DEPARTMENT OF THE ARMY
SOUTHWESTERN DIVISION, CORPS OF ENGINEERS
1100 COMMERCE STREET, SUITE 831
DALLAS TX 75242-1317

CESWD-RBT

17 JUN 2015

MEMORANDUM FOR Commander, Fort Worth District

SUBJECT: Review Plan for the Trinity River Parkway

1. References:

a. Memorandum, CESWF-DE, 06 May 2015, subject: Review Plan for the Trinity Parkway Project (Encl 1).

b. EC 1165-2-216 (Water Resources Policies and Authorities – Policy and Procedural Guidance for Processing Requests to Alter U.S. Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408), 31 July 2014.

c. EC 1165-2-214 (Water Resources Policies and Authorities - Civil Works Review), 15 December 2012.

2. In accordance with 1.c., I hereby approve the enclosed Review Plan (RP) for the subject project.

3. Please post the final approved RP with a copy of this memorandum to the District's public internet website. Prior to posting to the District website, the names of USACE employees should be removed.

3. My Point of contact for further information regarding this issue is Mr. Paul Komoroske at 817-565-6241 or Paul.E.Komoroske2@usace.army.mil.

Encl

DAVID C. HILL
Brigadier General, USA
Commanding

REVIEW PLAN

Trinity Parkway, City of Dallas, Texas
Section 408 Submittal

Ft. Worth District

MSC Approval Date: 17 June 2015
Last Revision Date: 11 June 2015

US Army Corps
of Engineers ®

REVIEW PLAN

Trinity Parkway, City of Dallas, Texas
Section 408 Submittal

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1. PURPOSE AND REQUIREMENTS

a. Purpose. This Review Plan defines the scope and level of peer review for the Section 408 Permit application for the proposed Trinity Parkway within the City of Dallas, Texas. Pending receipt of an anticipated Federal Highway Administration (FHWA) Record of Decision (ROD) on the Final Environmental Impact Statement (FEIS), The City of Dallas (COD), Texas Department of Transportation (TxDOT) and the North Texas Tollway Authority (NTTA) are proposing to construct the Trinity Parkway to provide a transportation solution (reliever route) to manage traffic congestion and improve safety in the area of the Dallas Central Business District (CBD). The Parkway would be a limited access toll facility and would ultimately consist of six mixed-flow main lanes. The Trinity Parkway alignment has approximately 70 percent of its alignment within the limits of the Dallas Floodway, adjacent to the river side of the East Levee. The intent of the Section 408 Submittal will be to identify the impacts associated with the project and provide information to illustrate that the project will not adversely impact the operation and maintenance of the flood risk reduction project.

b. References

(1) Engineering Circular (EC) 1165-2-214, Civil Works Review Policy, 15 December 2012
(2) EC 1105-2-412, Assuring Quality of Planning Models, 31 March 2011
(3) Engineering Regulation (ER) 1110-1-12, Quality Management, 30 September 2006
(4) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 November 2007
(5) ER 1110-2-1150, Engineering Design for Civil Works Projects, 31 August 1999
(6) WRDA 2007 H.R. 1495 Public Law 110-114, 8 November 2007
(7) Army Regulation 15-1, Committee Management, 27 November 1992 (Federal Advisory Committee Act Requirements)
(8) National Academy of Sciences, Background Information and Confidential Conflict of Interest Disclosure, BI/COI FORM 3, May 2003
(9) Review Plan Dallas Floodway Feasibility Report and EIS (Project #: 329279) Dallas, Texas, Fort Worth District, 12 December 2012.
(10) CESWF Pamphlet 1150-2-1, Criteria for Design and Construction within the Limits of Existing Federal Projects, 1 October 2013
(11) ER 1110-1-1807, Drilling in Earth Embankment and Levees, 17 December 2013
(12) EC 1165-2-216, Policy and Procedural Guidance for Processing Requests to Alter US Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408, 31 July 2014
(13) Title 33 United States Code, Section 408

c. Requirements. This review plan was developed in accordance with EC 1165-2-214 and EC 1165-2-216, which establish an accountable, comprehensive, life-cycle review strategy for Civil Works products by providing a seamless process for review of all Civil Works projects from initial planning through design, construction, operation, maintenance, repair, replacement and rehabilitation (OMRR&R). The ECs outline multiple general levels of review, including a Sponsor Quality Control/Quality Assurance, District-Led Agency Technical Review (ATR), Independent External Peer Review (IEPR) and Policy and Legal Compliance Review.

2. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION

The RMO is responsible for managing the overall peer review effort described in this Review Plan. The RMO for the peer review effort described in this Review Plan is the USACE Risk Management Center (RMC).

The RMO shall coordinate the review team with Communities of Practice, other relevant Centers of Expertise and other relevant offices to ensure that a review team with appropriate expertise is assembled and a cohesive and comprehensive review is accomplished. The City of Dallas as the applicant and the NTTA as the presumed proponent, shall provide reviewers with sufficient information, including background information about the project, to enable them to understand the data, analytic procedures and assumptions.

The products applicable to determination of impacts to the operation and maintenance of the flood risk reduction project will be reviewed against published guidance, including Engineering Regulations, Engineering Circulars, Engineering Manuals, Engineering Technical Letters, Engineering Construction Bulletins, Policy Guidance Letters, implementation guidance, project guidance memoranda and other formal guidance memoranda issued by HQUSACE.

3. STUDY INFORMATION

a. Decision Document. This Review Plan is for determining the adequacy, appropriateness and acceptability of the design and construction activities associated with the proposed construction of the Trinity Parkway with respect to the function of the levees, floodway and sump components of the Dallas Floodway System for the purpose of assuring public health, safety and welfare. The Dallas Floodway provides flood risk management to a large population and therefore any significant increases in the threat to life will be considered in the evaluation and recommendation. The decision document for this project is a Section 408 Package.

The proposed Trinity Parkway project represents a significant encroachment into the Dallas Floodway System and will therefore require approval by HQUSACE. As a 408 Review, the package will require a District-Led ATR and a Type II Independent External Peer Review (IEPR). The decision of approval will rest at HQUSACE. The USACE is a cooperating agency in the preparation of an Environmental Impact Statement (EIS) for the entire Trinity Parkway project. This document includes an appendix that specifically addresses the impacts to the federally authorized project, in this case the Dallas Floodway System. The EIS and its appendices will serve to describe the effects as they relate to the Dallas Floodway System to satisfy the National Environmental Policy Act (NEPA) requirements.

b. Project Description. The Trinity Parkway is a proposed new tollroad approximately nine miles in length that would be located west of the Dallas CBD and Stemmons Freeway (I-35E). The northern terminus is near the interchange of I-35E and SH 183 and the southern terminus is near the interchange of US 175 and SH 310 (SM Wright Boulevard) with over six miles of the proposed tollroad located within the limits of the Dallas Floodway. The proposed Trinity Parkway is planned to improve mobility, safety and increase accessibility to businesses and public facilities. When constructed, this project is expected to relieve congestion in the IH 30 / IH 35E (Horseshoe)

interchange on the west edge of downtown Dallas, the segment of IH 30 (Canyon) along the southern edge of the CBD and IH 35E from the Horseshoe to the Dallas North Tollway (DNT).

The construction delivery method for the Trinity Parkway is not yet determined. Options are being considered including a Design-Bid-Build method, a Design-Build method and a Design-Build-Operate method, otherwise known as a Comprehensive Development Agreement (CDA). This Review Plan attempts to develop a process for the Section 408 requirements that could accommodate any of the delivery methods.

The USACE is involved via statutory authority through the project for flood control, Trinity River and tributaries, Texas, authorized by Section 2 of the Rivers and Harbors Act of 1945, Public Law 14, 79th Congress, First Session, Chapter 19 (March 2, 1945), 59 Stat. 10.

c. Factors Affecting the Scope and Level of Review. This project includes roadway placement on earthen embankment adjacent to the East Levee, usually set above the 100-year flood elevation. However, there are also locations which would require a flood separation wall and pump stations where the proposed roadway must pass under existing bridges crossing the floodway. At the Parkway entrance to the floodway and interchanges with major cross roads, there will also be bridge structures, some of which require pier foundation penetrations within the limits of the East Levee. Due to the potential impacts to the hydraulics of the system as well as the potential risk to human life and infrastructure protected by the East Levee, a District-Led ATR and Type II IEPR review are recommended.

Through the USACE led Comprehensive System Analysis for the Dallas Floodway Feasibility Study and the USACE participation as a cooperating agency in the Trinity Parkway FEIS preparation, a number of the technical documents (preliminary geotechnical, hydraulic, Section 404(b)(1)) associated with the Trinity Parkway Section 408 Submittal Package have already been reviewed by the Ft. Worth District and independent USACE team through the USACE Risk Management Center. Therefore, certain portions of the Section 408 Submittal Package will only require a Type II IEPR review. The District Chief of Engineering and Construction will make an assessment of significant threat for any portion proposed not to require a Type II IEPR review.

d. In-Kind Contributions. No in-kind products are anticipated.

4. SPONSOR QUALITY CONTROL

All documentation provided to the USACE for the Section 408 Process will have undergone a quality control review by the preparer, project proponent and sponsor (applicant). The USACE guidance for a Contractor Quality Control Plan (CQCP) has been included in the Section 408 package as a requirement for inclusion in the subsequent submittals by a future project developer. The package is a compilation of multiple contractors' documentation and reports prepared throughout the life of the project to this milestone. Each contractor was responsible for quality control of their deliverables, which in turn, were then reviewed by the NTTA Project Delivery Office. Please see Appendix A to this plan for more discussion on the CQCP.

5. DISTRICT-LED AGENCY TECHNICAL REVIEW (ATR)

All decision documents (including supporting data, analyses, environmental compliance documents, etc.) shall undergo a District-Led ATR. The current review is scheduled and funded under the Dallas Floodway Project – P2# - 329279. The District-Led ATR is an internal review process of basic science and engineering work products focused on confirming the requirements of EC 1165-2-216 have been met. The District-Led ATR team will make the following determinations:

- Impair the Usefulness of the Project Determination. The objective of this determination is to ensure that the proposed alteration will not limit the ability of the project to function as authorized and will not compromise or change any authorized project conditions, purposes or outputs. This determination includes a review of the technical adequacy of the design.
- Injurious to the Public Interest Determination. The objective of this determination is to identify the probable impacts, including cumulative impacts, on the public interest. The decision whether to approve an alteration will be determined by the consideration of whether benefits are commensurate with the risks.
- Legal and Policy Compliance Determination. A determination will be made as to whether the proposed alteration meets all legal and policy requirements.

The District-Led ATR Review shall include a review of the engineering, design and environmental impacts associated with the 408 Submittal utilizing the above mentioned objectives. District-Led ATR members will be senior level professionals and shall be selected from the nationally approved list of their Community of Practice. ATR members may be from their home district.

