SALT CREEK RESTORATION PLAN

PREPARED BY: Michael Peppard

FUNDED BY: The New Ontario Trillium Foundation

IN PARTNERSHIP WITH:
Quinte Watershed Cleanup Inc., The Salt Creek Landowners' Association,
Lower Trent Conservation, The Northumberland Stewardship Council
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To all those groups and individuals who participated in and lent their support to the Salt Creek Community Based Restoration Project, I would like to give our sincerest thank-you's.

The New Ontario Trillium Foundation

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And a special thank-you to Barry Jones who acted as supervisor to the project.

Sincerely, Michael Peppard; Project Coordinator
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INTRODUCTION

The restoration of our natural environment is not a goal, in and of itself. Rather, the desire for clean air, soil and water, upon which we depend for our existence, is the key driving force behind efforts to reduce the impact we have on the natural world. The need to find a place for ourselves in nature, without destroying it, and our livelihoods in the process, should be our common goal. In this light, it is individuals, and the community as a whole, who are in the best position to achieve these goals.

The restoration of Salt Creek is one such community-based effort. This manual, "The Salt Creek Restoration Plan", is designed to serve as a guide in these efforts. It sets out as much available information as possible, on the state of Salt Creek and its' surrounding landscape. This information is then put forward in such a way as to provide some direction, in terms of future landowner restoration activities. Finally, this manual includes details on methods which can be used by landowners in their future restoration efforts.

The key to the success of efforts to restore Salt Creek, will be the involvement of as many members of the community, as possible, in the process.

VISION STATEMENT : Future Direction: "Where do we hope to be"
This aspect of a community-based restoration plan should be completed by members of the community who should describe what they would like to ultimately achieve in their efforts to restore Salt Creek (eg. clean, sediment free, trout stream).

GOALS : "What can we achieve?"

- The establishment of an action plan designed to manage a step by step rehabilitation of Salt Creek and its' drainage basin.
- The involvement of all landowners in efforts to restore and protect the land, in such a way as to aid in the restoration of Salt Creek.

OBJECTIVES : "How can our goals be realized?"

- The implementation of the management plan.
- Use of the management plan to bring additional landowners into the process of managing the restoration of Salt Creek.
- Encourage awareness, and educational initiatives, on the part of the community, such that decisions which are made by landowners do not negatively impact upon the creek.
SALT CREEK RESTORATION PLAN

- Watershed Boundary
- ANSI: Areas of Natural And Scientific Interest
- Environmentally Sensitive Areas
- Vegetation
- Lake / River / Reservoir
- Wetland
- River / Stream
- Road
- Accessway
- Bridge
- Rail Line
- Rail Line - Abandoned
- Transmission Line
- Lots and Concessions
PART 1: SALT CREEK STATE OF THE WATERSHED REPORT

Salt Creek is one of many large water courses draining into the Trent River. The headwaters of this cold water trout stream, arise within the Oak Ridges Moraine. Downstream, the creek enters a drumlinized till plain, and meanders through gravelly, wooded areas and wetland before entering the heavily farmed sand plains in Cramahe Twp. The total area of the Salt Creek drainage basin is 9246.3 hectares, the length of the creek is 23.6 km and the average gradient is 6.3 metres per kilometre. The final reaches of Salt Creek pass through the edge of Murray Marsh before emptying into the Trent River.

The Salt Creek Landowners Association is a volunteer group of landowners on the banks of Salt Creek. The goal of this organization is the successful rehabilitation of their watercourse, through cooperative, community based efforts. Projects to date, have included land retirement, cattle access restriction, stream bank stabilization (bank bio-engineering) and tree planting.

Organizations which have worked in cooperation with the landowner association include, the Northumberland Stewardship Council, the Rural Water Quality Program and Quinte Watershed Cleanup Inc. (both: Bay of Quinte Remedial Action Plan), Lower Trent Conservation, the Ministry of Natural Resources, and the County of Northumberland.
(A): GEOGRAPHICAL FEATURES

(1): LANDSCAPE

The physiography of the Salt Creek sub-watershed, refers to the geographical features which define the landscape of the area. Historically, it has been glaciers which have shaped this region, both with an ancient embayment of glacial Lake Iroquois (now Lake Ontario), and with the creation of the Peterborough drumlin fields. This combination has created a pattern of clay flats and drumlin hills, through which the creek flows. The massive Oak Ridges Moraine (also a glacial feature) extending from the Niagara Escarpment, eastward to the Trent River serves as the key recharge area for the headwaters of the creek. The smaller drumlins, sand plains and wetlands throughout the sub-watershed, all serve as important water retention and recharge areas for the many tributaries feeding downstream reaches of Salt Creek.


(2): WATER

Owing to the numerous seepage areas, deep deposits of sand and gravel, and well developed wetland systems, Salt Creek constitutes a regionally important groundwater recharge zone, discharge and water detention area, and an important tributary to the Trent River.

![Figure 2.4 The hydrologic cycle on a watershed scale.](image-url)
(3): SOILS

The soils of the Salt Creek sub-watershed are as varied as the landscape. Pontypool Sand is found in the headwaters region, overlying the Oak Ridges Moraine. This quickly gives way to the Granby sandy loams found within the Salt Creek Wetland, and the Brighton sandy loams found just upstream of the town of Norham. The main channel of Salt Creek, downstream of Norham, flows through a narrow band of Simcoe silty clay loam, before encountering Stockdale silt loam in the vicinity of the Correctional Institute, and finally a gravelly / sand mix before entering the Marsh soils of Murray Marsh.

(Agriculture Canada, 1974. Soils of Northumberland County.)

Overall, the soil types found within just a few metres of the creek are quite variable, becoming even more so when the entire sub-watershed is considered. This variation means significant differences exist all along the creek. Differences in terms of, the quality of agricultural land, landuse, natural vegetation cover and perhaps, most importantly, differences in susceptibility to erosion and disturbance.

Differences in soil types along the length of Salt Creek may mean that some areas are more susceptible to slumping and erosion than others. The lesson here is that each stretch of the creek may have its own unique set of problems and no single solution may be optimal for all of the problems found along Salt Creek.
(B): NATURAL AREAS

As already noted, the landscape and soils of the Salt Creek sub-watershed are highly diverse. The natural areas are just as much so. From the Oak Ridges Moraine headwaters, to the Salt Creek wetland complex; from the Red Cloud Cemetery prairie preserve, to the Cramahe Hills and Murray Marsh, the Salt Creek sub-watershed is significant in terms of regional rarity and diversity.

(1): OAK RIDGES MORaine

The Oak Ridges Moraine stands out as one of the most distinctive landscape units of Southern Ontario. Its general altitude is about 1,000 feet above sea level.

It extends from the Niagara Escarpment to the Trent River, forming the height of land dividing the streams of the Lake Ontario drainage basin from those flowing into Georgian Bay and the Trent River system. In Haldimand Township the highest point on the moraine is 1,175 feet above sea level. For the most part, the hilly topography (lay of the land) on top of the moraine is composed of sandy or gravelly materials, overlying the mixed till (rock, gravel, sand, clay) of the moraine itself.

This upland area is the source of many streams which drain the till plains on either side of it. Water drains vertically down through the sand and gravel, eventually moving laterally, and reappearing as springs along the slopes of the moraine. The original vegetation of the area was a mixed forest of pine and hardwoods. Much of this forest has been lost leaving exposed the sandy soil which is subject to blowing. (Chapman L.J. and Putnam D.F. 1984. The Physiography of Southern Ontario. Ontario Ministry of Natural Resources)

The characteristic soil of this type of moraine is droughty and unstable under cultivation, or even pasture. Attempts to stabilize these soils with pine plantations have been relatively successful in a number of areas.

