

STATEMENT OF QUALIFICATIONS

Levee Accreditation Engineering Services

City of New Haven, MO



March 4, 2014

March 4, 2014

Mr. Steve Roth
City Administrator
City of New Haven
101 Front Street
New Haven, Missouri 63068

Re: Levee Accreditation Engineering Services

Dear Mr. Roth and Members of the Selection Committee:

Horner & Shifrin is pleased to present the City of New Haven with our qualifications to provide Levee Accreditation Engineering Services. We have assisted several clients and the United States Army Corps of Engineers with similar levee inspection, repair and accreditation projects. We know from experience that the City of New Haven will require an expert team to complete your project properly. We have enlisted the services of Shannon & Wilson, Inc., to provide geotechnical engineering services. Our firms have worked together on several similar projects, and we have the experience to deliver a successful levee accreditation project for New Haven. Choosing the Horner & Shifrin/Shannon & Wilson team brings you the following benefits:

- **You won't have to worry about whether we know what we're doing.** As you can see from our qualifications, our staff has a great deal of experience with the requirements of projects like yours. We thoroughly understand the standards, recommended practices, policies and procedures for your type of projects.
- **You won't have to meet new key people during your project.** We make certain that we commit the very best people to our projects and that they see the project through to a successful completion. As your Project Manager, I will be involved with the project from the very beginning to the very end of the project.
- **As a firm of over 70 people,** we are just the right size: not so big that you will get lost in the shuffle or handed off to another person during a project, but big enough to have the wherewithal to deliver your project right, from start to finish.
- **We place the highest priority on achieving your project goals.** We will be certain to discuss with you and your staff each of your goals in detail before we assume that we understand all that you wish to accomplish. This is something we do for every project, and we'll make sure that we're all on the same page throughout yours. We want to be sure that you get exactly what you want and what the City of New Haven needs.

We trust you will see the examples of our experience and expertise contained in the following pages show that we are more than qualified to assist the City with your levee system needs. We would consider it a privilege to do so, and look forward to your favorable consideration of our qualifications. If you have questions regarding any of the enclosed information, please feel free to call me at 314-335-8641 or to email me at srandolph@hornershifrin.com.

Very truly yours,



Stepheon Randolph, PE, CFM, CPESC, LEED Green Associate
Project Manager
Environmental Engineering



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A. HORNER & SHIFRIN OVERVIEW

MARKETS
Commercial
Education
Health Care/Senior Living
Industrial
Municipal/Government/Public Works
Private Sector
SERVICES
Airport Land-Side Design
Bridges
Building Structures
Code Compliance
Construction Administration
Design/Build
Electrical Engineering
Emergency Response Facilities Design
Energy Audits
Facility Power Distribution Systems
Fire Protection Engineering
Geographic Information Systems
Grant Writing
Health Care Compliance Reviews
Highways, Roadways and Streets
Hydraulics/Modeling Studies
Infiltration and Inflow Studies
LEED/Sustainable Design
Levees/Navigation Structures
Mechanical Engineering
Parking Structures
Parks and Recreation
Pedestrian and Bicycle Facilities
Plumbing Engineering
Regulatory Review
Residuals/Biosolids Management
Seismic Analysis and Design
Site Development and Drainage
Stormwater Engineering
Streetscapes
Surveying
Traffic Studies, Signalization and Calming
Transit
Value Engineering
Wastewater Treatment and Collection
Water Supply, Treatment and Distribution

Horner & Shifrin, Inc. is a professional engineering firm with offices in St. Louis, Springfield, and Poplar Bluff, Missouri, and O'Fallon and Springfield, Illinois. Recently designated a small business by the U.S. SBA standards and with a staff of over 70 engineers, technicians and support personnel, our firm has the experience and capability to serve a wide variety of clients in Missouri, Illinois and throughout the United States.

EXPERIENCE AND DEDICATION IN PROVIDING PROFESSIONAL ENGINEERING TO OUR CLIENTS HAS BEEN THE KEY TO THE LONG-STANDING SUCCESS OF HORNER & SHIFRIN

Founded in 1933 by W.W. Horner and H.G. Shifrin, the company has grown to be a multidisciplinary engineering firm with unusual versatility. We have expanded our services to meet our clients' continuously changing needs and to keep ahead of technological developments in the field of engineering.

We offer engineering services in all phases of a project, including feasibility, planning, development, design and construction administration. The firm has the in-house capability to execute projects of major scope. We are structured to ensure that our principals and senior personnel are directly involved with all projects, whether they are large or small. Many of our projects have demonstrated innovative techniques and designs, for which we have received numerous professional awards and repeat assignments from appreciative clients.

Horner & Shifrin is devoted only to the practice of professional engineering. We are a 100-percent employee-owned corporation, managed by our officers and directors. We have no proprietary interest in any other corporation, firm, company or subsidiary or in any equipment or process.



As employee-owners, we share a commitment to apply our expertise to the highest standards, exercising our knowledge and skills for the benefit of our community, client and fellow employee.

OUR CORPORATE VISION

COMMUNITY	We strive to improve and preserve the quality of life within the communities we serve.
CLIENT	We endeavor to exceed our clients' expectations by providing innovative, cost-effective solutions, superior service and personal attention.
EMPLOYEE	We cultivate a work environment that fosters creativity, personal growth, cooperation, and unity. We develop, recognize, and reward all who are committed to moving our organization forward.

visualized, defined and adopted by the employee-owners of Horner & Shifrin, Inc.





OFFICERS AND KEY PERSONNEL

OFFICERS	YEAR JOINED FIRM	STATE REGISTRATION OR LICENSE
Duane Siegfried, P.E., S.E., President	1997	Missouri, Illinois
Linda R. Hopkins, Vice President Director, Business Operations	1990	
Gino E. Bernardez, P.E., Vice President Manager, Transportation/Civil Engineering	1999	Missouri, Illinois, Texas
James E. McCleish, P.E., Vice President Manager, Environmental Engineering	1999	Missouri, Illinois
Michael A. Banashek, P.E., S.E., Associate Vice President Manager, Structural Engineering	2000	Missouri, Illinois
Steven R. Donahue, P.E., Associate Vice President Manager, O'Fallon, IL, Office	1998	Illinois
Brian D. Heideman, P.E., Associate Vice President Manager, Commercial and Institutional	2005	Missouri, Illinois, Washington
Jarrett D. Jasper, P.E., Associate Vice President Assistant Department Manager, Transportation/Civil	1998	Missouri, Illinois
Kevin C. Skibiski, P.E., S.E., P.L.S., Associate Vice President Manager, Springfield, MO, Office	2010	Missouri, Illinois, 38 other states
Robert C. Summers, P.E., Associate Vice President Southeast Missouri Operations Manager, Poplar Bluff, MO, Office	2012	Missouri, Kansas
Jeffrey S. Stahlhuth, GISP, Associate Vice President Director, Information Technologies/GIS	1995	Missouri, Illinois
KEY PERSONNEL		
Glen T. Cherry, F.SAME Director, Business Development	1996	
Brooks K. Brestal, P.E. Senior Engineering Manager	2009	Illinois
Jeffrey L. Bane, P.E., S.E., Senior Project Manager, Structural Manager, Springfield, IL Office	2011	Missouri, Illinois, Indiana, Wisconsin
Michelle M. Miller Manager, Marketing	2012	
Kelly L. Hayes, P.E. Manager, Construction Engineering	2000	Missouri, Illinois
ASSOCIATES		
Ramin D. Ashrafzadeh, P.E.	1998	Missouri
Dennis L. Campbell, P.E.	1993	Missouri, Illinois
Lisa E. Fennewald, P.E.	1993	Missouri, Illinois
Karen S. Frederich, P.E.	1999	Missouri, Illinois
John D. Gilmore	1995	
Richard W. Halteman, P.E., CEM	2012	Missouri, Illinois, NCEES
Eric M. Lagemann, P.E., S.E.	2005	Missouri, Illinois
Thomas P. Lohman, P.E., S.E.	2007	Missouri, Illinois
Stephen Randolph, P.E., LEED G.A.	1995	Missouri, Illinois
Bradley E. Riechmann, P.E.	2008	Missouri, Illinois
Gene L. Rovak, P.E.	1991	Missouri, Illinois, Maryland
Brian D. Schmidt, P.E., P.T.O.E.	2000	Illinois
G.E. "Ed" Sewing, P.E.	1990	Missouri, Illinois



RECENT AWARDS

2014

Broadway Streetscape
Cape Girardeau, MO

- **Honor Award**
American Council of Engineering Companies (ACEC) of Missouri
- **Excellence in Revitalization through Placemaking (2013)**
Old Town Cape
- **Streetscape and Public Space Improvements (2013)**
Missouri Main Street Connection



IL 3 over the UPRR / Prairie
DuPont Canal
Dupu, IL

- **Merit Award**
American Council of Engineering Companies (ACEC) of Illinois



2013

Route 76 Bridge over Lake Taneycomo
Rehabilitation
Branson and Hollister, MO

- **Grand Award**
ACEC of Missouri
- **Rehabilitated Bridge Design Award (2012)**
Precast/Prestressed Concrete Institute (PCI)



Illinois Route 3 CSS
Waterloo, IL

- **Merit Award**
ACEC of Illinois

2012

Salt River Road Extension
St. Peters, MO

- **Honor Award**
ACEC of Missouri



2012 (*cont.*)

Kirkwood High School
Ernest L. Lyons Memorial Field
Kirkwood, MO

- **Honor Award**
ACEC of Missouri



I-270 / IL 3 Interchange Reconstruction
Granite City, IL

- **Special Achievement Award**
ACEC of Illinois

Porter-Simmons Roundabout
O'Fallon, IL

- **Merit Award**
ACEC of Illinois

2011

Jefferson Avenue Viaduct
Replacement and Enhancements
St. Louis, MO

- **Honor Award**
ACEC of Missouri





2010

New I-64 Design/Build Project
St. Louis, MO

- **America's Transportation Awards Grand Prize**
American Association of State Highway and Transportation Officials, AAA and U.S. Chamber of Commerce



2009 (cont.)

State and Obernuefemann Roundabout
O'Fallon, IL

- **Merit Award**
ACEC of Illinois
- **Small Construction Project Award**
Illinois Department of Transportation



2008 (cont.)

Lower Meramec Lift Station
St. Louis, MO

- **Grand Conceptor Award**
ACEC of Missouri
ACEC-MO's highest honor, denotes best overall engineering achievement



2009

Kirkwood High School
Science Building
Kirkwood, MO

- **Special Facility Outstanding Design Award**
American School & University Magazine



IL 336 Phase II

Quincy to Macomb, IL

- **Special Achievement Award**
ACEC of Illinois
- **Exceptional Service Award (2008)**
Illinois Department of Transportation
IDOT presents this award to only four firms annually, recognizing "projects that demonstrate the highest level of design excellence."



Black Creek Sewer Microtunneling
St. Louis, MO

- **Honor Award**
ACEC of Missouri



2008

Route 21 Improvements
Jefferson County, MO

- **Excellence in Paving Award**
American Concrete Pavement Association

2006

Grossman Iron & Steel
300-ton-per-hour Mega Shredder
St. Louis, MO

- **Grand Award**
ACEC of Missouri





B. PREVIOUS PROJECT EXPERIENCE

St. Louis Flood Protection System Certification City of St. Louis, Board of Public Service

Horner & Shifrin and Shannon & Wilson provided certification services, in accordance with Title 44 Code of Federal Regulations (CFR) Section 65.10, for the St. Louis Flood Protection System, which stretches for 11 miles along the Mississippi River. Floodwalls make up 6.75 miles of the flood barrier while earthen levees comprise the other 4.25 miles. In addition, there are thirty-nine closure structures and twenty-eight pump stations located along the length of the system.