Reviews shall include:

- Section 408 Submittal Package:
    - This package will establish the overall footprint of the Trinity Parkway Project based on the schematic drawings and its impacts on the operation and maintenance of the floodway system. The design received USACE review during the Comprehensive System Analysis for the Dallas Floodway Feasibility Study. See Paragraph 5.b (1) below for specific inclusions of this package.
    - The draft final Comprehensive System Analysis report will serve as the base technical document and concludes for the feasibility level that the Trinity Parkway project is not anticipated to adversely impact the operation and maintenance of the flood risk reduction project provided that the parkway design integrates all the features throughout the design phase. This conclusion will be documented in the package and recommended to HQUSACE for final approval.
    - The Trinity Parkway FEIS and its appendices will serve as the base documentation to describe the effects as they relate to the Dallas Floodway System, satisfy the National Environmental Policy Act (NEPA) requirements and propose the determination that the project is not injurious to the public interest.
    - Fort Worth District legal council will serve to review the submittal for legal and policy compliance. Legal Office of Counsel review will follow and include the technical and environmental determinations.
    - Expected outcome of the review of this submittal is 408 approval for the Trinity Parkway. The 408 approval will not constitute construction approval. Construction approval will be sought through review of the subsequent submittals described below.
- Intermediate Construction Submittal Package:

  - This package will be prepared by either the designer or a design-builder based on an approximate 60% complete level of project design. This package will include a Design Documentation Report (DDR) for the Trinity Parkway documenting USACE required analyses such as the supplemental geotechnical data including under seepage analyses based on proposed foundation layouts, updated hydraulic analyses, floodwall design details and other applicable information based on current conditions and updated criteria. This submittal will include detailed grading plans, with contours, for the entire area of the system impacted by the project; this is necessary to facilitate the USACE review that the system will still flow/operate/drain as designed with the project in place. This submittal will be designed based on design-level quality topographic survey; controls and datum will be coordinated in advance with the Ft. Worth District. This package will also include an Emergency Action Plan for the operations and closure of the Trinity Parkway during a flood event. This documentation will illustrate consistency with and/or highlight differences from the Section 408 Submittal. This package could also include final details for construction for some elements within the Federal Project under the design-build (D-B) method. See Paragraph 5.b (2) below for specific inclusions of this package.
  - The expected outcome of this package, under the design-bid-build method, is USACE review comments for consideration of incorporation into the completed plans and, if applicable, a request from the USACE for a Contingency Technical Review of items believed to be inconsistent with the Section 408 Package.
  - The expected outcome of this package, under the D-B method, is construction approval on some of the items as outlined below in Paragraph 5.b (2), USACE review comments for consideration of incorporation into the completed plans for future construction approval items and, if applicable, a request from the USACE for a Contingency Technical Review of items believed to be inconsistent with the Section 408 Package. The construction approval letter is also expected to include documentation of the Section 404/10 permit determination.
- Construction Approval Package(s):
  - This package will include further advanced plans (95% level of completeness) and details for elements still requiring construction approval within the limits of the Federal Project. See Paragraph 5.b (3) below for specific inclusions of this package.
  - The expected outcome of this package(s) is construction approval for remaining project elements or features or, if applicable, a request from the USACE for a Contingency Technical Review of any items believed to be inconsistent with the Intermediate Construction Submittal Package. The construction approval letter is also expected to include documentation of the Section 404/10 permit determination.
- Contingency Technical Review Package(s):
  - This package will be prepared if the USACE concludes that details of the design have appreciably changed from previously approved analyses, if there are proposed temporary construction elements not previously reviewed or if additional analysis and/or information has been requested by the USACE to show the new impacts from the Construction Approval Package do not change or increase from the Section 408 Package.
  - The expected outcome of this package(s) is construction approval.
- Released for Construction Packages (D-B method only):

- These packages will be submitted for all proposed construction within or directly adjacent to the floodway system and are intended for situation awareness only. The USACE will review at its own discretion. For packages including construction items subject to previous USACE construction approval review, a transmittal letter will be included affirming no appreciable changes from previously reviewed and approved plans.
- The expected outcome of these packages is to provide the USACE a complete record set of final DDR, plans and specifications for all proposed construction within or directly adjacent to the floodway and affirmation, without additional USACE review, that theses final plans are not appreciably different from previous review packages.

a. Documentation of District-Led ATR. All reviews, except the Released for Construction Plan Sets, will be conducted and documented within DrChecks. The Released for Construction Plan Sets will be submitted for USACE situational awareness. The four key parts of a quality review comment will normally include:

(1) The review concern – identify the product's information deficiency or incorrect application of policy, guidance or procedures;
(2) The basis for the concern – cite the appropriate law, policy, guidance or procedure that has not been properly followed;
(3) The significance of the concern – indicate the importance of the concern with regard to its potential impact on the plan selection, recommended plan components, efficiency (cost), effectiveness (function/outputs), implementation responsibilities, safety, federal interest or public acceptability; and
(4) The probable specific action needed to resolve the concern – identify the action(s) that the reporting officers must take to resolve the concern.

In some situations, especially addressing incomplete or unclear information, comments may seek clarification in order to then assess whether further specific concerns may exist.

District-Led ATR may be certified when all concerns are resolved and the District-Led ATR documentation is complete. The District-Led ATR Lead will prepare a Statement of Technical Review certifying that the issues raised by the review team have been resolved. A Statement of Technical Review should be completed based on work reviewed to date. A sample Statement of Technical Review is included in Attachment 1.

b. Products to Undergo District-Led ATR.

(1) The Section 408 Submittal Package shall include:
- Summary Report
  - Introduction
  - Purpose and Need
  - Description of Alteration
  - Non-Federal Request for Alteration Authorization
  - National Environmental Policy Act (NEPA) Documentation
  - Discussion of Executive Order 11988
  - Technical Analysis and Adequacy of Design

        - Operation & Maintenance
        - Real Estate Analysis
        - Discussion of Residual Risk
        - Administrative Record
    - Schematic Drawings (Previously reviewed by USACE)
    - Final Environmental Impact Statement (FEIS) (Previously reviewed by USACE)
    - Geotechnical Analysis and Report
        - Geotechnical Memorandum (HNTB, June 2013) (Previously reviewed by USACE)
        - Geotechnical Engineering Report Trinity Parkway (Fugro, March 2010) (Previously reviewed by USACE)
    - H&H Analysis and Report (Trinity Parkway FEIS Appendix F) (Previously reviewed by USACE)
    - Preliminary Construction Details
        - Flood Emergency Action Plan (EAP) Requirements (design-bid-build method)
        - Levee Raise Details (if applicable)
        - Riprap Details
        - Filter Collar Details
        - Drilled Shaft Construction Details
        - Levee Maintenance Road Relocation Details

(2) The Intermediate Construction Submittal Package shall include:
    - Contractor Quality Control Plan
    - Design Documentation Report including:
        - Revised Geotechnical Report Trinity Parkway based on 2013 Criteria
        - H&H Report based on current conditions
        - Floodwall Design Analyses
    - 60% complete Plans and Details for all proposed construction within the Dallas Floodway System including both earthen and structural features of the Trinity Parkway
    - Detailed grading plans with contours for entire impacted area of the floodway and levee system
    - Emergency Action Plan (EAP) for Trinity Parkway Operations
    - Potential items for Construction Approval (for D-B method) including:
        - Roadway Plan/Profiles
        - Typical and Design Grading Cross Sections
        - Bridge and Retaining Wall Layouts
        - Foundation Layouts (Bridges, Oncor, overhead sign structures, illumination, etc.)
        - Excavation and Bench Placement Details
        - HTRW Management Plan
        - Drainage Details for Outfall Structure Extensions and Roadway Drainage Systems within the floodway
        - Flood Separation Wall Layouts
        - Cutoff Wall Details (if applicable)
        - Maintenance Road Relocation Details
        - Existing Utility Relocation/Adjustment Details
        - Temporary Works Details

(3) Construction Approval Package(s) shall be submitted for all proposed construction that penetrates the existing ground surface within existing levee template, floodway and within

200 ft. of the existing levee landside toes of slope, is constructed directly on the levee template, impacts hydraulic flow or storage within the floodway system or impacts existing maintenance roads:

- 95% complete construction documents for design-bid-build method
- Items for Construction Approval for D-B method not previously reviewed and approved for construction under the Intermediate Submittal for D-B method including:
  - Parkway Storm Water Pumping System Details
  - Final Levee Raise, Riprap and Filter Collar Details
  - Signing, Illumination and Toll Collection Infrastructure Foundation Details
  - Trinity Parkway Flood Emergency Operation Plan and Systems Details
  - Parkway Landscaping Details

(4) Contingency Technical Review Package(s) (if needed) shall include:

- Temporary Works Details for design-bid-build method
- Any additional analysis or information requested by the USACE following the Intermediate or Construction Approval reviews

(5) Released for Construction Packages containing final approved D-B plans for all proposed construction within or directly adjacent to the floodway system.

c. Required District-Led ATR Expertise. For this project, the following expertise is requested:

District-Led ATR Team	Expertise Required
District-Led ATR Lead	The District-Led ATR Lead should be a senior professional with extensive experience in preparing Civil Works decision documents and conduction an ATR. The lead should also have the necessary skills and experience to lead a virtual team through the District-Led ATR process. The District-Led ATR Lead may also serve as a reviewer for a specific discipline.
Hydraulics and Hydrology Engineering	Team member should be an H&H subject matter expert, demonstrate experience in the field of urban hydrology and hydraulics and have a thorough understanding of levee systems, the effects of management practices, high impact of urban development on hydrology, the use of levees and floodwalls within the space constraints of an urban environments, the use of non-structural systems as they apply to flood proofing, warning systems and evacuation and the use of HEC computer modeling systems. The individual should be a certified PE.
Geotechnical Engineering	Team member should be a geotechnical subject matter expert and have extensive experience in levee and floodwall design, pre- and post-construction evaluation and rehabilitation. The individual should be a certified PE.
Civil Engineering	Team member should be a general civil engineering subject matter expert and have extensive experience in levee and floodwall design, pre- and post-construction evaluation and rehabilitation. The individual should be a certified PE.

District-Led ATR Team	Expertise Required
Construction/Operations	Team member should be a construction/operations subject matter expert and should have extensive experience in levee and floodwall operations, pre- and post-construction evaluation and rehabilitation. The individual should be a certified PE.
Real Estate	Team member should have experience developing real estate plans for multi-objective USACE Civil Works projects. Such projects would include acquisition of multiple interests and estates, planning for issues related to contaminated sites, significant utility and facility relocations, relocations of residential owners and businesses and modifications to existing federal projects. The RE ATR reviewer will be a senior RE professional selected from the Nationally approved RE ATR list.
Environmental Resources	Team member should be an environmental subject matter expert and be familiar with preparing, processing, and reviewing environmental impact statements.

6. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)

IEPR is the most independent level of review and is applied in cases that meet certain criteria where the risk and magnitude of the proposed project are such that a critical examination by a qualified team outside of USACE is warranted. A risk-informed decision, as described in EC 1165-2-214, is made as to whether IEPR is appropriate. IEPR panels will consist of independent, recognized experts from outside of the USACE in the appropriate disciplines, representing a balance of areas of expertise suitable for the review being conducted. There are two types of IEPR:

- Type I IEPR. Type I IEPR reviews are managed outside the USACE and are conducted on project studies. Per EC 1165-2-216, because Section 408 requests are not planning studies, Type I IEPRs are not required.

- Type II IEPR. Type II IEPR, or Safety Assurance Review (SAR), are managed outside the USACE and are conducted on design and construction activities for hurricane, storm and flood risk management projects or other projects where existing and potential hazards pose a significant threat to human life. Type II IEPR panels will conduct reviews of the design and construction activities prior to initiation of physical construction and, until construction activities are completed, periodically thereafter on a regular schedule. The reviews shall consider the adequacy, appropriateness and acceptability of the design and construction activities in assuring public health safety and welfare.

a. Decision on IEPR. Type II IEPR, as discussed in Paragraph 3.c, is recommended based on the critical infrastructure and lives behind the East Levee, as well as the significant length of East Levee immediately adjacent to the project.

b. Products to Undergo Type II IEPR (SAR).

- Section 408 Submittal Package (see paragraph 5.b(1) for details)

- Intermediate Construction Submittal Package (see paragraph 5.b(2) for details)
- Contingency Technical Review Package(s) (see paragraph 5.b(3) for details)
- Construction Kick-Off Site Visit
- Construction Midpoint Site Visit

c. Required Type II IEPR Panel Expertise. The Type II IEPR panel will be selected and managed by the City of Dallas. Selection of IEPR review panel members will be made up of independent, recognized experts from outside of the USACE in the appropriate disciplines, representing a balance of expertise suitable for the review being conducted.

Per EC 1165-2-214, selection of the SAR Panel members for IEPR efforts will adhere to the National Academy of Science Policy on Committee Composition and Balance and Conflicts of Interest, which set the standard for "independence" in review processes and complexity in a national context.

Type II IEPR factors to be considered include:

- Complex hydraulic modeling associated with linear roadway facility encroachment inside a floodway system.
- Design of flood separation wall to protect roadway and users from 100-yr discharges and resiliency against overtopping by greater discharges within the floodway.
- Potential for Design-Build method delivery system.

d. Documentation of Type II IEPR. Panel comments will be compiled into a letter to the City and should address the adequacy and acceptability of the economic, engineering and environmental methods, models and analyses used. The Project Proponent will tabulate comments from the panel into a Comment Response Form. Draft responses will be submitted to the panel for review and acceptance or subsequent resolution. The panel letter and Comment Response Form will be compiled in an appendix to the Summary Report.

For more information on the Type II IEPR requirements, execution and documentation, please see Appendix C, Safety Assurance Review Plan.

7. POLICY AND LEGAL COMPLIANCE REVIEW

All decision documents will be reviewed throughout the study process for their compliance with law and policy. Guidance for policy and legal compliance reviews is addressed in Appendix H, ER 1105-2-100. These reviews culminate in determinations that the recommendations in the reports and the supporting analyses and coordination comply with law and policy and warrant approval or further recommendation to higher authority by the home MSC Commander. District-Led ATR augments and complements the policy review processes by addressing compliance with pertinent published Army policies, particularly policies on analytical methods and the presentation of findings in decision documents.

8. MODEL CERTIFICATION AND APPROVAL

EC 1105-2-412 does not cover engineering models used in planning. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed. As part of the USACE Scientific and Engineering Technology (SET) Initiative, many engineering models have been

identified as preferred or acceptable for use on Corps studies and these models should be used whenever appropriate. The selection and application of the model and the input and output data is still the responsibility of the users and is subject to District-Led ATR and IEPR.

a. Engineering Models. The following engineering models are anticipated to be used in the development of the decision document:

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Approval Status
Dallas Floodway Feasibility Study Trinity River Model HEC-RAS 4.1.0	The 1988 Trinity River EIS Record of Decision H&H Criteria is to be used to evaluate the proposed project for decisions regarding flood risk impacts. The goal of the 1988 Record of Decision Criteria is the stabilization of flooding risk along the Trinity River Corridor in North Central Texas. The Section 408 Process requires the USACE to review and approve the hydraulic analysis and report. Typically, the current Corridor Development Certificate (CDC) HEC-RAS model is used for analysis of 404/408 permit actions for developments within the Upper Trinity River Corridor. However, because the Trinity Parkway Project is a project component considered in the ongoing Dallas Floodway Feasibility Study (DFFS), the DFFS HEC-RAS Existing Conditions HEC-RAS model will be used for this 408 approval process to maintain consistency with the DFFS. The modeling is expected to indicate that the 1988 Trinity River ROD H&H criteria are met for both the 1% Annual Exceedence Probability (AEP) and the Standard Project Flood (SPF) flood events. Should the modeling not show meeting the 1988 Trinity River ROD H&H criteria, a variance will be requested from the USACE. The hydraulic analysis will include a valley storage evaluation consistent with the revised valley storage evaluation process established for the DFFS. The DFFS Existing Conditions HEC-RAS model and description of the DFFS valley storage evaluation process may be provided by the USACE Fort Worth District upon request.	Preferred USACE Model
Geo-Slope, Inc. GeoStudio 2007	Geo-Slope is a tool for completing seepage and slope stability analysis. It will be used to determine the existing seepage and slope stability and to analyze any impacts caused by the proposed project.	Preferred USACE Software

9. REVIEW SCHEDULES AND COSTS

The following schedule is preliminary and subject to change:

Approval of the Section 408 Submittal Package by HQUSACE is needed by April 2015.

Package Reviews:

Package	Review Type	Review Initiation	Comments Due	Resolution	Modifications Finalized	Costs
Initial Section 408 Package	DQC	June 13, 2014	July 3, 2014	July 11, 2014	July 25, 2014	Approx. $50,000
	ATR	June 13, 2014	July 3, 2014	July 11, 2014	July 25, 2014	
	SAR	June 13, 2014	July 3, 2014	July 11, 2014	July 25, 2014	
Section 408 Package	District-Led ATR	January 16, 2015	March 6, 2015	March 20, 2015	March 31, 2015	Approx. $50,000
Intermediate Construction Package	All	TBD				Approx. $50,000
Construction Approval Package	District-Led ATR	TBD				Approx. $50,000
Contingency Technical Package(s)	All	TBD				TBD
Released for Construction	District-Led ATR	TBD				N/A

10. PUBLIC PARTICIPATION

Public participation has been facilitated through the Federal Highway Administration's Trinity Parkway EIS process and through the USACE's Dallas Floodway EIS process.

11. REVIEW PLAN APPROVAL AND UPDATES

The Southwestern Division Commander is responsible for approving this Review Plan. The Commander's approval reflects vertical team input (involving district, MSC, RMO and HQUSACE members) as to the appropriate scope and level of review for the decision document. Like the PMP, the Review Plan is a living document and may change as the project progresses. The sponsor, with the assistance of the home district, is responsible for keeping the Review Plan up to date. Significant changes to the Review Plan (such as changes to the scope and/or level of review) should be re-approved by the MSC Commander following the process used for initially approving the plan. The latest version of the Review Plan, along with the Commanders' approval memorandum, should be posted on the Home District's website, http://www.swf.usace.army.mil/. The latest Review Plan should also be provided to the RMO and home MSC.

ATTACHMENT 1: SAMPLE STATEMENT OF TECHNICAL REVIEW FOR DECSION DOCUMENTS

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the *<type of product>* for *<project name and location>*. The ATR was conducted as defined in the project's Review Plan to comply with the requirements of EC 1165-2-214. During the ATR, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing US Army Corps of Engineers policy. The ATR also assessed the District Quality Control (DQC) documentation and made the determination that the DQC activities employed appear to be appropriate and effective. All comments resulting from the ATR have been resolved and the comments have been closed in DrChecks[sm].

SIGNATURE _____ Date _____
Name
ATR Team Leader
Office Symbol/Company

SIGNATURE _____ Date _____
Name
Project Manager
Office Symbol

SIGNATURE _____ Date _____
Name
Architect Engineer Project Manager[1]
Company, location

SIGNATURE _____ Date _____
Nathan Snorteland
Review Management Office Representative
Office Symbol

CERTIFICATION OF AGENCY TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows: *Describe the major technical concerns and their resolution.*

As noted above, all concerns resulting from the ATR of the project have been fully resolved.

SIGNATURE _____ Date _____
Name
Chief, Engineering Division
Office Symbol

SIGNATURE _____ Date _____
Name
Chief, Planning Division
Office Symbol

[1] Only needed if some portion of the ATR was contracted

ATTACHMENT 2: REVIEW PLAN REVISIONS

Revision Date	Description of Change	Page / Paragraph Number

APPENDIX A – Contractor Quality Control Plan

The Section 408 Package is a compilation of multiple contractors' documentation and reports prepared for the NTTA in the development of the project schematic, NEPA documents and technical reports required for the FHWA ROD and USACE approvals. Each contractor was responsible for quality control of their respective deliverables. Each deliverable was submitted to the NTTA Project Delivery Office for review and comments.

Upon resolution and modifications based on the NTTA review, deliverables were then provided to the project sponsor, City of Dallas, as well as the TxDOT Dallas District, TxDOT Environmental and Design Divisions, FHWA and the USACE as appropriate for further review, comment and modification.

The QA/QC processes and plan for the subsequent deliverables outlined in this Review Plan will be addressed in the future FHWA Project Management Plan and as required by reviewing agencies and the procurement process if the project moves forward. The USACE guidance and template for the required Contractor Quality Control Plan is included in the Section 408 Package Appendix 6, *Pending USACE Coordination,* as a requirement for inclusion in the subsequent submittals by the future project developer.

APPENDIX B – USACE Team Roster

Role	Name	Telephone
District-Led ATR Team Roster		
Team Lead		
O&M		
H&H		
Civil		
Geotechnical		
Environmental		
Real Estate		
Construction		
Vertical Team Roster		
RMO, Risk Management Center		
MSC, Levee Safety Program Manager		
RIT, Deputy SWD		

APPENDIX C – Safety Assurance Review (SAR) Plan

This plan serves to satisfy the Safety Assurance Review (SAR) requirements for the proposed Trinity Parkway project as required by Engineering Circular (EC) 1165-2-216, Policy and Procedural Guidance for Processing Requests to Alter US Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408, dated 31 July 2014.

The City of Dallas (COD), Texas Department of Transportation (TxDOT) and North Texas Tollway Authority (NTTA) are proposing to construct the Trinity Parkway within the Dallas Floodway, adjacent to the flood side of the East Levee. The Dallas Floodway is a federally authorized, though non-federally operated and maintained, levee system.

The USACE Ft. Worth District is working with the City of Dallas, the local sponsor of the system, to ensure the Independent External Peer Review (IEPR) of the project meets the requirements of EC 1165-2-216. This document outlines how the SAR will be performed and identifies the independent consultants who will comprise the SAR Panel charged with executing an adequate review for the Trinity Parkway.

