WOODENS RIVER WATERSHED
RESOURCE ANALYSIS

FOR THREE BROOKS HOMEOWNERS ASSOCIATION

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Environmental Planning Studio 1
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TABLE of CONTENTS

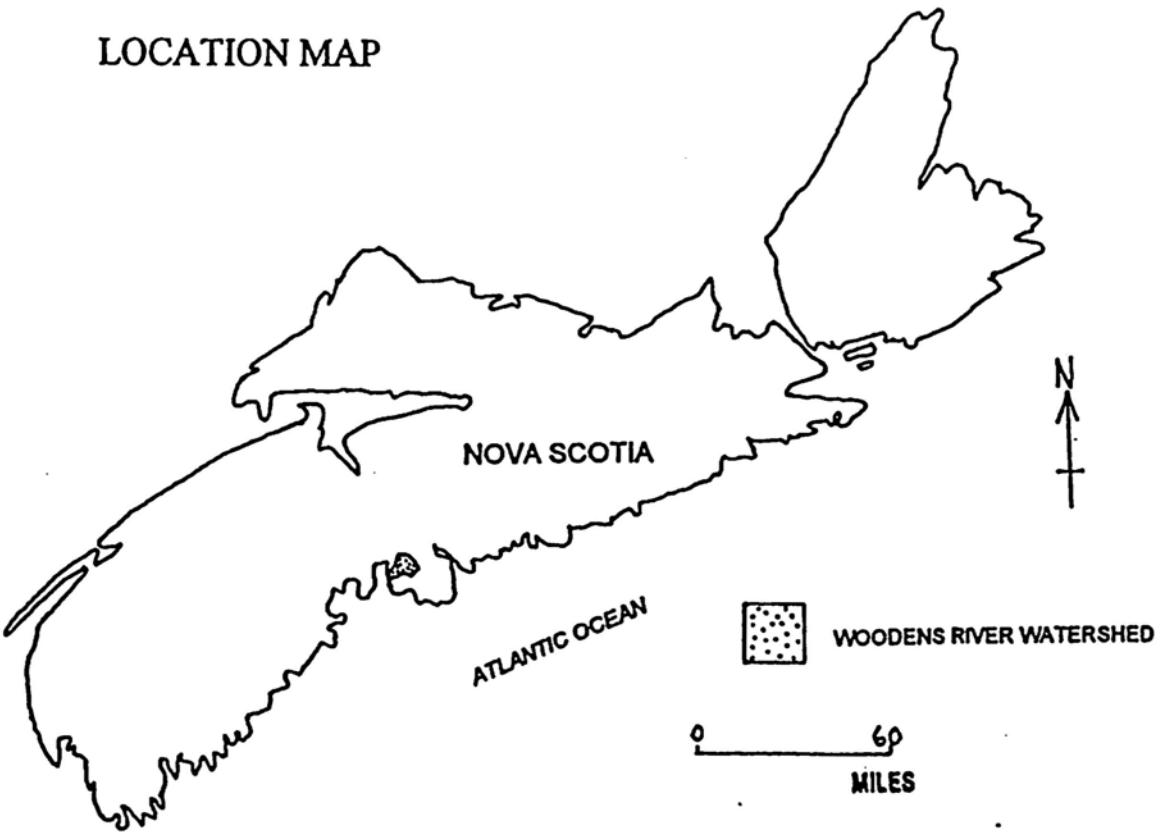
INTRODUCTION

In 1992, the Three Brooks Homeowners Association approached the Nova Scotia College of Art and Design Environmental Planning Department for information on protecting the brook trout population in Hubley Big Lake, where the Three Brooks community is located. Because Hubley Big Lake is part of a larger drainage basin, a resource analysis of the entire watershed area was needed to provide information on all factors affecting the brook trout habitat. The goal of this resource analysis is to identify these factors and provide a synthesis delineating sensitive areas and to provide recommendations for future land use.

LOCATION

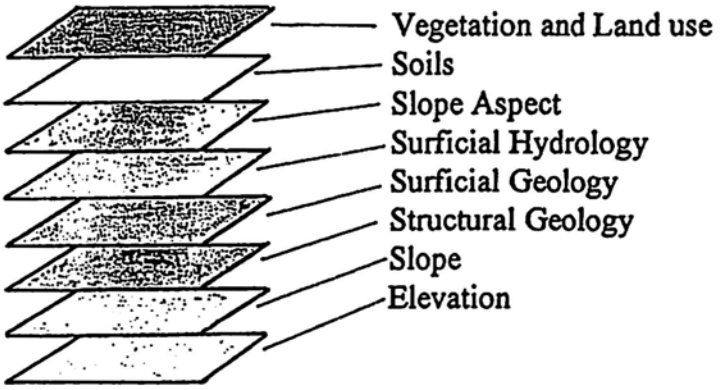
The Woodens River watershed covers an area of approximately 65 square kilometres on the Chebucto Peninsula, in Nova Scotia, 20 kilometres west of Halifax. The outflow of the Woodens River is at St. Margaret's Bay, 20 kilometres to the south west of the headwaters.

LOCATION MAP



METHOD

To produce the resource analysis, the overlay technique was used. This involves overlaying the various resources, in map form, to define areas of differing sensitivity.



For other, related information, other maps and resource professionals were consulted. Field trips were made to the study area to examine vegetation patterns and collect water samples, which were tested at the Department of Fisheries and Oceans.

RESOURCE ANALYSIS

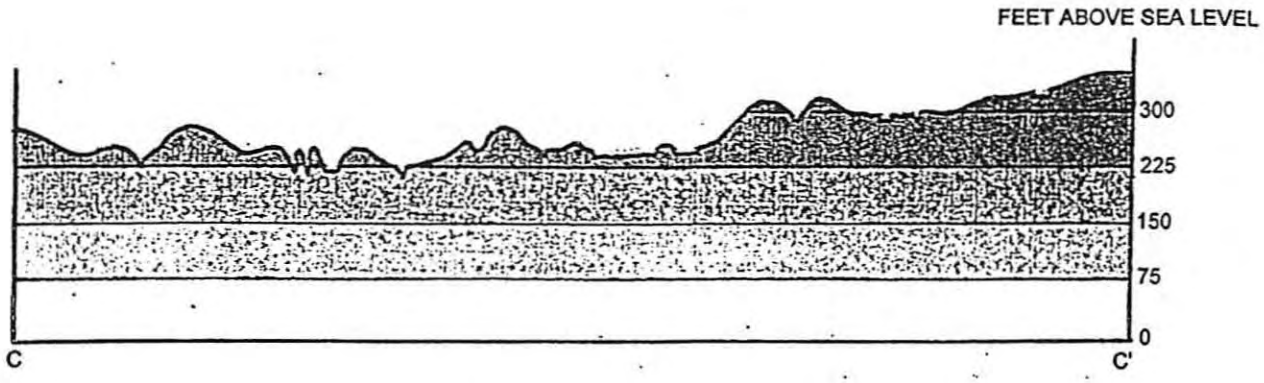
This section describes and illustrates, in map format, the environmental inventory of the bio-physical aspects of the Woodens River watershed.

ELEVATION

The head-waters of the Woodens River Watershed are approximately twenty kilometres north west of the Woodens River outflow into St. Margaret's Bay. The change in elevation from the very north of the area, to sea level is 450 feet. The terrain is gently rolling or undulating. While most of the watershed is between 200 and 300 feet above sea level, shown in the medium brown colour on the map, there are still some steep, hilly areas. In the lower western part of the watershed, around Long Lake, there is drumlin topography. Drumlins are hills of glacial debris which have a distinctive elongated profile due to shaping by ice movement. They are visible on the Elevation map where the contour lines form concentric ovals.

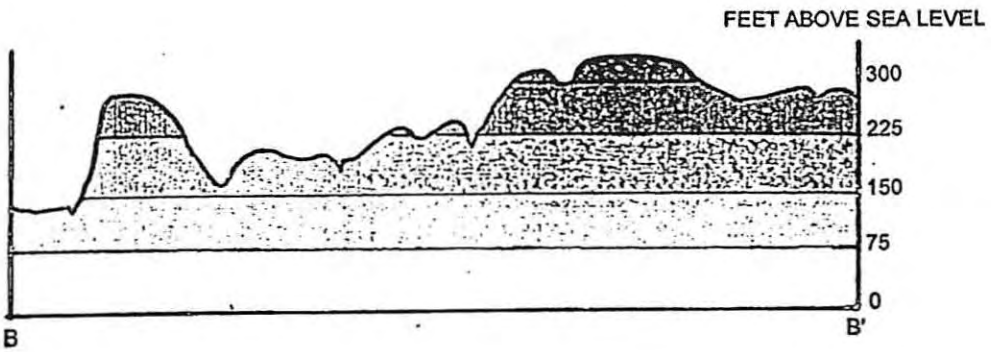
The cross sections show how the terrain changes from the south to the north of the watershed. The vertical scale exaggerates the relief, so the upper portion of the area is actually flatter than shown and, while the lower portion is much more varied, it is still only gently rolling.

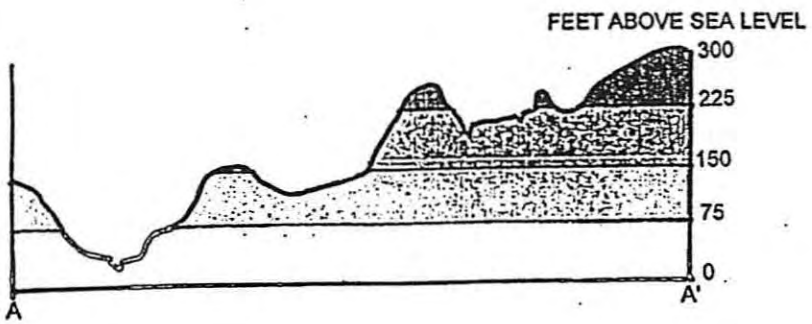
ELEVATION PROFILES

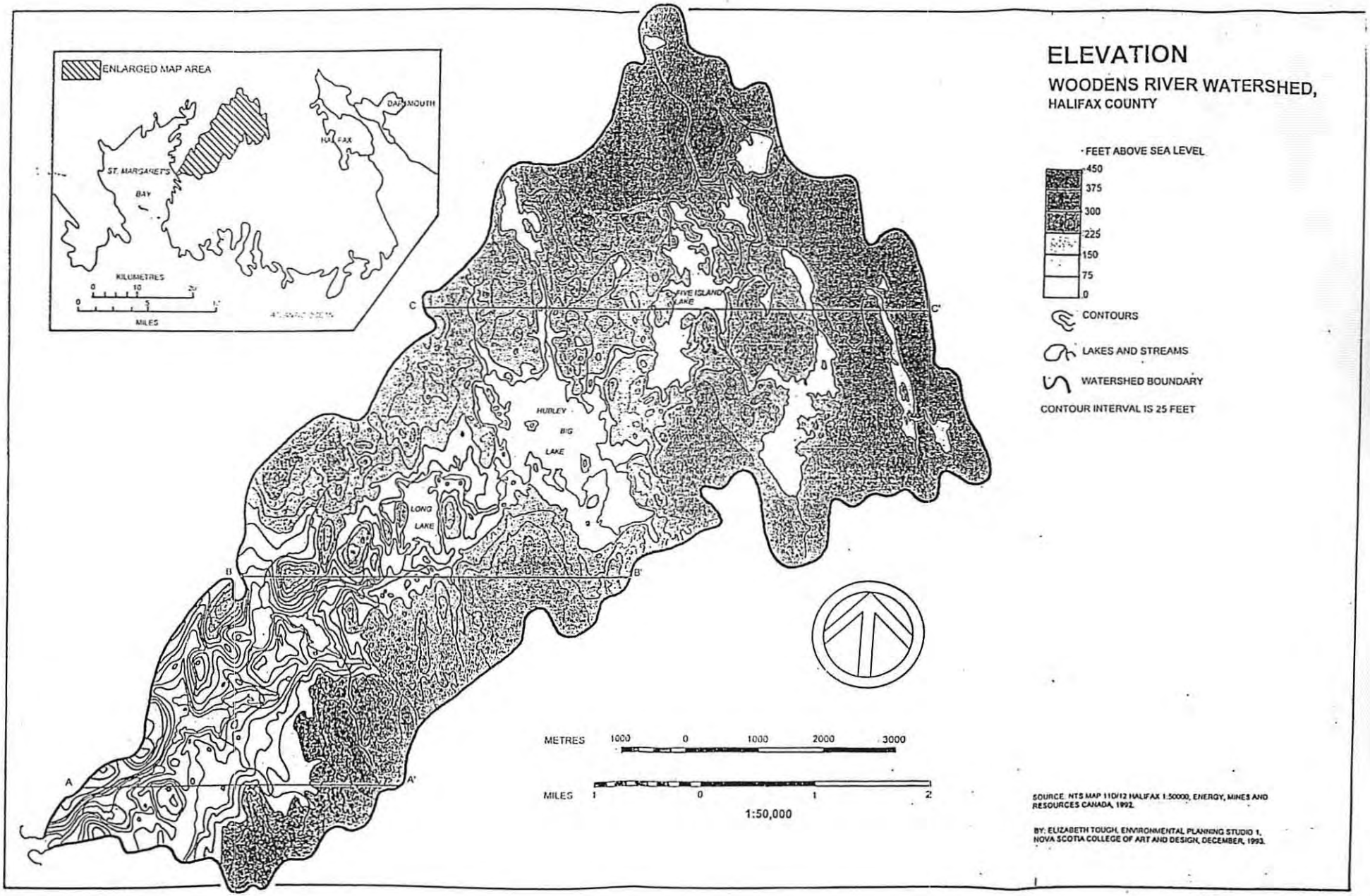


VERTICAL EXAGGERATION=16 FOR ALL CROSS SECTIONS

HORIZONTAL SCALE SAME AS MAP







ELEVATION

WOODENS RIVER WATERSHED,
HALIFAX COUNTY

FEET ABOVE SEA LEVEL

450
375
300
225
150
75
0

CONTOURS

LAKES AND STREAMS

WATERSHED BOUNDARY

CONTOUR INTERVAL IS 25 FEET

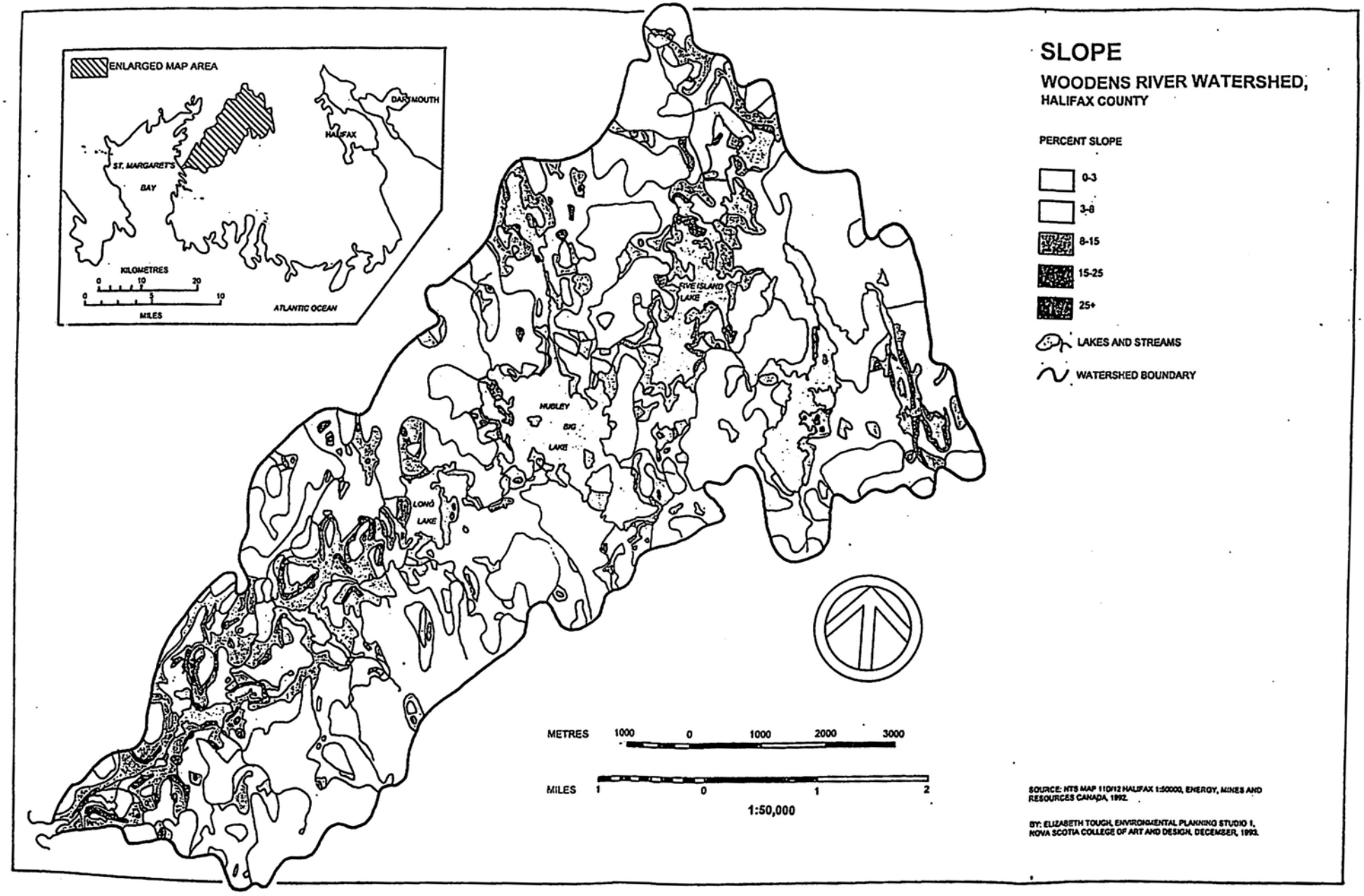
SOURCE: NTS MAP 11D/12 HALIFAX 1:50000, ENERGY, MINES AND RESOURCES CANADA, 1992.

BY: ELIZABETH TOUGH, ENVIRONMENTAL PLANNING STUDIO 1,
NOVA SCOTIA COLLEGE OF ART AND DESIGN, DECEMBER, 1993.

SLOPE

Much of the watershed is flat or very gently sloping. Moderate or steep slopes occur in the south west part of the watershed, around Long Lake and the stream itself and are shown in the darker tones on the map. The areas in the south east and, in particular, those north of Long Lake, are much flatter. The area north and west of Five Island Lake is primarily below 3 percent grade.

While it is possible to build on the steeper grades, septic systems and roads become limiting factors on slopes steeper than 10 percent. In addition to limiting the type of building allowed on these slopes, it is important to maintain as much of the natural vegetation as possible to stabilize the slope itself and to retard erosion of the soil. Hubley Big Lake and Frederick Lake are the only two lakes in the watershed which have substantial percentages of their shorelines at grades below 10 percent. All of the other lakes are surrounded by slopes that would limit development possibilities.

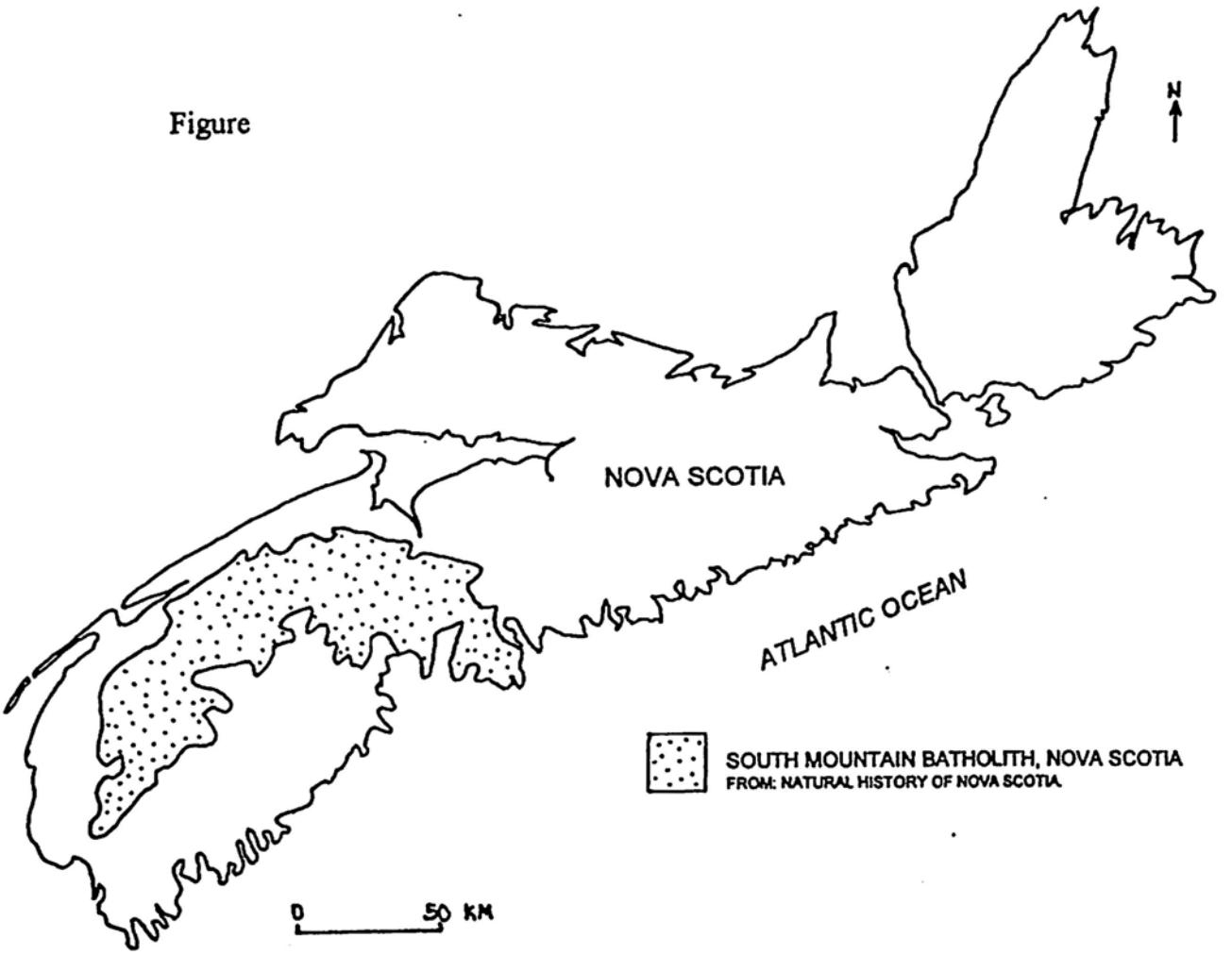

ENLARGED MAP AREA
DARTMOUTH
HALIFAX
ST. MARGARET'S
BAY
KILOMETRES
0 10 20
0 5 10
MILES
ATLANTIC OCEAN
FIVE ISLAND
LAKE
HUSLEY
BIG
LAKE
LONG
LAKE
SLOPE
WOODENS RIVER WATERSHED,
HALIFAX COUNTY
PERCENT SLOPE
0-3
3-8
8-15
15-25
25+
LAKES AND STREAMS
WATERSHED BOUNDARY
METRES 1000 0 1000 2000 3000
MILES 1 0 1 2
1:50,000
SOURCE: NTS MAP 11D/12 HALIFAX 1:50000, ENERGY, MINES AND RESOURCES CANADA, 1992.
BY: ELIZABETH TOUGH, ENVIRONMENTAL PLANNING STUDIO I, NOVA SCOTIA COLLEGE OF ART AND DESIGN, DECEMBER, 1993.