Available historic supporting data were reviewed, including: as-built and design drawings, operations and maintenance manuals, hydraulic and hydrologic design memoranda, Flood Insurance Study text and maps, and current hydrologic and hydraulic modeling results. Geotechnical investigations were conducted along the flood protection system including the drilling of ninety-six borings. Physical inspections were conducted of the levee, floodwall, closure structures, and pump stations. Selected closure structures were inspected with an ultrasonic thickness gauge to determine deterioration.

H&S reviewed the original design calculations for the structural components of the flood protection system to verify the original loading conditions and to determine if the original design meets current criteria. H&S also developed spreadsheet tools to calculate, analyze and assess the floodwalls and closure structures. Review of the structural components was based on current design manuals (EM) and engineering technical letters (ETL).

The system assessment included analysis of the floodwall and embankment sections for stability and underseepage using existing and new boring and soil information. Analysis for critical sections identified during the system review and boring and sampling review was completed as discussed in ETL 1110-2-570.

Global stability analyses considered embankments, foundation stability for flood walls, and underseepage for embankments and floodwalls. The analysis was based on procedures described in USACE Engineering Manual 1110-2-1902 (Slope Stability) to demonstrate that seepage into or through the levee foundation and embankment during loading conditions associated with the base flood will not jeopardize embankment or foundation stability.

Embankment protection was reviewed using procedures described in USACE Engineering Manual 1110-2-1913 (Design and Construction of Levees) to determine if the protection has been designed in accordance with those procedures such that no appreciable erosion of the levee embankment is anticipated during the base flood and that anticipated erosion should not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability.

Settlement analysis was done using procedures described in USACE Engineering Manual EM 1110-1-1904. This analysis addressed embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods.

Based on the analyses described above, some deficiencies were noted in the original report and remedial actions were required. The City quickly implemented the following projects, designed by Horner & Shifrin and Shannon & Wilson, to correct those deficiencies:

- Geotechnical calculations indicated that an exit gradient greater than 0.5 exists for length of about 200 feet between STA 8+20 and STA 11+00. Several design options were discussed with the Corps to remediate this problem including riverside and landside berms, a sheet-pile cut-off wall, relief wells, slurry walls and jet grouting, and a



trench drain. Based on cost, site constraints and a preference to avoid relief wells the trench drain was chosen as the selected alternate.

- To replace a missing panel structure, a new concrete stop-log closure structure was designed to take its place. Horner & Shifrin provided the plans and specifications for construction of the structure and it was built in November 2013.
- The Trigen Energy Facility was identified as a potential site of system failure due to an obsolete cooling water tunnel that penetrates the floodwall at the plant. Additional investigations found that a screen well was a deficiency in the system because the top of the screen well was open to the atmosphere and water could escape the tunnel at the well if the water surface elevations were high enough. To fix this problem, it was decided to raise the height of the screen well. Structural engineers from Horner & Shifrin designed the improvements and they were constructed in May, 2011

Cape Girardeau Flood Protection System Certification Analysis, Cape Girardeau, MO

Similar to the previous project for the City of St. Louis, Horner & Shifrin provided an analysis of the City's flood protection system to assess compliance with the guidelines of CFR 44, Section 65.10. Included a review of available historic supporting data including: as-built and design drawings, operations and maintenance manuals, hydraulic and hydrologic design memoranda, Flood Insurance Study text and maps, and current hydrologic and hydraulic modeling results. Geotechnical investigations and analysis of underseepage, global stability, embankment erosion and settlement. Structural analysis of floodwalls and closure structures. Physical inspections were conducted of the levee, floodwall, closure structures and pump stages. The project also included interior drainage analysis and evaluation of freeboard requirements.

Various Task Orders for Multiple Levee and Drainage Districts

U.S. Army Corps of Engineers

Since 2009 Horner & Shifrin has performed a variety of tasks for multiple levee and drainage districts in the Mississippi and Missouri River Drainage Basin. Among them are:

USACE Periodic Inspections (MES Services):

- Consolidated North County (Missouri)
- St. Peters Old Town (Missouri)
- City of Ste. Genevieve (Missouri)
- City of Hannibal (Missouri)
- City of Fulton (Missouri)
- Metro East Sanitary District (Illinois)
- Prairie DuPont/Fish Lake (Illinois)



Independent Technical Reviews. Design Criteria Reviews and/or Pre-Inspection Packets:

- Illinois Levee and Drainage Districts – Bois Brule, Coon Run, Grand Tower, Harrisonville, McGee Creek, Prairie DuRocher, New Athens, Big Swan, Eldred, Hartwell, Hillview, Keach, Mauvaise Terre, Meredosia Lake, Nutwood, Spankey, Valley City
- Minnesota Levee and Drainage Districts – Elk River, Hastings, Kellogg, South St. Paul, Winona, Alvarado, Noyes, Argyle, Halstad, Oslo, East Grand Forks
- Iowa Levee and Drainage Districts – Bettendorf, Clinton, Des Moines, Dubuque, Decorah, Guttenberg, Muscatine
- Wisconsin Levee and Drainage Districts – Boscobel, Portage, Spring Valley, Arcadia



Levee District Services

Howard Bend Levee District

Horner & Shifrin has provided engineering services to the Howard Bend Levee District since 1987 when the firm aided in the initial formation of the district. The area protected by the District lies adjacent to the Missouri River in St. Louis County. Following the flood of 1993, Horner & Shifrin developed plans for improving the levee from its status as an agricultural levee to that of a major urban levee. Throughout this process, various levee alignment alternatives were evaluated with respect to both environmental and cost considerations and permitting issues were addressed. Horner & Shifrin worked with a geotechnical firm for evaluation of geotechnical conditions and design of the levee section, relief well system and under-seepage berms. Floodwalls were also included at several locations.

The project was coordinated with the Corps of Engineers, the Missouri Department of Transportation, the Metropolitan St. Louis Sewer District, the St. Louis County Water Company, the City of Maryland Heights and the City of St. Louis. The firm engaged photogrammetrists to produce controlled topographic maps and three-dimensional computer files of the entire levee district, from which it was possible to construct alignment plans and compute earthwork quantities.

Horner & Shifrin provided management and inspection services throughout the construction period.

The firm computed hydraulics for interior drainage that included both local rainfall and the considerable hillside tributary drainage areas using the ICPR computer model to determine location and extent of interior ponding under both existing and future conditions. Horner & Shifrin also prepared the documentation to obtain a Letter of Map Revision (LOMR) from FEMA affecting 6000 acres in six Flood Insurance Rate Maps. The documentation included the MT-2 application forms, detailed workmaps, annotated Flood Insurance Rate Maps, and other related exhibits.

In addition to the levee, Horner & Shifrin designed major enhancements to the gravity outlet structure with structural improvements to the gates and increasing the height of the floodwall. The improvements allow it to resist a 500-year river flood.

Flood Protection and Interior Drainage

Earth City Levee District

Horner & Shifrin was responsible for the design of a 2.6 mile earthen levee and pump station as part of the overall site development services. The levee is designed in accordance with U.S. Army Corps of Engineers standards to contain a flood having a recurrence interval of about one in 700 years. The system of multiple lakes, channels, washouts, gates and pumps protected Earth City during the severe flooding of 1993. Horner & Shifrin was responsible for all aspects of this project except geotechnical engineering.

Horner & Shifrin also designed a major upgrade and enhancement to the primary outlet structure. Using the original triple 10x12 outlet structure, one culvert was converted to provide an additional 100 cfs of pumping capacity with a diesel pump, independent of power feeds to the original pumps.

The gravity operation of the remaining two culverts was upgraded with re-built roller gates and new actuators. At one of the culverts, a weir was constructed to allow the lake levels to be maintained without the need for periodic pumping.



Levee Repair Reconnaissance Reports and Plans & Specs

U.S. Army Corps of Engineers, St. Louis District

Under an indefinite delivery order contract with the St. Louis District, Corps of Engineers, Horner & Shifrin played a major role in bringing the levees within the District back to 1995 pre-flood protection levels. Within a span of 10 weeks, Horner & Shifrin received three separate delivery orders related to emergency repairs to levees within the St. Louis District. Project highlights include:

- Visually inspected nearly 140 miles of levees, documented damages, calculated repair quantities, and prepared Damage Survey Reports
- Prepared plans and specifications for levee repairs in seven levee districts
- Plans and specifications were completed on a fast-track, two-week schedule

Levee Repairs and Upgrade on Cuivre River

Old Monroe, Missouri

Horner & Shifrin designed repairs for damaged sections of the levee protecting the City from flooding along the Cuivre River in Lincoln County, Missouri. The project included improvements to increase the height of the levee in several critical portions and to extend the reach of the levee to tie to an existing levee east of the city.



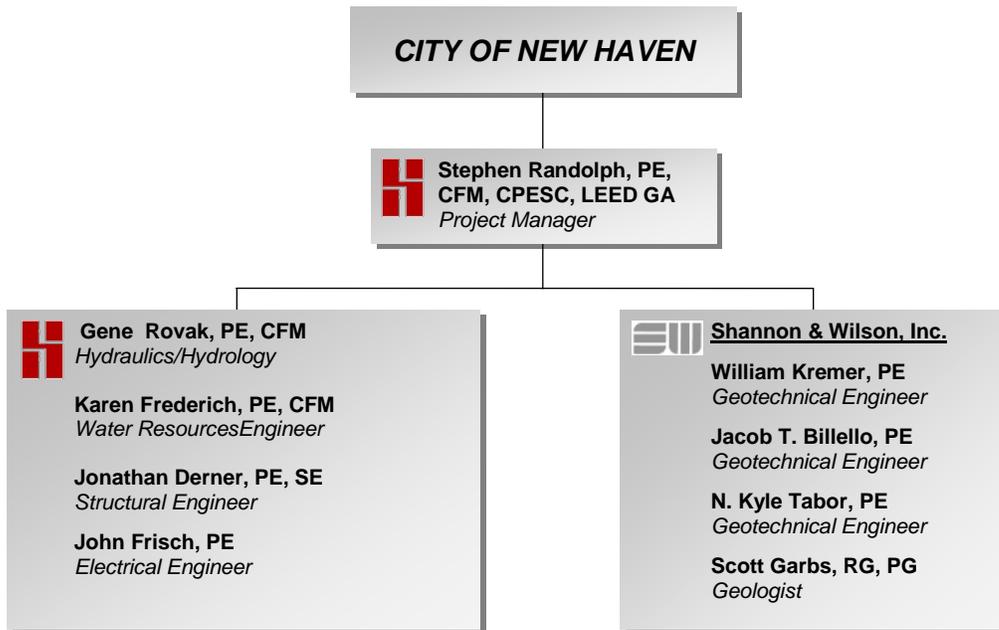


C. KEY PERSONNEL

To achieve a successful outcome on the City of New Haven's Levee Accreditation project, we have assembled a team of experienced staff members. Mr. Steve Randolph, who will be the project manager, has **over 17 years** of experience in flood protection engineering. Mr. Gene Rovak has **over 40 years** of experience in this field of study, and Ms. Karen Frederich has **15 years of experience**. Steve, Gene and Karen have been working together on flood protection and stormwater projects of all types for over ten years and **all three are Certified Floodplain Managers**.

