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February 1, 2006

Anjali Jaiswal
Natural Resources Defense Council
1314 Second St.
Santa Monica, CA 90401

RE: Morro Bay 301(h) Waiver
CEA No. 03072

Dear Ms. Jaiswal:

Carpenter Environmental Associates, Inc. (CEA) on behalf of the Natural Resources Defense Council (NRDC) has reviewed relevant documents regarding the 301(h) waiver application and the schedule for the proposed upgrade of the Morro Bay – Cayucos JPA Wastewater Treatment Plant ("Sewage Plant") to secondary treatment and provides the following comments. Specifically CEA has been retained by NRDC to discuss water quality impacts from current wastewater treatment practices, the advantages of secondary wastewater treatment, and JPA's proposed schedule for completing secondary treatment upgrades. In this letter, I first provide my background and qualifications as an expert in the area of wastewater management followed by a section evaluating the water quality impacts of the Sewage Plant's discharge. Lastly, I will provide a recommendation for an expedited time schedule for a Plant upgrade along with a critique of the proposed 9.5 year upgrade schedule.

BACKGROUND AND QUALIFICATIONS

I am currently president of C.E.A., Monroe, New York, an environmental science and engineering firm. I hold a Bachelor's degree in civil engineering, a Master's degree in environmental engineering, and a Ph.D. in environmental engineering, all from New York University. I am a registered professional engineer in New York and New Jersey. I am Board Certified by the American Academy of Environmental Engineers. I have over 35-years experience in environmental engineering.

My experience includes design, construction, and evaluation of wastewater treatment systems. I have taught environmental engineering courses including wastewater treatment plant design at the undergraduate and graduate levels at New York University, The George Washington University, and the New Jersey Institute of Technology. My qualifications, along with a list of my publications, are contained in my curriculum vitae (attached).

I have extensive experience in the design, construction, and evaluation of publicly owned treatment works (POTW) and its impacts on receiving waters. I have designed secondary and tertiary treatment plants ranging from less than 1 million gallons per day (mgd) to 35 mgd. I have served on technical review or advisory panels for POTWs as small as 500,000 gpd to 330 mgd. For the last 11 years, I have served on the Nitrogen Technical Advisory Committee that advises the City of New York on the upgrade of its 14 secondary treatment plants for nitrogen removal; a project estimated to involve hundreds of millions of dollars of construction. I also served as a peer reviewer on the City of San Diego's evaluation of the potential upgrade of its Point Loma Wastewater Treatment Plant (WWTP) to secondary treatment using biologically activated filters. While Professor of Engineering at The George Washington University I regularly taught the graduate course in the design of WWTPs..

I also have extensive experience in evaluating and modeling water quality impacts from wastewater and stormwater discharges. I have performed numerous water quality modeling efforts in support of National Pollutant Discharge Elimination System (NPDES) permitting. At The George Washington University and at New Jersey Institute of Technology, I taught the graduate course in evaluation of receiving waters, which included water quality modeling.

I have been recognized as an expert in environmental engineering by federal courts in cases involving the design and operation of WWTPs and have provided testimony at depositions and at trial.

EVALUATION OF WATER QUALITY IMPACTS

Providing less than secondary treatment results in adverse water quality impacts when compared with full secondary treatment. Biological treatment results in higher removal of metals and many organic toxins than does primary treatment.[1,2] When a portion of the wastewater bypasses secondary treatment, higher loadings of metals and organic toxins will be discharged to the receiving waters. Partial secondary and partial primary treatment will result in higher effluent total suspended solids (TSS) concentrations than will secondary treatment. The higher TSS will result in the discharge of more pathogenic organisms to receiving waters. If the pathogens at issue are otherwise more difficult to destroy because of idiosyncrasies associated with their physical structure, the relative inefficiencies associated with primary treatment described above may be, accordingly, more pronounced.

TSS interfere with disinfection by shielding pathogenic organisms from the disinfectant. Chlorine, as used in the Sewage Plant, kills microorganisms by interfering with enzymes in the cell wall of the organisms.[3] Organisms that are attached to or inside of the TSS are protected from coming into contact with the chlorine and thus, are not

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1 U.S. Environmental Protection Agency Office of Water Enforcement and Permits, *Guidance Manual for POTW Pretreatment Program Development*, October 1983.

2 U.S. Environmental Protection Agency, Office of Water and Waste Management, *Fate of Priority Pollutants in Publicly Owned Treatment Works – Pilot Study*, EPA-440/1-79-300, October 1979.

