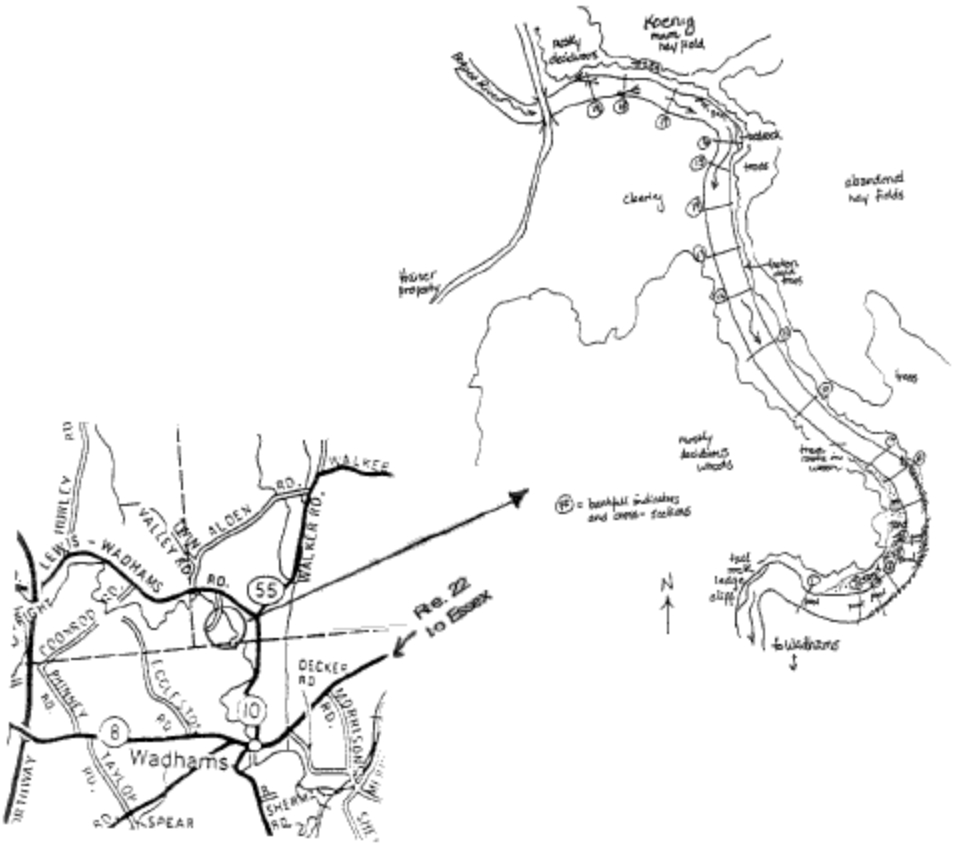
STREAM MORPHOLOGY II:
BRASS GRANT PROJECT

Wadhams, Downstream of Ox Bows

Why BRASS surveyed this area: The Boquet River downstream of the Wadhams ox bows is at a 230-foot elevation with very little gradient (a 0.007% slope). It sits in an old silt/clay lacustrine (lake) bed created 12,000 years ago when glaciers retreated northward and "Glacial Lake Vermont" occupied the area. This glacial lake, as well as the "Champlain Sea" that covered Whallonsburg when it was depressed below sea level by the weight of mile-thick ice, deposited the clays, silts and sands that became the rich soils of our current agricultural districts along the Boquet River.

The relatively slow-moving, sandy-bottomed river section in Wadhams with its broad flood plains is like other farming areas in Whallonsburg and along the North Branch in Reber. Most of these sections are currently exhibiting massive streambank erosion and bank slumping. The Wadhams section downstream of the ox bows, however, still looks somewhat stable.

Remember, "stable" means the reach carries its water and sediment load over time without building up its channel bed (aggrading) or cutting it down (degrading), and at the same time keeps its proportions of width, depth, incline and curves. Stable does not mean stationary.



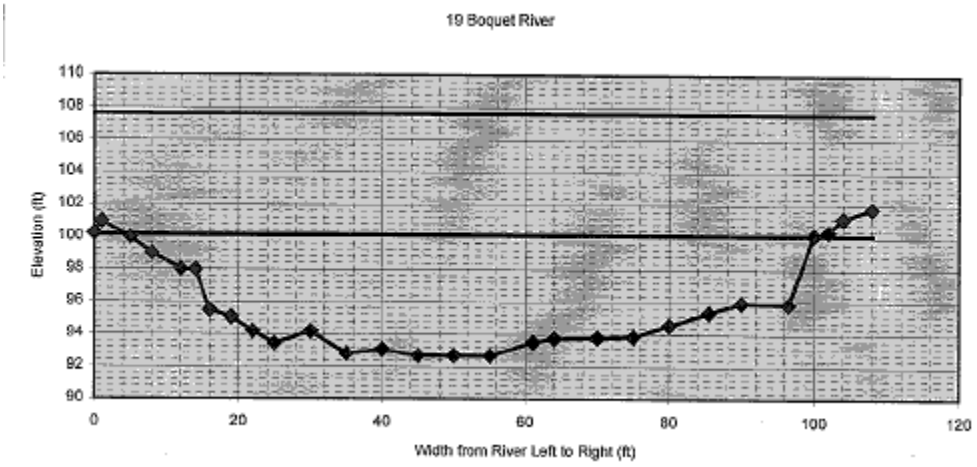
BRASS was interested in the stream measurements and ratios of the lower ox-bow area in Wadhams. Did different depths, widths, bank heights, or curve patterns make this section more stable? Or, was it the type of vegetation or land uses? Could this section become a model for how BRASS might try to restore other agricultural river areas? Or, are appearances deceiving; is the section unstable?

