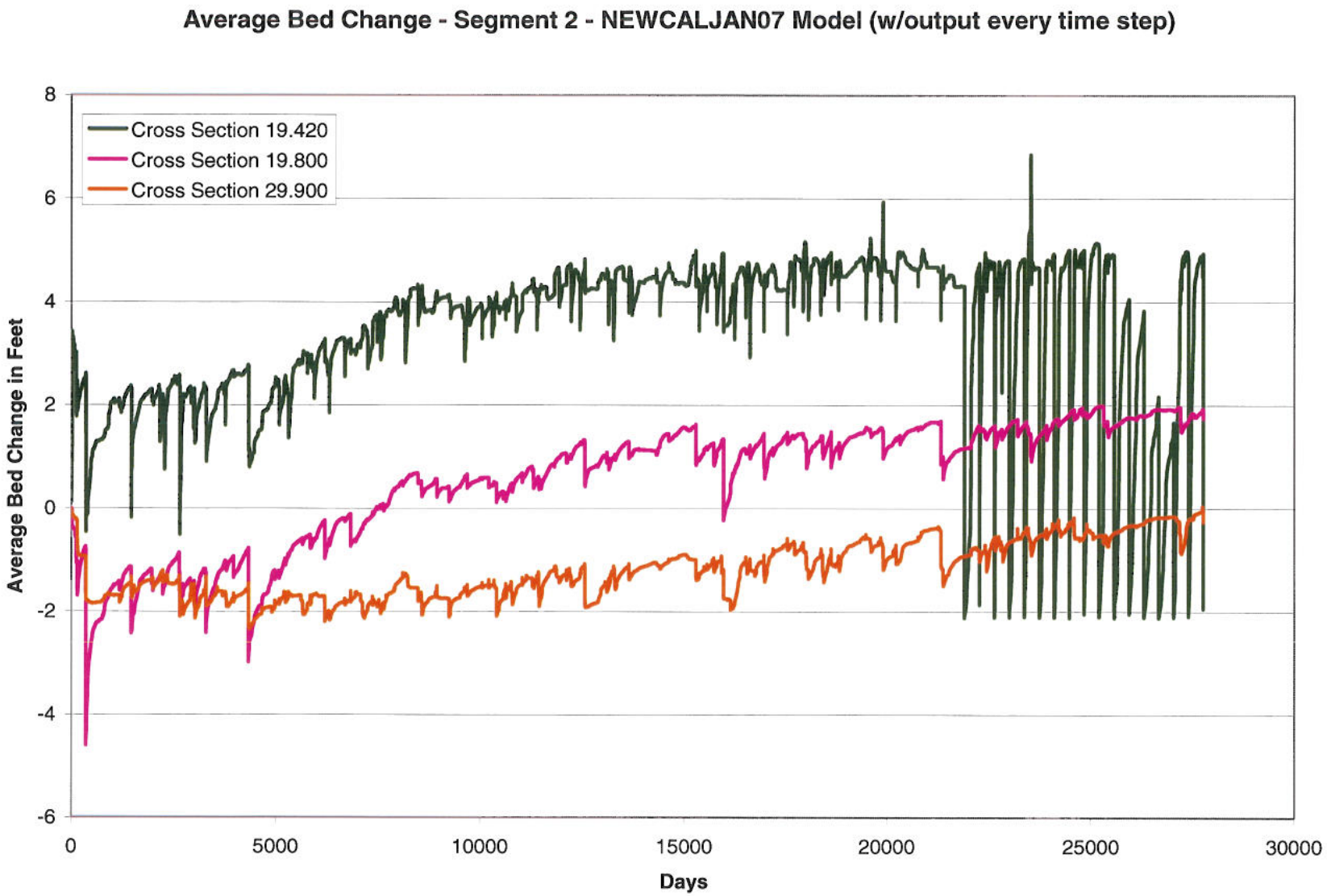

Figure 3. Average Bed Elevation Change for Selected Cross Sections, Total Simulation Period, Segment 2

