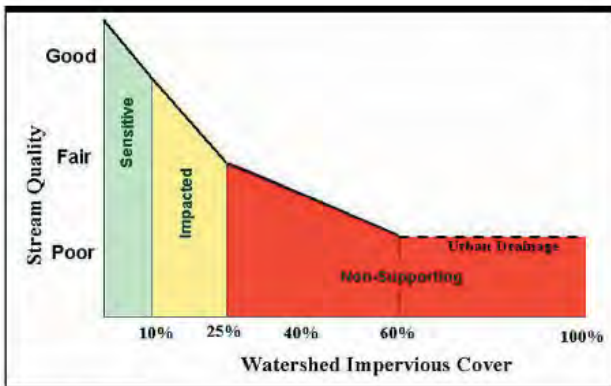
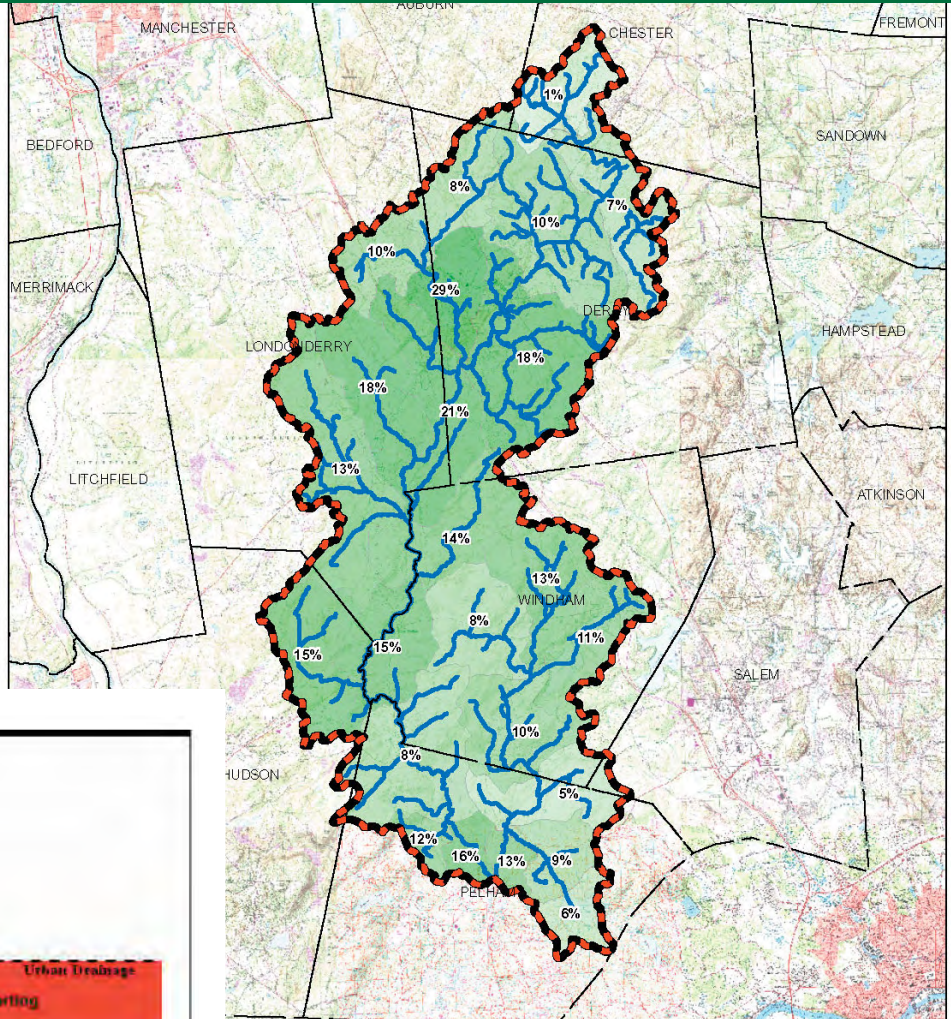


Submitted to:



United States Environmental Protection Agency
Region I



(Source: Schueler, 2003)

