



**THE MOST BANG FOR THE BUCK:
DEVELOPING A WATERSHED RESTORATION
PLAN FOR A RAPIDLY URBANIZING
VERMONT WATERSHED**

Lori Barg and Bob Kort

Stormwater Management in Cold Climates

November 5, 2003

CAN ALLEN BROOK BE RESTORED?



- **WHY WE DID IT**
- **WHAT WE DID**
- **WHAT IT MEANS**
- **WHAT CAN BE DONE**
- **QUESTIONS**

ALLEN BROOK DOES NOT MEET STATE WATER QUALITY STANDARDS DUE TO NONPOINT SOURCES OF POLLUTION



PRIMARY POLLUTANT:
SEDIMENT

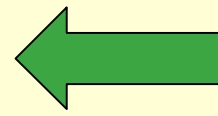
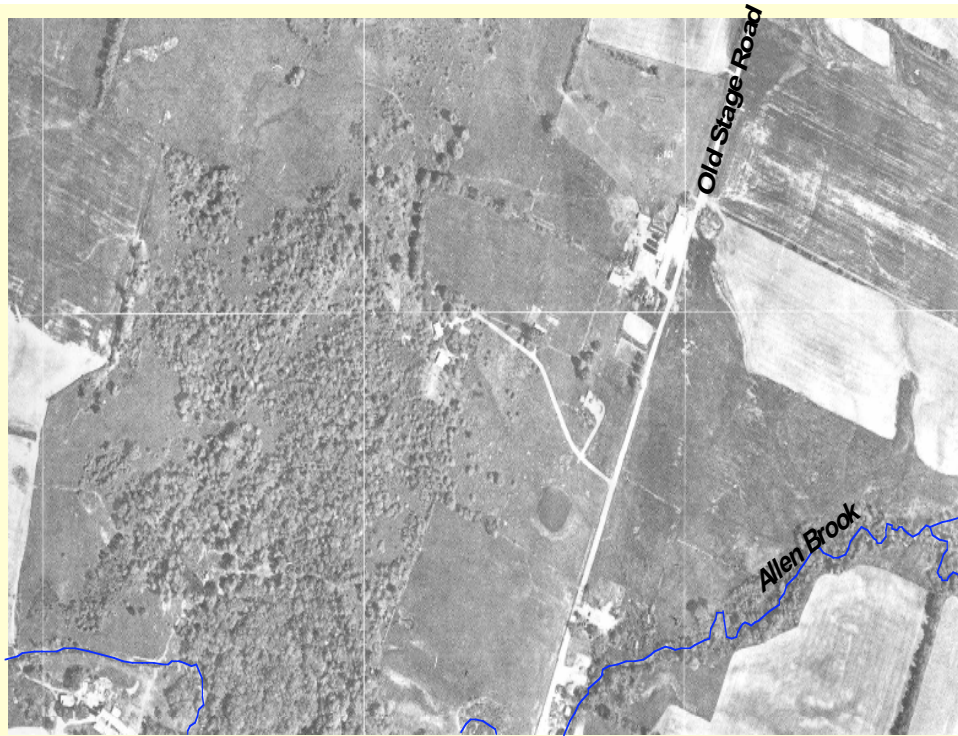
PRIMARY PROBLEM:
CHANGES IN HYDROLOGY

*INCREASED URBAN DEVELOPMENT =
INCREASED RUNOFF =
DECREASED INFILTRATION =
INCREASED SEDIMENT LOAD*



ALLEN BROOK IS IMPAIRED, BUT STILL HAS NOT MET PREDICTED BUILD-OUT

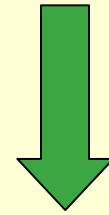
- Williston Zoning allows a maximum lot coverage of 65% in the Commercial I and II Districts and 70% in the Industrial District.
- The predicted build-out of the lower Allen Brook watershed *has not been reached*.
- Rapid growth is *also* occurring outside the Sewer Service Area. Target for new dwelling units of 20% in this district has been exceeded almost every year for the past 10 years.



