American Water Resources Association
2010 SUMMER SPECIALTY CONFERENCE
GIS & Water Resources VI
March 29 – 31, 2010
Orlando, FL

Monday, March 29
3:30 PM – 5:00 PM
SESSION 6: LiDAR II

Hydrologic & Hydraulic Modleing of the Rancocas Creek Dam Failures - Dennis Johnson, Juniata College, Huntiogdon, PA (co-authors: Arthur C. Miller, Norm Fulmar)

In July of 2004, an intense rainfall over the Rancocas Creek Watershed in New Jersey resulted in the failure of 16 dams located within this 347 square mile watershed. To aid in determining the impact that the dam failures had upon the flood inundation, a study was performed and both a hydrologic and hydraulic model were developed. While site visits were made, much of the study relied heavily upon GIS databases, and LIDAR data. HEC-HMS was used for the hydrologic modeling and Geo-HMS was used to develop the basin model, which consisted of 86 sub basins. Radar derived precipitation hyetographs were obtained for the event. The hyetographs were developed for each sub basin at a six minute time resolution. The model was calibrated using recorded hydrographs from four USGS stream gages within the watershed. An unsteady flow model was then developed with HEC-RAS. Cross-sectional geometry was developed using Geo-RAS utilizing the LIDAR data. The geometry model consisted of 13 river reaches and eventually over 5000 cross-sections were used. Stream flow hydrographs determined from HEC-HMS were linked directly to the HEC-RAS model for all 86 sub basins. A total of 33 dams were modeled with 16 of them breaching. Comparisons of results were made between peak stages obtained from model executions for the dam breach conditions and the scenario of the dams not being breached.

Using Lidar Data to Assess the Interdependence of Headwater Wetlands, Groundwater Levels, and Streamflow in Central-Florida Watersheds - Terrie Lee, US Geological Survey, Tampa, FL (co-author: Geoff Fouad)

Lidar data provide a versatile tool for assessing the capacity of depressional wetlands to generate streamflow in the exceptionally flat landscapes of Florida. In humid central Florida, where groundwater levels hover below the low-lying terrain and wetlands cover about one fourth of the land area, seasonally-flooded depressional wetlands constitute the headwaters of many streams. Yet headwater wetlands and the channel networks connecting them to streams are typically not well described in watershed studies. Further, the shallow surficial aquifer encompassing the streams and wetlands can alternately leak downward toward the deeper semi-confined aquifer, or gain upward discharge when artesian head conditions exist in the deeper aquifer. The distribution of discharging and recharging conditions across the watershed changes in time depending upon the distribution of groundwater pumping and rainfall. The same factors affect the amount of water stored in and flowing from depressional wetlands over time. Lidar elevation data were used to assess the interdependence of depressional wetlands, groundwater heads, and streamflow in three watersheds in west-central Florida: the 330-square mile Charlie Creek basin - a tributary to the Peace River, and two wetland-rich regions with large groundwater withdrawals located in the watersheds of the Anclote River and Cypress Creek, respectively. Lidar data were used in four ways: 1) to define topographic depressions in the watershed and delineate the network of surface-water channels interconnecting depressional wetlands and streams; 2) to interpret recharging and discharging (artesian) groundwater conditions near wetlands and streams over time; 3) to develop a coupled surface and groundwater flow model (MIKE SHE) to simulate the water stored in depressional wetlands and streamflow generated by the headwaters region of the Charlie Creek basin, and; 4) to create hydrologic-assessment variables to compare the hydrologic setting of wetlands in different watersheds. These lidar-based approaches greatly expand our ability to describe the hydrology of wetlands in watersheds in Florida compared with traditional topographic data sources.

LiDAR Data Collection and Modeling for Rehabilitation of Mine Impaired Creek in Idaho - Robbie Parsons, CDM, Denver, CO (co-authors: Moosub Eom, Brian Murphy, Todd Bragdon, Bill Adams, Jeff Johnson)

Tributary Creek is a highly degraded stream that has been impacted by historic mining activities and is located in a remote area of the Coeur d'Alene National Forest, Shoshone County, Idaho. Four tailings piles were constructed along Tributary Creek. The EPA and USFS recognize this and are committed to cleaning up and restoring the Tributary Creek drainage with a vital first step being the Jack Waite Mine remediation activities related to historic mine wastes. USFS wants to achieve as natural a stream channel as possible because the stream is an important westslope cutthroat trout habitat and potential Bull Trout recovery habitat area. The presentation will discuss the collection of reliable topographic data of sufficient accuracy, (high resolution aerial photography and LIDAR data), to support remedial design and stream modeling in a remote National Forest location. Raw LIDAR data and post processed data products, including bare-earth data and 2-foot contours in DXF format, were provided by the aerial survey subcontractor. These DXF files were then migrated to an ArcGIS personal geodatabase for use with the site GIS. Further data processing was completed on the geodatabase data to create digital elevation models (DEM) across the site. These DEM's were used to perform various hydrologic and engineering analyses. An overview of the use of GIS/DEM information in the hydrologic and engineering analysis will be presented. The use of these data to support other stream rehabilitation design efforts will also be discussed.

Using LiDAR Data to Assess Landscape Vulnerability to Coal Bed Methane Extraction in the Powder River Basin of Wyoming - Charles Yuill, West Virginia University, Morgantown, WV (co-authors: Michael P. Strager, Paul Kinder)

Abstract This project integrated LiDAR data for terrain analysis in the Powder River Basin in Wyoming with a goal to aid in overland flow management by tracking excess fractured water from storage areas and pump sites involved in coal bed methane extraction. Methods included processing the LiDAR data and running analysis for concavity, convexity, moisture index, cumulative drainage area, and a newly developed flow path and time of travel equation. Terrain analyzed locations were compared with field site measurements to determine the most useful indices. Results indicated that the LiDAR derived outputs were critical to explaining local variation in flow paths. Lateral flow was also identified to be a driving force in determining cumulative runoff toward managing the assimilative capacity of the fractured water into the Power River.