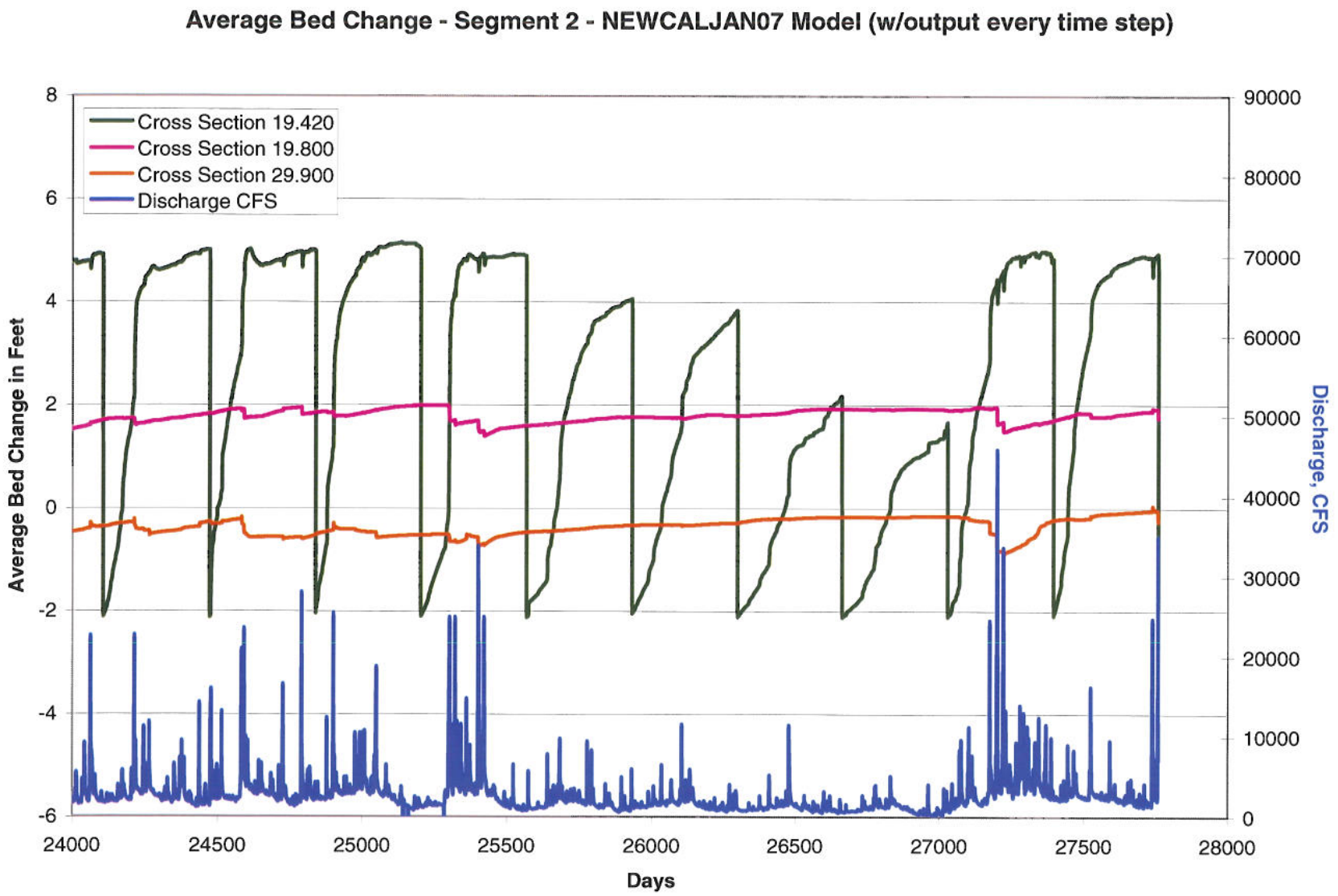

Figure 4. Average Bed Elevation Change for Selected Cross Sections, Days 24000 to 28000 Simulation Period, Segment 2

EXHIBIT B

AFFIDAVIT OF PAUL F. SHIERS, P.E.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Alcoa Power Generating Inc.	)	Project No. 2197-073

AFFIDAVIT OF PAUL F. SHIERS, P.E.

I am Paul F. Shiers, P.E., Vice President/Water Resources Group for PB Power, a unit of the national construction and engineering firm of Parsons Brinkerhoff. My areas of professional expertise related to this affidavit are civil engineering, hydraulic engineering, and hydraulic modeling and sediment. My curriculum vitae is attached as Exhibit 1.

I have read and begun a preliminary analysis of the February 23, 2007 filing by the City of Salisbury entitled "City of Salisbury Scoping Comments and Response to Commission Request for Study Results" with a particular focus on the work of Dr. Martin Doyle, which is attached to the filing as Exhibit 2 and titled “High Rock Dam and Sediment Delta Flooding and Sedimentation Effects (1927-2058) on City of Salisbury Critical Infrastructure.” I have identified four major areas of concern in the analyses presented in this document, which are as follows:

1. The Doyle report relies heavily on data assumptions interpolated from topographic map with no better vertical accuracy than +/- 2.5 ft (as discussed in Appendix E-3 of the Yadkin FLA) above elevation 630 Yadkin Datum and +/- 5 ft below elevation 630 Yadkin Datum. Although the best data available, this information is inadequate to justify the findings in the Doyle report. Flow data records back in 1916 may not have been available immediately as they are today, and the HEC-RAS model and high resolution aerial topography were not available to more

accurately calculate the water elevations upstream at river mile 19.4 during flood events. Dr Doyle merely presumes that intimate knowledge of the water surface elevation that the flood elevation reached were available at this time.

2. In Section 3.3 of his Report, Dr Doyle incorrectly states the location of the 1916 design flood discharge of 121,000 cfs at River Mile 19.4, which is erroneous and misleading. The USGS gage station in place at that time [USGS 02121000] was located at River Mile 15.2, not River Mile 19.4. Being further downstream of the SRU pump station, this gage measured, in addition to Yadkin River flows, the outflow from the Grant's Creek drainage area which intersects below the confluence of the Yadkin and South Yadkin Rivers. This disparity materially affects Dr. Doyle's analysis. Moreover, as reported by USGS, the 121,000 cubic feet per second (cfs) flow in 1916 represented a peak hourly flow [Peak Streamflow, USGS 02121000 – Yadkin River near Salisbury, NC]. The average daily flow for this July 18, 1916 storm event, as reported by USGS at the Salisbury gage, is 103,000 cfs. Adding the peak flow data value [121,000 cfs] to the bottom of the Table 3.1 and labeling it design flow is misleading. In fact this peak hourly flow is associated with a different USGS gage [Salisbury ~ 1896 to 1927 period] than was used to create the other information in the table [Yadkin College ~ 1928 to 2004 period]. Additionally, the peak stream flow at the Yadkin College station, as reported by USGS [Peak Streamflow for the Nation, USGS 02116500 at Yadkin College] for July 1916 is 94,300 cfs. Using the 1.23 correlation factor discussed in Section 3.5 of Dr. Doyle's report, the flow at the SRU pump station, RM 19.4 would be 116,000 cfs, not 121,000 cfs. In addition, Dr Doyle presents no specifications, calculations or drawings to substantiate his claim that the 1916

discharge as measured at the USGS gage station, located 5 miles downstream of the Pump Station, was the flood for which the Pump Station was designed.

