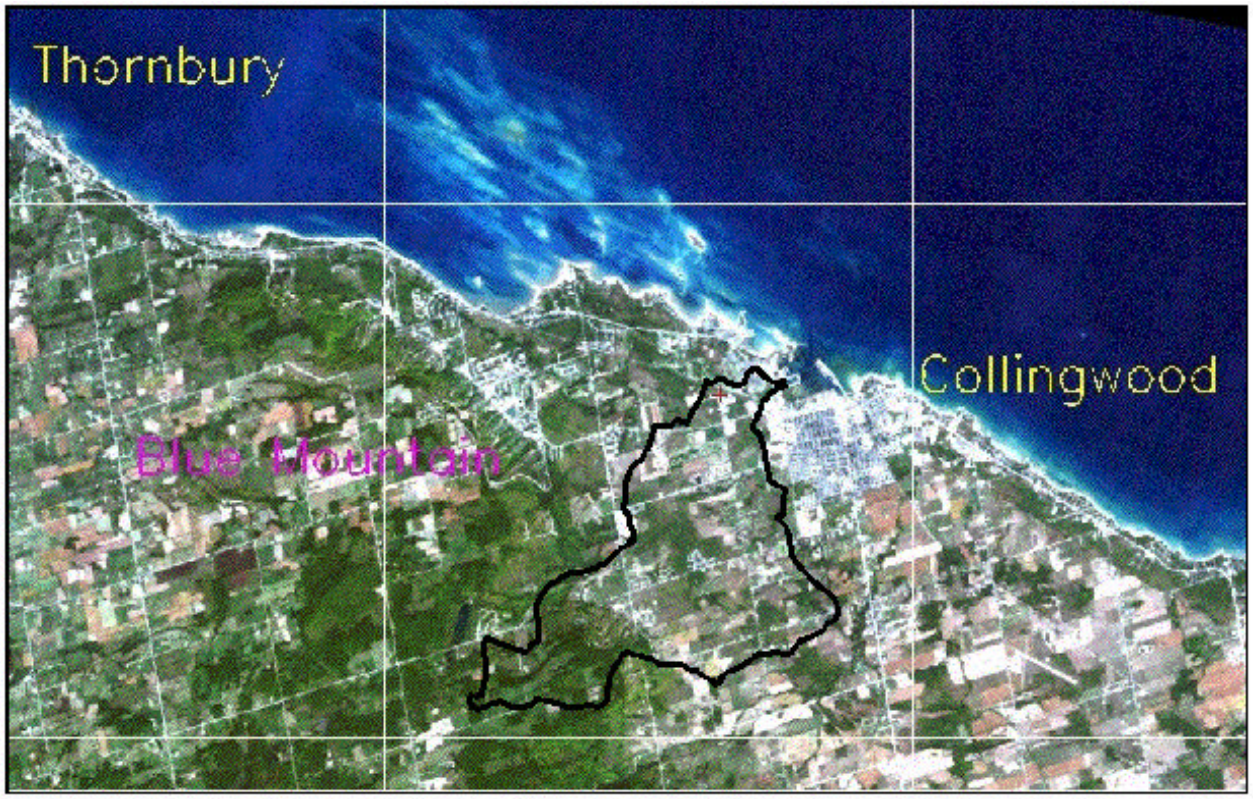
Black Ash Creek
Subwatershed Plan



August 2000

Nottawasaga Valley
Conservation Authority

Black Ash Creek

Subwatershed Plan

August, 2000

Prepared
By The
Nottawasaga Valley Conservation Authority

In association with the
Town of Collingwood,
Township of Clearview,
Town of The Blue Mountains,
Ministry of Environment

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1.0 INTRODUCTION

1.1 Project History and Local Context

Over the past decade, substantial evidence has been collected in Ontario regarding the cumulative impacts of urbanization on our ecosystems, as well as increasing flooding, and erosion problems. In response, a growing number of municipalities and regulatory agencies have implemented watershed management plans as an effective means of addressing these impacts.

In 1995, the Nottawasaga Valley Conservation Authority (NVCA) developed the "Nottawasaga Valley Watershed Management Plan (1996-2015)" dealing with water management issues across the entire watershed. The goal of the Watershed Plan is "*to conserve natural resources within the Watershed in a co-operative, integrated manner in which human needs are met in balance with the need to sustain the natural environment".*

The watershed plan provides direction for water resource management in the following areas:

- A commitment to the integration and co-ordination of water resource management;
- The identification, protection, enhancement, and rehabilitation of significant natural heritage areas;
- The enhancement of water conservation practices;
- The protection and enhancement of groundwater and surface water quality and quantity;
- The identification and protection of significant groundwater recharge/discharge areas; and
- The protection of human life and property from water-related hazards, such as flooding and erosion.

One of the recommendations coming from the Watershed Plan, was the preparation of subwatershed planning studies for the Blue Mountain Watershed, which includes Black Ash Creek.

The preparation of a subwatershed plan for Black Ash Creek was also supported through the planning process at an Ontario Municipal Board (OMB) hearing for the Town of Collingwood's Official Plan Amendment No. 37 dealing with commercial developments. During this hearing, it was suggested by the Ministry of Environment that a subwatershed plan would be a good approach for dealing with the Town's water management issues including stormwater management and flood control.

Historically, Black Ash Creek overtops its banks during major (regional) storm events and generally spills in an eastward direction causing extensive flooding in the Town of Collingwood.

It should be noted that for the purposes of this study, the watershed boundary was defined as those lands draining into Black Ash Creek under "normal" flow conditions. As a result, the lands outside of this definition of the watershed, but affected by the flooding from the Black Ash Creek spill zones (under regional storm conditions), were not included within the boundary of the subwatershed. However, these lands are directly impacted by the spilling floodwaters of Black Ash Creek under regional storm conditions.

As early as the mid-70's, flood control studies were undertaken to address these flooding problems. They originally only focused on providing flood protection, since information available at the time indicated that there were no fisheries concerns with Black Ash Creek.

In 1977, the International Joint Commission (IJC) identified Collingwood Harbour as a "*Great Lakes Area of Con*cern" because of pollution problems in the harbour. Sediment loading and nutrient enrichment were two factors identified as having significant impacts upon the quality of water.

In 1992 the Black Ash Creek Rehabilitation project was initiated as part of the Collingwood Harbour Remedial Action Plan (RAP) since it is the largest watercourse entering the harbour. The study located the major sources of sediment and nutrient discharge. Working with landowners, they identified opportunities for improving aquatic habitat and water quality in the streams and harbour. Many projects were initiated over the next few years on Black Ash Creek to control erosion and sediment loading. Fish community inventory and habitat evaluations were also significant components of the Rehabilitation Project.

As a result of this work, the potential impacts from the channelization project on fish habitat was recognized as being a significant issue. Protecting and enhancing fish habitat became an integral part of a revised proposal for flood control of Black Ash Creek.

In response to these fisheries concerns, the 1995 Environmental Study Report (ESR) outlined a revised approach to the flood control channelization project. The proposal redesigned the original flood control project, incorporating fisheries concerns and documenting a plan for effectively managing Black Ash Creek as an "urban stream" ecosystem. This revised project is scheduled to proceed in the near future (2001) following completion of the acquisition program for the channel.

Another water management issue relates to the stormwater management (SWM) facilities that were constructed over time through the land development process. They were often historically designed to only deal with water quantity not quality issues, and also in isolation from each other.

However, truly "effective" stormwater management and environmental protection is dependent on addressing "key issues" not simply on a site by site basis, but at a larger and integrated subwatershed scale. These "key issues" include a solid understanding of the study area's aquatic ecosystems; developing ecologically based design criteria or targets; and selecting the most appropriate "best management practices" and mitigation measures.

As a result of all the above factors, the Town of Collingwood agreed that participating in a subwatershed plan would be the most appropriate way to address these issues. The Town, NVCA, Ontario Government, and the development community formed a partnership in 1999 to carry out this study. NVCA is acting as the co-ordinating agency, while Greenland International Consulting Inc. was retained by the Conservation Authority to provide water resources computer modelling, field survey and baseline data monitoring support.

1.2 Subwatershed Issues

Many of the water management issues associated with the Black Ash Creek Subwatershed have been known for some time. Previous studies, the Blue Mountain Watershed Conferences and consultation with the municipalities, environmental groups and the development industry, have focused the water management issues.

Subwatershed planning for Black Ash Creek must deal with many diverse issues effecting the natural environment. These issues are as follows:

- The need to prevent flood damage to the Town of Collingwood, through the updating of existing flood plain information, and the identification of any potential flood hazard/risk zones within the Town of Collingwood, upstream of the future flood control channelization works;
- The integration of stormwater management systems to improve water quality and quantity control based on our resource management objectives, targets and development criteria.
- The identification and protection of the subwatershed's Natural Heritage System, including surface and groundwater water quality and quantity protection;
- The rehabilitation and restoration of degraded natural habitats (for example, by replanting priority stream riparian sites, and restoring drained wetlands);
- The means to augment or protect the baseflow of streams during droughts in order to sustain the wetland and aquatic ecosystems; and
- The need to balance the demands for growth with our obligation to ensure a safe, clean and self-sustaining environment.