1978

OLD STAGE ROAD

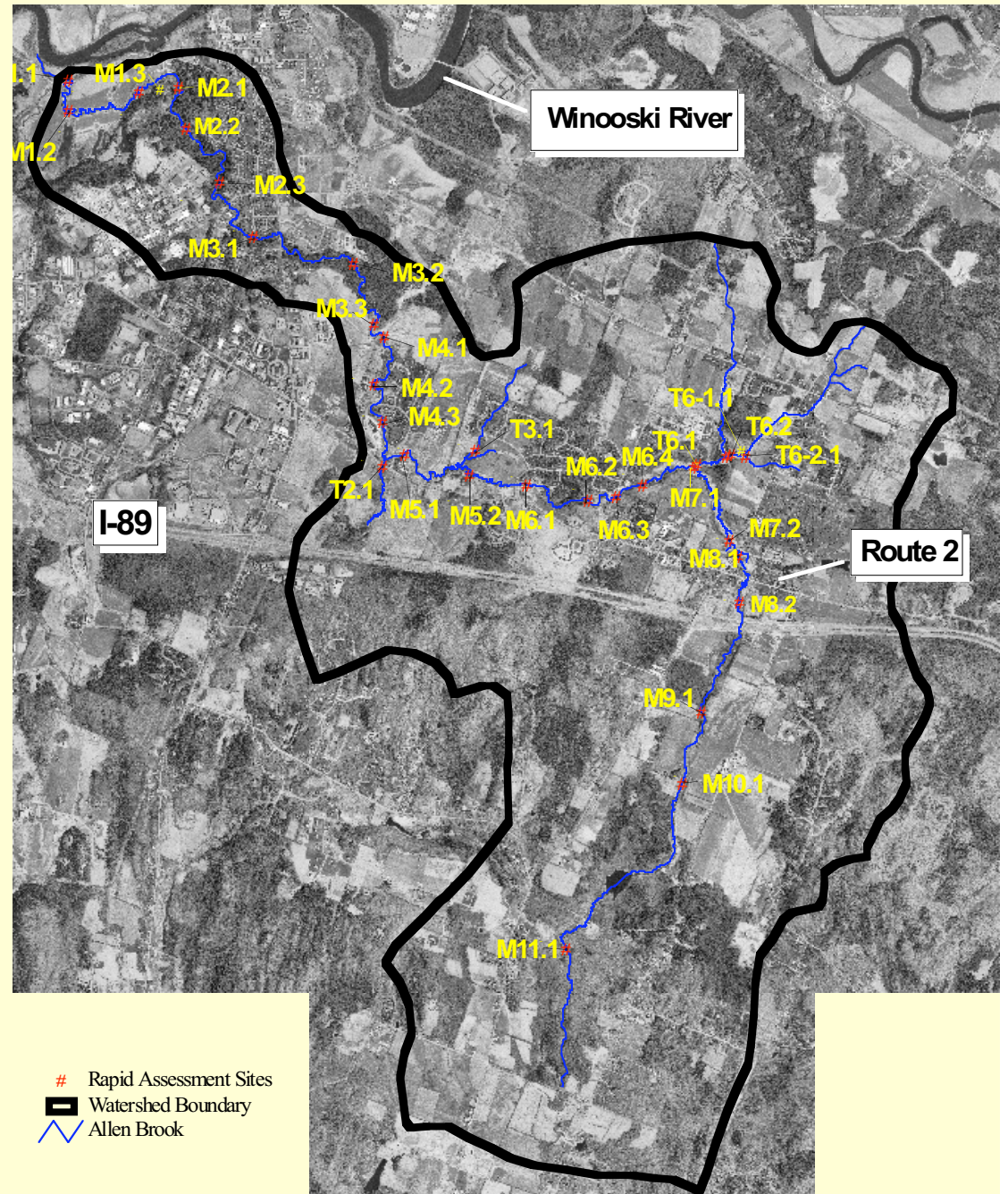
1999



WHAT WE DID

- PHYSICAL ASSESSMENT
- MODELED SEDIMENT LOAD
- MAPPED IMPERVIOUS AREA
- STORMWATER RETROFIT SURVEY- 138 STORMWATER SYSTEMS
- PUBLIC OUTREACH: developers, homeowners associations, town commissions.

