Attachment from Candia Selectmen's Meeting on 8/22/2011

ENVIRONMENTAL
Fact Sheet

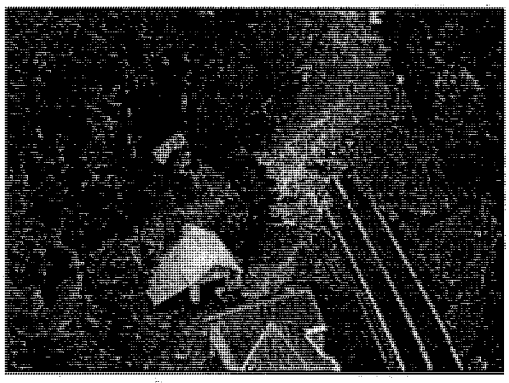
NEW HAMPSHIRE DEPARTMENT OF Environmental Services

29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

CO-GEO-10 2010

Fluvial Erosion Hazards and River Geomorphic Assessment Program

Overview



Flooding, and the associated damage caused by both the ensuing inundation and bank erosion, represents New Hampshire's greatest recurring natural hazard risk. During the flood events in 2005, 2006 and 2007, New Hampshire experienced a total of $75.6 million in flood related damages. As a result, the New Hampshire Geological Survey has recently begun focusing its scientific and mapping expertise to address some of the risks associated with flood events and the potential for significant erosion and catastrophic bank failures. These efforts are part of a longer term goal to establish a geologic hazards evaluation program.

Floods are well known for posing inundation risks to property, as currently identified by National Flood Insurance Rate Maps (FIRMs) produced by the Federal Emergency Management Agency (FEMA), but there is a less-appreciated danger associated with sudden channel scouring and bank collapse, or even wholesale changes in the course of rivers. These phenomena all fall under the general heading of "fluvial erosion hazards," where the term "fluvial" is used by earth scientists to indicate action by flowing water and by rivers in particular. The most dramatic of these is the relatively rare event when a river cuts through one of its banks and erodes an entirely new channel, known as a channel "avulsion," usually abandoning its old channel in the process. Such an event occurred on the Suncook River in the town of Epsom during the Mother's Day Flood of 2006 when Huckins Mill Dam and Bear Island were bypassed by a new channel that cut through an area of wetlands, and a gravel pit.

Flooding in the News

The Suncook River Avulsion made headline news in New Hampshire and was the subject of news reports across the nation, but attention was also drawn to other areas throughout the state where significant erosion and resulting

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property damage in floodplains occurred. Most alarming was the amount of damage that materialized where bridges and culverts were unable to adequately convey flood flows, or where development close to rivers and streams had destabilized the banks. Increased density of roads and other impervious surfaces, together with the loss of natural riparian vegetation buffers during the conversion of forests and agricultural lands to suburban uses, are known to increase the frequency and intensity of flooding events.

Throughout New Hampshire, many of the same properties and structures that were damaged in 2006 were affected again in 2007. A more localized, but nonetheless highly damaging, "flash" flood occurred in July 2008, damaging the boardwalk on the west side of Lake Winnipesaukee. Watershed residents and local officials are increasingly aware of their vulnerability to fluvial erosion hazards and the need to plan accordingly. To do this effectively requires site-specific information that characterizes the form, function, underlying geology, and dynamic behavior of the state's rivers and streams. Investigations to obtain such information are in the realm of the science of fluvial geomorphology, a specialized branch of the earth sciences that studies how running water in river channels shapes the physical landscape.

Fluvial Geomorphic Assessment of Erosion Hazards

Fluvial geomorphology has received an increasing amount of attention in recent years for its potential to contribute not only to flood hazard mitigation and avoidance, but also instream habitat and floodplain restoration efforts. The state of Vermont is recognized as one of the leading practitioners in this area, having developed a set of comprehensive protocols for conducting river geomorphic assessments as part of a dedicated river management program. The protocols are organized into three successive phases, reflecting an increasing dependence on field survey and greater site-specific measurement detail and accuracy. Funding to embark upon a similar program for river geomorphic assessment in New Hampshire was provided in 2008 by the New Hampshire Department of Safety, Division of Homeland Security and Emergency Management. With this as a foundation of support, NHGS collaborated with the Rivers Management and Protection Program at DES, and other project partners to undertake an application of the Vermont Stream Geomorphic Assessment Protocols in the Exeter River watershed and to develop standards for collecting field data to evaluate river stability in the vicinity of bridge and culvert crossings. The long term goal is to use this information as a tool to prioritize the replacement of crossings that may be at risk for failure based upon the degree of river bed and bank instability that exists near such crossings.

