EFFECTIVE RIPARIAN CORRIDOR MANAGEMENT TO PROTECT NATURAL SYSTEMS FROM DEVELOPMENT IMPACTS

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Stormwater and Urban Water System Modelling - February 24-25, 2005

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Outline

- Riparian Corridor Management
  - what is it
- Need for Corridor Management
  - subwatershed planning
- Corridor Identification, delineation
- Management Tools
- Gaps

Riparian Corridor Management – What is it

- Watershed context
- Form and Function
- Functional Elements

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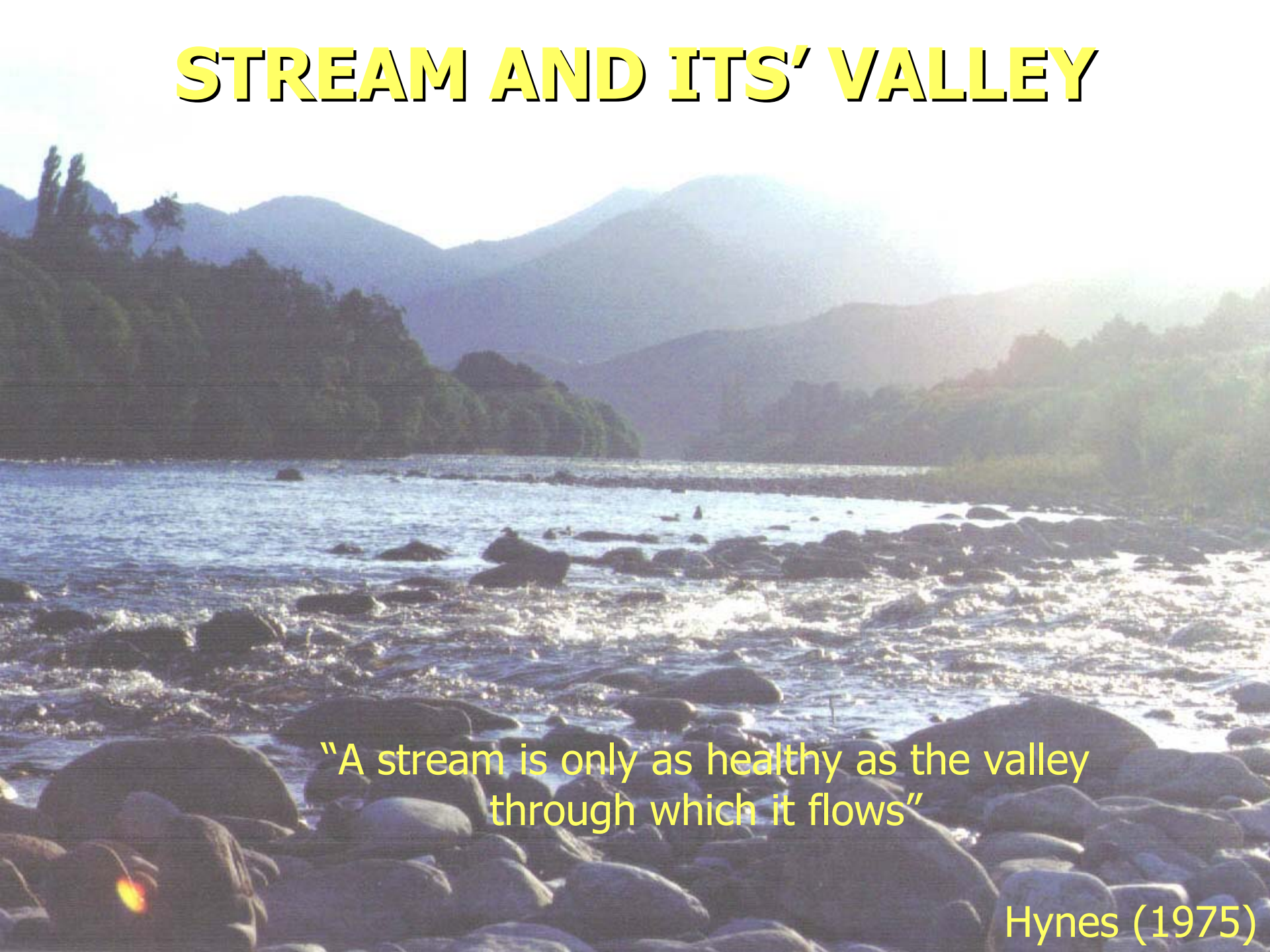
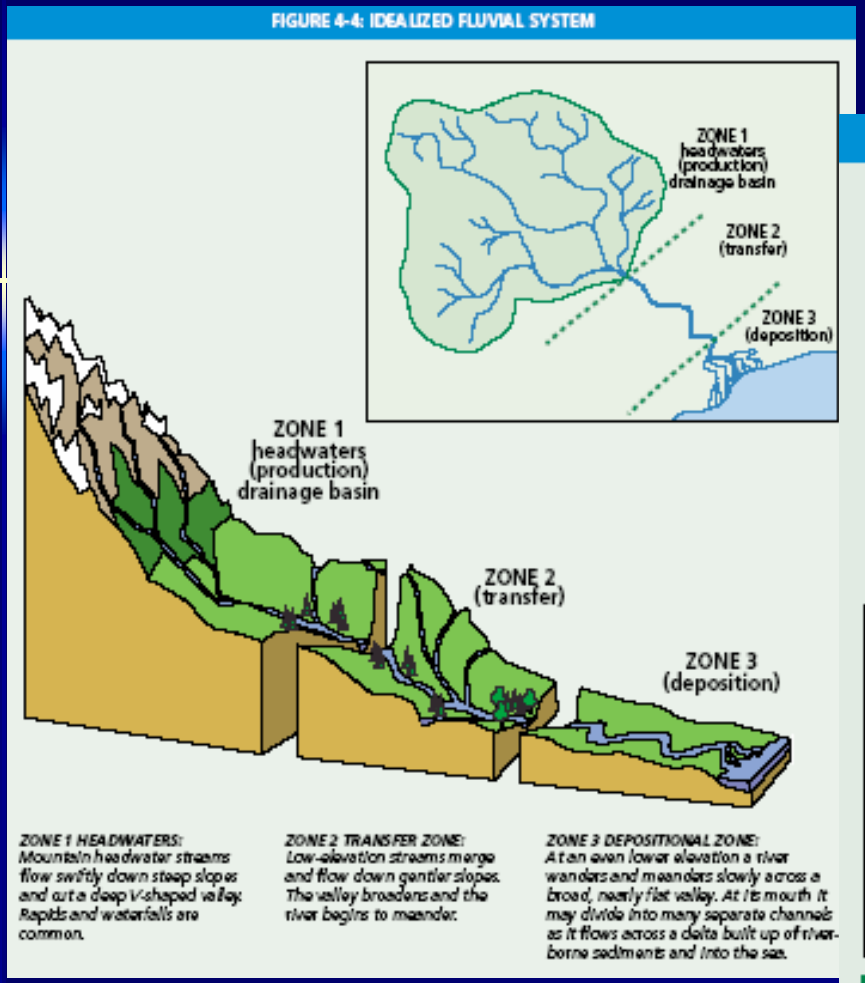
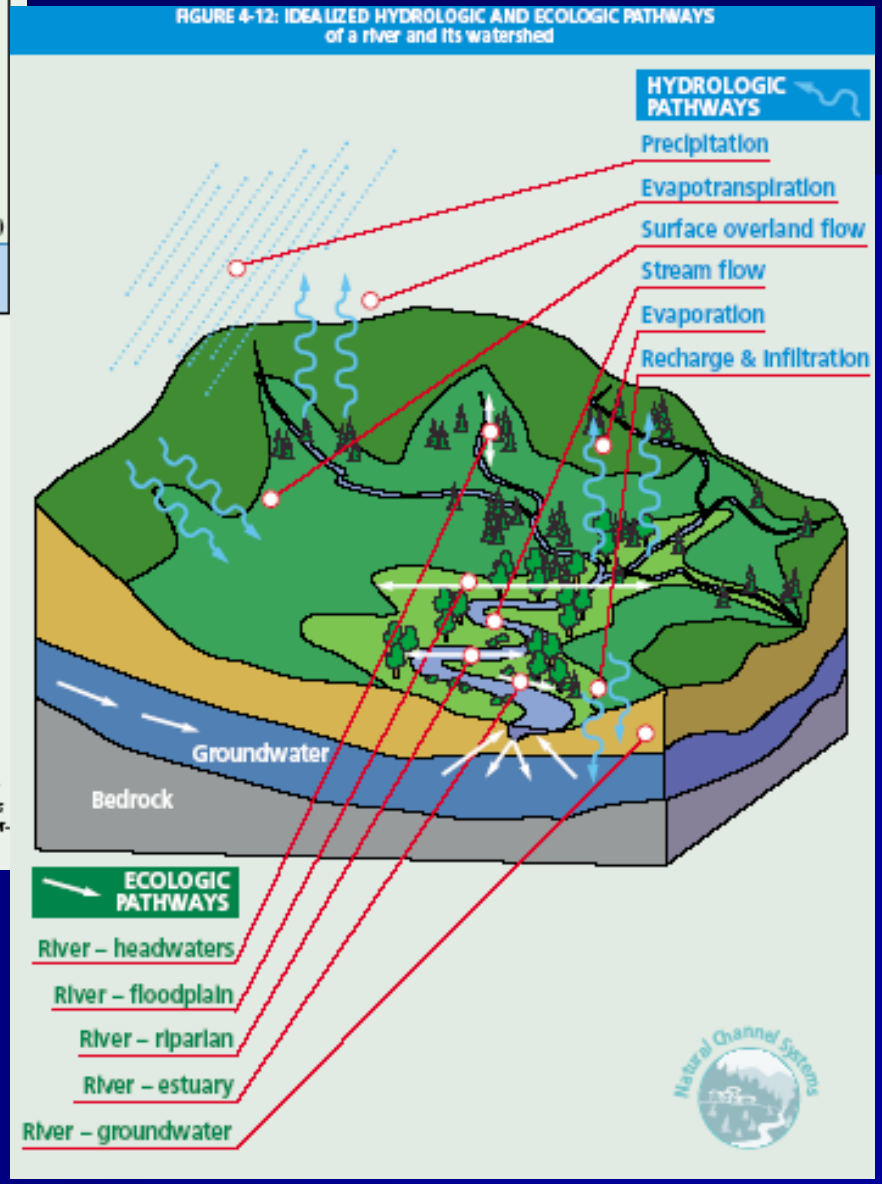
STREAM AND ITS' VALLEY

