"1,500-Foot" Sand Saltwater Intrusion Simulation and Management Using Scavenger Wells
Frank Tsai, LSU

Abstract: Saltwater intrusion in the "1,500-foot" sand of the Baton Rouge area is getting attention from the public since some Baton Rouge Water Company's water wells at Lula station are receiving undesirable chloride concentration. Using historical water well pumpage data, a calibrated model was completed to understand saltwater intrusion pattern from 1945 to 2010. The simulation result clearly showed a trend of saltwater intrusion toward Lula wells. It was predicted that at the current withdrawal rate chloride concentration at some Lula wells may exceed drinking water standard in next 10 years. To immediately stop saltwater approaching to Lula wells, this study considers scavenger wells in the model to extract salty water before it reaches the water wells. Twelve scavenging scenarios were designed and tested to find feasible solutions that could add at least 50 years of life to Lula wells. The impacts of scavenger wells on causing additional saltwater intrusion and additional drawdown were also evaluated.

Biography: Frank Tsai holds a B.S. degree in Agricultural Engineering from the National Chung Hsing University, Taiwan, an M.S. degree in Civil Engineering/Hydraulics from the National Taiwan University, and a Ph.D. degree in Civil Engineering/Water Resources Engineering from UCLA. He is an associate professor and has been with the LSU Department of Civil & Environmental Engineering since 2003. His research interests are groundwater flow, fate and transport modeling in aquifer systems, uncertainty analysis, surface water and groundwater conjunctive use, water resources system optimization and management, multi-reservoir operation optimization, and hydropower optimization.

October 8, 2010

Acid Mine Drainage: Formation, Mitigation, and Prevention
Judi Stoute, M.S.

Abstract: Acid mine drainage (AMD) is one of the predominant environmental challenges faced by coal mining activities. AMD primarily occurs through the oxidation and dissolution of pyrite, a process which ultimately forms sulfuric acid. Low pH conditions alone are harmful to most flora and fauna but also can mobilize metals in solution, often to toxic concentrations. Many factors determine the amount and rate of pyrite oxidation and the final pH of any water draining from the site. At sites where AMD has already been established, primarily abandoned mines, there are a number of mitigation options, including treatment systems of various designs. AMD treatment is a long term costly commitment, both to operators of active mines and state programs addressing abandoned mines. Current mining regulations stipulate prediction of the potential for AMD as well as operation plans designed to prevent it prior to permitting any new coal mine. The primary method of AMD prevention is special material handling involving the segregation of acid forming materials. The key to effective AMD control is a combination of careful mine planning and operator vigilance.
Biography: Judi Stoute studied geology at LSU, earning a BS in geology in 2004 and an MS in 2007. Her undergraduate research was on reconstructing the shape of deepwater turbidite flows in the Tanqua

Karoo Subbasin in South Africa, working with Arnold Bouma, the findings of which were published in the 2003 GCAGS transactions. Her master's research was on altered komatiites in the Barberton Greenstone Belt in South Africa and their implications for near-surface Archean environments, studying with Gary Byerly. Since graduation, she has worked in environmental consulting and as a state coal mining regulator.

September 10, 2010

"What Went Wrong"

Julius Langlinais

Abstract: Many rumors and opinions have circulated since the BP Macondo Well blew out and spilled a record amount of oil into the Gulf of Mexico. When hearings and depositions became available, I made my own attempt to explain what may have happened. With the small amount of data that became available and many calculations, I formed an opinion as to the causes of the blowout, which I have laid out in a PowerPoint presentation. As more data becomes available, that opinion may need revising.

Biography: I received my BS (1967) in Physics from ULL (then USL) in Lafayette, LA, and then received the PhD (1971) and MS in Physics from LSU. I taught 4 years at the University of Tampa for 4 years, and then joined Conoco as a Production Engineer in the New Orleans office in 1975. About 2½ years later, I joined Superior Oil Company as a Drilling Engineer. In 1980, I joined the Petroleum Engineering Dept at LSU, where I worked for 28 years. I retired in May, 2008.
During that time at LSU, I was the Associate Dean for the College of Engineering (1988-2003), and served as the interim Chairman for Petroleum Engineering for 1 year. Since retiring, I have worked on small consulting jobs. During the LSU years, my research and teaching focused on production and drilling, resulting in 23 refereed journal articles and 5 MS and 6 PhD students. Over the years, I have taught courses in Well Design, Petrophysics, Engineering Economy, and Advanced Production topics such as Two Phase Flow in Pipes, Nodal Analysis, and Artificial Lift. I was also an instructor in the Blowout Control Training Center during the 1980's.