3 Water Environment Federation, *Wastewater Disinfection, Manual of Practice FD-10*, 1996, p.45.

killed by the chlorine. As a result more pathogens are discharged. Implementation of full secondary treatment will result in lower effluent TSS, and, thus, in more effective disinfection resulting in lower levels of pathogens discharged to the receiving waters.

Metals have been measured in the sediments near the outfall at levels exceeding the ERL and ERM for nickel and approaching the ERL for chromium.[4,5] The argument made by the Sewage Plant that the ERL and ERM levels are not fully supported by the toxicology appears only to be applied when a contaminant is at or near the ERL and ERM. When the contaminant is well below the ERL or ERM, the ERL and ERM are assumed to be good ecological benchmarks. ERL and ERM are routinely used as a screening tool to determine ecological risk. Since metals readily attach to solids and since TSS removals during secondary treatment are notably higher than TSS removal during primary treatment, higher levels of metals discharge are occurring when biological treatment is being bypassed.[6] The median chromium removal through primary treatment is 16% and through secondary treatment is 71%. Nickel removals are 6% and 32% through primary and secondary treatment, respectively.[7] Implementation of full secondary treatment will result in the discharge of less nickel and chromium and would reduce the Sewage Plant's contribution to the nickel and chromium accumulation in the sediments near the outfall.

The Sewage Plant has violated effluent limits for dioxin. Dioxin has also been detected in additional samples collected from the Sewage Plant near 70% of effluent limit making the argument presented by the Sewage Plant that the dioxin violation was an anomaly highly suspect. Rather, detection of dioxin in samples at this rate suggests a more systematic problem. Dioxin, a known human carcinogen, is readily adsorbed onto TSS, particularly biomass. A likely source of the dioxin is the commercial laundry.[8] While source control of dioxin should be undertaken, the current combination of primary and secondary treatment results in higher discharges of TSS and thus dioxin to the environment with its associated adverse water quality impacts than would full secondary treatment. This is particularly important because dioxin bioaccumulates in the food chain potentially resulting in elevated dioxin levels in fish taken in the area and eaten.[9] Because no sediment samples were run for dioxin, the actual water quality impacts cannot be assessed. Full secondary treatment would result in lower dioxin discharges to the waters.

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4 At the ERL, 10% of the benthic organisms are expected to be adversely affected. At the ERM, 50% of the benthic organisms are expected to be adversely affected.

5 U.S. Environmental Protection Agency, Office of Water & Waste Management, *Fate of Priority Pollutants in Publicly Owned Treatment Works, Pilot Study,* EPA-440/1-79-300, October 1979.

6 U.S. Environmental Protection Agency Office of Water Enforcement and Permits, *Guidance Manual for POTW Pretreatment Program Development*, October 1983.

7 U.S. Environmental Protection Agency Office of Water Enforcement and Permits, *Guidance Manual for POTW Pretreatment Program Development*, October 1983.

8 U.S. Environmental Protection Agency, *Draft Exposure and Human Health Reassessment of 2,3,7,8-tetrachlorobidenzo-p-dioxin (TCDD) and Related Compounds*, September, 2000.

9 U.S. Environmental Protection Agency, National Center of Environmental Assessment, Dioxin and Related Compounds, Frequently Asked Questions," http://cfsan.fda.gov/l~rd/dioxinqa.html.

The argument made by the Sewage Plant regarding elimination of the acute toxicity test appears to make no sense. The Sewage Plant argues that acute toxicity should not be limited in the new permit because new EPA Guidance on acute toxicity testing does not allow removal of ammonia in the same way it is currently; therefore the Sewage Plant argues it should not have to do acute toxicity testing because it might fail the acute toxicity test. The Sewage Plant also argues that chronic toxicity testing is more appropriate because acute toxicity does not reflect the toxicity of ammonia to marine organisms as well as chronic. The argument ignores the fact that acute toxicity applies within mixing zones while chronic toxicity does not, and that acute and chronic toxicity testing measure different things.