The eastern end of the Oak Ridges Moraine serves as the headwater source for Salt Creek, as well as a number of others in the lower Trent watershed. It is therefore perhaps the most important area of the Salt Creek sub-watershed which requires protection. Forest and natural vegetation cover is required to maintain the flow of these springs and their related streams. Any loss of forest cover, or other disruptive land use in this area, will have a significant impact upon the entire creek.
Principally, it is this source of cold ground water which allows Salt Creek to flow throughout the driest summer months and which provides for valuable cold water trout habitat.

(2): SALT CREEK VALLEY NATURAL AREA

Condition / Quality of Plant Communities
The complex of wetlands, ravines and slopes associated with the upper reaches of Salt Creek are very diverse in terms of landforms and vegetation communities. Extensive shrub thicket, conifer and mixed forest swamps are associated with the creek. The steep valley slopes were modified by the wave action of the glacial Lake Iroquois, and support high quality forest of unusual composition. Provincially rare, dry, woodland and remnant tall-grass prairie communities are present on the moraine and sand plain in the western and central portions of the area. Other significant plant communities range from spicebush seepage slopes, to dry, black oak/white oak/red maple/white pine woodland and white pine/white cedar forest.

The area supports a relatively high proportion of high quality plant communities containing 8, provincially rare plant species, and 19 plant species which are considered rare in Eastern Ontario. Two bird species considered to be rare within the Lake Ontario region have also been recorded in the area (Golden-crowned Kinglet and Canada Warbler). Overall, the upper reach of the Salt Creek valley contains a total of 107 different natural vegetation communities.(Brownell V.R. and Blaney S., 1996. Lower Trent Region Natural Areas, Volume 3.)

Of particular importance to the whole of Salt Creek, the wetland portion of this natural area is considered to be a major recharge area and spring source for the creek. The additional function of retaining water serves to alleviate the impact of high spring flows, while slowly releasing water back into the creek, alleviating the impact of hot dry weather.
Overall, the quality of the area is very high. But recent logging has occurred in several sections of mixed swamp forest and in the deciduous forest in the southeast corner. Other communities are recovering from more distant past disturbances, including logging, clearing for agriculture, and grazing by cattle. Several forest communities were rated as mature or potential old growth and as being good to excellent in quality.

Linkage To Other Natural Areas
The western end of Salt Creek is located about 3 km east of the Burnley-Carmel Headwaters Significant Natural Area, with the region between containing good forest cover. This linkage and the long east-west shape of the Salt Creek Valley may make it important as a linkage between Murray Marsh and the forested uplands of the Oak Ridges Moraine.

Vulnerability
The Salt Creek Valley Natural Area wetland is relatively large but remains vulnerable, owing to the numerous roads which criss-cross it, and the adjacent landuse of cropland, pasture and low density residences.

Recommendations
Recommendations as to how best to preserve and protect this area include, avoiding activities which may heavily disturb the natural communities, encouragement of selective logging practices instead of clear-cutting (especially on steep slopes), and determining how important the area is in terms of trout spawning and rearing.

Rare and Significant Species

Plants: panic grass, blazing star and juneberry, riverbank wild rye, black oak, northern black currant, butterfly weed
Birds: red-shouldered hawk, golden-crowned kinglet, Canada warbler, blackburnian warbler
Fish: spawning and rearing site for speckled trout
Mammals: locally significant for white-tailed deer
(3): RED CLOUD CEMETERY

Red Cloud Cemetery is a representative area of prairie grassland that once covered large parts of southern Ontario. Prairies were found where the soils were sandy and prone to drought. The Rice Lake Plain in Northumberland Co. was once prairie, and savanna woodland. Presently, less than 1% of this type of habitat is left in the province.

The cemetery is included within the boundaries of the Salt Creek Valley Natural Area. This site is another representative example of the diverse natural ecosystems found within the Salt Creek sub-watershed. Rare species found here include, grasses such as Big blue stem, Little blue stem and Indian grass. Wildflowers such as Butterfly weed and Blazing star are also found on-site. (Brownell V.R, and Blaney S. 1996. Lower Trent Region Natural Areas: Volume 3.)

(4): CRAMAHE HILL COMPLEX

A portion of the Cramahe Hills is located within the Salt Creek sub-watershed. Altogether, seven separate blocks of natural habitat make up this natural area. Here, there remains potential old growth forest, three important ravine systems and a headwater and seepage area. The Carolinian species, spicebush, reaches its northern limit in eastern Ontario within these hills.

The Cramahe hills, which are located in a line just north of the town of Codrington, are deeply underlain by sand, silt and gravel. There are found within these hills, large areas of major springs and seeps, which act as headwater sources of Marsh Creek as well as two tributaries of Salt Creek. (Brownell V. and Blaney S. 1996. Lower Trent Region Natural Areas: Volume 3.)
Vegetation Community Representation and Diversity
The Cramahe Hills Complex support good examples of rare forest communities, and may contain potential old-growth forest sites with age estimates of 90 to 100 years.

Condition / Quality of Plant Communities
Those sites not being used for agriculture are in fairly good condition. Some forest areas are still recovering from past grazing, while portions of the largest central hills are still being grazed. As well, recent logging has taken place in the southern fragments. Most recently, a number of new homes are under construction at the north-east corner, bordering an important tributary to Salt Creek.

Species Diversity and Rare Species
Rare Plants: sedge, and ginseng
Rare Bird Species: six in total are considered rare within the Ontario Lowlands area (Blue-gray Gnatcatcher, Blue-winged Warbler, Brewster's Warbler, Wild Turkey, Solitary Vireo, Magnolia Warbler)

Linkage To Other Natural Areas
The Cramahe Hills are significant as they provide an important node or linkage point of natural area joining Salt Creek, Cold Creek and Murray Marsh.

Vulnerability
The total area of the Cramahe Hills Complex is small (149.3 ha) and is broken into fragments by a variety of landuse activities. It is therefore highly vulnerable to disturbance and degradation. A loss of natural vegetation cover could heavily impact upon the regions ability to act as a source of clean recharge water for the tributaries of Salt Creek.

Recommendations
Some of the recommendations for the area in terms of preserving into the future include, an investigation of potential old-growth forest communities, and the owners of the site should be encouraged to avoid pasturing cattle within the existing natural habitats.
(5): MURRAY MARSH

Salt Creek, Marsh Creek and a number of intermittent streams, pass through Murray Marsh. Overland drainage from the surrounding countryside also flows into the area. The marsh (once part of an ancient embayment of glacial Lake Iroquois) serves as a flood water storage area for the Trent River. This valuable wildlife resource provides nesting and feeding sites for over 100 bird species. Of particular interest, a heronry can be found in the north-west portion of the marsh. Numerous migrating waterfowl species also use the marsh as a resting and feeding area, while deer find cover here in the winter. The diversity of the marsh habitat includes at least 13 different major vegetation communities. Approximately 300 plant species and over 85 species of trees and shrubs are found there. (Murray Marsh, Biophysical Inventory. 1982. LTRCA)

The health of the marsh and the natural communities found along the Salt Creek valley are intimately linked. The mouth of the creek flows through the north-west end of the marsh and the Salt Creek sub-watershed itself acts as a natural corridor between the marsh and the upland areas of the Cramahe Hills and the Oak Ridges Moraine.
STATE OF THE FISHERY

Analysis of current fisheries habitat conditions on Salt Creek have determined that the system is moderately sensitive to the effects of landuse and disturbance. That is, a sufficient amount of degradation of the creek has occurred in the past that the creek is no longer considered to be pristine. However, its conditions remain in a reasonably healthy state that landuse activities are more than capable of degrading the creek further.