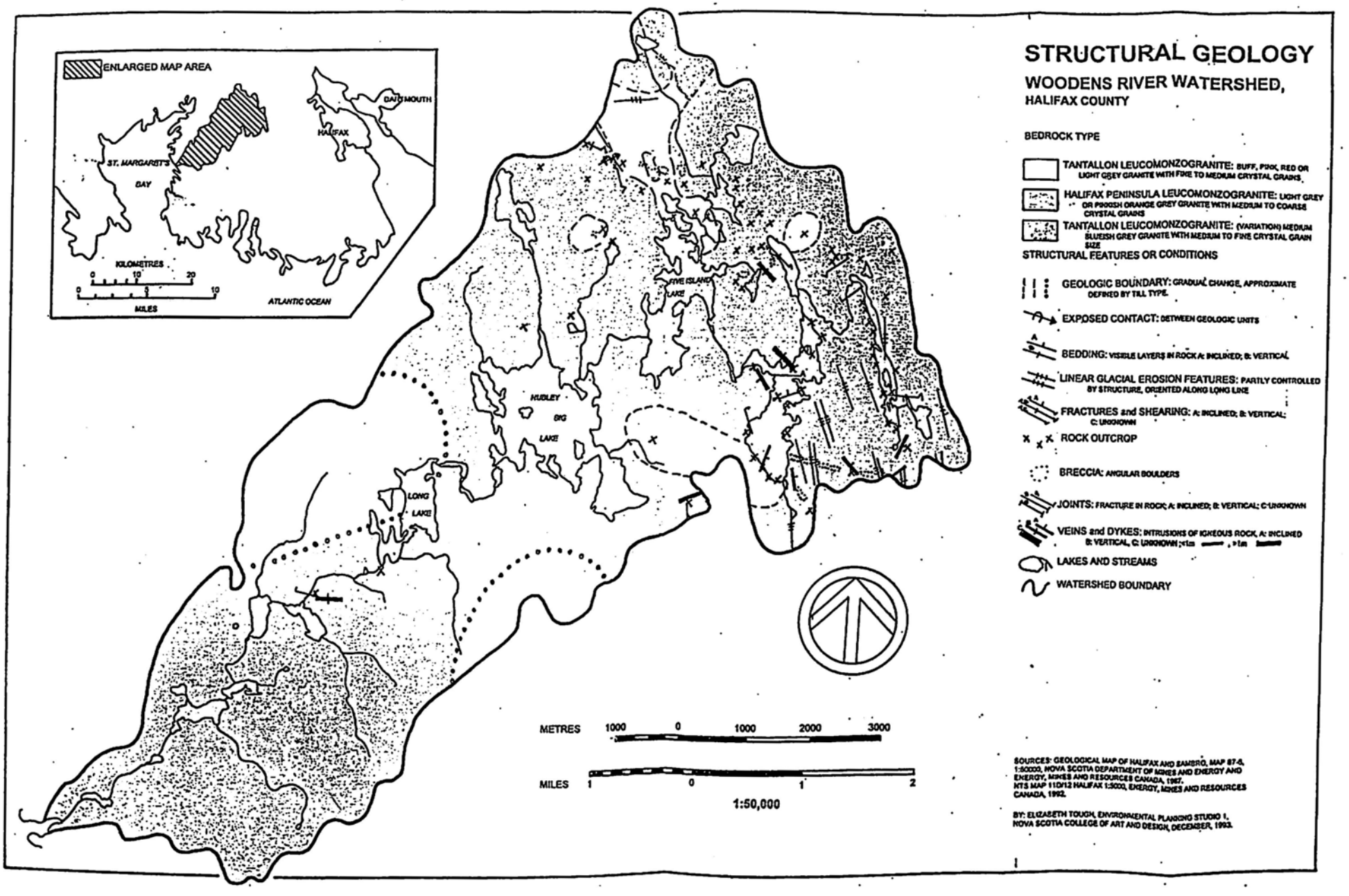
STRUCTURAL GEOLOGY

The entire watershed is underlain by granite which is part of the South Mountain batholith (shown in Figure1). This batholith is a huge granite intrusion of the Devonian period (about 400 million years ago), which runs across south western Nova Scotia. There are slight variations in colour and crystal grain size of the three granite types in the area, but the main characteristics are the same. The small grey area in the north of the watershed is a variation of the light pink Tantallon Leucomonzogranite. The main bedrock type is the Halifax Peninsula Leucomonzogranite. It is in this granite that most of the fractures, shearing and ridge structures occur in, in the north west portion of the area.

Granite is not easily eroded, which means that the soil in the area is poor. Granite also contributes to the natural acidity of the area because it is primarily silica and has little or no buffering minerals. Because it underlies the entire area, it tends to acidify the soil and the water.

Figure


N
NOVA SCOTIA
ATLANTIC OCEAN
SOUTH MOUNTAIN BATHOLITH, NOVA SCOTIA
FROM: NATURAL HISTORY OF NOVA SCOTIA
0
50 KM



STRUCTURAL GEOLOGY

WOODENS RIVER WATERSHED,
HALIFAX COUNTY

BEDROCK TYPE

TANTALLON LEUCOMONZOGRANITE: BUFF, PINK, RED OR LIGHT GREY GRANITE WITH FINE TO MEDIUM CRYSTAL GRAINS.

HALIFAX PENINSULA LEUCOMONZOGRANITE: LIGHT GREY OR PINKISH ORANGE GREY GRANITE WITH MEDIUM TO COARSE CRYSTAL GRAINS

TANTALLON LEUCOMONZOGRANITE: (VARIATION) MEDIUM BLUEISH GREY GRANITE WITH MEDIUM TO FINE CRYSTAL GRAIN SIZE

STRUCTURAL FEATURES OR CONDITIONS

GEOLOGIC BOUNDARY: GRADUAL CHANGE, APPROXIMATE DEFINED BY TILL TYPE.

EXPOSED CONTACT: BETWEEN GEOLOGIC UNITS

BEDDING: VISIBLE LAYERS IN ROCK A: INCLINED; B: VERTICAL

LINEAR GLACIAL EROSION FEATURES: PARTLY CONTROLLED BY STRUCTURE, ORIENTED ALONG LONG LINE

FRACTURES and SHEARING: A: INCLINED; B: VERTICAL; C: UNKNOWN

ROCK OUTCROP

BRECCIA: ANGULAR BOULDERS

JOINTS: FRACTURE IN ROCK; A: INCLINED; B: VERTICAL; C: UNKNOWN

VEINS and DYKES: INTRUSIONS OF IGNEOUS ROCK, A: INCLINED B: VERTICAL, C: UNKNOWN; <1m ——— , >1m ———

LAKES AND STREAMS

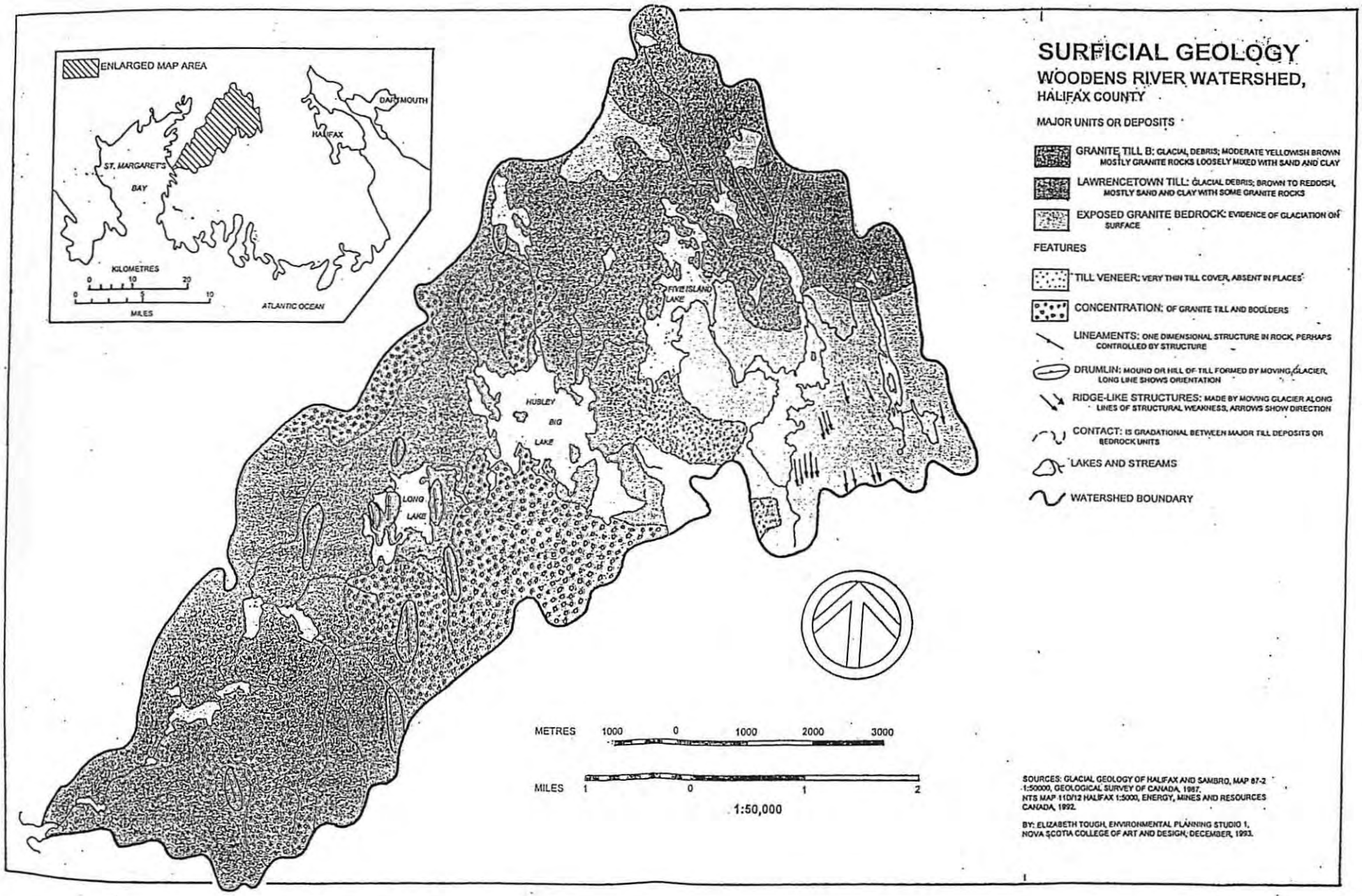
WATERSHED BOUNDARY

SOURCES: GEOLOGICAL MAP OF HALIFAX AND BAMBRO, MAP 87-6, 1:50000, NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY AND ENERGY, MINES AND RESOURCES CANADA, 1987.
NTS MAP 11D/12 HALIFAX 1:5000, ENERGY, MINES AND RESOURCES CANADA, 1992.

BY: ELIZABETH TOUGH, ENVIRONMENTAL PLANNING STUDIO I, NOVA SCOTIA COLLEGE OF ART AND DESIGN, DECEMBER, 1993.

SURFICIAL GEOLOGY

Most of the watershed is covered by till, which is glacial debris brought in and deposited as the ice receded, around 10,000 years ago. The till which covers most of the area is Granite Till B which is made up of mostly granite rock fragments with a small amount of sand and clay. In some areas in the south east and a few in the north west, this till has a very high concentration of granite boulders. In the northern part of the watershed the till deposits are very thin, forming a till veneer. The other till type, which covers about 10 percent of the area, is Lawrencetown Till. This till is mostly sand and clay, with only a few rock fragments. This till is the most fertile of the two types because of the lower concentration of rock, and also, it contains Meguma material. Meguma contains slates, shales and some limestone, all of which break down to form less acidic, more mineral soils. There is conflicting information about which of the tills forms the drumlins in the southern part of the watershed, but which ever it is, the drumlin hills are areas of deep till and form the best soils.



SURFICIAL GEOLOGY

WOODENS RIVER WATERSHED, HALIFAX COUNTY

MAJOR UNITS OR DEPOSITS

- GRANITE TILL B: GLACIAL DEBRIS; MODERATE YELLOWISH BROWN MOSTLY GRANITE ROCKS LOOSELY MIXED WITH SAND AND CLAY
- LAWRENCETOWN TILL: GLACIAL DEBRIS; BROWN TO REDDISH, MOSTLY SAND AND CLAY WITH SOME GRANITE ROCKS
- EXPOSED GRANITE BEDROCK: EVIDENCE OF GLACIATION ON SURFACE

FEATURES

- TILL VENEER: VERY THIN TILL COVER, ABSENT IN PLACES
- CONCENTRATION: OF GRANITE TILL AND BOULDERS
- LINEAMENTS: ONE DIMENSIONAL STRUCTURE IN ROCK, PERHAPS CONTROLLED BY STRUCTURE
- DRUMLIN: MOUND OR HILL OF TILL FORMED BY MOVING GLACIER, LONG LINE SHOWS ORIENTATION
- RIDGE-LIKE STRUCTURES: MADE BY MOVING GLACIER ALONG LINES OF STRUCTURAL WEAKNESS, ARROWS SHOW DIRECTION
- CONTACT: IS GRADATIONAL BETWEEN MAJOR TILL DEPOSITS OR BEDROCK UNITS
- LAKES AND STREAMS
- WATERSHED BOUNDARY

SOURCES: GLACIAL GEOLOGY OF HALIFAX AND SAMBRO, MAP 87-2 1:50000, GEOLOGICAL SURVEY OF CANADA, 1987.
NTS MAP 11D/12 HALIFAX 1:5000, ENERGY, MINES AND RESOURCES CANADA, 1992.

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SURFICIAL HYROLOGY

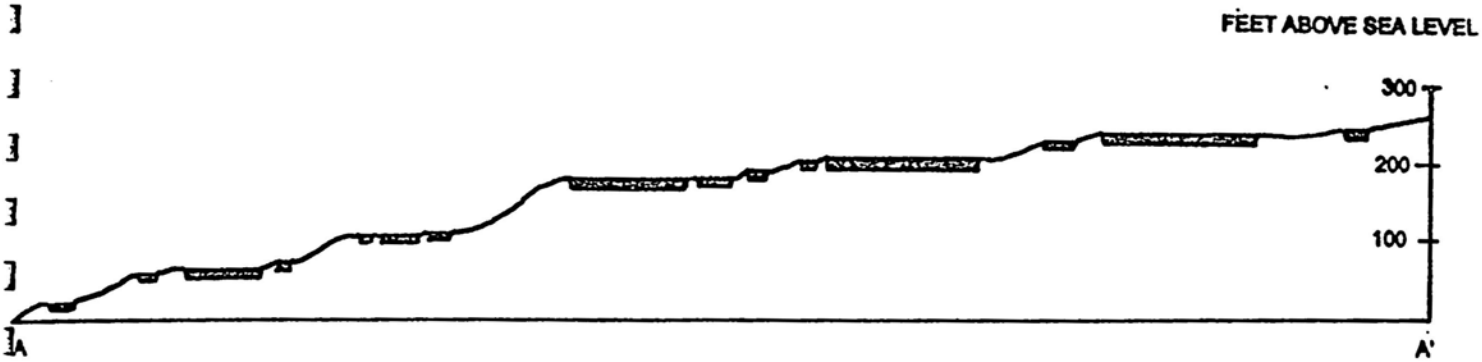
The surface hydrology of the watershed depends on both the surficial and structural geology. The main stream was probably once a fault controlled stream with a more regular pattern. The glaciation re-organized the formation, deepening stream valleys and scouring the landscape, creating a deranged pattern. Those places where the ice scraped the bedrock clean do not have good drainage and the many puddles that form in depressions in these areas become bogs and marshes over time.

The drainage area of the entire watershed is 65 square kilometres and there are four sub-watershed systems within the larger system. The largest encompasses all the area south of Hubley Big Lake, as well as a strip going north from Hubley, to the west of Five Island Lake. There are three head-waters systems, the largest of which drains an area of approximately 7 square kilometres, in the north west of the watershed. The smaller two are in the very north and in the north west and drain areas of approximately 6 and 4 square kilometres respectively.

The main stream profile illustrates that the overall gradient of the main stream is extremely low, at only 0.4 percent. Even so, there are short runs which are relatively steep. The run from the northern most lake, going into Five Island Lake is the longest and steepest and, while the run from Long Lake is shorter, it is just as steep.

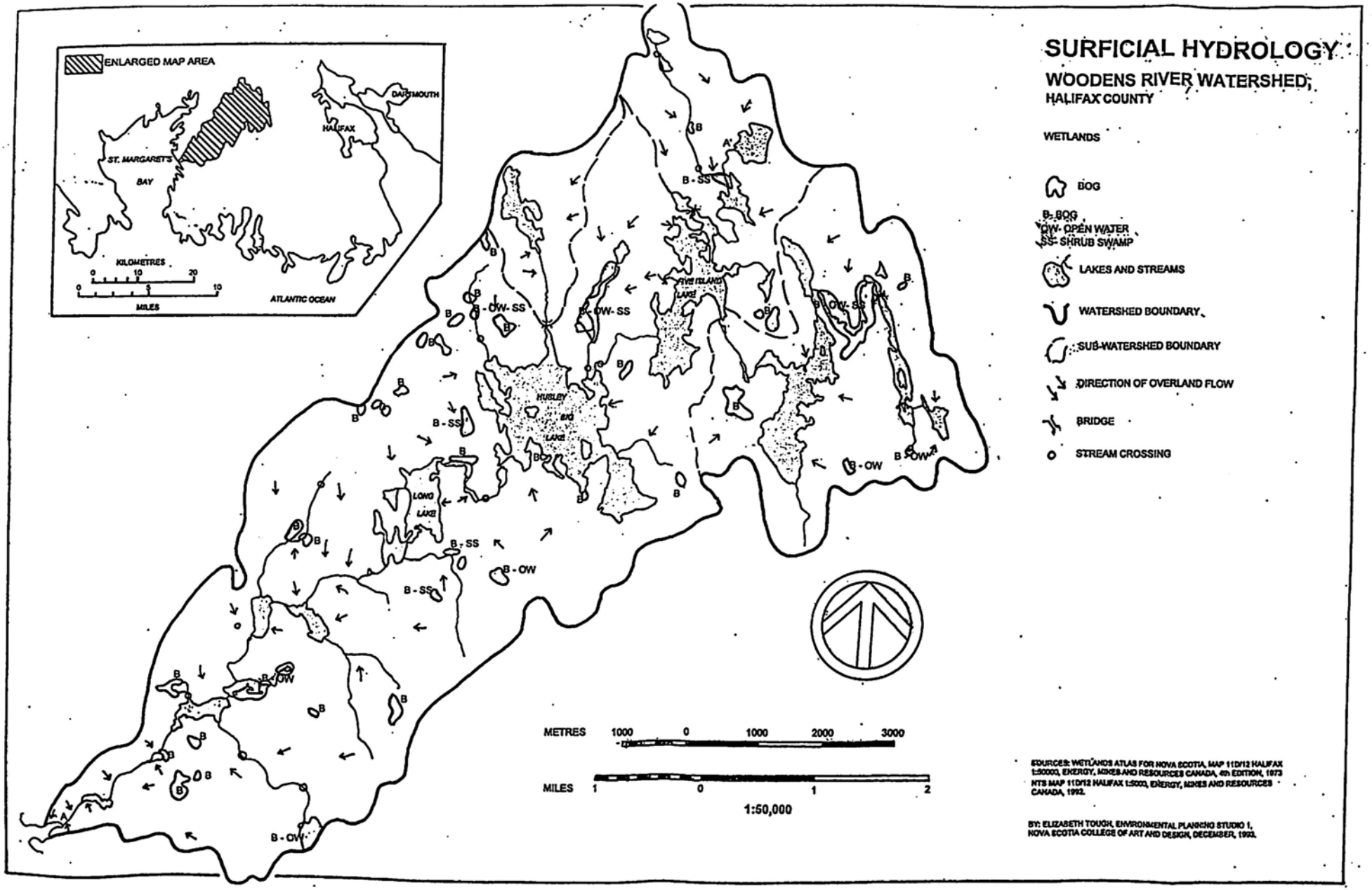
The wetlands in the area are all bogs, sometimes containing ponds and shrub, with vegetation or black spruce at the edges. They are found throughout the area in low, poorly drained areas, often associated with streams or seasonal streams. The bogs are characteristically acidic due to high organic content. The waters in the system range from mildly to strongly acidic, depending on the location of the waterbody or stream relative to bogs, drumlins or development. Acid precipitation affects the area on a large scale and the water is naturally acidic because of the influence of the granite in the till and the bedrock. The bogs also influence the colour of the water. Water flowing out of these wetlands tends to be very dark yellow or brown, up to 360 times darker than clear for parts of the watershed, which is a sign that the water contains dissolved organic material.

MAIN STREAM PROFILE



*VERTICAL EXAGGERATION=16
HORIZONTAL SCALE IS 1:100,000

AVERAGE STREAM GRADIENT IS 0.4%

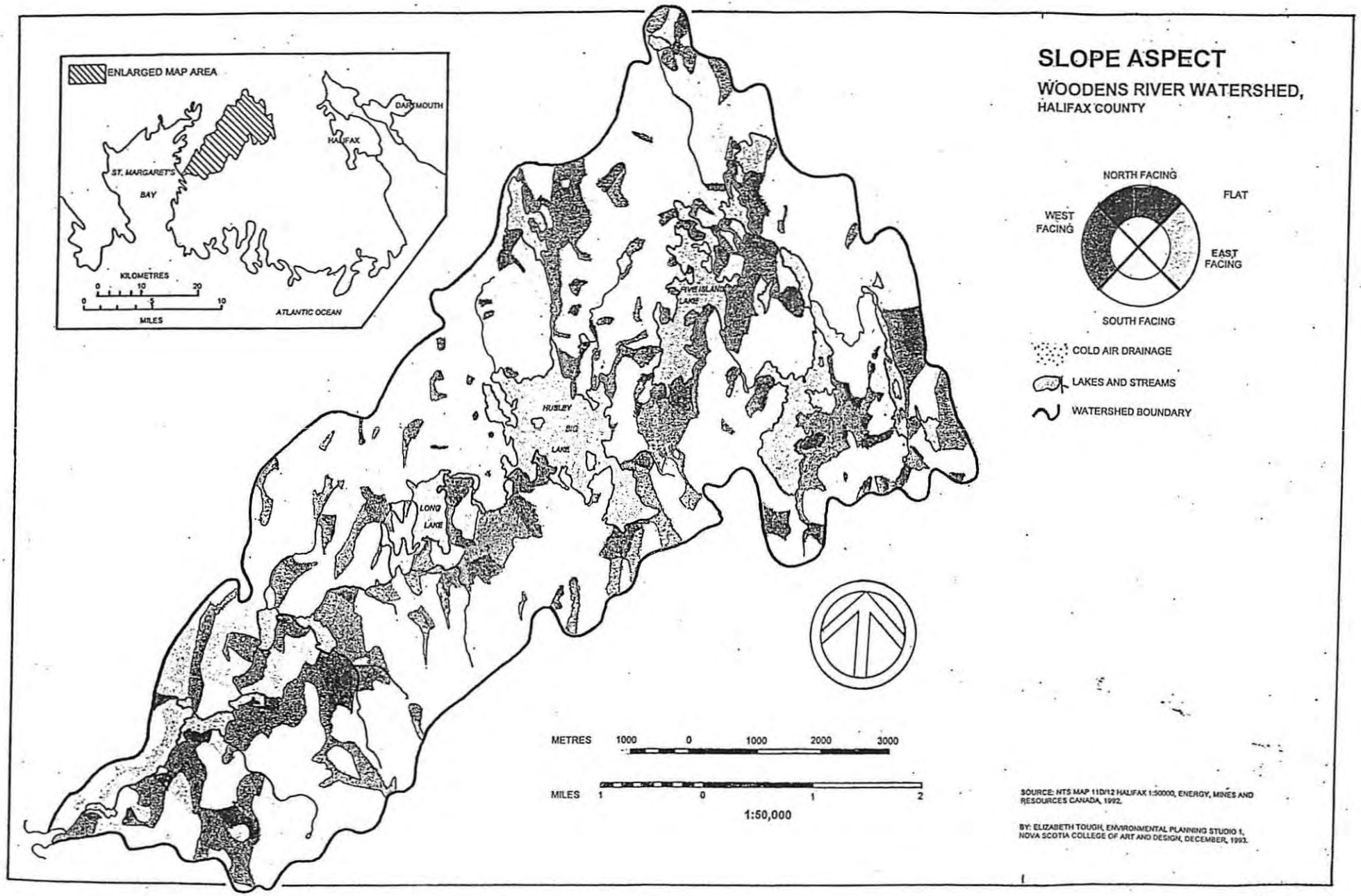

ENLARGED MAP AREA
DARTMOUTH
HALIFAX
ST. MARGARET'S
BAY
KILOMETRES
0 10 20
0 5 10
MILES
ATLANTIC OCEAN
SURFICIAL HYDROLOGY
WOODENS RIVER WATERSHED,
HALIFAX COUNTY
WETLANDS
BOG
B- BOG
OW- OPEN WATER
SS- SHRUB SWAMP
LAKES AND STREAMS
WATERSHED BOUNDARY
SUB-WATERSHED BOUNDARY
DIRECTION OF OVERLAND FLOW
BRIDGE
STREAM CROSSING
FIVE ISLAND LAKE
HUSLEY BIG LAKE
LONG LAKE
METRES 1000 0 1000 2000 3000
MILES 1 0 1 2
1:50,000
SOURCES: WETLANDS ATLAS FOR NOVA SCOTIA, MAP 11D/12 HALIFAX 1:50000, ENERGY, MINES AND RESOURCES CANADA, 4th EDITION, 1973
NTS MAP 11D/12 HALIFAX 1:5000, ENERGY, MINES AND RESOURCES CANADA, 1992.
BY: ELIZABETH TOUGH, ENVIRONMENTAL PLANNING STUDIO I, NOVA SCOTIA COLLEGE OF ART AND DESIGN, DECEMBER, 1993.