1. Project Background

The Trinity Parkway is a limited access toll facility proposed as a transportation solution to manage traffic congestion and improve safety in the area of the Dallas Central Business District. The intent of the Section 408 Submittal is to identify the impacts associated with the project and provide information to illustrate that the project will not adversely impact the operation and maintenance of the flood risk reduction project.

2. Purpose

This document outlines the SAR Plan for the Trinity Parkway Project. EC 1165-2-216 outlines the policy on review of decision documents, including with regard to IEPR and SAR, which is also referred to as Type II IEPR. As discussed in more detail in the Trinity Parkway Review Plan Section 3.c, a Type II IEPR/SAR is necessary.

The SAR Panel provides and impartial and independent review of the project. The review shall be on a regular schedule sufficient to inform the Chief of Engineers on the adequacy, appropriateness and acceptability of the design and construction activities for the purpose of assuring that good science, sound engineering and public health, safety and welfare are the most important factors that determine a project's fate.

Specifically, the SAR will address the following questions:

1) Are the assumptions made for the hazards appropriate?
2) Is the quality and quantity of the surveys, investigations and engineering for the conceptual design sufficient to support the models and assumptions made for determining the hazards?
3) Does the analysis adequately address the uncertainty given the consequences associated with the potential loss of life for this type of project?
4) Do the assumptions made during the planning phase for hazards remain valid through the completion of design as additional knowledge is gained and the state-of-the-art evolves?

5) Do the project features adequately address redundancy, robustness and resiliency with an emphasis on interfaces between structures, materials, members and project phases?
6) Do the assumptions made during design remain valid through construction to project completion?

3. References

- EC 1165-2-216, Policy and Procedural Guidance for Processing Requests to Alter US Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408, 31 July 2014
- EC 1165-2-214, Civil Works Review Policy, 15 December 2012
- EC 1105-2-412, Assuring Quality of Planning Models, 31 March 2011
- Engineering Regulation (ER) 1110-1-12, Quality Management, 30 September 2006
- ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment No. 1, 20 November 2007
- ER 1110-2-1150, Engineering Design for Civil Works Projects, 31 August 1999
- WRDA 2007 H.R. 1495 Public Law 110-114, 8 November 2007
- Army Regulation 15-1, Committee Management, 27 November 1992 (Federal Advisory Committee Act Requirements)
- National Academy of Sciences, Background Information and Confidential Conflict of Interest Disclosure, BI/COI Form 3, May 2003
- CESWF Pamphlet 1150-2-1, Criteria for Design and Construction within the Limits of Existing Federal Projects, 1 October 2013

4. SAR Review Expertise and Management

The City of Dallas, as the project applicant and the NTTA as the presumed project proponent, will identify and select three experts based on varied professional disciplines to serve on the SAR Panel. Selection will be based upon availability, technical credentials and absence of perceived or actual conflict of interest. A panel lead will be chosen by the USACE Ft. Worth District. The expert reviewers shall not have any financial or litigation association with the USACE, City of Dallas, NTTA, TxDOT, engineering design team, subcontractors or construction contractors. The SAR Panel shall fully disclose any known or potential conflict of interest that may arise from the performance of the work. Areas of conflict may include, but are not limited to, current employment by the federal or county governments, participation in development of the Trinity Parkway project, a publicly documented statement advocating for or against the Trinity Parkway or current/future interests in the Trinity Parkway.

The panel will consist of a geotechnical engineer, hydraulic engineer and expert familiar with construction practices related to flood control facilities. The geotechnical engineer will be a recognized expert in the analysis, design and construction on alluvial foundations with extensive experience in subsurface investigations, as well as seepage and slope stability analysis. The hydraulics expert will have extensive experience in hydraulic modeling associated with roadway facility encroachment in a floodway.

The SAR Panel shall:

- Conduct the review in a timely manner in accordance with the project and SAR Plan schedule;
- Follow the “charge”, but when deemed appropriate by the panel lead, feel free to request other products relevant to the project and purpose of the review;

- Receive from the USACE any public written and/or oral comments provided on the project;
- Provide timely written and oral comments throughout the development of the project as requested;
- Submit reports in accordance with the review plan milestones; and
- The panel lead shall be responsible for ensuring comments represent the group, be non-attributable to individuals and where there is lack of consensus and note the non-concurrence and reasoning.

5. SAR Review Panel Expertise

Per EC 1165-2-214, selection of the SAR Panel members for IEPR efforts will adhere to the National Academy of Science Policy on Committee Composition and Balance and Conflicts of Interest, which set the standard for "independence" in review processes and complexity in a national context.

Panel members shall be registered professional engineers in the United States. The reviewers must have an engineering degree. A master's degree in engineering is preferred, but not required. Hands-on, relevant engineering experience in the listed disciplines is critical. The panel members shall have a minimum twenty years' experience in each of their respective fields.

6. Comment Tracking

The SAR Panel will provide written comments and recommendations to the City of Dallas and design team for response. Based on a panel review of the design team responses, the issues raised will be closed for items resolved satisfactorily or remain open for unresolved items.

Upon completion of each stage of the review, the panel lead shall prepare a response detailing any actions undertaken or not taken in response to the comments. Comments that lack consensus shall be clarified to explain the non-concurrence. All comments shall be addressed.

7. Schedule and Costs

As discussed in the Trinity Parkway Review Plan, the potential submittals and schedules are dependent on a yet undetermined project procurement type. The SAR will be conducted at each deliverable milestone as needed, but at a minimum, will occur at:

Package	Completion Schedule	Costs
Schematic/Section 408 Submittal (Preliminary Plans)	December 2014	$83,600
Intermediate Construction Submittal Package	TBD	Approx. $50,000
Construction Approval Submittal Package	TBD	Approx. $50,000
Start of Construction	TBD	Approx. $30,000
Mid-Point of Construction	TBD	Approx. $30,000

The SAR panel has the option to request additional or alternate milestone reviews where warranted and reasonable. In advance of each review, the City of Dallas and/or design team will prepare an agenda including important topics, questions for the panel, etc., as well as provide and supporting reports and/or project briefing materials.

8. Adequacy of the SAR

The information provided in this SAR Plan demonstrates the City of Dallas' effort to ensure good science and sound engineering, as well as public health, safety and welfare are the most important considerations during the development of the Trinity Parkway. The planned actions outlined in this document satisfy the intent of EC 1165-2-216 and 33 USC 408. This SAR Plan is a living document and may be modified in the future as warranted.

9. Proposed SAR Panel Roster

The current SAR Panel has only been contracted for the initial Schematic/Section 408 Submittal review. The plan and schedule for moving the Trinity Parkway project forward beyond the initial federal authorization by the USACE and FHWA is undetermined. Therefore, the SAR Panel listed below is accurate for the initial submittal, but may be updated in the future when the project progresses to the next phase of review. Resumes for the SAR Panel members are included as part of this appendix.

Role	Name	Resume Page	Telephone
SAR Panel Roster			
Panel Lead and Geotechnical	George Sills	C-5	601.638.0436
H&H	David Williams	C-15	619.823.4778
Construction	Arun Wagh	C-44	901.755.3230

George Sills Geotechnical
Engineering Consultant, LLC
470 Dogwood Lake Drive
Vicksburg, MS 39183
Office: 601-638-0436
Cell: 601-529-3407

Qualifications for George L. Sills, PE

EDUCATION

- Advanced graduate work, Civil Engineering, Louisiana State University, toward Ph.D.
- ME, Civil Engineering, Texas A & M University. 1981
- BS, Civil Engineering, Mississippi State University, 1975

REGISTRATION

Professional Engineer: MS, TX, LA

AWARDS

- Tau Beta Pi Member
- Selected by National Society of Professional Engineers as USACE National Engineer of the year and one of the Top 10 Federal Engineers of the Year-1999
- Award for Outstanding Team Effort for planning and testing of temporary, barrier-type flood-fighting technologies. Award-May 2008
- Commander's Award for Superior Civilian Service, 2007-for service to ERDC
- Commander's Award for Superior Civilian Service, 2007- for service to IPET Team
- Certificate of Appreciation from Sacramento District, U.S. Army Corps of Engineers for leading the Levee Seepage Task Force for developing criteria for flood protection – 2003
- Commander's Award for Civilian Service-1995, 1999
- Commander's Award for Community Service-1994, 1999

- Appointed to MS State University National Board of Directors and recipient of the Distinguished Service Award-1994

- Commander's Award for Civilian Service-1994. During the 1993 Midwest flood, George served as technical advisor for the USACE St. Louis District to answer seepage related questions in the field during the flood event.

PROFESSIONAL SUMMARY

George currently serves as manager of his private consultant company, George Sills Geotechnical Engineering Consultant, LLC, which he opened in 2008. George is retired from the U.S. Army Corps of Engineers (Corps) where he worked for over 36 years. He was employed by the Vicksburg District for 32 of those years and the Engineer Research & Development Center (ERDC) for 4 years. He has extensive experience in the evaluation, design, and construction of dams, levees, and flood fighting. George has lead several investigations into the causes and mechanisms of seepage distress along levees and dams, and has helped the Corps develop a comprehensive understanding of these issues. He has lectured and published numerous technical papers on levee seepage distress and levee design.

While at ERDC, George led the joint Corps and Bureau of Reclamation (Reclamation) team that developed a toolbox for use in performing Probabilistic Risk Assessments (PRAs) on Corps and Reclamation dams with regard to seepage and piping distress. Much of this effort involved leading a diverse group to resolve complex and conflicting guidance criteria to create useable tools for practitioners from different agencies. George also served on the Corps' National Levee Safety Program to help set policy/methodology for Corps levee assessments in the future. George also led the team assigned to rewrite the Corps Levee Design Engineering Manual, which instructs engineers in proper design procedures for levee underseepage. This document is currently in draft form and undergoing review.

George served on a team from 2006 through 2007 to provide Independent Technical Review of the design for repairs to the Herbert Hoover Dike in Florida. This 145-mile-long dam/dike was constructed over peat and limestone which created seepage problems. Currently, George was a member of the Independent Consulting Board reviewing the ongoing design work for urban and non-urban levees in the Central Valley of California from 2006 through March 2013. He also serves on numerous Independent External Peer Review Boards: he is member of the Senior Board of Consultants for the review of levee designs for the Natomas Levee Improvement Program for the Sacramento Area Flood Control Agency. He also serves on a similar Board of Senior Consultants for the Cities of West Sacramento, CA, Sutter-Butte, CA, and Dallas, TX. During 2008, George was selected and served as a member of the National Levee Safety Committee Review Team which reviewed the new levee proposals made to Congress.

George is currently a sub-consultant supporting the GEI/HDR Design Team as a member of the Value Engineering, Constructability Reviews, Cost Estimating (VCC) Panel. As a member, he participated in Alternatives Identification workshops, assisted in determining

design criteria, reviews and provides feedback to geotechnical analyses performed by the GEI team, reviews preliminary design details and supports the GEI team with evaluations for construction sequencing and site access constraints, provides constructability reviews, and cost estimating reviews. The goal of this design approach is to provide a project with the highest degree of public safety at the lowest cost.