The basic unit of river assessment is the geomorphic "reach." Each study reach is defined through analysis of a number of key physical attributes of the stream channel and its associated floodplain. By providing a consistent, logical framework for describing streams and rivers, classification of a stream or river into discrete geomorphic reaches represents a critical first step in the assessment process. This framework offers multiple benefits to property owners, resource managers and planners. It ultimately informs decisions affecting activities in riparian zones and aids interpretation of data collected in fluvial environments. Stream channel migration and bank instability and collapse are natural fluvial processes. Susceptibility of channel reaches to stream bank erosion and sedimentation is one factor that is considered in the classification. Potential problem areas are identified using the physically-based assessment criteria. This information, together with observations regarding the occurrence and distribution of critical aquatic habitats

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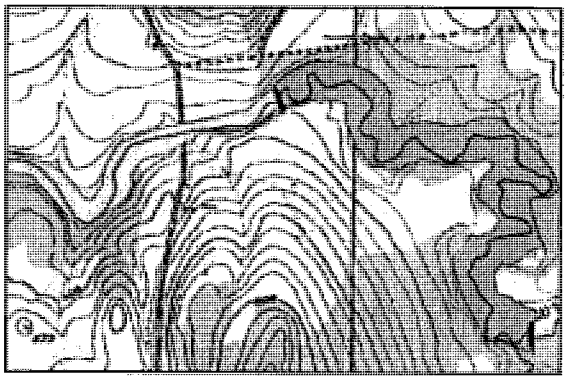
and their associated riparian zones, greatly assist in prioritizing and targeting bio- and civil engineering and stream restoration projects and land conservation efforts adjacent to river channels and within their watersheds.



An additional end-product of the geomorphic assessments is the delineation of fluvial erosion hazard (FEH) zones adjacent to rivers, which is illustrated in the picture to the right. The river geomorphic assessment tools allow individual reaches to be typed and scored, based on the condition of the river at the time of the assessment. The scoring allows for the determination of the sensitivity of a particular reach to future erosive events that could lead to bank failures and the subsequent potential for property and infrastructure damage during high flow events. With the right flow and geological conditions, a river could also carve a new path for itself (e.g., an avulsion). The delineation of these FEH zones can be used as a hazard planning tool by emergency management officials and communities to minimize risks to the residents and property owners within the zones.

In addition to the assessment project in the Exeter River watershed in 2008, NHGS in collaboration with the DES Rivers Management and Protection Program embarked upon assessments on two rivers in 2009 – the Ammonoosuc and Isinglass. The field component of these assessments has been completed, and the data are currently being analyzed. Final products will include maps and digital datasets that identify those areas that are susceptible to potential future erosion events and delineate fluvial erosion hazard zones. In 2010, approximately 120 river miles will be assessed in the Cocheco and Lamprey watersheds. The assessment will include the main stems of both rivers, in addition to Axe Handle Brook and the Mad River in the Cocheco watershed; and the Little, North, North Branch Lamprey, and Piscassic (lower 5 miles) rivers in the Lamprey watershed.

More information

For more information about the fluvial erosion hazards program, contact Shane Csiki, Fluvial Geomorphology Specialist at the New Hampshire Geological Survey, at (603) 271-2876, or shane.csiki@des.nh.gov.