The subwatershed plan is focused on resolving these issues which will form the basis for this plan.

1.3 Study Purpose, Goal and Objectives

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To address the above issues, we have developed the following purpose, goal and objectives.

STUDY PURPOSE

To prepare an integrated subwatershed plan, which will identify and protect the significant natural heritage features, and functions, as well as natural hazards. It will develop an action plan ensuring this protection while accommodating future development through "state of the art" flood plain and Best Management Practices. It will provide the tools for striking a balance between the demands for growth, and the need to ensure, over the long term, a safe, self-sustaining ecosystem.

Our motto in developing the subwatershed plan will be to **"*keep it simple*".**
We will produce a tightly focused and scoped subwatershed plan, dealing with the specific issues of Black Ash Creek in a clear and concise manner.

This "keep it simple" approach comes from "The Blue Mountain Watershed Conference" held in the early 1990's. The purpose of that conference was "to develop awareness and to promote partnerships that are required to successfully implement watershed planning in the Blue Mountain Watersheds". Black Ash Creek a subwatershed within the Blue Mountain Watershed.

Goal:

The goal for the subwatershed is the conservation of natural resources within the Black Ash Creek Subwatershed in a co-operative, integrated manner in which human needs are met in balance with the need to sustain the natural environment.

Resource management objectives:
The natural resources (aquatic and terrestrial) of Black Ash Creek are all interconnected as components of the overall ecosystem. As a result, there is some overlap between the management objectives for various resources. For example, surface water management objectives must focus not only on maintaining good water quality and eliminating flood risk, but also geared towards the enhancement of the aquatic ecosystem, Collingwood Harbour and its wetland.

Conflicts can arise from competing demands for resources, especially with regard to their use and protection. It is the uses and activities that need to be managed to balance and resolve any conflicts.

The identification of management objectives and appropriate specific targets will be particularly important for future developments as they will be required to meet the development standards and criteria established. Upper and lower limits will be set (as required) for the targets following the technical investigations. These include, " standards essential to maintain the existing ecosystem" and " standards to maximum enhancement to the existing ecosystem i.e.: reach its potential". The challenge will be ensuring that the quality of the aquatic habitats is not compromised without totally eliminating opportunities for development.

To meet this challenge, we are proposing the following resource management objectives:

Aquatic:

- The integration and co-ordination of water resource management (primarily stormwater and flood control), with ecosystem protection and management.
- The identification, protection, enhancement, and where possible rehabilitation, of the quality and quantity of both ground and surface water (including Collingwood Harbour).
- The enhancement of water conservation practices.
- The protection of human life and property from water related hazards, particularly flooding.

Terrestrial:

- The identification, and protection, of the subwatershed's Natural Heritage System, including wetlands, woodlands, wildlife habitats, and valley lands.
- The enhancement, and where possible rehabilitation, of the Natural Heritage System.

1.4 Outline of our Study Approach

The Black Ash Creek Subwatershed Plan will be a "living document". It will continually evolve as development proceeds, and new information becomes available. This information will be incorporated into the databases of both the municipalities and NVCA. It is very important that NVCA receive these updates since they will be used to evaluate the cumulative impacts of land use changes on "stream health" across the entire subwatershed.

The updates will also include the monitoring that will be continuing as well as the results from related studies. This approach ensures that the plan, the technical models and mapping will remain current and up-to-date.

In addition, there should be reviewed and update of the plan (if appropriate), every five years to ensure the plan remains current and relevant.

The development of the Black Ash Creek Subwatershed Plan consists of a phased process as follows:

Phase I: Background Review and Mapping - Identification of the subwatershed issues, goal and objectives, and significant environmental features that characterize the subwatershed plan area. This includes developing the technical water resources background information and models.

Phase II: Alternatives and Evaluation – Review and assessment of the flood hazards and other water management models and the potential environmental impacts from future land use scenarios. This phase will assess the potential impacts on the environment and the optimum Best Management Practices (BMPs) and long-term mitigation options. This will guide and direct development by outlining standards for conservation and enhancing the subwatershed's natural features and functions.

Phase III: Action Plan – Development and implementation of the subwatershed plan incorporating protection and enhancement techniques for natural features and functions and selected BMPs for future development. The implementation strategy may also outline opportunities for other partnerships regarding study recommendations and a long term monitoring program for parts of the study area.

An integrated approach has been applied in natural heritage identification, establishing development criteria, exploring alternatives, evaluating options and ultimately generating an integrated subwatershed plan and implementation strategy.

The study was developed with the following aquatic and terrestrial management strategies:

1) Flood risk reduction through a review and update of existing flood plain mapping, and the proposed channelization project.
2) Assess erosion of the affected watercourses, through a review of the results of Collingwood Harbour RAP studies and make recommendations for additional stabilization (if necessary);
3) The identification of opportunities for interaction between the community and the stream corridors including the opportunity for monitoring or management partnerships;
4) The development of options to enhance the ecological integrity of all streams and if appropriate, the conveyance function by exploring opportunities to:

- Control existing runoff volumes, peaks and quality.
- Provide relief to existing and potential flooding and erosion problems.

- Control (if possible) existing land-based activities, which are resulting in the degradation of the streams, using “at-source”, “conveyance” and “end-of-pipe” Best Management Practices (BMPs).
- Enhance existing vegetation communities (where practical) through the eradication of any invasive alien species, installation of infill and understory plantings and the establishment of linkages between isolated fragments and patches.
- Strengthen the riparian vegetation community along the specified reaches of the tributaries with the objective of enhancing the stability of the stream system and improving aquatic habitat.
- Increase the diversity of wildlife communities through the introduction of a range of trees and shrubs to provide food and shelter for a variety of birds and wildlife.
- Identify opportunities that interpret the cultural and archaeological heritage of the Black Ash Creek Subwatershed and downstream corridor linkage to Collingwood Harbour.
- Recommend land management techniques suitable for implementation on private lands abutting the stream corridors, which will contribute to the health and diversity of the valley land ecosystem.
- Develop an effective, practical and simple, means of maintaining and monitoring streams to ensure improvements continue in the future.

Compatibility with the Environmental Assessment (EA) Process:

This study has also been tailored to be compatible with the “environmental assessment process”, whereby the tasks will also be governed by the guidelines and provisions set out in the document, “*Class Environmental Assessment for Municipal Water and Wastewater Projects*” (Municipal Engineers Association, June 1993). This Class Environmental Assessment process represents an approved planning procedure for some municipal projects. It ensures that social, economic and natural environment factors are considered in the planning and design of new infrastructure (including stormwater management, and channelization, etc.).

1.5 Public Consultation

Public Consultation for this study was one of the most important components since it defined the studies direction through the issue identification process. The major sources for public consultation were as follows:

- A review of the public’s issues and concerns regarding Black Ash Creek already identified by other studies and forums; for example from the Nottawasaga Valley Watershed Management Plan; Blue Mountain Watershed Conference; and the Collingwood Harbour Remedial Action Plan (RAP);
- The establishment of two advisory committees as follows: the “Steering Committee’, made up of the funding partners, (,the Town of Collingwood NVCA and MOE, representing the Province,);

- The "Study Team", which includes the Steering Committee members, plus the Township of Clearview, Town of the Blue Mountains, Counties of Simcoe and Grey, Niagara Escarpment Commission, Osler Bluffs Ski Club, a representative from the development community, and The Blue Mountain Watershed Trust;
- The placement of public notices in the local newspaper, requesting input, and advertising the public meeting;
- Local municipal councils were kept informed of the progress of the study and their input and advice sought on the draft document;
- A public open house was held, on June 6th receiving comments and input on the information collected and proposed directions. We received feedback and discussion, particularly surrounding the proposed engineering solutions (the channelization project), the mapping of the Significant Natural Heritage Areas (Figure 4) and the areas for possible restoration. Revisions were made to the final mapping as a result of this input.

Consultation also included presenting field data and other study findings to the Steering Committee members for their input and comments.

Information on the study will also be posted on the NVCA's web-sites.

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1.6 Physical Characteristics

1.6.1 Drainage

The total area of the Black Ash Creek watershed is 3258 hectares. The major tributaries have a total length of approximately 32km (Figure 1 Base Map).

There are two main branches of Black Ash Creek. The north branch originates above the Niagara Escarpment and flows north-east for approximately 13km before discharging into Collingwood Harbour. It receives groundwater discharge in its headwaters due to the porous soils, spring seepage from cracks in the face of the Niagara Escarpment and steep gradients. The stream in this area provides excellent coldwater fish habitat.