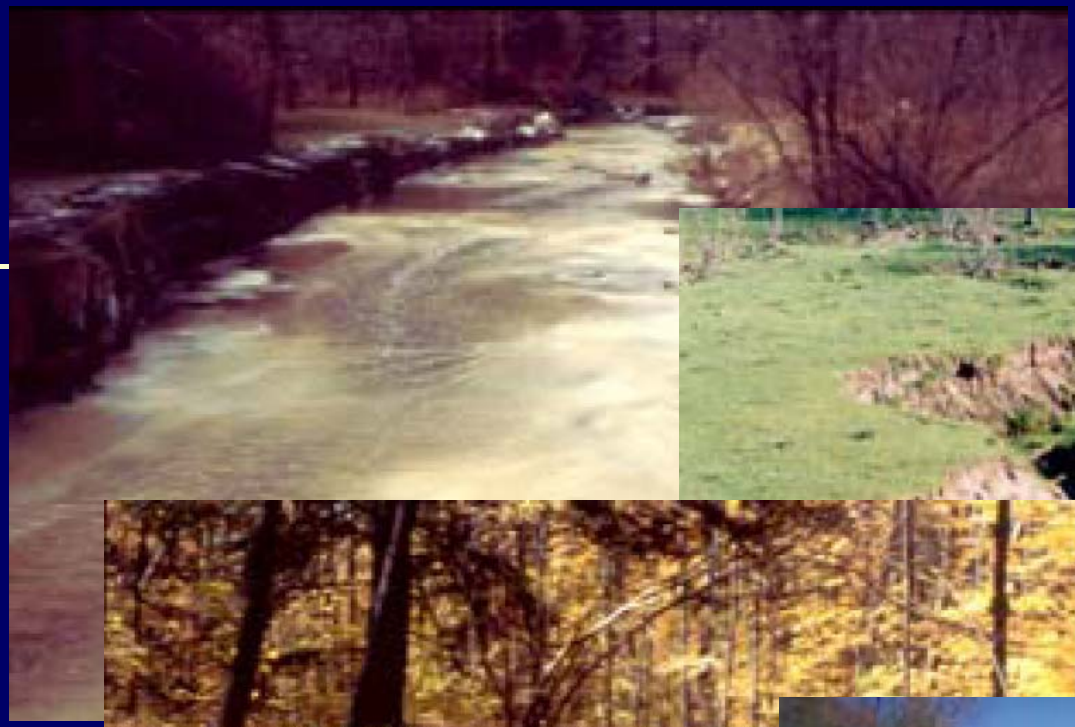


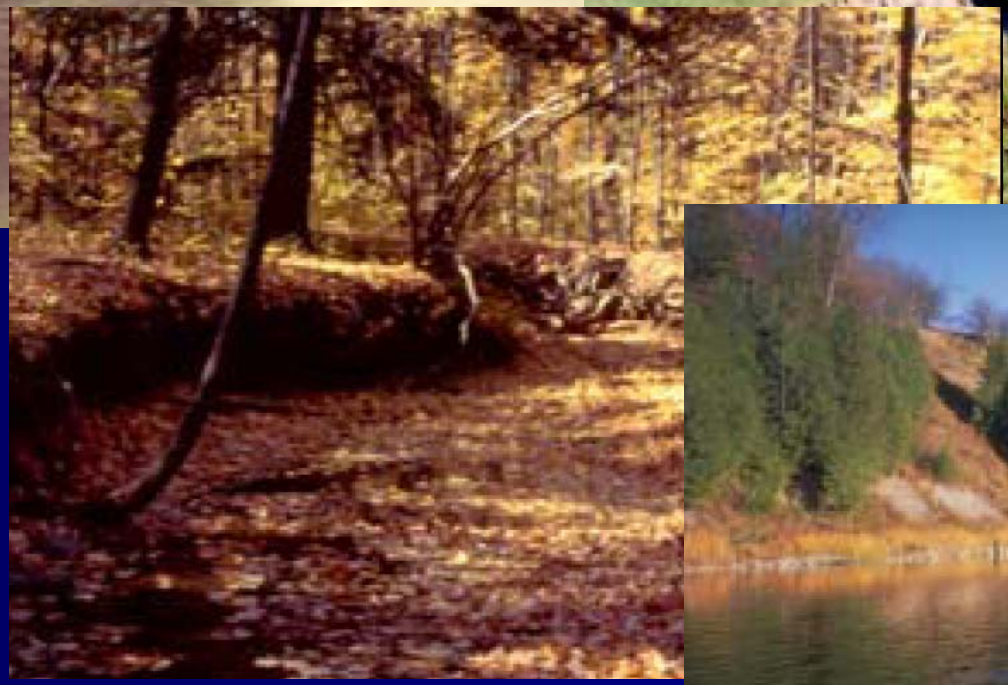
"A stream is only as healthy as the valley through which it flows"

Hynes (1975)









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Form and Function

Elements

- Environmental
- Fluvial Geomorphology/Erosion Protection
- Hydraulics/Flood Protection
- Hydrogeology
- Water Quality

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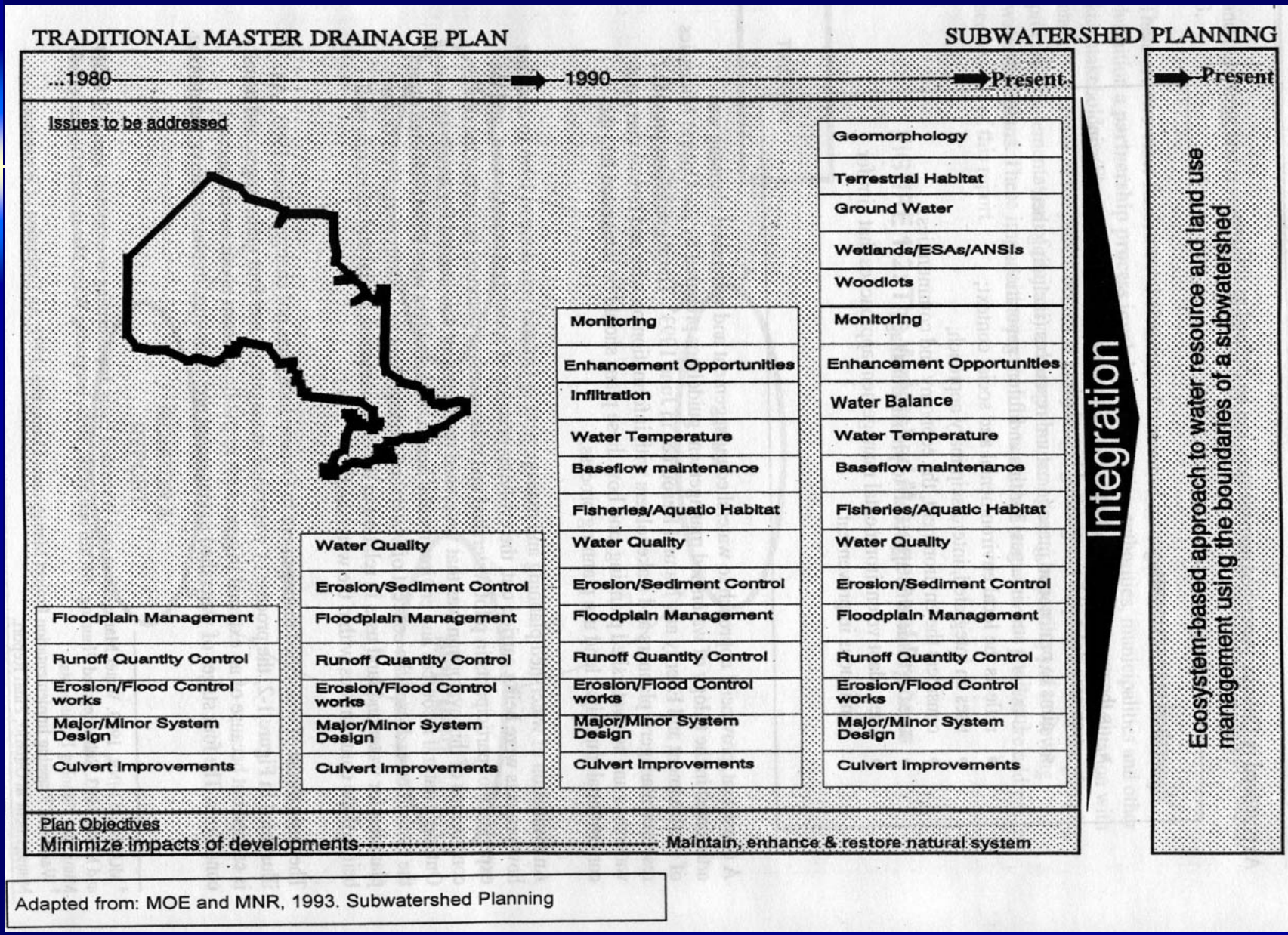
Need for Corridor Management