(1): Fish Species Collected From Salt Creek

( Ontario Ministry of Natural Resources. 1997. Stream Survey. )

BROWN TROUT - SENSITIVE
BROOK TROUT (STOCKED) - MODERATELY SENSITIVE
SMALLMOUTH BASS - MODERATELY SENSITIVE
WHITE SUCKER - TOLERANT
CARP - TOLERANT
ROCK BASS MODERATELY SENSITIVE
JOHNNY DARTER - MODERATELY SENSITIVE
FALLFISH - TOLERANT
BROOK STICKLEBACK - MODERATELY SENSITIVE
MOTTLED SCULPIN - SENSITIVE
BLACKNOSE DACE - TOLERANT
LONGNOSE DACE - SENSITIVE
PEARL DACE - TOLERANT
FATHEAD MINNOW - TOLERANT
CREEK CHUB - TOLERANT

*For definitions of sensitive, moderately sensitive and tolerant see Glossary pg.

(2): HABITAT REQUIREMENTS FOR SENSITIVE FISH SPECIES

BROOK TROUT: high quality water and high quality in-stream cover preference; prefers cold, clear well oxygenated streams and lakes; spawning in shallow headwaters over gravel beds with ground water upwelling and moderate current.

MOTTLED SCULPIN: High quality water and high quality cover preference; cold water fish which prefers, cool, low volume streams and rivers and also lakes.

LONGNOSE DACE: High quality water and high quality cover preference; prefers clean, swift-moving, gravel/ boulder streams, and rarely, the lake-shore waters of lakes over gravel / boulders.
(D): EXAMPLES OF CONDITIONS ON SALT CREEK

Areas of Concern: Stream cover is extremely low throughout much of the system; poor quality habitat is most evident in a number of upstream reaches which may have implications for the entire system.

LANDUSE
41% : Developed, agricultural, open and low density
59% : Natural vegetation and wetland
(E): EXISTING ASSESSMENTS / REPORTS

Provided within this section of the State of the Watershed Report, are the combined results of two assessments of the environmental conditions on Salt Creek. The first and most recent of these is a 1997 stream assessment study conducted by the Ministry of Natural Resources, Peterborough District. Stream reaches upstream of the town of Norham were largely absent from this study however. As such, data from an earlier (1970's) study by Lower Trent Conservation, was used to supplement the information. In addition, the information from those sites on Salt Creek which were examined in both studies, were compared to see what changes if any, had taken place on the creek, over the past twenty years.


*Please see accompanying map on page for site locations.

Habitat Conditions Within Stream Reach Units

(a) Main Channel from Trent River to Norham (lower reach)
*Cold water is required for year-round inhabitation by sensitive trout species, cool water is suitable for spring migration

Site sc 40: Juncture of Salt Creek and McCann Tributary: June-July 1997

<table>
<thead>
<tr>
<th>23 C cool but not cold water</th>
<th>good substrate conditions</th>
<th>adjacent vegetation is &gt;60% natural cover i.e. forest and shrub swamp &amp; 40% agricultural</th>
<th>fish species include the sensitive species: Longnose Dace and Mottled Sculpin</th>
<th>stream bank stability is rated as moderately unstable</th>
</tr>
</thead>
</table>

Site sc 39: At north juncture of McCann Rd. & Hwy. 30: June - July 1997

| 21 C cool but not cold water | good substrate conditions | adjacent vegetation is 60% natural and golf course | fish species include the sensitive: Longnose Dace | stream bank stability is rated as highly unstable |
Site sc 32: At the upstream end of the Salt Creek Golf Course: June - July 1997

| 21°C cool but not cold water | fair substrate conditions only 40% rock, gravel, rubble 60% sand/silt | adjacent vegetation is close to 100% native cover of hardwood & shrub swamp (this may have changed since input of golf course) | fish species include the sensitive: Mottled Sculpin | stream bank stability is rated as moderately unstable |

(b) Lower Reach Tributaries

Site sc 37: At crossing of County Rd. 29, north of Correctional Institute: June - July 1997

| 17°C cold water | poor substrate conditions only 10% gravel with 90% silt/muck/detritus | 30% swamp and 70% marsh and agriculture | central mudminnow is the only species found at this site | stream bank stability is rated as stable |

Site sc 41: At south juncture of McCann Rd. and Hwy. 30: June - July 1997

| 16°C cold water | good substrate conditions 60% rubble and gravel & 40% sand & clay | forest and swamp over 60% remainder is agriculture | sensitive fish species include: longnose dace, mottled sculpin, and moderately sensitive brook stickleback | stream bank stability is rated as moderately unstable |
Site sc 38: At point where ditched tributary enters south end of Pine Ridge Golf Course

| 14 C cold water conditions | fair to poor substrate conditions 30% gravel, 70% sand, detritus and clay | over 80% native vegetation cover with golf course on one side | sensitive fish species include: longnose dace, mottled sculpin, stream bank stability is rated as highly unstable |

Site sc 42: Rd. crossing upstream of site 38; lot 6 con. 10, Cramahe Twp.

| 11 C cold water conditions | good substrate conditions 60% rock, boulder, gravel | over 80% native vegetation cover of hardwood/conifer & shrub swamp with some agriculture | sensitive fish species include: brook trout and mottled sculpin, stream bank stability is rated as moderately unstable |

Site sc 35: At point where County Rd. 29 crosses 1st tributary west of Hwy. 30, which flows south into the Pine Ridge Golf Course

| tributary was dry temp. data not available | substrate conditions are fair with: 50% rubble, & gravel and 50% sand, silt and detritus | adjacent vegetation and landuse is 100% agricultural | tributary was dry, stream bank stability was rated as stable |
### Site sc 30: Newman Drive crosses 2nd tributary west of Hwy. 30 & west of site 38

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Substrate Conditions</th>
<th>Vegetation Cover</th>
<th>Fish Species</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 C</td>
<td>cold water</td>
<td>poor</td>
<td>hardwood swamp</td>
<td>no fish species</td>
</tr>
<tr>
<td></td>
<td>conditions</td>
<td>substrate</td>
<td>60% of adjacent</td>
<td>collected</td>
</tr>
<tr>
<td></td>
<td>only 10% boulder</td>
<td>vegetation</td>
<td>and the remainder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with 90% sand,</td>
<td>cover</td>
<td>is shrub swamp</td>
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<tr>
<td></td>
<td>muck, detritus</td>
<td>and agriculture</td>
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</tbody>
</table>

**Conditions:**
- Poor hardwood swamp
- Cold water substrate
- 60% of adjacent vegetation cover
- The remainder is shrub swamp
- No fish species collected
- Stream bank stability was rated as moderately unstable

### Site sc 34: On tributary flowing south to east end of Salt Creek Golf Course (upstream at crossing of Norham Rd.)

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Substrate Conditions</th>
<th>Vegetation Cover</th>
<th>Fish Species</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 C</td>
<td>cold water</td>
<td>poor</td>
<td>all adjacent land is native vegetation: upland conifer forest, swamp hardwood and shrub swamp</td>
<td>no fish species collected</td>
</tr>
<tr>
<td></td>
<td>conditions</td>
<td>substrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>only 10% rock and</td>
<td>vegetation cover</td>
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</tr>
<tr>
<td></td>
<td>90% is silt, muck</td>
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<tr>
<td></td>
<td>&amp; detritus</td>
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</tbody>
</table>

**Conditions:**
- Poor all adjacent land
- Cool water substrate
- Covered by native vegetation: upland conifer forest, swamp hardwood and shrub swamp
- No fish species collected
- Stream bank stability was rated as moderately unstable