In 2005, George was selected to serve on the Corps' Interagency Performance Evaluation Task Force (IPET) following Hurricane Katrina as a member of the Perishable Data Team and also as a member of the Performance Analysis Team. He made major contributions to these efforts and to the IPET document that summarized the team's findings. He has also testified in court about their efforts on this study.

During 2003, George was selected to lead the Sacramento District (SPK) Levee Seepage Task Force. The Task Force consisted of six levee experts: two from the federal government, one from the State of California, one private consultant, and two consultants from universities. George led this diverse team to accomplish their mission within budget and within schedule. George later took the information from this study and wrote an Engineering Technical Letter to change procedures currently used by USACE for their nationwide approach to seepage design.

While at the Vicksburg District, Mr. Sills led a study to determine the effects on area groundwater along the Red River which might occur from impounding the pools for navigation on the Red River.

Mr. Sills has been performing structural and foundation inspections, evaluations, and assessments for residential and commercial buildings from 1985 until present. These assessments have dealt with all aspects of issues relating to foundation problems as well as poor construction techniques.

RELEVANT EXPERIENCE

1994-2003
While working at the Vicksburg District George performed the following as a Geotechnical Coordinating Specialist: George assisted the Branch Chief with the overall management, direction, control, administration, planning, and review of the engineers and design functions of the Geotechnical Branch of the Vicksburg District (MVK). He evaluated technical staffing and performance and made recommendations on the most economical, efficient, and feasible methods and/or manner to accomplish work. He also established schedules and priorities. He served as Technical Expert and Consultant for guidance and recommendations to MVK, other Corps Districts, A-E firms, and higher Corps echelons. During this period, George led the design effort for the soil nailing of the Natchez Bluffs.

July 1994-December 1994
Served as a Project Engineer in the Programs and Project Management Division, managing the $1.8 billion Red River Basin Project. Daily, he coordinated all District functions concerning District policies and procedures. He served as major liaison

between the project sponsor and Corps. He also worked closely with Congressional staff in order to meet project milestones. He used innovative problem solving techniques to enable the District to begin pool impoundments as scheduled.

December 1994-December 1995
Supervisory Civil Engineer, GS-0810-13, Acting Chief of the Analytical Section with the responsibility of supervising twelve engineers and professionals. This responsibility included personnel and administrative matters as well as scheduling and programming funds. During this period, the Section met or exceeded all schedule requirements and operated within budget requirements.

December 1989-July 1994
Geotechnical Specialist responsible for the designs and reviews of all geotechnical work associated with the Red River Project. This work included designing the foundations for the locks and dams, dewatering requirements, and all other Geotechnical requirements. During this project, George invented a method of slide repair reported in ASCE and currently used by private and government sectors.

January 1991-November 1991
Served as a professional specialist in Project Management, CEMVD General Management Branch. Responsibilities included executing the project management function for Engineering Division by furnishing staff assistance and managerial and technical advice to Districts and MVD staff. He also coordinated the review of reports and studies, monitored District schedules, identified potential slippages, and took corrective action when necessary.

January 1981-December 1989
Served as Project Engineer in the Analytical Section where George was responsible for geotechnical design of complex multimillion dollar projects, as well as supervision of as many as 20 engineers and professionals in the execution of field testing operations. These field tests included the pile load test at John H. Overton Lock and Dam for a period of 8 months, as well as field pumping tests at Locks and Dams No. 4 and 5 on the Red River. He was also responsible for programming funds for the entire Red River in CEMVK-ED-G. George was the primary point of contact for design and/or construction problems for Locks and Dams No. 2, 3, 4, and 5 on the Red River.

CONCRETE LOCKS AND DAMS

- Served as Geotechnical Project Engineer for the Red River Waterway Project and was responsible for designing and reviewing all Geotechnical designs of this $1.8 billion dollar project. This design work included the foundations for the locks and dams, dewatering requirements, and all other Geotechnical requirements.

- Geotechnical Project Engineer for the Joe D. Waggoner, Jr. L&D (Lock & Dam No. 5) on the J. Bennett Johnston Waterway Project (Red River Waterway). His design and construction experience on this project included a slurry trench design and dewatering wells to unwater the excavation. He also led a field pumping test at this site.
- Geotechnical Project Engineer for the design and construction of the Russell B. Long L&D (Lock & Dam No. 4) on the Red River Waterway, this design included a slurry trench, dewatering wells, and excavation through a rock formation. He also led a field pumping test at this site.
- Geotechnical Project Manager for Lock & Dam No. 3 for the design and construction which also included a field pump test.
- Geotechnical Project Manager for John H. Overton L&D (Lock & Dam No. 2) for the construction phase which included the redesign of the field pile load test program. The pile test program was modified using a method never tried before. Because of these changes, the modified program was able to collect more useable data while saving the Government a sum of $450,000.
- Geotechnical Project Manager for the construction of Lindy C. Boggs L&D (Lock & Dam No. 1) where he answered all geotechnical related questions during construction.
- Geotechnical Engineer performing all phases of geotechnical design for the foundation of Felsenthal L&D and T.K. Thatcher L&D (Calion L&D) on the Ouachita-Black Navigation Project.

DAMS AND LEVEES

- Served on a group to provide Independent Technical Review for the Herbert Hoover Dike in Florida. This 145 mile long dam/dike was constructed over peat and limestone which has created seepage problems. This review team was responsible for assuring the safety of the design repair.
- He led a diverse team of Corps, State of California personnel, and leading academic experts to review the Sacramento Districts practices of levee construction. Results from this study have led to major changes in the procedures the Corps used nationwide in levee design.
- Geotechnical Engineer managing the geotechnical designs of the Sicily Island Levee system. This project included numerous drainage structures, several large pumping plants, and approximately 70 miles of levees.
- Geotechnical Engineer designing numerous miles of mainline Mississippi River Levee enlargements that included stability berms, seepage berms, and relief well designs.
- Geotechnical Engineer designing and providing construction design support for the Swan Lake levee project. This project was constructed over very soft soils with shear strengths less than 100 psf.

Geotechnical Project Manager for the geotechnical design for the earthen closures at Locks & Dams 2, 3, 4, and 5 on the Red River. All these closures were constructed in the wet.

OTHER EXPERIENCE

- George has worked on numerous deep slurry trenches and has been heavily involved both in design and in the oversight of construction. He is widely known as an expert in several fields of Geotechnical Engineering.
- Publication and expertise in long-term behavior of soils and slope stability, pile design and driving.
- Experience in dewatering, slope stability, slurry trench design and construction, ground water movements, seepage, and foundation design.
- Ameristar Casino (Vicksburg) – review of cofferdam cell keyed into limestone that was sliding – including the development of recommendations to stabilize (for Sverdrup).
- Served as lead geotechnical designer for the $1.8 billion Red River Waterway project that included five locks and dams. Work included pile design, cofferdam cells, dewatering, slope stability, etc.
- Invented a method of slide repair using stone filled trenches that was later published by the American Society of Civil Engineers.
- Responsible geotechnical engineer for the Natchez Bluff Stabilization Project which used "soil nailing".

Expert Witness for Litigation

- Prepared an expert report and assisted in mediation in connection with the Appeal of Nicholson Construction Co., ASBCA Nos. 58145, 58182, 58183, and 58184 December 2012, Washington, DC.
- Prepared an expert report and testified in Court Deposition in case: John Douglas Coots, et ux.v. James Terrell Machen, et al, Number 44284 Div: D, 18th Judicial Court Parish of Pointe Coupee, State of Louisiana, File #5356.135, for Kyle Law Firm, Baton Rouge, LA, December 2012.
- 2006 testified on IPET forensic work for New Orleans in: Colleen Berthelot, et al., v. BOH Brothers Construction Co., LLC, et al., Civil Action No. 05-4182, May 4, 2006, United States District Court, E.D. Louisiana.
- Calion Lock and Dam - dewatering and differing site condition construction claim - a second claim for rock in the outlet channel.
- Felsenthal Lock and Dam - dewatering construction claim

- John H. Overton Lock and Dam - access road construction claim differing site conditions
- Lock and Dam No. 3 - access road claim - differing site conditions construction claim
- Lock and Dam No. 4 - differing site conditions construction claim - rock in the inlet channel evaluation of difficult driving of sheep pile in rock
- Provided technical assistance to EPA in trial conducted in Texas (1995).
- Provided testimony and assistance concerning "sudden drawdown failures" in lawsuit defended by the Red River Waterway Commission
- Provided numerous depositions in the above listed cases and disputes.

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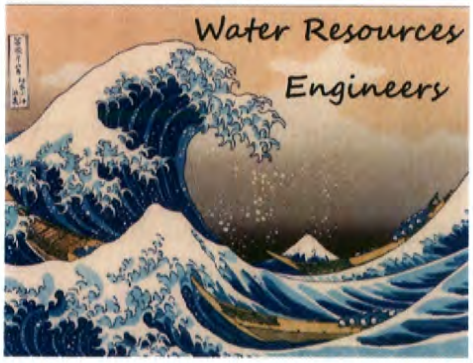

DTW and Associates, LLC

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Education

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

Registrations

Professional Engineer (Civil) license number and date:

Arizona 24349, 1990
Colorado 42353, 2008
Louisiana, 34075, 2009
New Mexico 12187, 1993
Texas 80003, 1994
Missouri 2012015265, 2011
California 57020, 1997
Hawaii 7796, 1993
Mississippi 08242, 1981
Oregon 16963, 1993
Washington 27190, 1990

Registered Professional Hydrologist (PH: 96-H-1146)
Certified Professional, Erosion and Sediment Control (CPESC: #703)
Certified Floodplain Manager (CFM; US-08-03224)

Work History

2011 – 2012: Director of Water Resources, NV5, Centennial, CO

2008 – Present; President, David T. Williams and Associates, Engineers, LLC, Fort Collins, CO

2005 - 2008; National Technical Director for Water Resources, PBS&J, Fort Collins, CO

2002 - 2005; National Director for Hydrology and Hydraulics, HDR Engineering, San Diego, CA

1988 - 2002; President and co-founder of WEST Consultants, a premier water resources engineering firm

1979 - 1988; Research Hydraulic Engineer, Hydraulics Lab, Engineering and Research Development Center (formerly Waterways Experiment Station), Vicksburg, MS

1983 - 1984; Acting Chief, Hydrology and Hydraulics Section, Baltimore District Corps of Engineers

1977 - 1979; Civil Engineer, Hydrology Branch, Nashville District Corps of Engineers

1975 - 1977; Research Hydraulic Engineer, Planning Branch and Research Branch, Hydrologic Engineering Center (HEC), Davis, CA

1972 - 1975; Infantry Platoon Officer and Combat Engineering Unit Officer, 7th Special Forces Group, Fort Bragg, NC