May 14, 2010

3D Virtual Reality Investigations of Louisiana Geology - LIDAR Geomorphology Near Lafayette and Well-log Studies for Coalbed Natural Gas in Northern Louisiana

Gary L. Kinsland, University of Louisiana at Lafayette

Abstract: For several years Dr. Christoph Borst, in the Center for Advanced Computer Studies at UL Lafayette, and I have collaborated in developing techniques for displaying, interacting with and interpreting geologic data in 3D Virtual Reality (VR). Christoph's group has the capability to image data and the desire to create interaction tools…I have the data and the desire to interact with and interpret the data. Together we have developed some unique approaches to dealing with geologic data.

In our system LIDAR data from the area of Lafayette and Opelousas, LA exhibit details of Pleistocene fluvial geomorphology and faulting which we are interpreting to develop a detailed geologic history of the late Pleistocene. In the data we see meandering leveed distributaries emanating from an approximately 100 kya Red River deltaic system centered near Opelousas. These leveed distributaries are cut by faults which we think are cut by Pleistocene Mississippi River meander belts. After we work out the relative ages we are to work with Dr. Torbjorn Tornquist and Dr. Zhixiong Shen of Tulane to apply quartz luminescence dating to the identified features.

In our studies of northern Louisiana coalbed natural gas we have created a database of over 1000 digital well-logs. We have a system within which we display, interact with and are beginning to interpret these logs in 3D VR. My goal is to be able to walk amongst the subsurface of northern Louisiana interpreting as I go…in virtual reality.

It has been my experience that I see relationships in data much faster in 3D VR than when studying the data in 2D or in pseudo 3D. The interaction with the data is just so much more intuitive…it is like being at the outcrop. When I want to look at something that catches my eye I simply walk to it and look at it…both at the outcrop and in our 3D VR system.

Coauthor: Christoph Borst

Biography: Gary was born in Eugene, Oregon 6/10/47 and grew-up in southwestern Oregon. He graduated from Coquille High School in 1965. From 1965 until 1969 he attended the University of Rochester (U of R) in Rochester, N.Y. and received his B.S. in Physics. The next fall he entered the Geology program at the U of R and received an M.S. in 1971 and a Ph.D. in 1974 pursuing studies in high-pressure earth mantle mineral phases and strengths. After two years as a post-doc at U of R Gary took a visiting assistant professor job at Arizona State University for the 1976 -77 year where he learned and taught exploration geophysics. In the fall of 1977 he accepted a position at, then, USL here in Lafayette as a mineralogist/geophysicist. He has remained here, no longer teaches mineralogy, has concentrated on geophysics and petroleum geology and has recently become interested in applications of 3-D virtual reality to investigations in geophysics, geology and geomorphology. He is now a full professor holding the Pioneer Production Endowed Professorship in Geology and Petroleum Engineering.

April 9, 2010

Water Quality in Lake Pontchartrain April-October 2008 as a Response to the Bonnet Carre' Spillway opening, April 11 to May 8, 2008

Dennis Demcheck, U.S. Geological Survey

Abstract**:** The Bonnet Carre' Spillway, located 28 miles above New Orleans, was constructed in the early 1930s as part of an integrated flood-control system for the lower Mississippi River system. Heavy rains in the Mississippi River basin in early spring 2008 increased the pressure on levees along the lower Mississippi River, threatening the City of New Orleans. In response, on April 11 the U.S. Army Corps of Engineers (COE) opened the Spillway for the first time in eleven years. Mississippi River water was diverted into the 625-square mile Lake Pontchartrain. Average peak flows through the Spillway were about 169,000 cubic feet per second. The Spillway was closed on May 8.

