CICEET Progress Report
for the Period 09/01/2010 through 02/28/2010

Project Title: Assessing the Risk of 100-year Freshwater Floods in the Lamprey River Watershed of New Hampshire Resulting from Changes in Climate and Land Use
Principal Investigator: Cameron Wake
Project Start Date: 1 Aug 2009 to 31 July 2011
Report compiled by: Cameron Wake, Ann Scholz, and Michael Simpson
Contributing team members and their role in the project:
Steve Miller, Great Bay NEER (Collaboration, Evaluation, Dissemination)
Robert Roseen and Ann Scholz, UNH Stormwater Center (Technical)
Fay Rubin, EOS, UNH (Technical, Dissemination)
Michael Simpson, Antioch University New England (Technical)
Cliff Sinnott, Rockingham Planning Commission (Collaboration, Dissemination)
Lisa Townson and Julia Peterson, UNH Cooperative Extension (Evaluation)

A. Progress on objectives for this reporting period:

Technical Objectives:

Collect climate data and downscaled GCM model output:

Daily precipitation and temperature (min, max, mean) values from four Atmospheric-Ocean Global Climate Models (AOGCMs)(CCSM3, PCM, HadCM3, GFDL CM2.1) for two greenhouse gas emissions scenarios out to the year 2100 (SRES A1fi and B1) have been downscaled and are currently being analyzed by PI Wake. Projections of 100 year precipitation events in the future serves as a key input for the hydraulic and hydrological modeling.

Hydraulic Modeling:

The study length of the Lamprey River network and associated tributaries including structural data has been entered in the hydraulic software program Hydrologic Engineering Center –River Analysis System (HEC-RAS). The model has been calibrated with observed water surface elevations during two major flooding events (April 2007 and March 2010) and the rating curves for two USGS gages. The water surface elevation and spatial flooding extent are completed for the 2005 Updated land use conditions and new Cornell Atlas 100 year precipitation values (based on precipitation data up through 2010).

Hydrology Modeling:

Modeling with the Hydrologic Engineering Center's Geospatial Hydrologic Modeling System (HEC-GeoHMS) is completed for the 2005 land use conditions. Parameters developed have been input into HEC-HMS and calibrated to observed precipitation and discharge values by running optimization trials. Flood flow data is completed for the Flood Insurance Study and Updated conditions scenarios. The build out and build out with low impact design included scenarios will be completed before the end of March.

Zoning Build Out Analysis Approach

Utilizing geographic information system (GIS) overlay techniques, a series of data sets are overlain to identify areas that ineligible for future development. Those areas included currently developed land (based on 2005 aerial photography), wetlands, steep slopes (> 15%), and conservation parcels. The remaining areas within the watershed are considered candidates for the build-out. These areas are then overlain with zoning districts to map potentially buildable areas in each zoning district within each of the watershed's communities.

Growth Scenarios

The technical team in consultation with the Advisory Committee has written a plan to project build-out rates for residential and commercial/industrial land uses under both conventional and LID zoning scenarios. The rates are based on growth projections that have been assembled by Rockingham and Strafford Regional Planning Commissions. For residential this is approximately 1.2% from today until 2030 and 0.6% after 2030. Job growth used as the coefficient for non-residential development is projected to be 1.7% from today until 2030 and 1.1% after 2030.

Putting it all Together

Finally, the growth rates are applied to the buildable areas to quantify developed lands by 2050 (to represent middle of the century land use) and 2085 (to represent end of the century land use). Areas most desirable for development, based on slope and proximity to roads, are built-out first. The resulting land use maps for 2050 and 2085 provide the basis for determining the new runoff curve number (which defines the relationship between precipitation and runoff for different land use/soil types) that serves as a key input for the hydraulic and hydrological modeling. This overlay will be completed in the near future and, along with projections for future 100 year precipitation events, will be used to drive the hydraulic and hydrological models to quantify future projected flood elevations and 100 year floodplains.

Evaluation Efforts:

Evaluation of how we obtain and use input from the Advisory Committee is ongoing (Led by Julia Peterson). We have completed our detailed plans and detailed evaluation questions for the discussion groups and workshops we will be hosting.