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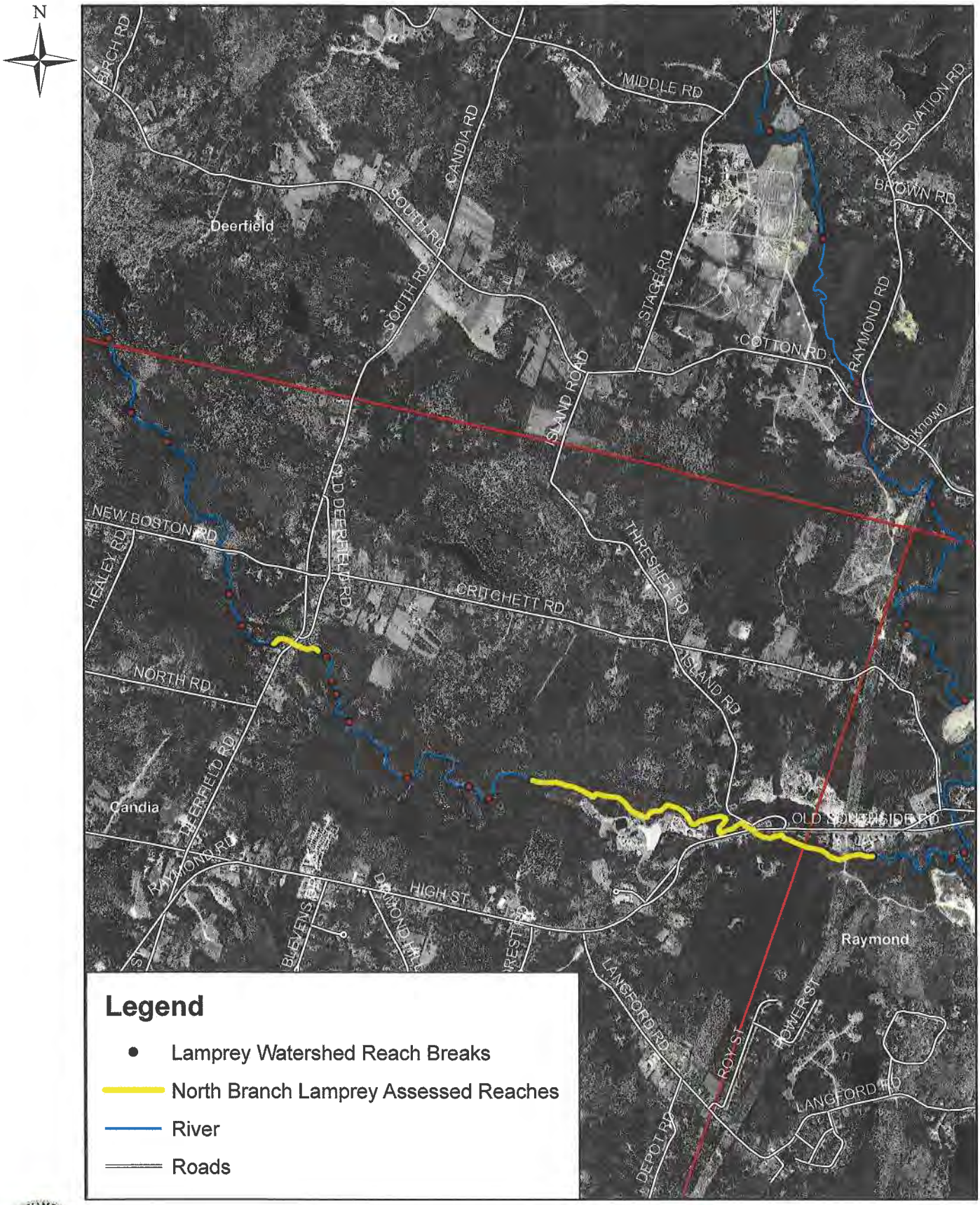
Fluvial Erosion Hazard Assessments
North Branch Lamprey River in Candia



Fluvial Erosion Hazards and Geomorphic Assessments of the Lamprey River Watershed

What is fluvial erosion?

Fluvial refers to water flowing in a river or stream channel. ***Fluvial erosion*** is the wearing away of river beds and banks by action of the water.

