A pilot project to assess the efficacy of woody debris jams creation in aggrading an incised channel in a fine-particle dominated stream.

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The Hubbardton River is a small, low gradient warm water river in west-central Vermont in the Lake Champlain basin (Figure 1). The river passes through a valley that consists of fine particle lake-bottom silt and clay soils. These soils were deposited during a previous geological epoch that featured higher water levels of what now is Lake Champlain. Until about 35 years ago, the riparian areas of the river were heavily used for agriculture – most of the riparian habitats were deforested and used for pasture/hayfields. Grazing ceased on many of these lands over the past few decades, and now over half of the riparian areas on the river are protected either under easements, planting agreements, or fee protection. However, much of the riparian area is still deforested, consisting of brushy old fields or areas of sparse young second growth trees.

The river is threatened by ongoing threats of extensive bank erosion, sedimentation, and channel instability. With funds from the Vermont Department of Environmental Conservation's River Management Program, TNC contracted with Field Geological Services (Farmington, ME) to conduct a gemorphological assessment of the river in 2005 to assess the causes of chronic channel instability and suggest strategies to abate associated threats. Results of this study suggested that the lack of large woody debris in the river channel is likely a major cause of instability and channel entrenchment. This applied especially to a river reach in to lower portion of the Hubbardton River valley in an area that TNC has heavily invested in land conservation for the protection of both the river and remnant clayplain forests found in the Champlain Valley.

This study (Field, 2006) recommended reforesting riparian habitats along the river and creating debris jams to simulate to the function of large woody debris in the system: trapping sediment, aggrading the river channel, and eventually reducing channel instability. However, while the practice of installing debris jams to aggrade entrenched channels is well established in streams occurring in soils with a much higher proportion of boulder, cobble, and gravel, this practice has yet to be employed in a fine-particle system in Vermont such as the Hubbardton River. Given the highly erodible fine particle soils in the Hubbardton, there is considerable uncertainty over exactly how the river channel would respond to the creation of woody debris jams.

To address this uncertainty, a low-cost pilot project was designed in a small entrenched tributary of the Hubbardton River to assess the effectiveness of woody debris placement in aggrading incised channels. In the summer of 2006, 13 woody debris jams were created on a small, intermittent tributary of the Hubbardton River that lies entirely on TNC owned property (Figure 2). The tributary (Figure 3) is a small intermittent channel that is entrenched via headcutting processes in response to main-channel entrenchment. The active head-cut in this channel is at the upper end of the study area, and the river grade is currently being maintained by an old relict piece of large woody debris (Figure 4). The riparian area of the tributary in the study area is forested with young second-growth trees.

To determine the number and spacing of debris jams, sinuosity and pool/riffle/run sequencing and spacing were measured by with GPS by walking the channel of the tributary. Log size and debris jam placement frequency were then determined in accordance with specifications used by the Green Mountain National Forest for streams of similar size, pool/riffle/run spacing, and sinuosity (Steve Roy, GMNF). Debris jams were dispersed in accordance with these recommendations over approximately 930ft of stream channel, with debris jams placed no more than 100ft apart. Each jam consisted of 4 logs (mostly larger than 4' long and 8" in diameter). Debris placement in the channel were made in accordance with judgments of most effective location (generally bends in the channel) and orientation for the purposes of sediment trapping given site-specific channel characteristics. Debris jams consisted of two basic designs: augmenting existing debris jams; and channel-spanning jams that were dug into channel banks while leaving sufficient area for water passage to avoid channel damming (Figures 5 and 6).

Photo-monitoring stations were established for each debris jam, and a series of four channel cross sections were marked and measured for future monitoring (Figure 7). Photo monitoring and channel measurements will be repeated annually in order to assess the response of the channel to debris jam placement.

Success of the project will be gauged from monitoring for the following channel responses: aggradation of incised channels, persistence of existing debris jams, and minimal lateral erosion around debris jams. If these responses are observed, we will seek to scale the methods used in this project up for use in the mainstem of the Hubbardton River.

References:

Field, J. 2006. Poultney River and Hubbardton River Fluvial Geomorphology Assessment. Report to The Southern Lake Champlain Valley Program of The Nature Conservancy. 39pp.