The south branch has two additional major tributaries, Underwood, and Nottawa Creeks. Originally these creeks discharged into Collingwood Harbour through what are now the Hickory and Oak Street Canals. A diversion channel was constructed in the 1950s, linking these streams with the North Branch, in order to direct flood flows away from the centre of Collingwood. The construction of the diversion channel has effectively combined the three smaller subwatersheds into one. The south branch receives significantly less groundwater discharge, and the base flows are more dependent on runoff. As a result, stream temperatures are warmer in the south than in the north branch.

1.6.2 Physiography

The Black Ash Creek Subwatershed has very diverse physiography for such a small subwatershed (Figure 2). The steep, irregular topography associated with the Niagara

Escarpment and the till areas in the eastern quarter of the subwatershed, contrasts sharply with the flat to gently sloping sand, and clay plains bed of Glacial Lake Algonquin adjacent to Nottawasaga Bay. These different areas of the subwatershed exhibit a wide range of vegetation and physical characteristics reflecting the different physiography and soils.

The uppermost shoreline cliff of glacial Lake Algonquin is very significant in that the shoreline and its associated woodlands and groundwater discharge areas, acts as a major linkage or corridor to the streams valleys coming off the escarpment. The geological significance of the old shorelines in this area has also been recognized by Chapman and Putnam (1984) stating that, "No finer assemblage of abandoned shorelines is to be found in the Province". 1

The main branch of Black Ash Creek originates at an elevation of 474m above sea level on top of the Escarpment and has an average gradient of 4.0% up to County Road 19. This causes rapid drainage and significant sediment transport. However, the average gradient from County Road #19 to the harbour, is only 0.9%. This results in much slower drainage, potentially causing flooding in Collingwood and an increase in sediment deposition.

The south branch originates from a lower elevation 445m above sea level, from the face of the Escarpment resulting in a lower gradient. These two branches drain opposite slopes of the Osler Bluffs flowing through sand, clay and till plains and discharge into Collingwood harbour at an elevation of 176m above sea level.

1.6.3 Soils

The physiographic diversity of the Black Ash Creek Subwatershed has resulted in the presence of a wide variety of soil types ranging from impermeable clay to highly porous sand and gravel (See Figure 3 the soils map and the soils chart Appendix A). As a result of the varying soil permeability adjacent to Black Ash Creek, groundwater discharge into this stream tends to be very inconsistent.

The location of the porous sand and gravel becomes very important in identifying potential groundwater recharge and discharge areas.

The south-west portion of the Black Ash Creek Subwatershed above the Niagara Escarpment is composed primarily of well-drained Osprey loam soils. Precipitation infiltrating into these soils discharges through the fissures in the limestone rock of the Escarpment adjacent to the headwaters of the north branch of Black Ash Creek providing a great deal of the stream's base flow.

Black Ash Creek adjacent to County road # 19, passes through areas of Vincent Silty Clay Loam, Dunedin Clay, and Kemble Clay Loam. These soils are not porous and it is unlikely they provide a great deal of groundwater discharge.

1 The physiography of Southern Ontario, third edition, Chapman and Putnam, 1994, page74.

Upstream from Concession Road #10, Black Ash Creek flows through areas of Sargent gravely sandy loam and Percy fine sandy loam. These porous soils could be expected to contribute additional base flows in these areas.

The south branch of Black Ash Creek originates on the margin of the Osprey soils, but at a significantly lower elevation than the main branch. It passes through more nonporous soils such as Vincent clay loam, Wiarton loam, and Dunedin clay. This area receives much less groundwater discharge and as a result the baseflows of the south branch and its tributaries are considerably less than that of the main branch.

1.6.4 Land Use

In general, land use within the subwatershed as a whole, is predominantly rural/agricultural. The study area within the Town of Collingwood is the most developed, but still contains large rural/agricultural areas including a golf course, as well as industrial and commercial malls and existing and proposed residential developments.

The Township of Clearview is primarily rural/agricultural with several existing and proposed estate residential developments such as Osler Bluffs, Buckingham Woods, Collingwoodlands and Mountain Air Estates.

The subwatershed within The Town of the Blue Mountains, in Grey County is within the Niagara Escarpment. It contains the major recreation areas and developments of Osler Bluff ski club and Castle Glen. It has large undeveloped areas of wooded Escarpment Protection, Natural areas (including the Petun Conservation area and a portion of the Pretty River Valley Provincial Park) and agricultural Escarpment Rural areas.

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2.0 ECOSYSTEM MANAGEMENT

For the purposes of this study we will be focussing on the natural heritage system, and aquatic ecosystems. We recognize that the natural heritage and aquatic ecosystems are interconnected and dependent on one another. For example, fish habitat is part of the natural heritage system and is obviously a significant component of aquatic ecosystems. However, the separation of the two will be useful in this study during implementation because of the requirements of the "Provincial Policy statement" (PPS) and the emphasis of this study on the aquatic ecosystem in relation to stormwater and flood plain management.

It has been recognized for some time that our natural heritage is a very important shared public and private trust, and that landowners and public agencies such as municipalities, manage it both independently and through partnerships.

Natural heritage is valued for its long-term contribution to the environmental quality of provincial, regional and local ecosystems. It is also very important to the economic and social fabric, and in many instances defines the character of an area.

2.1 The Natural Heritage System

The Natural Heritage System identified in this study (figure 4), is an integrated network of natural features including woodlands, valley lands, wetlands and other fish and wildlife habitats, linked by natural corridors. This approach focuses on the natural environment as an ecosystem that is integrated and connected, as opposed to simply identifying and protecting a series of individual features.

The identification of a natural heritage system has had a good deal of support for some time, and was summarized by Riley and Mohr, 1994, "Integrated networks of conservation lands and water are the appropriate and practical method to define the natural landscape we wish to conserve". 2

This ecosystems concept is also the approach used by Simcoe County in identifying their "Greenlands" as part of the County Official Plan and in the Town of Collingwood's Official Plan.

The Subwatershed Plan also identifies areas where rehabilitation such as tree planting would most significantly enhance and improve the Natural Heritage System (figure 5). This includes the riparian areas along the watercourses as well as upland areas where plantings would fill in open spaces making for larger interior forest blocks. The larger blocks would greatly improve the wild life habitats, particularly those species requiring larger interior forest.

2 . " The Natural Heritage of Southern Ontario's Settled Landscapes", Riley and Mohr, MNR, 1994 page 32.

Naturally this rehabilitation work could only proceed with the landowner permission and often through a partnership with an interested group.

The areas that were identified as having the highest priority for rehabilitation were those riparian areas needing revegetation along the north branch of Black Ash Creek to the harbour. It is the north branch that contains the coldwater fisheries, and will also be part of the channelization project from where it joins the South branch to the harbour.

It should also be noted that some restoration of the Collingwood Harbour wetland was undertaken as part of the Collingwood Remedial Action Plan. There may be some additional opportunities to restore this wetland, but because of the work already completed, the harbour was not included as a rehabilitation area.

2.1.1 Identification

The Black Ash Creek Natural Heritage System was identified by using and interpreting existing resource information such as Simcoe County and Town of Collingwood's Natural Heritage Studies, MNR's Landsat Image Classification, OBM and topographic mapping, 1998 colour infrared air photos and regular 1989 air photos. Reconnaissance level field investigations were also undertaken to verify the interpretation.

The components of the Black Ash Creek Natural Heritage System include the following "significant" features in accordance with the "Provincial Policy Statement" (PPS) sections 2.3 Natural Heritage, and 2.4 Water quality and Quantity:

- Fish Habitats - The North branch of Black Ash Creek and a tributary have been identified as a cold water fishery stream. The South Branch supports a warmwater fishery.
  A minimum of 30 metres on either side of both branches and its tributaries has been identified as part of the natural heritage system, regardless of the amount of riparian vegetation present. Poorly vegetated riparian zones will be identified as candidates for rehabilitation.

- Groundwater Recharge/Discharge Areas – Sensitive ground water areas were included, where known (i.e.: escarpment recharge/discharge areas, and the Sargent gravelly sandy loam adjacent to the north branch along County rd 32). They play a very important role in maintaining water quality and base flows necessary for a healthy aquatic ecosystem.

- Wetlands - Collingwood Harbour Wetland was included as a provincially significant wetland.

- Wildlife Habitats – The mature woodlands combined with the successional/transitional vegetation communities such as abandoned orchards and shrub thickets, provide very important and diverse habitats for a variety of wildlife species.

- Woodlands – The significant woodlands selected provide important ecological functions, linkages and diversity. They contain diverse vegetation community types, ages, composition and size. Most of the woodlands are connected to each other along the base of the old shoreline of Glacial Lake Algonquin. This provides a very important linkage and corridor between the Black Ash Creek valley lands with the Escarpment ecosystem and Silver Creek in the north and to the Pretty River Valley system to the south.