3. Contrary to Dr. Doyle's assertion [Section 8 of Report], APGI did not suggest that the sediment accumulation was not caused by the reservoir. Rather, APGI posited that the flood elevations in the riverine section of the Yadkin River at the SRU pump station, as defined by Salisbury [Appendix E-3 of Yadkin FLA], are caused at least in part by the natural constrictions created by channel geometry and bends in the river, conditions which pre-dated construction of High Rock Dam. APGI has also presented evidence that other manmade impediments in the river, including railroad and interstate bridges, are contributing to flooding in the vicinity of the pump station [Review of January 1998 Flood of Yadkin River, Stone and Webster, February 1998]**.** Furthermore, Dr. Doyle's analysis fails to provide substantiation for its assumption that in the late 1800's and early 1920's, when sediment was determined to be a problem and subsequently reached its peak, the Yadkin River, one of the most heavily sediment laden rivers in the eastern United States [USGS Robert Meade, 1982], was in approximate geomorphic equilibrium [Section 3.1 of Doyle Report] before High Rock Dam was constructed, or to provide any data that it would have remained so. I have noted areas of aggradation and degradation in the river channel upstream of the impoundment, mid channel bars and sand deposits following large floods. USGS gage station sections upstream of the SRU pump station have also shown aggradation and degradation as shown in Appendix E-3 of the FLA.

4. Section 3.4 of Dr. Doyle's report indicates that the Grants Creek Waste Treatment Facility plant, which was constructed long after High Rock Dam was built, suffers flood damage

at El. 634 ft USGS datum when concrete structures at the plant are overtopped. Dr Doyle does not report that APGI retains flood rights at the Facility location to El. 638.9 ft USGS datum and has owned those rights since before the plant was built. Since flood damage occurs at nearly five ft below the level that APGI owns the right to flood, it is apparent that Salisbury failed to give adequate consideration to flood design criteria when the Facility was constructed. Dr Doyle's analysis also fails to account for the impact of high flood flows down Grants Creek, as well as the recent urban development in this drainage area that may also contribute to an increase in runoff, which causes corresponding increases in flooding at the plant location.

5. In conclusion, the Doyle Report's mischaracterizations of APGI’s positions, insufficient substantiation for many of its claims and erroneous information completely invalidate the results of the study.

FURTHER, Affiant Saith not.

I, Paul F. Shiers, hereby declare that I am submitting the foregoing Affidavit on behalf of Alcoa Power Generating, Inc., that information in this Affidavit was prepared by me or under my direction, and that the contents hereof are true and correct to the best of my knowledge, information, and belief.

Dated: 27 March, 2007

Paul F. Shiers

Paul F. Shiers

Sworn to and subscribed before me on this 27th day of March, 2007.

Notary Public
My commission expires: June 5, 2009

PAUL F. SHIERS, P.E.

Vice President, PB Americas, Inc.
Senior Engineering Manager
Senior Project Manager

Years of Experience
35 (7 with PB; 28 with others)

Education
M.S., Civil Engineering, Massachusetts Institute of Technology, 1973;
B.S., Civil Engineering, Northeastern University, 1970

Professional Affiliations
American Society of Civil Engineers (ASCE);
Boston Society of Civil Engineers Section (BSCES): Past Chairman, Hydraulic Group;
American Society of Mechanical Engineers (ASME)

Professional Registrations
Massachusetts, 2006 (29167); Connecticut, 2007 (13140); Maine, 2007 (4055); Rhode Island, 2007 (3650); Virginia, 2006 (10188); North Carolina, 2007(031995); Tennessee, 2008 (110715)

Key Qualifications
Mr. Shiers is a vice president with Parsons Brinckerhoff (PB) experienced in the field of water resources and hydroelectric power. He is qualified as an Independent Consultant and PFMA facilitator for FERC Part 12 safety inspections under the new DSPMP requirements. During his career, he has served as independent consultant for two Alcoa projects in North Carolina and Tennessee, which included a total of eight hydro developments, two of which involve alkali aggregate reactivity (AAR), and for four Great Northern Paper Company projects in Maine, which included a total of eleven hydro developments, three of which involve AAR. This work included FERC safety-related items and relicensing assistance. He also served as project manager of a 2,000-MW pumped storage project, and completed an assignment as principal engineer for work performed under a multi-year continuing services agreement with the FERC for hydro relicensing and compliance tasks.

Mr. Shiers has been assigned as project manager, project engineer, and consultant for numerous water resources projects. Special assignments have included the underwater inspection of hydroelectric project facilities, safety inspections of dams and hydroelectric projects, penstock and tunnel inspections, independent review of small hydro projects, fluid system hydraulic analyses, field testing of cooling water systems, and pump performance testing. His water resources activities have included the supervision of equipment procurement for turbine-generator packaged units, a steel penstock, automatic control equipment, bascule gates and operators, and slide gates and operators; conceptual design of project facilities; feasibility assessments of small hydro projects; preparation of federal and state licensing documents; dam stability analyses; dam spillway adequacy evaluations; dam settlement analyses; dam monitoring programs; flood inundation studies; probable maximum flood studies; dam breach analyses; development of reservoir operating rule curves; expert testimony at hearings on dam safety; and development of emergency response plans for dam failures.