Professional Affiliations

American Society of Civil Engineers (Fellow and Life Member)
International Erosion Control Association (IECA – past president)
American Society of Testing and Materials (ASTM)
American Institute of Hydrology (Chair, Board of Registration and Executive Committee Board member)

Honors and Awards

Fellow and Life Member, American Society of Civil Engineers
Founding Diplomate, American Academy of Water Resources Engineers
Hogg-Owen Award for Meritorious Achievement, Floodplain Management Association
Sustained Contributor Award, IECA
Small Business Person of the Year, Chamber of Commerce, Carlsbad, California, 1993
Sustained Superior Performance, USACE
Special Act Award, USACE
U.S. Army Commendation Medal
U.S. Army Commendation Medal with Oak Leaf Cluster

Summary

David T. Williams and Associates (DTW) is a certified MBE, SBE, DBE and Disabled Veteran owned business. Dr. David Williams, the president of DTW, has over 35 years of experience in the water resources industry and is known nationally and internationally for his contributions to the industry. He served as Principal-in-Charge for several FEMA 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 for the World Bank. He is well versed in the computer programs HEC-1, HEC-HMS, HEC-2, HEC-RAS, HEC-6, STORM, and WQRRS. Dr. Williams is also 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 River Restoration Committee. He served as a committee member of ASTM A05.12 (Wire specifications), where he helped develop the standards for both welded and twisted (woven) gabions. He also served on ASTM D18.25 (Erosion Control Products), where he helped develop a variety of standards related to erosion control. While chair of the Federal Interagency Technical Committee on Sedimentation when Dr. Williams was with the U.S. Army Corps of Engineers, 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 (HEC) 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, Federal and State Agencies for computer training workshops on using HEC-2, HEC-RAS, HEC-HMS 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

Expert and Independent Technical Review Panels

Member of 4 Board of Senior Consultants – The Sacramento Area Flood Control Agency (SAFCA), the West Sacramento Area Flood Control Agency (WSAFCA), and the Three Rivers Levee Improvement Authority (TRLIA) are each upgrading their levee systems in the northern California to the 200 year protection level and the City of Dallas (Trinity River Watershed Protection) to the 100 year flood level. After the devastation brought on by Hurricane Katrina, the U.S. Army Corps of Engineers required that all new or upgraded flood control projects that received federal cost sharing funding are to have an Independent Technical Review (ITR) comprised of national experts in the appropriate disciplines. In response to this edict, these agencies appointed Dr. Williams as a member of the Board of Senior Consultants (BOSC) for their 4 project to review and provide expert advice on the risk and uncertainty analysis, plan formulations, erosion control, sediment transport analyses, fluvial geomorphology, hydrology and hydraulic aspects of the project.

Member, FEMA's Scientific Resolution Panel (SRP), Washington DC - The Federal Emergency Management Agency makes available an independent scientific body referred to as the Scientific Resolution Panel (SRP) that can be convened when deemed necessary by FEMA or upon a joint agreement between FEMA and a community. SRPs are independent panels of experts organized, administered, and managed by the National Institute of Building Sciences. They are established for the purpose of reviewing and resolving conflicting scientific and technical data submitted by a community challenging FEMA's proposed flood elevations. Dr. Williams is on a pre-qualified roster of national experts on FEMA regulations and procedures and was recently appointed to a Panel for a dispute in Texas.

NCHRP 24 – 34, Risk Based Approach for Bridge Scour Prediction. For the U.S Department of Transportation, Transportation Research Board, Dr. Williams is on the technical advisory committee for this research. The project objective is to develop a risk-

based methodology that can be used in calculating bridge pier, abutment, and contraction scour at waterway crossings so that scour estimates can be linked to a probability. The developed probabilistic procedures would be consistent with LRFD approaches used by structural and geotechnical engineers.

EPA Selection Panel, Washington D.C. – Dr. Williams has served on 3 EPA selection panels in the areas of climate change, ecological indicators and thresholds. The panel evaluated research proposals from universities and non-profit organizations and made recommendations to EPA on which proposals to approve. The panels were comprised of experts in the engineering and naturals sciences. Dr. Williams was the only private consultant on each panel, which was composed of academic and government personnel.

Scour and Sediment Transport Analysis

Levee Breach Analyses, California – A private client wanted to place a buried gas pipeline through the Sacramento–San Joaquin River Delta but was concerned with the possiblity of levee breaches that could erode out and destroy the pipeline. Under Dr. Williams' technical direction, historic levee breaches were examined, likely location of levee breaches along the proposed pipeline alignment were identified, and breaching parameters determined from the available data and other information sources. The hydraulic model, HEC-RAS, was used to determine potential erosive breach discharges using combinations of possible water surface elevations and levee breaching scenarios. These discharges were then used to determine potential erosion limits (vertical and lateral linits) on the landside of the levees. These erosion limits were presented to the client to determine the feasibility of placing the pipeline at these locations.

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 using HEC-RAS as the hydraulic model. Several of these projects involved fluvial geomorphic analyses.

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.

Evaluation and Re-Design of Palm Canyon Grade Control Structure, Riverside County Flood Control and Water Conservation District, CA – Dr. Williams was called upon to evaluate what caused the failure of the Palm Canyon grade control structure. This structure had a low flow notch in a riprap structure with a riprapped stilling basin. The work involved forensic engineering, examination of design and specification documents, and evaluation of construction techniques. He was then asked to redesign the grade control while salvaging as much material as possible and minimal rearrangement of the remaining existing structure.

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.

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.

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.

Pipeline Crossings over Desert Rivers and Washes, Arizona and New Mexico - Dr. Williams was Project Manager and Project Engineer for numerous Pipeline Crossings over Desert Rivers and Washes in Arizona and New Mexico for the El Paso Natural Gas Company. 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, 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 Westlake Lake in Westake Village, 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.

Various Projects for the Flood Control of Maricopa County - Dr Williams was the Principal-in-charge 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.

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.

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.

Stream Restoration, Fluvial Geomorphology and Streambank Protection

Lower Cogan Creek Restoration, City of Santa Rosa, CA – Dr. Williams was the technical advisor for this stream restoration project in an urban setting. The restoration effort required innovative design because of the special conditions posed by such items as right of way limitations, bridges, existing "hard" structures and other conditions often encountered in an urban environment.

Sevenmile Creek Restoration, SW Oregon – This project involved the restoration of Sevenmile Creek which included features to enhance the migration of various species of fish. Maximum use of historic creek features were implemented using natural channel design concepts. As the QA/QC of the project, Dr. Williams helped oversee the development of the concepts into plans and specification, which he was the engineer of record

Cuddy Creek Restoration Study, Kern County, CA – This study for Kern Co. involved the sediment transport conditions for Cuddy Creek, which has been ravaged by materials mining. The study included evaluation of pre-existing conditions, existing conditions, and proposed conditions. These conditions were then used to determine any mitigation measure that would minimize the continuing adverse impacts of the historic mining as well as the proposed condition.

Sellar Gulch Restoration Study, Castle Rock, CO. – As technical advisor, Dr. Williams provided guidance in the fluvial geomorphology analysis for the restoration of Sellars Gulch. This included andextensive field reconnaisance of the project area and the use of geomorphic principles to determine the best slope and channel dimensions that would be self sustaining.

Santa Clara River 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 Clara Creek which included a No-Action plan, as well as non-structural and structural solutions. The consensus alternative was the use of river training structures such as spur dikes along with minor bank protection. 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.

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.

Cumulative Effects Study of Sedimentation Impact, Upper Mississippi River - Dr. Williams helped 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 climate change 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.

Restoration/Environmental Enhancement Plans, Tres Rios and Rio Salado Projects, Los Angeles Corps of Engineers, 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 for the Los Angeles Corps of Engineers. 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.

Flood Control and FEMA Mapping

FEMA Studies of 27 Streams in the Unincorporated Areas of San Diego County, California – Dr. Williams was the principal-in-charge for this project for FEMA. He also took on some of the studies are the project manager. The studies involved over 50 miles of streams using FEMA standards for surveying, hydraulic modeling and floodplain and floodway delineations which and resulted in new and updated FIRM maps.

Approximate Floodplain Study for Orange County, California - Dr. Williams and his team 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. Dr. Williams was the Project Manager and Principal in Charge.

St. Tammany Flood Control Analysis, U.S. Army Corps of Engineers, New Orleans District, New Orleans, Louisiana - Dr. Williams and his engineers 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 Corps of Engineers 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.

Dam Breach Analyses for San Diego County Water Authority (SDCWA) – As principal in charge, Dr. Williams also acted as the technical advisor for this series of contracts to analyse numerous dam breach projects for SDCWA. This contact involved using the NWS DAMBreak model for FERC re-authorization of existing hydroelectric dams as well as for scenarios of raising dams to obtain additional storage and power. The results, which included numerous breach scenarios, output hydrographs and resulting inundation areas for FEMA flood mapping, were used to create new or revise Emergency Action Plans.

Hydraulics and Hydrology

Reservoir Sedimentation Analysis for FERC relicensing, Alcoa Power Generating Inc. – Dr. Williams was in charge of this reservoir sedimentation study for the High Rock Dam in North Carolina. The client needed this information for the application for relicensing of the dam. The sediment transport model was used to evaluate the effects of the dam on sedimentation that had a potential to adversely affect adjacent infrastructure.

Examination of Hydraulic Rollers at Run of the River Dams, Illinios Dept. of Natural Resources, Springfield, IL – As technical advisor to this project, Dr. Williams provided technical guidance in developing solutions to the hydraulic roller problem at the downstream portion of the weir at Geneva Dam. The temporary solution was the placement of rock riprap at this location and its design based upon high turbulence conditions.

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.

IDIQ for Los Angeles District Corps of Engineers - During this IDIQ contract for hydrology and hydraulics with the Los Angeles District, Dr. Williams and his team completed multiple work orders. A spillway inundation study was conducted for Carbon

Canyon simulating dam break using HEC-RAS. A two-dimensional link node model was applied to Mission Creek in Santa Barbara to evaluate flooding due to overspilling of the channels to lower elevations and connector streams. In the Santa Margarita river watershed study, HEC-1, HEC-2 and HEC-6 were used to evaluate flooding extents and sedimentation problems in the river. Two channel restoration and environmental enhancement plans were developed in Phoenix area 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. A major flood map revision study and levee analysis report was conducted for the Los Angeles River and Compton Creek, resulting in hundreds of thousands people taken out of the 100 year regulatory floodplain. 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.

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, U.S. Army Corps of Engineers, St. Paul District - 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 his staff and 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' team 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.

Wellhead Protection Plan for the Los Angeles Corps of Engineers, Planning Division, 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.

Two-Dimensional Study of the Missouri River, Chamois Reach, USACE, Kansas City District IDC - Dr. Williams was Principal in Charge for a 2-D study of the Missouri River called the Chamois reach between RM 116.5 and RM 113.5. The model used was RMA2, which is a part of the WMS system. It was used to identify low and medium

flow habitat areas and the depths and velocities associated with those areas. The results were used to determine opportunities for habitat enhancements.

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.