In addition, our team includes Shannon & Wilson, Inc., a nationally recognized leader in geotechnical and environmental engineering.

Resumes for the personnel listed in the project organization chart, below, are included on the following pages.





STEPHEN RANDOLPH, P.E., CPESC, CFM, LEED Green Assoc. **Project Manager** **Environmental Engineering**

Steve has over seventeen years of experience as a civil engineer with expertise in environmental projects and construction. He is skilled in the use of several hydraulic and hydrologic computer simulations such as HEC-1, HEC-2, SWMM and HYDRA.

St. Louis Flood Protection System Certification **City of St. Louis Board of Public Service**

Project Manager for project involving Project Management and Structural, Mechanical and Electrical Engineering Services for recertification of a series of levees and floodwalls performed in accordance with Title 44 Code of Federal Regulations (CFR) Section 65.10 for the City of St. Louis Board of Public Service. Project elements include freeboard survey, closure inspections, embankment protection analysis, embankment and foundation stability analysis, settlement analysis, interior drainage analysis, and a design criteria review of all elements. Selected elements of the levee system were analyzed to determine their fitness. A testing program to confirm as-built plans was undertaken where necessary.

Levee Certification Assistance **City of Cape Girardeau, MO**

Project Manager for project involving Project Management and Structural, Mechanical and Electrical Engineering Services for recertification of a series of levees and floodwalls performed in accordance with Title 44 Code of Federal Regulations (CFR) Section 65.10 for the City of Cape Girardeau. Project elements include freeboard survey, closure inspections, embankment protection analysis, embankment and foundation stability analysis, settlement analysis, interior drainage analysis, and a design criteria review of all elements. Selected elements of the levee system were analyzed to determine their fitness. A testing program to confirm as-built plans was undertaken where necessary.

Dam and Levee Inspections **U.S. Army Corps of Engineers, St. Paul District**

Project Engineer for periodic inspection of fourteen levee systems in the St. Paul District. Provided Independent Technical Review (ITR) of periodic inspection reports on mechanical components of pump stations and interior drainage structures for levee districts in Iowa, Wisconsin and Minnesota.

Levee Inspections **U.S. Army Corps of Engineers, St. Louis District**

Project Engineer for periodic inspection of 1) Consolidated North County Levee District, St. Charles County, MO; 2) North Main Street Levee System; Cape Girardeau, MO; 3) Prairie DuPont and Fishlake Levee, St. Clair Co., MO; 4) St. Genevieve #3 Levee System, St. Genevieve, MO. Duties included preparation of design criteria review, pre-inspection packets and drafting of periodic inspection reports. Also performed on-site inspection of system pump stations.

Levee Inspections **U.S. Army Corps of Engineers, Memphis District**

Project Engineer for periodic inspections of two levee systems in the Memphis District. Prepared design criteria review and pre-inspection packets for mechanical components of pump station and interior drainage structures for levee districts near Cairo, Illinois.

EDUCATION

M.B.A., Webster University, 2002

B.S. Civil Engineering, Washington University, 1995

REGISTRATIONS

Registered Professional Engineer, Missouri, Illinois

LEED Accreditation – Green Associate Level

Certified Professional in Erosion and Sediment Control

Certified Floodplain Manager

PROFESSIONAL ACTIVITIES

American Society of Civil Engineers

Missouri Floodplain & Stormwater Managers Association



Levee Inspections

U.S. Army Corps of Engineers, St. Louis District

Project Engineer for periodic inspection of twenty-one levee systems in the St. Louis District. Prepared design criteria review, pre-inspection packets and drafted periodic inspection reports for levee districts in Missouri and Illinois. Also performed on-site inspection of system pump stations.

Levee Improvements and Pump Station Concept Design

City of St. Charles, MO

Analyzed the stormwater runoff along Fifth Street to Dusable Park as part of a project that included levee improvements and a concept design for a proposed stormwater pump station. The project included investigations of potential tributary area reaching up to the Blanchette Park area. Effort included field investigations and characterization of the component tributary areas, and TR-55 modeling of the 100-year, 24-hour storm. The analysis was performed for various combinations of stormwater detention volumes and pump capacity, as well as determining the maximum "footprint" for detention to and the exploration of alternate locations for the storage component. Concept-level cost estimates were presented for the combinations of storage and pump capacity to aid decision-making and to define a subsequent design scope.

Stormwater Model

Howard Bend Levee District | St. Louis, MO

Part of a design team developing a stormwater model of 6,000 acres of bottom land. The total size of the tributary watershed is 42 square miles. The stormwater model was used as a tool to obtain a Letter of Map Revision (LOMR) from FEMA as well as a planning tool for future flood protection works.

Mississippi River No-Rise for Kellogg Port

Slay Industries, Mudd Landing, IL

Project Engineer for HEC-RAS modeling of alternate configurations of a barge handling facility and the effect and the effect on flood elevations on the Mississippi River for IDNR submittal.

Haddington Court Flood Buyout Project

City of Clayton, MO

Project Manager for a \$1.6M buyout of flood-prone properties funded by the FEMA Hazard Mitigation Grant Program (HMGP). Project tasks included: a cost-benefit analysis using the FEMA BCA software program, preparation and submittal of the HMGP application, project cost estimates and administration, property negotiation and purchase, asbestos abatement and demolition, and final site restoration.

Levee Recertification, Monroe County, IL

G. J. Grewe, Inc.

Project Engineer for developing IDOT Drainage Report for levee recertification in support of Columbia Crossing project.

River City Casino BMP Design and Stormwater Pollution Prevention Plan

Pinnacle Entertainment Corp.

Developed Stormwater Pollutions and Prevention Plans (SWPPPs) for construction of Pinnacle Entertainment's River City Casino and access road. The SWPPP's incorporated erosion and sediment control Best Management Practices (BMP's) to meet three major challenges. The first included the protection of the Mississippi River along the eastern boundary of the project. Second, the River Des Peres on the north side of the project had to be protected and; thirdly, the original site contained nine wetland areas comprised of seven acres of federally protected land that requires safeguarding. Duties for this project also included weekly inspections and reports as part of St. Louis County's Special Inspector Program for major land disturbance projects. During the Phase II improvements that included additional surface parking, a hotel and parking garage, designed best management practices (BMP's) for stormwater control and treatment. The BMP's incorporated low-impact design approaches such as permeable pavement and bioswales



GENE L. ROVAK, P.E., CFM, F.ASCE
Senior Project Manager
Environmental Engineering

With a career spanning over 40 years, Gene Rovak has extensive experience with hydraulic and hydrologic analyses for flood investigations, drainage design and master planning studies, and construction documents for site development and infrastructure systems. He has worked with many existing hydraulic and hydrologic computer models as well as having developed several programs for related applications.

Levee Certification Assistance
City of Cape Girardeau, MO

Project Engineer for project involving Project Management and Structural, Mechanical and Electrical Engineering Services for recertification of a series of levees and floodwalls performed in accordance with Title 44 Code of Federal Regulations (CFR) Section 65.10 for the City of Cape Girardeau. Project elements include freeboard survey, closure inspections, embankment protection analysis, embankment and foundation stability analysis, settlement analysis, interior drainage analysis, and a design criteria review of all elements. Selected elements of the levee system were analyzed to determine their fitness. A testing program to confirm as-built plans was undertaken where necessary.

Howard Bend Levee District
Maryland Heights, MO

- **Flank Levee Improvements.** Development of construction plans for Flank Levees Improvements along Creve Coeur and Fee Fee creeks. Obtain permits from City of Maryland Heights, St. Louis County and Corps of Engineers. The 3 ½ miles of flank levees will contain the 100-year rainfall event from 42 square mile tributary area.
- **Stormwater Management Guidelines.** Developed criteria manual for development aspects of levee-protected floodplain, to address displacement of floodwater by on-site fill and provide formula to quantify limits, and provide guidelines to BMP selection for minimizing runoff (Limited Impact Development). Guidelines parallel interior drainage design analysis based on computer modeling of stormwater flooding in this area for revised interior flood maps.
- **Master Plan for Levee Improvements.** Developed preliminary engineering for major improvements to a levee system protecting 7,000 acres of Missouri River floodplain. This work included analysis of Creve Coeur and Fee Fee Creek discharge and development of HEC-1 and EPA SWMM EXTRAN computer models of flood discharge through the area.

Flood Protection and Interior Drainage
Earth City Levee District, Earth City, MO

Design of a major upgrade and enhancement to the primary outlet structure. Using the original triple 10-ft by 12-ft outlet structure, one culvert was converted to provide an additional 100 cfs of pumping capacity with a diesel pump, independent of power feeds to the original pumps. Gravity operation of the remaining two culverts was upgraded with re-built roller gates and new actuators. At one of the culverts, a weir was constructed to allow the lake levels to be maintained without the need for periodic pumping.

DFIRMs Review
St. Charles City and St. Charles County, Missouri

Project Manager for review of St. Charles DFIRMs to enumerate and quantify issues, BFE errors, regarding the unsuitability of the new maps to properly reflect flood risks. Items noted included mapping inconsistencies and the omission of available hydrologic data resulting in unusable mapped zones. Recommendation was incorporated into subsequent revisions.

EDUCATION

B.S. Civil Engineering,
 Washington
 University, 1967

Professional
 Development Degree,
 Civil Engineering,
 Missouri University
 of Science and
 Technology, Rolla,
 1976

REGISTRATIONS

Professional Engineer:
 Missouri, Illinois,
 Maryland

Certified Floodplain
 Manager

**PROFESSIONAL
 ACTIVITIES**

Past President,
 St. Louis Section
 American Society of
 Civil Engineers

Chair, St. Louis ASCE
 Environmental &
 Water Resources
 Institute

Fellow of ASCE

American Public
 Works Association

Missouri Society of
 Professional
 Engineers

National Society of
 Professional
 Engineers

PUBLICATION

Development of a
 Stormwater Master
 Plan, *Erosion
 Control*, April 2000,
 pp. 36-43.



**Computer Modeling Analysis of Chesterfield-Monarch Levee Protection Area
St. Louis County Department of Highways and Traffic**

Chesterfield Valley interior drainage analysis including computer modeling analysis of existing and future conditions in 4,000 acre, multiple-reservoir area of Missouri River Bottoms to determine location and extent of interior ponding.

**Levee Improvement Study
Riverside Mobile Home Park, Arnold, MO**

Analyzed potential effects of proposed levee improvements to 100-year flood elevations on the adjacent upstream reach of the Meramec River utilizing HEC-2 computer models.

**Levee Rehabilitation and Improvements
City of Old Monroe, MO**

Project Manager for design and repair of damaged sections of the levee along the Cuivre River in Lincoln County, Missouri. The project included improvements to increase the height of the levee in several critical portions and to extend the reach of the levee to tie to an existing levee east of the city.

**Restoration and Repair of Agricultural Levee
City of Chesterfield, MO**

Project Manager for restoration and repair of an agricultural levee.

**Hydraulic and Hydrologic Review of Base Flood Elevations on Preliminary DFIRM
City of St. Charles, MO**

Performed technical review of the Preliminary DFIRM and the hydrologic and hydraulic analyses that were used as the basis of the Base Flood Elevations on the DFIRM Panel for Cole Creek in the Dardenne Creek Watershed. Made recommendations for refining the study with the use of unsteady modeling to address inconsistencies between rainfall and runoff volumes between flood hydrograph flow and bankful volumes.