### Site sc 31: Norham Rd. crosses tributary which enters Salt Creek on property just west of Salt Creek Golf Course

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Substrate Conditions</th>
<th>Vegetation Cover</th>
<th>Fish Species</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 C</td>
<td>cool water</td>
<td>poor</td>
<td>all adjacent land is covered by native vegetation: upland hardwood, upland conifer and swamp hardwood</td>
<td>no fish species were collected</td>
</tr>
<tr>
<td></td>
<td>conditions</td>
<td>substrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>only 10% rubble &amp;</td>
<td>vegetation</td>
<td></td>
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<tr>
<td></td>
<td>90% is sand, silt,</td>
<td>cover</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; detritus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Conditions:**
- Poor all adjacent land
- Cool water substrate
- Covered by native vegetation: upland hardwood, upland conifer and swamp hardwood
- No fish species were collected
- Stream bank stability was rated as highly unstable
Site sc 29: At point where north flowing tributary enters south-east end of lot 20, con. 1, Percy Twp.

| tributary was dry | very poor substrate conditions: 100% sand, silt, muck, & detritus | adjacent landuse and vegetation cover consisted of a grassed waterway with agricultural land on either side | no fish species collected | stream bank stability was rated as stable |

Site sc 36: Juncture of Norham Rd. and ditched tributary which enters east side of Honey property

| 13 C cold water conditions | fair substrate conditions with 40% gravel & the remainder is sand, silt, muck, & detritus | all adjacent land is covered by native vegetation of upland conifer and swamp hardwood / shrub swamp | sensitive fish species include: brook trout | stream bank stability was rated as highly unstable |

Site sc 28: Tributary & road crossing site just west of site 29 (south end of lot 19)

| seasonal flow but was still running 19 C cold water conditions | poor substrate conditions: 100% sand, muck, detritus | grassed waterway with agricultural fields on either side | no fish species collected | stream bank stability was rated as stable |
### Site sc 33: Norham Rd. and tributary which enters west side of Lot 19 / Con. 2

| tributary was dry | fair to poor substrate conditions with 30% gravel and 70% sand, silt, detritus | 100% native vegetation cover of upland conifer, swamp hardwood and grass field | no fish species were collected | stream bank stability was rated as stable |

### Site sc 25: On tributary which flows north to south through the town of Norham

| 18 C cold water conditions | very good substrate conditions 70% rock, rubble, & gravel | adjacent land is covered 100% by native vegetation: swamp hardwood and shrub swamp | no fish species collected | stream bank stability was rated as stable |

### Site sc 27: Upstream site from site 25 on same tributary, just south of Warkworth

| 18 C cold water conditions | substrate conditions are poor with only 20% rock and boulder cover and 80% muck & detritus | adjacent land is covered by hardwood and shrub swamp 70% and 30% by agricultural and residential land | no fish species were collected | stream bank stability was rated as stable |
(c) Main Channel from Norham to Salt Creek Wetland Complex
(mid reach)

Site sc 16: Approximately 500 metres upstream of old Norham Dam

| 14 C cold water conditions | poor substrate conditions with only 10% rubble and 90% sand, muck, & detritus | 50% native vegetation cover: upland hardwood forest, swamp hardwood & shrub swamp and 50% agriculture | no fish species collected | stream bank stability was rated as highly unstable |

(d) Large Tributary to mid reach channel at Norham

Site sc 20: At crossing of Gravel Rd. in Norham with large north-west tributary

| 18 C cold water conditions | fair substrate conditions with 40% gravel and 60% sand, marl, & detritus | vegetation cover on adjacent land: upland hardwood 10%, swamp hardwood 70%, shrub swamp and agriculture 20% | fish species collected include the sensitive longnose dace, the moderately sensitive common shiner and the tolerant northern redbelly dace | stream bank stability was rated as moderately unstable |
## Site sc 19: Upstream of site 20 half-way between Norham and County Rd. 25

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
<th>Vegetation</th>
<th>Fish Species</th>
<th>Stream Bank Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>19°C cold water</td>
<td>poor substrate conditions with only 5% gravel and 95% sand, silt, &amp; detritus</td>
<td>adjacent vegetation cover: 40% upland hardwood, 20% swamp hardwood and 40% mixture of shrub swamp and agriculture and residential land use</td>
<td>fish species collected: brown trout (sensitive), and spottail shiner</td>
<td>stability was rated as highly unstable</td>
</tr>
</tbody>
</table>

## Site sc 17: Crossing point of County Rd. 25 and north-west tributary-upper branch

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
<th>Vegetation</th>
<th>Fish Species</th>
<th>Stream Bank Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>15°C cold water</td>
<td>poor substrate conditions with only 10% gravel on the stream bottom and 90% sand, silt, detritus &amp; clay</td>
<td>vegetation cover on adjacent land: upland hardwood 40%, swamp hardwood 20%, and a mixture of shrub swamp and agriculture (pasture) 40%</td>
<td>fish species collected include the sensitive brown trout and the tolerant blacknose dace and bluntnose minnow</td>
<td>stability has been rated as moderately unstable</td>
</tr>
</tbody>
</table>
Site sc 18: Crossing point of County Rd. 25 & north-west tributary - lower branch

<table>
<thead>
<tr>
<th></th>
<th>14°C cold water conditions</th>
<th>very poor substrate conditions in the creek at this site 100% sand, silt, muck and detritus</th>
<th>adjacent lands: 50% shrub, 50% mixture of marsh and agricultural land</th>
<th>fish species collected include: blacknose dace, hornynosed chub, northern redbelly dace, spottail shiner</th>
<th>stream bank stability rated as moderately unstable</th>
</tr>
</thead>
</table>

(e) Tributaries to mid reach channel

Site sc 22: At first tributary upstream of old Norham dam

<table>
<thead>
<tr>
<th>tributary dry during summer</th>
<th>no substrate data available</th>
<th>vegetation cover on adjacent land: 80% upland hardwood and 20% a mixture of marsh and agriculture</th>
<th>no fish collected</th>
<th>no data on bank stability</th>
</tr>
</thead>
</table>

Site sc 23: Upstream of site 22 where tributary crosses Percy / Cramahe Twp. line

<table>
<thead>
<tr>
<th>tributary dry</th>
<th>no data</th>
<th>adjacent vegetation cover: 50% upland conifer, 10% swamp hardwood, 30% swamp conifer, 10% shrub swamp</th>
<th>no data</th>
<th>no data</th>
</tr>
</thead>
</table>

### Site sc 21: see map for site location

| tributary dry | no data | adjacent vegetation: 80% swamp hardwood and 20% a mixture of marsh and agricultural land | no data | no data |

### Site sc 26: Please see map for site location

| tributary dry | no data | adjacent vegetation is 70% swamp hardwood and 30% is a mixture of shrub swamp and agricultural land | no data | no data |
(Ontario Ministry of Natural Resources. 1997. Stream Survey: Salt Creek)
(2) LOWER TRENT STREAM ASSESSMENT DATA: 1970'S

Data collected from three sites on the upper reaches of Salt Creek by Lower Trent Conservation (during the 1970's) is provided below in order to supplement the Ministry of Natural Resources database above.

(f) Salt Creek Wetland Complex: (Lower Trent Conservation, 1976)
*Please refer to accompanying map on next page for site locations

*Only 3 sites from this older study which were not included within the more recent 1997 study, are listed here*

Site 5: see map for location: lot 30, con. 10 Cramahe Twp.

<table>
<thead>
<tr>
<th>no temperature data</th>
<th>fair quality substrate of gravel, sand, rubble, and detritus</th>
<th>shading of creek is fair with 80% partial sunlight</th>
<th>fish species collected include the mottled sculpin, a sensitive species</th>
<th>stream banks stable</th>
</tr>
</thead>
</table>

Site 6: On main channel south of Oak Heights: lot 3, con. 7, Haldimand Twp.