Miscellaneous

Lead Instructor and Course Notes Author – Dr. Williams developed short course notes for and taught HEC-RAS, HEC-HMS, HEC-6, Bridge Scour, Fluvial Geomorphology, Sediment Transport and Streambank Protection short courses for such entities as the Floodplain Management Association of California and Nevada, Association of State Floodplain Managers, American Society of Civil Engineers, Federal Highway Administration, Flood Control District of Maricopa County, Riverside County Flood Control and Water Conservation District, Ventura County Watershed Protection District, the International Erosion Control Agency and numerous other state and federal agencies. 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.

Uncertainty Analyses Using Simplified Methods for the Flood Control District of Maricopa Co., AZ – The study developed simplified methods to evaluate the uncertainty for flood control projects using cutting edge techniques that are not usually seen in 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 based upon experience and technical literature. The results were the determination of the uncertainty in the outputs so that decisions could be made such as the height of freeboard, operation schemes for reservoir operation, etc. Dr. Williams was the chief technical advisor for this effort.

Development of State Standards for Floodplain Modeling, Arizona Department of Water Resources - Dr. Williams worked with the Arizona Department of Water Resources State Standards Work Group (SSWG) to develop a State Standard for floodplain modeling. The Standard provides guidance on mathematical modeling of hydraulic processes in watercourses and floodplains. Topics of interest included split flows, floodway encroachments, ineffective flow areas, breakout/overflow zones, alluvial fans, levee analysis, confluences, channel roughness characteristics and other topics. The study included evaluation of several 1-Dimensional hydraulic models. Four of the models were applied to four case studies and evaluated. The final product was the development of State Standard for Floodplain Modeling. This document provided guidelines and criteria for floodplain modeling and procedures for the preparation of submittals for floodplain hydraulic modeling as well as for the review and approval of models by local agencies.

Expert Testimony and Support

Expert Consultant: Flooding of property by US Army Corps of Engineers, Missouri, for private party

Expert Consultant: Stream restoration design and construction defects, North Carolina, for private party

Expert Testimony: Flooding death, for Metropolitan St. Louis Sewer District

Expert Testimony: Gabion technical claims dispute, for Terra Aqua Gabions

Expert Consultant: Subdivision Flooding, for City of Reno, NV

Expert Consultant: Analysis of Milltown Dam Removal and Potential Deposition at Thompson Falls Reservoir, Montana, for Pennsylvania Power and Light

Expert Consultant: FERC relicensing, North Carolina, for Alcoa Power Generating Corporation

Expert Consultant: Scour Evaluation of Grading Plan Changes for Cyrus Wash, for Kern County, CA

Expert Consultant: Baker River FERC relicensing, WA, for Puget Sound Energy

Expert Consultant: Blackfoot and Clark Fork River Restoration Plan, Montana for unnamed client

Expert Consultant: Agua Fria River Streambank Scour Analyses, Phoenix, AZ, for Flood Control District of Maricopa Co., AZ

Expert Consultant: Erosion and Drainage, Newport Beach, California, for private client

Expert Consultant: Subdivision Flooding Problems and Floodplain Mapping Procedures, Dayton, Ohio, for private client

Expert Consultant: Flooding Problems, Unnamed creek, Los Angeles, California, for private client

Expert Testimony: Murrieta Creek Flooding, Riverside County, California, for Riverside Co. Flood Control District

Expert Testimony: Flooding Potential and Analysis of Coconut Grove, Kailua, Oahu, Hawaii, for private client

Expert Consultant: Subdivision Flooding Problems, Waialae Iki V, Oahu, Hawaii, for private client

Expert Testimony: Flood Problems at Carlton Oaks Country Club, Santee, California, for private client

Expert Consultant: Alpine Mobile Home Park Flooding, Alpine, California, for private client

Expert Consultant: River Effects of Sand Mining Operations, San Luis Rey River, California, for private client

Expert Testimony: Pecos Road Pipeline Scour, Phoenix, Arizona, for El Paso Natural Gas Company

Expert Consultant: San Diego Creek Revetment Failure, Irvine, California, for private client

Expert Consultant: San Luis Obispo Creek Flooding, San Luis Obispo, California, for private client

Expert Consultant: Kern River Ordinary Highwater Litigation, Bakersfield, California, for private client

Misc. Floodplain Hydraulics and Flood Protection

Reconnaissance Study Report and Project Management Plan for the Tijuana River Watershed Study – USACE, Los Angeles District

Spillway, Outlet, and Stilling Basin Design for Reelfoot Lake Sedimentation Basin – USACE, Memphis District

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, for USACE, Huntington District

Flood Information Study of Pineville, Kentucky, for USACE, Nashville District

Murrieta Creek Flood Control and Environmental Restoration Project – USACE, Los Angeles District

Hydraulic Design of Supercritical and Subcritical Flood Control Channels for the Rio Puerto Nuevo Flood Control Project, San Juan, Puerto Rico, for USACE, Jacksonville District

Flood Control Channel Design, Buena Vista Creek, Vista, California, City of Vista, CA

Forest Falls Community Flood Warning System – USACE, Los Angeles District

Misc. 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

Misc. Stable Channel and Sediment Transport 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

Misc. 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
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
Development of Channel Design using Geosynthetics Computer Program

Professional Society Activities

American Society for Testing and Materials (ASTM), Member - D18.25, Committee on Erosion and Sediment Control Technology, 2001 - present

American Society for Testing and Materials, Member – A05.12, Committee on Wire products, 1990 - present

American Society for Testing and Materials, Member - D19 Committee on Water, 1983 – present

American Society of Civil Engineers (ASCE), Past Chair, Sedimentation Committee, 1992 - 1996

American Society of Civil Engineers (ASCE), Past Chair, Computational Hydraulics Committee, 1999 - present

American Society of Civil Engineers (ASCE), Member, Committee on Management Practice for Control of Erosion and Sediment (MPCES), 2005 – 2008

American Society of Civil Engineers (ASCE), Past Chair, Committee on River Restoration, 2006 - present

American Society of Civil Engineers (ASCE), Chair, Committee Probabilistic Approaches, 2009 – present

American Society of Civil Engineers (ASCE), member, Task Committee on Dam/Levee Breaching, 2009 - present

American Society of Civil Engineers (ASCE), Past Chair - Task Committee; Analysis of Laboratory /Field Sediment Data Accuracy and Availability, 1987-1991

International Erosion Control Association, Board of Directors, 1990

International Erosion Control Association, President, 1994-1995

International Erosion Control Association, Vice President-1995

International Erosion Control Association, Member, 1998

International Erosion Control Association, President, 1998-1999

American Institute of Hydrology, Chair of Board of Registration, Executive Board Member, 2009 to present

Instructional Experience

Hydrology 101; For those that skipped it in college, Forester University
Hydraulics 101; For those that skipped it in college, Forester University
Ethics for Engineers and Academics; 2010 EWRI/ASCE Conference, Providence, RI
Fluvial Geomorphology & Alluvial Fans, Floodplain Management Association, May 2010
Streambank Stabilization and Erosion Control Design, Floodplain Management Association, July 2009

So You Have Been Asked To Be An Expert Witness? Now What?; 2010 EWRI/ASCE Conference, Providence, RI
P.E. Review Course, Hydrology and Hydraulics; University of California, San Diego
Use of Fluvial Geomorphology Principles in the Design of Natural Channels, for ASFPM
HEC-RAS, Basic and Advanced, taught for various organizations and ASCE at various locations
HEC-HMS, taught for various organizations and agencies at various locations
HEC-2, Basic and Advanced (Unsteady), taught for ASCE at various locations
Fluvial Geomorphology, for various organizations
Stream Restoration, for numerous agencies
Streambank Protection, for numerous agencies
Bridge Scour Analysis, taught for ASCE at various locations
Hydrology and Hydraulics for non-Engineers, various locations
Open Channel Hydraulics, San Diego State University, San Diego, California
Water Surface Profile Computation Using HEC-2, Advanced, HEC, Davis, California
Engineering Problem Analysis, San Diego State University, San Diego, California
FESWMS-2DH, WEST Consultants, San Diego, California
Sedimentation in Forested Watersheds, Alaska and Montana
Civil Engineering Planning, University of California, Davis, California
Sediment Transport Course, HEC, Davis, California
Spatial Data Management, HEC, Davis, California
Water Quality in Rivers and Reservoirs, HEC, Davis, California
Sedimentation in Rivers and Reservoirs, HEC-6, HEC, Davis, California
Sedimentation Analysis, Waterways Experiment Station (WES), Mississippi
Sediment Transport in Reservoirs and Inland Waterways, WES, Mississippi
Numerical Modeling for Engineers, WES, Vicksburg, Mississippi
Hydraulic Design of Flood Control Channels, WES, Mississippi
Water Surface Profile Computations on the Microcomputer, Fort Collins, Colorado
HEC-6, Sediment Transport Modeling, various locations
Stable Channel Design, Memphis State University, Memphis, Tennessee
Bank and Channel Protection in Rivers, (IECA), Vancouver, BC, Canada
Short Course on Sediment Problems in Rivers, Oregon State University
Calculus I-IV, Hinds Junior College (HJC), Vicksburg, Mississippi
Differential Equations, HJC, Vicksburg, Mississippi

Publications

Professional Papers

Wu, Weiming, Williams, David T., et.al, "Earthen Embankment Breaching, "Earthen Embankment Breaching," *J. Hydraul. Eng.*, 137(12), 1549–1564, 2011

Williams, David T,. and Stedinger, Jey R., "Practical Applications of Risk & Uncertainty Theory in Water Resources: Shortcuts Taken and Their Possible Effects," *Proceedings*, World Environmental & Water Resources Congress 2011, Environmental & Water Resources Institute, ASCE, Palm Springs, CA, May 22 - 26, 2011

Yescas, Alex, Norman, Kirk, Williams, David T.,"Bank Stabilization by Redirective Structures on the Santa Clara River, Ventura Co., CA," *Proceedings*, World Environmental & Water Resources Congress 2011, Environmental & Water Resources Institute, ASCE, Palm Springs, CA, May 22 - 26, 2011

Williams, David T., Harder, Leslie, Jr., Sills, George, and Martin, Ray, "The Value Added to Flood Control Projects By Use of External Review Panels," *Proceedings*, World Environmental & Water Resources Congress 2010, Environmental & Water Resources Institute, ASCE, Providence, RI, May 16 - 20, 2010

Depue, Michael, Williams, David T., and Esterson, Kris, "Planning for Climate Change in the Technical Analysis of Floodplain Mapping and Flood Control Projects," Association of State Floodplain Managers Conference, Orlando, FL, June 2009

Su, Yu-Chun, Wobig, Loren, Winters, Brad, He, Xin, and Williams, David T., "The Geneva Dam, IL Hydraulic Roller Problem: Design of a Temporary Steep Riprap Ramp," *Proceedings*, World Environmental and Water Resources Congress 2009, Kansas City, MO

Williams, David T., and Countryman, Joseph, "Uncertainty Analysis: You Need to Know What You Don't Know," *Proceedings*, World Environmental and Water Resources Congress 2009, Kansas City, MO

McEvoy, Donald M., and Williams, David T., "Proposed Procedures in Utilizing Risk and Uncertainty Principles in Floodplain Management and Mapping," *Proceedings*, Association of State Floodplain Managers Conference, Reno, 2008.