- Subwatershed Planning

Evolution



Adapted from: MOE and MNR, 1993. Subwatershed Planning

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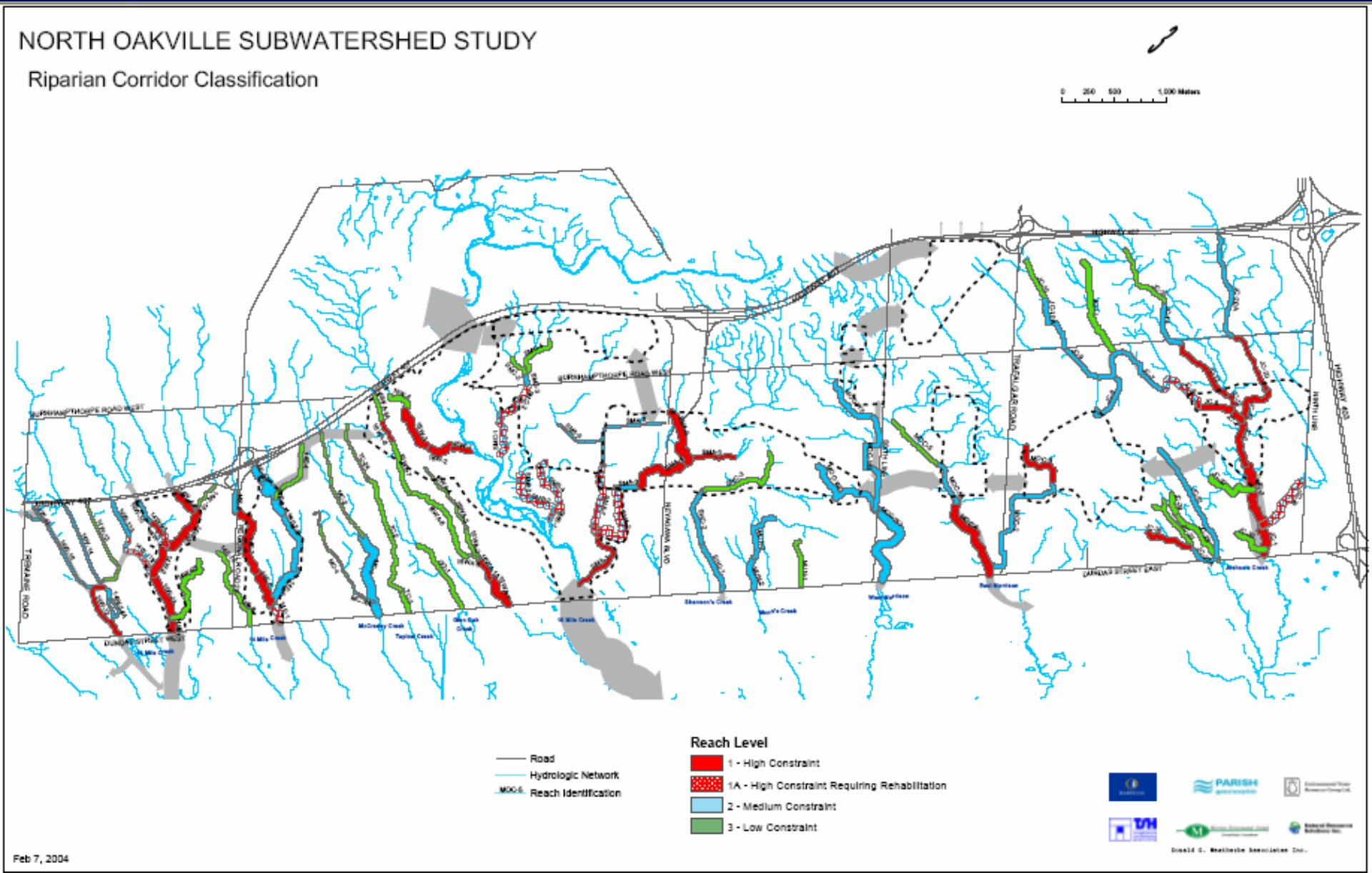
North Oakville Map



Corridor Identification/Delineation

Elements

- **Environmental**
  - **Terrestrial**
  - **Aquatic**
  - **Linkages**
- Fluvial Geomorphology
  - Planform
  - Erosion Control
  - Drainage Density
- Hydraulics
  - Flow Stages
  - Flood Control
- Hydrogeology
  - Regional
  - Local
- Water Quality
  - Temperature
  - Nutrients
  - Pollutant Reduction

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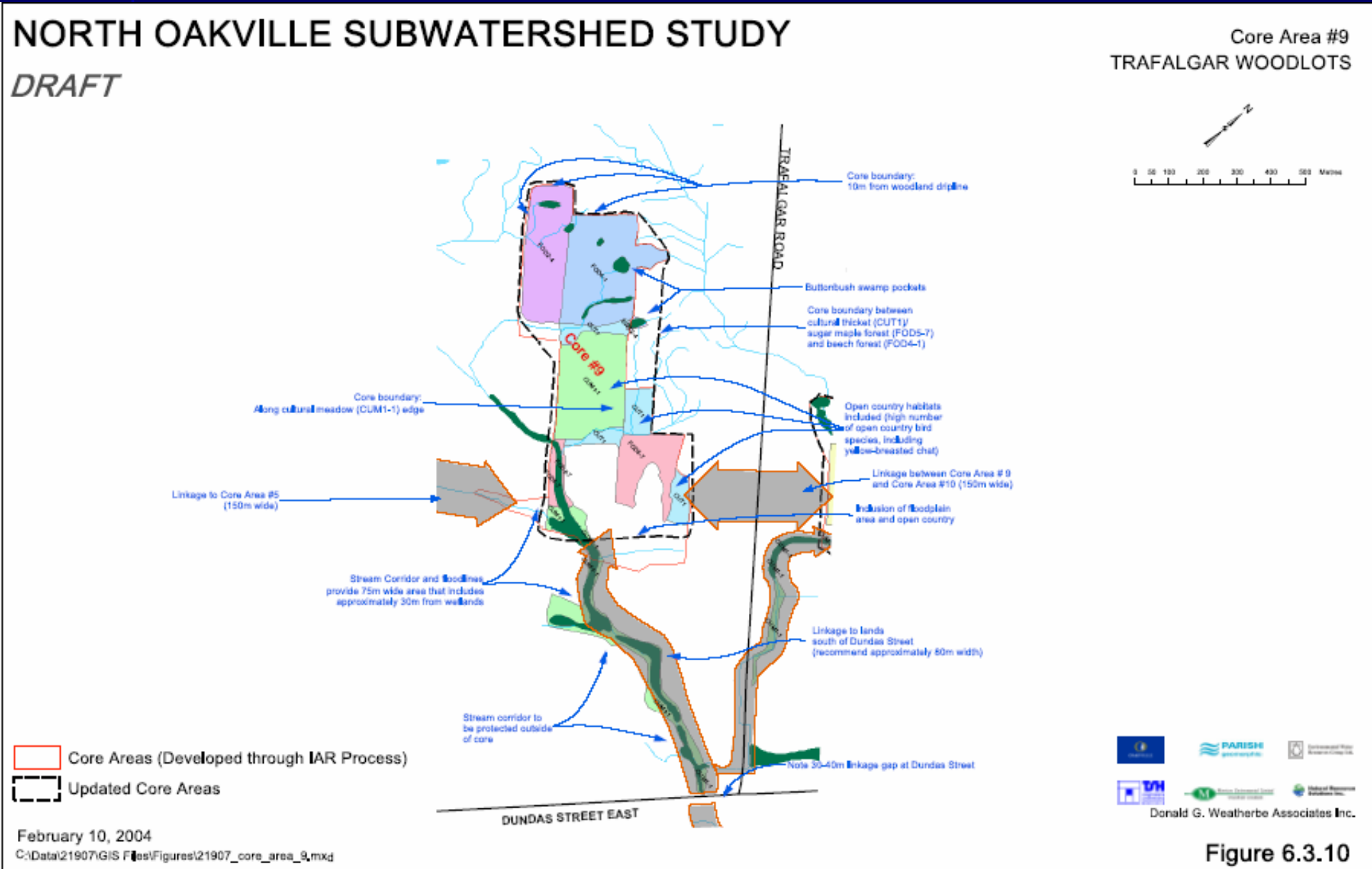
Sample for Oakville North Core 9