**MADE
RECOMMENDATIONS**



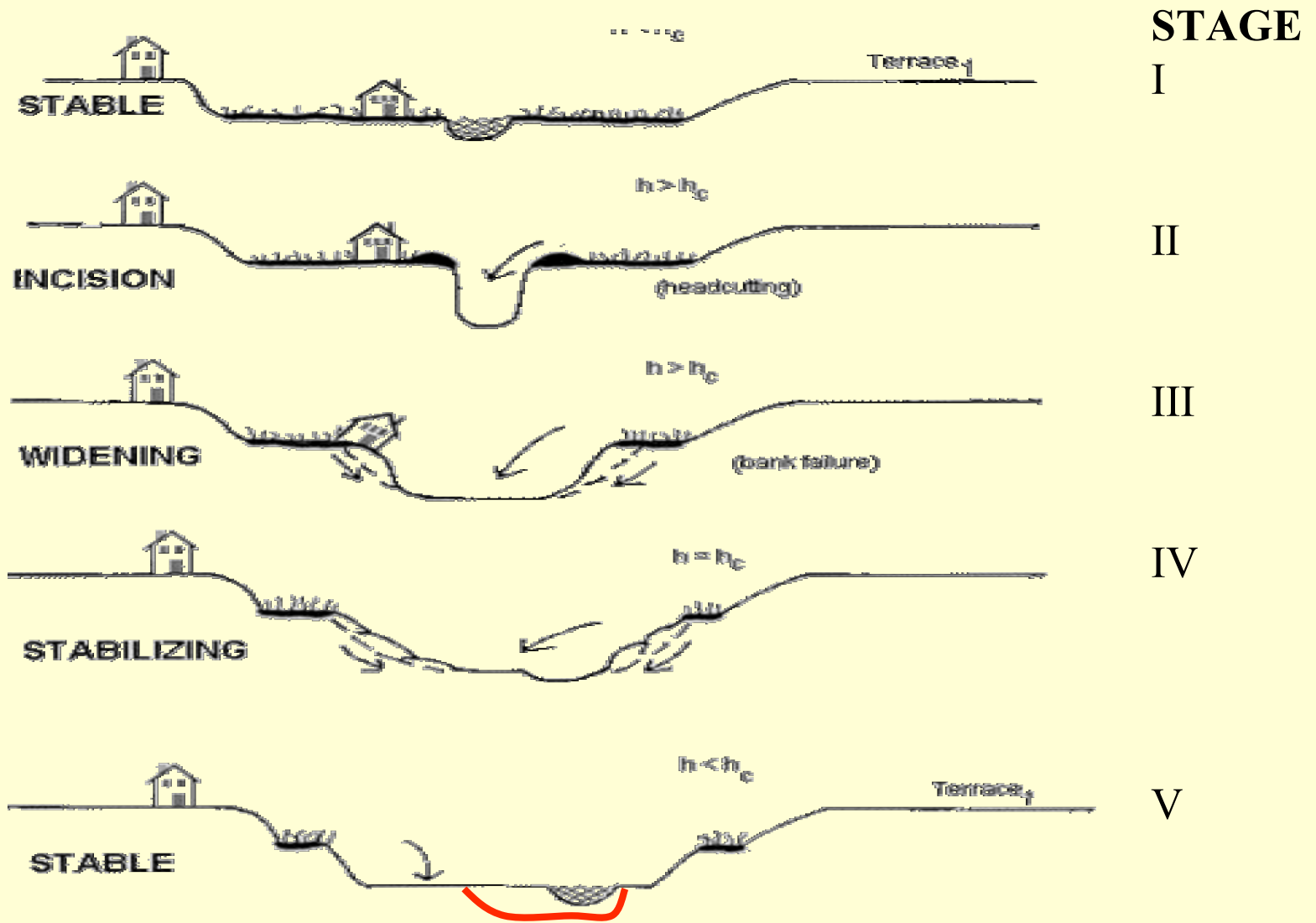
SUMMARY MATRIX: STREAMS IN ADJUSTMENT

Mainstem reaches in the middle part of the watershed, reaches 4 – 8, have the most problem. Tributaries are at risk too.

Reach Number	Site Number	CEM in Adjust-ment	RGA: Poor or Fair	RBP: Poor or Fair	Unstable Rosgen Stream Type
1	1	x	x	x	
1	2	x	x		
2	2		x		
2	3		x		
3	1	x			
3	3	x			
4	1			x	
4	3	x		x	x
5	1	x	x		
5	2	x	x	x	
5	T3.1	x	x	x	
5	T3.U			x	
6	1	x	x		x
6	2	x	x		x
6	3	x			
6	4	x	x		
7	1	x	x	x	
7	2	x	x	x	x
7	T6.1	x	x	x	
7	T6.2	x	x	x	x
7	T6-1.1			x	
7	T6-2.1	x		x	
8	1	x	x	x	
8	2	x			