Additionally, Mr. Shiers' activities as lead hydraulic engineer have included supervision and design work, equipment purchases, and drawing preparation for various steam electric power station systems, including circulating water, makeup water, and condenser tube cleaning. His hydraulic engineering activities have included the supervision of hydraulic modeling studies of intakes, pumps, and orifice plates; field testing of circulating water, vacuum priming, and bearing cooling water systems; performance and cavitation testing of pumps; and flow measurement studies.

Hydroelectric Services

- ANP: as project manager responsible for due diligence assessment of a major hydro acquisition in the northeast. Effort includes CAPEX, OPEX, and technical assessment of hydro facilities.
- Massena Electric Department, NY: as project manager, responsible for the overall direction, including budget and schedule, for the MED hydro project. This project includes conceptual engineering, licensing, and economic analysis for a planned 2.5 MW hydro project.
- New York Power Authority: as project manager, responsible for the overall direction, including budget and schedule, for FERC Part 12 / PFMA sessions on the Robert Moses, FDR, Jarvis, and Blenheim Gilboa Hydroelectric Projects.
- FERC DSPMP Safety Inspection, Falls Development, Yadkin Project, APGI: This Project has the capacity of 30 MW and consists of a powerhouse (3 units) and a 526' long spillway with 10 Stoney Gates, 2 Tainter gates, and a trash gate. Paul was the DSPMP Independent Consultant for the 8th Part 12 Safety Inspection conducted in 2003.
- FERC DSPMP Safety Inspection, Narrows Development, APGI: This Project has the capacity of 109 MW and consists of a powerhouse (4 units) and a main spillway, 640' long with 22 Tainter gates, and a bypass spillway, 520' long with 10 Stoney Gates. Paul was the DSPMP Independent Consultant for the 8th Part 12 Safety Inspection conducted in 2003.
- Tapoco and Yadkin Projects, Alcoa Power Generating Inc., North Carolina and Tennessee: as relicensing consultant, responsible for planning, scheduling, and budgeting of relicensing for two hydro licenses, including eight hydro developments with more than 500 MW of installed capacity in North Carolina and Tennessee. Work was performed as a team effort, including a three-member Alcoa relicensing team. The licenses expire in 2005 and 2008.
- FERC Safety Inspections—Santeetlah, Cheoah, Calderwood, and Chilhowee Developments, APGI, North Carolina: as independent consultant, responsible for the 5-year periodic safety inspection of the concrete gravity dams and hydroelectric powerhouses in accordance with FERC Order No. 122. The licensed project includes four dams and powerhouses, including concrete gravity and arch dams. Also responsible for technical direction of the stability analysis and spillway adequacy evaluation of project facilities.
- High Rock Dam: as project manager, responsible for engineering, design, contractor selection, and engineering support during construction for the installation of 19 post-tensional anchors in the spillway of an existing concrete spillway.
- Santeetlah Dam, North Carolina: as project manager, responsible for engineering, design, contractor selection, and engineering support during construction for cutting three slots in a concrete gravity abutment section to relieve stress and reduce displacement. Work included a semi circular caisson for work during construction and installation of vertical and inclined rock anchors.
- FERC Safety Inspections—High Rock, Tuckertown, Narrows and Falls Dam Developments, APGI, North Carolina: as independent consultant, responsible for the 5-year periodic safety inspection of the concrete gravity dams and hydroelectric powerhouses in accordance with FERC Order No. 122. The licensed project includes four dams and powerhouses. Also responsible for technical direction of the stability analysis and spillway adequacy evaluation of project facilities.
- Falls Powerhouse Monitoring Program, North Carolina: as project manager, responsible for the overall direction, including budget and schedule, for the Falls Powerhouse Monitoring Program in North Carolina. The program included concrete and rock drilling, high order surveying, and the installation of inclinometers and extensometers. The work also included

sampling and testing of the powerhouse concrete for the presence of alkali-aggregate reactivity (AAR) and the extent of reactivity in the powerhouse structure. (September 1991)

Previous Experience
Before joining PB, Mr. Shiers' project experience with other engineering consulting firms included:

- Hydro License Application Review, FERC: as principal engineer, responsible for direction of the technical input on task order assignments received on the FERC contract. The technical work included safety and design assessment reports, environmental analyses, environmental impact statements, project economic analyses, and compliance issues.
- Phoenix Hydroelectric Project, FERC: as deputy project manager, responsible for a FERC compliance section investigation of the impact of the operation of the Phoenix Hydro Project in upstate New York on flooding in the Oswego River Basin. Technical work included spillway and river flow analysis, evaluation of plant performance, and interaction with concerned citizens in the area, the licensee, and the FERC staff.
- Deep River Hydroelectric Projects, FERC: as deputy project manager, responsible for a FERC compliance section study of a river basin in North Carolina concerning violations of license requirements for minimum flow and run of river operation. The purpose of the study was to determine if positive steps could be taken working with small (<10 MW) exempted and licensed projects to enhance their operation and compliance record.
- Mt. Hope Waterpower Project, Mt. Hope Hydro Inc.: as project manager, responsible for the overall direction, including budget and schedule, for the conceptual engineering and design of a 2,000-MW underground pumped storage facility with six-units at a gross head of 2,500 feet. Work included the preparation of cost estimates and construction schedules. Project management support was also provided in the areas of licensing, permitting, financing, and utility interface.
- Ripogenus Upstream Face Repair, Great Northern Paper, Inc. (GNP): as project manager, responsible for the overall direction, including budget and schedule, for the planning, cost estimate, and engineering and design of Phase II of the repair of the upstream face of a concrete gravity dam 83 feet high (25.3 meters high) and 695 feet long (212 meters long). The work included engineering and design of necessary repairs, construction schedules and cost estimates, and report preparation.
- Dolby Dam Concrete Repair, Great Northern Paper, Inc.: project manager responsible for overall direction, including budget and schedule, of the engineering and design for repair of the hydro unit intakes and spillway gates at Dolby Dam. Work included inspection, report preparation, engineering and design of the necessary repairs, construction inspection, and preparation of as-built documents.
- FERC Safety Inspections—Ripogenus, Penobscot Mills and Great Northern Storage Projects, Great Northern Paper, Inc.: independent consultant responsible for the 5-year periodic safety inspection of concrete gravity and earth embankment dams and hydroelectric powerhouse in accordance with FERC Order No. 122. The three licensed projects included ten dams and five powerhouses. Also responsible for preparation of stability analysis and spillway adequacy evaluation of project facilities.
- Coulonge Hydro Project, Hydro Pontiac Inc.: project manager responsible for independent review of general construction contract and turbine generator equipment package on a 17-MW hydro project. This project involved the use of two 8.5-MW vertical axis Francis turbines and a 2,000-foot-long (610-meter-long), 16-foot-diameter (4.9-meter-diameter) rock penstock.
- Groundwood Bleaching System, Millinocket Operations, Georgia Pacific-Northern Paper Division: project manager responsible for the overall direction, including budget and schedule, for conceptual engineering and design for installation of a groundwood bleaching

system. The work included preparation of P&I diagrams, general arrangement drawings, preparation of an appropriation estimate, and preparation of a final report.

- Water Use Plan, Relicensing Studies, Ripogenus and Penobscot Mills Projects, Georgia Pacific-Northern Paper Division: project manager/project engineer responsible for the direction, including budget and schedules, of work performed on a comprehensive water use plan developed to evaluate the impact of various agency requests for water use and determination of the corresponding impact on mill hydro power generation. The study evaluated safety, fishery, recreation, and other environmental requests for flow releases from project facilities. The study determined, through the use of a flow simulation model and a power generation model, that the environmental requests could be prioritized and accommodated with an acceptable impact on hydropower generation.
- Construction Inspection, Hydro System Projects, Georgia Pacific-Northern Paper Division: project manager responsible for the overall direction, including budgets and schedules, for construction inspection services on ten hydro and pulp and paper construction projects. The projects included concrete repair of hydraulic structures, both underwater and above water, sewer installation, powerhouse roof repair, and slide and crest gate repairs.
- Weldon Dam Roller Gate Repair, Great Northern Paper Company: project manager responsible for overall direction, including budget and schedules, for engineering and design for the repair of gate seals on a 20-foot-diameter (6.1-meter-diameter), 90-foot-long (27.4-meter-long) roller gate and associated concrete repair. The work included inspection, engineering, and design for necessary repairs and construction drawings.
- Conemaugh, Hydro-Kennebec, Little Falls, and West Delaware Hydro Projects, United American Energy Company: project manager responsible for overall direction, including budget and schedules, for work performed under an engineering services agreement for four operating hydro plants. The work performed included plant safety inspections, system modifications, stream gauge installation, a feasibility study of rubber dam installation, development of plant safety manuals, and increased turbine output evaluations.
- Ripogenus Dam Concrete Repair, Great Northern Paper Company: project manager responsible for overall direction, including budget and schedule, of the engineering and design for repair of the upstream face and a resurfacing of the downstream faces of a concrete gravity dam 83 feet-high (25 meters-high) and 695 feet long (212 meters long). The work included inspection, report preparation, engineering and design of the necessary repairs, and construction inspection.
- Millinocket Mill Penstock and Headgate Structure Inspection, Great Northern Paper Company: project manager responsible for overall direction, including budget and schedules, for the inspection of seven 10-foot-diameter (3-meter-diameter) steel penstocks, 1,000 feet long (305 meters long), and associated headgate structure. The project included a feasibility study of improvements to the headgate structure.
- Grinder Room Sewer Project, Georgia Pacific-Northern Paper Division: project manager responsible for overall direction, including budgets and schedules, for the engineering, design, and engineering support during construction of a sewer back fit to an existing pulp grinding room. The project involved difficult access for construction and unknown field interferences due to lack of drawing information. The project successfully collected the various grinder room waste streams for subsequent discharge to the mill sewer.
- FERC Relicensing—Ripogenus and Penobscot Mills Projects, Great Northern Paper Company: as project manager, he was responsible for overall direction of the development of Exhibits A, B, C, and F for two licensed projects, including six dams and associated hydro facilities. The work also included supplemental studies on river flow and energy impacts associated with revised operation of the storage and release facilities to run of river operation.
- Stone Dam Gatehouse Concrete Repair, Great Northern Paper Company: project manager responsible for overall direction, including budget and schedules, for the engineering

and design of repairs for a 100-year-old gatehouse with ten submerged steel gates. The work included inspection, report preparation, engineering and design of the necessary repairs, and construction inspection.