Schematic of the Flood-Pulse Concept

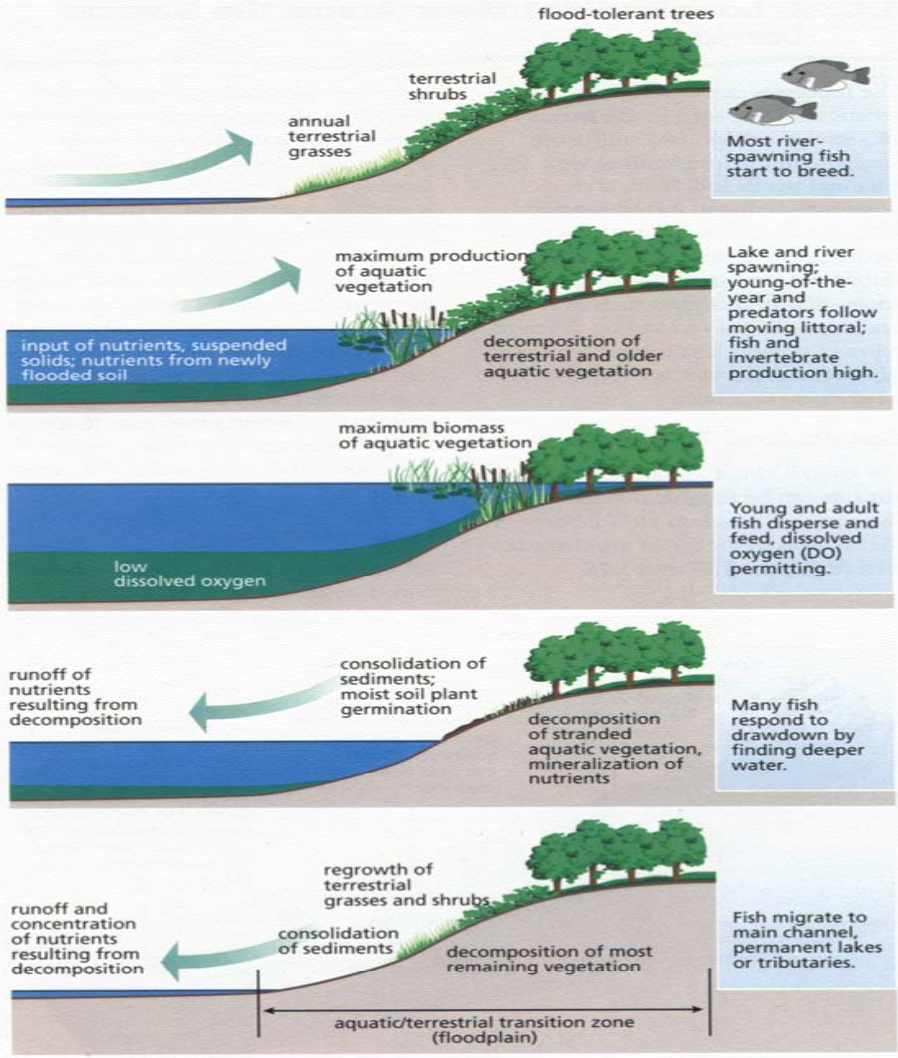


Figure 1.26: Schematic of the flood-pulse concept. *A vertically exaggerated section of a floodplain in five snapshots of an annual hydrological cycle. The left column describes the movement of nutrients. The right column describes typical life history traits of fish.*
Source: Bayley, ***Bioscience***, vol. 45, p.154, March 1995. ©1995 American Institute of Biological Science.

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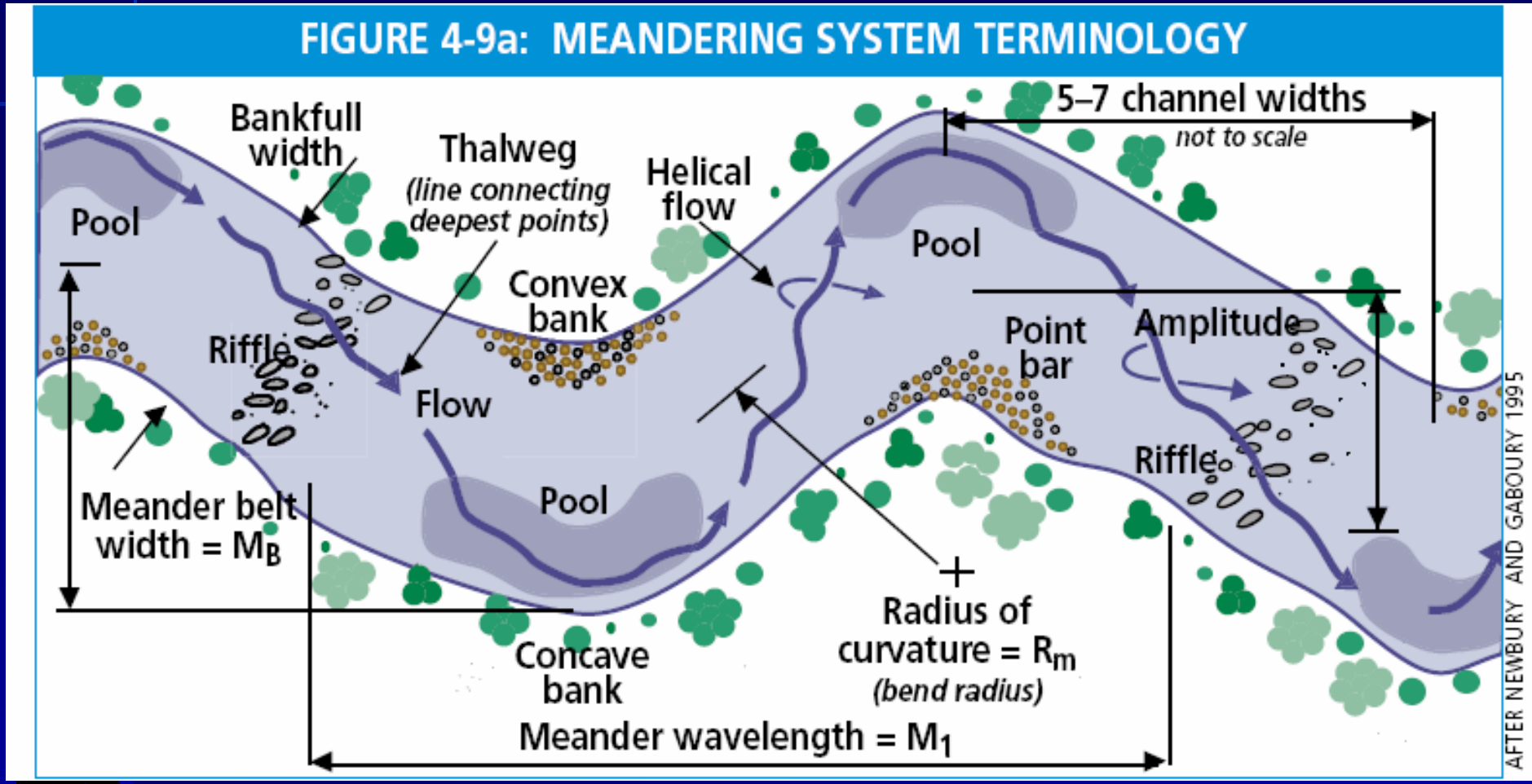
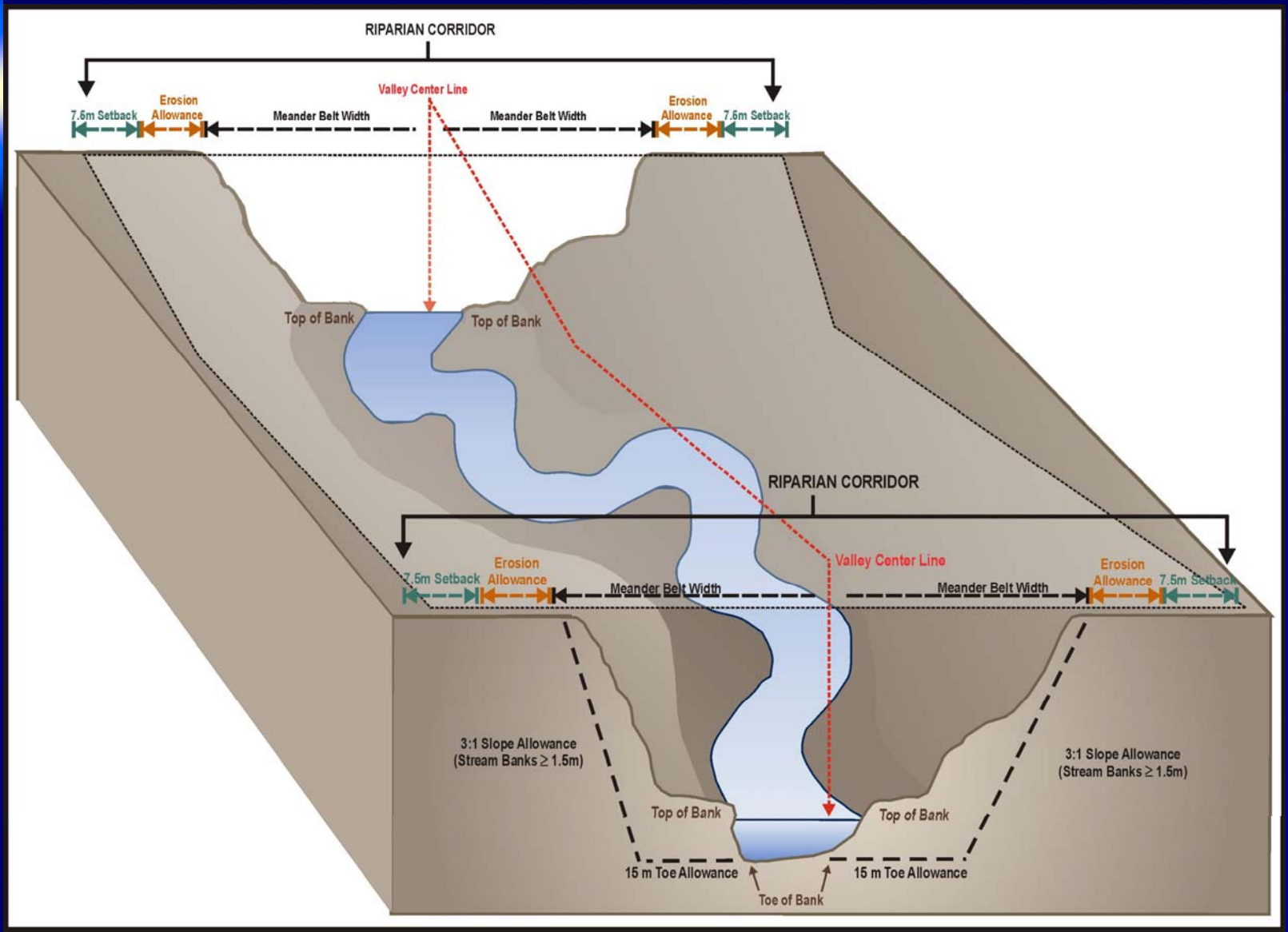


FIGURE 4-9a: MEANDERING SYSTEM TERMINOLOGY
Bankfull width
Thalweg
(line connecting deepest points)
Helical flow
5–7 channel widths
not to scale
Pool
Convex bank
Pool
Point bar
Amplitude
Riffle
Flow
Riffle
Pool
Meander belt width = M_B
Radius of curvature = R_m
(bend radius)
Concave bank
Meander wavelength = M_1
AFTER NEWBURY AND GABOURY 1995