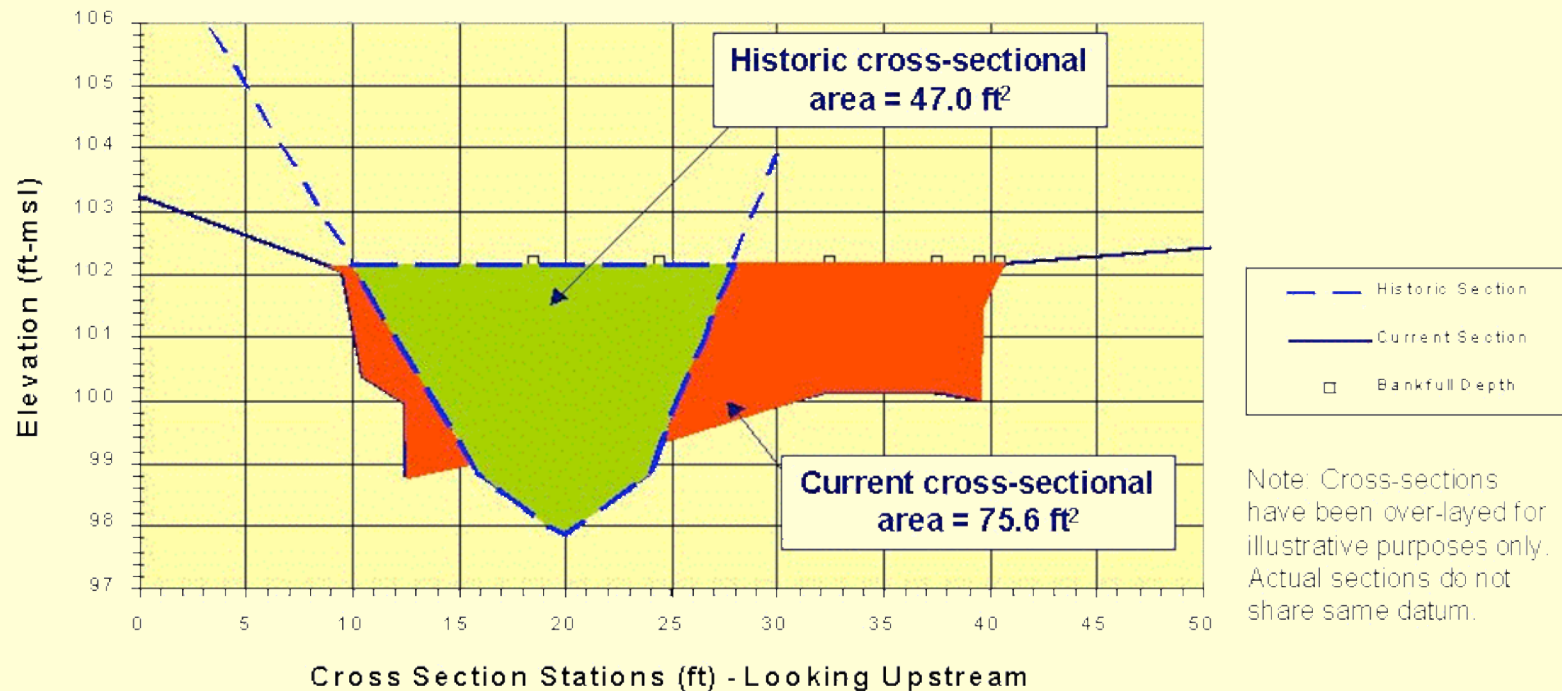
CHANNEL EVOLUTION MODEL

(AFTER SCHUMM)