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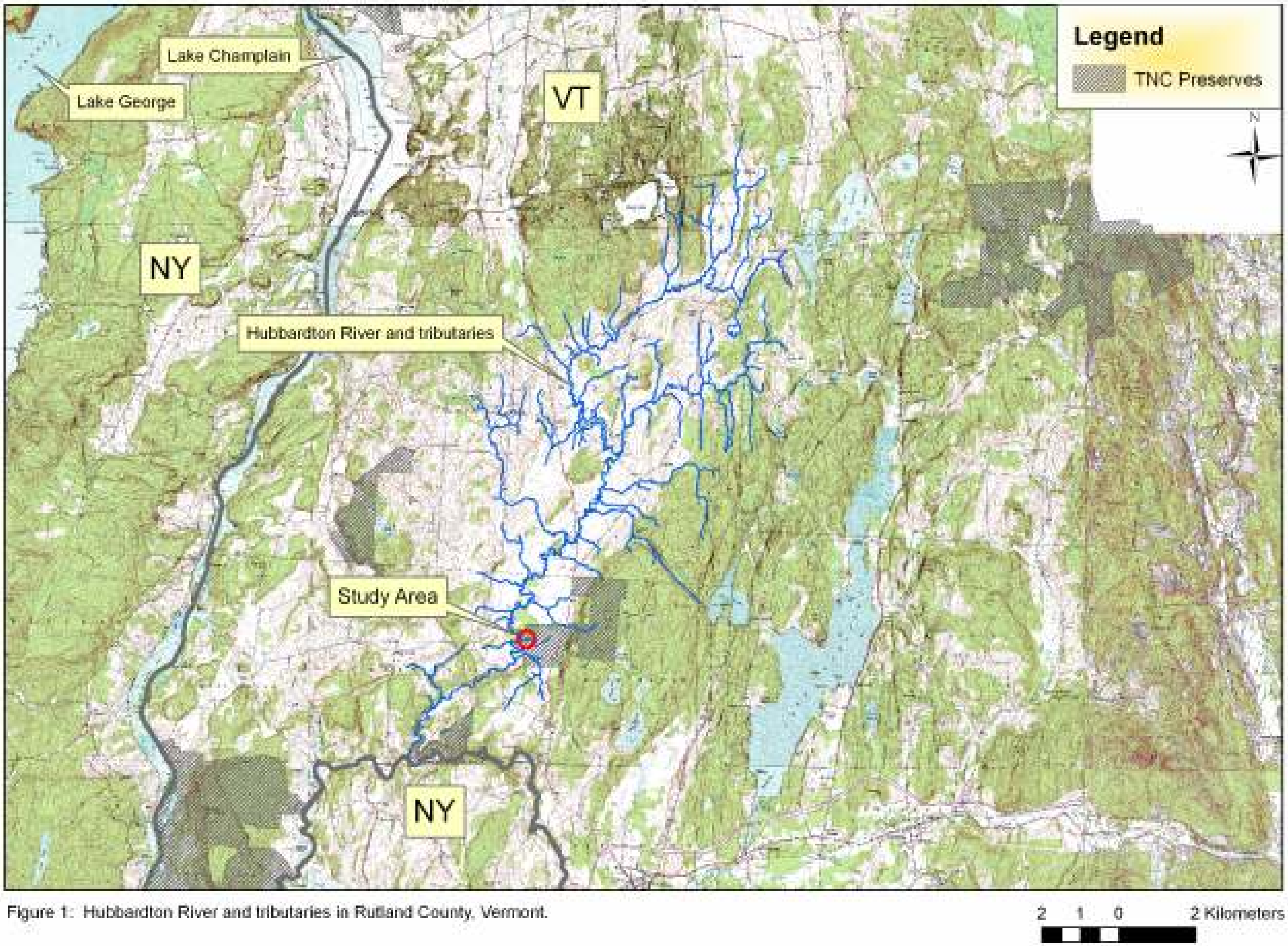

Figure 1: Hubbardton River and tributaries in Rutland County, Vermont.