Conceptual Belt Width



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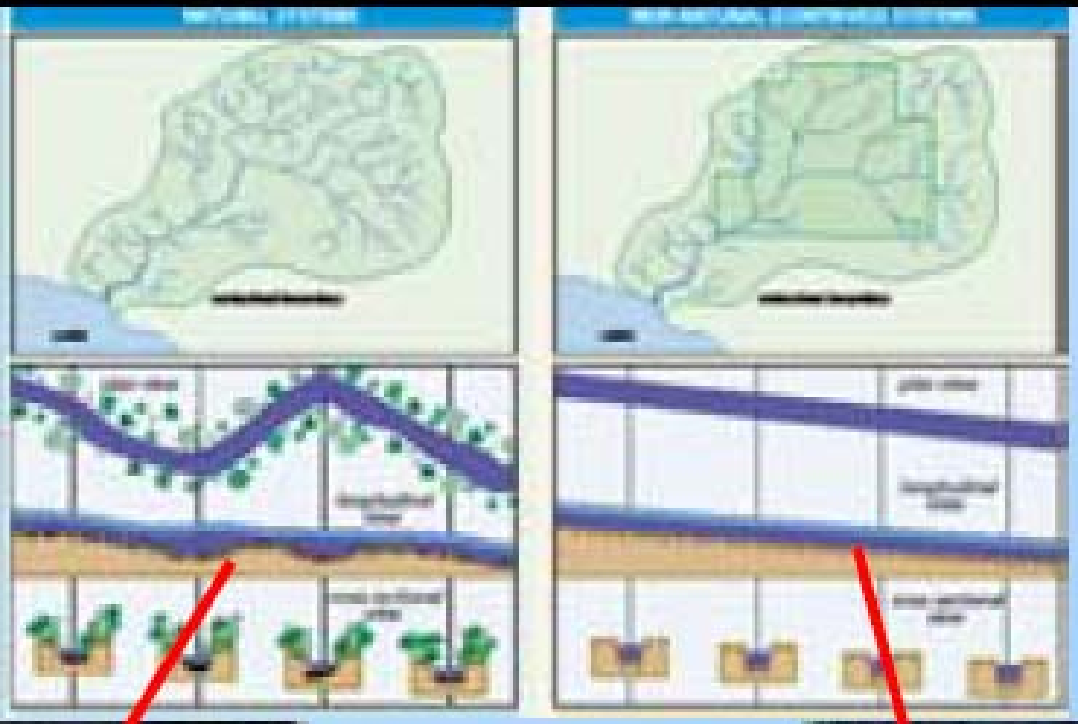
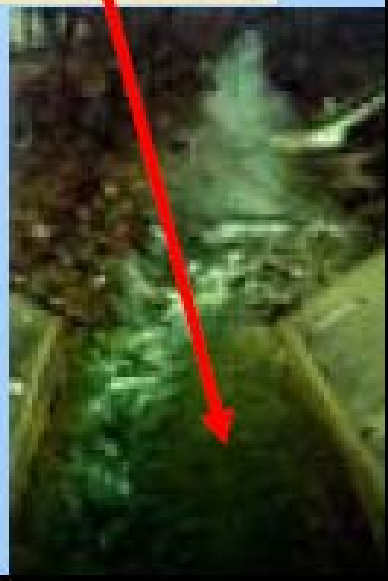
FISH HABITAT IN RIVERS
IS DRIVEN BY
HYDROLOGY,
GEOMORPHOLOGY
AND HYDROGEOLOGY



Salmonid reproduction occurs at the tail of a pool, head of a riffle where sorting after spring floods is the highest. This critical habitat is lacking from traditional river engineering designs.



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Drainage Density

Table 1 Drainage Densities Based on Existing Conditions and OBMs				
Subcatchment ID	***Subdrainage Area (km^2)***	***Protected Drainage Density*** *(red and blue streams)* ***(km/km^2)***	***Potential Drainage Density*** *(red, blue and green streams)* ***(km/km^2)***	***Drainage Density based on 1:10,000 OBMs (km/km^2)***
EM1	1.88	1.05	1.05	1.47

Table 2 Drainage Densities Targets for the North Oakville Subwatersheds					
Subcatchment ID	***Drainage Density Target*** *Minimum* ***(km/km^2)***	***Drainage Deficit[1]*** *Red and blue streams* ***(km)***	***Drainage Deficit[2]*** *Red, blue and green streams* ***(km)***	***Surplus Stream Length[3]*** *Red and blue streams* ***(km)***	***Does the subcatchment meet the target?***
EM1	1.29	0.45	0.45	--	No – use surplus

To determine Drainage Deficit red and blue streams (in km):

(Drainage Density Target Minimum- Protected Drainage Density) X Subdrainage Area

Example – EM1:
Drainage Density (red and blue streams) for EM1
= (1.29 km/km2 – 1.05 km/km2) X 1.88 km2
= 0.45 km

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  - **Flow Stages**
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  - Regional
  - Local
- Water Quality
  - Temperature
  - Nutrients
  - Pollutant Reduction

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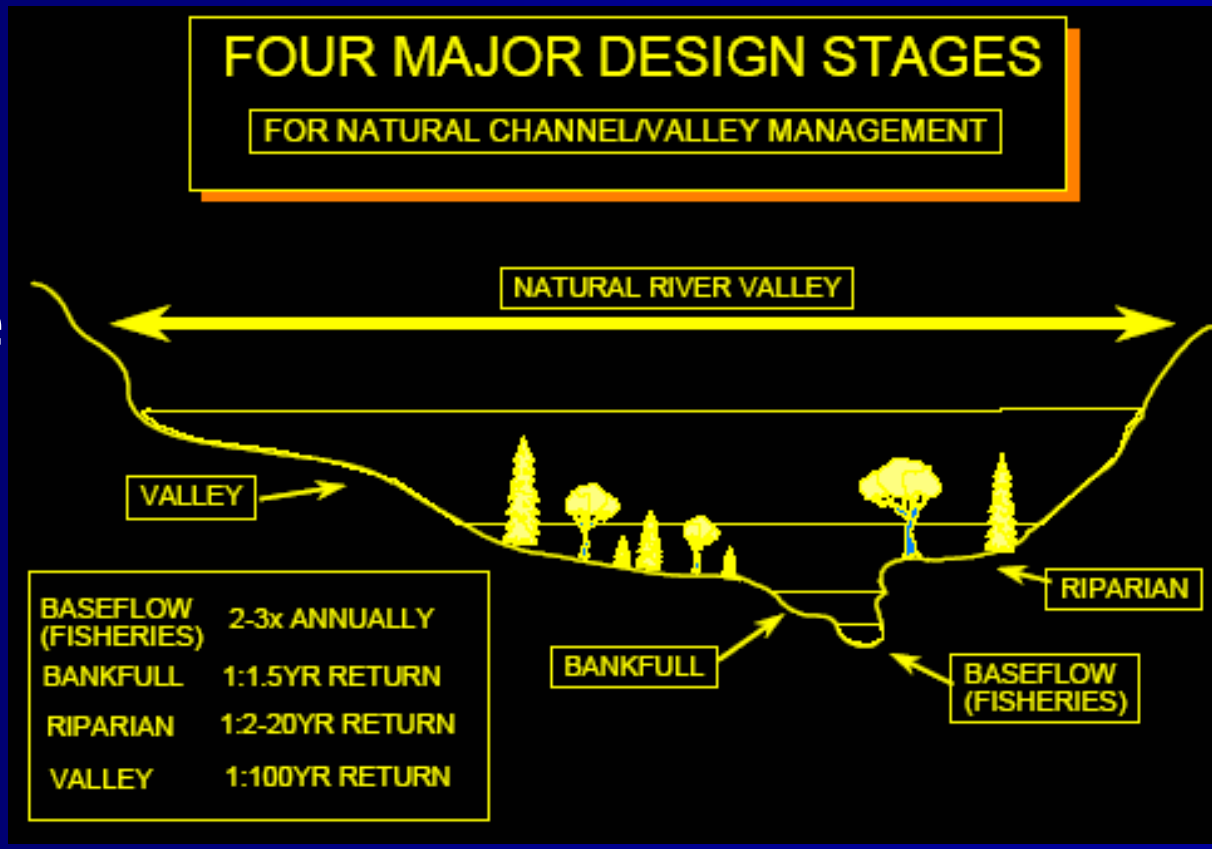
Learning to Speak the Same Language – Linking Habitat to Physical Features and Processes