- Valley lands – These areas represent the "skeleton or framework" for the Black Ash Creek natural heritage system containing important fish and wildlife habitats. In some cases the areas identified represents the actual defined valley. In other cases for example through flat agricultural areas with no defined valley or riparian vegetation, a strip 30m on either side of the stream has been included in the Natural Heritage System.

2.1.2 Rehabilitation and Enhancement

The Study has identified priority areas for rehabilitation, restoration and enhancement. We have essentially identified two types. The first is riparian area along the watercourses that do not have adequate vegetation (30 m. on either side) to protect the water quality of the stream, nor provide riparian wildlife habitats. The second type is those upland areas that if restored would substantially contribute to creating a large block of interior forest, an ecosystem in very short supply in this area.

In both cases, the type of rehabilitation and enhancement may simply involve planting of indigenous trees and shrubs, or encouraging natural regeneration to provide shade, food and cover.

The identification of these areas will be very useful to landowner, service clubs, municipalities, and any other organizations considering planting programs within the watershed. They will benefit from knowing where the greatest ecological gain may be made through their restoration and planting programs.

Naturally the full cooperation and participation/concurrence of the landowner is required.

2.1.3 Recommendations and Implementation

The recommendations are outlined in the body of this report and the appendices as the issues are reviewed and discussed. Please see Table 3.3 in section 4.0 for a summary of the recommendations and implementation requirements.

It is recommended that the municipalities incorporate the Black Ash Creek Natural Heritage System as identified in figure 4 into their official plans and provide the appropriate policies to protect the system and it's functions from incompatible land use and development.

The Provincial Policy Statement supports this approach by stating the following:

- *"Natural heritage features and areas will be protected from incompatible development"* (Section 2.3.1);

- *"The quality and quantity of groundwater and surface water and the functions of the sensitive ground water recharge/discharge areas, aquifers and headwaters will be protected or enhanced* (section 2.4.1)

-) *"The diversity of natural features in an area, and the natural connections between them should be maintained and improved where possible"*. (section 2.3.3) 3

One of the most effective ways of fulfilling these requirements of the PPS is through the identification and protection of the natural heritage system.

It is very important to note that the identification of this Natural Heritage System does not result from a detailed environmental impact assessment of the subwatershed. It represents, for the most part, a "red flag" or an "early warning system", locating the significant natural areas where additional environmental reviews (Environmental Impact Study) should be undertaken before new development is considered.

The exception to this is the provincial significant wetland in the harbour where the Provincial Policy States that no development is permitted.

Official plan policies should indicate that council would require an Environmental Impact Study (EIS) before considering development proposals within or adjacent to (within 50 m of) the natural heritage system.

The level of detail required for the environmental impact study would depend on the type of development proposed and/or the sensitivity of the resources being impacted. For example, a proposal for a single-family dwelling adjacent to or on the edge of large woodland may only require a simple or "scoped assessment". In some cases, where there are obviously no impacts at all, the municipality, approval authority and appropriate agencies may wave the requirement for even the scoped EIS.

However, a subdivision development in the interior of a large woodland may require a full site environmental impact study. The EIS should identify in detail, the features and significant functions of the site, and outline the possible impacts from the proposal on these functions. For example, the impacts of the proposal on the habitat of interior forest bird species. The EIS should then suggest design modifications if required, mitigation and monitoring options to ensure no negative impacts on those features and functions.

3 Provincial Policy Statement; Government of Ontario, Queen's Printer 1997, pages 8,9.

It is recommended that landowners, environmental organizations, or interested agencies adopt the "Rehabilitation Area" identified in figure 5 as priority areas for future restoration programs.

The landowners and partner organization, depending on their objectives, may chose their rehabilitation projects from a variety of the identified riparian or upland sites. Selecting projects from these areas will provide the greatest benefits to the aquatic or terrestrial ecosystems.

Again it must be emphasized that none of these restoration programs can proceed without the permission and full cooperation of the landowners.

Distribution and use of this Subwatershed Plan and the mapping by the Study Team members and others will disseminate the information to landowners and potential restoration partners. The NVCA can also promote the restoration area to landowners through its own tree planting programs.

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2.2 Aquatic Ecosystem

Black Ash Creek is the largest tributary entering Collingwood Harbour. It drains over 30 square km containing predominantly agricultural/rural lands, scattered residential (farm) development and several estate residential subdivisions. In its lower reaches within the Town of Collingwood (approximately 25% of its length), Black Ash Creek is an urban stream that causes extensive flooding during major (regional) storm events. Effectively managing this stream for aquatic habitat and flood prevention requires a subwatershed plan which links and integrates stormwater Best Management Practices (BMPs) and flood control works with ecosystem objectives and targets.

Fish sampling and stream assessment data collected during the Collingwood Harbour Remedial Action Plan (RAP) studies indicated that Black Ash Creek provides important habitat for migratory rainbow trout entering the system from Nottawasaga Bay. The stream provides rainbow trout spawning and early rearing habitat in spite of low baseflows (less than 20 L/s at the mouth). Black Ash Creek also supports a diverse population of other species including:

- common shiner
- emerald shiner
- mimic shiner
- blacknose dace
- longnose dace
- northern redbelly dace
- bluntnose minnow
- brassy minnow
- creek chub
- common carp
- white sucker
- redhorse sucker
- brook stickleback
- johnny darter
- smallmouth bass
- native brook trout
- northern pike
- migratory brown trout
- migratory chinook salmon

One of the most effective ways of managing an aquatic ecosystem is to establish realistic and achievable objectives, targets and development criteria or standards for that particular system. They will provide for example the technical standards for stormwater best management practices that any new development must meet before proceeding.

These standards were initially established through the environmental assessment process for the Black Ash Creek channelization project. They have been revised and updated by our biologists for incorporation into this study.

It is the physiography and soils conditions in the Black Ash Creek Subwatershed that determine much of the cold water habitat potential of the stream.

In general coldwater stream habitats receive relatively abundant groundwater discharge resulting in stable baseflows and moderate water temperatures. Warmwater stream habitats tend to receive less groundwater discharge and have more variable flow and water temperature. The quantity of groundwater discharge received by any part of the stream depends a great deal on the permeability of the adjacent soils.

2.2.1 North Branch Objectives and Targets

The North Branch of Black Ash Creek receives significant groundwater discharge in its headwaters within the Niagara Escarpment due to the proximity of porous soils and fractured bedrock. At least one of the headwater area tributaries provides excellent brook trout habitat.

The Ecosystem objective for the North Branch of Black Ash Creek is a diverse, stable and productive cold/coolwater stream ecosystem dynamically linked to warmwater habitat in Collingwood Harbour and coldwater habitat in Nottawasaga Bay.

The following targets or standards, contribute to the cold/coolwater stream Ecosystem Objectives for the Main Branch:

1. Four p.m. stream temperatures should be less than 22 °C on a standardized sample day where the maximum air temperatures is 30 °C (see Stoneman and Jones 1996 DFO/MNR Habitat Management Series).
2. Baseflow (currently 10 - 15 L/s) should be maximized (i.e. limit evaporation and maximize adjacent infiltration).
3. Water clarity should be enhanced, and suspended solids reduced through sediment/erosion controls and rehabilitation of riparian vegetation.
4. Dissolved oxygen concentrations should be at saturation.

In general, natural channel form and functions should be protected and enhanced through the implementation of BMPs for riparian vegetation and stream rehabilitation.

2.2.2 South Branch Objectives and Targets

The South Branch of Black Ash Creek receives considerably less groundwater discharge than the North Branch and has less baseflow (0 to 2 L/s). The potential for this tributary to support cold/coolwater stream habitat is fairly low.

The South Branch Ecosystem currently provides warmwater habitat for all life history stages of common shiner, blacknose dace, longnose dace, bluntnose minnow, creek chub, brook stickleback and johnny darter. Spawning and early rearing habitat in the South Branch is utilized by white suckers, which migrate into the creek from Nottawasaga Bay and Collingwood Harbour.

The ecosystem objective for the South Branch of Black Ash Creek is a diverse, stable and productive warmwater stream ecosystem dynamically linked to warmwater habitat in Collingwood Harbour.

However, management standards for the South Branch should not compromise ecosystem targets identified for the North Branch.

The following are the warmwater ecosystem targets for the South Branch of Black Ash Creek:

1. Summer stream temperatures should be lowered wherever possible (e.g. through planting of riparian vegetation).
2. Baseflow (currently 0 - 2 L/s) should be maximized (i.e. limit evaporation and maximize adjacent infiltration).
3. Water clarity should be enhanced and suspended solids reduced through sediment/erosion controls and rehabilitation or riparian vegetation.
4. Dissolved oxygen concentrations should be at saturation.