Pilot TMDL Applications using the Impervious Cover Method

Submitted by:



2 Technology Park Drive
Westford, MA 01886

ENSR Corporation

October 2005

Project No.: I0598-001-002

CONTENTS

1.0 INTRODUCTION.....	1-1
2.0 IMPERVIOUS COVER METHOD.....	2-1
2.1 Overview of the Impervious Cover Model	2-1
2.2 IC Method Application Process.....	2-5
2.2.1 Watershed Delineation	2-5
2.2.2 Impervious Cover Mapping	2-6
2.2.3 Determination of Watershed Impervious Cover.....	2-6
2.2.4 Annual Runoff Volume Estimate – Expanded Application.....	2-6
2.2.5 Pollutant Selection and Estimation of Pollutant Loads – Expanded Application	2-7
2.3 Modifications to the Basic IC Method	2-10
2.4 Assumptions and Limitations of the IC Method	2-10
3.0 APPLICATION OF THE IC METHOD FOR TMDL DEVELOPMENT	3-1
3.1 Evaluation of Impairments	3-2
3.2 Specifying TMDL Targets	3-3
3.3 Allocating Loading Capacity	3-3
3.3.1 Allocations	3-3
3.3.2 Margin of Safety (MOS).....	3-4
3.3.3 Seasonal Variation	3-4
4.0 TMDL APPLICATIONS	4-1
4.1 Beaver Brook	4-2
4.1.1 Watershed Description	4-2
4.1.2 Available Data.....	4-3
4.1.3 Impervious Cover and Pollutant Load Calculation.....	4-4
4.1.4 Summary and Conclusions	4-7

CONTENTS (Cont'd)

4.2	Goodwives River	4-11
4.2.1	Watershed Description	4-11
4.2.2	Available Data.....	4-12
4.2.3	Impervious Cover and Pollutant Load Calculation.....	4-12
4.2.4	Summary and Conclusions	4-13
4.3	Peters River.....	4-17
4.3.1	Watershed Description	4-17
4.3.2	Available Data.....	4-18
4.3.3	Impervious Cover and Pollutant Load Calculation.....	4-18
4.3.4	Summary and Conclusions	4-20
4.4	Three Ponds Brook	4-23
4.4.1	Watershed Description	4-23
4.4.2	Available Data.....	4-24
4.4.3	Impervious Cover and Pollutant Load Calculation.....	4-24
4.4.4	Summary and Conclusions	4-26
4.5	Cohas Brook	4-29
4.5.1	Watershed Description	4-29
4.5.2	Available Data.....	4-30
4.5.3	Impervious Cover and Pollutant Load Calculation.....	4-31
4.5.4	Summary and Conclusions	4-33
4.6	Artic Brook (aka, Stream on Valley Ave)	4-37
4.6.1	Watershed Description	4-37
4.6.2	Available Data.....	4-38
4.6.3	Impervious Cover and Pollutant Load Calculation.....	4-38
4.6.4	Summary and Conclusions	4-40
4.7	Tributary to Bond Brook, Maine	4-43
4.7.1	Watershed Description	4-43
4.7.2	Available Data.....	4-44
4.7.3	Impervious Cover and Pollutant Load Calculation.....	4-44
4.7.4	Summary and Conclusions	4-46
4.8	Summary	4-49

CONTENTS (Cont'd)

5.0 TMDL IMPLEMENTATION.....	5-1
5.1 TMDL Implementation Approach.....	5-1
5.2 Evaluation of Alternative Management Actions.....	5-2
5.3 Summary.....	5-4
6.0 REFERENCES.....	6-1