CLIMATE and SLOPE ASPECT

The climate of the area is modified continental and is characterized by relatively long, cool, wet winters and drier, warm summers. In the summer months, from May to August, the winds are generally from the south or south west and in the winter, from September to April, from the north and north west. The graphs show that rain falls all year round with snow also occurring in the months from October to May. The least precipitation falls in June, with an average of 83.9 millimetres, and the most in December, with an average of 147.7 millimetres. The temperature falls to averages of -4 degrees Celsius in December, January and February and rises to highs of 17 degrees Celsius in June and July, being the months with the most sunshine hours.

Since the watershed is in the temperate latitudes of the northern hemisphere, the sun will always be to the south and at an angle to the surface, but because of the rolling topography, there are places which receive more sunlight than others. Most of the watershed is flat, meaning it will receive sunlight all day long. South facing slopes, shown in yellow on the map, are warmer longer than other slopes and also tend to be drier due to increased time for evaporation. Because of this factor they may also be more susceptible to erosion. North facing slopes, shown in blue, receive the least amount of sunlight and therefore tend to be cooler and more moist. East and west facing slopes receive moderate amounts, with western slopes receiving a little more. Because of the orientation of the entire watershed, south and wet facing slopes dominate.

The areas of cold air drainage show possible frost pockets, and are located in low lying areas, especially around stream valleys and between drumlin hills.


ENLARGED MAP AREA
DARTMOUTH
HALIFAX
ST. MARGARET'S BAY
KILOMETRES
0 10 20
0 5 10
MILES
ATLANTIC OCEAN
SLOPE ASPECT
WOODENS RIVER WATERSHED,
HALIFAX COUNTY
NORTH FACING
FLAT
WEST FACING
EAST FACING
SOUTH FACING
COLD AIR DRAINAGE
LAKES AND STREAMS
WATERSHED BOUNDARY
RIVER ISLAND LAKE
HUSLEY BIG LAKE
LONG LAKE
METRES 1000 0 1000 2000 3000
MILES 1 0 1 2
1:50,000
SOURCE: NTS MAP 11D/12 HALIFAX 1:50000, ENERGY, MINES AND RESOURCES CANADA, 1992.
BY: ELIZABETH TOUGH, ENVIRONMENTAL PLANNING STUDIO 1, NOVA SCOTIA COLLEGE OF ART AND DESIGN, DECEMBER, 1993.

SOILS

The soils which are present in the watershed are derived from granite till, except for very small areas which have soil derived from shale and sandstone. There are two types of soil derived from granite. These are the Gibraltar series and the Aspotogan series. Gibraltar is by far the dominant type. It is characterized by good to excessive drainage and a relatively thin organic layer. The Aspotogan series is very poorly drained and is distinguished by a mottled appearance which is due to the removal of oxygen. Both these soils are non-arable due to high stone content, but will support forest and wildlife. The other mineral soil is the Wolfville series, which is located on or around the drumlins. It is the only soil in the area which could sustain agriculture. It is roughly 60 percent arable and has good drainage.

The only other soil type is organic soil, or peat, which forms in the depressional areas from decaying plant material. The peat is non-arable due to high acidity and extremely poor drainage, but provides wildlife habitat and has an important hyrologic function. The rocklands will have this peaty soil in the pockets and minor depressions.

The soil profiles show the colour and approximate depth of the soil horizons. pH values, which are the measure of acidity, are only given for the Wolfville series as it is the only arable soil type. This series becomes less acidic with depth.

SOIL PROFILES

GIBRALTAR SERIES

SEMI DECOMPOSED, FIBROUS, GREASY ORGANIC MATTER (NEEDLES AND LEAVES)

VERY POROUS AND CRUMBLY; STRUCTURELESS

FIRM; POROUS; STONY; THIN, FLAKY PARTICLES

STRONGLY CEMENTED; STONY

GRAVELLY; POROUS; STONY

WOLFVILLE SERIES

SEMIDECOMPOSED ORGANIC MATTER (CONIFEROUS NEEDLES)

POROUS; CRUMBLY, pH 4.2

MEDIUM GRANULAR; CRUMBLY; MODERATELY POROUS; STICKY WHEN WET; pH 4.5

WEAKLY DEVELOPED FINE GRANULAR STRUCTURE; MODERATELY POROUS; COMPACT; pH 4.9

MODERATELY FIRM; pH 5.2

FIRM; SOME STONE; pH 5.2

ASPOTOGAN SERIES

BLACK PEATY ORGANIC MATTER (MOSS AND NEEDLES)

CRUMBLY; MOTTLED; STONY

CRUMBLY; MOTTLED; STONY

CRUMBLY; MOTTLED; STONY

STONY, SOME QUARTZITE STONES

ROCKLAND

ORGANIC LAYER (ABSENT OR SHALLOW)

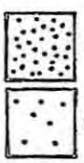
TILL LAYER (ABSENT OR SHALLOW)

BEDROCK (GRANITE, OFTEN EXPOSED)

PEAT

SEMIDECOMPOSED FIBROUS MATERIAL (MAINLY SPHAGNUM MOSS)

FIBROUS ORGANIC MATERIAL (VARIOUS STAGES OF DECOMPOSITION)



LOAM

SANDY LOAM

A: MIXING LAYER; MINERAL SOIL, ORGANIC MATERIALS
B: MINERAL LAYER; LITTLE ORGANIC MATERIAL
C; WEAKLY WEATHERED PARENT MATERIAL
O; ORGANIC MATTER
e: CHARACTERIZED BY THE REMOVAL OF MINERALS OR ORGANICS
f: ENRICHED WITH IRON
g: CHARACTERIZED BY LACK OF OXYGEN, OFTEN MOTTLED
h: ENRICHED WITH ORGANIC MATTER
pH: MEASURE OF ACIDITY; 7---> 0 BECOMES MORE ACIDIC

CLIMATE and SLOPE ASPECT

The climate of the area is modified continental and is characterized by relatively long, cool, wet winters and drier, warm summers. In the summer months, from May to August, the winds are generally from the south or south west and in the winter, from September to April, from the north and north west. The graphs show that rain falls all year round with snow also occurring in the months from October to May. The least precipitation falls in June, with an average of 83.9 millimetres, and the most in December, with an average of 147.7 millimetres. The temperature falls to averages of -4 degrees Celsius in December, January and February and rises to highs of 17 degrees Celsius in June and July, being the months with the most sunshine hours.

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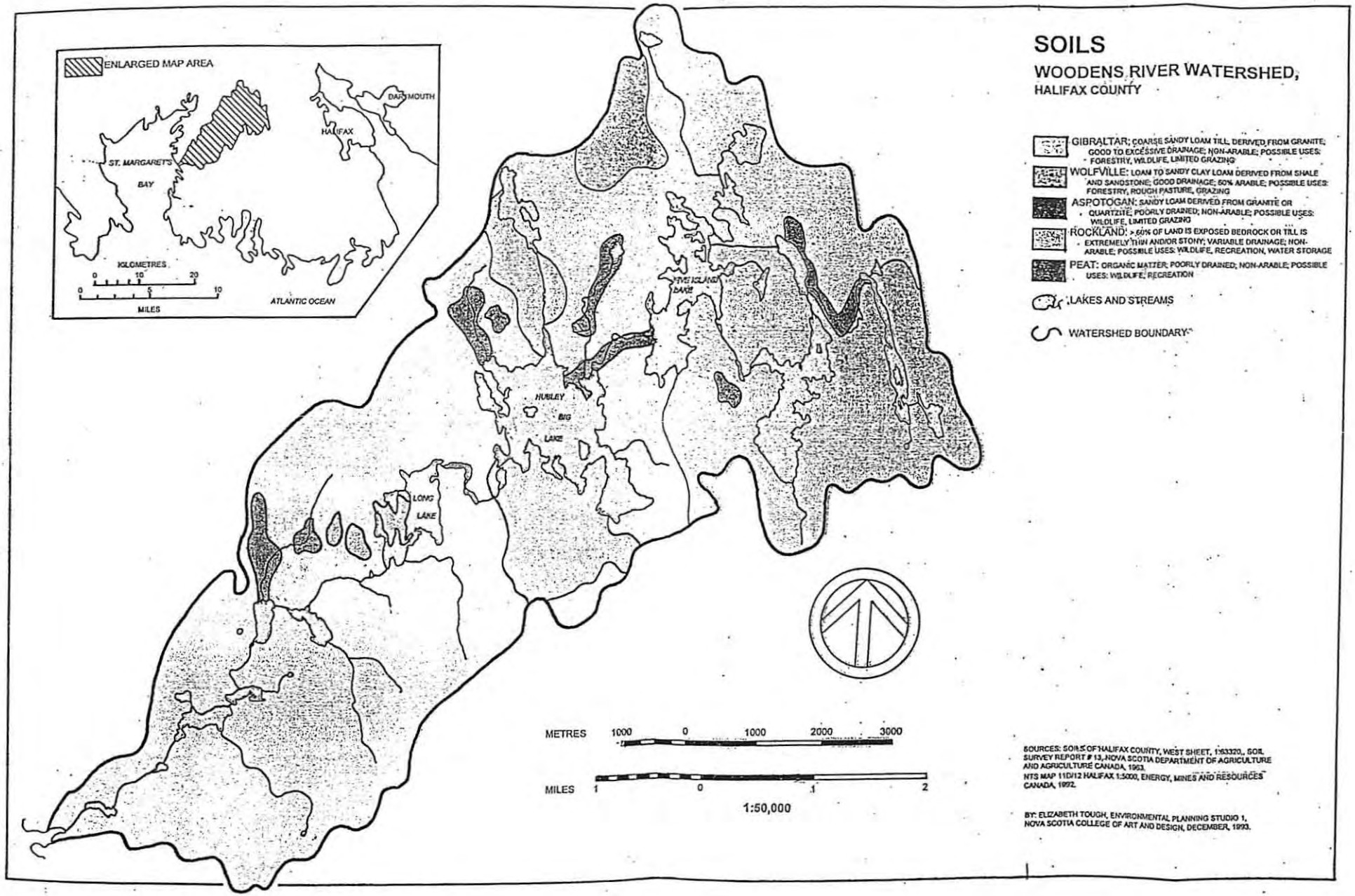


SOILS

WOODENS RIVER WATERSHED,
HALIFAX COUNTY

- GIBRALTAR: COARSE SANDY LOAM TILL, DERIVED FROM GRANITE; GOOD TO EXCESSIVE DRAINAGE; NON-ARABLE; POSSIBLE USES: FORESTRY, WILDLIFE, LIMITED GRAZING
- WOLFVILLE: LOAM TO SANDY CLAY LOAM DERIVED FROM SHALE AND SANDSTONE; GOOD DRAINAGE; 60% ARABLE; POSSIBLE USES: FORESTRY, ROUGH PASTURE, GRAZING
- ASPOTOGAN: SANDY LOAM DERIVED FROM GRANITE OR QUARTZITE; POORLY DRAINED; NON-ARABLE; POSSIBLE USES: WILDLIFE, LIMITED GRAZING
- ROCKLAND: >60% OF LAND IS EXPOSED BEDROCK OR TILL IS EXTREMELY THIN AND/OR STONY; VARIABLE DRAINAGE; NON-ARABLE; POSSIBLE USES: WILDLIFE, RECREATION, WATER STORAGE
- PEAT: ORGANIC MATTER; POORLY DRAINED; NON-ARABLE; POSSIBLE USES: WILDLIFE, RECREATION
- LAKES AND STREAMS
- WATERSHED BOUNDARY

SOURCES: SOILS OF HALIFAX COUNTY, WEST SHEET, 1:63320., SOIL SURVEY REPORT # 13, NOVA SCOTIA DEPARTMENT OF AGRICULTURE AND AGRICULTURE CANADA, 1963.
NTS MAP 11D/12 HALIFAX 1:5000, ENERGY, MINES AND RESOURCES CANADA, 1992.

BY: ELIZABETH TOUGH, ENVIRONMENTAL PLANNING STUDIO 1, NOVA SCOTIA COLLEGE OF ART AND DESIGN, DECEMBER, 1993.

VEGETATION and LAND USE

While the micro-climate variations in the watershed may affect vegetation to some degree, it seems to be more strongly influenced by some of the other physical features of the region. There are five main vegetation categories in the area, not including the rockland or bog sections. Softwood trees dominate the watershed, covering about 65 percent. The dominant softwood species is Red Spruce. Red Spruce, in association with Black Spruce, signifies that the ground is depressional and poorly drained. This association, shown in plain dark green, dominates the watershed area. Red Spruce dominates some region alone, occurring with small amounts of Red Oak and Red Maple as well as Poplar and Balsam Fir. Where Red Spruce is associated with White Spruce it is probably a regenerating cut over, a field left to go wild or along the well drained shores of river or lakes.

The hardwood stands are dominated by Red Oak and are situated mostly on high, well drained ground. These stands are shown in the plain light green on the map. In these stands there is some Yellow Birch, Red Maple and Red Spruce. About 30 percent of the hardwood stands are dominated by Red Maple. These stands occur on upper hillsides as well as hilltops, and include Sugar Maple, Red Spruce, Balsam Fir, Yellow Birch and Red Oak in small quantities. Hardwoods need better drainage and richer soil than spruces, which actually increase the acidity of the soil when their needles decompose.

Other than the fairly new land development around Hubley Big Lake, most of the human settlement and permanent land use is in the north and the southern tip of the watershed. Forestry has been a big activity in the past and continues in some small areas. It is responsible, along with fire, for the current vegetation structure. Also, the land has been used for hunting, fishing and recreation by the local population for decades. Old logging roads were maintained by recreational users as walking and all terrain vehicle trails. Recently some of these roads have been upgraded to allow heavy machinery access to the lake for development purposes.

CHARACTERISTIC TREES OF THE AREA

RED OAK

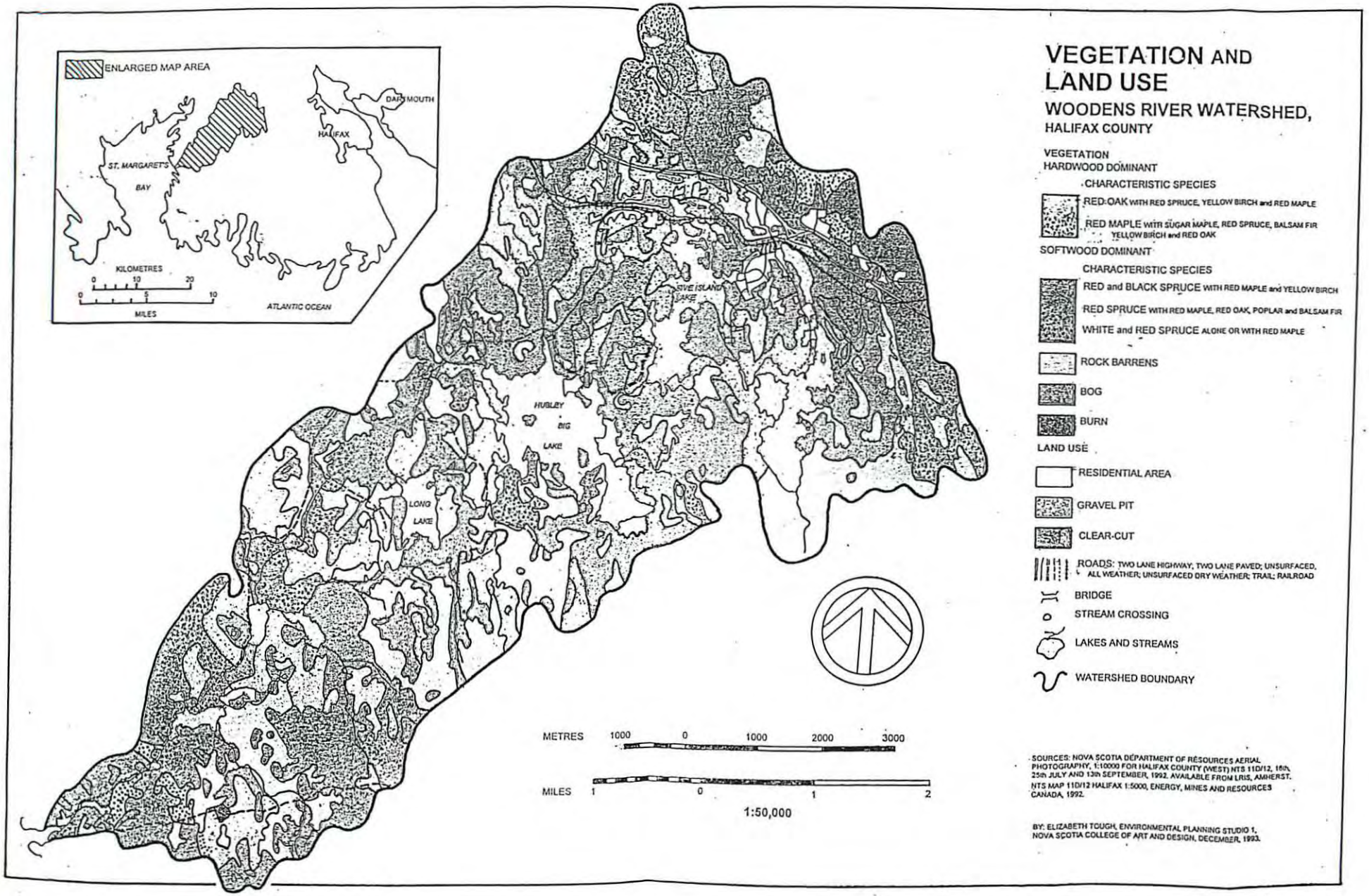
RED MAPLE

RED SPRUCE

BLACK SPRUCE

WHITE SPRUCE

From: Trees of Nova Scotia.



VEGETATION AND LAND USE

WOODENS RIVER WATERSHED, HALIFAX COUNTY

VEGETATION

HARDWOOD DOMINANT

CHARACTERISTIC SPECIES

- RED OAK WITH RED SPRUCE, YELLOW BIRCH and RED MAPLE
- RED MAPLE WITH SUGAR MAPLE, RED SPRUCE, BALSAM FIR YELLOW BIRCH and RED OAK

SOFTWOOD DOMINANT

CHARACTERISTIC SPECIES

- RED and BLACK SPRUCE WITH RED MAPLE and YELLOW BIRCH
- RED SPRUCE WITH RED MAPLE, RED OAK, POPLAR and BALSAM FIR
- WHITE and RED SPRUCE ALONE OR WITH RED MAPLE
- ROCK BARRENS
- BOG
- BURN

LAND USE

- RESIDENTIAL AREA
- GRAVEL PIT
- CLEAR-CUT
- ROADS: TWO LANE HIGHWAY, TWO LANE PAVED; UNSURFACED, ALL WEATHER; UNSURFACED DRY WEATHER; TRAIL; RAILROAD
- BRIDGE
- STREAM CROSSING
- LAKES AND STREAMS
- WATERSHED BOUNDARY

SOURCES: NOVA SCOTIA DEPARTMENT OF RESOURCES AERIAL PHOTOGRAPHY, 1:10000 FOR HALIFAX COUNTY (WEST) NTS 11D/12, 15th, 25th JULY AND 13th SEPTEMBER, 1992. AVAILABLE FROM LRIS, AMHERST. NTS MAP 11D/12 HALIFAX 1:5000, ENERGY, MINES AND RESOURCES CANADA, 1992.

BY: ELIZABETH TOUGH, ENVIRONMENTAL PLANNING STUDIO 1, NOVA SCOTIA COLLEGE OF ART AND DESIGN, DECEMBER, 1993.

SYNTHESIS

The final goal in bringing the resource elements together is to identify sensitive areas and opportunities and constraints which relate to the maintenance of brook trout habitat quality in the watershed.

The basic qualities of brook trout habitat include water which is not too acidic for reproduction and survival (see Figure). They also need shaded areas, summer water temperatures between 16 and 18 degrees Celsius, high levels of dissolved oxygen and clear water with low levels of suspended sediment. For reproduction, trout need a clean gravel stream bed to allow their eggs to settle out of the current and to provide protected spaces for the young fish.

Any type of land use which means the removal of vegetation from stream banks and slopes near watercourses would jeopardize all of these requirements. It would lessen stream bank shade and contribute to raising temperatures above the optimum level, as well as removing a source of food, in the form of deciduous leaves. With vegetation gone, soil erosion rates would go up, and soil would enter the streams and lakes. Added soil darkens the water and causes it to retain more heat. As the temperature rises, the ability to hold dissolved oxygen is reduced. As well, the suspended particles would impede the trout's vision and lessen its ability to find food. Soil that settles out of the current would fill the spaces in the gravel stream beds and destroy reproduction grounds.

Acidity levels in the waterbodies are affected by many agents. On a large scale, acid precipitation increases acidity in lake system in areas which have no natural buffering agents, which includes at least 60 percent of Canada and all of Nova Scotia. On more local scales, the environmental features of an area may contribute to natural acidity. Granite bedrock has little or no buffering components and contributes to natural acidity as it breaks down. Areas with a predominance of softwoods may also be more acidic, as conifer needles decompose to an acidic organic layer. Swamps and bogs are also highly acidic, due to high levels of decomposing organics.

To maintain brook trout habitat, sensitivity categories must be delineated which take these factors relating to trout habitat quality into account. Areas of high sensitivity are those in which only limited activities may occur. In areas of medium sensitivity, there are more opportunities for use or development, if certain limitations are observed. The most opportunities exist in areas of low sensitivity. Here, development would have the fewest limitations and the uses could be more varied.

Landscapes which would be encompassed in the highly sensitive category include steep slopes, being those above 15 percent, around or near waterbodies, especially those with southern aspects as these tend to be drier and more susceptible to erosion. Areas

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Landscapes which would be encompassed in the highly sensitive category include steep slopes, being those above 15 percent, around or near waterbodies, especially those with southern aspects as these tend to be drier and more susceptible to erosion. Areas

defined by bedrock, soil or other ground cover which has buffering capacities, also near water bodies are in this category as well. Likewise, areas of deciduous vegetation since, as well as providing food for trout, they are also more efficient at retaining soil than conifers. Also included in this category are wetlands or bogs which are connected to the water system, as the disturbance of these would upset the water balance by changing storage capabilities and acidity levels.

Included in the category of medium sensitivity are slopes of medium grade (8 to 15 percent) near the water system, and areas in the collection zone, as this area is susceptible to drainage problems. The bogs in this category are those that are near to, but not connected to the water system since, at times of peak discharge , the boundaries of the bogs may expand and connect with nearby streams or lakes.

Areas of low sensitivity encompass the upland zone, areas of low relief, stable rocklands and bogs which are removed from the water system, at enough of a distance that there is no danger of overflow during periods of high water.