**Riverport Flood Protection System Inspection and Report
Duke-Weeks Realty, St. Louis, MO**

Project Manager for complete inspection of the Riverport Flood Protection System, including 8,400 feet of 500-year levee, pump station, and relief well system, as well as the related interior drainage facilities. Project elements included a descriptive report, recommendations for improved facilities or operations, and information related to incorporation as a levee district.

**Flood Protection
Executive Walk Apartments, Brentwood, MO**

Project Manager for design of flood protection for several buildings in an existing apartment complex southeast of Brentwood and Manchester Roads. Floodwalls and watertight gates were designed to fit in aesthetically with architecture of individual buildings. The system was designed for 50-year flood elevation.

**Flood Protection Evaluation
Harrah's Casino and Event Center, Maryland Heights, MO**

Project Manager for evaluation of flood protection alternatives, CLOMR/LOMR development services, and design of relocated flank levees

U.S. Army Corps of Engineers, St. Louis District

- **Section 205 Study.** Update of USACE's 1969 report on interior flood control improvements for three drainage and flood control districts in Illinois. Thirty years of rainfall and river stage data were used to perform interior flood modeling with HEC-IFH. Cumulative risk avoidance benefits of various levels of pump capacity were calculated for range of rainfall, using USACE model Computerized Agricultural Crop Flood Damage Assessment System (CACFDAS). Economic risks and benefits were compared using USACE method for cumulative risk and benefit calculation.
- **Revision of Missouri Flood Maps, Cape Girardeau, MO.** Project Manager for revision of HEC-2 modeling and completion of FEMA LOMR application to revise Cape Girardeau flood maps. Maps were revised to reflect channel improvements and construction of a major detention lake by USACE.



KAREN S. FREDERICH, P.E., CFM

Project Manager

Environmental Engineering

Karen Frederich is a civil engineer experienced in flood protection and environmental projects. Typical projects have included construction management, hydraulic and hydrologic analyses for flood studies, FEMA flood insurance rate map changes, sanitary sewer and wastewater treatment plant design and rehabilitation, combined sewer consolidation and stormwater studies, landfill leachate generation collection studies, landfill air quality compliance, and construction/ contract management of public works projects.

Howard Bend Levee District

Maryland Heights, MO

Consultant District Engineer overseeing engineering-related issues for the 6,000-acre levee district. Projects include the following.

- **Levee and Berm System**

Developed construction bid documents for 500-year levee and underseepage berm system. Levee system is 7 miles in length, along the Missouri River. Ten bid packages range in cost from \$500,000 to \$3,500,000 totaling in excess of \$7.5 million. Managed construction contracts, approved payment applications and reported to the District Board of Supervisors.

- **Stormwater Model**

Part of a design team developing a stormwater model of 6,000 acres of bottomland. The total size of the tributary watershed is 42 square miles. The stormwater model was used as a tool to obtain a Letter of Map Revision (LOMR) from FEMA as well as a planning tool for future flood protection works.

- **Flank Levee Improvements - North Creve Coeur Creek**

Project Manager for development of construction plans for Flank Levees Improvements along Creve Coeur Creek. Obtain permits from the City of Maryland Heights, St. Louis County and Corps of Engineers. The one-mile flank levee improvements will protect 1,400 acres from flooding by levee overtopping.

- **Flank Levee Improvements - South Creve Coeur Creek and Fee Fee Creek**

Project Manager for development of construction plans for Flank Levees Improvements along south Creve Coeur Creek and Fee Fee Creek. Obtain permits from the City of Maryland Heights, St. Louis County and Corps of Engineers. The 3.5 miles of flank levees will contain the 100-year rainfall event from the 42 square mile tributary area.

- **New River Outlet Design**

Project Manager for layout and design of new gravity outlet to convey stormwater for large-flow, small return-frequency storm events. The four-barrel, 12 x 10 ft, 200-ft long culvert will have two backflow prevention devices incorporated into the design to prevent backflow from the Missouri River during a major river flood. The 500-year river levee will be relocated as part of this work.

- **Regulatory Compliance Activities**

Work with Corps of Engineers to upgrade participation level in the PL84-99 program. This program is a cost-share program, which pays 80% of repair costs of a levee failure with Corps funds; the balance is paid by the levee district. Obtain 404 permits when creek bank repairs are required, and obtain other clarifications to maintain compliance with environmental laws (such as tree removal from riverside of levee).

- **Stormwater Modeling**

Project Manager for a stormwater-modeling task in which a subconsultant was asked to create an optimizer computer program to maximize stormwater conveyance and storage, and minimize costs and land area consumption.

EDUCATION

B.S., Civil Engineering,
University of
Missouri, Rolla,
1993

A.S., Pre-Engineering,
East Central
College, 1991

REGISTRATIONS

Professional Engineer,
Missouri, Illinois

Certified Floodplain
Manager

PROFESSIONAL ACTIVITIES

American Society of
Civil Engineers,
Membership Roster
Editor

The Engineers Club of
St. Louis

Missouri Floodplain &
Stormwater
Managers
Association

Society of American
Military Engineers,
Individual Members
Committee Chair

Association of State
Floodplain
Managers

Levee Certification Assistance

City of Cape Girardeau, MO

Project Engineer for planning a program for the City to follow to provide information necessary for recertification of levee system to allow reaccreditation by FEMA.

Levee Inspections

U.S. Army Corps of Engineers, St. Louis District

Performed an independent technical review on the mechanical portion of the Periodic Inspection Report for levee systems in the cities of St. Genevieve and Cape Girardeau and the Prairie Dupont Levee District. The purpose of this task was to confirm the proper application of established criteria, regulations, laws, codes, principles, and professional practices, and that the level of detail was commensurate with the contracted scope of work. The pre-inspection packets and the summary of findings during the field inspections were reviewed and commented upon. Follow-up reviews confirmed that comments were adequately addressed.

Improvement Plans

Earth City Levee District | Earth City, MO

Review improvement plans of proposed developments within the Earth City tributary area for compliance with Earth City Levee District's stormwater management requirements.

Elevation Survey of Primary Flood Protection System

Earth City Levee District | Earth City, MO

Project Manager for coordination of fieldwork to obtain top-of-levee elevations. Created drawings showing a plan and profile of the flood protection system. These documents were used in the Levee District's efforts to continue to show the area as a flood-protected area on the new FEMA flood maps.

Flood Protection Evaluation

Harrah's Casino | Maryland Heights, MO

Project Manager for evaluation of flood protection alternatives.

Levee District River Model

Husch, Blackwell, Sanders, LLC | St. Louis, MO

Project Manager for modification of the methodology used by FEMA to determine the limits of the floodway, using the HEC-RAS model from the preliminary DFIRMs. This effort is limited to the reach of the Missouri River from a point downstream of I-370 to a point near Bonhomme Creek (including Earth City, Riverport, and Howard Bend levee districts). This information will be used as part of an appeal of the preliminary maps.

Pump Station No. 6, Gravity Outfall Project

City of Chesterfield, MO

Project Manager responsible for coordination of the civil and structural design of a gravity outlet through a 500-year urban levee. The outlet involves 3-60 inch diameter pipes and a gatewell structure with two forms of backflow protection. Review authority coordination involves the St. Louis District, Corps of Engineers (since this improvement will extend through a levee improvement planned for 2007 & 2008) the Monarch-Chesterfield Levee District and the City.

Terra Vista

City of Chesterfield, MO

Performed stormwater modeling, document preparation and mapping associated with LOMR application

Mill Ridge

City of Chesterfield, MO

Stormwater modeling support, mapping, and other related tasks for LOMR application.

Haddington Court HGMP Application

City of Clayton, MO

Assisted project engineers in completing SEMA/FEMA Hazard Mitigation Grant Program Application. Activities included completing forms and assembling supporting documentation included with the application.



JONATHAN J. DERNER, P.E., S.E.
Senior Project Engineer
Structural Engineering

Jon Derner has more than 10 years of experience in structural engineering design including bridges, buildings and stormwater drainage structures. Jon is proficient in designing bridges that meet LFD and LRFD design guidelines (including seismic). Specialization includes steel and prestressed bridge design, reinforced concrete design, foundations and seismic design.

Levee Certification, St. Louis, MO
City of St. Louis Board of Public Service

Lead Structural Engineer for structural analysis of the city's downtown flood protection system which includes over 10 miles of concrete floodwall and 39 closure structures. Project involved condition inspection and analysis for the design flood to assure system met current Corps of Engineers criteria for strength and stability for certification.

Levee Certification
City of Cape Girardeau, MO

Lead Structural Engineer for structural analysis of the city's flood protection system which includes concrete floodwall and 5 closure structures. Project involved condition inspection and analysis for the design flood to assure system met current USACE criteria for strength and stability for certification.

Wood River Levee District Closure Structures and Floodwall
Applied Energy Management, East Alton, IL

Project Manager, Lead Structural Engineer and Designer of Record for design of replacement of 3 closure structures and adjacent concrete floodwall. The closure structures consist of swing gates over a road and railroad. Project is design/build.

Levee Inspection
U.S. Army Corps of Engineers

Assisted a team of engineers by inspecting, identifying and reporting structural deficiencies for structures on the following levees:

- Muscatine, Iowa (15 Miles)
- Hannibal, Missouri (1 Mile)

Salt River Road Extension, Phase II and III
City of St. Peters, MO

Structural Project Engineer for design of bridges over Spencer Creek and Dardenne Creek, and grade separation structure over Spencer Road. All bridges accommodate four lanes of traffic and 10-foot-wide pedestrian/bicycle trail. Spencer Creek 3-span structure is comprised of P/C concrete bulb tee girders, features a partially curved deck, and spans between USACE-regulated Lakeside 370 levee and an agricultural levee. Dardenne Creek bridge is a two-span, P/C concrete I-girder structure with 30-degree skew and features pile cap center bent and pile-supported integral end bents. An MSE was required due to end bent's proximity to the creek bed. Bridge spans between the Old Town Levee and a relocated agricultural levee. The simple span Spencer Road bridge utilized concrete NU girders with MSE wall abutments and was part of a tight diamond interchange.

2012 ACEC-MO Engineering Excellence Honor Award Winner

EDUCATION

M.S., Civil
Engineering,
University of Missouri
(now Missouri
University of Science
and Technology),
Rolla, 2001

B.S., Civil
Engineering,
University of Missouri
(now Missouri
University of Science
and Technology),
Rolla, 2000

REGISTRATIONS

Professional Engineer:
Missouri

Structural Engineer:
Illinois

PROFESSIONAL

ACTIVITIES
Engineers Club of
St. Louis

Stacy Park Reservoir Repairs
City of St. Louis – Water Division

Project Manager and Lead Structural Engineer for emergency repairs to the dead end anchors of a post tension concrete slab that covers a 100 million gallon reservoir. In just six weeks, the plans and technical specifications were delivered to the city for review and approval. The repairs will be made while the reservoir is in service.

150-Ton-Per-Hour Shredder
Azcon Corporation, Alton, IL

Lead Structural Design Engineer for equipment foundations for an 82", 4,000 HP motor rated to shred 150 tons of metal per hour located in Alton, Illinois. Foundations were designed to meet IBC 2003 design code, site class E. Shredder, motor, and pin puller were supported by piles and the rest of the foundations were supported by spread footings.

New Carlinville Area Hospital
Carlinville, IL

Structural Engineer for a new 50,000-sq-ft hospital. The hospital is a single story steel framed structure with a metal stud/brick veneer façade.