LIST OF TABLES

Table 2-1	Hydrologic, Physical, Water Quality, and Biological Impacts Associated with IC	2-2
Table 4-1	Beaver Brook: Major Landuse Distribution.....	4-3
Table 4-2	Beaver Brook: Estimated Percent Impervious Cover by Landcover	4-4
Table 4-3	Beaver Brook: Sub-basin Estimated Impervious Cover.....	4-5
Table 4-4	Beaver Brook: Estimated Existing and Target TMDL Values for Key Parameters	4-6
Table 4-5	Goodwives River: Major Landuse Distribution	4-11
Table 4-6	Goodwives River: Estimated Percent Impervious Cover by Landcover	4-12
Table 4-7	Goodwives River: Estimated Existing and Target TMDL Values for Key Parameters	4-14
Table 4-8	Peters River: Major Landuse Distribution.....	4-18
Table 4-9	Peters River: Estimated Percent Impervious Cover by Landcover.....	4-19
Table 4-10	Peters River: Estimated Existing and Target TMDL Values for Key Parameters....	4-19
Table 4-11	Three Ponds Brook: Major Landuse Distribution	4-24
Table 4-12	Three Ponds Brook: Estimated Percent Impervious Cover by Landcover	4-25
Table 4-13	Three Ponds Brook: Estimated Existing and Target TMDL Values for Key Parameters.....	4-25
Table 4-14	Cohas Brook: Major Landuse Distribution.....	4-30
Table 4-15	Cohas Brook: Estimated Percent Impervious Cover by Landcover	4-31
Table 4-16	Cohas Brook: Sub-basin Estimated Impervious Cover.....	4-32
Table 4-17	Cohas Brook: Estimated Existing and Target TMDL Values for Key Parameters ..	4-32
Table 4-18	Artic Brook: Major Landuse Distribution	4-37
Table 4-19	Artic Brook: Estimated Percent Impervious Cover by Landcover.....	4-38
Table 4-20	Artic Brook: Estimated Existing and Target TMDL Values for Key Parameters.....	4-39
Table 4-21	Tributary to Bond Brook: Major Landuse Distribution	4-43
Table 4-22	Tributary to Bond Brook: Estimated Percent Impervious Cover by Landcover	4-44
Table 4-23	Tributary to Bond Brook: Estimated Existing and Target TMDL Values for Key Parameters.....	4-45
Table 4-24	Pilot TMDL Watersheds with Area and Estimated Percent IC.....	4-50
Table 5-1	Management Practices, Mitigation Provided, and Land Use Applicability Matrix.....	5-5

LIST OF FIGURES

Figure 2-1	Schematic Water Balance: Natural Conditions vs. Developed Conditions	2-3
Figure 2-2	Stream Quality vs. Watershed Impervious Cover	2-4
Figure 2-3	IC Method for Calculating Runoff Volume and Constituent Loads	2-9
Figure 4-1	Beaver Brook with Watershed Boundary Indicated - Pelham, NH	4-8
Figure 4-2	Beaver Brook Landuse Map - Pelham, NH	4-9
Figure 4-3	Beaver Brook Watershed Impervious Cover Map - Pelham, NH	4-10
Figure 4-4	Goodwives River with Watershed Boundary Indicated - Darien, CT	4-15
Figure 4-5	Goodwives River Landuse Map - Darien, CT	4-16
Figure 4-6	Peters River with Watershed Boundary Indicated - Bellingham, MA	4-21
Figure 4-7	Peters River Landuse Map - Bellingham, MA	4-22
Figure 4-8	Three Ponds Brook with Watershed Boundary Indicated - Warwick, RI	4-27
Figure 4-9	Three Ponds Brook Landuse Map - Warwick, RI	4-28
Figure 4-10	Cohas Brook with Watershed Boundary Indicated - Manchester, NH	4-34
Figure 4-11	Cohas Brook Landuse Map - Manchester, NH	4-35
Figure 4-12	Cohas Brook Sub Watershed Impervious Cover Map - Manchester, NH	4-36
Figure 4-13	Artic Brook with Watershed Boundary Indicated - Bangor, ME	4-41
Figure 4-14	Artic Brook Landuse Map - Bangor, ME	4-42
Figure 4-15	Tributary to Bond Brook with Watershed Boundary Indicated - Augusta, ME	4-47
Figure 4-16	Tributary to Bond Brook Landuse Map - Augusta, ME	4-48