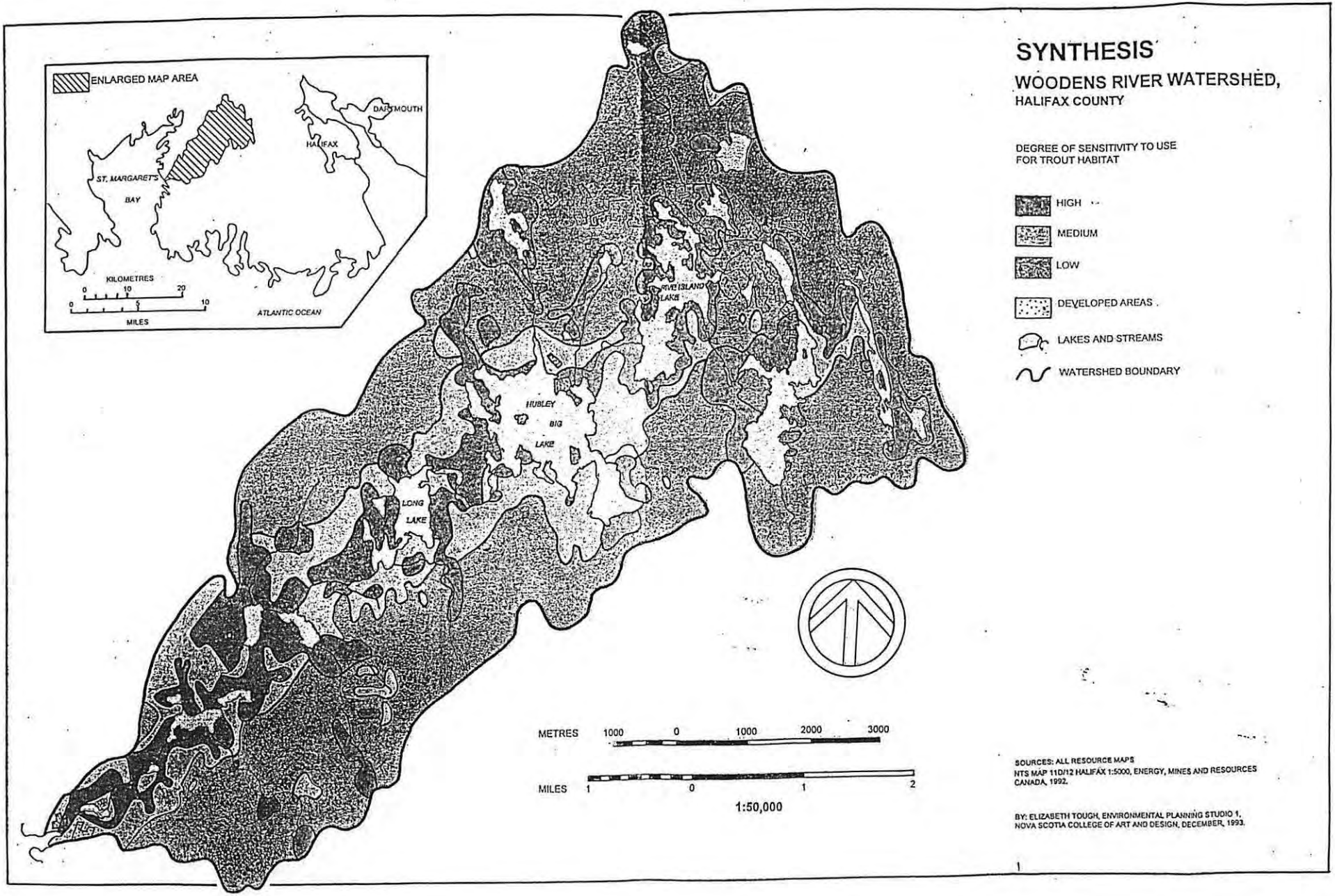
The areas of the Woodens River Watershed which fall into the highly sensitive category, shown in red on the synthesis map, include the drumlins around Long Lake, which are composed of Lawrencetown Till and have natural buffering capacities, as well as having steep slopes. The other areas of steep slopes are around Five Island Lake and cover much of the south west portion of the watershed, especially around the stream valley, as well as in the north east corner. Very few of the bogs in the watershed are not connected with the water system and therefore most of them fall into this category.

The orange areas on the map show areas of medium sensitivity and encompass the bogs not included in the previous category, and the areas of medium slope around Hubley Big Lake and the streams and Lakes to the south west. The collection zone is included also. Since the relief in the area is moderate, this zone is prone to flooding during times of increased run-off.

The largest area on the map, in light brown, is the area of low sensitivity. It includes the rocklands in the north east and the upland zone. This zone is least prone to drainage problems as it encompasses the headwaters of the watershed and has no other drainage systems flowing into it. The areas of low relief, which are all around the borders of the watershed, and cover most of the northern portion, are included as well.

CONCLUSION

Within each of the sensitivity categories there are appropriate or tolerable uses. Areas of high sensitivity may still be used for low impact recreation, such as hiking, canoeing or fishing. These activities may also take place in the areas of medium



SYNTHESIS

WOODENS RIVER WATERSHED, HALIFAX COUNTY

DEGREE OF SENSITIVITY TO USE FOR TROUT HABITAT

- HIGH
- MEDIUM
- LOW
- DEVELOPED AREAS
- LAKES AND STREAMS
- WATERSHED BOUNDARY

SOURCES: ALL RESOURCE MAPS
NTS MAP 11D/12 HALIFAX 1:5000, ENERGY, MINES AND RESOURCES CANADA, 1992.

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sensitivity. As well, development could occur if certain limitations were observed. These limitations include minimal removal of vegetation and restricted slope disturbance. Use or development in the areas of low sensitivity would have the least effect on the trout habitat, and therefore they present the most opportunities. Here there are possibilities for recreational use, with fewer limitations than in the other two categories. All terrain vehicle use of trails in this area would have the least impact. Development of land in this category is also less limited, in particular by slope factors. The optimum grade for building is in the 3 to 8 percent range and much of this region is composed of this range of slopes.

Not delineated on the map is a buffer zone which would surround all lakes and streams. The width of this zone depends on slope and soil type, with the widest areas needed on steep slopes with well drained soils. An adequate buffer zone is characterized by either stable, rocky banks or by at least 80 percent vegetation cover. When possible this vegetation cover should be the natural, undisturbed growth and should not consist of grass lawns, as these provide none of the requirements for maintaining brook trout habitat quality.

GLOSSARY

BARRENS: Rocky heathland supporting dwarf shrub and lichen vegetation.

BATHOLITH: A large body of intrusive Igneous rock, usually *granite* in which there is no observable bottom to the structure. It must have more than 100 square kilometres of surface exposure

BOG: A northern wetland containing a wide diversity of vegetation. They are characterized by deep organic deposits, typically peat, and tend to be acidic.

BUFFER: 1) A solution which resists changes in hydrogen ion concentration and thus keeps pH levels constant. Natural buffers are present in some areas, such as those with limestone bedrock.

2) A land management tool in which an area is left relatively undisturbed, between regions of differing land use, to protect the qualities of an environment

CONTACT: The interface or boundary between adjacent but dissimilar rock types.

DERANGED STREAM PATTERN: An uncoordinated pattern of drainage characteristic of a region recently vacated by an ice sheet.

DEVONIAN PERIOD: The time period between 415 and 370 million years ago.

DRAINAGE BASIN: That part of the land surface which is drained by a unitary river .system

DRUMLIN: A whaleback hillock of *till.* Its long axis is parallel to the direction followed by the former ice sheet.

GRANITE: An igneous rock, generally of coarse grain due to slow cooling at great depths. It consists of quartz (20-40 percent) with feldspar and mica.

HABITAT: The place where an organism normally lives, characterized by its biotic or physical characteristics.

HORIZON: A soil layer of any thickness, generally running parallel to the ground surface and exhibiting a relatively uniform character in its material.

LOAM: An easily worked, permeable soil. It comprises an almost equal mix of sand and silt, but with less than 30 percent clay.

NORMAL: Used in climatology to denote the average value of any climatological element over a given period of time, usually 30 years.

ORGANIC MATTER: That portion of the soil which contains material of organic origin, broken down to varying degrees and providing an important source of nutrients in addition to improving the structure of the soil.

OVERLAND FLOW: The surface movement of water derived from precipitation which is not intercepted by vegetation and which runs as a shallow unchannelled sheet across the soil.

PEAT: A dark brown *organic material* produced by the partial decomposition of mosses and other plants which grow in marshes and wetlands.

pH: A number used to express the acidity of a solution. The pH scale runs from0-14, with 7 being neutral, anything above being alkaline and anything below being acidic. It is measured on a logarithmic scale, thus a change of one unit of pH indicates a tenfold change in acidity (See Figure 2).

TILL: A type of sediment in which the components have been brought into contact by the direct agency of glacial ice. It is non sorted and non stratified.

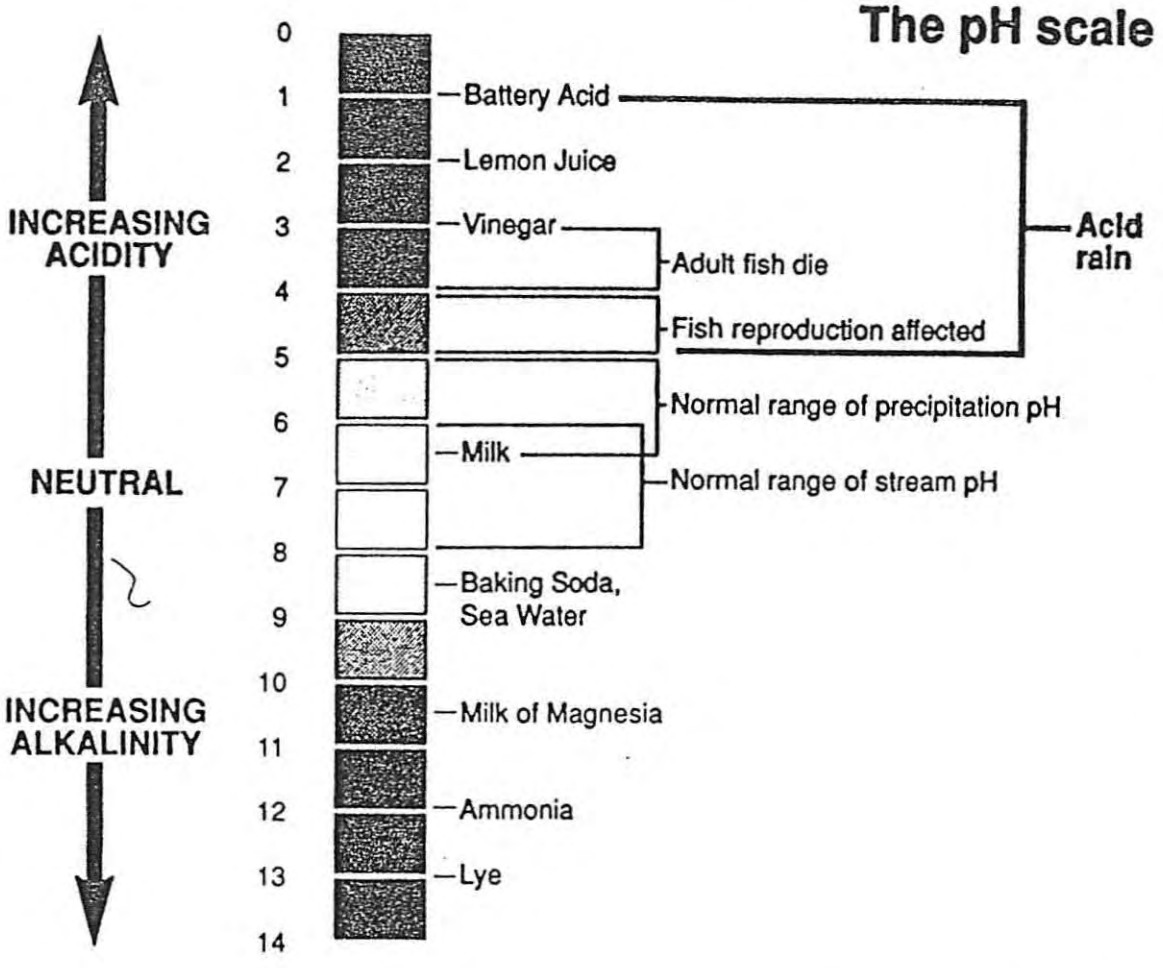
TILL PLAIN: A wide area of low relief created by a till sheet which masks all irregularities in the bedrock relief.

TOPOGRAPHY: The description of the surface geographical features of a region.

WATERSHED: The entire catchment area of a single *drainage basin.*

Note: Italicised words appear in glossary also.

gure2



The acidity of a water sample is measured on a pH scale. This scale ranges from **0** (maximum acidity) to **14** (maximum alkalinity). The middle of the scale, **7**, represents the neutral point. The acidity increases from neutral toward **0**.

Because the scale is logarithmic, a difference of one pH unit represents a tenfold change. For example, the acidity of a sample with a pH of **5** is ten times greater than that of a sample with a pH of **6**. A difference of 2 units, from **6** to **4**, would mean that the acidity is one hundred times greater, and so on.

Normal rain has a pH of **5.6** — slightly acidic because of the carbon dioxide picked up in the earth's atmosphere by the rain.

From: Environment Canada Conservation and Protection Fact Sheet #3, "Clean Water-Life Depends on it.", 1990.

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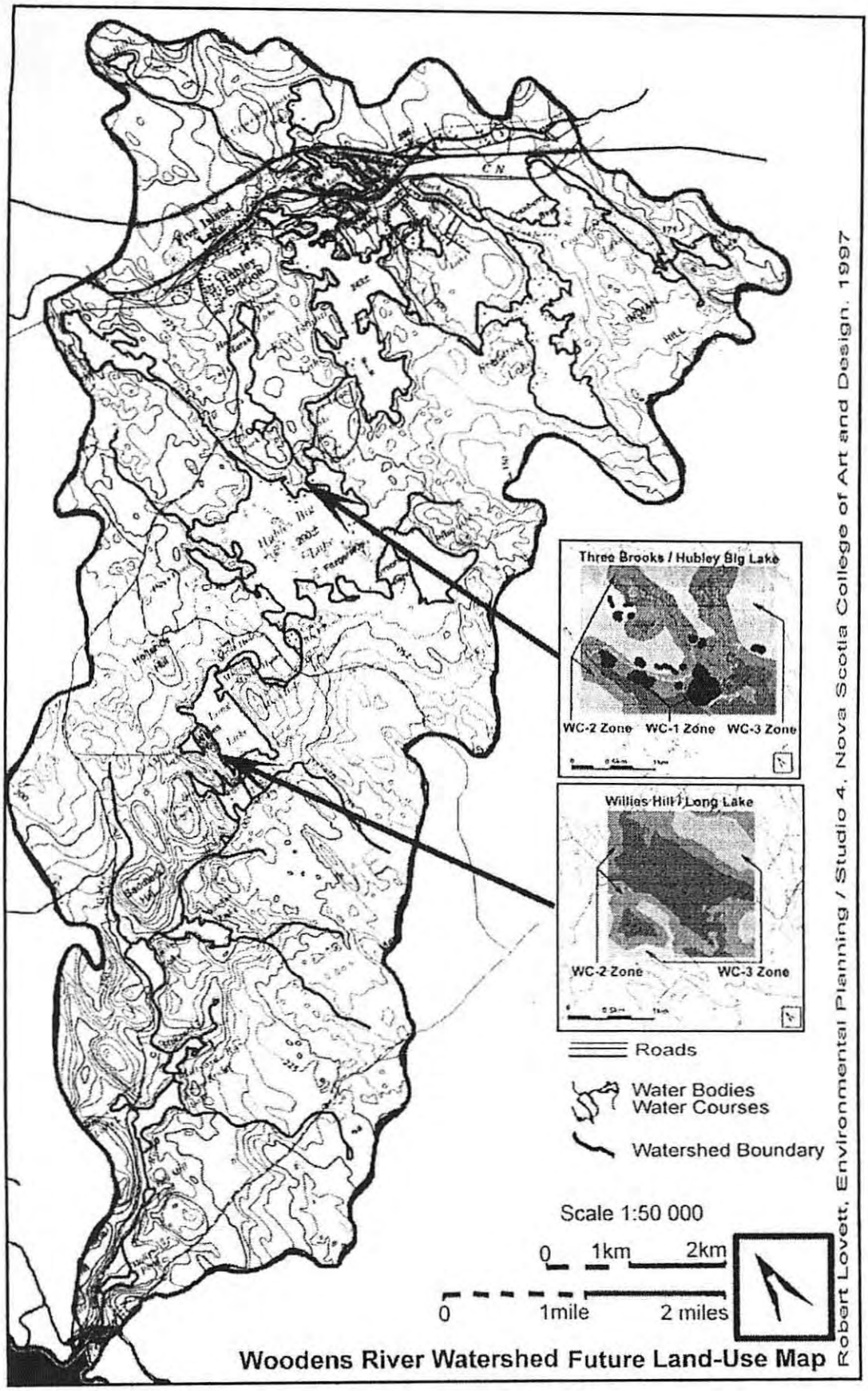
Three Brooks / Hubley Big Lake
WC-2 Zone
WC-1 Zone
WC-3 Zone
Willies Hill / Long Lake
WC-2 Zone
WC-3 Zone
Roads
Water Bodies
Water Courses
Watershed Boundary
Scale 1:50 000
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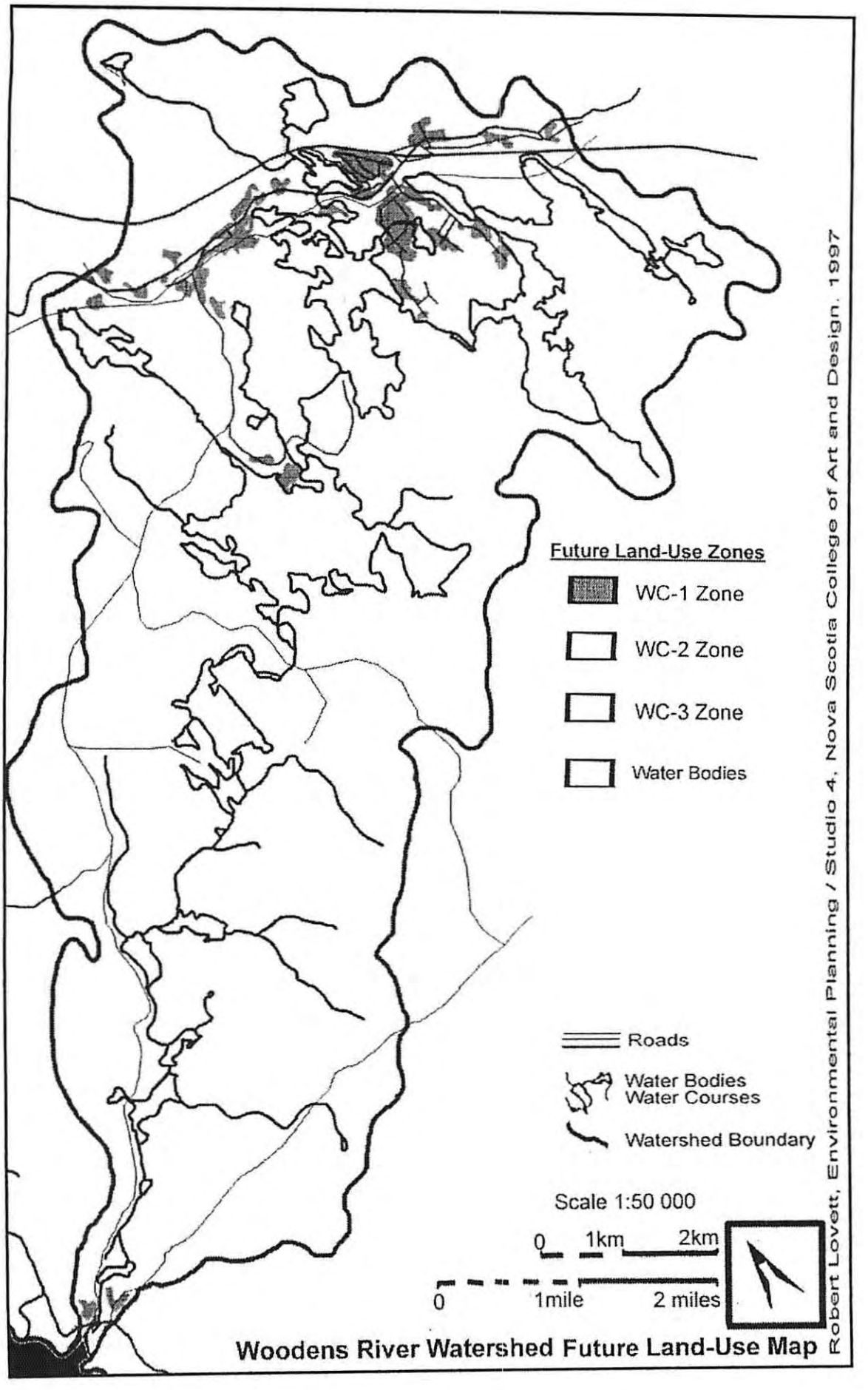
Woodens River Watershed Future Land-Use Map
Robert Lovett, Environmental Planning / Studio 4, Nova Scotia College of Art and Design, 1997



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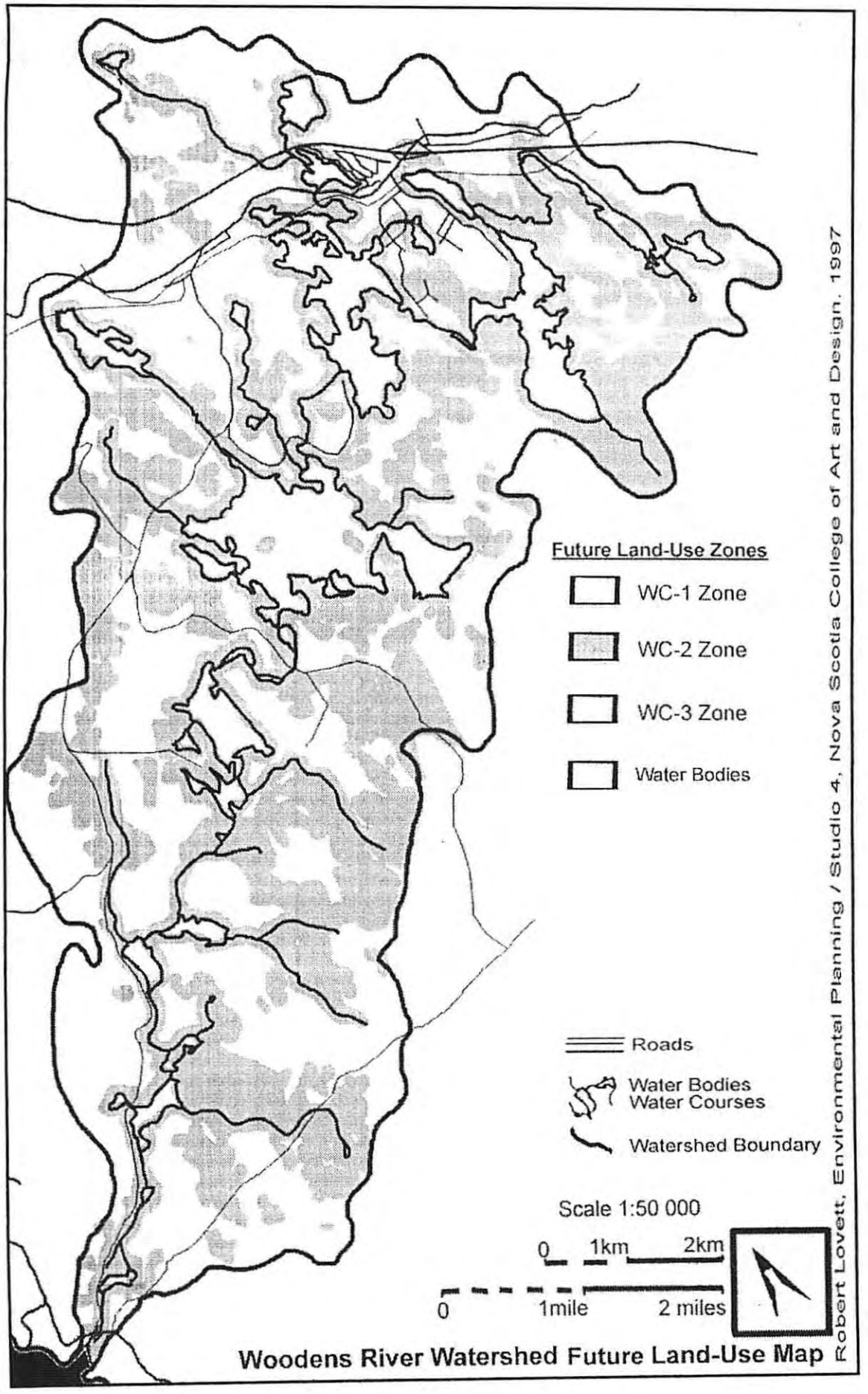
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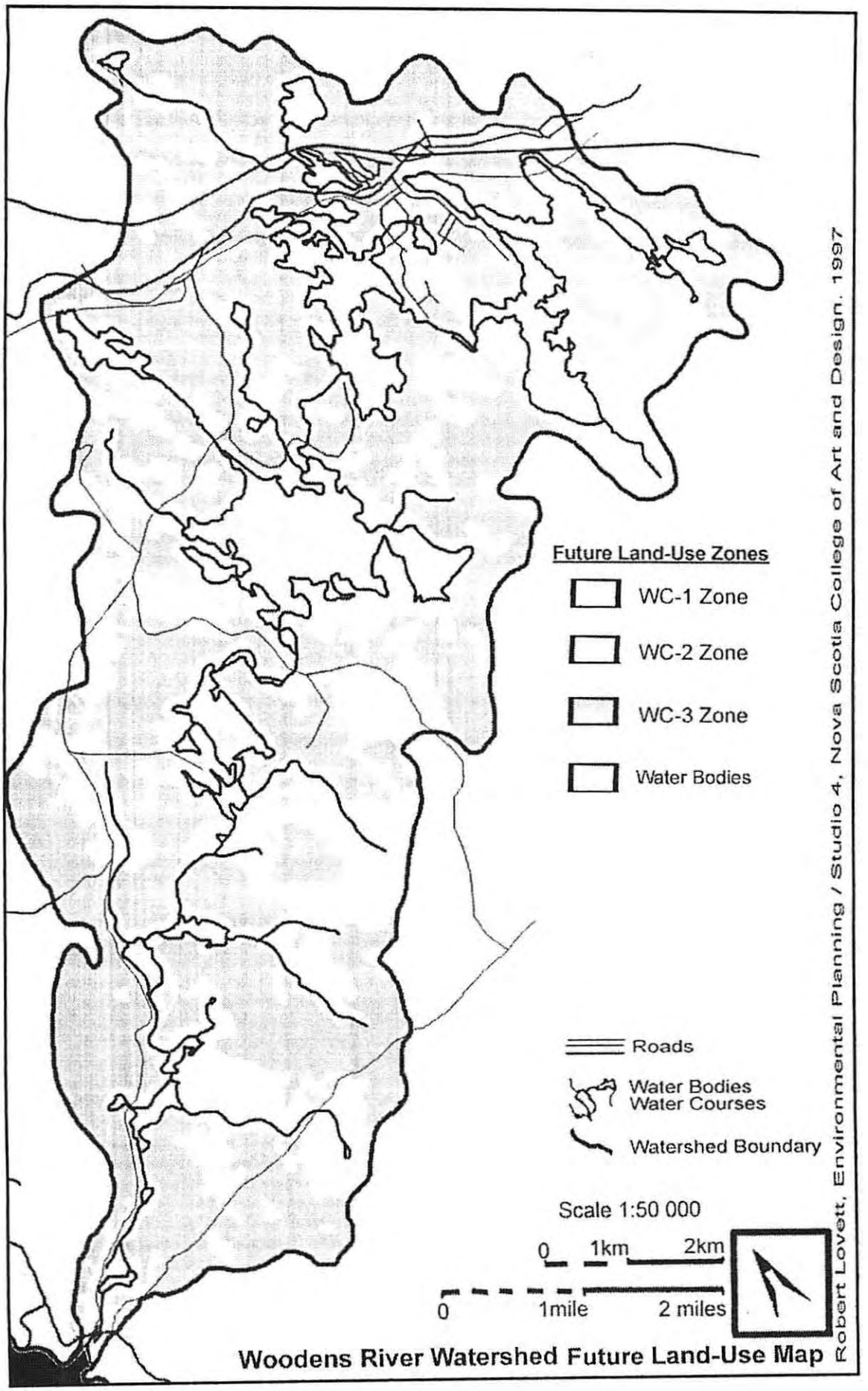