- Emergency Action Plan, Great Northern Storage, Ripogenus, Penobscot Mills, and Mattaceunk Projects, Great Northern Paper Company: project manager responsible for the overall direction of the revision and update of an emergency action plan for dam failures in a system of 11 dams. The work also included follow-on efforts for the engineering, design, and installation of river monitoring and river warning devices, as well as exercises and annual updates of the plan.
- FERC Safety Inspection—Mattaceunk Project, Great Northern Paper Company: independent consultant responsible for the 5-year periodic safety inspection of a concrete gravity dam and powerhouse in accordance with FERC Order No. 122. Also responsible for preparation of stability analysis and adequacy evaluation of spillways in project facilities.
- Hydro-Kennebec Project: project engineer responsible for the detailed engineering, design, and equipment specification for a 15-MW hydroelectric project that included the design and preparation of construction specifications for a new 30-foot-high (9.1-meter-high) concrete gravity dam and a 200-foot-long (61-meter-long) gated spillway section with three 60-foot-long (18-meter-long) bascule gates. The turbines are of the pit design with a 12.8-foot (3.9-meter) runner diameter. The project's commercial operation was achieved in February 1989.
- East Millinocket Hydro Feasibility Study, Great Northern Paper Company: project manager responsible for the overall direction of the engineering analysis of an upgrade of six existing double runner 50-year-old horizontal units. The hydro plant is operated in a run of river mode and the existing runner capacity is 1,600 kW per unit.
- Facility Inspection/Concrete Reactivity—North Twin, Seboomook, Stone, Weldon, and Ripogenus Dams, Great Northern Paper Company: project manager responsible for overall direction, including budget and schedules, of the inspection of various facilities at GNP and preparation of reports with recommendations for required repairs. The work included an 80-year-old gatehouse with severe concrete deterioration underwater; a concrete gravity dam with significant concrete deterioration; a tainter gate section which included a large retaining wall with loss of foundation material; and a general investigation of concrete reactivity, including petrographic analysis and other reactivity studies conducted at Construction Technology Laboratories.
- Concrete Repair—Ripogenus, Weldon, Stone and North Twin Dams, and Millinocket Mill, Great Northern Paper Company: project manager responsible for overall direction, including budget and schedules, of the engineering and design of numerous concrete repair jobs. Work included concrete repair both above and below water at various existing structures, including concrete gravity dams, a powerhouse, a gatehouse structure, tailraces, concrete water passage facility, spillway gates, and retaining walls. Work included definition of the scope of repair work, preparation of specifications and drawings, preparation of a budget estimate, preparation of contract documents, bid analysis, construction inspection, and preparation of as-built documents.
- North Twin Runner Replacement, Great Northern Paper Company: as project manager, he was responsible for overall direction of the engineering analysis of an upgrade of two existing 50-year-old fixed blade runners in a three-unit hydro plant. The plant is operated in a store and release mode and the existing runner capacity is 2,700 kW per unit.
- Penstock Repair—Millinocket Mill, Great Northern Paper Company: project manager responsible for overall direction of the engineering and design for repair of an 80-year-old, 11-foot-diameter (3.4-meter-diameter) steel penstock. Work included engineering and design of a steel liner to be welded inside the existing pipe, preparation of specifications and contract documents, and construction inspection.

- Facility Inspection/Tailrace Repair Program—Millinocket and East Millinocket Mills, Great Northern Paper Company: project manager/project engineer responsible for the field inspection, conceptual design of repairs, preparation of specifications and drawings for performing repair work, and construction inspection of repair work. The work involved inspection of hydroelectric plant tailrace facilities, including underwater inspections assisted by divers, and included concrete and granite block wall deterioration with construction efforts performed under adverse environmental conditions.
- FERC Safety Inspections—Ripogenus, Penobscot Mills and Great Northern Storage Projects, Great Northern Paper Company: independent consultant responsible for the 5-year periodic safety inspection of concrete gravity and earth embankment dams and hydroelectric powerhouses in accordance with FERC Order No. 122. Also responsible for preparation of stability analysis and spillway adequacy evaluation of project facilities.
- FERC Penstock Inspections—Ripogenus and Penobscot Mills Projects, Great Northern Paper Company: project manager/project engineer responsible for the preparation of the FERC required penstock inspection programs for two hydroelectric facilities. The first project (Ripogenus Penstock) includes a 4,000-foot-long (122-meter-long), 16-foot-diameter (4.9-meter-diameter) concrete lined rock tunnel, which terminates to three 11-foot-diameter (3.4-meter-diameter) steel penstocks. The second project (Millinocket Mill) includes seven 10-foot-diameter (3-meter-diameter) buried steel penstocks. The work on the first project also included a follow-on dewatered inspection of the tunnel and associated facilities.
- Stability Analysis—Dolby Power Station, Great Northern Paper Company: project manager responsible for resolution of potential stability problems for a rock/soil founded hydroelectric facility with artesian pressure conditions beneath the powerhouse. The scope of work included installation of monitoring equipment; subsurface investigations; stability analysis; field inspections, including underwater inspections with divers; preparation of monitoring programs; relief well design; and structural analysis required to ensure stability of the powerhouse structure.
- ARCO Metals Hydroelectric Project, ARCO Metals Company: project engineer responsible for the detailed engineering and design and equipment procurement for a 1,450-kW hydroelectric project to be operated in a run of river mode. The project is at an existing dam and includes a shallow intake, penstock, powerhouse, and tailrace. The work on this project included supervision of the safety inspection of repair work performed on the existing concrete gravity dam under the State of Connecticut dam safety program.
- Big A Project—Expert Testimony, Great Northern Paper Company: consultant responsible for the engineering evaluation and presentation of expert testimony on spillway adequacy and dam stability analysis for GNP's proposed Big A Project at the State of Maine Land Use Regulatory Commission hearings.
- FERC Safety Inspection—Mattaceunk Project, Great Northern Paper Company: as a consultant, participated in the field safety inspection of concrete gravity dam, spillway, and powerhouse in accordance with FERC Order No. 122. Also responsible for the preparation of stability analysis and spillway adequacy evaluation of project facilities.
- Big A Project—PMF Analysis, Great Northern Paper Company: project engineer responsible for probable maximum flood analysis of the proposed Big A Project. The flood analysis applied HMR's 51 and 52 to generate the PMF inflow hydrograph to the proposed dam with a drainage area of 1,400 square miles (362,602 hectares).
- Wallowa Valley Project, PRU Capital: special consultant responsible for independent review of a 7.5-MW hydro project. This project involved use of both horizontal and vertical pumps as turbines and included three powerhouses. The review included detailed design, equipment procurement, and project energy estimate.
- Dam Freeboard Analysis, Great Northern Paper Company: project engineer responsible for engineering analysis of dam freeboard requirements for earth embankment sections at the