Veterans Home Generator and Fire Lane, Cape Girardeau, MO
Missouri Division of Facility Management, Design and Construction

Structural Design Engineer for new a wood structure housing a generator and a fuel tank to meet the IBC 2006 code.

Infrastructure Improvements
Chateau Girardeau, Cape Girardeau, MO

Structural Design Engineer to evaluate existing structural elements to support new roof top units for infrastructure improvements to a nursing home and assisted living facility.

2010 Infrastructure Improvements
Kirkwood School District, Kirkwood, MO

Structural Design Engineer to evaluate existing structural elements to support new roof top units for infrastructure improvements to a high school campus.

RFID Parking Lots at Various Facilities
Anheuser-Busch, Inc.

Structural Engineer for four breweries in Virginia, New York, Texas and Florida light poles and some drafting of contract documents.

Route 364, Phase 3 – Design/Build | Missouri Department of Transportation (MoDOT), St. Louis District
St. Charles County, MO

Project included the design and construction of 9 miles of new 4-lane freeway extending Rte. 364 from Mid-Rivers Mall Drive to I-64 in St. Charles County. *Engineer of Record for:* dual steel bridges with variable skewed abutments at Route K which is part of a single point urban interchange (SPUI); dual 212-ft two-span concrete girder bridges over Dardenne Creek; single span concrete girder structure of Tributary B. *Bridge Engineer for:* 200-ft long 2-span bridge carrying Gutermuth Road over Rte. 364, dual 72-ft simple span bridges over Hanley Road. All work was completed in 9 months.

I-64 Approach to Poplar Street Bridge, City of St. Louis
Missouri Department of Transportation

Project Engineer for evaluation and rehabilitation of dual 8000-ft-long structures that approach Poplar Street Bridge on the Missouri side. Project included evaluation of the deck using infrared and ground penetrating technology to aid in finding the best retrofit strategy. The final plans included a concrete overlay for most of the bridge, with epoxy polymer concrete overlay used where weight or vertical clearance is an issue. Many different overlay strategies were investigated and hydro demolition JSP was re-written to improve quality and speed. The design also included the replacement of 37 expansion joints. Project challenges included a short time-line to develop final plans, construction sequencing to minimize traffic disturbances and unique funding limitations. This project required close coordination with MoDOT at the District and Bridge Division.



JOHN C. FRISCH, P.E.
Senior Project Engineer
Electrical Engineering

John Frisch is an electrical engineer with over 10 years of combined design and field experience. His areas of specialization include lighting, controls, power systems and related elements for commercial, education and institutional facilities; power plants; large government installations; emergency response facilities; roadways; and water and wastewater treatment facilities.

Washington Headquarters Services-BRAC 133 | Alexandria, VA
US Army Corps of Engineers, New York District

Electrical Engineer for reviewing construction documents for compliance with RFP; verifying code compliance; and evaluation of best design practices.

New Water Treatment Plant
City of Crystal City, MO

Electrical Engineering for design of the proposed new 1.2 MGD water treatment plant for the City of Crystal City, Missouri, to replace the existing 57-year-old treatment plant. Project involves the rehabilitation of the old Pittsburg Plate Glass (PPG) collector well located along the Mississippi River, reviewing the feasibility of alluvial wells in the area, and review of two treatment plant design options including conventional lime softening using lime slaking and gravity filtration or the use of green sand pressure filters prior to nano-filtration membranes.

Raw Water Transmission Line Replacement
City of Hannibal, MO

Electrical Engineering for SCADA and controls upgrades as part of the replacement of existing 14- and 20-inch-diameter transmission lines with two new parallel 18-inch-diameter, ductile iron pipes, approximately 4,300 feet long. The new alignment provides a common corridor for a new SCADA communication line, a secondary power source between the plant and pump station, and new outfall pipe for the residuals line, if required.

UV Disinfection System
City of Hannibal, MO

Electrical Engineering for the design of an ultraviolet disinfection system for the City's water treatment plant. The new UV disinfection system will be housed in a new building. The UV system will consist of two UV reactors with medium pressure mercury vapor lights and associated piping and controls. One UV reactor will be a standby unit.

ADM Collector Well | Decatur, IL
Robinson Construction Company

Electrical Engineer for the construction of a new collector well at the ADM facility in Decatur, Illinois.

ADAL Communication Facility (P8) | Springfield, IL
Illinois Air National Guard

Lead Electrical Engineer for 8,000-sq-ft of remodeled space plus 3,000-sq-ft of new construction for main communication facility for the Illinois Air National Guard in Springfield. Responsibilities included power distribution, lighting design, lighting protection and grounding. Project was phased to allow the main telephone switch room to remain in operation during demolition and construction. Responsible for construction support including answering RFI's and shop drawing approval.

EDUCATION

B.S., Electrical Engineering, Rose-Hulman Institute of Technology, 1999

REGISTRATIONS

Registered Professional Engineer: Missouri

PROFESSIONAL ACTIVITIES

Member, Institute of Electrical and Electronic Engineers

Member, Power Engineering Society

**New Armed Forces Services Center | Farmingdale, Long Island, NY
New York Army National Guard**

Electrical Engineer for 185,471 SF of space in the Readiness Center and 21,609 SF of Field Maintenance Shop space. The facility is to be a joint facility used by the Army National Guard, Army Reserves, Marine Reserves, and potentially the Naval Reserves. Each Service Component will have their own specialized individual work spaces, but where appropriate, common spaces will be combined for use by all the groups. The project is a scheduled BRAC project. The project is to be self-certified with a LEED goal of Silver.

Responsible for preliminary load calculations and short-circuit analysis for the electrical system, design of the lightning protection system for the building. Also actively involved in type "C" services and given the task of reviewing all the electrical shop drawings, answering all electrical RFI's from contractor. Other duties included electrical design changes that arose throughout the construction process and numerous site visits for construction progress meetings and walk-throughs.

**BRAC-Add to Alert Complex Building 566
Selfridge Air National Guard Base, MI**

Lead Electrical Engineer for design services for the necessary facilities for Aerospace Ground Equipment (ASE) to support the alert aircraft as a standalone detachment. The existing alert complex has adequate space to accommodate the new facility areas, but an upgrade is required to provide adequate conditions. The new areas are to include an Aerospace Ground Equipment Maintenance Shops and Storage. Included with these areas will be fire protection modifications and modifying existing utilities systems and/or provide new systems as required. Responsibilities included all aspects of electrical design including power distribution, grounding, lighting design, telecommunications, fire alarm systems. Also performed design duties that included lighting and electrical load calculations.

**Add to A10 Fuel Cell Corrosion Hangar Building 154
Selfridge Air National Guard Base, MI**

Lead Electrical Engineer for design services to convert an existing 15 PAA F-16 wing hangar to a 24 PAA A-10 hangar. The existing hangar is wide enough, but not deep enough to accommodate the A-10 aircraft. In addition to extending the depth of the hangar, additional scope of work includes replacing or reusing the existing hangar doors, modifications to the fire protection system and access pavements. Responsible for all aspects of electrical design including power distribution, grounding, lighting design. Also performed design duties that included lighting and electrical load calculations.

**Ellington Field, ASOS (Air Support Operations Squadron) Beddown | Houston, TX
Texas Air National Guard**

Lead Electrical Engineer for a new facility of approximately 35,000-sq-ft which will include operations and support space, shop area, vehicle storage area, and a vehicle wash rack area. Responsible for all aspects of electrical design including power distribution, grounding, lighting design, telecommunications. Also performed design duties that included site lighting, lighting and electrical load calculations. Additional duties included answering RFI's and reviewing product submittals during construction phase.

**F-16 Mission Training Center (MTC) Flight Simulator Facility, Kelly Field | San Antonio, TX
Lackland AFB**

Lead Electrical Engineer for A/E design services for the conversion of 6,000 square feet of an existing prefabricated metal building (building 937) currently used for general storage and the addition of 3,340 square feet to said building into an F-16 Mission Training Center (MTC) Flight Simulator Training Facility. The F-16 Mission Training Center houses four simulator bays, classrooms, briefing areas, and support/equipment maintenance space. The center must also support the Regular Air Force, Reserve, and Air Guard air crews scheduled to attend training. The simulator bays must be windowless rooms, as the simulators require complete darkness. Responsibilities included several aspects of electrical design including power distribution, grounding, lighting design and lightning protection. Also performed design duties that included specification writing, lighting and electrical load calculations, and for answering RFI's and reviewing product submittals during construction phase.

William B. Kremer, PE | Senior Associate

LEAD GEOTECHNICAL ENGINEER

EDUCATION

Graduate Studies, Geotechnical Engineering, University of Missouri at Rolla, 1984
BS, Civil Engineering, University of Missouri at Rolla, 1981

REGISTRATION

Professional Engineer-Civil, Missouri, E-23952

CERTIFICATIONS

Missouri Well Drillers and Pump Installer Restricted Permit
USACE Levee Inspection Workshop

EXPERIENCE OVERVIEW

Bill is an experienced geotechnical engineer who has worked on many of St. Louis's most notable projects. He has practical experience and technical capability in soil mechanics, hydrology, hydrogeology, and surveying and is adept at planning and overseeing large-scale geotechnical investigations. He oversees field reconnaissance, subsurface exploration, laboratory testing, and the development of design recommendations for a wide variety of infrastructure and vertical construction projects. In addition, he provides engineering services such as instrumentation, construction monitoring, and surveying.

Bill started his career with the U.S. Army Corps of Engineers, where he was involved in seepage, stability, and pile analyses for the Illinois River Levee System; Clarence Cannon Dam in Ralls County, MO; and Lock & Dam No. 26(R) projects.

Saint Louis Flood Protection System, Saint Louis, MO. Project Manager for the geotechnical evaluation of the St. Louis Flood Protection System (STLFPS) located within the Mississippi River floodplain. The purpose of this study was to provide supporting data to meet certification requirements for the flood protection system as outlined by the Federal Emergency Management Agency (FEMA). The STLFPS consists of a 10.9-mile system of floodwalls and levees. Various foundation and structural designs are used throughout the STLFPS depending on the soil and subsurface conditions. The scope of this study included a review of the STLFPS to become familiar with the configuration and to identify pertinent available foundation and soils information. The review included a site reconnaissance to observe existing conditions; a review of existing documentation concerning the design, construction and performance of the STLFPS; and a review of exploratory boring and laboratory testing. The scope also included identifying and selecting soil parameters based on the available subsurface information. Geotechnical analyses included review of global stability and underseepage at selected embankment and floodwall locations, embankment erosion protection, and settlement relative to freeboard standards.

USACE Saint Louis District, Sainte Genevieve Flood Protection Project, Sainte Genevieve, MO. Project Engineer for an independent geotechnical review of all design features for a new urban levee. Shannon & Wilson also provided construction monitoring and quality assurance/quality control for the levee.

USACE St. Louis District, Periodic Levee Inspections, Cape Girardeau, Saint Genevieve, MO. Project Manager for the levee periodic inspection to verify proper operation and maintenance, evaluate operational adequacy and structural stability, review design criteria to identify changes in current design standards, identify features to monitor over time, and improve the ability to communicate the overall condition. Bill led the team that performed periodic inspections on the Ste. Genevieve #3 Levee System in Ste. Genevieve, Missouri and the North Main Street Levee System in Cape Girardeau, Missouri.

Festus-Crystal City Levee, Festus, MO. Project Manager for Quality Assurance/Quality Control services during the construction of a 500-year flood protection levee, mechanically stabilized embankment, pump station, and railroad closure structure.