[Photo: NH Geological Survey, Lamprey River, Raymond, NH, April 2010]

Fluvial erosion is most prevalent at very high flows and in loosely consolidated soil and surface materials. Fluvial erosion that occurs during storm or flood events can cause collapse of stream banks or catastrophic relocation of river channels, resulting in the destruction of houses, buildings, roads and river crossings. The risk of fluvial erosion expands as land development produces increased stormwater inputs to rivers during storm events, resulting in higher flows with more power to erode the landscape.

Why are floodplains important for managing FEH areas?

A floodplain is the area surrounding a river or stream channel where active river and channel forming processes – mainly deposition and erosion – take place. During storm events, floodplains serve the essential purposes of slowing and storing floodwaters and capturing sediment. Without floodplain access river and stream channels are subjected to the full power of flood flows, leading to extensive erosion of their bed and banks.

FEH areas are those areas in which the river will either need access to over time to maintain balance or achieve balance if not in a stable condition (i.e. straightened, over-widened, eroded, etc.). Floodplains and FEH areas do not always match, as existing and future erosion and channel changes can exceed the bounds of the existing or historical floodplain.

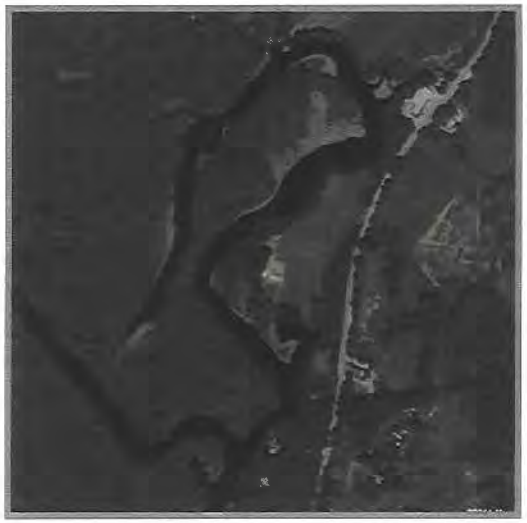
Benefits of mapping FEH Areas

While National Flood Insurance Program (NFIP) maps delineate flood prone areas, they do not map FEH areas or identify private property and infrastructure risks. Additionally, many of these maps are outdated. FGA and FEH assessments and mapping can provide information that can be useful in planning for land use and development, and for resource management and protection.

- Target resources to minimize future flood impacts, protecting *lives, property,* and *infrastructure,* thus enhancing *public safety*.
- Identify areas at risk to reduce potential economic losses.
- Identify transportation infrastructure (bridges, culverts) most threatened by fluvial erosion.
- Aid municipalities in developing pre-disaster mitigation plans.
- Support identification of areas for future river restoration projects and long-term goals of preserving healthy aquatic and wetland ecosystems, and high water quality.

While flood damage (temporary inundation of land and structures) is a significant component of storm events, the predominant mode of damage is fluvial (river-related) erosion.

Local governments have the mapping, planning, and zoning tools to minimize the impacts of fluvial erosion hazards, and thus, are the most appropriate entities to implement appropriate flood hazard planning and mitigation efforts.



[Photo: Mapquest, Lamprey River in Epping, NH]

For more information about the Lamprey River and its watershed, visit the following websites: Lamprey River Local Advisory Committee at www.lrwa-nh.org and the Lamprey River Watershed Association at http://www.lampreyriver.org/

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Fluvial Erosion Hazards and Geomorphic Assessments of the Lamprey River Watershed

Fluvial Erosion Hazards (FEH) & Fluvial Geomorphic Assessments (FGA) in the Lamprey River Watershed, 2011

Rivers are among the most beautiful features of nature, but they can also be destructive agents. During three major storm events between 2005 and 2007, flood and other storm-related damages cost New Hampshire taxpayers $75.6 million. As experienced in these storms, the collapse of stream banks can wash out roads and destroy houses and other buildings, or, in rare cases, change the course of a river.

A large component of this storm damage was the result of erosion of the river channel and banks and the floodplain. Fluvial (water flowing in a river) erosion is a natural process most powerful during very high flows and especially during storm events when rivers have more energy to erode stream beds and banks. Damage from fluvial erosion also occurs each day, slowly over time.