<table>
<thead>
<tr>
<th>no temperature data</th>
<th>fair quality substrate in creek: gravel, sand and silt,</th>
<th>shading of creek is somewhat poor with 70% full sunlight</th>
<th>fish species collected include the sensitive brook trout</th>
<th>stream banks are moderately unstable</th>
</tr>
</thead>
</table>

(4) Headwater Tributaries and Tributaries to Upper Reaches
Site 10: Morganston Dr. & Tait Rd.

<table>
<thead>
<tr>
<th>no temperature data</th>
<th>poor substrate quality 100% silt, sand, &amp; muck</th>
<th>shading of creek is very poor with 100% full sunlight</th>
<th>sucker minnows collected</th>
<th>stream banks are considered to be highly unstable</th>
</tr>
</thead>
</table>
Lower Trent Conservation. no date. Stream Assessment Data. *(1970's data)
CHANGES OVER TIME IN STREAM ASSESSMENT RESULTS

A number of sites along the lower reaches of Salt Creek were tested both in the 1970's (O.M.N.R.) and again in 1997 (LTC). Looking at changes which may have occurred over this time period can help to show whether or not the creek has improved, worsened or remained about the same.

i) North juncture of McCann Rd., Hwy. 30 and Salt Creek has gone from stable to highly unstable over an approximately 20 year period (1970's to 1997), but substrate conditions have improved somewhat and more species of fish were collected in 1997.

ii) At the site where the tributary flowing south from Warkworth enters Norham, the tributary to Salt Creek appears to have changed little in terms of being in good shape overall.

iii) At the site approximately 500 metres upstream of the old Norham Dam, conditions in the 1970's were found to be poor in terms of unstable banks and heavy siltation, and this remains the case today.

iv) At the crossing point of Gravel Rd. in Norham with the large north-west tributary (tributary 13 on assessment map), conditions appear to have improved somewhat, particularly in terms of reduced sediments on the creek bottom and an increase in the number of fish species collected here, especially sensitive species.

It would appear from comparing these two sets of duplicate site assessments that there has been a mix of change and stability. Some improvements have occurred in some areas and a worsening of conditions in others.
PART 2: ON-SITE ASSESSMENT OF THE LOWER REACH OF SALT CREEK (HWY. 30 TO NORHAM): 1999

The lower reach of Salt Creek has been under active cultivation for over a century. Combined with the added stresses imposed by upstream landuse activity, the lower reach of the creek has been significantly disturbed and degraded over time. At the request of the Salt Creek Landowners' Association, the management plan for the creek is complemented with a more intensive assessment of this reach of the creek.

(A): GENERAL DESCRIPTION

The reach of Salt Creek between the town of Norham and Hwy. 30, is characterized by the strong meandering of the creek over a low gradient landscape of clay plain, overlain by sand, with steep valley slopes which channel a number of small tributaries quickly downhill into the main channel.

These general characteristics mean that this reach of the creek, is susceptible to the degradation associated with the removal of natural vegetation, intensive agricultural activity, and ditching or channelizing of water-ways.

The history of landuse in the area has meant that these activities, along with the construction of roads, culverts and dams have all occurred, over the last century. The consequences of these activities have resulted in significant changes. Within the Norham to Hwy. 30 reach, there has been a significant increase in the meandering of the creek, an increase in both stream bank and sheet erosion followed by siltation (covering over with soil and silt) of riffle (fast-flowing rocky areas) and pool areas within the creek. The result has been a reduction in water quality, an increase in water temperature and loss of fish and wildlife habitat.

The assessment of this reach of the creek has revealed that a few key problems are common along the entire reach. The single greatest issue facing this reach and indeed much of the creek would be the lack of adequate buffers of natural vegetation along the watercourse. This is true along stretches of the main channel and along tributaries especially. A wide buffer of natural vegetation (minimum 15 metres) has the ability to reduce the impact on the watercourse of many land use activities. The combination of loss of buffers, loss of topsoil, erosion of stream banks and nutrient/chemical run-off, has resulted in a serious deterioration in the health of the creek.
Over the past few decades, land use along this stretch of the creek has changed. There are less livestock being grazed in the area, and turf - grass (golf course and residential) has replaced pasture in some areas. Likewise, some floodplain lands have been retired. At the same time, however, numerous tributaries have been ditched / channelized, and low density residential areas have been subdivided into more concentrated housing communities. Over time, there will no doubt will be more changes to the way the land in this lower stretch of valley is used.
(B): ISSUES / IMPACTS / OPTIONS (Lower Reach)

The biggest issue locally, facing this reach of creek would be inadequate buffers of natural vegetation along the creek, tributaries, ditches.

Local problems can be caused by both activities within the immediate area and activities far upstream as well.

Outlined in the table below is a list of problems facing the creek just within the reach between Hwy. 30 and the town of Norham. Although the issues are specific to this area, a number of them are common throughout the entire length of Salt Creek.

<table>
<thead>
<tr>
<th>ISSUES</th>
<th>IMPACTS</th>
<th>OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STREAM BANK EROSION</td>
<td>siltation of the creek / loss of fish habitat</td>
<td>bio-remediation (see glossary of terms), vegetation buffers, rip-rap(rock)</td>
</tr>
<tr>
<td>STREAM BANK SLUMPING</td>
<td>loss of sizeable areas of floodplain land with siltation of the creek / fish habitat</td>
<td>buffers of natural vegetation and avoid using heavy equipment near the creek where possible</td>
</tr>
<tr>
<td>EROSION OF TRIBUTARIES / DITCHES</td>
<td>siltation of the creek</td>
<td>vegetation buffers, drop structures, no ditching</td>
</tr>
<tr>
<td>Siltation of the Creek including Riffles (high flow rocky areas) &amp; Pools (of deeper water)</td>
<td>loss of fish habitat through in-filling of pools and suffocation of riffle areas for feeding and spawning</td>
<td>vegetation along stream banks will help to slow the flow of water thus allowing excess sediments to drop out and settle on the banks (particularly during spring flooding)</td>
</tr>
<tr>
<td>LACK OF NATURAL VEGETATION BUFFERS</td>
<td>increased bank erosion, increased in-put of topsoil, nutrients and chemicals into the creek, increased water temperature where there is no shading, and loss of fish and wildlife habitat</td>
<td>stop ploughing or cutting or grazing livestock next to the creek, seed the area &amp;/or plant shrubs and trees</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>NUTRIENT, CHEMICAL AND SEDIMENT RUN-OFF INTO THE CREEK</td>
<td>reduced water quality, loss of fish habitat and poisoning of fish and wildlife</td>
<td>avoid applying close to the creek, establish vegetation buffers to capture run-off before it reaches the creek</td>
</tr>
<tr>
<td>WORKING / GRAZING, LOW FLOODPLAIN FIELDS</td>
<td>erosion, slumping or banks and more topsoil run-off into the creek</td>
<td>retire low floodplain fields, establish wider buffers, maintain a cover crop</td>
</tr>
<tr>
<td>LACK OF COVER CROPS, PARTICULARLY WITHIN THE FLOODPLAIN</td>
<td>during heavy rainfall, snow-melt events or during spring run-off, these fields are especially likely to loose large amounts of topsoil and nutrients into the creek</td>
<td>use no-till, conservation tillage practices and always maintain a cover crop</td>
</tr>
<tr>
<td>WORKING THE LAND TOO CLOSE TO THE TOP OF THE STREAM BANK OR SLOPE</td>
<td>the top of any slope whether close to or distant from the creek will be subject to greater erosion</td>
<td>keep all plough lines well back of the top of slopes and stream banks</td>
</tr>
<tr>
<td>LIVESTOCK ACCESS TO EITHER THE CREEK, LOW FLOODPLAIN FIELDS OR STEEP SLOPES &amp; WOODLOTS</td>
<td>erosion, compaction, and slumping of adjacent lands as well as increased in-put of nutrients into the creek / livestock also deteriorate woodlots and stream buffers which reduce their ability to capture soils and nutrients and also reduces their value as wildlife habitat</td>
<td>restrict livestock from all water-ways, wetlands, woodlots and steep slopes where ever possible</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>LACK OF VEGETATION COVER ON STEEP SLOPES</td>
<td>increased erosion of cultivated lands, increased inflow of water to creek during snow melt and rain storms and reduced infiltration of water into the ground</td>
<td>the steepest slopes should have the greatest natural vegetation cover or strips of vegetation to capture and slow run-off of topsoil and water into the creek</td>
</tr>
<tr>
<td>ALTERING THE COURSE OF THE CREEK &amp;/OR TRIBUTARIES</td>
<td>erosion and &quot;blow-outs&quot; on tributaries, ditches and stream banks</td>
<td>allow all water courses to meander naturally to reduce the force of the water, altering stream channels should never be done</td>
</tr>
<tr>
<td>BRIDGES, CULVERTS, ROADS</td>
<td>erosion, increase in the force of water through ditches and stream channels</td>
<td>rip-rap (rock), shrub and tree plantings at sites where the force of the water is greatest will aid in reducing erosion and bank blow-outs, replace culverts with &quot;fish friendly&quot; units</td>
</tr>
<tr>
<td>OPERATING EQUIPMENT IN, OR TOO CLOSE TO THE CREEK</td>
<td>erosion of banks and compaction of soils which leads to slumping and increased run-off</td>
<td>avoid the use of heavy equipment close to all water-ways and under wet soil conditions or establish a green-way of grass to drive over</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ROAD DRAINAGE INTO THE CREEK OR ITS TRIBUTARIES</td>
<td>in-put of salt, sand, gasoline contaminants into ditches and other water-ways</td>
<td>allow natural vegetation to grow up in and around ditches and close to roads to reduce nutrient / chemical run-off into the creek</td>
</tr>
<tr>
<td>EXCESSIVE DEBRIS IN THE CREEK</td>
<td>some debris is natural and beneficial, but heavy tree fall into the creek can increase erosion of stream banks and impede fish migration</td>
<td>if debris in the creek is excessive then careful removal of those causing the most damage to stream banks will aid in reducing erosion and sedimentation of the creek bed; for the most part however, it is probably best to leave most debris where it is as it provides fish habitat, changes in flow and shade</td>
</tr>
</tbody>
</table>
Some deforestation in the headwaters / Lack of natural buffers in the lower reaches
Well buffered, good quality habitat can still be found in the lower stream reaches.
PART 3: ACTION PLAN FOR THE RESTORATION OF SALT CREEK