Union Pacific Railroad, Selma Farm Levee, Selma, MO. Geotechnical Engineer for the design of a 1,000-foot-long, 30-foot-high levee in southeast Missouri.

Grand Tower Levee, Grand Tower, IL. Project Manager for the repair of an existing 15-ft-high agricultural levee. The Corps of Engineers is repairing slides along this 5-mile-long levee. Shannon & Wilson provided monitoring of the repair and geotechnical laboratory testing for approximately 60 individual slides.

River City Casino Access Road, Lemay, MO. Project Manager for the geotechnical investigation for a new four-lane road running from Interstate 55 at the Carondelet Boulevard exit to the site of the Pinnacle Casino development. The road is carried by two bridges. The first bridge is near existing grade and spans Kayser Creek. The second bridge spans the Union Pacific Rail Yard. Both bridges bear on H-piles driven to bedrock. Bill oversaw the field and laboratory testing programs; performed engineering analysis of the collected data; and developed design recommendations for foundations, earthwork, and pavements for the road, the bridge, and the approach embankments. To counteract the presence of soft, alluvial subsoil, Bill proposed the use of lightweight fill to address slope stability, bearing pressure, settlement, and global stability of the approach embankments.

Arnold Tenbrook Road Relocation, Saint Louis, MO. Project Manager for the geotechnical investigation for the construction of a new 4,200-lineal-foot collector roadway connecting an existing industrial area to Missouri Highway 231 (Telegraph Road). The new roadway was designed with two 12-foot lanes and 8-foot-wide shoulders with a design speed of 40 miles per hour. Most of the alignment crosses the Meramec River flood plain. The northern half of the roadway required an average fill height of 10 feet and most of the southern half required embankment fills of 20 to 35 feet in thickness to keep the roadway above the 100-year flood elevation. A three-span, 165-foot-long bridge was also constructed over Pomme Creek near Telegraph Road. The total surface area of construction was on the order of 13 acres with 9 in the flood plain and over 5 within forested wetlands.

Saline Creek Wastewater Treatment Plant Expansion, Fenton, MO. Project Manager for the geotechnical exploration and report for treatment plant expansion near the Meramec River. The completed facility consists of three clarifiers, two oxidation ditches, two sludge basins, one flow equalization basin, and miscellaneous one-story structures to be used for storage and offices.

Times Beach Remediation, Times Beach, MO. Project and Quality Assurance Manager for testing of earthwork, including the ring levee, access roads, and landfill cells.

Jacob T. Bilello, PE | Principal Engineer

GEOTECHNICAL ENGINEER

EDUCATION

ME, Geotechnics, Missouri University of Science and Technology, 2011

BS, Geological Engineering, University of Missouri at Rolla, 1999

REGISTRATION

Professional Engineer-Civil, Missouri, PE-2004017134

CERTIFICATIONS

Nuclear Gauge Safety Trained and Certified

USACE Construction Quality Management for Contractors

EXPERIENCE OVERVIEW

Jake joined Shannon & Wilson in 2008 and serves as project manager and geotechnical engineer. He has performed a wide variety of geotechnical investigations and geotechnical design projects. His duties include design and implementation of geotechnical investigations involving field reconnaissance, subsurface exploration, laboratory testing, and design recommendations for residential, commercial, and industrial sites.

USACE Memphis District, Periodic Levee Inspections, Various Locations, AR. Jake performed inspection of 117 miles of levee embankments, floodwalls, and closure structures extending from St. Francis, Arkansas to the end of the levee system near Wayne, Arkansas. The inspection consisted of walking the levee and using USACE's levee inspection system tool (LIS) to note potential problems with the levee. Jake was also involved in the preparation of the reports documenting the condition of the levees.

USACE St. Louis District, Periodic Levee Inspections, Cape Girardeau, Saint Genevieve, MO. Geotechnical Engineer and Inspector for 2 miles of levee embankments, floodwalls, closure structures, and pump stations in Cape Girardeau, Missouri. Jake walked the levee alignment documenting conditions encountered and prepared Periodic Inspection reports for the U.S. Army Corps of Engineers, Saint Louis District.

FutureGen 2.0, Meredosia, IL. Project Geotechnical Engineer for the geotechnical investigation and design recommendations for foundations and earthwork for the conversion of a traditional coal power plant to a first-of-its-kind, near-zero emissions coal-fueled power plant. The conversion incorporates new equipment and re-use of foundations for existing equipment. Duties included the organization and interpretation of laboratory data for preparation of a Geotechnical Data Report; shallow foundation analysis including settlement predictions; lateral earth pressure analysis; evaluation of corrosion potential; and development of general earthwork recommendations for the site, and for heavy haul roads and coal runoff ponds.

Harper Lake Dam, French Village, MO. Project Manager for the exploration of subsurface conditions, laboratory testing, slope stability analysis, preparation of geotechnical report and slope failure repair plans, and obtaining of construction and operating permits from Missouri Department of Natural Resources for an existing 600-foot-long dam with a maximum height of 37 feet. Jake also performed construction observation and materials testing and prepared as-built plan.

N. Kyle Tabor, PE | Senior Engineer

GEOTECHNICAL LEAD ENGINEER

EDUCATION

MS, Civil Engineering, University of Missouri at Columbia, 2007

BS, Civil Engineering, University of Missouri at Columbia, 2005

REGISTRATION

Professional Engineer-Civil, Missouri, 2012000058

CERTIFICATIONS

USACE Levee Inspection Workshop

American Concrete Institute Field Testing Technician, Grade 1

Nuclear Gauge Safety Trained and Certified

OSHA 10 Hour (Construction Industry 29 CFR 1926)

EXPERIENCE OVERVIEW

Kyle joined Shannon & Wilson in June 2007 and serves as a geotechnical Senior Engineer. He has performed a wide variety of projects, from hydraulic analysis of stream restorations to geotechnical investigations and geotechnical design projects. His duties include design and implementation of geotechnical investigations involving field reconnaissance, subsurface exploration, laboratory testing, and design recommendations for residential, commercial, and industrial sites.

USACE St. Louis District, Periodic Levee Inspections, Cape Girardeau, Saint Genevieve, MO.

Project Engineer performing periodic inspection of levee systems to find deficiencies that may impact system performance during flooding events. Responsibilities included researching and reviewing original design documents and performing a design criteria review to compare original design to current design standards. Kyle also wrote the pre-inspection packet, performed field inspections, and operated the Levee Inspection System (LIS) computer tablet which was used to collect inspection data and GPS locations.

Howard Bend Levee, Maryland Heights, MO. Designed relief wells and a seepage berm for the Creve Coeur Creek outlet structure.

Ameren Wood River - Stallings Line, East Alton, IL. Project Manager for the geotechnical investigation for eleven transmission line towers between 85 and 100 feet in height. Kyle oversaw the subsurface exploration, laboratory testing of collected soil samples, and engineering analyses. He also provided construction recommendations for pier construction, including inspection, pier excavation, control of water, and concrete placement.

Columbia River Crossing, Portland, OR. Kyle performed deep foundation analysis for piles and drilled shafts for a new bridge carrying Interstate 5 across the Columbia River. The drilled shafts were 10 feet in diameter and extended 200-300 feet deep.

Scott B. Garbs, RG, PG | Senior Principal Geologist
PROJECT GEOLOGIST

EDUCATION

BS, Earth Sciences, Southern Illinois University, 1982

REGISTRATION

Registered Geologist, Missouri, 0846

EXPERIENCE OVERVIEW

Scott has been involved in many facets of geologic engineering, including field reconnaissance, exploration, laboratory work, quality control, design, and systems installation. He has worked on such projects as deep, high-capacity, drilled pier installations; tunnel enlargement/rehabilitation; instrumentation installation and monitoring; hazardous waste removal and in situ treatment; temporary shoring; engineered fill; auger-cast pile installation; concrete testing; surveying; ground water monitoring; and shallow, low-capacity foundations.

East Cape Levee, McClure, MO. Monitored/documented the sonic drilling crew work and prepared descriptive boring logs. The primary purpose for having a sonic rig on the project was to drill into and install 2-inch-diameter monitoring wells in the bedrock that would be sampled for various groundwater contaminants. A significant part of this work was documenting to verify compliance with the project standard operating procedures which included assisting the contractor in resolving problems, preparing detailed descriptions of daily events, well installation documentation, PPE used, decontamination procedures, and disposition of waste.

Non-urban Levee Evaluation for the Sacramento & San Joaquin River Flood Control System, Sacramento, CA. Project Geologist. Observed and documented investigative drilling activities for geotechnical levee investigations and feasibility studies of non-urban levees. To date, Scott has provided on-site logging services for borings as part of the PIGDR effort for the RD 403, Rough and Ready Island Levee. As such, Scott was responsible for developing the specific field forms and procedures to be used to meet DWR's logging standards. The final products of our work were Geotechnical Evaluation Reports (GERs) that document levee subsurface geotechnical conditions, analyze those conditions as they relate to the project, and assess impacts of the geotechnical conditions on the stability, settlement, seepage, erosion, geomorphic, and seismic characteristics of the project levees.

USACE, Omaha District, Dam Safety Instrumentation Installation, Inspection, Rehabilitation, Repair, and Replacement, Northcentral, USVAR. On-site, Field Operations manager for the installation, response testing, rehabilitation, repair and abandonment of open-tube instruments in 20 dams at nine sites spread across Nebraska, Colorado, South Dakota, North Dakota, and Montana. The purpose of the work was to install new, open-tube instruments; response test, rehabilitate and repair, existing open-tube instruments; and abandon open-tube instruments. Scott's other duties included performing various tests, managing field staff, down-loading and transmitting test results to the main office, planning upcoming work, liaising with USACE staff, and coordinating with partner subcontractors.



D. SCOPE OF SERVICES

The scope of services presented below for the New Haven Levee Accreditation Project are based on the federal levee accreditation requirements listed under 44 CFR 65.10, the City's RFP and on similar projects that the Horner & Shifrin/Shannon & Wilson team have completed for the cities of St. Louis and Cape Girardeau, Missouri.

Introduction

The services to be performed shall consist of furnishing the professional, technical, and other services necessary for the accreditation of the New Haven Flood Protection System. This includes compilation of existing levee data; making site visits; attendance at various meetings; performing numerous engineering studies, investigations, and analyses of hydraulic, hydrologic, structural, and geotechnical data; investigating interior drainage behind levees; performing system evaluations of emergency response plans and status, probability of levee failure and consequences analysis, and preparation of the final levee accreditation report (LAR) to show that the levee meets the requirements of Section 65.10 of the NFIP Regulations for submission to FEMA.

The levee is an earthen berm structure approximately 2,230 feet in length on the right bank of the Missouri River and includes six drainage structures and one pumping plant (sanitary lift station). All work on this project will be in English units.

Principles of Accreditation

The accreditation will be based on the principles of the USACE "Certification of Levee Systems for the National Flood Insurance Program", dated September 12, 2007. The procedure outlined in this document will satisfy FEMA requirements.