CHANNEL ENLARGEMENT DUE TO INCREASED IMPERVIOUS SURFACE

Comparison of Historic vs. Current Cross-Sections at Station POT1





SOURCES OF SEDIMENT

CONCENTRATED
FLOW FROM
STORMWATER

and
CHANNEL
ADJUSTMENT
Stage 2



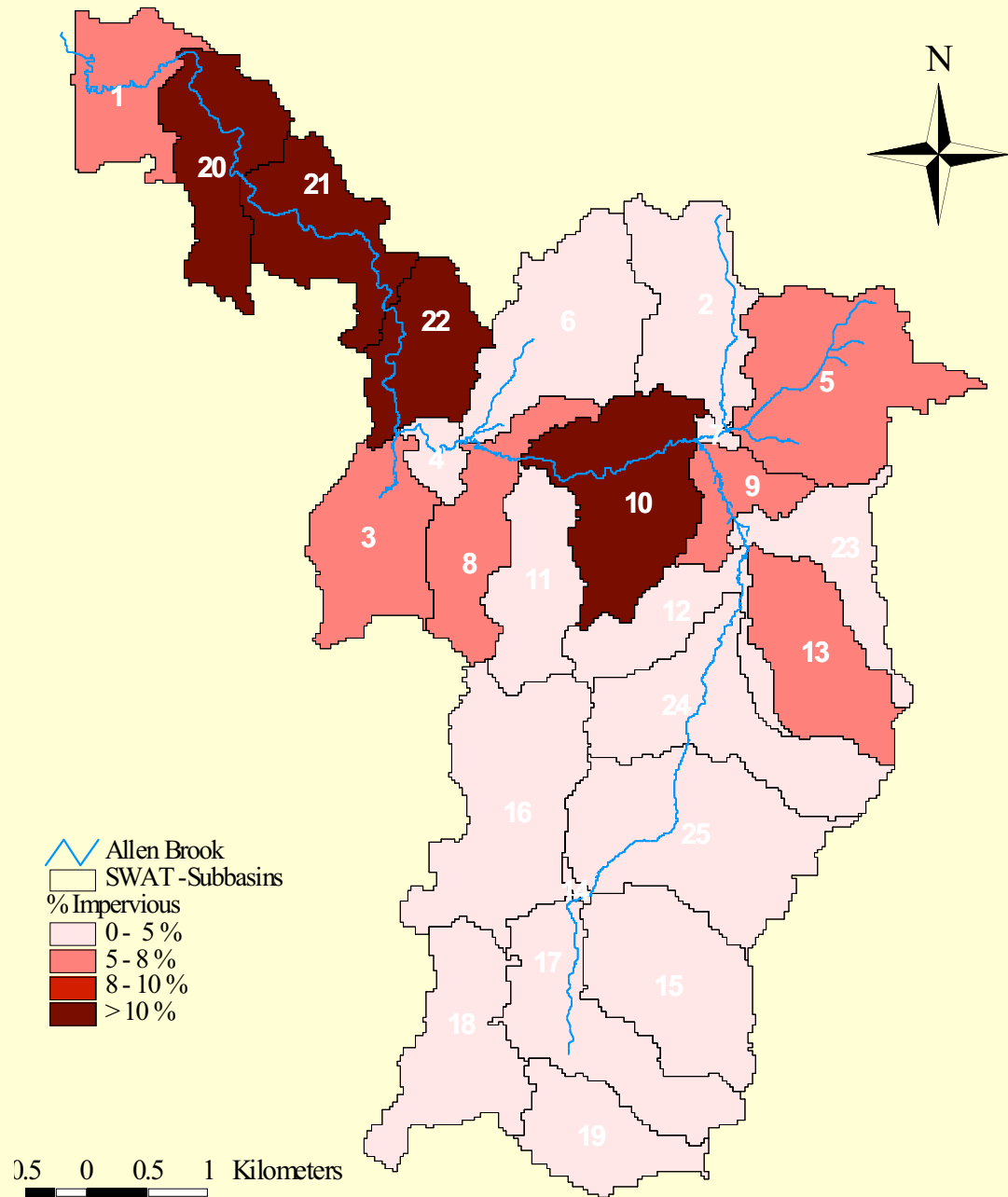
WHAT IT MEANS

ALLEN BROOK IMPERVIOUS COVER

Over 8% timp.
Vermont stormwater manual recommends extra attention to stormwater.

MORPHOLOGICAL CHANGES OCCUR WITH AS AS LITTLE AS 2% TIMP.

20 = 25%
21 = 13%
22 = 13%
10 = 16%



HYDROLOGY IS KEY

**WORK WITH COMMUNITY TO
DISCONNECT IMPERVIOUS SURFACES**

and

TOWN SHOULD ADOPT THREE KEY TOOLS

1. **VERMONT STORMWATER MANAGEMENT
MANUAL WITH REQUIRED USE OF CREDITS**
2. **ENFORCEABLE MAINTENANCE AGREEMENTS**
(Watershed Management Institute)
3. **NEW YORK EROSION AND SEDIMENT CONTROL
GUIDELINES** (implemented through enforceable agreements)

VERMONT STORMWATER MANAGEMENT CREDITS

- NATURAL AREA CONSERVATION
- DISCONNECTION OF ROOFTOP RUNOFF
- DISCONNECTION OF NON-ROOFTOP RUNOFF
- STREAM BUFFERS
- GRASS CHANNELS
- ENVIRONMENTALLY SENSITIVE RURAL DEVELOPMENT

STRUCTURAL CHANGES

Culverts and Bridges

- USE BRIDGES

- NO DOUBLE CULVERTS

- BUILD WIDE ENOUGH FOR PREDICTED BUILD-OUT

(use enlargement curve)