B. Please describe knowledge dissemination activities during this reporting period.

We continue to work on our project web site: http://100yearfloods.org/. In addition to the Advisory Committee meetings, we made the following presentations that described preliminary results of our project :

Cameron Wake - Assessing Flood Risk in the Lamprey River Watershed. Presented at NH Local Government Center – 69th Annual Conference. Manchester, NH, 17 November 2010.

Cameron Wake - Climate Change in New England: Past, Present, and Future. Presented at the Grappling with Stormwater Management in the Era of Climate Change. Augusta, Maine, 30 November 2010.

Ann Sholz - The path taken to remap the 100-year Lamprey River floodplain. Presented at the Fourth Annual Lamprey River Symposium. Durham, NH 7 January 2011.

Cameron Wake - Assessing Flood Risk in the Lamprey River Watershed. Presented at Southern NH Planning Committee - Regional Comprehensive Plan Update Advisory Committee, Manchester, NH 22 Feb 2011.

Cameron Wake - Assessing the Risk of 100-year Freshwater Floods in the Lamprey River Watershed of New Hampshire Resulting from Changes in Climate and Land Use. Presented at the Lamprey River Advisory Committee – Lamprey on the Horizon lecture series. Newmarket, NH, 24 February 2011.

C. Have the results/data gathered during this reporting period indicated that a change to your original approach is necessary? If so, who was involved in the decision-making process? Please explain.

There has not been a change in our approach. However, we have made one modification that will affect the completion date of our project. To date, we have mapped the updated 100-year floodplain extent (based upon the 2005 land use and 2010 Cornell Atlas precipitation values). The process involved applying the water surface elevations produced by the hydrological model to the best currently available digital elevation model (10-meter horizontal resolution, <= 7-meter vertical accuracy). Our results are unexpected in some areas. For example, we know from our river cross sections that the flood elevation is several feet higher for the updated conditions as compared to the Flood Insurance Study [FIS] conditions used by FEMA, and yet the areal extent of the floodplains of the updated conditions is less than the FIS conditions. Our hypothesis is that the resolution of the existing digital elevation model is not adequate to support floodplain mapping in relatively flat areas (note the existing digital elevation model used in the original FIS study is not available).

Our team does not want to produce a series of maps with obvious errors. Our current plan to rectify this is to wait for new topographical data from the planned LiDAR survey. Flights should be flown this spring and data should be available this summer. Once we have the new LiDAR based digital elevation model, we will need to re-create the hydraulic and hydrological models, and then run the models using the input from the various land use and climate scenarios. We expect that this new effort will require additional time and additional resources.

D. Please describe collaboration activities with target stakeholders during this period. Has interaction with stakeholders during this period brought about any changes to the project? Have the stakeholders confirmed the relevance of the technology or approach you are working on?

We met with our Advisory Committee on October 10, 2010 and again on February 15, 2011. The October meeting was focused on an project update and a discussion of a proposal we were developing to investigate legal issues regarding the potential use (or non use) of the 100 year flood plain maps we will be developing. Five members from the Vermont Lay School (led by John Echeverria and Peg Elmer) were on hand to lead the discussion. The Advisory Committee provided substantial input to the discussion and helped provide additional detail for

our proposal that was submitted on Nov 19, 2010 to the National Sea Grant Law Center. We were informed on 25 February 2011 that our proposal for $25,000 had been funded. The legal research that this will support will provide an extremely valuable addition to the information we can provide to municipalities, regional planners, and state official as we role out the 100 year floodplain maps in the future. The February meeting focused on obtaining feedback regarding our initial map products. We discussed the maps for over an hour and are currently making changes both in the content and the overall appearance of the maps as a result of Advisory Committee input.

E. Please describe technical and non-technical objectives for the next reporting period and outline your work plan to meet identified objectives.

Technical Objectives:

Complete build out scenario overlays
Quantify future 100 year precipitation event based on downscaled AOGCM output
Integrate new LiDAR based digital elevation model into hydraulic and hydrological models
Develop set of maps showing 100 year floodplains of the future
-based on selected land use and climate scenarios

Non-Technical Objectives

Conduct fourth and final Advisory Committee Meeting
Plan for facilitated discussion and workshop in fall, 2011

F. Please describe any activities, accomplishments, or obstacles not addressed in other sections of this report that you feel are important for CICEET to know about.

None.