On April 8 (3 days before the Spillway opened) the U.S. Geological Survey deployed a nitrate analyzer and a multi-parameter water-quality meter in Lake Pontchartrain to assess the water-quality effects of the diversion on the Lake. The 2 units were deployed at Lake Pontchartrain Causeway Crossover 7, about 3.5 miles from the south shore of the Lake. As part of this survey, water-quality samples of major inorganic ions, nutrients, chlorophyll, and triazine herbicides were collected within the Lake Pontchartrain basin either weekly or bi-weekly from April-September 2008 at 4 additional sites.

The water quality results were driven by inorganic chemistry (salinity, nitrates) during April and early May. The emphasis changed to eutrophication processes and algal blooms from mid-May through August. Phytoplankton data from the lake (as an indicator of water quality) illustrated an extended response from the river water even after traditional water- quality samples had indicated the lake had returned to pre-diversion conditions.

Paper co-author: Scott V. Mize

Biography**:** Dennis K. Demcheck received a B.S. in zoology from Louisiana State University in Baton Rouge in 1975 and began working for the U.S. Geological Survey in 1978. He has spent his entire 32-year career at the Louisiana Water Science Center in Baton Rouge. His specialties include water-quality studies of the lower Mississippi River, Lake Pontchartrain, and other southern Louisiana rivers and lakes. Currently he is the water-quality specialist and the study-unit chief for the Acadian-Pontchartrain National Water Quality Assessment program.

March 12, 2010

Geology and biodiversity in the Galapagos Archipelago, Ecuador

Dale Nyman, Nyman and Associates

Abstract**:** The Galapagos were made famous after Charles Darwin visited the archipelago in 1835 during his trip around the world on the HMS Beagle. Darwin spent a little over a month visiting several islands collecting specimens and taking notes on the many fascinating animal groups. After he returned to England and reviewed his notes and collections he concluded that several animal groups each started from a common ancestor. Because these groups were terretorial (lived on the same island or returned to a particular island to breed) over time they were forced to physically adapt as their habitat changed from a highly vegetated to a desert type of environment. Based on these observations Darwin wrote his most famous work--The Origin of Species.

Geologic advances during the past 40 to 50 years have established that the Gelopagos are moving eastward toward South America and that they are moving over a "hot spot" in the earth's crust that causes volcanic action and island building. However, as the volcanic islands move eastward away from the "hot spot" they lose the support of the magma chamber that created them and the entire island begins to sink. As the volcanic mountains age and erode the habitat on the island changes from lush vegetation to a desert type because the mountains are no longer high enough to force the moist sea breezes to rise, form clouds, and rain.

The talk will discuss the basis of plate techtonics and spend much of the presentation as a "travel log" presenting pictures and videos taken during the trip. Much of the information presented will be from videos taken of the local guide and the geologic leader from the Geologic Society of America. There will be many pictures of the local animals--they pose for pictures because they are as curious about humans as humans are about them.

Biography**:** Dale Nyman is a charter member of the Baton Rouge Geological Society. He has a Bachelor's and Master's Degrees in geology from Iowa State University, Ames, Iowa. He retired from the US Geological Survey in 1987 after 31 years working as a hydrologist in Tennesee, Indiana, and most of that time in Louisiana. He has actively worked in hydrogeology for over 20 years as a one-man consulting firm--Nyman & Associates.

February 12, 2010

Numerical Modeling of the Lower Mississippi River

Clinton Willson, Department of Civil and Environmental Engineering, LSU

Abstract: A number of medium and large freshwater diversion structures have been proposed that would serve as conduits for freshwater, with sediment and nutrients, to pass through river levees and into the Louisiana coastal marshes. The intent is to supply the wetlands and marshes with organic matter and mineral sediment to help them vertically accrete and to serve as a base for wetland vegetation. Here, I will discuss our numerical modeling efforts directed at better understanding the hydrodynamics of the lower Mississippi River-the goal is to develop a tool that captures the dynamic forcings and processes in the system and can be used to investigate the effectiveness of diversions to supply the necessary water and sediment as well as to examine the impact of future sea level rise on the hydrodynamics.