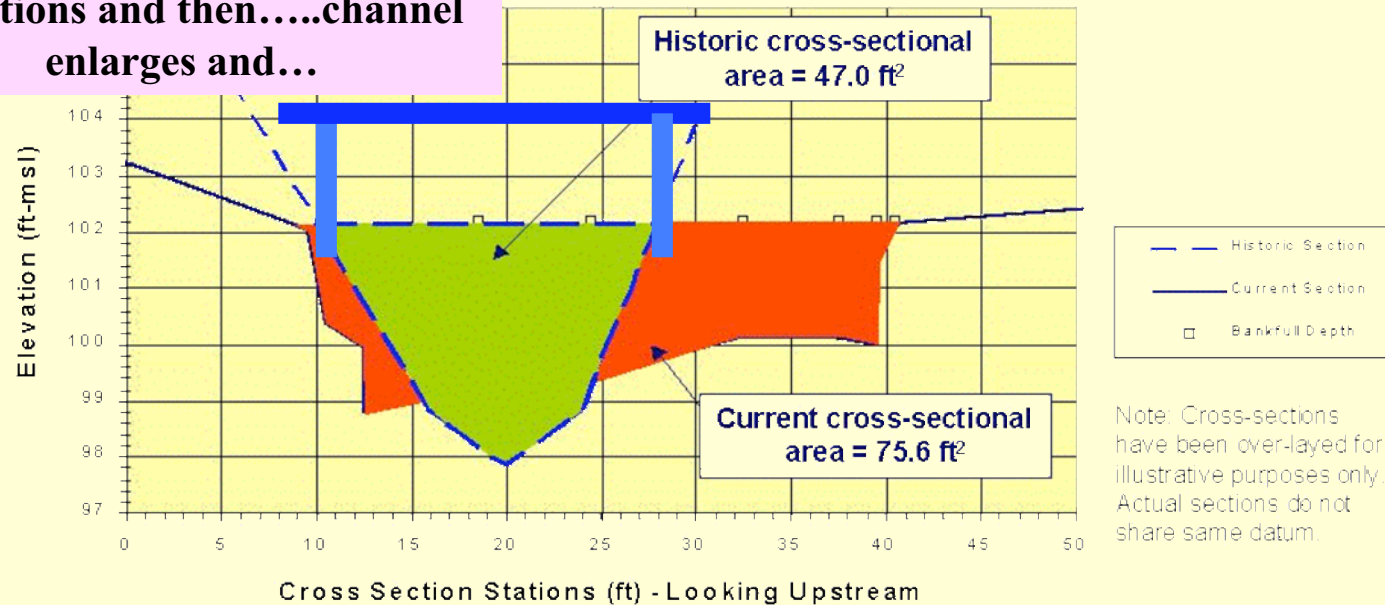


Scour downstream of undersized Culvert-ANR Photo

MANAGEMENT IMPLICATIONS

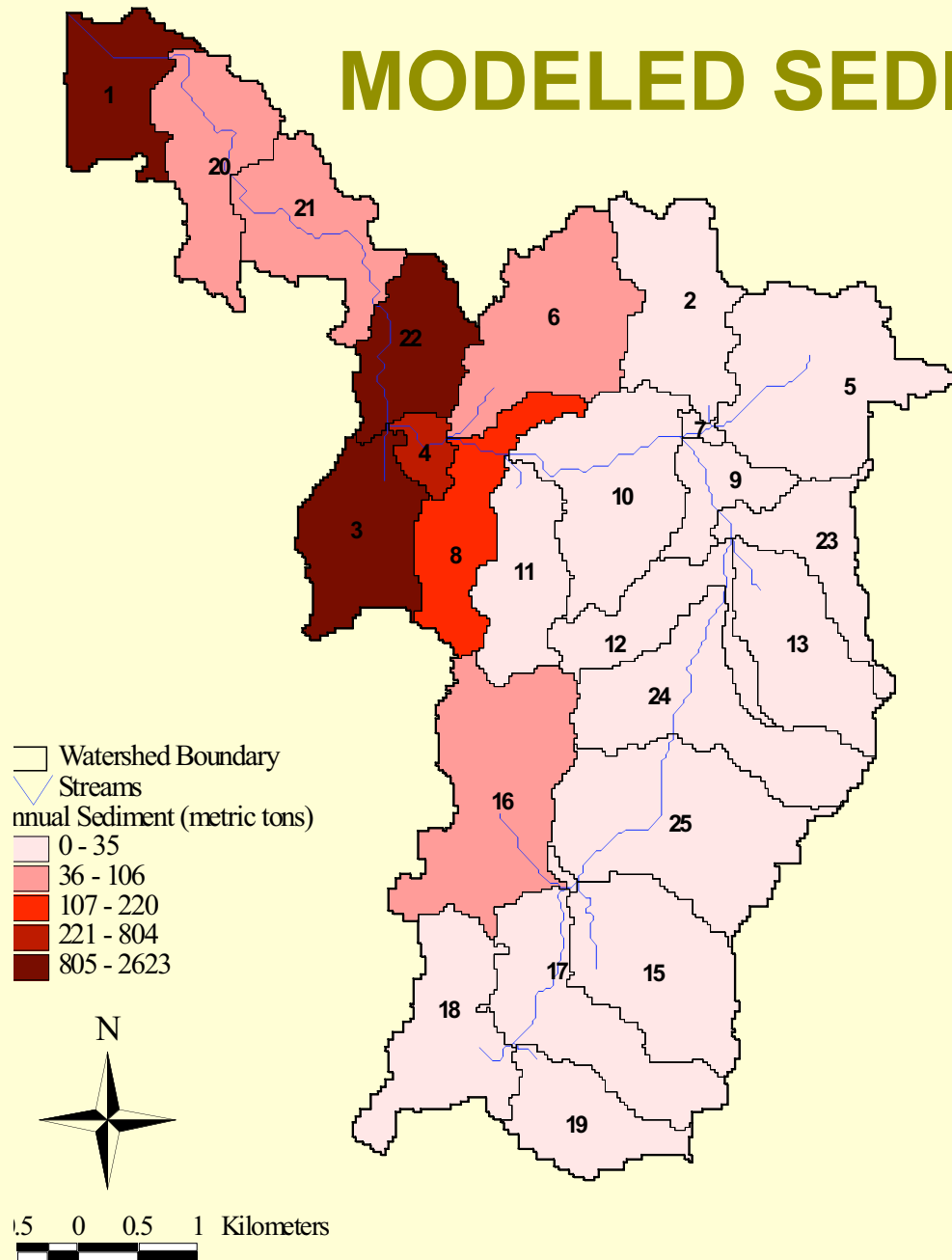
Comparison of Historic vs. Current Cross-Sections at Station POT1

Build a bridge for current conditions and then.....channel enlarges and...



Opportunity: Size infrastructure for predicted channel enlargement based on “build-out analysis” using current zoning

MODELED SEDIMENT LOAD



Average annual sediment load (metric tons/year) based on SWAT model outputs.
Numbers on map indicate subbasins delineated for modeling purposes.