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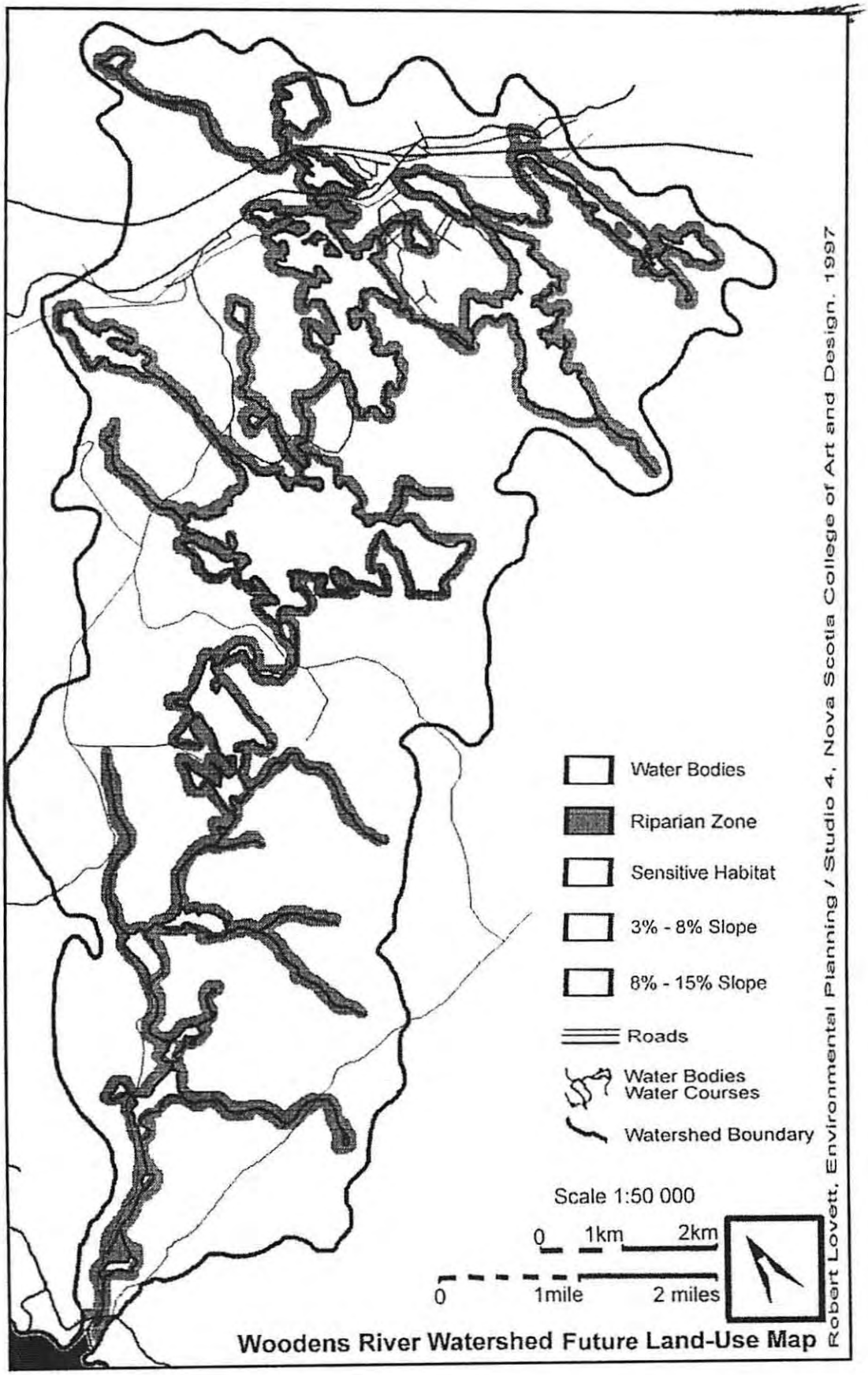
Water Bodies
Riparian Zone
Sensitive Habitat
3% - 8% Slope
8% - 15% Slope
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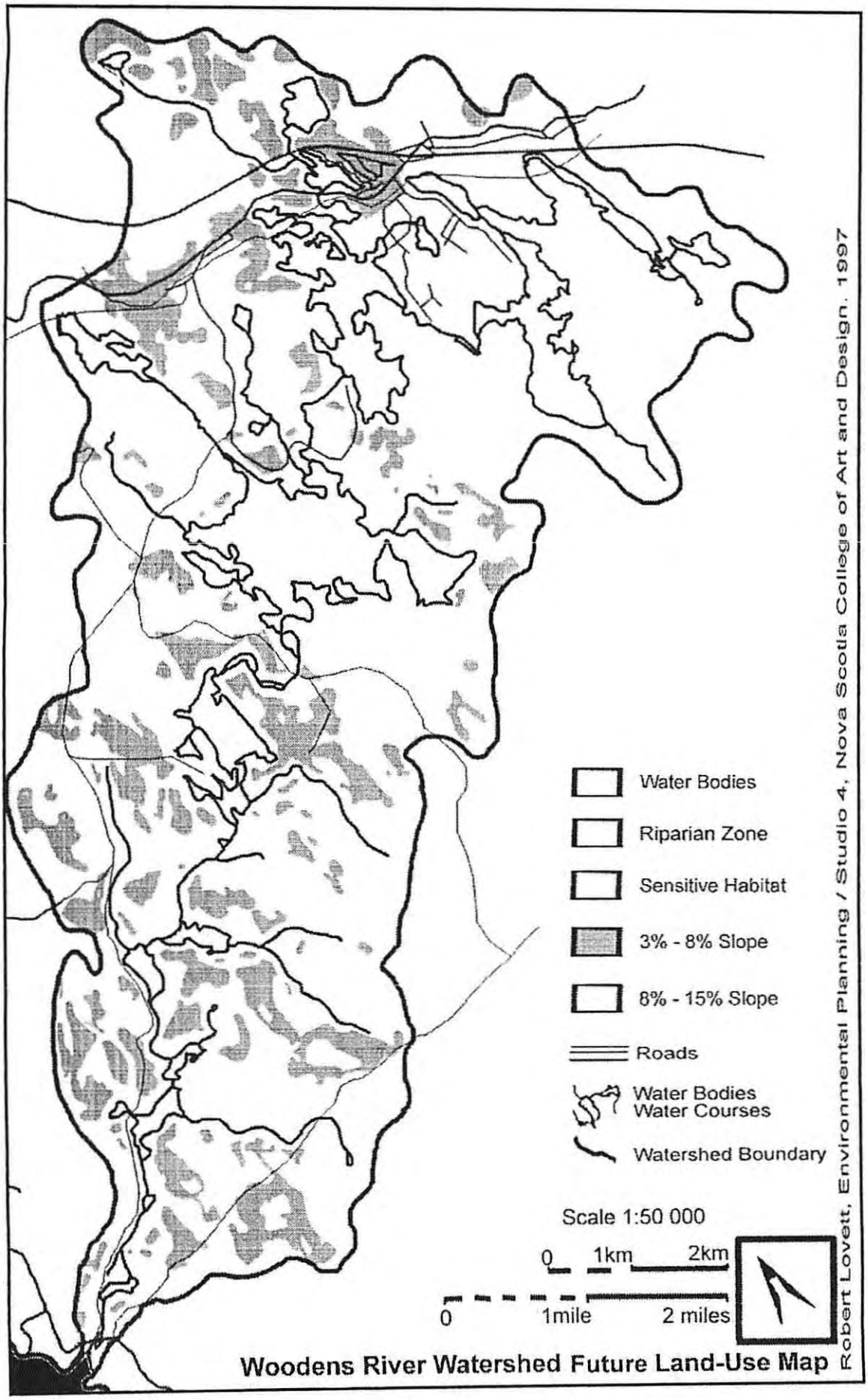
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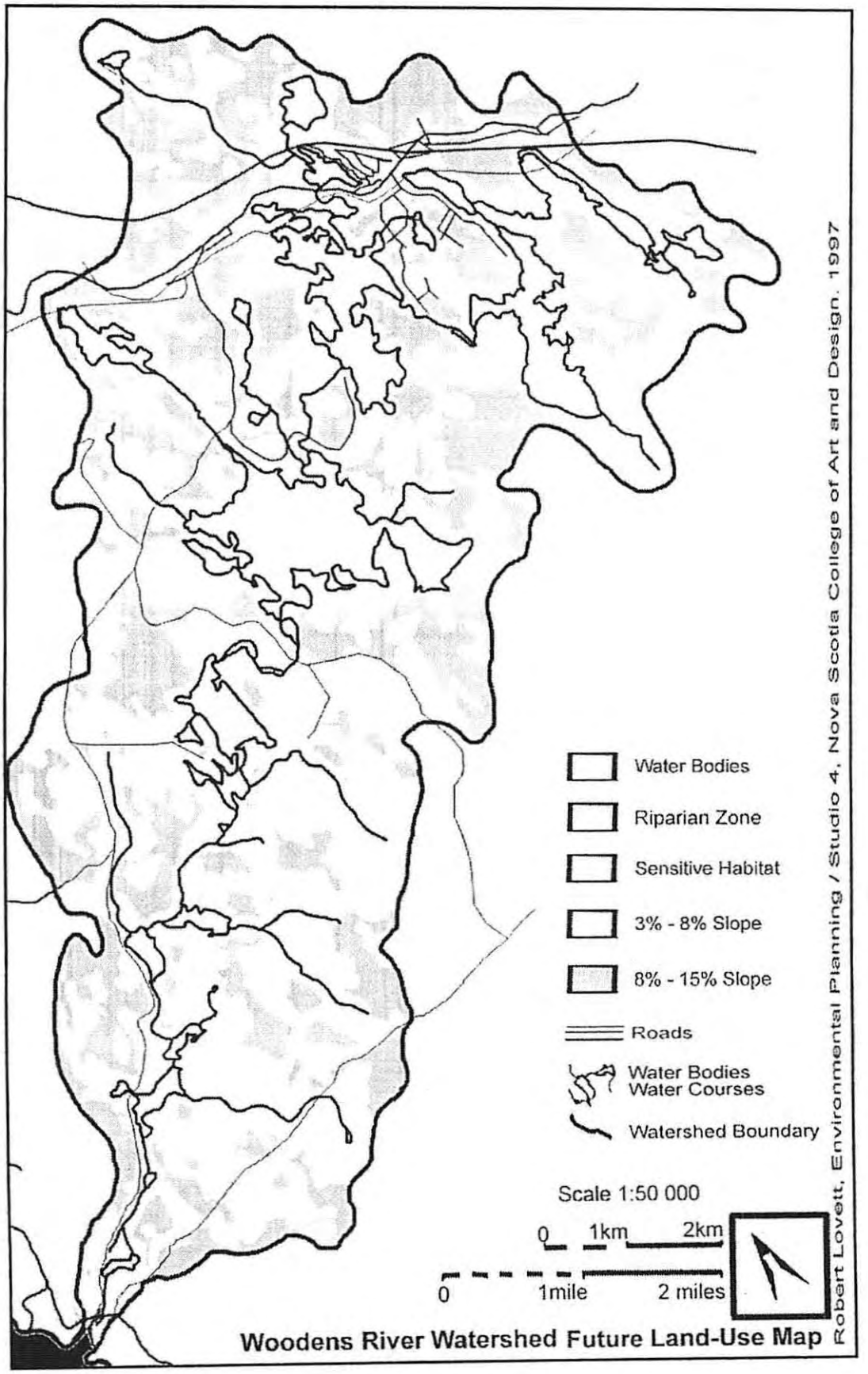
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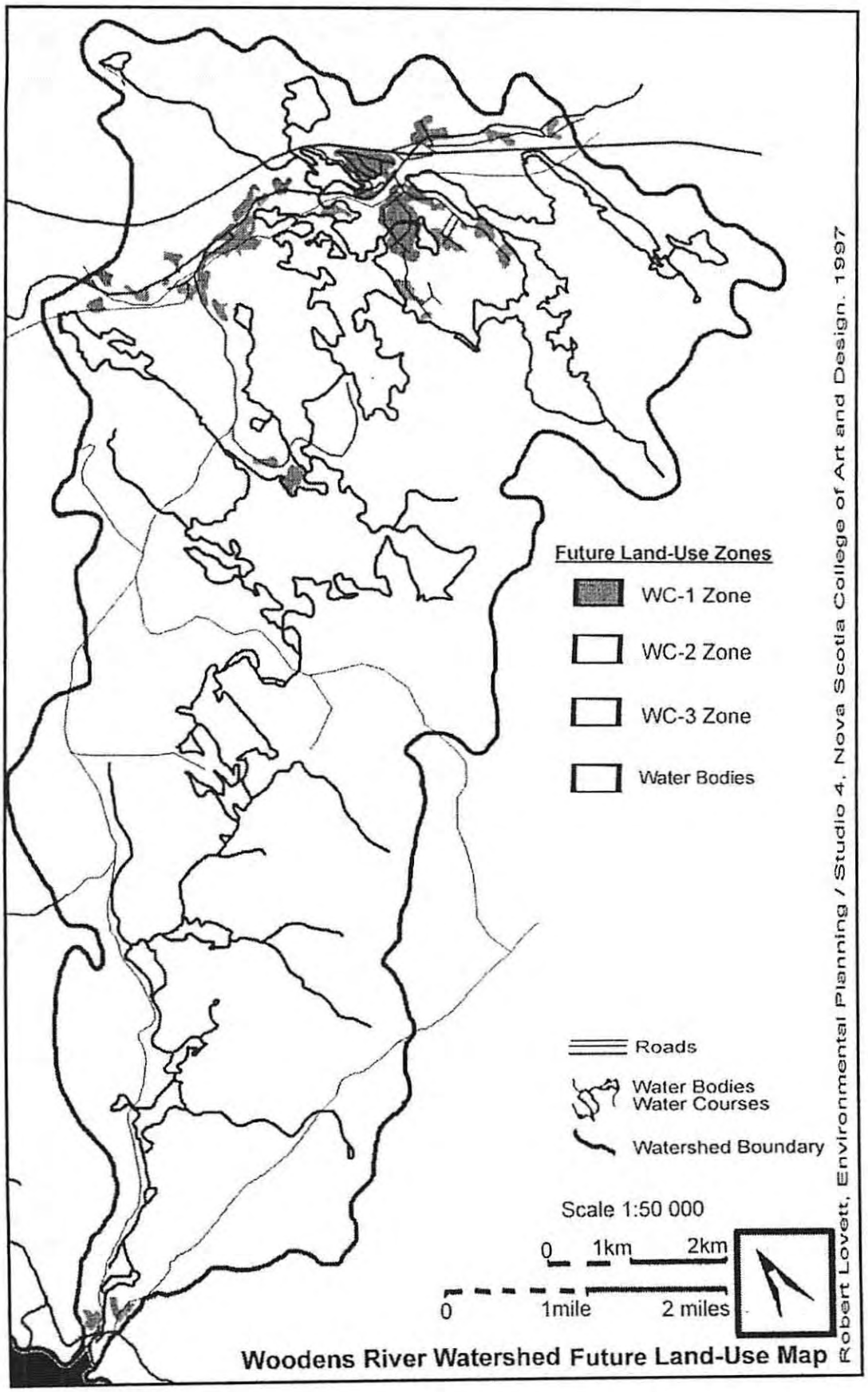