References for the analysis of the existing levee system will be as follows:

- a. Engineer Regulation (ER) 1110-2-100, 15 February 1995, Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures.
- b. ER 1110-1-12, 21 July 2006, Quality Management.
- c. ER 1110-2-1405, 30 September 1982, Hydraulic Design for Local Flood Protection Projects.
- d. Engineering Manual (EM) 1110-2-1418, 31 October 1994, Channel Stability Assessment for Flood Control Projects.
- e. EM 1110-2-1601, 30 June 1994, Hydraulic Design of Flood Control Channels.
- f. EM 1110-2-1416, 15 October 1993, River Hydraulics
- g. EM 1110-2-1913, 30 April 2000, Design and Construction of Levees.
- h. EM 1110-1-1904, 30 September 1990, Settlement Analysis.
- i. EM 1110-2-1901, 30 April 1993, Seepage Analysis and Control for Dams.
- j. ETL 1110-2-569, 1 May 2005, Engineering and Design, Design Guidance for Levee Under-seepage
- k. EM 1110-2-1902, 31 October 2003, Slope Stability.
- l. EM 1110-2-1908, 30 June 1995, Instrumentation of Embankment Dams and Levees
- m. EM 1110-2-1914, 29 May 1992, Design, Construction and Maintenance of Relief Wells.
- n. ER 1110-2-1806, 31 July 1995, Earthquake Design and Evaluation for Civil Works Projects.
- o. EM 1110-2-2705, 31 March 1994, Structural Design of Closure Structures for Local Flood Control Protection Projects.
- p. EM 1110-2-2007, 30 April 1995, Structural Design of Concrete Lined Flood Control Channels.
- q. EM 1110-2-2100, 01 December 2005, Stability Analysis of Concrete Structures.
- r. EM 1110-2-2104, 20 Aug 03 (Change 1), Strength Design for Reinforced Concrete Hydraulic Structures.
- s. EM 1110-2-2105, 31 May 1994 (Change 1), Design of Hydraulic Steel Structures.

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- t. EM 1110-2-2502, 29 September 1989, Retaining and Flood Walls.
 - u. EM 1110-2-2504, 31 March 1994, Design of Sheet Pile Walls.
 - v. EM 1110-2-2705, 31 March 1994, Structural Design of Closure Structures for Local Flood Protection Projects.
 - w. EM 1110-2-2902, 31 March 1998 (Change 1), Conduits, Culverts, and Pipes.
 - x. EM 1110-2-2906, 01 5 January 1991, Design of Pile Foundations.
 - y. EM 1110-2-6054, 01 December 2001, Inspection, Evaluation and Repair of Hydraulic Steel Structures.
 - z. EM 1110-2-2002, 30 June 1995, Evaluation and Repair of Concrete Structures.
 - aa. ER 1110-2-8157, 31 Jan 1997, Responsibility for Hydraulic Steel Structures.
 - bb. EM 1110-2-3105, 30 November 1999, Mechanical and Electrical Design of Pumping Stations
 - cc. EM 1110-2-3102, February 1995, General Principles of Pumping Station Design and Layout.
 - dd. Engineering Technical Letter (ETL) 1110-2-571, 10 April 2009, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures.
 - ee. Engineering Circular (EC) 1110-2-6065, 1 July 2007, Engineering and Design - Comprehensive Evaluation of Project Datum.
 - ff. EC 1110-2-6058, 20 November 2005, Stability analysis of Concrete Structures.
 - gg. Engineering Regulation (ER) 1110-2-8160, 1 March 2009, Policies for Referencing Project Elevation Grades to Nationwide Vertical Datum.

Field Survey Data

Field surveys will be performed to provide cross-sections along the length of the levee at 100 feet on center and at other areas of special interest. A survey along the centerline of the top-of-levee will also be performed.

Geotechnical Borings

In addition to soil data shown on the as-built drawings, additional borings will be taken on top of the levee system, on the riverside of the levee, and at special areas of concern. The actual number and specific locations of the borings will be determined by Shannon & Wilson.

Interior Drainage Study

In order to verify the validity of the existing interior drainage system of the levee system, a review of the depicted local flooding and its sources will be made. Comparison of currently mapped areas and the volumes they contain with estimated runoffs from their contributing rainfall areas will be performed. A review of the pumping capacity and gravity outlet characteristics of the storm-water conveyance through the flood protection line to the river will be made. Re-analysis of the coincident flooded areas is included.

Hydraulic Analysis

A hydraulic study, based on the USACE method of probabilistic risk-based analysis, will be provided that considers the probability of exceedance and uncertainty of the levee containment. This analysis shall include a probabilistic treatment of the types of events that alone, or in concert with other events, produce a level of flooding that results in a 1% chance of exceedance of the levee system protection. This level will then be compared to the height of levee protection.

Levee Drainage Structures

There are a total of 6 drainage structures along the levee system. Horner & Shifrin will review the designs of the drainage structures based on the references above and physically inspect the structures to assess their current condition.



As-built Plans

A certified set of as-built plans will be provided to FEMA, based on plan information provided. The plans provided by the City/USACE will be compared to the existing construction, by comparing the plans to findings obtained during field inspections. The plan set will be organized so that elements of the system that have been reconstructed or replaced will be correctly included. The Consultant shall not be responsible for the accuracy of the plans regarding hidden defects or conditions that are not readily discernible based upon completion of the services and tasks described above.

Levee Embankment & Foundation Stability (Geotechnical Evaluation)

The levee embankment protection will be assessed for compliance with the following criteria: (1) that no appreciable erosion of the levee embankment can be expected during the base flood, and (2) anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. Factors to be addressed in such analyses include the following actions or such actions as the H&S/S&W team may consider:

- a. Expected flow velocities (especially in constricted areas);
- b. Expected wind & wave action;
- c. Ice loading;
- d. Impact of debris;
- e. Slope protection techniques;
- f. Duration of flooding at various stages & velocities;
- g. Embankment and foundation materials;
- h. Levee alignment, bend, and transitions; and
- i. Levee side slopes.

Embankment and foundation stability will be analyzed to demonstrate that seepage into or through the levee foundation and embankment during loading conditions associated with the base flood will not jeopardize embankment or foundation stability. Factors to be addressed shall be:

- a. Depth of flooding;
- b. Duration of flooding;
- c. Embankment geometry and length of seepage path at critical locations;
- d. Embankment and foundation materials;
- e. Embankment compaction;
- f. Penetrations;
- g. Other design factors affecting seepage (e.g. drainage layers);
- h. Other design factors affecting embankment and foundation stability (e.g. berms)
- i. Review corrugated metal pipe (CMP) inspection records & reports.

The potential and magnitude of future losses of freeboard as a result of levee settlement will be assessed. Any reduced freeboard resulting from settlement will be compared to the minimum freeboard standards. This analysis will address:

- a. Embankment loads;
- b. Compressibility of embankment soils;
- c. Compressibility of foundation soils;
- d. Age of the levee system; and
- e. Construction compaction methods



Levee Pumping Station

An electrical and mechanical condition assessment will be performed, similar to the same process as done during the Periodic inspections, of the system pump stations to determine failure modes of pump stations and drainage structures. The following list of items which may contribute to pump station failure modes will be considered in the accreditation determination:

- a. Plant building;
- b. Pumps;
- c. Motors, engines, fans, gear reducers, etc.;
- d. Power supply;
- e. Megger testing on pump motors;
- f. Motor control center;
- g. Enclosures, panel, conduit and ducts;
- h. Circuit breakers;
- i. Instruments;
- j. Sumps/wet well;
- k. Intake & discharge pipes;
- l. Flap gates/flap valves/pinch valves;
- m. Trash racks;
- n. Sluice/slide gates;
- o. Fuel systems for pump engines.

Site Visits

Site visits will be conducted to collect pertinent information to support the accreditation determination and/or to identify areas that need further analyses. The entire length of the levee system shall be walked to physically inspect all aspects of the system.

Sewer Inspections

There are sewers of various sizes along the Protection System. If it becomes advisable based on inability to directly inspect the condition of the sewers, a contract supplemental agreement may be necessary.

Emergency Response Plan

A status review will be made of the City's Emergency Response Plan. Should there be opportunities for improvements recognized in this review; recommendations for such improvements will be made to the City.

Levee System Operation and Maintenance Plan

Levee systems must be operated and maintained in accordance with an officially adopted O&M plan and a copy of this plan must be provided to FEMA. The O&M plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained.

The levee system O&M plan, as adopted by the City, shall be evaluated to ensure compliance with the accreditation requirements. A list of maintenance activities to be performed; the frequency of their performance; and the person by name or title responsible for their performance; shall be included in the O&M plan.



Levee Accreditation Report

After all field survey and geotechnical data have been completed, and all inspections, structural and hydraulic analyses have been performed in accordance with 44 CFR 65.10, a draft of the Levee Accreditation Report (LAR) shall be prepared for review by the City. As-built drawings and exhibits shall be prepared for inclusion into the LAR. Based upon review comments, the first draft will be edited and the Final LAR will be prepared, certified, and delivered to the City.

The Accreditation Report is not intended to be a warranty or guarantee of performance. The accreditation will only be good for a 5-year period from the date of the Letter of Certification. The accreditation will only consider the 100-year flood event as required by FEMA, and will provide data and documentation to show that the levee meets the requirements of Section 65.10 of the National Flood Insurance Program (NFIP) regulations.

Assist City in Evaluating Options for Meeting Freeboard Requirements

The Horner & Shifrin/Shannon & Wilson team will evaluate options to meet the federal freeboard requirements and prepare an alternative analysis report for the City's consideration. Based on the City's RFP, it is our understanding that an evaluation of methods to raise the levee elevation by approximately three feet would be necessary.

Scope Exclusions

The following items are specifically excluded from the accreditation portion of the scope of work and shall be performed by others, or shall be authorized as additional services:

1. There will be no responsibility for finding existing, hidden flaws or defects in the levee system except for those that would be reasonably identifiable by the analyses as described above.
2. No "flood-fighting" (levee system will need constant surveillance and immediate action if local failures present themselves) will be required, should any flood failures occur during the preparation of this report. Continued surveillance of the levee system, to ensure the condition of the levee does not deteriorate or change over time from conditions at the time these accreditation services are being performed, will not be required.
3. Engineering for any special repairs or additional construction is not included.
4. Accreditation of as-built drawings will not be required for features of the existing levee system for which no engineering plans exist. Only existing as-built drawings of the levee system which are furnished shall be reviewed and certified.
5. Mapping of utilities is not included.



E. PROJECT SCHEDULE AND FEE PROPOSAL

The schedule and fee presented below for the New Haven Levee Accreditation Project are based on the scope of work described in the previous section and on similar projects that the Horner & Shifrin/Shannon & Wilson team have completed for the cities of St. Louis and Cape Girardeau, Missouri.

Schedule

The Horner & Shifrin/Shannon & Wilson team would expect to complete the scope of work described in the previous section in approximately 5 months. The adherence to this schedule is, of course, contingent on timely receipt from the City of information needed by the H&S/S&W team to carry out this assignment, prompt review and return of all documents submitted to the City for comment and/or approval, and the physical accessibility to complete the geotechnical testing and levee inspections. The timeline is especially dependent on rainfall and Missouri River stages.

The major deadlines anticipated by the H&S/S&W team are as follows:

Complete Borings	15 calendar days after notice to proceed.
Complete Levee Inspections	30 calendar days after notice to proceed.
Geotechnical Laboratory Testing Complete	45 calendar days after notice to proceed.
Draft Final Levee Accreditation Report	90 calendar days after notice to proceed.
Deliver Final Levee Accreditation Report	120 calendar days after notice to proceed.
Draft Final Freeboard Alternative Analysis Report	135 calendar days after notice to proceed.
Deliver Final Freeboard Alternative Analysis Report	150 calendar days after notice to proceed.