The Sewage Plant argues that no toxics were discharged by industry. The Sewage Plant, however, attributed the 2002 plant upset to an unknown external event. Clearly, discharge into the plant's influent of material toxic or inhibitory to biomass is a likely external event that would have caused a plant upset. In addition, commercial laundries have been identified as a source of dioxin as well as a source of toxic organics and metals from articles washed at the laundry. In addition, the Sewage Plant's argument that any chromium from industrial sources would likely be hexavalent chromium - not the trivalent chromium contained in its effluent - is wrong. Any hexavalent chromium discharged to the reducing environment found in sanitary sewers would be rapidly reduced to trivalent chromium. Influent and effluent sampling at the plant for chromium would be required to determine the contribution of chromium to the plant from industry and the amount of the plant's contribution to the elevated chromium in sediments near the outfall.

Moreover, the fact sheet to the draft Permit shows that sanitary sewer overflows occurring on a regular basis reach surface waters through the storm drain system or overland flow. Spills of untreated sewage contain, among other things, toxic pollutants and bacterial pathogens known to harm public health and marine life.[10]

EVALUATION OF SECONDARY TREATMENT UPGRADE SCHEDULE

CEA has reviewed the scheduling recommendations for upgrading the Sewage Plant as contained in the *Staff Report, Morro Bay-Cayucos J.P.A. Wastewater Treatment Plant* ("Staff Report"), prepared by Mr. Bruce Keogh, Wastewater Division Manager dated May 13, 2005, and Carollo Engineers, PC ("Carollo") "Revised Full Secondary 9-1/2 year Timeline – Dated May 19, 2005," dated May 12, 2005. Carollo recommends a 9.5 year schedule for upgrading the WWTP to full secondary treatment capacity. This is the schedule proposed by the Plant to the Regional Board.

The Staff Report and Carollo claim that a 9.5 year schedule is required due to the following factors:

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10 U.S. Environmental Protection Agency, Office of Wastewater Management, "Why Control Sanitary Sewer Overflows?," SSO Fact Sheet, http://www.epa.gov/npdes/sso/control/index.htm.

- Staff claims project is highly complex
- Conflicting political motivations
- Unforeseen circumstances

Carollo's schedule includes tasks with unusally long durations (up to and over 1-year) for the parties to deal with the assumed internal political conflicts (including whether to upgrade to tertiary treatment, impact on user's rates, etc.). As will be discussed herein, the WWTP upgrade can be completed under reasonable conditions in 56 months (a little more than 4.5 years) plus time for the Regional Water Quality Control Board (RWQCB) to review the facilities plan or in 79 months (approximately 6.5 years) plus facilities review time under a schedule that is less demanding while still reflecting a project planning approach that is typical in the field. The primary differences between CEA's schedule and Carollo's schedule are 1) CEA's reduction of time for political and agency negotiations, and 2) CEA's overlapping scheduling of tasks rather than Carollo's linear task schedule, an approach that Carollo itself acknowledges is dissimilar to schedules the firm has developed for other clients.

Staff Report Issues

There is nothing unusual or complex about upgrading an existing plant to secondary or even tertiary treatment. It has been done many times in many places in far less than 9.5 years. Carollo (the City of Morro Bay and the Cayucos Sanitary District Consultant) supports this opinion in the revised timeline letter dated May 12, 2005, by stating that upgrading the plant from full secondary to tertiary treatment is a common practice and does not affect the ability or timing for upgrading the plant with tertiary treatment if desired.

The "complexity" alluded to in the Staff Report appears to be based on conflicting political interests between the City and the District. For example, the Staff Report states that the City and the District potentially have divergent interests with the City potentially desiring tertiary treatment and the district having little interest beyond secondary treatment; however, tertiary treatment for reuse, particularly for Title 22 reuse, often consists of secondary treatment followed by filtration and UV disinfection. The divergent interests, therefore, can be satisfied by building secondary treatment without resolving the final issue of whether or not tertiary treatment will be added. Once resolved, if tertiary treatment is desired, it could be added. The additional costs in this approach would be small if the original design considered the potential for adding tertiary treatment, yet the timeframe for achieving secondary treatment, with its associated water quality benefits, would be considerably reduced. Additional costs when compared to the cost of building secondary and tertiary at one time should be limited mostly to additional bidding and contractor mobilization costs. Whether or not to upgrade to full tertiary treatment is a side issue that should have no effect on the time required to complete the WWTP upgrade.[11]

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[11] In a letter from David, L. Stringfield, PE, Carollo Engineers, to Joint Boards of City of Morro Bay and Cayucos Sanitary District, Subject: Revised Full Secondary 9-1/2 year Timeline – Dated May 19, 2005, Carollo agrees with this assessment.