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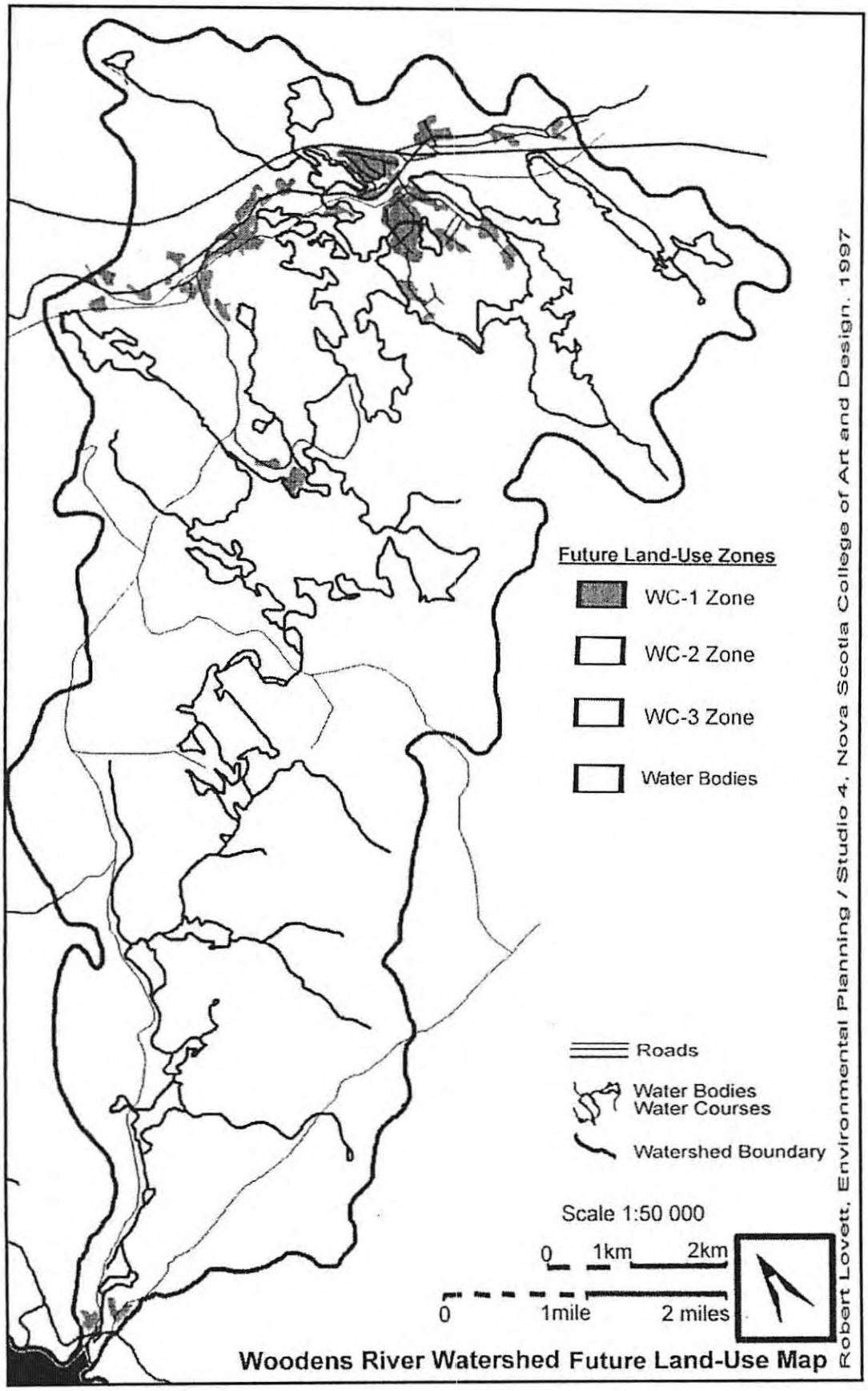
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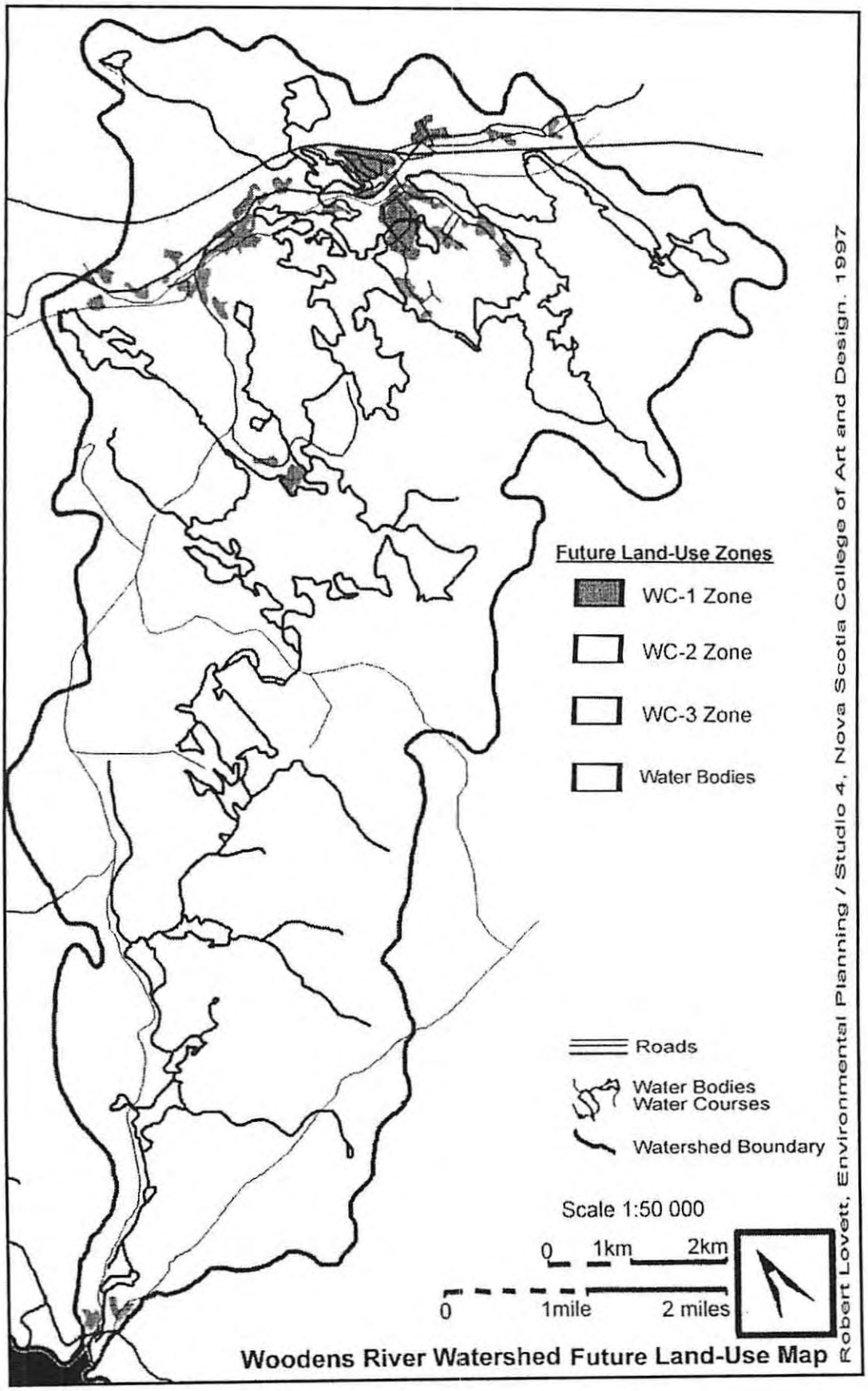
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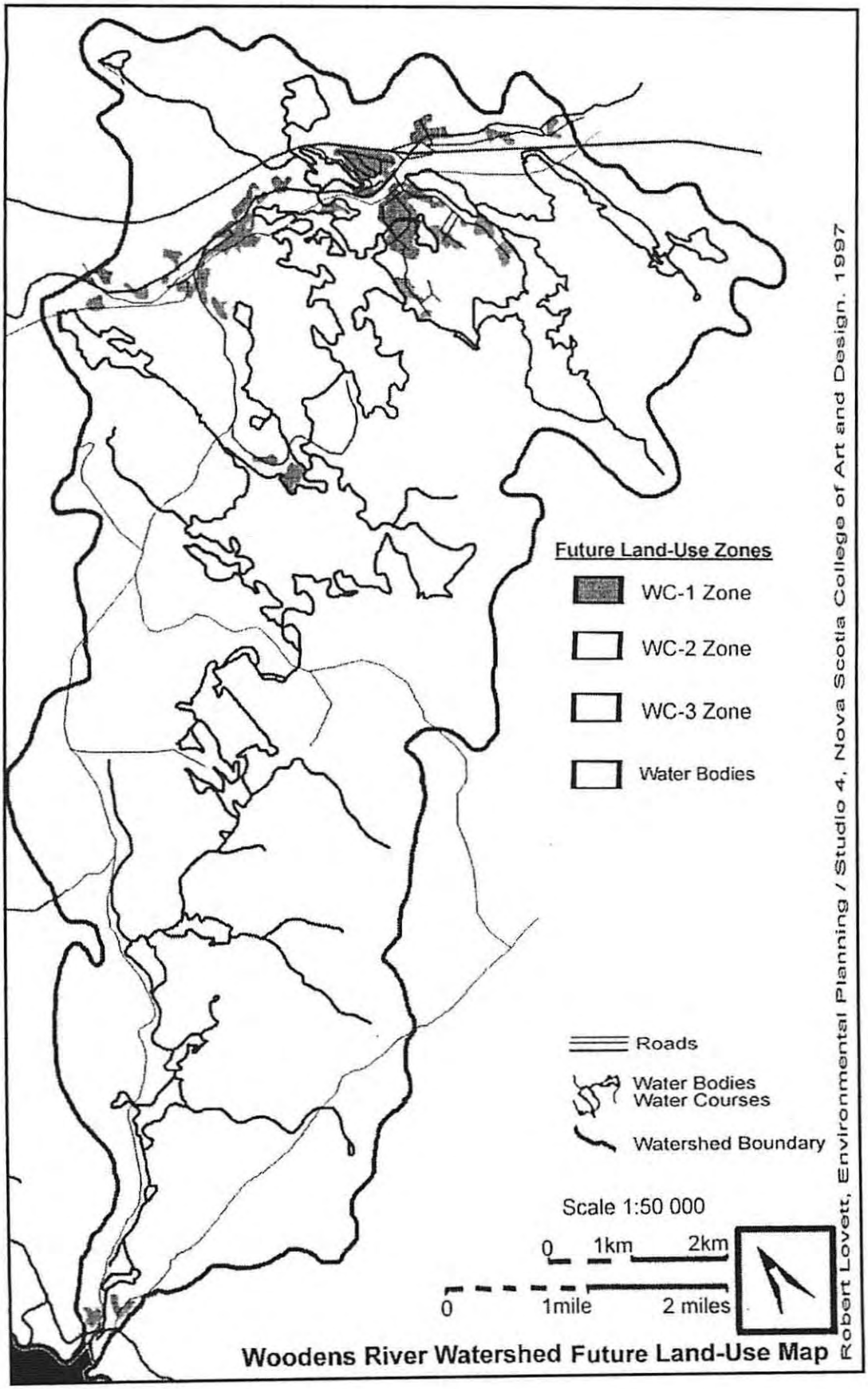
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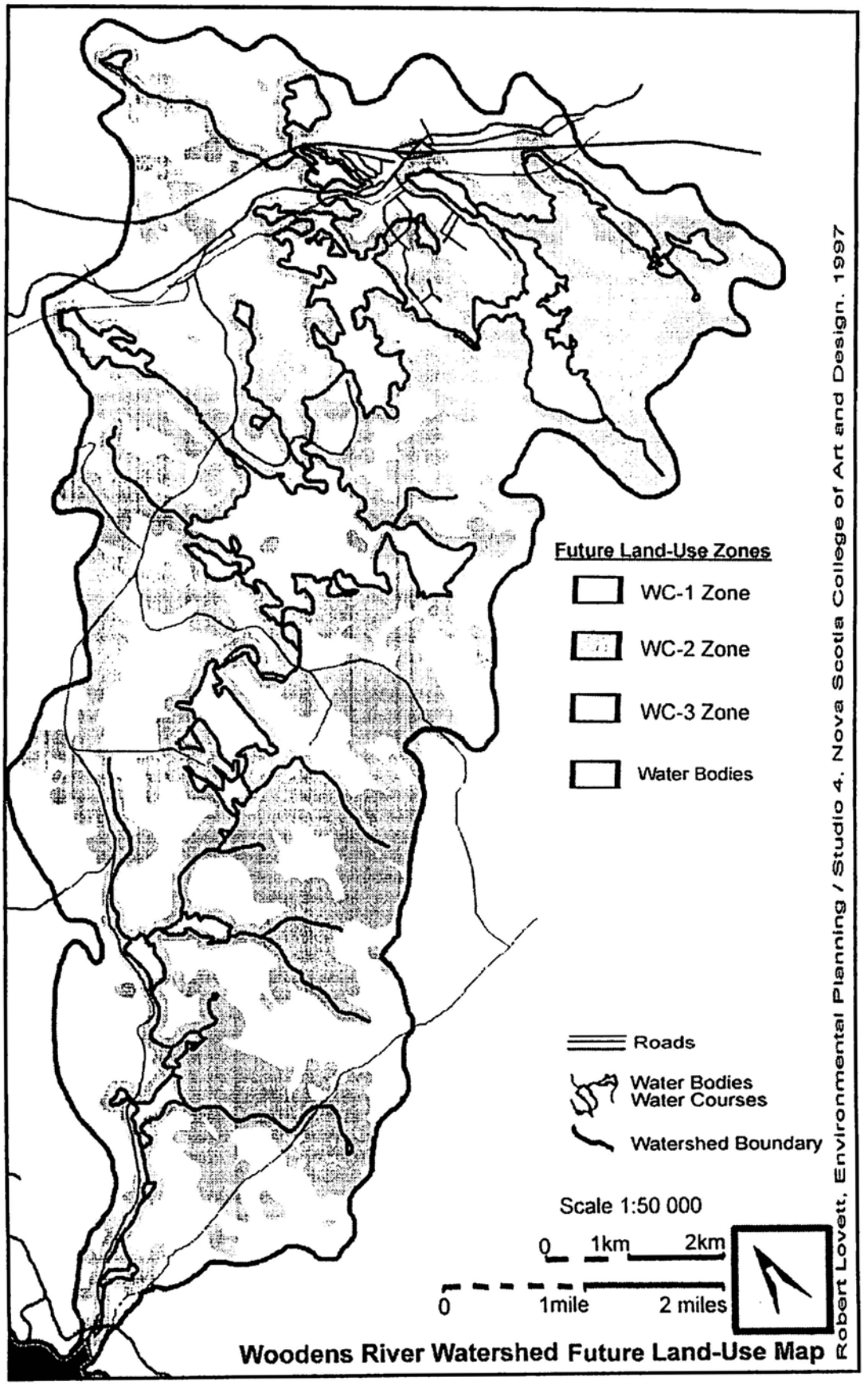
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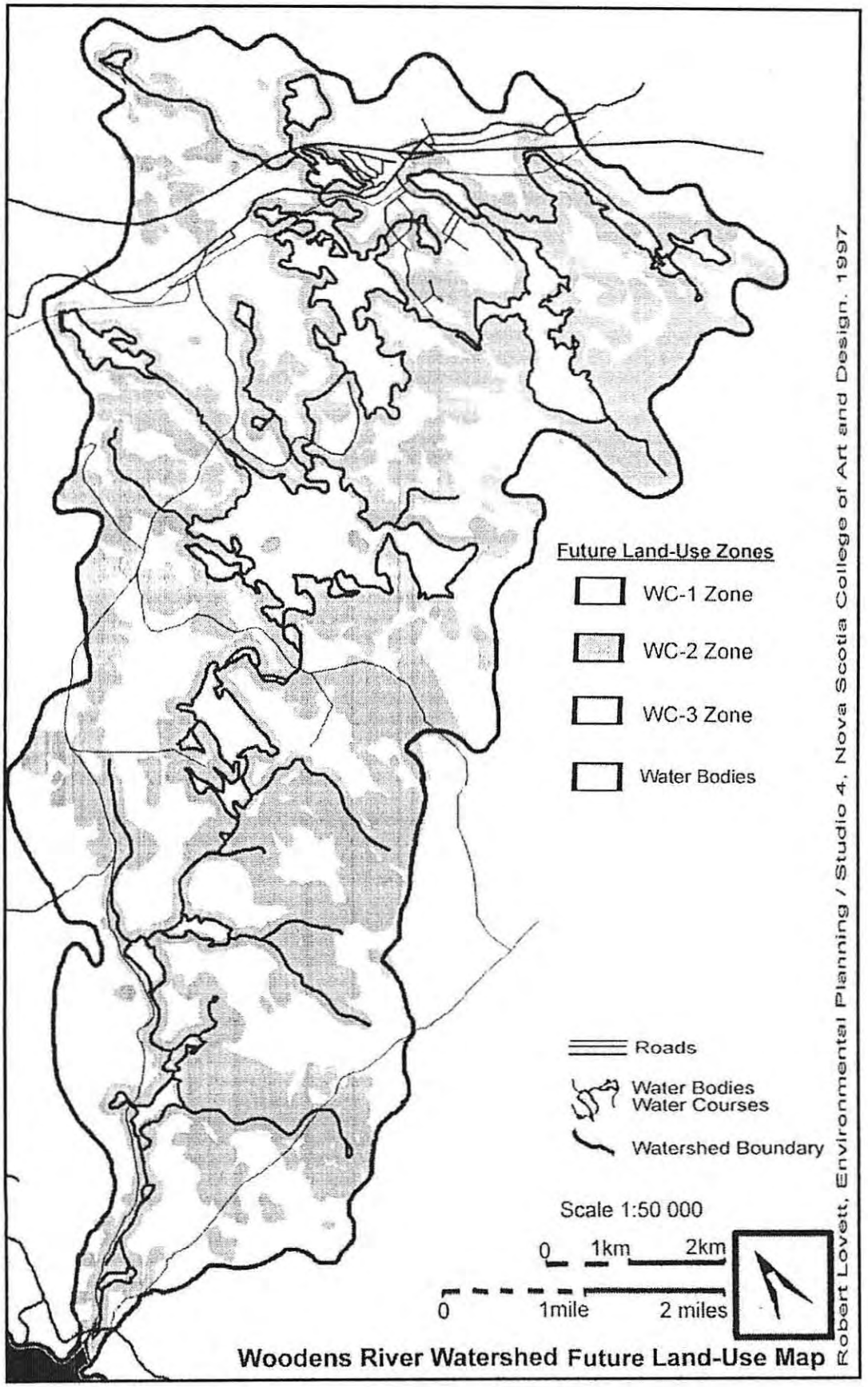
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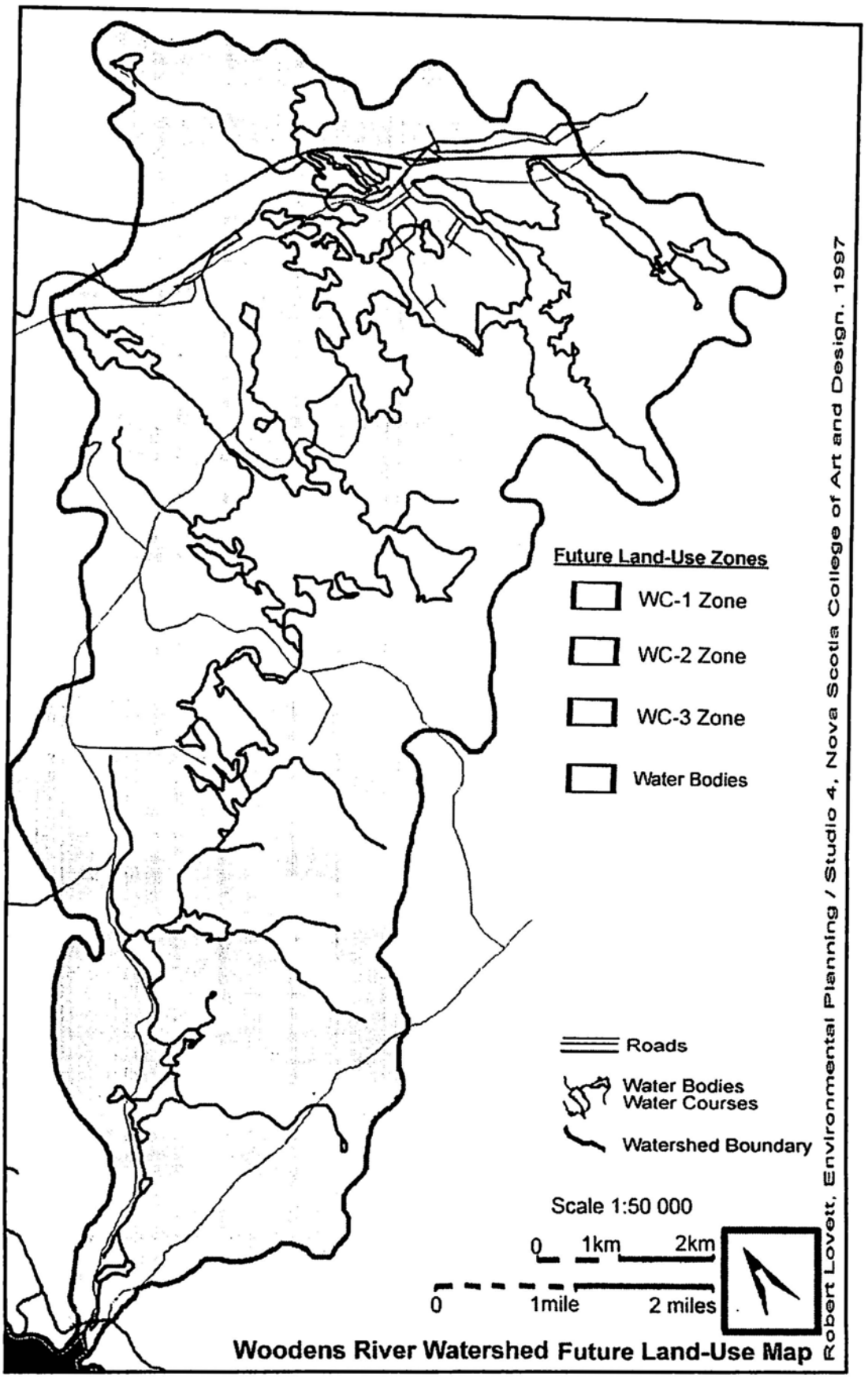
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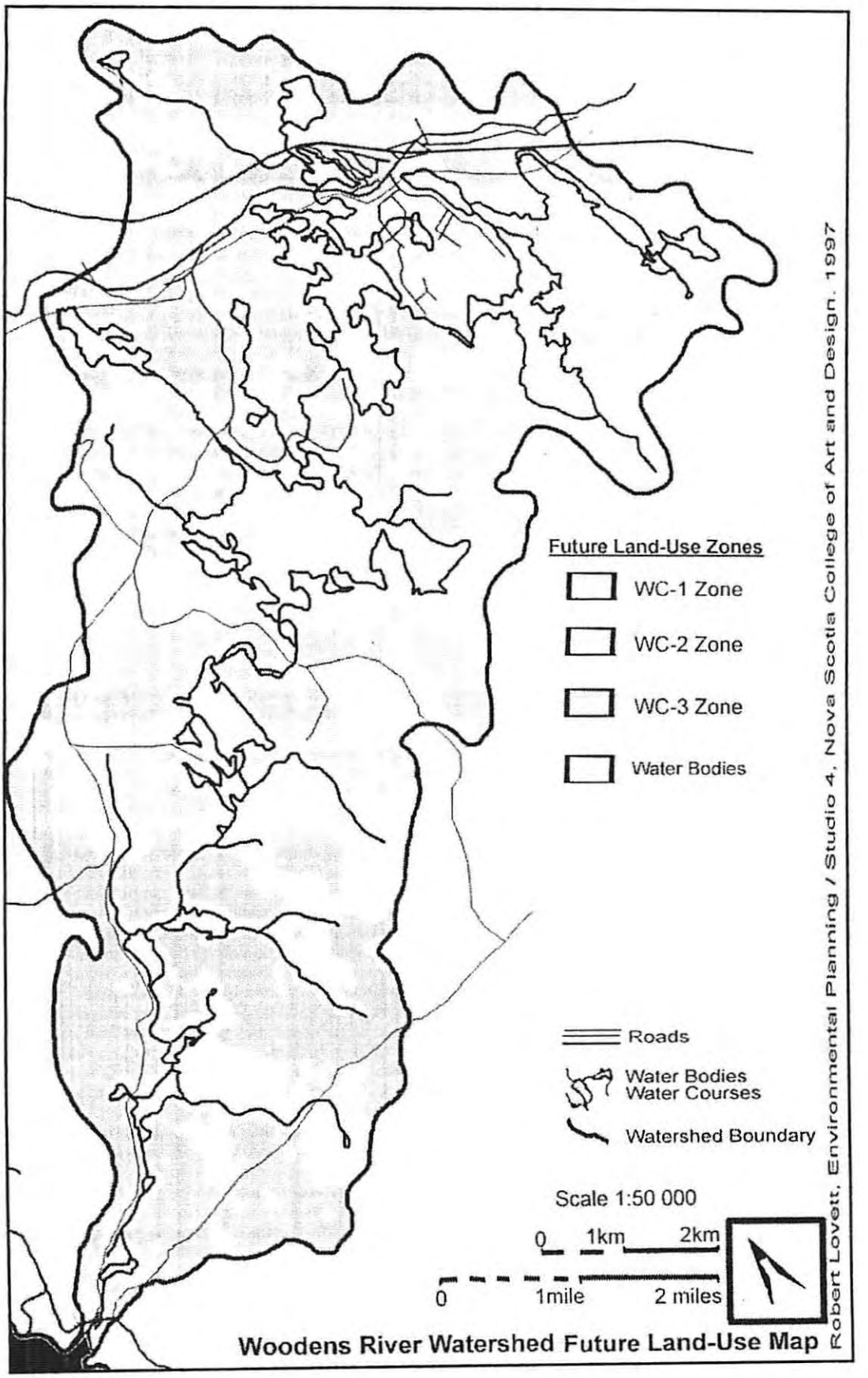
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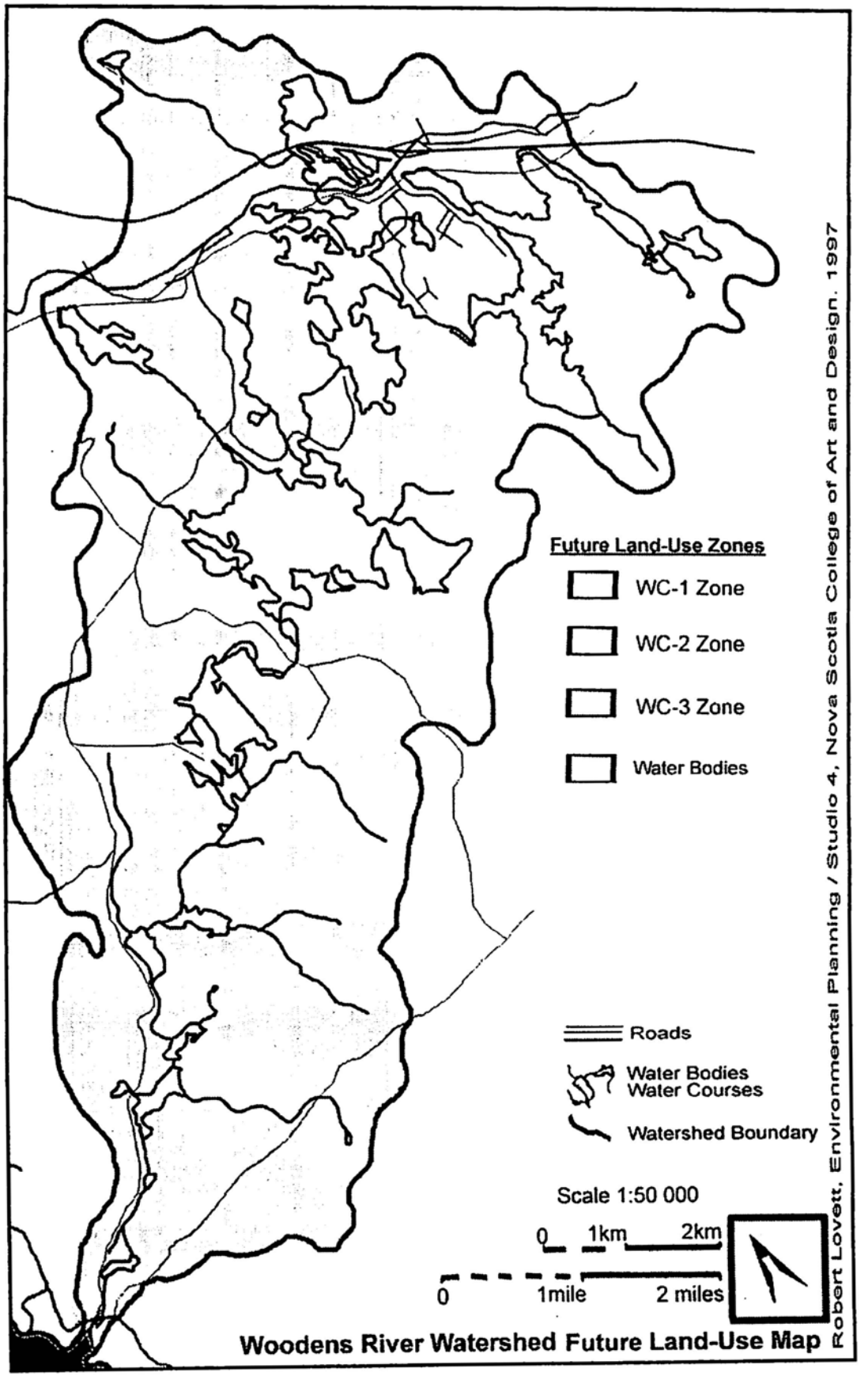