(A): GENERAL PRINCIPLES
In order to achieve the goal of restoring a watercourse, one must take into account the entire sub-watershed. As such, several key issues need to be addressed. First and foremost, is the maintenance, protection, and restoration of watershed function (ie. everything it takes to maintain a healthy creek and surrounding landscape). Secondly, all restoration projects, regardless of their size and location, can contribute, in some way, to the maintenance of hydrological cycle (flow of water from air to land to watercourse), as well as that of watershed function and integrity.

Certain sites however, may be specifically targeted for restoration because of their specific role, in the maintenance and protection of water quality and aquatic habitats. These may include, the creek itself, ponds, ditches, embankments, grass mown to the water's edge, degraded wetlands, drainage channels or existing stormwater management ponds.

Restoration activities at any of these sites may serve to reduce excessive flow rates and erosion, and to reduce nutrients and chemicals entering the watercourse. Vegetated buffer strips can aid in insulating the creek from surrounding landuse activities, and provide shading in order to keep water temperatures lower. The restoration and protection of upland forest sites can reduce surface run-off and promote better ground water recharge.

The restoration of watershed function should, ideally, also take into account the restoration of degraded wildlife habitat, the enlargement or buffering of wildlife habitat or the creation of new wildlife habitat, be they forest, prairie, wetland or river.

(B): DETERMINING WHICH REACHES ARE THE HIGHEST PRIORITY
In the development of the restoration plan for Salt Creek, a number of reaches of the creek have been identified as specific areas of concern. That is, areas where restoration activities should be focused, if possible. These "flagged" areas can serve as a means of directing future activities on the part of the Salt Creek Landowners' Association. All remaining reaches have been rated in accordance with the need to focus activities throughout the sub-watershed as a whole.
(C): CRITERIA TO DETERMINE PRIORITY REACHES

The reaches of the creek which have been "flagged", were selected, based upon both their importance to the overall health of the creek, as well as their need for restoration. The criteria used to determine which reaches were flagged as areas of concern include:

**ADJACENT LANDUSE ACTIVITY:** stream reaches adjacent to agricultural or other intensive landuse activities

**AMOUNT OF NATURAL VEGETATION BUFFER:** no vegetation buffers or minimal buffers along a significant length of the stream reach

**STEEPNESS OF SLOPES:** usually tributaries or upper reaches of the creek which flow down steep slopes

**MAIN CHANNEL VERSUS TRIBUTARY:** tributaries are more important as they have an impact upon all downstream areas

**PROXIMITY TO A SIGNIFICANT NATURAL AREA:** reaches located within, or just upstream of significant natural areas which contribute to the overall health of the creek

**UPPER VERSUS LOWER REACH OF THE CREEK:** problems associated with reaches of the creek located within the upper half of the sub-watershed will have an effect upon the entire system

**EROSION PROBLEMS:** the severity of erosion problems were also used to decide which areas should be flagged

**SUBSTRATE QUALITY:** specific reaches of the creek which were determined to have poor (silty, mucky) bottoms were added to the process of flagging stream reaches

**SUMMER WATER TEMPERATURE:** specific reaches of the creek determined to have higher than normal summer water temperatures were also added to the process of flagging stream reaches

**FISH SPECIES PRESENT:** specific reaches of the creek determined to have either no fish present in the summer months or only tolerant species were also added to the flagging process
THE MAPPING OF PRIORITY REACHES FOR
FUTURE SALT CREEK
RESTORATION ACTIVITIES
SALT CREEK SUB-WATERSHED
PRIORITY REACHES (AREAS OF CONCERN)

[Map of Salt Creek Sub-Watershed with various symbols indicating areas of concern, such as vegetation, lakes, rivers, reservoirs, wetlands, streams, primary, secondary, and tertiary concerns, roads, accessways, bridges, rail lines, rail line - abandoned, transmission lines, lots and concessions.]

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(D): PRIORITY REACHES

The map of the Salt Creek sub-watershed indicating stream reaches of Primary (first), Secondary (second), and Tertiary (third) Concern, can be used as a very general, and flexible guide to future activities on the creek.

All major reaches of the creek including tributaries, have been assigned a rating which reflects the level of attention each should receive. Briefly, this system has taken into account not only, problems occurring on these reaches, as some may still be in relatively good condition, but it also includes the value of each reach within the sub-watershed (eg. tributaries and headwater areas have a greater overall impact and are more sensitive to disturbance).

In determining the focus of activities for the Salt Creek Landowners' Association, the stream reaches of concern have been narrowed down to those with either some landowner interest, and / or where studies have been completed. However, as stated earlier, this prioritizing is meant only to serve as a guide in terms of directing future efforts. Certainly, any site on the creek where the landowner is interested in aiding in restoration efforts is also important.

The following section outlines those reaches of Salt Creek which are recommended as the focus of landowner efforts and attention over the next five years. Immediately following this guide is a section outlining restoration recommendations for the lower reach of Salt Creek from the town of Norham to Hwy. 30.
(E): PRIORITY STREAM REACHES AND RECOMMENDED ACTIONS

TRIBUTARY 2 (T2): Flows from the Cramahe Hills across Hwy. 30 & McCann Rd.