All stages are important for the creation and maintenance of habitat



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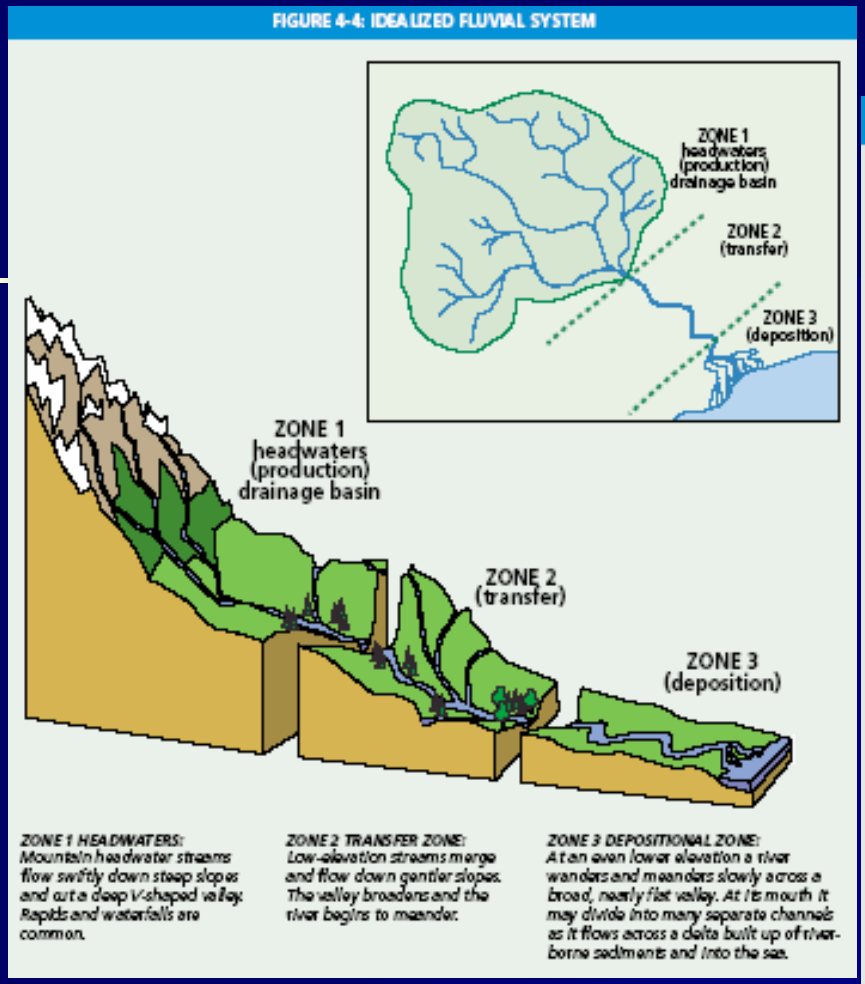

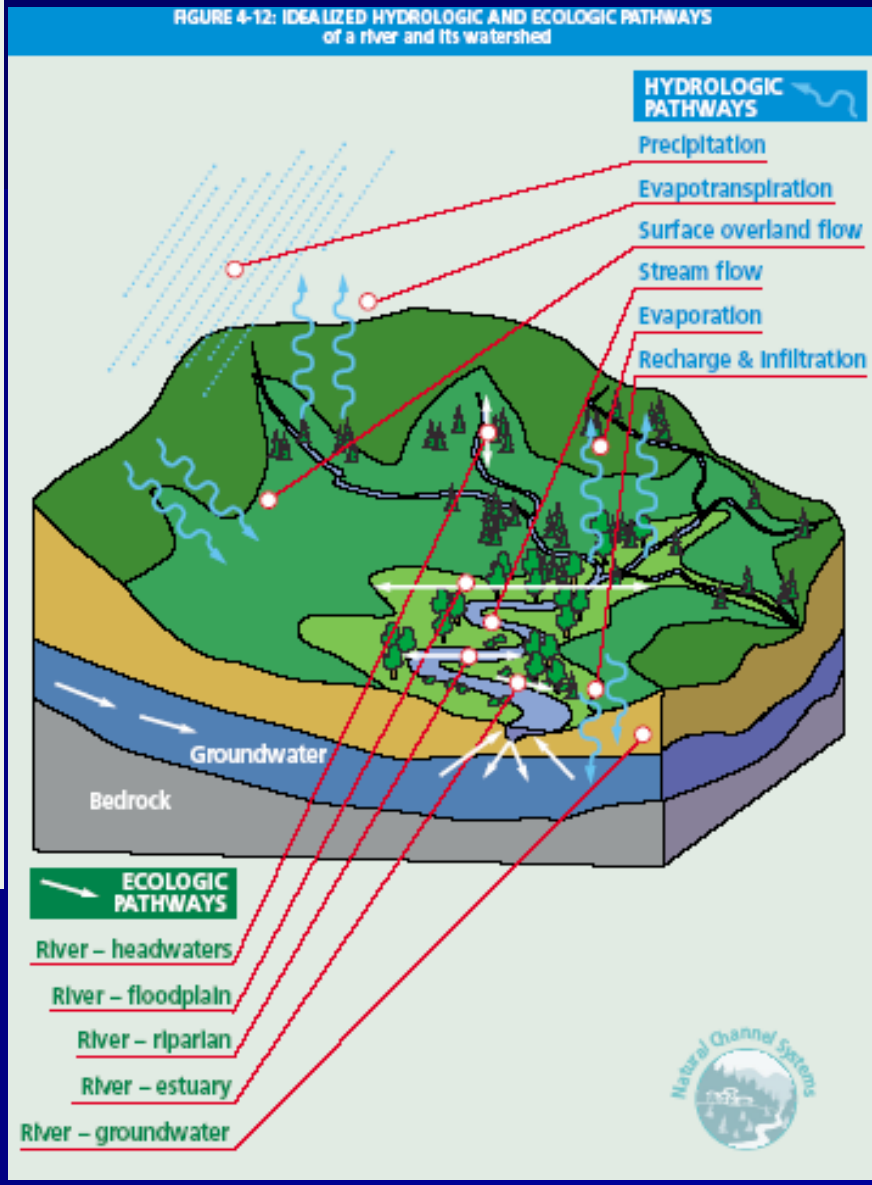

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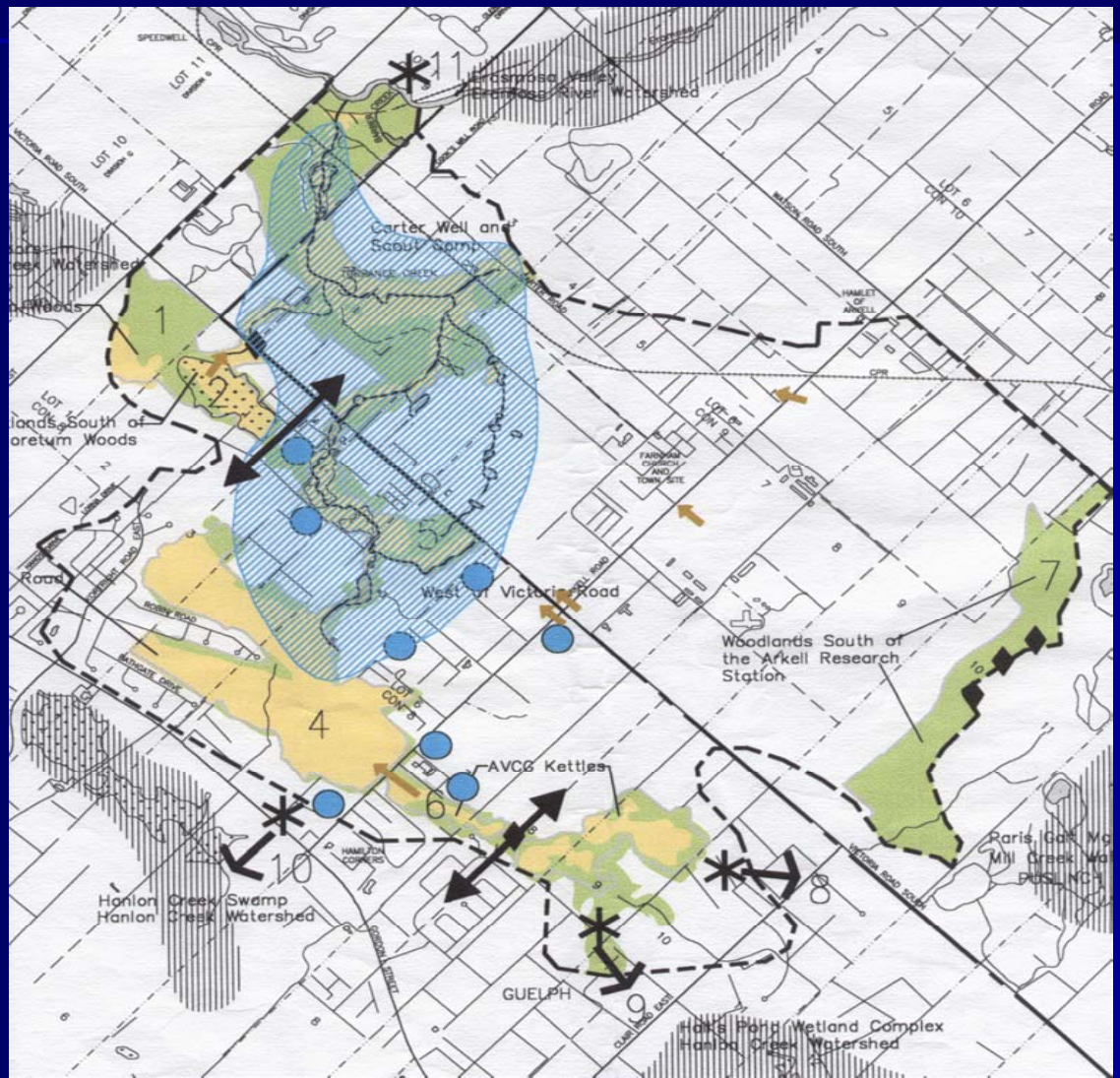
Natural Heritage and Stormwater Management