RIPARIAN CONDITION

(not just the river)

- **BANK/BUFFER VEGETATION**
- **SWALE EROSION**
- **VEGETATIVE COVER**

MOST BANG FOR THE BUCK

5 NON-STRUCTURAL APPROACHES

1. BETTER SITE DESIGN (good for environment *and* developers) cluster housing, reduce road width, decrease impervious surfaces, conserve land.
2. ENFORCEABLE EROSION AND SEDIMENT CONTROL OR PERMIT FEE Watershed Management Institute
3. ENFORCEABLE MAINTENANCE AND MANAGEMENT AGREEMENTS Watershed Management Institute and Vermont Stormwater Management Manual
4. BUFFER ORDINANCE
5. CHANGES TO LOCAL ORDINANCE

*are the most cost effective methods
to reduce sediment loads.*

STORMWATER TREATMENT FACILITIES

SUMMARY: Stormwater Treatment Retrofit Ranking

Priority Rank	1	2	3	4	5
Number of Retrofits	48	30	29	21	8

1 – Highest priority retrofit (significant contributor due to proximity to AB, size of development (IC), high traffic volume, poor or nonexistent treatment, etc.)

2 – High priority retrofit (lack of STP; deficient design, construction, and/or maintenance; significant offsite impacts)

3 – Retrofit recommended

4 – Low priority retrofit (pretty good treatment already; small DA, high cost for treatment gained, etc.)

5 – No retrofit recommended at this time

COMMON PROBLEMS WITH EXISTING STORMWATER TREATMENTS

1. Lack of maintenance (significant erosion, sediment deposits, clogged basin outlets, etc.).
2. Poor design or not constructed as designed (or at all).
3. No treatment of smaller storms by detention basins.
4. Few infiltration BMPs at suitable sites.
5. Little or no treatment by vegetative BMPs due to concentrated flows, poor vegetative cover (sparse or too short), or steep slopes.
6. Erosion and poor vegetative cover adjacent to roads and parking areas.
7. Need for education of property owners/users (dumping, swales, etc.).

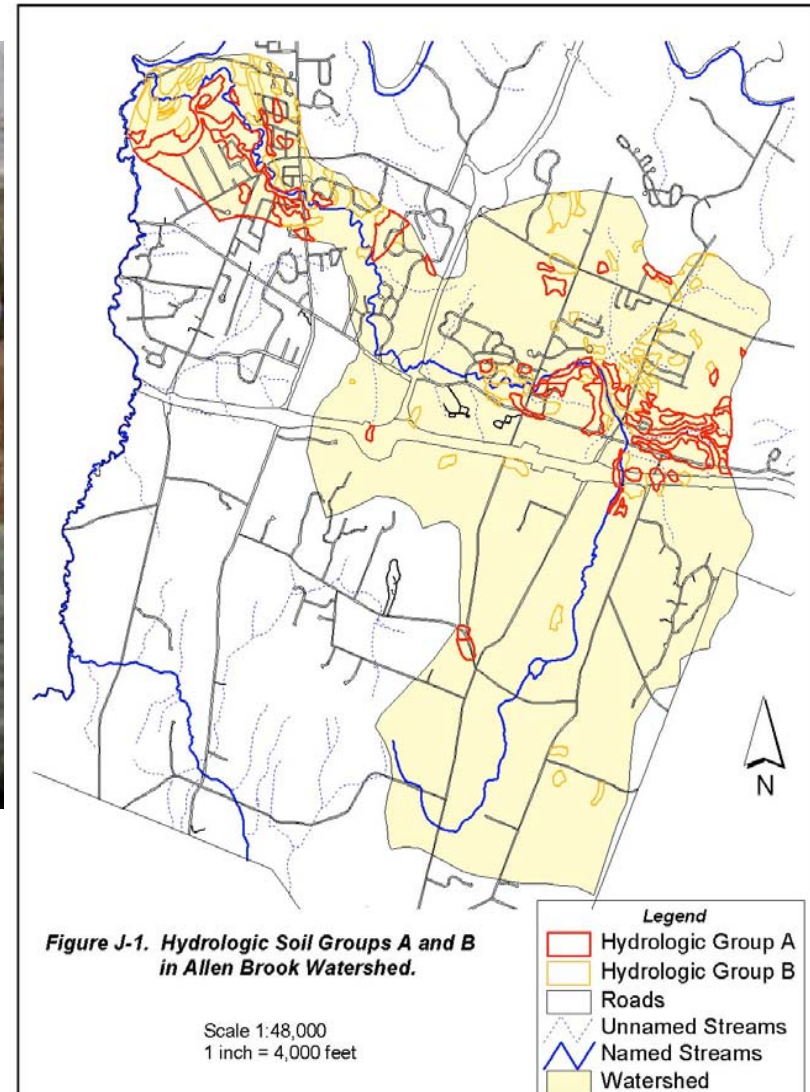
RECOMMENDED STORMWATER RETROFITS

1. Utilize cold regions design considerations in the Vermont Stormwater Management Manual.
2. Primary structural BMP should not rely solely on vegetative treatment (short Vermont growing season).
3. Retrofit existing ponds for 1 year extended detention.
4. Modify ponds to eliminate short circuiting.
5. Many sites permitted for “overland flow through vegetation” need to utilize a BMP such as biofiltration or dry swale.
6. Utilize infiltration BMPs at suitable sites currently lacking adequate treatment.
7. Other maintenance, repair or design modification needs as noted in report (stabilize eroding areas, vegetation, etc.).