North Twin and Millinocket Lake Dams. Analysis involved determination of wave height and run-up, and design of necessary earth embankment protection requirements. The results of this effort were presented to FERC regulatory staff members in Washington, DC, in August 1984.

- Feasibility Assessment and FERC Exemption Application, ARCO Metals Company: project engineer responsible for the preparation of a feasibility assessment of adding a 1,300-kW unit to the Kinneytown Dam Project to operate in a run of river mode. Also responsible for preparation of an exemption application to the FERC for the Kinneytown Dam project.
- Emergency Action Plan, Great Northern Paper Company: project engineer responsible for additional study work on EAP as requested by GNP and FERC. This work included travel time data for the food wave for the 11 dams in the study, development of critical flows at the downstream project limits, field measurement of the plan, development of a training program for dispatchers, and presentation of training material.
- FERC Safety Inspection—Great Northern Storage Project, Great Northern Paper Company: consultant participating in the field safety inspection of four concrete gravity dams, spillways, and gate sections. Also responsible for office studies, including spillway adequacy and stability analysis of project facilities for this initial safety inspection under FERC Order No. 122.
- Stability Analysis, FERC Licensed Projects—West Branch of the Penobscot River, Great Northern Paper Company: project engineer responsible for additional stability analysis evaluation of seven dams. The evaluation included the earthquake loading condition and a modified uplift analysis for cases where the base of the dam is not in full compression.
- Sears Island IGCC Plant, Central Maine Power Company: lead hydraulic engineer responsible for conceptual design and cost estimates for circulating water, component cooling water, and makeup water systems for a feasibility study of a proposed integrated gasification combined cycle power plant.
- FERC Safety Inspection—Ripogenus and Penobscot Mills Projects, Great Northern Paper Company: project engineer responsible for field safety inspection of five dams for the FERC's 5-year safety inspection program. The inspection included concrete gravity dams, tainter gates, powerhouses, and earth embankment sections.
- Emergency Action Plan, Great Northern Paper Company: project engineer responsible for preparation of an emergency action plan for dam failures in a system of 11 dams. The study investigated the domino effect of dam failures, and the plan included instructions for operating the system to minimize the impact of a dam failure and instructions for prompt notification of public safety agencies.
- North Anna Main Dam Performance Evaluation, Virginia Electric and Power Company: as a consultant, participated in the field safety inspection of the North Anna Dam, reservoir, dikes, and canals. The inspection included the main dam concrete structures and earth embankments, monitoring instruments and records, tainter gates, gate operating equipment, and emergency power facilities.
- Probable Maximum Flood and Spillway Adequacy Studies, Stability Studies FERC Licensed Projects—West Branch of Penobscot River, Great Northern Paper Company: project engineer responsible for a stability analysis evaluation of seven dams in the State of Maine. Particular responsibilities included hydraulic, environmental, geotechnical, and structural efforts. Work included determination of flood hydrographs, flood routing, development of reservoir operation procedures, and spillway capacity determinations.
- North Anna Main Dam, Virginia Electric and Power Company: lead hydraulic engineer responsible for hydraulic engineering related to the North Anna Main Dam. Work included determination of probable maximum flood hydrographs, flood routing, gate capacity determination, and development of reservoirs operating procedures. Also responsible for the

investigation of seepage in the spillway construction joints and development of recommended remedial work. He reviewed design of tainted gate and operating system to confirm the adequacy of increased openings required to pass the PMF inflow hydrograph.