Philips, Bruce M., and Williams, David T., "Design Considerations for Confining and Guiding Levees on Alluvial Fans," *Proceedings*, World Environmental and Water Resources Congress 2008, Honolulu, Hawaii, May 12–16, 2008.

Kreymborg, Leo, R., and Williams, David T., "The PBS&J Scour Spreadsheet: A Tool for Stream Restoration, Utility Crossings and Streambank Protection Projects," *Proceedings*, World Environmental and Water Resources Congress 2008, Honolulu, Hawaii, May 12–16, 2008.

Williams, David T., "Tips on Using the Dambreak Option in HEC-RAS," *Proceedings*, Arid Regions and CASFM Conference, Breckenridge, CO, 2007.

Williams, David T., and Houghland, Sarah, "Alluvial Fan Management and Analysis:

Methods used in the State of Colorado," *Proceedings*, Arid Regions and CASFM Conference, Breckenridge, CO, 2007.

Williams, David T., "So You Have Been Asked to Be an Expert Witness? Now What?" Floodplain Managers Association Annual Conference, San Diego, CA, Sept., 2008

Thomas, Iwan M., and Williams, David T., "Common Modeling Mistakes Using HEC-RAS," Proceedings, World Environmental and Water Resources Congress 2007: Restoring our Natural Habitat, Tampa, Florida, May 15–19, 2007.

Kreymborg, Leo R., Williams, David T and Thomas, Iwan M., "Rapid Floodplain Delineation," Proceedings, World Environmental and Water Resources Congress 2007: Restoring our Natural Habitat, Tampa, Florida, May 15–19, 2007.

Williams, David T., "Finessing 1-D Hydraulic Models into 2-D Performance," Proceedings, World Environmental and Water Resources Congress 2007: Restoring Our Natural Habitat, Tampa, Florida, May 15–19, 2007.

Williams, David T., Marcy, Jennifer K., and DePue, Michael, "FEMA Levee Analysis Requirements for Floodplain Mapping," Proceedings, Association of State Floodplain Managers Conference, Norfolk, VA, 2007.

Desai, Harshal, Baird, Matt, and Williams, David T., "2-D Floodplain Hydraulic Modeling using 1-D Hydraulic Models," Proceedings, Association of State Floodplain Managers Conference, Norfolk, VA, 2007.

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

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., 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 notes, 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.

Stefanovic, Dragoslav, Williams, David T., "Two-Dimensional-Vertical Numerical Modeling of Stratified Environments", 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

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.

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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.

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

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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.

"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.

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.

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"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.

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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

RESUME OF
ARUN N. WAGH, P.E.

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EDUCATION

M.S., Soils/Structures	University of Cincinnati
M.Tech., Geotechnical Engineering	Indian Institute of technology, Bombay, India
B.Tech., Civil Engineering	Indian Institute of technology, Delhi, India

CONTINUING EDUCATION

Embankment Dams, University of Missouri, Rolla, Missouri
Graduate level courses in Hydraulics and Hydrology, University of Memphis, Memphis, TN
Behavior of Deep Foundations Under Axial and Lateral Loading, University of Texas, Austin, Texas
Machine Foundation Design and Analysis, University of Missouri, Rolla, Missouri

PROFESSIONAL REGISTRATION

Professional Engineer: Tennessee, Texas, New Jersey, Arkansas, Mississippi

SUMMARY - REPRESENTATIVE EXPERIENCE

Mr. Wagh has over 40 years experience in Geotechnical and Environmental engineering profession. **His experience includes geotechnical analysis, design, and construction oversight**

- **Panel Member Safety Assurance Review Team (SAR) Trinity River Corridor Levee Improvement Project, City of Dallas, TX:**

  As a panel member review the geotechnical and construction aspects of the substations and levees. Make comments regarding the adequacy, appropriateness, and acceptability of the design and construction activities in assuring public health, safety, and welfare.

- **Panel Member Safety Assurance Review Team (SAR) East-West Bank Interceptor Sewer Project, City of Dallas, TX:**

- **Evaluations for Earth Dam/Levee Projects**

  Mr. Wagh's experience includes: Analysis for the feasibility of construction of dams and design for Bobo Bayou, Indian Creek dams in Mississippi, evaluation (for adequacy) of the existing Fred Smith Lake dam in Mississippi, evaluation of problems and make

recommendations for corrective actions for the existing levee at Duck River Unit of Tennessee National Wildlife Refuge, and slope stability analysis for: One Riverside Drive Office and Residential Complex, Auction Avenue Bridge (Foundation analysis also mentioned later) in Memphis, Garnac Grain and Vlasic Foods in Mississippi, and St. Jude Industrial Park in New Madrid, MO.

- **(More) Evaluations for Earth Dam Projects**

  Bent Tree Golf Course Dam, Jackson, TN: Investigation of dam failure and presenting recommendations for corrective actions.
  Martin Lake Dam: Presented a discussion regarding the present status of the dam and recommendations for corrective actions.
  Forest Lake Dam, Gibson Co., TN: Evaluation of field and laboratory investigations and presenting recommendations for the design of the dam and implementation of quality control during the construction of the dam.
  Reserve at Pickwick – Lake #7: Evaluation of field and laboratory investigations and presenting recommendations for the design of the dam and implementation of quality control during the construction of the dam.
  Joe Bigford Lake Dam:, Jackson, TN: Evaluation of field and laboratory investigations and presenting recommendations for the design of the dam and implementation of quality control during the construction of the dam.

- **Large Tanks, Cofferdam, Landfill Projects**

  As an employee of Woodward-Clyde Consultants, Mr. Wagh managed some major geotechnical engineering projects, including:

  Landslide evaluation and recommendations for stabilization – slope adjacent to Maraven refinery in Venezuela.

  Evaluation of the site planned for a large (80 to 160 feet diameter) storage tank, making recommendations for and planning and monitoring of the tank's stage loading program.

  Geotechnical design of solid waste landfills – Woolworth Road Landfill, City of Shreveport, LA; Plantation Oaks Sanitary Landfill, Adams Co., MS; Boise Cascade, Alexandria, LA. This work involved: slope stability analysis, investigations of groundwater seepage and cell bottom heave, settlement analysis, design of leachate collection/removal systems and liners, and the preparation of related plans and specifications. For the Plantation Oaks Landfill, Mr. Wagh also oversaw the construction of the liner.

  Mr. Wagh was involved in analysis and design of sheetpile coffer dam for Shell Oil Company in Norco, Louisiana. This work was to prevent polluted waters from migrating into a clean pond.

Working for AWI, Mr. Wagh performed geotechnical evaluation including slope stability analysis and liquefaction analysis for several large tanks at Cargill facility in Hales Point, TN.

- **Airport Projects**

  Mr. Wagh was the geotechnical project manager for the KLM/Northwest expansion project (Federal Inspection Area and Connector Bridge), Concourse Expansion (A, B, and C), and Reconstruction of Taxiway Charlie North at Memphis/Shelby County Airport; field investigation for Runway 18-36C Reconstruction, and extension of NAVAIDS installation. He has also worked on pavement design at Jonesboro, Arkansas airport and Blytheville Air Force Base.

- **Bridges**

  Mr. Wagh has performed geotechnical evaluations for several major bridges, including Auction Avenue Bridge (across Mississippi Harbor) in Memphis, Tennessee, Connector Bridge in Blytheville, Arkansas, and a railroad bridge in Steele, MO.

  Mr. Wagh also did the geotechnical seismic retrofit evaluation for the following bridges near Memphis, TN: SR-3 Bridge Over Hatchie River, I-40 Bridge Over Loosahatchie River, and Hickory Withe Bridge Over I-40.

- **Multi-Story Buildings/Major Buildings**

  Mr. Wagh was involved as a project geotechnical engineer for several multi-story and major building projects. Some of the projects were: FedEx Head Quarters, Penn-Marc Building, Crescent Building, Hyatt Regency Garden Hotel (all in Memphis). Presented recommendations for site preparation and shallow/deep foundation systems for these projects.

- **Machine Foundation**

  Mr. Wagh analyzed a machine foundation for a compressor and a punch press machine foundations for a facility in Halls, TN. He evaluated the dynamic properties of the subsoils and prepared a report of recommendations presenting dynamic soil parameters and design of the machine foundation.

- **Vibrofloatation**

  Two sites for water tanks and a site for the courthouse in Missouri (near New Madrid) were determined to be susceptible to liquefaction. Mr. Wagh recommended and oversaw the implementation of site improvement with vibrofloatation, and subsequent reevaluation of the sites to determine whether they had become suitable to resist liquefaction.

- **Construction Oversight**

  Some of the major construction projects Mr. Wagh oversaw were:

  - Pile Foundation Installation at Cardinal Power Plant, Brilliant, Ohio
  - Pier Foundation at FedEx Head Quarters, Memphis, TN
  - Pier Foundation, Soil Compaction, and Concrete Testing for Crescent Building, Memphis, TN,
  - Site preparation, Soil Compaction, Shallow Footing Foundation, and Concrete Testing for Hyatt Regency Garden Hotel, Memphis, TN

- **Expert Witness**

  Mr. Wagh has worked as an expert witness in several cases during his 20+ years experience working as a consulting engineer for Arun Wagh, Inc. (AWI). Recently he worked on a case where two building had settled excessively causing severe damage. Mr. Wagh evaluated the available data to make inferences regarding the cause/s of the settlements and damage and submit a report to the attorneys.

- **Teaching**

  As a substitute teacher Mr. Wagh taught Soil Mechanics to undergraduate students and Machine Foundations to graduate students at the University of Memphis, TN, and Foundation Engineering to undergraduate students in Christian Brothers University, Memphis, TN.

PUBLICATION

Mr. Wagh co-authored a paper entitled "Preloading Wastewater Treatment Plant Tanks," which was presented at the Case Histories conference held in St. Louis, Missouri in June 1992.

PROFESSIONAL HISTORY

Arun Wagh, Inc. (AWI), Germantown, TN, President, June 1993 - Present

Woodward-Clyde Consultants, Baton Rouge, LA, Group Manager/Senior Project Engineer Geotechnical Engineering Dept., January 1990 - June 1993

Engineering and Testing Services (ETS), Memphis, TN, Chief Geotechnical Engineer, February 1987 - December 1989

U.S. Testing, Memphis, TN, Senior Project Engineer, April 1976 - January 1987

W. F. Loftus & Assoc., Englewood Cliffs, N.J., Geotechnical Engineer, September 1973 - March 1976

Greenbaum & Assoc., Louisville, KY, Geotechnical Engineer, October 1972 - August 1973

Soil Mechanics, Ltd., London, England, Field Soils Engineer, September 1970 - June 1971