<table>
<thead>
<tr>
<th>Issues of Concern</th>
<th>Landowners</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Moderately unstable stream banks</td>
<td>Lot and Concession</td>
</tr>
<tr>
<td>* Agricultural landuse activity</td>
<td>Lot 24, Con. 1</td>
</tr>
<tr>
<td>* Minimal vegetation buffers in some areas, and some cattle access</td>
<td></td>
</tr>
<tr>
<td>* Steep slopes upstream</td>
<td></td>
</tr>
<tr>
<td>* Importance as a cold water tributary</td>
<td></td>
</tr>
<tr>
<td>* Sourced within the Cramahe Hills Natural Area</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommendations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>* Meet with landowner to discuss participation and fill out survey questionnaire</td>
<td></td>
</tr>
<tr>
<td>* Minimum recommendation of landowner involvement in widening of creek buffers</td>
<td></td>
</tr>
<tr>
<td>and restricting cattle from watercourse</td>
<td></td>
</tr>
</tbody>
</table>
TRIBUTARY 3 (T3) : Flows from the Cramahe Hills, down through the Pine Ridge Golf Course

| Issues of Concern | * Highly unstable stream banks  
|                   | * Moderately poor quality creek bottom  
|                   | * Agricultural, golf course landuse  
|                   | * Poor buffers in some areas  
|                   | * Steep slopes in upper reaches  
|                   | * Importance as a tributary  
|                   | * Sourced within the Cramahe Hills Natural Area  
|                   | * Lower reach is ditched and channelized |

<table>
<thead>
<tr>
<th>Lot and Concession</th>
<th>Lot 24, Con. 1 &amp; 2</th>
</tr>
</thead>
</table>
| Landowners         | William McNeil, RR4 Warkworth, Ont., K0K 3K0  
|                    | Kenneth DaFoe, RR4, Warkworth, Ont. K0K 3K0  
|                    | Eleanor Murfin, 475 The West Mall, apt. 1511 Etobicoke, Ont. M9C 4Z3  
|                    | Leonard & Joan Hanesiak, 8 Ebvers Dr., Etobicoke, M9C 3E5  
|                    | Taisto & Gloria Havimaki, 477 Concession 2 East, RR4 Warkworth, Ont. K0K 3K0  
|                    | Richard & Donna Edwards, RR4 Warkworth, Ont. K0K 3K0  
|                    | James Van Meer, 23 Ramsay Ave., Trenton Ont., K8V 2P6  
|                    | Wayne Emino, RR4 Warkworth, Ont. K0K 3K0  
|                    | William Schloen, 521 Percy 2nd Line, Codrington, K0K 1H0  
|                    | David Haywood, RR4 Brighton, Ont. K0K 1H0 |

| Recommendations | * Involve new landowners (new housing development) in the restoration effort  
|                | * Encourage landowners to maintain a strong buffer of natural vegetation along this tributary  
|                | * Encourage re-naturalization (plantings etc.) of the lower reach which passes through the golf course |
Tributary 4 (T4): Flows from north to south across the Pine Ridge Golf Course

| Issues of Concern | * Unstable stream banks  
|                  | * Agricultural landuse activity  
|                  | * Minimal vegetation buffers in some areas  
|                  | * Moderately steep slopes  
| Lot and Concession | Lot 24, Con. 2  
| Landowners       | Norman and Doreen McCubbin, RR4, Warkworth, K0K 3K0  
|                  | Pine Ridge Golf Course, RR3, Warkworth, K0K 3K0  
| Recommendations  | * Consider increasing the buffer width of vegetation along this tributary (even decorative ornamental horticultural shrubs)  
|                  | * Add or enhance grassed waterways in upstream agricultural fields  

TRIBUTARIES 7, 8, 9, 11 (T7, T8, T9, T11): A series of small tributaries draining down steep slopes to the creek

| Issues of Concern | * The entry of sediments and excess nutrients into Salt Creek via these tributaries  
| | * The force of the water as it flows down steep slopes  
| | * Lack of buffers of natural vegetation in some areas  
| | * Agricultural landuse activities  
| | * Highly unstable stream banks in some areas  
| | * Possible inflow of pesticides, herbicides, fungicides  

| Lot and Concession | T7: Lot 22, Con. 2, Percy Twp.  
| | T8: Lot 20, Con. 2, Percy Twp.  
| | T9: Lot 20, Con. 2, Percy Twp.  
| | T11: Lot 19, Con. 2, Percy Twp.  

| Landowners | Donald and Bonnie Ducie, 425 Norham Rd. RR4 Warkworth, Ont. K0K 3K0  
| | Dennis Laver, 295 Norham Rd., RR #4 Warkworth, Ont., K0K 3K0  
| | Bill Honey, RR# 2 Warkworth, Ont., K0K 3K0  

| Recommendations | * Each of these tributaries is subject to erosion and picking up eroding topsoil and nutrients from upland fields. As such, any opportunity to widen the buffer areas around the upstream end of these small tributaries (combined with conservation tillage and grassed waterways) would do a great deal to limit sediment input and reduce the force of water flowing down to meet the main channel  

SITE OF THE OLD NORHAM DAM

<table>
<thead>
<tr>
<th>Issues of concern</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>* Deep silt deposits left over from the dam site</td>
<td></td>
</tr>
<tr>
<td>* Widening and warming of the creek in this area</td>
<td></td>
</tr>
<tr>
<td>* Silt flowing to downstream areas</td>
<td></td>
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</tbody>
</table>

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<tr>
<th>Lot and Concession</th>
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<tr>
<td>Lot and Concession</td>
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| Landowners                          |   |
|-------------------------------------|   |
| Gordon Partridge, RR#1, Castleton, Ont. K0K 1M0 |

<table>
<thead>
<tr>
<th>Recommendations</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>* This is one of the more complex sites to work with, however a possible option for the future could involve the use of brush bundles to draw silt up onto the banks therefore deepening and narrowing the creek along this reach</td>
<td></td>
</tr>
<tr>
<td>* Typically, such an effort would require a number of permits and much cooperation from those with professional expertise in this aspect of restoration</td>
<td></td>
</tr>
</tbody>
</table>
## TRIBUTARY 13: (Upper Branch T13R1)
The upper branch of the first main tributary upstream of Norham

<table>
<thead>
<tr>
<th>Issues of concern</th>
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</thead>
<tbody>
<tr>
<td>* Highly unstable stream banks in some areas</td>
</tr>
<tr>
<td>* Poor substrate in some areas</td>
</tr>
<tr>
<td>* Adjacent agricultural activity</td>
</tr>
<tr>
<td>* Steep slopes in upper reaches</td>
</tr>
<tr>
<td>* Importance as a tributary</td>
</tr>
<tr>
<td>* Sourced from the Cramahe Hills Natural Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lot and Concession</th>
<th>Lot 16, Con. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landowners</td>
<td>Janetta Lawson, RR#2, Warkworth, Ont. K0K 3K0</td>
</tr>
<tr>
<td></td>
<td>Gary and Clarke Newman, P.O. Box 62, Warkworth, Ont., K0K 3K0</td>
</tr>
<tr>
<td></td>
<td>Doreen McCubbin, RR#4, Warkworth, Ont. K0K 3K0</td>
</tr>
<tr>
<td></td>
<td>Benson Robert and Caterhine Brown, RR # 2 Warkworth, Ont. K0K 3K0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Although water temperature is suitable for trout in most areas, erosion is still a concern in some areas</td>
</tr>
<tr>
<td>* A significant portion of this tributary has a bottom substrate consisting mostly of silt</td>
</tr>
<tr>
<td>* This tributary would be an excellent place to expand upon the activities of the Salt Creek Landowner Association as it would involve and important trout bearing tributary and a new group of interested landowners</td>
</tr>
</tbody>
</table>
TRIBUTARY 17: (T17) The small tributary flowing west to east just north of where
the main channel crosses Hwy. 25