Publications

- Coauthor, "Use of OASIS Model in Developing Agreements among Various Interest Groups," presented at 2004 USSD Conference, St. Louis, MO, April 2004.
- Coauthor, "Narrows Dam Deck Slot Cutting and Tainter Gate Remediation," presented at 2004 USSD Conference, St. Louis, MO, April, 2004.
- Coauthor, "Anchoring the Way to Long Term Remediation," presented at 2003 USSD Conference, Charleston, SC, April 2003.
- Coauthor, "Applying GIS Technology to the FERC Relicensing Process and Project Operations," presented at 2002 USSD Conference, San Diego, CA, June 2002.
- Coauthor, "Applying the OASIS Model to the FERC Relicensing Process and Project Operations," presented at 2002 USSD Conference, San Diego, CA, June 2002.
- Coauthor, "Santeetlah Dam: On the Cutting Edge of Instrumentation," presented at Waterpower XII, Salt Lake City, Utah, July 2001.
- Coauthor, "Installing High Capacity Rock Anchors to Meet Stability Requirements," presented at the 21st Annual USSD Lecture Series, Denver, Colorado, July/August 2001.
- Coauthor, "Slicing Concrete to Improve Dam Safety," presented at the 21st Annual USSD Lecture Series, Denver, Colorado, July/August 2001.
- Coauthor, "Challenging Solutions to High Capacity Rock Anchors," presented at Waterpower XII, Salt Lake City, Utah, July 2001.
- Coauthor, "Removing a Concrete Slice to Improve Dam Safety," presented at Waterpower XII, Salt Lake City, Utah, July 2001.
- Coauthor, "Adverse Conditions Require a Unique Approach to Long-Term Dam Safety," presented at Hydrovision 2000, Charlotte, North Carolina, August 2000.
- Coauthor, "A Unique Approach to Long-Term Dam Safety Under Adverse Conditions," presented at Waterpower 99, Las Vegas, Nevada, July 1999.
- Coauthor, "Instrumentation Monitoring for Santeetlah Dam," presented at Waterpower 99, Las Vegas, Nevada, July 1999.
- Coauthor, "The Mt. Hope Waterpower Project: A Pumped Storage Facility that Enhances the Environment while Supplying On-Demand Electrical Needs," presented at Waterpower '95 Conference, San Francisco, California, July 1995.
- Coauthor, "Engineering the Mt. Hope Pumped Storage Plant—One of the Largest Underground Excavations in the United States," presented at the North American Tunneling Conference, Denver, Colorado, June 1994.
- Coauthor, "Engineering Mt. Hope—A State of the Art Pumped Storage Plant," presented at Waterpower '93, Nashville, Tennessee, August 1993.
- "Hydro Project Increases Energy Output with Corresponding Headpond Level Control Benefit," presented at ECO World '92, Washington, DC, June 1992.
- Coauthor, "Team Approach Completes Hydro Project Ahead of Schedule," presented at EPRI Fossil Plant Construction Conference, Washington, DC, September 1991.

- Coauthor, "Millinocket Mill Hydro System Inspection and Rehabilitation," presented at the American Power Conference 52nd Annual Meeting, Chicago, Illinois, April 1990.
- Coauthor, "New Dam, Pit-Type Turbines Extend Plant's Operating Range," *Power Magazine*, April 1990.
- Coauthor, "Tunnel Inspection Meets Outage Schedule," presented at the American Power Conference 50th Annual Meeting, Chicago, Illinois, April 1988.
- Coauthor, "Turbine Generator Unit Selection for the Hydro Kennebec Project," *Hydro Review*, Volume VII, Number V, October 1988.
- Coauthor, "Turbine Generator Equipment Evaluation: Pit Versus Bulb Design," presented at the Fourth International Symposium on Hydropower Machinery, Anaheim, California, December 1986.
- Coauthor, "Case Study of Existing Site's Optimum Capacity," presented at Waterpower '85, Las Vegas, Nevada, September 1985.
- "Hydro Power Equipment Evaluation," panel discussion held at Third Small Scale Hydro Symposium, New Orleans, Louisiana, December 1984.
- Coauthor, "Control of Probable Maximum Flood Runoff through Reservoir Operation," presented at the International Conference on Hydraulic Aspects of Floods and Flood Control, London, England, September 1983.
- Coauthor, "Interactive Reservoir Operation in a Controlled Watershed During the Probable Maximum Flood," presented at the Nineteenth Annual American Water Resources Association Meeting, San Antonio, Texas, October 1983.
- Coauthor, "Analysis of Probable Maximum Flood in a Complex Hydrologic System," presented at Nineteenth Annual American Water Resources Association Meeting, San Antonio, Texas, October 1983.
- Coauthor, "Perforated Plates as Hydraulic Energy Dissipators," Hydraulics Division Specialty Conference Proceedings, Chicago, Illinois, August 1980.
- Coauthor, "Mathematical Modeling of Vacuum Breaker Valve Operation in a Cooling Water System," presented at the Joint IAHR/ASME/ASCE Symposium on Design and Operation of Fluid Machinery, Fort Collins, Colorado, June 1978.
- Coauthor, "Economic-Environmental System Planning," presented at the Nuclear Utilities Planning Methods Symposium, Chattanooga, Tennessee, January 1974.
- Coauthor, "Economic-Environmental System Planning," presented at the IEEE Power Engineering Society 1974 Summer Meeting and Energy Resources Conference, Anaheim, California, July 1974.
- Coauthor, "A Thermal Pollution Abatement Model for Power Plant Siting," MIT Energy Laboratory Publications Number MIT-EL 73-013, February 1973.

CERTIFICATE OF SERVICE

I hereby certify that I have this 20th day of March, 2007, served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. §385.2010).

/S/

Ahren S. Tryon

Counsel for Alcoa Power Generating Inc.