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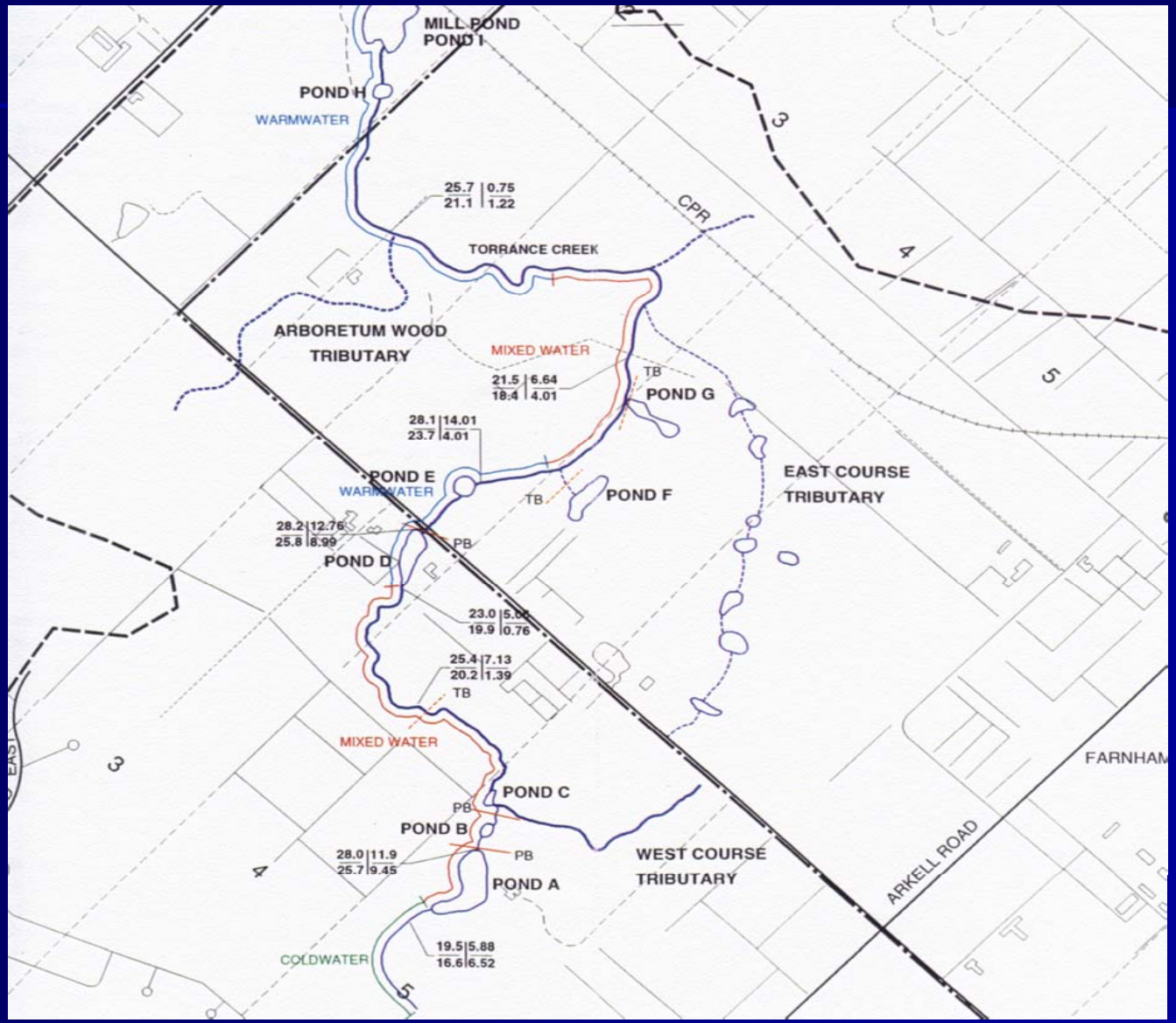
Max/Min Temperatures and Habitat Conditions



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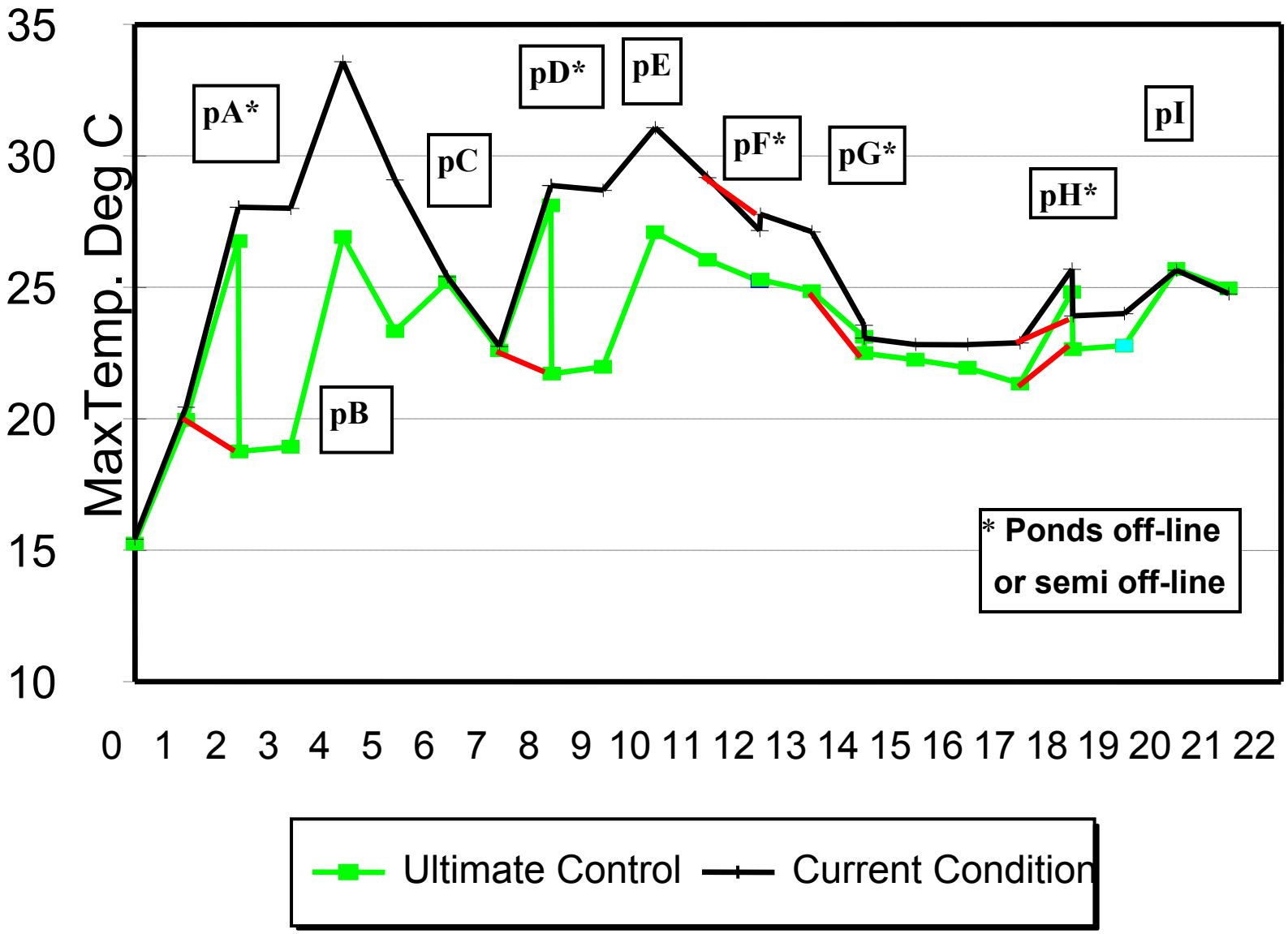
Torrance Ck Temperature Profile



Gaps

- Need for Appropriate Legislation
  - Hazard Lands, PPS
- Research Needs
  - Drainage Density
  - Hydrogeologic Functions
  - Biological Functions

Stream Classification - Example

- Physical Stream Characteristics
  - Overall Geormorphological Classification
  - Relative Hydrologic Function
  - Hydrogeologic Contribution to Stream Health
- Terrestrial/Wetland Habitat
- Aquatic Habitat Characterization

Physical Stream Characteristics

- Overall Geomorphic Classification
  - Stream bed type
  - Bank conditions
  - Bed morphology
  - Presence/absence of barriers
  - Constraints and opportunities
  - Sediment supply/transport
  - Channel disturbance
  - Stream Sensitivity
  - Rehabilitation Potential

Physical Stream Characteristics

- Relative Hydrologic Function
  - Ability to provide water quality improvement
  - Valley present
  - Hydraulic conveyance conditions (ability to detain/store streamflow)
  - Linkage to headwater functions

Physical Stream Characteristics

- Hydrogeologic Contribution to Stream Health
  - Flow type (flowing or not flowing)
  - Groundwater discharge observations
  - Interpreted groundwater contribution to stream flow

Habitat Unit Characteristics

- Presence of Designate Area (ANSI, ESA, PSW)
- Size Total, beyond 100, 200 and 300 m from edge
- Part of Riparian/Drainage System
- Presence of Rare Species
- Number of Native Plants and Wildlife
- Presence of Rare Vegetation Community
- Number of Vegetation Types
- Presence of 'Mature' Vegetation Type
- Character of Surrounding Habitats/Land use etc.