The City and District are concerned that if no grant funding is available, City ratepayers must bear the cost of a large project. That is true of every plant that has been upgraded to secondary treatment (almost all of the WWTPs in the country). The City must convince the ratepayers that tertiary treatment upgrades are worth the added cost; however, as discussed in the previous paragraph, the tertiary upgrade requirements (political as well as technical) are side issues that are not relevant technical rationales to prolong the secondary treatment upgrade.

Resolving political issues such as rate increases can be more comfortably handled if stakeholders are involved from the very beginning of the process. There is no reason not to hold stakeholder meetings on a regular basis to maintain open dialogue without extending the design/construction process.

According to the Staff Report "The project will require coordination between City and JPA. The city council and JPA will require an 'extreme commitment' to meet monthly. Failure to meet or an impasse would result in failure to meet the schedule." It is hardly an "extreme commitment" to ask the City Council and/or JPA to meet as often as necessary to meet a schedule for a critical project. The best method to ensure meetings occur as necessary and to avoid an impasse would be to include consequences in the permit for failure to meet a schedule that is consistent with accepted practices in the field.

The Staff Report states "Unforeseen circumstances could result in failure to meet the schedule." Unforeseen circumstances beyond the control of the City or JPA could always delay a project. That is the reason for force majeure language being included in agreements and contracts.

In summary, the City and District's reasons for recommending the proposed 9.5 year schedules are based on political issues and not technical/construction issues.

Carollo Schedule

Carollo's 9.5 year schedule contains an "Initial Coordination with City and District" (Task 1) task with a duration of 12 months. The coordination period is based on the City and the District meeting meet every 2 months for 7 to 9 meetings. The Draft Facilities Plan is scheduled to be submitted for review 16 months after completion of the initial coordination between the City and the District, 28 months after the start of the project. CEA's schedule has the Draft Facilities Plan being submitted 9 months from start of project with no coordination period. The parties have already been aware of this WWTP upgrade project for quite some time; since at least the issuance of the Staff Report in May 2005, seven months ago. Coordination by the City and the District should have been long instituted and political issues resolved by the time a permit is finalized.

Carollo's estimated Task 1 duration could be decreased to 6 to 8 months from the 12 months allotted by meeting monthly instead of every 2 months. If Carollo has already been selected to do the facilities plan, then no procurement period is necessary and the

difference has been narrowed from CEA's 12 months (including procurement) to Carollo's 9 to 11 months (not including procurement).

Carollo has allocated six months to actually prepare the financial plan starting from the time the final facilities plan is virtually complete. If the facilities plan preparation is accelerated as described in the previous section (by the boards simply meeting monthly rather than every two months) the financial plan can be completed sooner than estimated by CEA.

CEA estimated that the Environmental Review and Permitting could be completed approximately 17 months after start of project. The draft facility plan could be completed within 9 to 11 months of project start. The environmental review should start several months before completion of the facilities plan.

Carollo has estimated a six month duration for procurement for a design engineer. CEA estimated three months. Carollo has estimated 20 months for design and bidding. CEA has estimated 15 months on an expedited schedule. We continue to believe that 15 months reflects an expedited approach, but it is achievable.

CEA's Schedule

CEA has prepared an expedited but achievable schedule for completing the WWTP upgrade. In this approach, we estimate that the project can be completed in 56 months (4.7 years) plus time for RWQCB facilities plan review from the start of the project. If it were supposed that no rationale existed for the Sewage Plant to take an expedited approach, a nominal and more relaxed schedule would result in the work being completed in 79 months (6.6 years) plus time for RWQCB review of the facilities plan. These schedules reflect typical engineering and project planning approaches in the field, and they would result in relative water quality improvements as soon as five years before these improvements would be realized under the current Carollo proposal.

CEA's Morro Bay Major Item Schedule

Activity	CEA Duration (Months) for Expedited Completion	CEA Duration (Months) Relaxed Schedule
Task 1 – Initial Coordination with City and District	0 Months	6 months
Task 2 - Facilities Plan	15 months plus RWQCB review time	18 months plus RWQCB review time
Task 3 - Financial Plan & Funding	16 months (concurrent with the last 9 months of Task 2)	18 months (concurrent with the last 9 months of Task 2)
Task 4 – Environmental Review and Permitting	9 months (concurrent with Task 3)	15 months (concurrent with Task 3)
Task 5 – Design and Construction (Totals)	44 months	44 months
Completion	56 months	79 months

*Duration for Design and Bid process

Please contact me at 845-781-4844 if you have any questions or comments.