HOW TO SUCCEED



Turtle Pond. Example of good stormwater design that improves property values.



A and B soils can be infiltrated (except hot spots).

\$\$ Funding \$\$

1. EPA's *Catalog of Funding Sources for Watershed Protection*
2. Grants: Lake Champlain Basin Program: Section 319, etc.

MONEY GENERATED WITHIN TOWN:

1. Stormwater utility or proxy - Chicopee Mass. example.
2. Initiate an enforceable stormwater maintenance agreement with funding from developer.
3. Pay for erosion and sediment control: A permit fee structure that covers the true cost of effectively implementing this program in the town of Williston.
4. Require developers to perform site inspection work for sediment and stormwater compliance at large construction sites as is done in Delaware's Certified Construction Reviewer Program.
5. Local property tax deductions for land in active agricultural or forest use.
6. Require better site design / conservation design. Economics are attractive for developers.

EXAMPLES OF RECOMMENDATIONS

1. Develop a maintenance and management plan for infrastructure, based on recommendations of the Watershed Management Institute, Vermont Stormwater Management Manual, Center for Watershed Protection.

2. Better construction site erosion and sediment controls.

- Erosion prevention and sediment control needs to move beyond inadequate designs with heavy reliance on hay bales and silt fence.
- Utilize more erosion prevention and not rely so heavily on just sediment controls.
- Implement institutional mechanisms to ensure good design, installation, site inspection and maintenance. This includes the use of performance bonds, line items in bid estimates for control practices, and a contingency line item in construction contracts for repair and maintenance of practices.

EXAMPLES OF RECOMMENDATIONS

3. Mitigate imperviousness of new construction. For example, if development creates 100 acres of imperviousness, mitigate 100 acres of impervious cover in the watershed through disconnection of impervious surfaces, roof tops, etc.

4. Reduce sediment through streetsweeping and catch-basin cleaning.

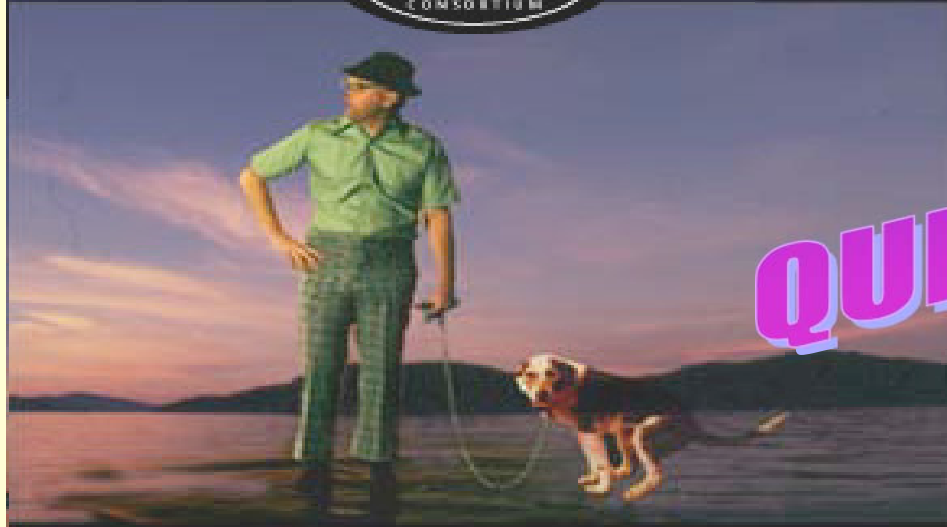
5. BMP's for snow storage, salt storage, and salt and sand spreading practices.

6. Culvert and bridge sizing. Size bridges for bankfull or floodprone width. Use Relaxation Curve combined with build-out analysis to size infrastructure for channel enlargement.

RECOMMENDED CHANGES TO WILLISTON TOWN ORDINANCES

1. Conservation/Open Space and Watercourse
Protection Overlay District (Buffers)
2. 2000 Comprehensive Plan
3. Subdivision Regulations
4. Zoning Ordinance, Amended 2000
5. Public Works Standards and Specification, 1997
6. Sample Ordinances Reference List

**WHEN YOUR PET
GOES ON THE LAWN,
REMEMBER IT DOESN'T JUST
GO ON THE LAWN**



**YOUR
QUESTIONS?**

When our pets leave those little surprises, rain washes all that pet waste and bacteria into our storm drains. And then pollutes our waterways. So what to do? Simple. Dispose of it properly (preferably in the toilet). Then that little surprise gets treated like it should.

A cooperative venture between the department of Ecology, King County and the cities of Seattle and Tacoma.

Public
Outreach
Restoration
Education

DOWNLOAD THE REPORT:

<http://town.williston.vt.us/gen/allen.htm>