Fee

The anticipated fee for completion of the scope of work described in the previous section is in the range of \$150,000 to \$225,000. The greatest variable in the fee estimate is the level of detail that the City would expect for the Freeboard Alternative Analysis Report. A conceptual design report would result in a fee towards the low end of the scale. A more detailed, preliminary design report would require additional testing and analysis resulting in a fee towards the high end of the scale.



F. SUBCONSULTANT

Horner & Shifrin has teamed with Shannon & Wilson, Inc. to provide geotechnical engineering services. Shannon & Wilson is a nationally recognized leader in the field of geotechnical engineering. Resumes for S&W key personnel are included in Section C. A brief firm overview and project examples are included on the following pages.



Statement of Qualifications for Levee Projects

Shannon & Wilson has a local presence with local knowledge backed by a national reputation for providing geotechnical engineering to support the design and construction of dams, levees, and appurtenant structures. Since its founding in Seattle in 1954, Shannon & Wilson has been a major provider of geotechnical engineering, applied geosciences, and environmental services. Our staff includes geotechnical engineers, civil engineers, geologists, hydrogeologists, and environmental scientists with significant experience in



exploration, engineering analysis and design, and construction administration, in eleven regional offices. With this staff Shannon & Wilson has played a key role in the design and construction of many complex and challenging projects across the country.

Established in 1954, Shannon & Wilson has earned the respect of our federal, state, and municipal clients, and peers within the A&E community for our work on many of the nation's most challenging projects. We provide practical geotechnical consulting based on our prior experience and our designs are constructible. We have built our record of accomplishment and successful service through responsive management practices, technically superior services, and a strong commitment to partnering.

We are an employee-owned geotechnical and environmental consulting firm employing 300 in our offices in Sacramento and Los Angeles, California; Seattle and Richland, Washington; Anchorage and Fairbanks, Alaska; Saint Louis, Missouri; Madison, Wisconsin; Denver, Colorado; Portland, Oregon; and Jacksonville, Florida.

Shannon & Wilson is an applied geoscience consulting firm, recognized by our clients and peers to be among the national leaders in geotechnical and environmental consulting. Our capabilities include:

- ◆ Geotechnical investigations and engineering studies for
 - Earth dams and levees
 - Riverfront structures
 - Industrial facilities
 - Commercial structures
 - Trenchless pipeline river crossings
- ◆ Hydrogeologic and dewatering studies
- ◆ Instrumentation
- ◆ Site-specific earthquake engineering studies
- ◆ Environmental assessments

Flood Protection Project | Sainte Genevieve, Missouri

U.S. ARMY CORPS OF ENGINEERS, SAINT LOUIS DISTRICT



Shannon & Wilson performed a complete review and re-assessment of the geotechnical features of the proposed urban levee to be constructed to preserve the historical district of Sainte Genevieve to determine if cost savings could be realized through modification of design features.

An evaluation of laboratory testing results showed the top strata along the levee to be generally over consolidated due to historical loading and/or desiccation. Determination of the apparent over-consolidation ratios reduced the predicted settlement of the levee by a factor of two, resulting in a recommended overbuild for consolidation settlement of about one-half of that originally calculated.

A detailed evaluation of levee configuration was performed to determine if the levee section could be reduced and still meet the design requirements. After this evaluation, it was recommended that the crest width be reduced by 6 feet and that most slopes be changed from one vertical to four horizontal to one vertical to three horizontal. These modifications resulted in significant material and construction cost saving.



“Your in-depth and exhausting review of numerous proposed project alternatives and the subsequent project changes adopted, led to a significant savings for the city of Ste. Genevieve and the citizens of the United States.”

Col Thomas Seurmann, PE
USACE, Saint Louis District



somewhat higher permeability could be used for riverside facing, replacing select upland clay on many reaches of the proposed levee.

The pump station was originally planned to be located near the center of an abandoned slough. Review of the subsurface conditions and coordination with both the Structures and Hydraulics Branches resulted in a recommendation for relocation of the pump station to an area where deep compressible clays are not present. Additionally, a berm was recommended to offset an unbalanced earth pressure load that effectively removed the need for a deep foundation to resist lateral loading conditions.

Shannon & Wilson also performed construction monitoring and quality assurance/quality control for the levee.

Underseepage was evaluated using a three-dimensional finite difference model (MODFLOW) at complex structures and a two-dimensional finite element model (FASTSEEP) along multiple reaches, as well as the technique specified in the Division Regulation and EM 1110-2-1913. As a result, the volume of required seepage berms was reduced by about 40 percent and the number of relief wells was reduced from 41 to 8. Through-seepage was computed using the FASTSEEP model. It was determined that available valley borrow sources of



“Because of your efforts, we were able to significantly reduce the cost of this project. You were specifically selected for this study because of your reputation as a “champion” within your highly respected firm. In addition to contributing your technical expertise in an open-minded and proactive manner, your ability to work with other Value Engineering team members was exceptional.”

Eugene A. Degenhardt, PE, CVS
USACE, Saint Louis District



Howard Bend Levee | Maryland Heights, Missouri

HOWARD BEND LEVEE DISTRICT

Following the Flood of 1993, the Howard Bend Levee District proposed to improve an earthen levee along the Missouri River extending along the Missouri side of the river from approximately the City of St. Louis Water Plant downstream to the Westport development just south of I-70. Consideration has been given to providing protection to both the 100-year and 500-year flood design levels.

Our studies included a visual reconnaissance of the site, including several areas where the levee had overtopped or breached during the recent high water event; a field exploration consisting of approximately 70 test borings and probes characterizing the Missouri River Valley, from the surficial cohesive materials down through the sand and gravel aquifer to limestone bedrock; supporting laboratory testing; and engineering analyses.

Our analyses included levee stability studies; elastic and consolidation settlement predictions; development of underseepage protection measures considering pressure relief wells and landside underseepage berms; special considerations for existing roadways and pipelines; and foundation recommendations for flood walls, a railroad closure structure, and a pile-supported creek discharge structure, which transmits collected interior drainage to the Missouri River. We also provided the exploration and characterization of six riverside borrow areas, and for the crossing of an existing Metropolitan St. Louis Sewer District sludge lagoon. Our studies included consideration of usage and placement techniques for the lagoon biosolids within the levee embankment, to minimize the cost of excavation, removal, and disposal.

Laboratory testing to support the levee design included soil classification, moisture contents, grain size analyses, Atterberg limits, triaxial testing (Q and R bar), and consolidation tests.

Shannon & Wilson developed plans and specifications for all earthwork which includes a raised or realigned levee, continuous landside seepage berm, and repair of a major scour hole formed during the Flood of 1993.

During the current construction phase, laboratory testing includes modified moisture-density tests and maximum and minimum density tests. Field construction services include testing of concrete and soils placed in the levee as well as engineering consultation to assist with conditions encountered during the project.

Periodic Levee Inspections | Illinois and Arkansas

U.S. ARMY CORPS OF ENGINEERS, MEMPHIS DISTRICT



Shannon & Wilson performed periodic inspections of Systems 1, 2, 5, and 10 for the U.S. Army Corps of Engineers (USACE), Memphis District. For each levee system inspection, our detailed project plan included: schedule, delivery milestones, protocol for client communications, progress measuring and reporting, risk management strategy, quality control plan, change management strategy, detail inspection team composition, Independent Technical Review (ITR) Team composition, a project safety and health plan, and appropriate contact information.

We cataloged and reviewed the documentation provided by the Memphis District and requested data to fill identified gaps from USACE, the project sponsor and/or maintaining entity. Where possible, the system documentation was used to determine the design criteria used. Where documentation was lacking, we assumed the design criteria in effect at the time of the original design was used.

We then completed a walking inspection of the levee systems. We used a four-person team typically comprised of two geotechnical engineers and two experienced geologists. In general, we completed 3 to 10 miles of inspection per day and worked 6 days per week. No field inspections were conducted on the floodwall(s), pump stations, and closure structures. For these structures, our services were limited to a review of the design criteria and summarization of the findings from the periodic inspections performed previously by the Memphis District.

We prepared Periodic Inspection Reports, summarizing all data reviewed and collected in the field. Shannon & Wilson professionals not involved with any other aspect of the project performed an independent technical review on the draft report prior to its submittal to Memphis District.

CLIENT

Ms. Melissa Mullen, P.E.
U.S. Army Corps of Engineers, Memphis District
167 North Main Street, Suite 590
Memphis, TN 38103
901-544-3222

COMPLETION DATE

2010

FEE

\$1,416,981

Levee System 1

This levee system extends along the western bank of the Ohio River from just north of Mound City to just south of Cairo extending up the east bank of the Mississippi River from just south of Cairo to the Cache River, all in Illinois. The system consists of 18 miles of levee, 3 miles of floodwall, 4 pump stations, 5 drainage structures, and 16 closure structures.

Levee Systems 2 and 5

These levee systems extend generally along the western bank of the Mississippi River from Commerce, Missouri to the mouth of the St. Francis River just north of West Helena, Arkansas. The two systems consist of 292.25 miles of levee, 0.75 miles of floodwall, 2 pump stations, 7 drainage structures, and 1 closure structure.

Levee System 10

This levee system is along the West Bank of the St. Francis Floodway System in Arkansas and consists of 117 miles of levee; no floodwall, pump stations or closure

Post-Katrina Levee Analysis | New Orleans, Louisiana

U.S. ARMY CORPS OF ENGINEERS, VICKSBURG DISTRICT

New Orleans Levee Analysis Review

Shannon & Wilson worked with the Vicksburg District Corps of Engineers performing an independent review of site characterization and embankment stability at four sections of levees that failed in New Orleans after Hurricane Katrina. We performed the stability analyses using the computer program UTEXAS4 and compared those results to the stability results from the Corps. We also double-checked the stability analyses with the computer program Slope/W. Stability analyses were performed for water at the still water level and the top of wall level, with and without tension cracks using Spencer's Method. Results of the study were used to determine how the factors of safety varied with water elevation and with the development of a tension crack behind the sheet piles.

Floodwall Inspection of the West Bank and Vicinity Hurricane Protection Project



Shannon & Wilson performed a stability assessment of floodwalls at 16 pump stations and at other T-walls and I-walls located along a 50-mile stretch of levees that comprise the West Bank and Vicinity Hurricane Protection Project. A total of 34 sections were analyzed for water at the still water level and at the top of wall level, with and without tension cracks. Physical inspections were made of all the floodwalls; and stability analyses were performed using available

data provided by the U.S. Army Corps of Engineers. Stability analyses were performed on I-walls and T-walls using the computer programs Uplift and CWALSHT following the design criteria provided by the Corps. This work was performed under subcontract to Brown Cunningham & Gannuch for the New Orleans District Corps of Engineers and was to be completed in approximately one month—by the beginning of the hurricane season. Within three days after given the notice to proceed, representatives from Shannon & Wilson were in New Orleans. Staff from several offices was utilized for the analyses to meet the project deadline. Results of the study were used to determine which areas of the protection system had low factors of safety requiring further evaluation.

Levee Risk Methodology

Working with ERDC, Shannon & Wilson performed a worldwide literature search regarding levee risk analyses and prepared a report presenting the current state of the practice. The study summarized the known modes of failure, the causes that can lead to the modes, and historical records of annual flooding loss. The results of the study were used to categorize levee failures by several factors to use as an aid in creating a national levee inspection plan.

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Levees/Navigation Structures
Mechanical Engineering
Parking Structures
Parks and Recreation
Pedestrian and Bicycle Facilities
Plumbing Engineering
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Residuals/Biosolids Management
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Stormwater Engineering
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