Aquatic Habitat Characteristics

- Rarity of Habitat
- Sensitivity to Development
- Function of Habitat in Sustaining Fisheries
- Groundwater Discharge
- Existing Level of Habitat Degradation and Modification
- Habitat Supports VTE Species or Species of concern
- Cool vs. Warm Water Status

Stream Classification - Example

SUB-CATCHMENT AREA	STREAM REACH/ HABITAT UNIT (HU)	AQUATIC HABITAT CATEGORIZATION	OVERALL GEOMORPHOLOGY CLASSIFICATION	RELATIVE HYDROLOGIC FUNCTION	HYDROGEOLOGIC CONTRIBUTION TO STREAM HEALTH (FISHERIES, WETLANDS, ETC.)	TERRESTRIAL/WETLAND HABITAT	CONTEXTUAL RATIONALE	OVERALL CLASSIFICATION	Potential for Rehabilitation
JOSHUA'S CREEK	JOSHUA'S CREEK								
JC15	JC-1	Important Habitat	HIGH	HIGH	LOW	manicured golf course		LEVEL 1	N/A

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North Oakville Map

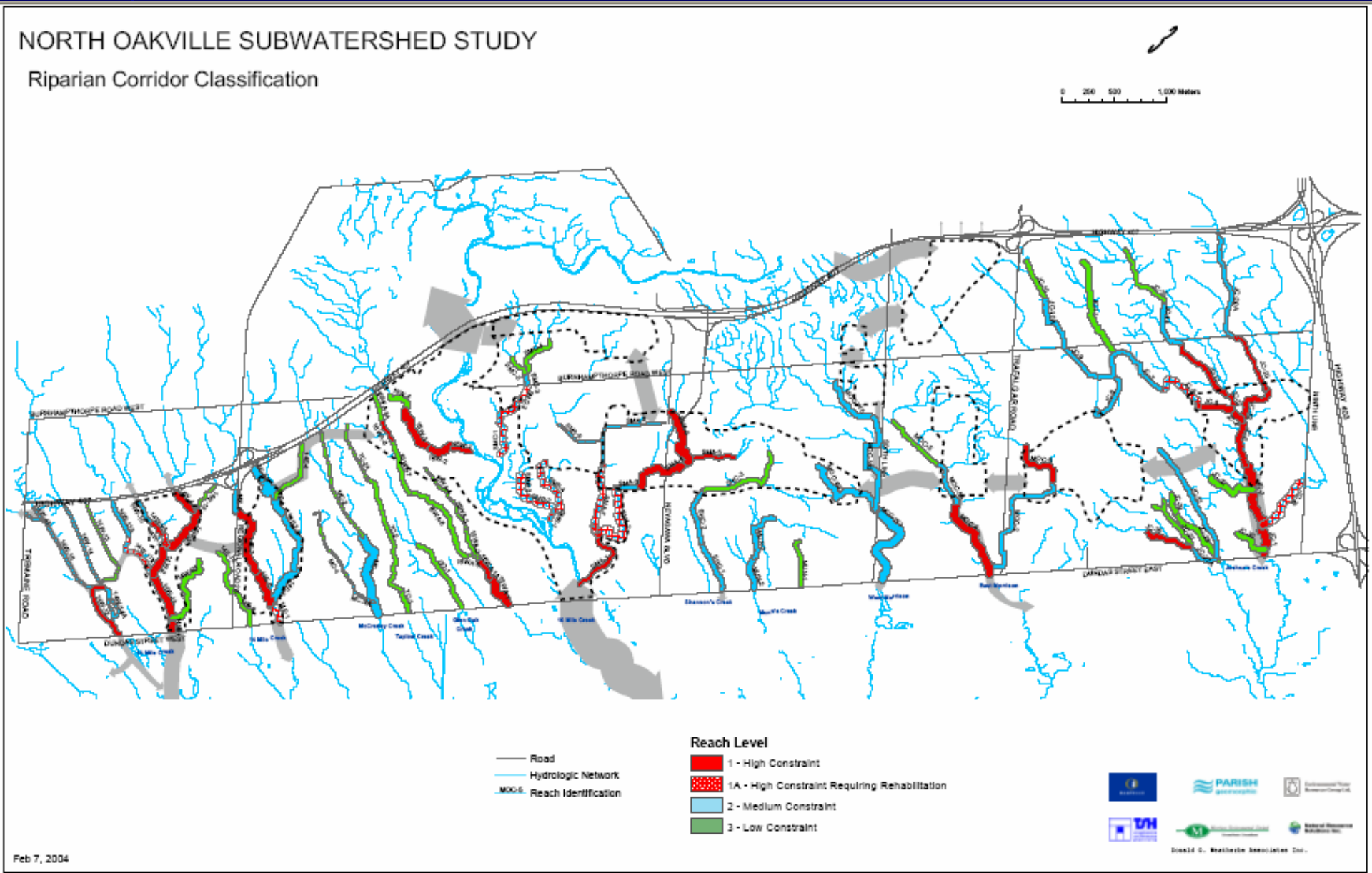


FIGURE 1-1a

The focus of this section is to demonstrate the relationship of the stream corridor management approach within the context of the existing legal framework.

The rationale for this approach is to demonstrate that existing policy and legislation provides sufficient guidance to proponents interested in achieving fully functional management objectives in stream corridor works.

List of abbreviations

DFO – Department of Fisheries and Oceans (Federal: Canada)

MMAH – Ministry of Municipal Affairs and Housing (Provincial: Ontario)

MNR – Ministry of Natural Resources (Provincial: Ontario)

MOE – Ministry of the Environment (Provincial: Ontario)

OMAFRA – Ontario Ministry of Agriculture, Food, and Rural Affairs (Provincial: Ontario)

FIGURE 1-1a: SELECTED LEGISLATION AFFECTING STREAM CORRIDORS

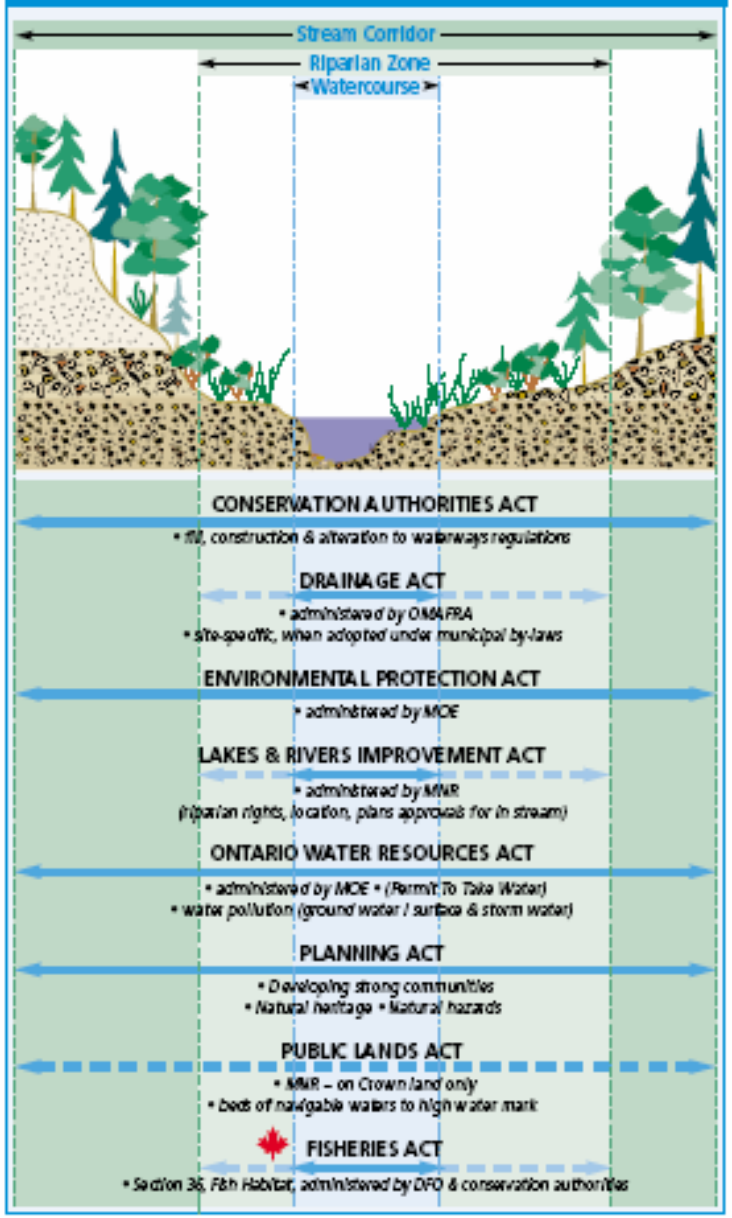
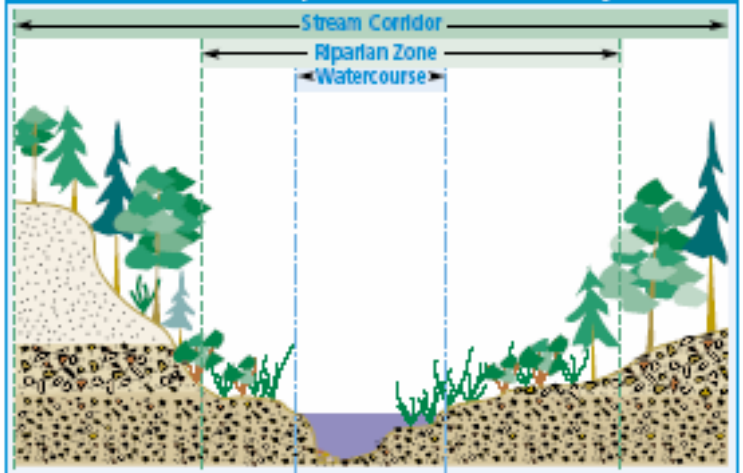


FIGURE 1-1b: POTENTIAL MANAGEMENT & PLANNING TOOLS & APPROACHES for watercourses, riparian zones, corridors and valleys



MUNICIPAL ACT, ONTARIO WATER RESOURCES ACT

URBAN AND RURAL BEST MANAGEMENT PRACTICES
(vary from top of bank to 15 – 30 m or more in some instances)
(habitat and water quality protection, urban drainage, stormwater management, bank stability, soil erosion and riparian zone management)

PROVINCIAL POLICY STATEMENT, PLANNING ACT

NATURAL HERITAGE POLICIES
Fish Habitat • Significant Wetlands • Significant Valley Lands

NATURAL HAZARDS POLICIES
Flooding Hazard Limit – Hurricane Hazel, 100 year, Timmins Storm, Observed Event
Erosion Hazard Limit – Stable Slope Allowance, Erosion Access Allowance, Meander Belt Width

CONSERVATION AUTHORITIES ACT

WATERSHED MANAGEMENT
Generic Regulations, various policies and setbacks – consult individual conservation authorities

RIPARIAN RIGHTS – COMMON LAW
(from case law rulings for issues generally not covered under statute law: affect watercourses, intermittent or perennial, floodplain and/or valley lands)

LAKES AND RIVERS IMPROVEMENT ACT

(location and design approvals for holding back and diverting surface water)

Potential extent of legislative authority:

generally, the area indicated by the darker arrows reflects the greatest applicability

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Natural Channel Systems