In general, natural channel forms and functions should be protected and enhanced through the implementation of BMPs for riparian vegetation and stream rehabilitation.

2.2.3 Recommendations and Implementation

The Stormwater Management Criteria and Best Management Practices outlined in this study be adopted by the municipalities, approval authorities and the development/consulting communities.

The following section on Water Management, Appendix D and Table 3.3 Summary of Implementation Requirements and Responsibilities, provide the details on how the aquatic ecosystem targets and standards for Black Ash Creek will be achieved.

3.0 WATER MANAGEMENT

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This section provides an outline of the water management issues, resolutions, criteria and recommendations. The details are found in the appendices.

3.1 Constraints and Opportunities

Based on existing conditions, any areas of constraint due to physical and ecological parameters (natural features and hazards) were identified during Phase I to ensure that those features worthy of protection were noted. Constraints refer to conditions that affect the long-term management, maintenance and enhancement of the Black Ash Creek Subwatershed. Constraints were defined and quantified where feasible. They served as important considerations in establishing study area targets for water management.

It is also very important to remember that, although by definition the natural features are called “constraints” (to development), their protection and enhancement plays a very positive role in protecting the areas ecosystems, as well as ensure the area remains a beautiful place in which to live, work and enjoy.

Opportunities for rehabilitation were also identified, however not only from a natural heritage perspective but also from a social and physical context. These opportunities were assessed primarily based on a lack of existing vegetation and potential for contribution to the ecosystem.

Details of our constraint/opportunity assessment for water management is presented in Appendix ‘D’.

3.2 Stormwater Management and Flood Control Assessment

From a stormwater management perspective for the Town of Collingwood, which assumed existing land use conditions for Clearview Township and Town of the Blue Mountains, four scenarios within Collingwood were assessed for developing Subwatershed Plan alternatives. Hydrologic and hydraulic computer models from Appendices ‘B’ and ‘C’, respectively, were used and these scenarios included:

1) Complete development within Collingwood “without” the Black Ash Creek Flood Control Project;
2) Complete development “with” the proposed Black Ash Creek flood control and channelization works;
3) Phased development “without” the proposed Black Ash Creek works; and,
4) Phased development “with” the proposed Black Ash Creek works.

It should be noted “complete” development within Collingwood also refers to a specified number of development applications that were made known to the Study Team prior to our

investigations. Proposed amendments to the municipalities' Official Plan and future Secondary Plan areas at the time of the study were not considered. Based on input from the Steering Committee and public feedback, the Subwatershed Plan recommendations will be a compromise between development within Collingwood and protection of the natural features. Specific details of the recommendations for stormwater management, flood control and monitoring within the Town of Collingwood are provided in Appendix 'D'.

3.3 Impact Assessment and Mitigation

The study area includes existing and future development lands, within the Town of Collingwood, as well as current land use designations within Clearview Township and Town of The Blue Mountains, to properly plan stormwater management facilities for urban growth within Collingwood. Figure 1 illustrates the location of the study area.
Figure 9 presents the proposed land uses within Collingwood's catchments of the Black Ash Creek Subwatershed - as per the municipality's recent Official Plan.

In terms of our SWM investigations, five (5) land use planning issues were identified at the beginning of the study. The issues of concern for the Black Ash Creek Subwatershed are:

1. The preservation of floodplain (riparian) storage, as a result of filling of any new lots and constructing any flood control or "peak flow shaving" facilities or extended detention water quality/quantity facilities within a floodplain;

2. Stormwater quantity controls (i.e. flood/peak flow and erosion/runoff volume or duration) and water quality enhancement (i.e. Level '1' fish habitat protection for all watercourses of the Black Ash Creek system) requirements;

3. Groundwater recharge/baseflow preservation and, if practical, enhancement;

4. Operation/maintenance responsibilities for the SWM plan; and,

5. Environmental protection, including the establishment of sufficient buffer widths between new lots/roadways and low flow channels of Black Ash Creek - as they relate to the protection of valley corridors and net environmental gains.

Consequently, the following objectives were established to develop a SWM plan for development lands within Collingwood that will provide a practical and environmentally sound approach for developing the study area:

- Protect, conserve, and enhance (where practical) all relevant natural resources within the study area, including water, aquatic, and terrestrial;
- Identify potential flooding impacts within the study area as a result of urbanizing the Subwatershed and recommend mitigative flood control measures to minimise the threat to life and destruction of property from flooding;

- Confirm general development limits from the Official Plan in a manner that considers the natural environment as well as the hydrologic functions of the proposed development blocks and phases;
- Identify potential urbanization impacts from the development blocks/phases upon flooding, erosion, water quality, baseflow supplies, and the natural environment within the study area;
- Select environmentally compatible and practical storm water management practices (SWMPs), to be located within future development lands in order to mitigate any identified surface water impacts from the urbanization; and
- Identify land use requirements and any constraints (e.g. locations of future SWM facilities) that will be accommodated in future planning documents about the proposed development areas.

Hydrologic Impacts

For the Black Ash Creek Subwatershed Plan area, ISWMS™ and Visual OTTHYMO© hydrologic computer programs were used to predict/compare "post-development" surface water impacts from the proposed concept land uses shown on Collingwood's Official Plan, relative to existing or "pre-development" conditions. Appendix 'B' presents our baseline findings for pre-development hydrologic conditions. The post-development hydrologic models were based on an interpretation of site specific aerial topography, soil reports, proposed land use schedules, etc. Our hydrologic models also accounted for flow attenuation affects from field-surveyed channel routing sections and required SWM facilities, as part of our stormwater management plan for the sub-catchments within the Town of Collingwood.

As shown on Figure 9, the same points of interest to establish pre-development peak flow targets (Figure 6) within the Black Ash Creek Subwatershed were again used for our post-development hydrologic analysis. Visual OTTHYMO© and ISWMS™ peak flows were calculated at these locations for various return periods to compare uncontrolled and controlled post-development scenarios, relative to existing hydrologic conditions. Pre-development flow data was also used in our hydraulic analysis to determine flood hazard areas, potential spill flows from Black Ash Creek across High Street and as "peak flow" targets to design the subwatershed SWM plan. Appendix 'D' presents the results from our investigations.

Hydrogeologic Impacts

Water balance is linked to the hydrologic cycle. It describes the process of water inflow from precipitation and the outflow of water by evapotranspiration, groundwater recharge and streamflow. This process forms a dynamic balance that can vary with time depending greatly upon climatic conditions – as evident over the past couple of years throughout Simcoe County. The water budget, or how much water is available in each stage of the cycle, is "critical" in that it dictates the conditions of an ecosystem. Human activities are part of this ecosystem and conflicts arise when water use exceeds the resources available in terms of the water budget conditions. These "baseline" conditions can only be

determined utilizing existing data records and/or implementing a monitoring program. A subwatershed management plan that includes a "groundwater management plan component" provides for the ability to investigate environmental processes on a broad scale within a reasonable (watershed or regional) boundary. There is still some cross boundary issues to deal with, such as the transfer of groundwater linkages between different municipalities. Watersheds, however, can provide the geographical basis for analyzing and quantifying the environmental and social processes that govern its condition.

Based on our streamflow monitoring results from November 1999 to May 2000 groundwater system(s) adjacent to the Black Ash Creek Subwatershed are contributing baseflow to the North and South Branches. However, our "scoped" study approach for stormwater management and flood control within Collingwood prevented consecutive four-season climate and streamflow monitoring which is necessary to determine accurate water balance parameters – including evapotranspiration. In addition, an examination of existing wells and monitoring of local groundwater levels was also not required by the study.

Given the *"A-E-M-O-T (Artemesia-Euphrasia-Melancthon-Osprey-The Town of The Blue Mountains) Groundwater Management Plan Study"* will be completed by the summer of 2001, an ideal opportunity exists now for developing a groundwater management plan for headwater basins of the Black Ash Creek system.

These investigations would also determine potential impacts from future development scenarios upon the water budget. At the municipal level, the resource management "partners" would include Clearview Township and Town of The Blue Mountains. However, the Town of Collingwood, Nottawasaga Valley Conservation Authority, Ministry of the Environment, public and local businesses should be consulted too so that targets from this scoped study are maintained.

By January 2001, a considerable amount of background information will exist from the on-going *"A-E-M-O-T Groundwater Management Plan Study"* for the Blue Mountain/Beaver Valley region to map local and regional groundwater systems – including those of the Black Ash Creek Subwatershed. Greenland International Consulting Inc. is undertaking the A-E-M-O-T study and the NVCA and Town of The Blue Mountains are members of the Steering Committee. Since ISWMS®, ViewLog/DB™ and MODFLOW computer models are also being developed for the A-E-M-O-T study area, the completed database could eventually be integrated with other similar "living document" models of the Black Ash Creek system. This would then enable the NVCA to conduct long-term surface hydrology simulation during summer and winter conditions, as well as comprehensive surficial infiltration capabilities, both of which are essential for water balance analysis. Further calibration (after this study) would consist of continued stream flow monitoring and "wide-spread" baseflow measurements throughout the study area during the summer/fall periods.