Sincerely,
CARPENTER ENVIRONMENTAL ASSOCIATES, INC.

Bruce A. Bell, Ph.D., P.E., DEE
President

CARPENTER ENVIRONMENTAL ASSOCIATES, INC.
CEA ENGINEERS, P.C.

CURRICULUM VITAE

BRUCE A. BELL, Ph.D., P.E., DEE, PRESIDENT

EDUCATION

B.S. Civil Engineering, New York University, 1968
M.S. Civil Engineering, New York University, 1969
Ph.D. Environmental Engineering, New York University, 1974

REGISTRATION

Registered professional engineer in New York and New Jersey
Diplomate, American Academy of Environmental Engineers

PROFESSIONAL HISTORY

President, Carpenter Environmental Associates, Inc., Monroe, New York, 1978 - present
Promoted to President in 1991.

Responsible for technical direction of all engineering activities of the firm including:

Wastewater/Stormwater

- Design and supervision of construction for the upgrading of municipal sewage treatment plants.
- Design of several small private wastewater treatment plants.
- Collection system evaluations: CSO/SSO.
- Operational evaluation, process testing and review, and troubleshooting of POTWs.
- Facility Planning review and analysis.
- Conceptual design for biological nutrient removal.
- Peer review of biological nutrient removal and BAF applied research
- Waste treatability studies for industrial wastes.
- Sludge treatment and management evaluations.
- Water quality modeling; Waste assimilative capacity studies.
- Stormwater runoff modeling.
- NPDES permitting, comments, negotiations, and appeals.
- Industrial pretreatment studies and implementation of industrial pretreatment programs.
- Preparation of stormwater management plans and Stormwater Pollution Prevention Plans (SWPPPs).

Site Assessments/Hazardous Materials

- SPCC/DPCC Plans.
- Hazardous waste site assessment and remediation.
- Preparation and evaluation of environmental impact statements.
- RCRA closures.

Litigation Support

- Technical litigation support and expert witness testimony at deposition and trial in federal and state courts in the areas of: Clean Water Act, RCRA, CAFOs, Storm Water, and Insurance.

Associate Professor and Professor of Engineering, The George Washington University, Washington, D.C., 1978 - 1987
Promoted to Professor of Engineering in 1982.

Responsible for the University's environmental engineering program.

Directed both graduate and sponsored research.

Taught undergraduate and graduate courses in water supply, wastewater treatment, industrial waste treatment, sanitary engineering design, hydraulics, environmental chemistry, principles of environmental engineering, and environmental impact assessment.

Served as visiting research scientist and consultant at the U.S. Army Medical Bioengineering Research and Development Laboratory.

Project Manager and Vice President, Flood & Associates, Inc., Consulting Engineers of Jacksonville, Florida, 1975 - 1978
Promoted to vice president and director of environmental engineering design in 1976.

Responsible for the technical and financial aspects of all of the firm's environmental engineering design projects.

Served as project manager for numerous major treatment plant, collection system, and pumping station design projects including: design of a 20 MGD advanced wastewater treatment plant which included phosphorous removal, nitrification, denitrification, filtration and ozonation, as well as sludge incineration and lime recovery through recalcination; design of the upgrading and expansion of a 10 MGD lime water softening plant; design of sludge and solids handling systems for a 35 MGD municipal wastewater treatment plant; design of a 5 MGD pure oxygen expansion for a combined municipal/brewery waste treatment plant; design of a 15 MGD activated sludge plant; and design of several large wastewater pumping stations and associated gravity sewers.

Responsible for review of technical content of the firm's 201 Facilities Plans and sludge management studies.

Directed the firm's efforts as consultant to the Commonwealth of Virginia in the research, development, planning, and design related to the contamination of the James River and Hopewell wastewater treatment plant with the pesticide Kepone. Responsible for the preparation of alternative analysis for the remediation of Kepone contamination of the Hopewell wastewater treatment plant. Directed research efforts in Kepone biodegradation and incineration.

Systems Manager, Envirotech Corporation, Belmont, California, 1973 - 1975
Responsible for profit and loss for chemical-physical and advanced wastewater treatment systems, including thermal and solids handling systems and carbon regeneration systems.

Provided marketing and technical sales support, as well as application engineering.

Responsible for allocation and management of research and development funds in the area of advanced wastewater treatment.