We are using the ADH (Adaptive Hydraulics) model---ADH is the modern, multi-dimensional, finite element hydraulic modeling program in development by the Coastal Hydraulics Laboratory of the U.S. Army Corps of Engineers (USACE) Engineering Research and Development Center (ERDC). The 2D Shallow Water Module of ADH coupled to its Sediment Transport Module (SEDLIB) is being used to model hydrodynamics and sediment transport over a 130 mile stretch of the Mississippi River (from Carrollton out into the Gulf of Mexico). The model has been calibrated and verified under several different flow and tidal conditions using stage data collected from 14 stations and recent discharge observation data obtained from USACE New Orleans District published reports and databases for the Mississippi River, distributaries and passes in the study reach. Simulations have also been run for several 2009 events in an effort to test our ability to model dynamics conditions. Results will be presented to demonstrate the performance of ADH in modeling two diversions-one, the diversion currently located at West Bay; the second, a hypothetical diversion located around River Mile 30.

Bibliography: Clinton S. Willson, Ph.D, P.E. is an associate professor in the Department of Civil and Environmental Engineering at LSU. Clint received a B.S. in Aerospace Engineering in 1985 from Penn State University and then was commissioned as an officer in the United States Marine Corps. In 1992 he began graduate school at the University of Texas at Austin where he received a M.S. in Environmental Engineering in 1994 and a Ph.D. in Civil Engineering in 1997. Before coming to LSU, Clint spent two years as a postdoctoral research associate in the Department of Environmental Science and Engineering at the University of North Carolina at Chapel Hill. He has been at LSU since 1998 where he has been teaching environmental and water resources engineering courses and conducting research in porous media multiphase flow and transport, groundwater modeling and physical and numerical modeling of the Lower Mississippi River.

January 8, 2010

Optimized Injection-Extraction Operations under Uncertainty for Saltwater Intrusion Remediation: A Case Study on "1,500-Foot" Sand Aquifer of Baton Rouge Area

Frank Tsai, Dept. of Civil and Environmental Engineering, LSU

Abstract: This study introduces Bayesian model averaging (BMA) to deal with model structure uncertainty while optimizing injection-extraction operations for saltwater intrusion remediation in the 1,500-foot" sand aquifer of Baton Rouge Area. A robust optimized policy should take into account model parameter uncertainty as well as uncertainty in imprecise model structure. Due to a limited amount of groundwater head data and hydraulic conductivity data, multiple simulation models are developed based on different head boundary condition values and semivariogram models of hydraulic conductivity. Instead of selecting the best simulation model, a variance-window-based BMA method is introduced to the management model to utilize all simulation models to predict chloride concentration. Given different semivariogram models, the spatially correlated hydraulic conductivity distributions are estimated by the generalized parameterization (GP) method. The model weights of BMA are estimated by the Bayesian information criterion (BIC) and the variance window in the maximum likelihood estimation. The simulation models are then weighted to predict chloride concentrations within the constraints of the management model. The methodology is implemented to manage saltwater intrusion in the "1,500-foot" sand aquifer in the Baton Rouge area, Louisiana. The management model aims to obtain optimal joint operations of the hydraulic barrier system and the saltwater extraction system to mitigate saltwater intrusion. A genetic algorithm (GA) is used to obtain the optimal injection and extraction policies. Using the BMA predictions, higher injection rates and pumping rates are needed to cover more constraint violations that, which do not occur if a single best model is used.

Biography: Frank Tsai holds a B.S. degree in Agricultural Engineering from the National Chung Hsing University, Taiwan, an M.S. degree in Civil Engineering/Hydraulics from National Taiwan University, and a Ph.D. degree in Civil Engineering/Water Resources Engineering from UCLA. He has been with the LSU Department of Civil & Environmental Engineering since 2003. His research interests are groundwater flow and fate and transport modeling in aquifer systems, uncertainty analysis, surface water and groundwater conjunctive use, water resources optimization and management, and multi-reservoir operations optimization and hydropower optimization.