Results of the laser level survey: The river section surveyed (as drawn on the map) is a somewhat stable "C5" type stream section. It is considered a "C5" stream from its physical dimensions (width/depth ratio, sinuosity, slope, access to a floodplain, and channel bottom materials). The section surveyed is 2,140 feet in length as measured along the deepest part of the channel. Its width at bankfull is 96 feet.

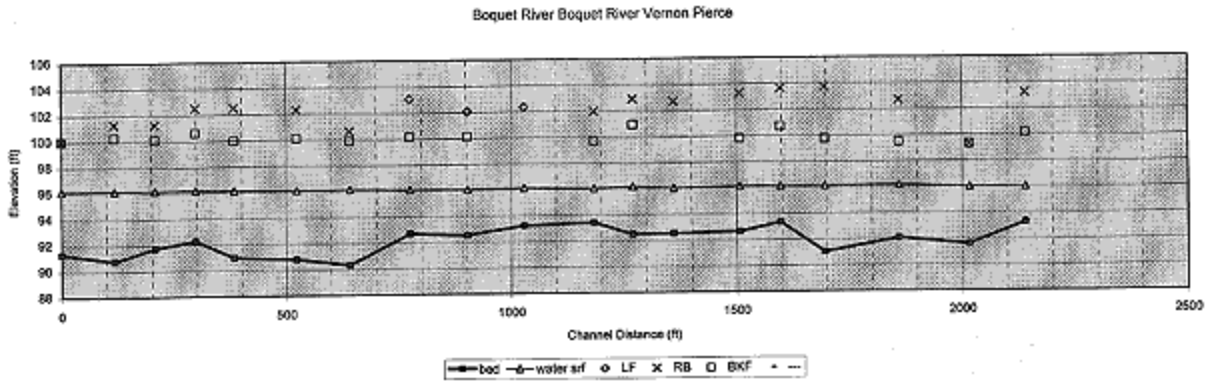
Remember, "bankfull" does not mean when water is at the top of both banks, but refers to that level when water just begins to flow over sediment material deposited on an inside bend of the river. This condition occurs about every 1.5 years, and it is this flow that forms how the channel looks.

The river on this section has good access to its floodplain, allowing it to move back and forth when needed and lessening its power during flood stage to do damage. This is called the "entrenchment ratio." Our section exhibits a 6 to 1 ratio when the flood prone width is divided by the bankfull width. (To determine flood prone width, which approximates a 50-year flood, you double the height of the river when at bankfull stage.) In the cross-section diagram of the river, you can see the contour of the channel's bed and banks by the dotted line. Each dot represents a surveyed point; each light horizontal line represents a foot in elevation.

The dark horizontal between the 100 and 102 instrument elevation is the bankfull line. The dark horizontal line at about the 108 elevation is the 50-year flood prone level. You can see it is well above the top of both banks by about 6 feet.



This section has an average sinuosity of 1.4, meaning the length of the wiggling river is 40% longer than a straight line down the valley from the beginning point of the survey to the downstream end. The bottom bed of the river, even though it consists primarily of medium sand, varies in contour as if it had shallow riffles and deep pools. (See the cross-section diagram of the river's length.)



Results of other assessments: Along with measurements obtained by survey equipment, BRASS also conducted some assessments used by professionals to indicate degrees of streambank and channel stability or instability. These are more subjective tools, and the potential for bank erosion was "moderate" when using a scale of low/moderate/high/very high/extreme. Indicators of this potential included the bank height to bankfull height ratio, rooting depth and density, the angle of the bank, and the amount of surface protection.

Channel stability assessments showed evidence of stress with siltation of pools, growing bars with no vegetation, leaning trees and exposed tree roots, non-cohesive soils in steep banks, and the lack of vegetation at eroding banks. Banks will erode even in a healthy stable stream, especially along an outside meander bend since the river must more and adjust to its varying load of water and sediment. An eroding section is considered stable if it keeps the same width/depth ratio and gradient. However, cross-sections downstream of the meander have increased in their width-to-depth ratio (from 12 to 17) which means the river is becoming less able to efficiently carry its water and sediment load.

Results compared to other surveys of C5 river sections: Although the Wadhams section shows a moderate potential for streambank erosion and some stress in channel stability, it still looks fairly good compared to other C5 sections surveyed on the Boquet and Au Sable Rivers. On the next page is a chart that shows other river areas having greater problems, usually associated with these attributes: an increasing width/depth ratio; decreased sinuosity; increased slope; decreased meander width ratio; increased bar development and deposition; and accelerated bank erosion.

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sings of instability	+	-	+	-	+	+
C5 survey sections	width/ depth ratio	sinu- osity	slope (%)	meander width ratio	increase in bars	accelerated bank erosion
Boquet "Wadhams Ox Bow," above Wadhams Falls	14	1.4	.007	5.9	no	moderate
Boquet "Bailey," Whallonsburg	15	1.2	.039	5.5	no	very high
Boquet "B.F.1," below Wadhams Falls	12	1.0	.025	no meander	no	very high
Boquet "B.F.2," below Wadhams Falls	25	1.7	.008	3.1	no	extreme
W.Branch AuSable, "Catch & Release 2"	23	1.2	.039	no meander	yes	moderate

So you can see by the chart that the lower ox-bow section in Wadhams usually looks better, under all categories, than other streams surveyed of the same type. But, because of the "moderate" bank erosion potential and signs of channel stability stress in this section, every effort should be made to keep trees, bushes, and other vegetation growing in a wide belt along both sides of the river.

Should BRASS use this part of the river as a model for restoring other "C5" stream sections? Perhaps, if we can find inexpensive ways of narrowing over-widened sections, and if other stream sections have high entrenchment ratios allowing flood water access to floodplains and meandering.