Flooding

Design flood profiles of the Black Ash Creek system for various land use scenarios and "controlled" post-to-pre development conditions, were calculated (along the watercourse reaches shown on Figure 8) for the 2 year, 5 year, 10 year, 25 year, 50 year, 100 year and Regional Storm events. The calculated floodplain limits of the 100 year and Regional Storm events for existing and proposed Black Ash Creek channel conditions, as well as the flood water elevations, were superimposed on the Town's 1:2,000 scale digital maps using the floodplain graphic module of the BOSS RMS computer program. Output data from our HEC RAS models (refer to Appendix 'C') were incorporated into BOSS RMS. The established floodlines were considered appropriate for use in the regulation of future development within the Town of Collingwood.

The general location of the regulatory floodline is shown on figure 8, and the detailed 1-2000 mapping is available from the Town of Collingwood or the Nottawasaga Valley Conservation Authority.

The existing spill mapping and special policy area designations in the Town of Collingwood's Official Plan should remain until the Black Ash Creek flood control project (channelization) has been completed.

Water Quality and Quantity Controls

The stormwater management plan for Collingwood's sub-catchments of the study area is based on conceptual land use information. As the various draft plans proceed through the planning process, it is anticipated that the land use types, densities, road patterns, etc. will be finalized. This will require that, at the "Functional Servicing Plan" stage associated with a Secondary Plan application, the hydrologic calculations undertaken as part of this study be refined to better reflect the approved development plans. The recommended approach for the handling of surface runoff, as outlined in this report, would however, not change. The recommended approach considered the policies and guidelines in Appendix 'D'.

Current water quality requirements for the Black Ash Creek Subwatershed calls for Level '1' protection, as per the MOE's 1994 Stormwater Management Practices Planning and Design Manual – namely, an 80% total suspended solids removal efficiency for any SWM facility. Also, the MOE's (1994) temperature mass balance criteria for mitigating thermal impacts from post-development drainage must also be considered during the design of stormwater management facilities within the subwatershed. For example, both functional design objectives (suspended solids removal and thermal impact mitigation) were considered recently during preliminary servicing investigations about the Town's future commercial lands (formerly known as "OPA 37"), in the vicinity of Old Mountain Road and Highway 26."

For quantity control, our stormwater management plan was designed to ensure that there would be no impacts from peak outflows above that of the pre-development condition at all

stream node locations shown on Figure 6. Where possible after this study, for headwater basins within Clearview Township and Town of The Blue Mountains, other post-development flows may have to be over-controlled in order to reduce potential flood hazards that currently exist along some downstream study reaches. Following construction of Collingwood's flood control/channelization works, post-development flow attenuation within Clearview Township and Town of The Blue Mountains may still be necessary and will have to be confirmed using this study's hydrotechnical computer models.

For future development areas within the Collingwood's sub-catchments of the Black Ash Creek Subwatershed and ultimate construction of the flood control/channelization works, storage of the first flush (associated with a 25 mm rainfall volume) for twenty-four hours is adequate as a base level for erosion control. Where practical, induced infiltration for maintaining or enhancing stream baseflow should be promoted. The NVCA and MNR require that the baseflow in the recipient watercourses not be impacted upon as a result of development. Also, in the event the flood control/channelization works are not constructed before the proposed Collingwood developments, "over-control" storage of the 2 year rainfall for forty-eight hours is also recommended as an interim measure to prevent erosion impacts within Collingwood reaches of the Black Ash Creek. For other development lands not considered in our investigations and that would outlet to other tributaries or stream branches (i.e. upstream of the Black Ash Creek Main Branch), erosion control requirements must be confirmed on case-by-case basis using this study's hydrotechnical models.

Appendix 'D' presents complete details about the recommended SWM design criteria. Utilizing our Visual OTTHYMO© and ISWMS™ pre-development and post-development condition models (refer to Appendix 'B' for schematics) surface water runoff simulations were undertaken for the 25 mm (first-flush), 2 year, 5 year, 10 year, 25 year, 50 year, 100 year and Regional Storm events. Initial conditions for the "controlled" and "over-controlled" post-development SWM models assumed empty detention storage facilities. Results of our stormwater management modelling analysis are presented in Appendix 'D'. For the 2 through 100 hydrologic models, the SCS-II (24-hour duration) design storm distributions were used. Appendix 'B' includes the hydrologic modelling output data for the Black Ash Creek system (i.e. existing and post-development (un-controlled) conditions). Tables 1 and 2 in Appendix 'D present the HEC-RAS modelling results using the ISWMS™ pre-development Regional Storm and 100 year peak flow database for existing and future Black Ash Creek Flood Control Project conditions.

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3.4 Stormwater Management Components

Development Controls

Stormwater Management Plans are prepared as an integral part of the municipal land use planning process. The methodology used for addressing stormwater drainage recognizes that when development is to occur within an area, an *ecosystem approach* should be

followed for mitigating environmental impacts from post-development stormwater runoff and snowmelt upon surface water and groundwater resources. The relationship between surface-groundwater regimes and the aquatic/terrestrial communities is also considered when assessing the potential for new development within a specified study area.

The goal of a stormwater management (SWM) plan, that forms part of the subwatershed plan, is to establish an environmentally sensitive approach, prior to the approval of any plan of subdivision, for the handling of stormwater runoff/snowmelt from an urbanizing area. It defines practical and environmentally sound source and/or end-of-pipe mitigative controls and provides conceptual design details which, when refined at the "functional servicing plan" or final design stage and implemented thereafter, will prevent adverse environmental impacts on the quantity/quality of both surface waters and groundwater. The recommended drainage and SWM infrastructure must also be of sufficient detail for use in the formulation of the master concept (land use) plan for each development block or phase.

Once the master concept plan is approved, its details are then used as a guide to regulate the municipal servicing and SWM requirements associated with each development of the new community. It also forms the basis on which the final SWM plans for each block/phase are generated as part of an overall functional servicing plan. Final SWM plans should provide specific details of location and design requirements, and conform with the master SWM plan's design objectives, prior to the approval of any site plan.

> Functional Servicing Plan reports will be required for all future development blocks (except for those lands already committed for development, i.e. designated/zoned), as part of an overall Secondary Plan. These reports will be submitted to the affected municipality, Nottawasaga Valley Conservation Authority and other regulatory agencies in support of each draft plan or site plan application. The purpose of the FSP will be to demonstrate that the proposed plan meets the general intent of the Subwatershed Plan, and any other Master Servicing Plan requirements of the municipality, with respect to servicing, grading and stormwater management. In addition, each FSP must be integrated with natural heritage system features that recognize details presented in Appendix 'D'.

<u>Evaluation of Stormwater Management Plan Options</u>

The results of our short-list assessment for water quality controls indicated that the preferred "end-of-pipe" solution should take the form of retention (wet) ponds, or variations thereof such as hybrid/wetland type facilities, as the ultimate on-site servicing solution. Full constructed wetlands may be practical for some developments but should address at the detailed design stage, surface area requirements and potential cool water or cold water stream constraints. In addition, the proposed natural channel features of the Black Ash Creek flood control/channelization works would also provide a major benefit to water quality enhancement. Appendix 'D' summarizes the Level '1' quality and ultimate 25mm rainfall erosion control requirements for Collingwood's sub-catchments of the Black Ash

Creek system. Figure 9 presents subcatchment locations of these SWM control requirements.

Our analytical process of developing SWM quantity control alternatives for the Black Ash Creek Subwatershed Plan began by outlining the concepts on a broad scale and eventually developing schemes specific to each headwater basin – in terms of type and location. Appendix 'D' presents complete details.

Appendix 'D' summarizes our Visual OTTHYMO© peak flow results at various nodes of interest in the subwatershed for 1) pre-development conditions, 2) "un-controlled" post-development conditions, 3) "controlled" post-development conditions to pre-development release rates, and 4) "over-controlled" post-development conditions to 50% pre-development peak flows. Comparative ISWMS™ model discharges for the 100 year and Regional Storm floods are also presented in Appendix 'D' to demonstrate the very close findings with our initial Visual OTTHYMO© models. Finally, flow nodes 1 through 8 correspond to those shown in Figure 8.

Recommended Stormwater Management Plan

The stormwater drainage infrastructure for the Town of Collingwood will be designed according to the dual drainage principle - with major and minor storm water drainage systems. Frequent flows up to that which is generated by the 5 year storm will be collected by the minor storm sewer system in accordance with Collingwood's design criteria. Streets and lots should be designed, where feasible, with continuous slopes to convey the major (overland) flows to the stream outlets, and basically consistent with the existing topographical relief. However, in some, as a result of grading constraints, a cascading road system (saw-tooth grading) could be implemented to subdivision design and must be consistent with accepted design practices (e.g. maximum allowable depth of ponding water within road sag areas, etc.).