Future Land-Use Zones
WC-1 Zone
WC-2 Zone
WC-3 Zone
Water Bodies
Roads
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Water Courses
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Scale 1:50 000
0 1km 2km
0 1mile 2 miles
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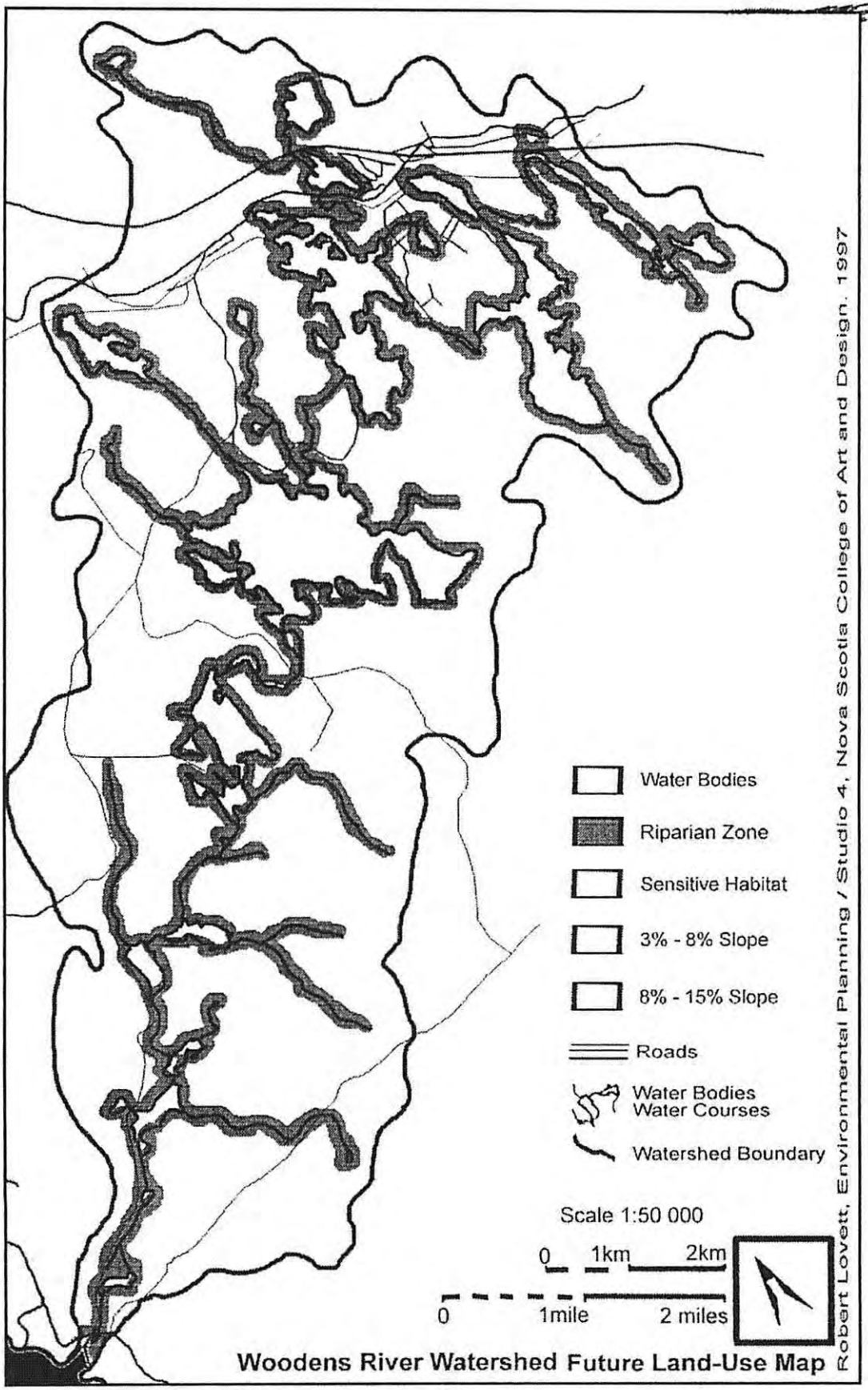
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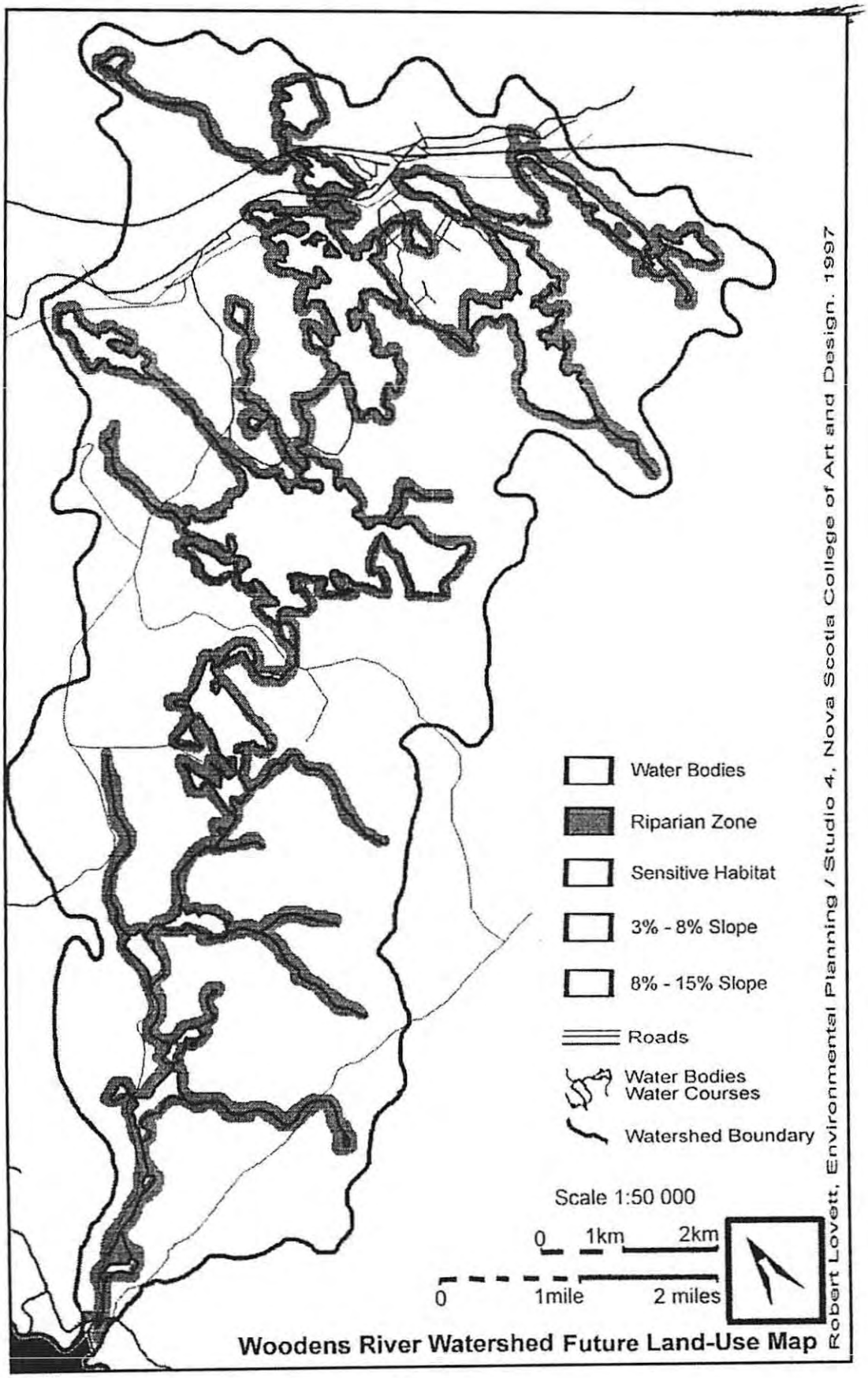
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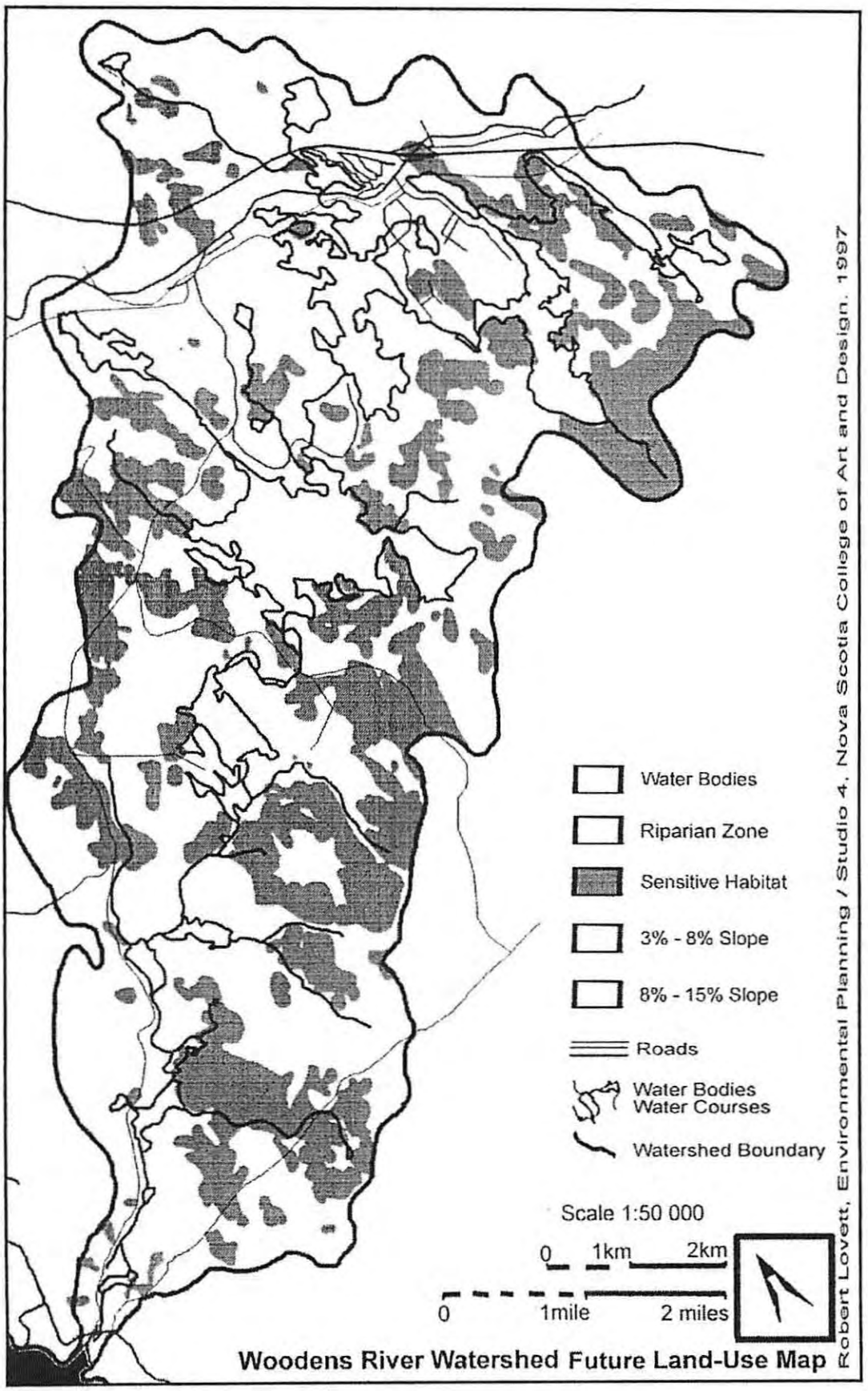
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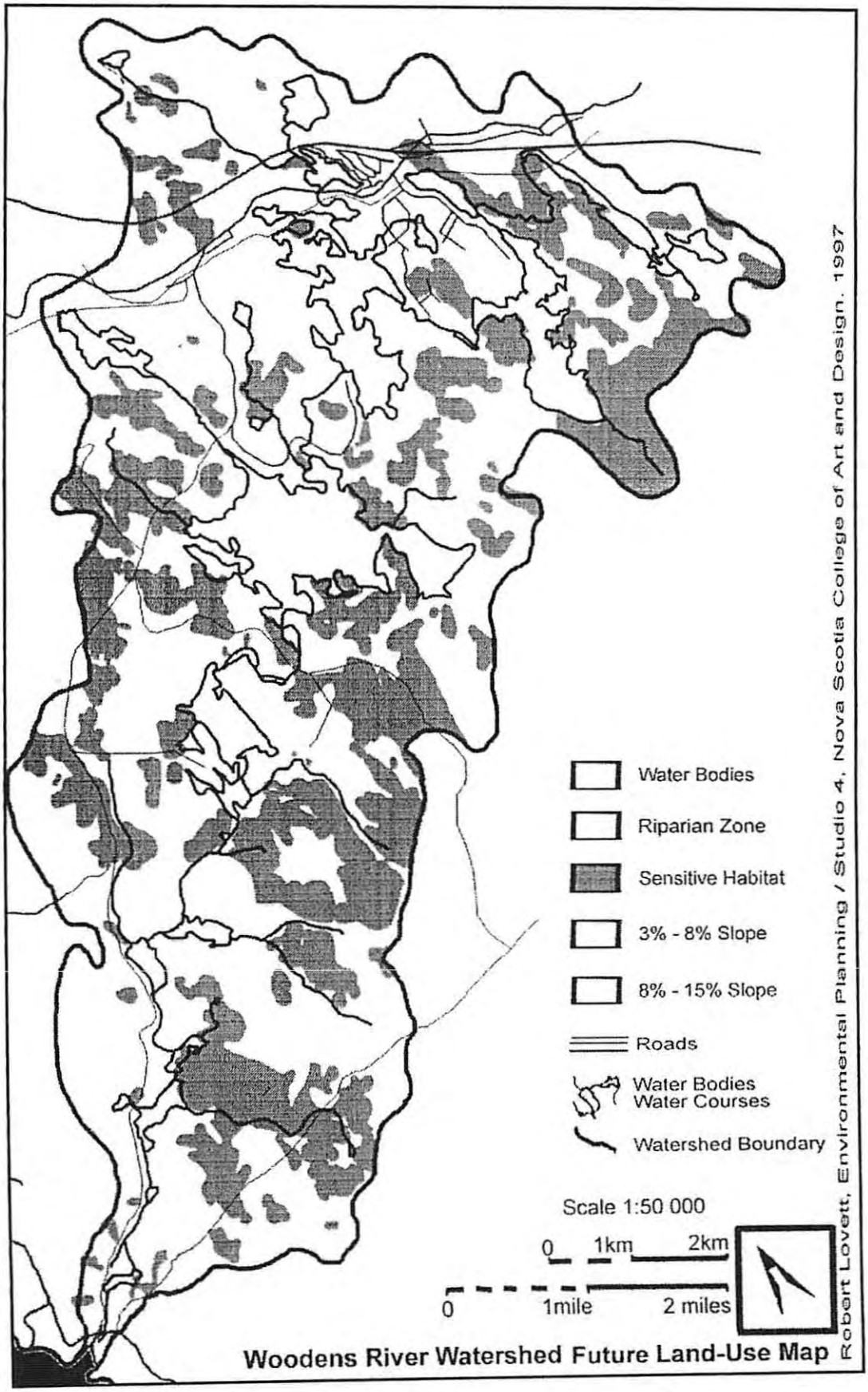
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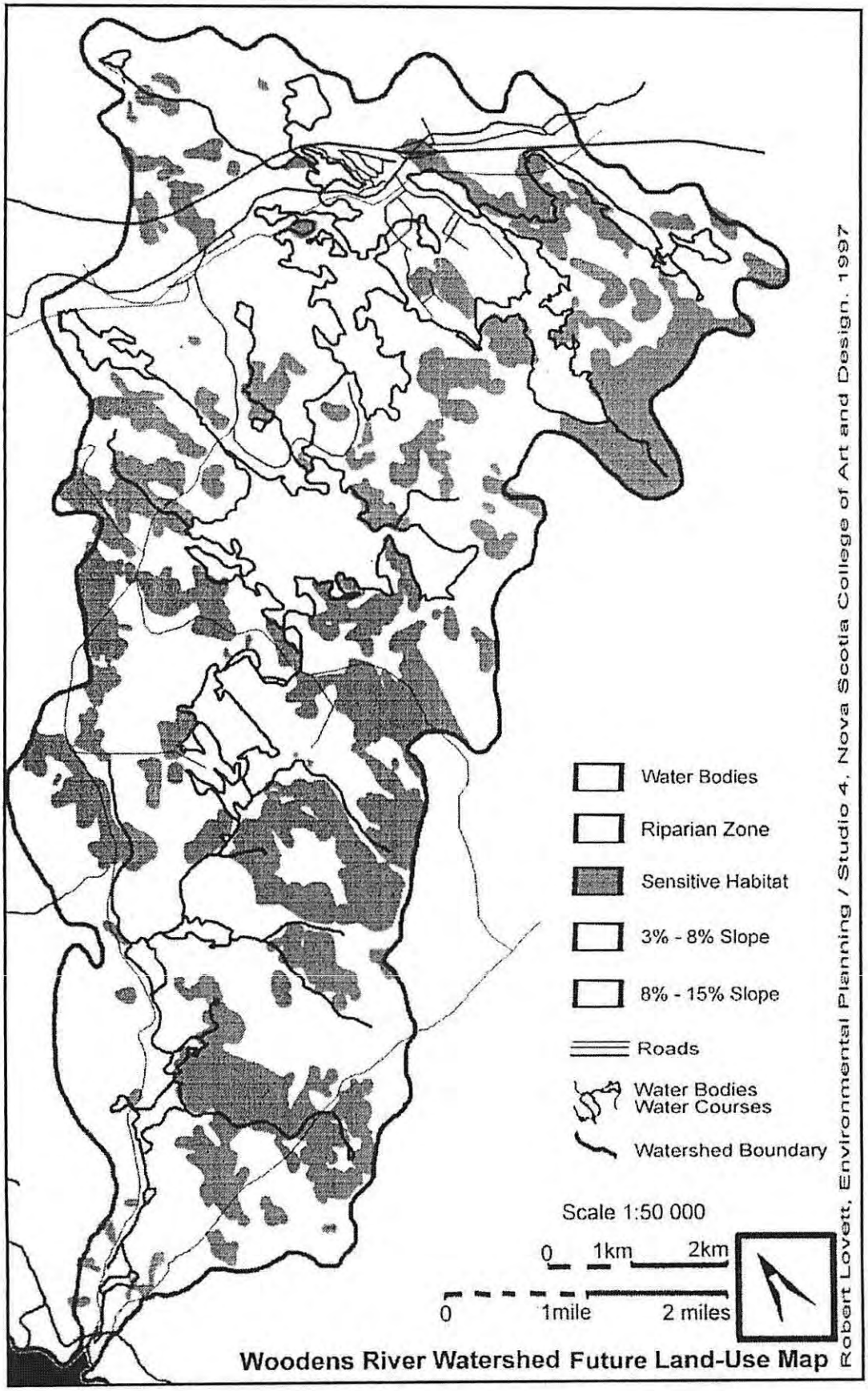
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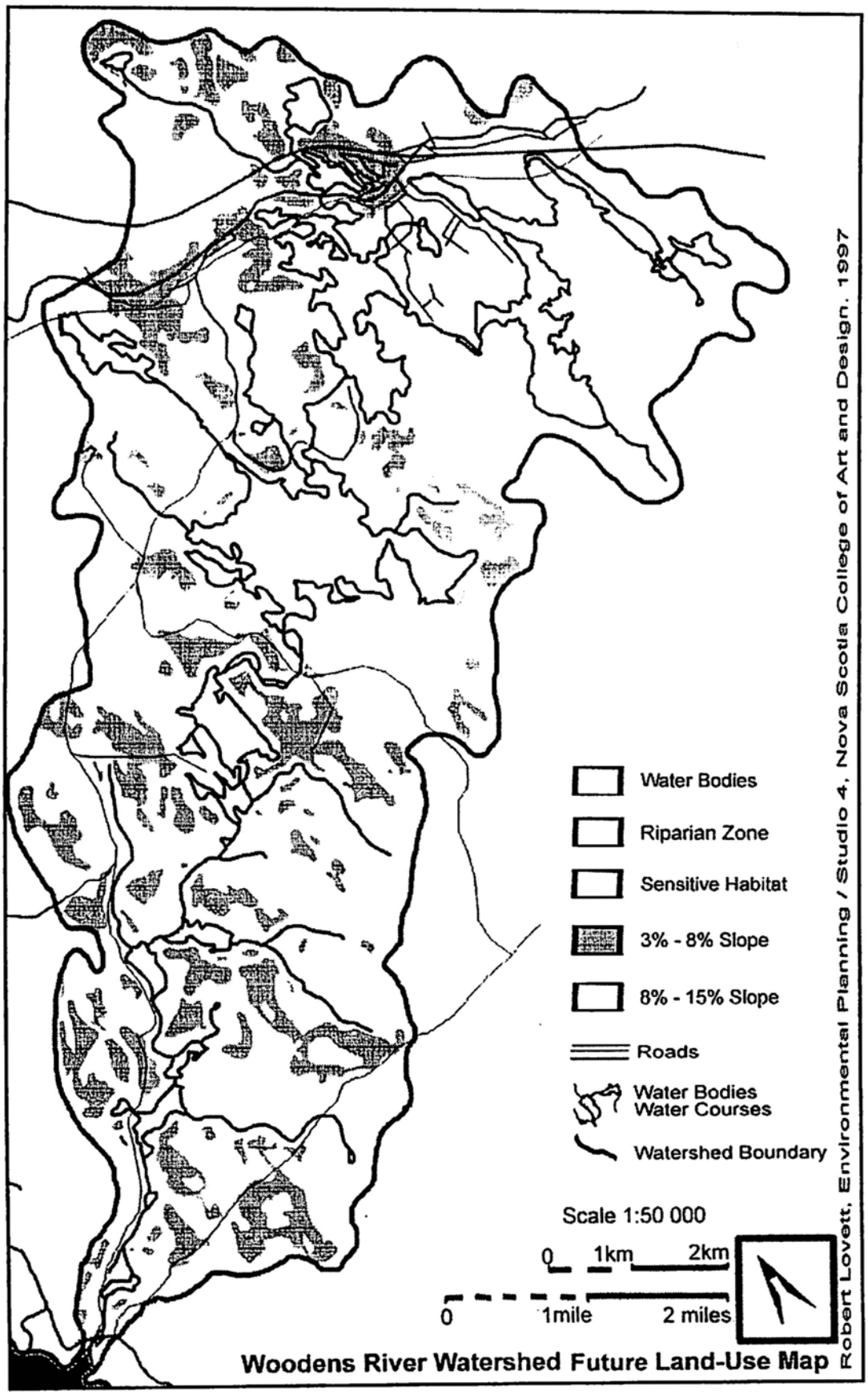