As a result of the consequences of fluvial erosion and the recent flood disasters New Hampshire has experienced, establishing a statewide Fluvial Erosion Hazard (FEH) program has been a high priority with the New Hampshire State Legislature, the Department of Safety, the Department of Environmental Services, and the New Hampshire Geological Survey. The Federal Emergency Management Association (FEMA) endorses the FEH program, and it has been implemented in other states.

What is a fluvial geomorphic assessment?

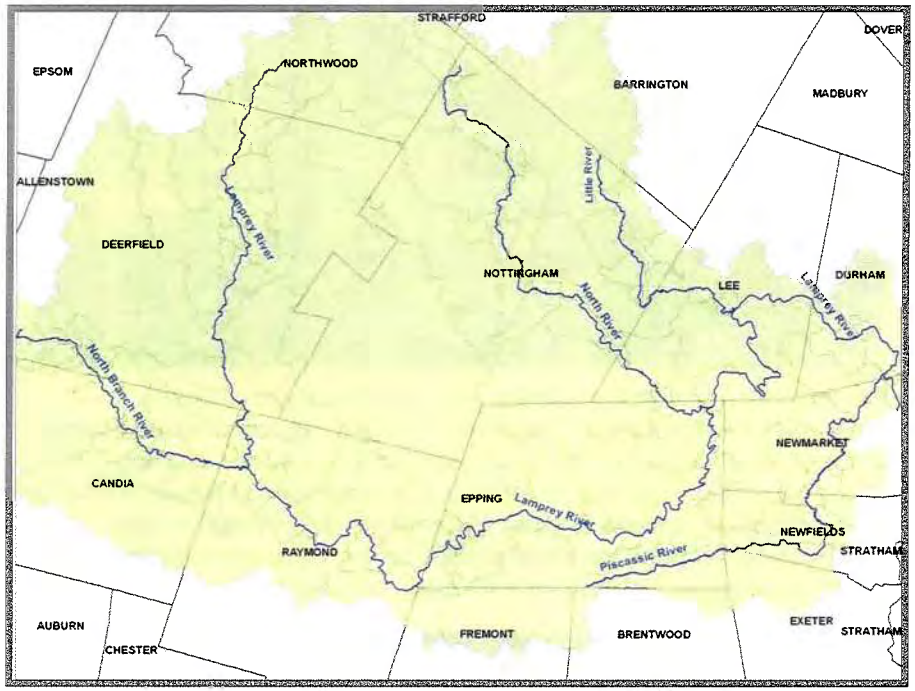
A fluvial geomorphic assessment (FGA) is the gathering of site specific measurements of a river channel and its floodplain including channel and floodplain dimensions, sediment transport capacity, flow volume, and vegetation type and cover (presence and absence). The assessment also documents locations where active erosion is taking place and where other channel disturbance and alteration are evident.

When geology and land use information is combined with the field assessment of a river's present condition, zones depicting the sensitivity to potential erosion can be delineated on maps. From this data, the fluvial erosion hazard (FEH) area for specific river segments is calculated.

The long-term goals of these assessments are to identify those areas most at risk to erosion, flooding and future river adjustments through an understanding of the present physical condition of the river, and to identify priorities for the replacement or rehabilitation of problematic culverts. Opportunities for future stream restoration are also identified through these assessments. The FGA and FEH maps can provide communities with information to develop hazard mitigation plans, as well as provide the region with the basis for an overall watershed wide plan.

Why study the Lamprey River watershed?

Rapid development in the Lamprey River watershed and seacoast region have made evaluating the present conditions of its rivers an important goal.



[Map of Lamprey River watershed: NH Geological Survey, 2011]

The State of New Hampshire (Departments of Safety and Environmental Services) is partnering with the Lamprey River Local Advisory Committee and the Lamprey River Watershed Association to conduct a geomorphic assessment that will identify areas in the watershed most at risk to FEH in order to develop a long-term watershed plan.

The 2011 FEH/FGA project will assess the main stem of the Lamprey River, and its tributaries including the Little River, North River, North Branch Lamprey River and Piscassic River. See the map above for reference.

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