The recommended SWMPs include the general surface storage, vegetative, soft measures, special purpose and conservation/restoration classes discussed earlier to address storm water quality concerns. They also address the other management concerns to mitigate storm water quantity (i.e. erosion and flooding) and groundwater recharge impacts. Further details of the recommended SWM plan are discussed in Appendix 'D' in terms of the proposed source and end-of-pipe controls.

Complete design details for each off-line pond (i.e. conceptual locations) shown on Figure 12 will be completed by the proponents, as the developments proceed. The extended detention (i.e. water quality and erosion control) requirements are referred to as facilities 'A', "B', 'C', 'D', 'E' and 'F'. Based on our hydrologic modelling assessment (Appendix 'D') flood control storage is not recommended for the affected Collingwood development lands given potential timing impacts with headwater basin runoff. This applies to Black Ash Creek conditions with and without the proposed flood control/channelization works. Appendix 'D' presents design details about engineering, landscaping, operation and

maintenance, construction controls and post-construction monitoring of these off-line SWM facilities.

Tables 3.1 and 3.2 below present the final hydrologic peak flow findings from the ISWMS™ models developed during this study.

The model output data presented in Table 3.2 incorporates the proposed water quality and 25mm rainfall erosion control facilities but does not include flood control storage for 2 year through 100 year design storm events.

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Table 3.1
ISWMS™ Pre-Development Peak Flows (m^3/s)

Node	Description	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	Regional Storm
1	Outlet to Collingwood Harbour	10.0	15.7	20.1	25.7	30.3	35.0	108.1
2	Main Channel – West Tributary Confluence, South of Old Mountain Road	9.7	15.1	19.3	24.8	29.1	33.7	103.3
3	Confluence of North and South Branches, North of Sixth Street	9.0	14.1	17.9	22.9	26.9	31.1	94.6
4	South Branch – West Tributary Confluence, West of Campbell Street	7.3	11.5	14.7	18.9	22.2	25.7	72.0
5	South Branch Tributary Confluence, North of Poplar Sideroad	6.1	9.6	12.2	15.7	18.5	21.3	53.2
6	South Branch @ Tenth Line	5.7	9.0	11.4	14.6	17.1	19.7	47.2
7	South Branch @ Osler Bluff Ski Club	1.5	2.4	3.0	4.0	4.7	5.5	14.8
8	North Branch @ Grey County Road 19	2.0	3.1	3.9	5.0	5.9	6.8	21.0
9	North Branch Outlet @ South Branch Confluence	2.7	4.3	5.4	7.0	8.2	9.5	30.0
10	West Tributary to Main Channel, South of Old Mountain	0.8	1.2	1.6	2.1	2.5	2.9	9.8

Table 3.2
ISWMS™"Un-controlled" Post-Development Peak Flows (m^3/s)

Node	Description	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	Regional Storm
1	Outlet to Collingwood Harbour	11.3	17.5	22.1	28.2	33.1	38.1	112.7
2	Main Channel – West Tributary Confluence, South of Old Mountain Road	10.2	15.9	20.2	26.0	30.5	35.3	106.7

Node	Description	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	Regional Storm
3	Confluence of North and South Branches, North of Sixth Street	9.2	14.4	18.3	23.5	27.6	31.9	95.9
4	South Branch – West Tributary Confluence, West of Campbell Street	7.5	11.7	14.8	19.1	22.4	25.9	71.8
5	South Branch Tributary Confluence, North of Poplar Sideroad	6.1	9.6	12.2	15.7	18.5	21.3	53.2
6	South Branch @ Tenth Line	5.7	9.0	11.4	14.6	17.1	19.7	47.2
7	South Branch @ Osler Bluff Ski Club	1.5	2.4	3.0	4.0	4.7	5.5	14.8
8	North Branch @ Grey County Road 19	2.0	3.1	3.9	5.0	5.9	6.8	21.0
9	North Branch Outlet @ South Branch Confluence	2.8	4.4	5.6	7.2	8.4	9.7	30.3
10	West Tributary to Main Channel, South of Old Mountain	1.0	1.5	2.0	2.5	3.0	3.4	11.0

3.5 Improvements to Current Land Use Practices

Opportunities for urban retrofitting are limited in developed watersheds, but they can be revealed through detailed evaluations. For example, stormwater management pond retrofitting has been the primary focus of restoration efforts in the Greater Toronto Area and has typically involved converting older dry SWM facilities into extended detention hybrid wet pond-wetland systems. Typically the best sites for urban retrofits for water quality enhancement, erosion protection and/or water quantity control are found: 1) at the “end of pipe of a storm drainage system, 2) across or within an open engineered channel, 3) adjacent to a natural or open engineered channel, or 4) within an older BMP system, such as stormwater detention ponds or surface water retention facilities.

Our retrofit assessment of stormwater management opportunities within the Town of Collingwood revealed no practical/cost-effective “end-of-pipe”’ or “conveyance” options for enhancing existing stormwater runoff from a water quality and quantity (erosion control) perspective.

However, the future implementation of a community-wide “at-source” control program would ensure achieving water resource management targets specified in the Subwatershed Plan. Potential benefits would include the moderation of more frequent flood flows and mitigation of urban runoff pollution – with or without potential improvements to upstream rural areas. Potential at-source control options would be limited to existing industrial and recreation (including the Blue Mountain Golf and Country Club) lands within the Town of Collingwood. Appendix ‘D’ presents further details and recommendations.

3.6 Capital Works Projects

The following lists the capital works projects associated with or affected by the Subwatershed Plan:

1) Construction of the Black Ash Creek Flood Control Project.

4.0 Recommendations and Implementation Summary

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The Subwatershed Plan Recommendations and Implementation Summary is outlined in Table 3.3. It contains components under the broad headings of 1) Constraint areas (Natural features and hazards), 2) Development Criteria, and 3) Conservation and Management Practices. In order for the Plan to achieve its full potential, progress must be made under each of these categories.

Table 3.3 summarizes the recommended action to be taken, the lead agency (and support agencies), the means or mechanism for completing the action, the time frame for implementation and the funding responsibility.

In many cases the time frame for action is “immediate and ongoing” or “ongoing”. The actions needed under the Subwatershed Plan are not simply reactive “fix and forget” type solutions. Rather they require an ongoing commitment and perseverance if they are to be ultimately successful. The Subwatershed Plan must change the way stakeholders develop and use the land if sustainable growth is to be achieved.

The lead agency for implementation varies from component to component but is always either the Town of Collingwood, Clearview Township, Town of the Blue Mountains or Nottawasaga Valley Conservation Authority. Provincial agencies and/or private sector partners are designated as supporting agencies in some cases and are assumed to be available for technical comment and support, as needed.

The responsibility of implementation may require modifications or additions to both municipal and NVCA structures to allow for the most effective implementation. The greatest change will be needed within the Municipality because the implementation of the Subwatershed Plan represents a new mandate. Just as the development of the Subwatershed Plan brought together divergent viewpoints, it will be necessary for all three municipalities to work together. They should form a structure that involves many of its departments and committees in the continuing implementation of the Plan.

It is recommended that the three municipalities undertake to form an <u>“Implementation Committee</u>”, as part of its endorsement of this Subwatershed Plan, as well as potential others in the future.

The Conservation Authority is structured in a manner, which is consistent with the responsibilities assigned to them under the Subwatershed Plan. There may however be a need to reorient some efforts and programs in order to increase liaison or delivery within the Black Ash Creek Subwatershed.

Funding responsibility is predominantly assigned to either the municipality or the proponent, although in some cases this responsibility rests with the NVCA or landowner. It is recommended that discussion continue within the Implementation Committee to assess

means of accessing provincial or federal sources of funding and reallocating resources to key areas such as agricultural land use improvement programs.

4.1 Monitoring

Despite our best efforts to establish a subwatershed management plan for the study area to maintain and enhance the features and functions of the natural environment, the plan is based on a finite set of information and assumptions about development timing, build-out period and human activity. Consequently, it is important that a set of indicators be established that can be monitored over time to determine if the components of the Management Plan have been appropriately determined and implemented. Monitoring will establish if changes to the plan need to be made to adapt to a different set of conditions. For example, changes may occur to stormwater management facilities as a result of post construction monitoring.

In addition, the subwatershed objectives, development standards and criteria could be adjusted in response to changes to our indicator, which is assessed by the stream health monitoring program (a biological monitoring program) of Black Ash Creek.

Stream health is a measure of how closely a stream's habitat, water quality and living community match its historical potential. We are able to evaluate a site's potential by comparing it to other streams (reference sites) that share similar physiological and historic attributes such as soil types, substrate, gradient, temperature, groundwater flows etc. but are still in a "pristine" (unimpaired) condition.