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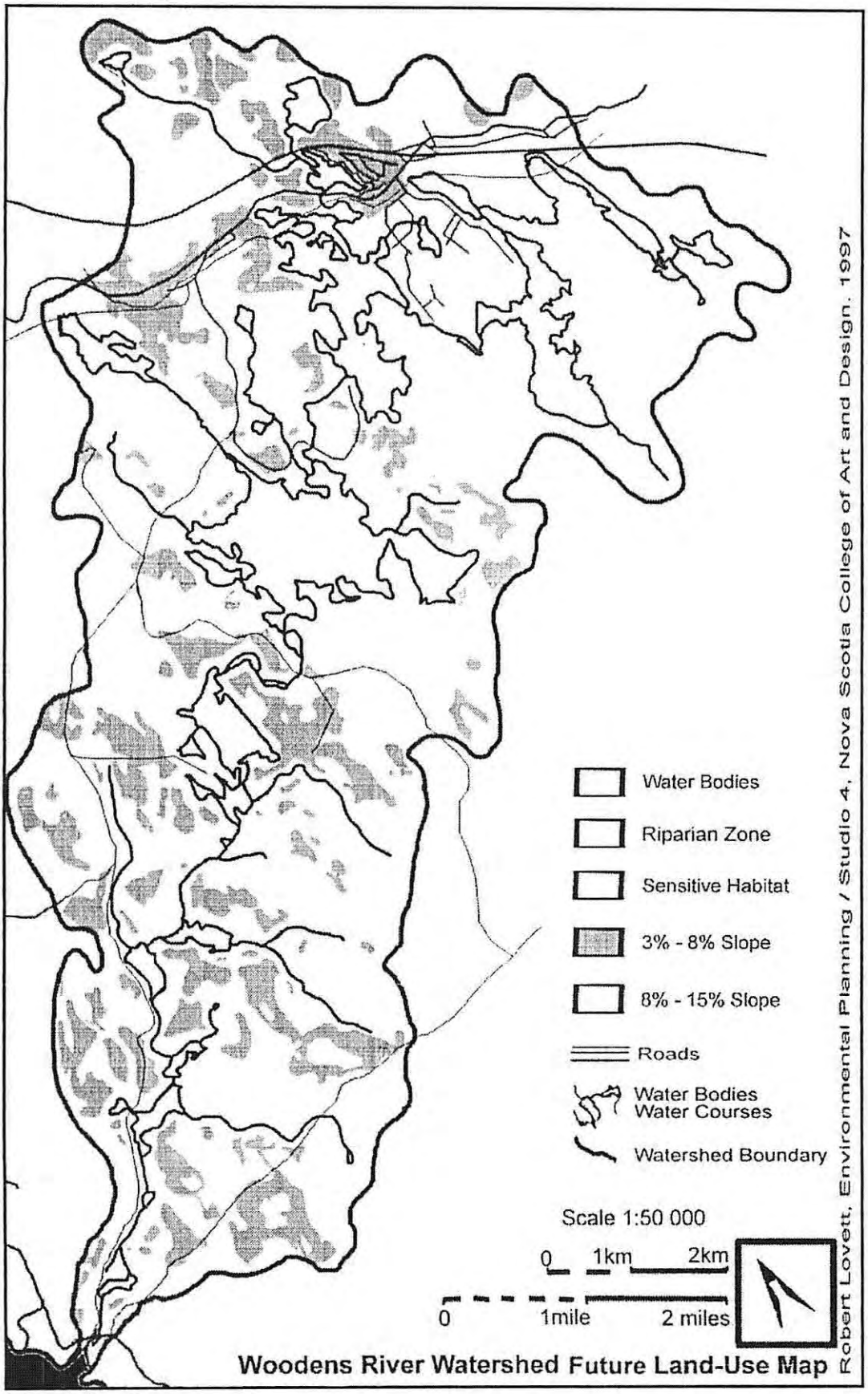
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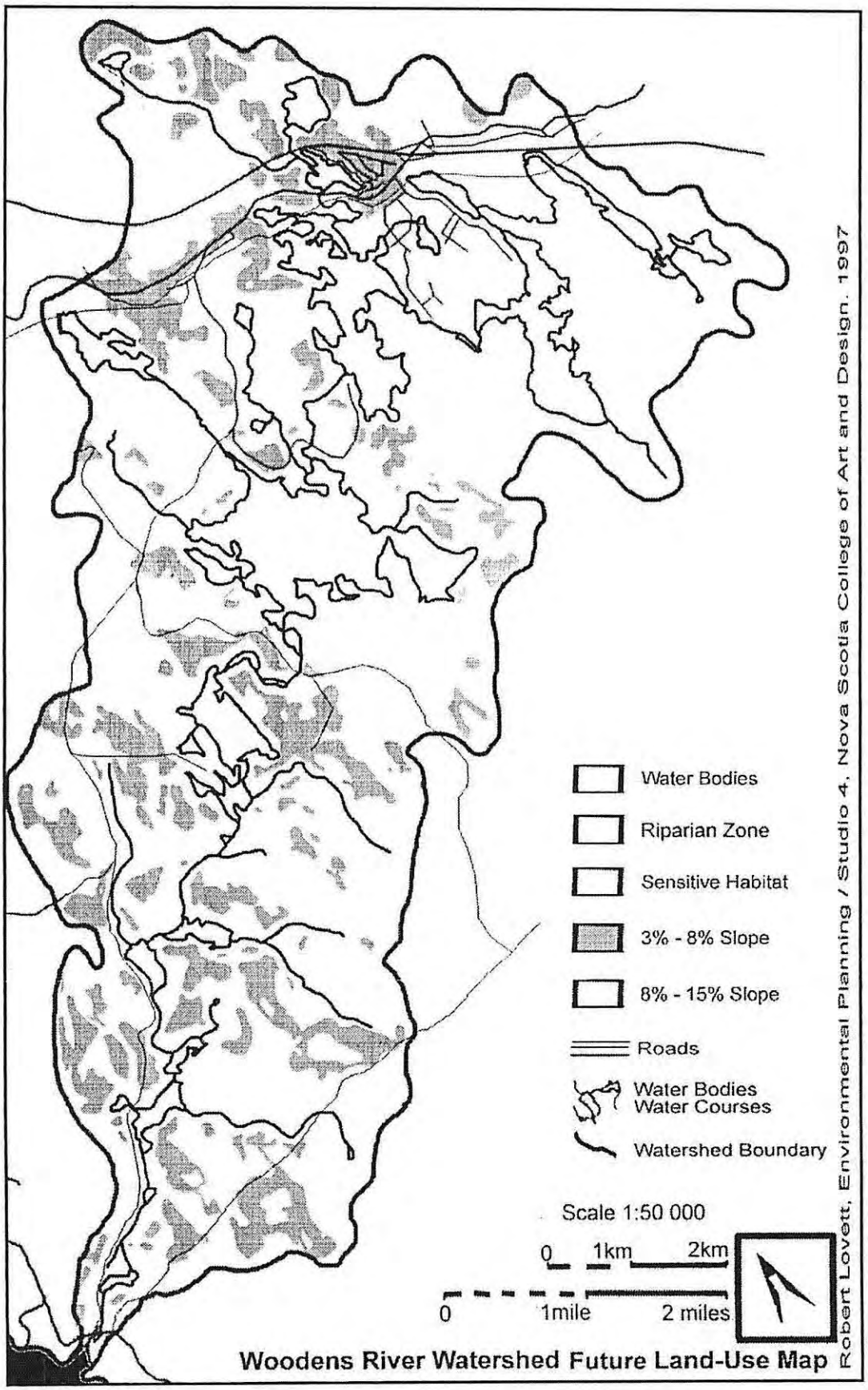
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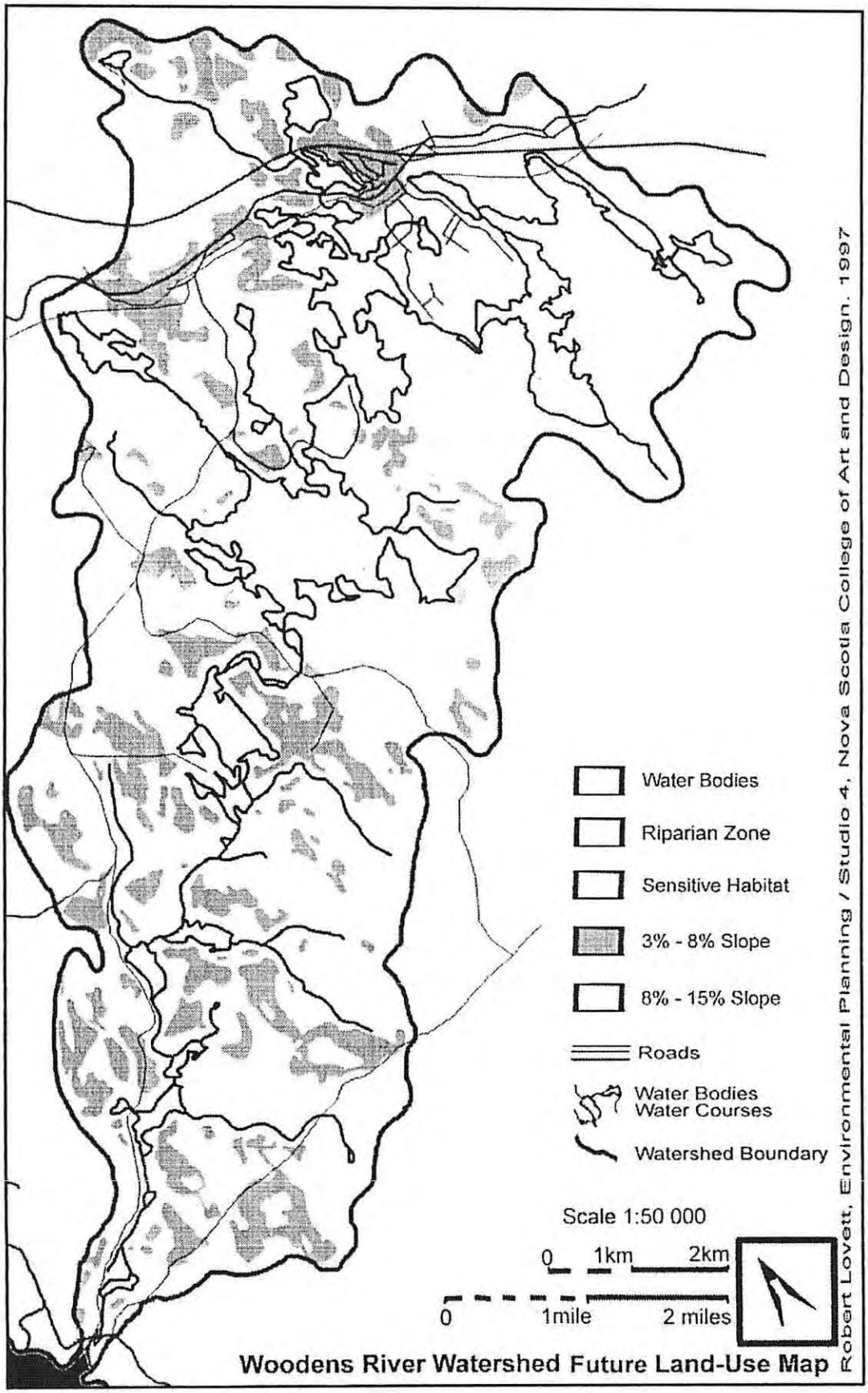
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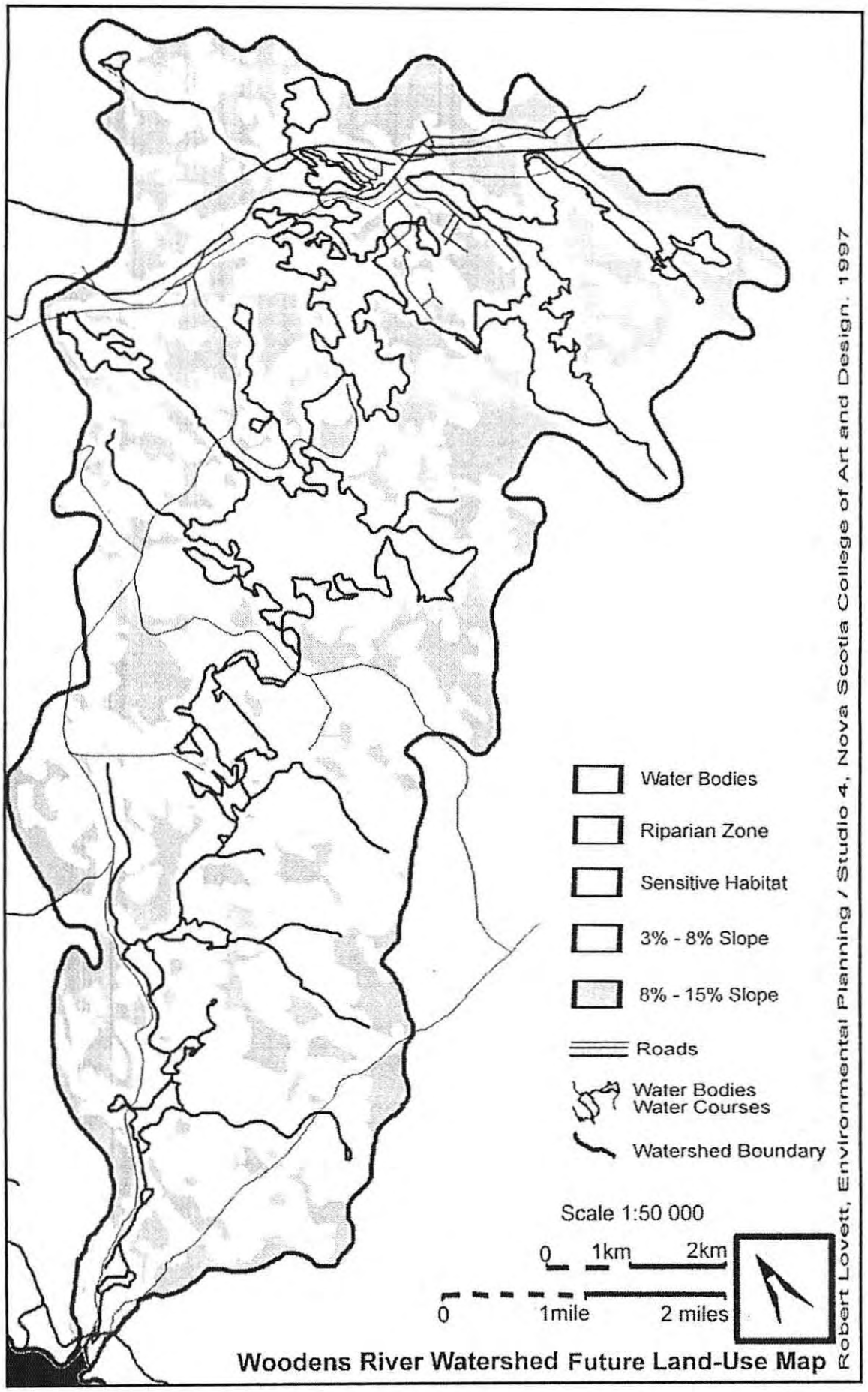
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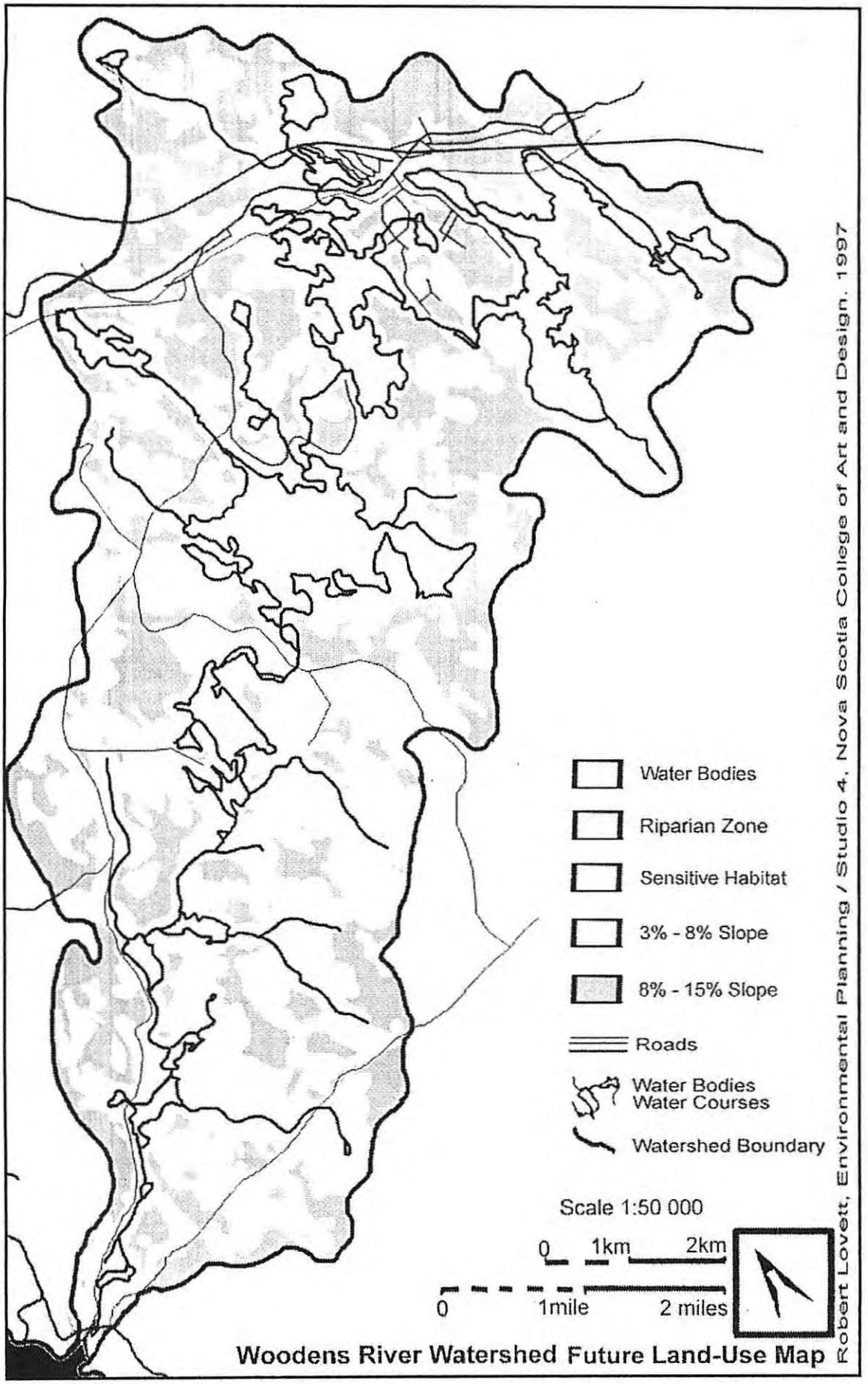
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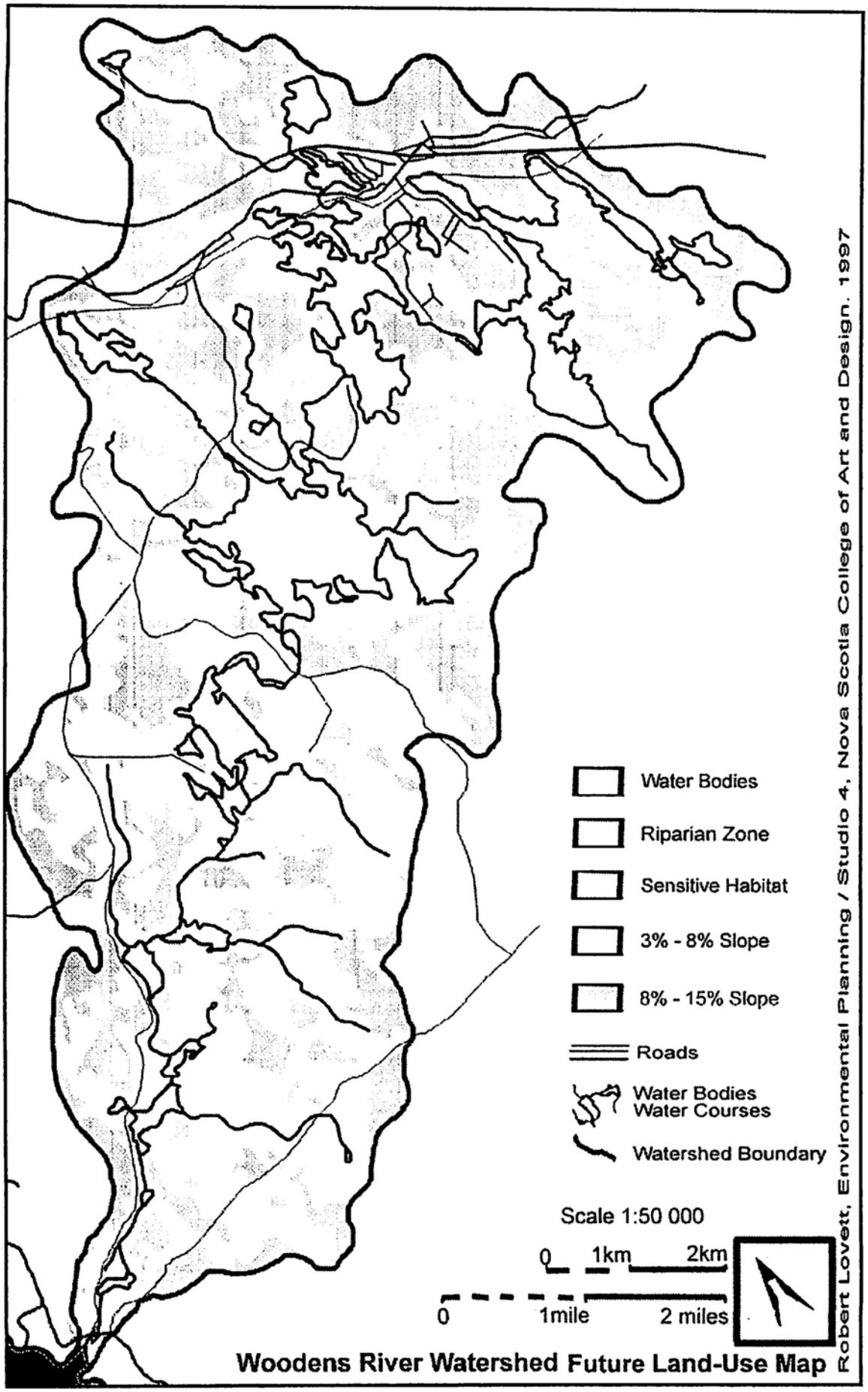
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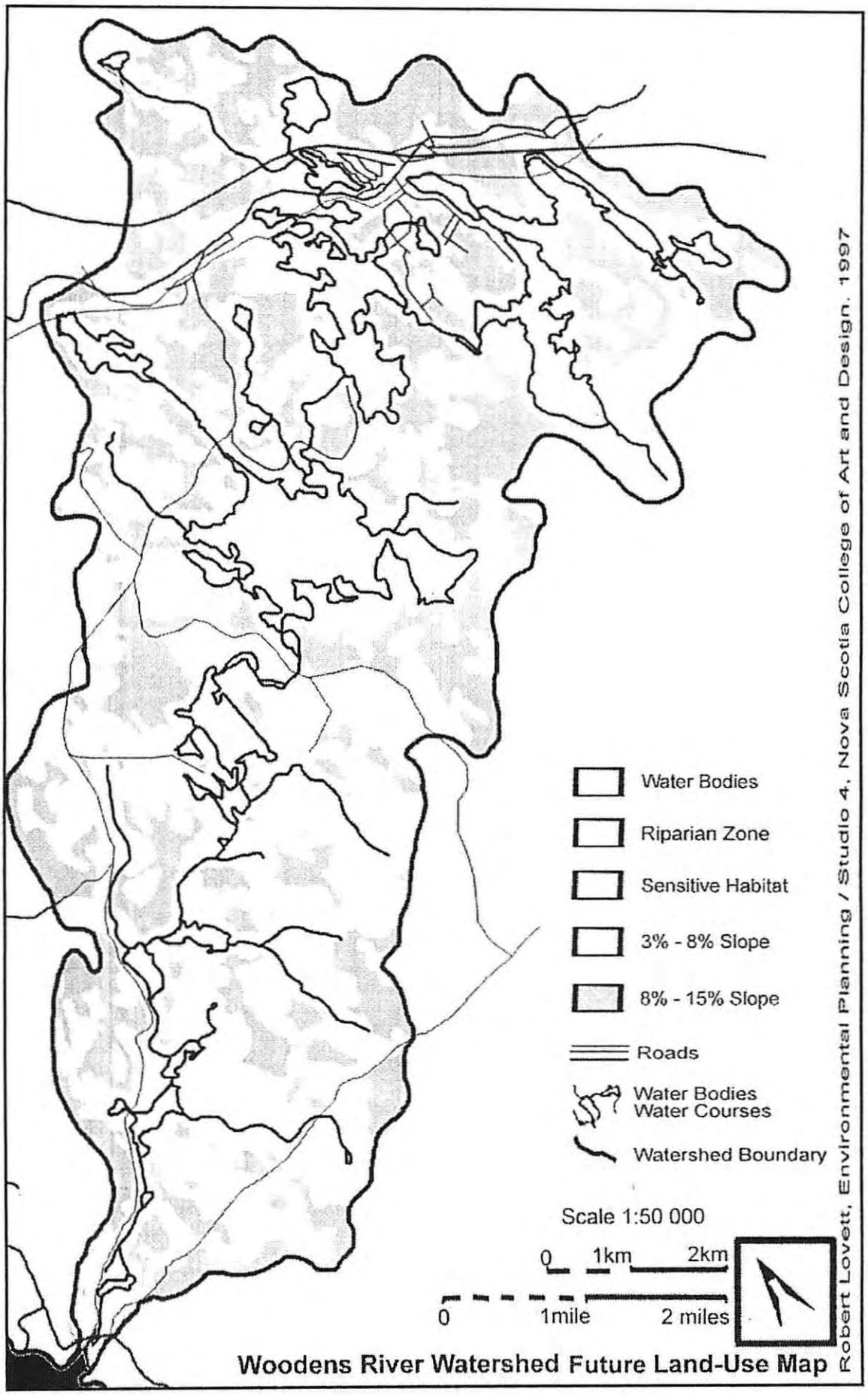

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