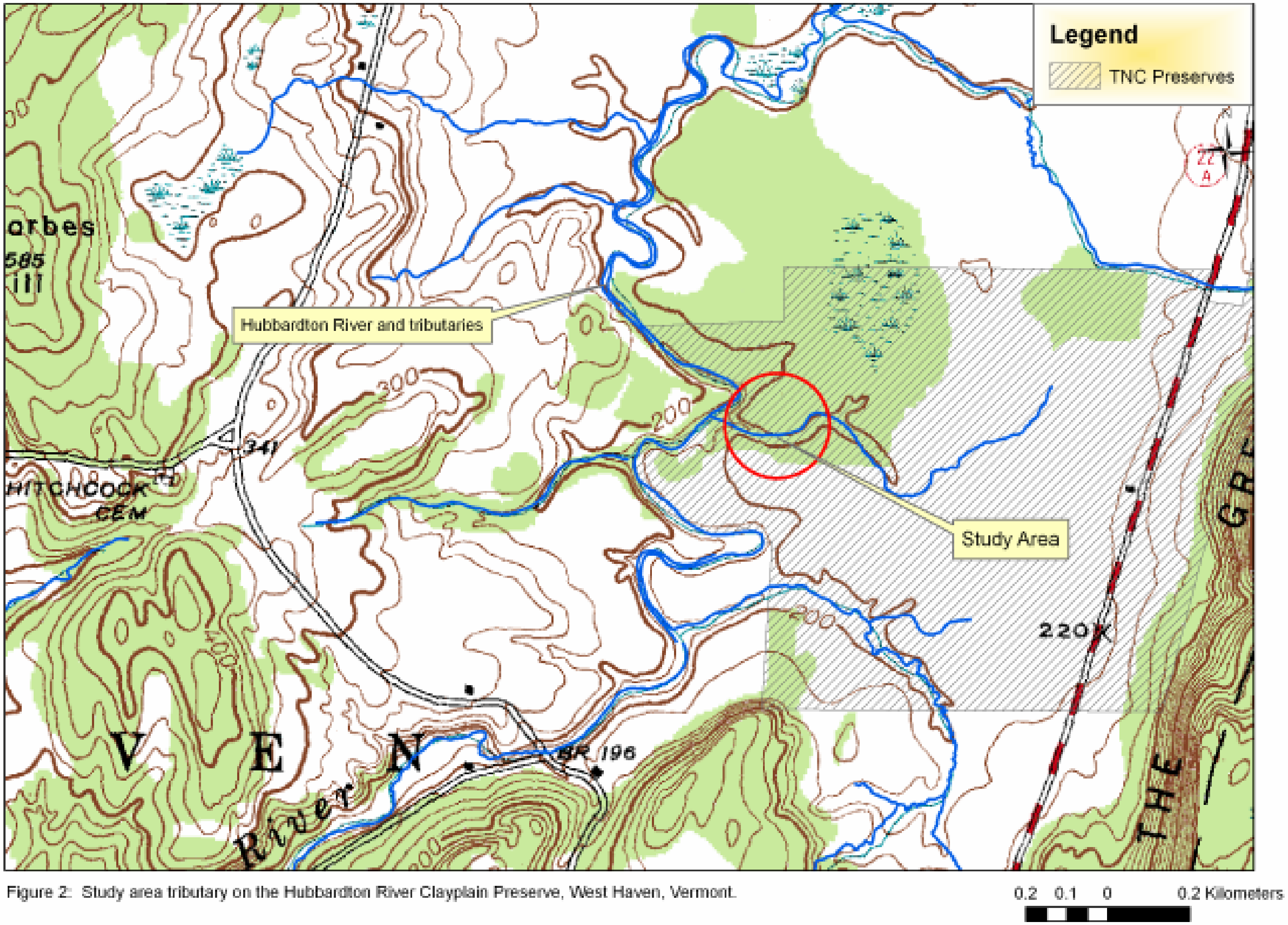

Figure 2: Study area tributary on the Hubbardton River Clayplain Preserve, West Haven, Vermont.

Figure 3: Tributary in the study area, August 2006.

Figure 4: Headcut location with relict old LWD as grade control, August, 2006.

Figure 5: Woody debris placement to augment existing debris jams.

Figure 6: Channel-spanning woody debris placement to create a new debris jam and trap sediment.


Figure 7: Channel cross section measurement.