Biological monitoring was borne out of the concept that the community of living things at a site tells a lot about habitat and water quality. Benthic (bottom dwelling) invertebrates are particularly useful indicators and have been used in many studies:

- To establish baseline water quality conditions prior to development or other land use change. Various community indicators and analytical approaches can then be used to detect changes over time to habitat and water quality;
- as surrogate indicators and to provide early warning of potential impacts to the fish community;
- as diagnostic indicators to determine the magnitude, range of effect and cause of impairments to the aquatic system.

Our approach to biological monitoring uses the BioMAP (Biological Monitoring and Assessment Program) protocol. BioMAP enables a stream health prognosis to be made based on an assessment of the aquatic invertebrate community present at a site.

Biological monitoring has been and will continue to be an important component of the Black Ash Creek Subwatershed Study, through the "Flood Control Project "(channelization). It will be through this project that the Subwatershed Study will be able

benefit from the continued biological monitoring.

Table 3.3 outlines the specifics of the monitoring recommendations as part of the implementation strategy.

TABLE 3.3
Implementation Strategy - Subwatershed Plan Recommendations and Responsibilities

Subwatershed Plan Component	Recommendations (Action)	Lead Agency (support agency and/or advisory municipality)	Mechanism	Proposed Time Frame	Funding Responsibility
Constraint Areas (Natural Features and Hazards) –					
Natural Heritage system	Identify and protect the Natural Heritage system within the Watershed.	Municipalities; Approval Authority; Review Agencies	Designate the Natural heritage System in Municipal Official Plans and outline policies for their protection in accordance with the Provincial Polity Statement.	Upon completion of the Subwatershed Plan; and ongoing	Municipalities and Proponents
Natural Heritage System rehabilitation	Promote the rehabilitation (tree planting) of priority sites	Interest groups, agencies(NVCA), and landowners	Promotion, through planting programs, and contacts with potential partners	Ongoing	Landowners and/or partner organizations
Areas within flood or fill lines (Town of Collingwood reaches of Black Ash Creek and designated urban lands that were examined during this study)	Protect lands within flood and fill lines as no development lands	Town of Collingwood (NVCA)	Update and register flood and fill lines, based on HEC-RAS modelling from study. Delineate new hazard areas within OP land use schedules	Complete in 2000	Municipality
Areas within flood or fill lines (Other Collingwood developments requiring amendments to the OP and as-required areas for Township of Clearview and Town of The Blue Mountains)	Protect lands within flood and fill lines as no development lands	Town of Collingwood, Clearview Township and Town of The Blue Mountains (NVCA)	Update HEC-RAS computer models from this study and register flood and fill lines prior to development approvals. Delineate new hazard areas within OP land use schedules	Unknown at this time	Developers & Municipalities

Subwatershed Plan Component	Recommendations (Action)	Lead Agency (support agency and/or advisory municipality)	Mechanism	Proposed Time Frame	Funding Responsibility
All significant headwater recharge and discharge areas within Black Ash Creek, as well as adjacent watercourse systems (e.g. Pretty River, etc.) that provide baseflow to Black Ash Creek via aquifer underflow connections	Protect lands subject to a detailed water balance and groundwater study that incorporates data from the *"A-E-M-O-T Groundwater Management Plan"* study.	Clearview Township and Town of The Blue Mountains (NVCA and Town of Collingwood)	Designate lands in Official Plans prior to consideration of development	Complete by December 2001	MOE and Municipalities
Development Criteria					
Peak flow attenuation (NOTE: Not necessary for the Collingwood developments examined during this study)	Provide quantity control storage to prevent increased flood damage as specified in the Subwatershed Plan	Clearview Township and Town of The Blue Mountains (NVCA and Town of Collingwood)	Update hydrologic models from this study prior to the preparation of individual stormwater management (SWM) reports by developers. Final design submission would also be in parallel with submissions for subdivision approvals.	Unknown at this time	Developers
Water Quality	Provide quality storage as specified in the Subwatershed Plan	Municipality	Submission of preliminary or "Stage 1" stormwater management (SWM) report to include pre-design of facility conformance with Plan. Final design submission in parallel with submissions for subdivision approvals.	Immediate and ongoing	Developers
Erosion/Stream Morphology (Town of Collingwood reaches of Black Ash Creek and designated urban lands that were examined during this study)	Provide "interim" 2-year or "ultimate" 25mm storm quantity storage to prevent increased erosion potential from new urban development	Municipality (NVCA)	As above	Immediate and ongoing	Developers

Subwatershed Plan Component	Recommendations (Action)	Lead Agency (support agency and/or advisory municipality)	Mechanism	Proposed Time Frame	Funding Responsibility
Baseflow Augmentation	Refer to water quality/erosion requirements and proposed at-source control initiative				
Infiltration	Provide lot level infiltration (5-10mm of roof runoff) on suitable soils (moderate recharge/discharge areas) if development approved	Municipality (NVCA)	Require detailed hydrogeologic studies of potential recharge or discharge areas in Plan. SWM report to include, if appropriate, infiltration techniques to be employed	Immediate and ongoing	Developers
Erosion control during construction	Require preparation of Sediment and Erosion Control Plan for all new developments	Municipality (NVCA)	Preparation of the Erosion and Sediment Control Plan to be included in the conditions of draft plan approval	Immediate and ongoing	Developers
Two-Zone Flood Policy	Not examined during this study. This policy should be considered, however, by the NVCA on a "case-by-case" basis if Black Ash Creek Flood Control Project construction is not initiated in 2001.				
Complete update of flood and fill lines	Undertake detailed floodplain mapping and prepare flood / fill line maps for remaining watercourses designated on OP land use schedules prior to consideration of development	NVCA, Clearview Township and Town of The Blue Mountains	N/A	Complete by December 2001	NVCA and Municipalities
Construction inspection	Require regular inspection by a qualified environmental inspector during construction	Municipality (NVCA)	Agreement to provide an environmental inspector to be included in the conditions of draft plan approval	Immediate and ongoing	Developers
Erosion monitoring	Require regular inspection of receiving watercourse by a qualified environmental inspector during construction and for period of two years after completion of construction	Municipality (NVCA)	As above	Immediate and ongoing	Developers

Subwatershed Plan Component	Recommendations (Action)	Lead Agency (support agency and/or advisory municipality)	Mechanism	Proposed Time Frame	Funding Responsibility
Encourage environmentally sensitive site planning techniques	Promote the use of good site planning techniques which seeks to limit grading and retain smaller natural areas and watercourses	Municipality (NVCA)	Municipality to develop guidelines and encourage their use in subdivision design	Immediate and ongoing	Developers
Conservation and Management, Practices, Projects and Programs					
Floodproofing and Local Flood Protection (i.e. if the Black Ash Creek Flood Control Project construction is not initiated in 2001)	Provide local flood protection for structures identified from study's HEC-RAS modelling, as well as potential spill areas from the North and South Branch and affected lands of the Blue Mountain Mall	NVCA and Town of Collingwood	Evaluate feasibility, if the Black Ash Creek Flood Control will be delayed indefinitely. The spill hazard through Collingwood should be mapped using HEC-RAS and the Town's digital mapping database.	Complete in 2001	Town of Collingwood and NVCA
"At-source" Control Retrofit Program for Industrialized Areas	Investigate feasibility of "smart" Best Management Practices that re-use stormwater for process water. Integrated water balance, SWM and "green-roof" system opportunities would also be identified.	Affected Industry, Town of Collingwood and On-going Public-Private Research Initiatives	Preparation of a report that could be incorporated with any Subwatershed Plan Addendum. This addendum would therefore incorporate detailed water balance and groundwater modelling calculations	Complete by December 2001	Affected Industry, Town of Collingwood, Available Funding Grants from Government and Public-Private Research Sources
Climate, Streamflow and Biological Monitoring	Maintain/operate continuous monitoring devices from this study for at least one year – beginning Sept 2000. Continue biological monitoring of Black Ash Creek and the wetland at its mouth	Town of Collingwood and NVCA	Finalize calibration of hydrologic models prior to water balance and groundwater system modelling for the headwater basins. Data would be used to monitor potential impacts from future development within headwater basins and provide real-time flood forecasting capabilities for the NVCA. Real-time web-based data collection capabilities could be implemented (if approved) as part-of a 2000 *"Ontario GeoSmart"* research initiative . Continue the Stream Health Monitoring Program established by NVCA, through the flood control project and include the wetland at its mouth.	Completed by 2001 (i.e. minimum one year data collection period for model calibration with the GeoSmart research initiative) Ongoing, continue through the flood control monitoring program	Town of Collingwood, Developers, Local Industry and Environmental Groups, NVCA, and MOE

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