Directed pilot studies in the areas of advanced wastewater treatment, carbon regeneration, and thermal sludge disposal. Carried out research into carbon adsorption and regeneration.

Responsible for process and system designs for solids handling systems and advanced wastewater treatment systems.

Instructor of Civil Engineering, New York University, New York, 1969 - 1973

Taught sixteen different courses in Civil and Sanitary Engineering.

Maintained active consulting practice in environmental engineering.

Consulting activities included wastewater treatability studies, pilot plant investigations, design of industrial pretreatment facilities, lake evaluations, and environmental impact analysis.

AFFILIATIONS

Water Environment Federation
International Water Association
American Society of Civil Engineers
American Academy of Environmental Engineers

HONORS

Diplomate of the American Academy of Environmental Engineers
Member of Tau Beta Pi, Chi Epsilon, and Perstare et Preaestare honor societies
Received the Founders Day Award and Hydraulics Prize from New York University
Received the Outstanding Design Achievement Award from the Florida WPCA
Nominated for the WPCF Eddy Medal for paper on Munitions Waste Treatment
Listed in **Who's Who in the South and Southwest, International Who's Who in Engineering,** and **American Men and Women of Science**

Revised 9/7/05

PROFESSIONAL ACTIVITIES

Served as a reviewer for WPCF (WEF) Manuals of Practice for Sludge Thickening, Nutrient Removal, and Sludge Conditioning.

Member of ASCE publication review committee (1979 -).

Member WPCF Technical Practices Committee (1977 - 1988).

Reviewer, Research and Equipment proposals, NSF (1979 - 1988).

Member Program Committee and Conference Co-chair, Seminar on Development and Assessment of Environmental Quality Standards, American Academy of Environmental Engineers (1981).

Faculty, short course on Hazardous Waste Management, Harvard School of Public Health (1982).

Faculty, short courses on Hazardous Waste Management in the 80's, American Public Health Association (1983).

Conference Co-Chairman, Conference on the Treatment of Metal Bearing Wastewaters, NRDC/Texas Instruments, Inc., Mansfield, MA. (1985).

State Membership Chairman, American Academy of Environmental Engineers (1985 - 1987).

Faculty member and developer of course materials, Industrial Pretreatment Enforcement - A Workshop for POTW Attorneys, USEPA and Environmental Law Institute (1990 - 1992).

Faculty member New England Judges' Conference on Environmental Law, Environmental Law Institute, (1991).

Faculty member, New Jersey Judicial College (1992).

Course developer and faculty member "Basic Enforcement Skills," USEPA National Environmental Training Institute, (1992-1993).

Member, Nitrogen Technical Advisory Committee, New York City Department of Environmental Protection (1994 -).

Member, Technical Review Committee for upgrading of Passaic Valley Sewerage Commissioners 330 mgd pure oxygen treatment plant, Newark, New Jersey (1995 - 2000)

Adjunct Professor, taught graduate course - Analysis of Receiving Waters, New Jersey Institute of Technology (1995 - 1997).

Member, Water Supply and Wastewater sub-committee, American Academy of Environmental Engineers, (1996-).

Member, Plant Operation and Design Technical Advisory Committee for 100,000 gpd municipal package plant, Town of Saluda, North Carolina (1998 - 2002).

Reviewer, ***Reference Manual on Scientific Evidence***, Federal Judicial Center (2000).

PUBLICATIONS

1. Schneider, G., Cardenas, R.R., Jr., Bell, B.A. and Beale, D., *The Passaic River*, Proceedings, Essex County Environmental Problems and Resources Conference, 1971.

2. Cardenas, R.R., Jr. and Bell, B.A., *Impact - An Environmental Case Study Involving a Lake and a Builder*, Proceedings, American Water Resources Association Conference, St. Louis, MO, 1972.

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16. Bell, B.A., *Energy Conservation and Production from the Anaerobic Digestion of Thermally Conditioned Sludges and Decant Liquors*, Proceedings Energy Optimization of Water and Wastewater Management for Municipal and Industrial Applications Conference, US D.O.E., ANL/EES-TM-96, 1979.

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20. Bostater, C.R., Jr., Ambrose, R.B. and Bell, B.A., *Modeling the Fate and Transport of Chemicals in Estuaries: Current Approaches and Future Needs*, Aquatic Toxicology and Hazard Assessment: 4th Congress ASTM, STP 737, D.R. Branson and K.L. Dickson, Eds. American Society for Testing and Materials, 1981.

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