<table>
<thead>
<tr>
<th>Issues of concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Highly unstable stream banks</td>
</tr>
<tr>
<td>* Poor stream bottom substrate</td>
</tr>
<tr>
<td>* Agricultural landuse activity</td>
</tr>
<tr>
<td>* Minimal buffers</td>
</tr>
<tr>
<td>* Importance as a tributary</td>
</tr>
<tr>
<td>* Lack of sensitive fish species</td>
</tr>
<tr>
<td>* Within the upper reaches of the creek</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lot and Concession</th>
<th>Lot 16, Con. 1, Percy Twp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landowners</td>
<td>Ronald William Grant, RR#2, Warkworth, Ont. K0K 3K0</td>
</tr>
<tr>
<td>Recommendations</td>
<td>* This tributary is small, and as such, holds a lot of potential as a manageable restoration project for the future. Where erosion is anything less than severe, the key is to increase / enhance buffers of natural vegetation. Where erosion is at its worst, then bio-remediation can be combined with rip-rap of rock * The key point here is to gain the support of the local landowner in finding the best / cost effective means of restoring this small tributary</td>
</tr>
</tbody>
</table>
TRIBUTARY 18: (T18): Large tributary which crosses the intersection of Hwy. 25 and Pine Grove Rd.

<table>
<thead>
<tr>
<th>Issues of concern</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>* Highly unstable stream banks in some areas</td>
<td>* Agricultural landuse activity</td>
</tr>
<tr>
<td>* Minimal buffers in many areas</td>
<td>* Steep slopes in some areas</td>
</tr>
<tr>
<td>* Importance as a tributary</td>
<td>* Lack of sensitive fish species</td>
</tr>
<tr>
<td>* Within the upper half of the creek</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lot and Concession</th>
<th>Cramahe Twp.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lot 11, Con. 9 // Lot 12, Con. 9 // Lot 14, Con. 9 // Lot 15, Con. 9 // Lot 16, Con. 9 // Lot 17, Con. 9 // Lot 18, Con. 9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landowners</th>
<th>David Massey, 192 Masse Lane, RR#1, Castleton, Ont. K0K 1M0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scott Turney, RR#1 Castleton, Ont. K0K 1M0</td>
</tr>
<tr>
<td></td>
<td>David Turney, 164 County Rd. 27, RR#1, Castleton, Ont. K0K 1M0</td>
</tr>
</tbody>
</table>

| Recommendations                      | * This tributary is of significant size, with above average agricultural activity and below average natural vegetation cover. It would be of great benefit to the restoration efforts on the creek if local landowners were encouraged to participate in finding ways to improve the condition of this tributary. Again, buffers, conservation tillage practices and remediation of severe erosion problems will go a long way towards restoring the health of the creek locally and downstream. |
TRIBUTARIES 23, 24, 25, 27, 29, 30: (T19-T30) Tributaries of the upper end of the creek

<table>
<thead>
<tr>
<th>Issues of concern</th>
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<tbody>
<tr>
<td></td>
<td>* These tributaries are indicated as reaches of concern particulary owing to their importance as key headwater recharge areas, the steepness of slopes in these areas as well as a lack of natural vegetation cover along many stretches</td>
</tr>
<tr>
<td></td>
<td>* Because they are located within the upper half of the creek, any problems here will impact upon the entire system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lot and Concession</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Trib. 23 / Cramahe Twp.</td>
<td>Lot 28, Con. 10 // Lot 27, Con. 10 //</td>
</tr>
<tr>
<td>Trib. 24 / Lot 30, Con. 10 (Cramahe Twp.) // Lot 6 Con. 1 (Percy Twp.)</td>
<td></td>
</tr>
<tr>
<td>Trib. 25: Lot 32, Con. 10 (Cramahe Twp.)</td>
<td></td>
</tr>
<tr>
<td>Trib. 27: Lot 33, Con 10 (Cramahe Twp.) // Lot 35, Con. 10 (Cramahe Twp.) // Lot 1, Con. 8 (Haldimand Twp.)</td>
<td></td>
</tr>
<tr>
<td>Trib. 29: Lot 2, con. 8 (Haldimand Twp.) // Lot 2, con. 7 &amp; Lot 8, con. 7 (Haldimand Twp.)</td>
<td></td>
</tr>
<tr>
<td>Trib. 30: Lot 6, Con. 7 &amp; Lot 7 Con. 7 &amp; Lot 8, Con. 7 (Haldimand Twp.)</td>
<td></td>
</tr>
<tr>
<td>Landowners</td>
<td>(Trib. 23)</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td></td>
<td>Vernon and Sylvia Vosburgh, 494 Red Cloud School Rd., RR#2 Warkworth, Ont. K0K 3K0</td>
</tr>
<tr>
<td></td>
<td>Douglas Welland, 458 Red Cloud School Rd., RR#2 Warkworth, Ont. K0K 3K0</td>
</tr>
<tr>
<td></td>
<td>John and Rita Leppiko, 8 Scarborough Golf Club Rd., Scarborough, Ont. M1M 3C5</td>
</tr>
<tr>
<td></td>
<td>(Trib. 24)</td>
</tr>
<tr>
<td></td>
<td>Edward Dudek, RR#2 Warkworth, Ont., K0K 3K0</td>
</tr>
<tr>
<td></td>
<td>Kenneth and Enid Marden, 752 Dawson, Rd. RR#2 Warkworth Ont., K0K 3K0</td>
</tr>
<tr>
<td></td>
<td>Alan and Judith Barker, 407 Colborne St. West, Whitby Ont., L1N 1X5</td>
</tr>
<tr>
<td></td>
<td>Kenneth Clarke, Suite 510, 80 Front Street East, Toronto, Ontario., M5E 1T4</td>
</tr>
</tbody>
</table>

| Recommendations   | * Tributaries in the upper reaches of the watershed play an important role in supplying cold ground water to the system. A number of these tributaries are lacking in significant natural vegetation cover, and are located upon steep slopes. It is important that future restoration efforts upon Salt Creek include working with landowners in the headwater areas to determine if there are any concerns with respect to siltation, erosion or excess nutrient input in these areas. |
PART 4: FOCUSED ACTIONS

Following the on-site assessment of the lower reach of Salt Creek (Norham to Hwy. 30), a series of recommended actions have been developed, which may or may not apply to other reaches of the creek.

(A): HOW TO ADDRESS EROSION OF HIGH FLOW DITCHES

In several locations along this reach of Salt Creek, field and road-side run-off has been funnelled into ditches and culverts which then drain down into Salt Creek. Many of these ditches may not be natural channels and are frequently incapable of handling the high flows received after heavy rain-storms, or during spring snow-melt. The consequences of these extreme flows include, erosion of the ditch banks, deepening of the ditches, and ultimately, the siltation of the creek.

Recommended Solution: Enforcement of culvert outflow area (apron), installation of a series of rock/fieldstone check dams to slow the flow/force of the water, combined with plantings to reinforce ditch banks.

Site Where This Technique Is Recommended: (Lot 19 / Con. 2, Honey Property)

The culvert outflow and steep drainage ditch on the west side of this property has endured some of the greatest damage due to water erosion. Outlined below is a potential remedial action plan for this ditch.

Step (1): Reinforce the ditch where the force of the water is greatest, ie. at the outflow of the culvert (for a distance of approximately 3-5 metres downhill)

Lorentz Drain Technique
(rip-rap curtain of rock):
The Lorentz Drain technique can be put to use where water is channelled over the surface, especially on steep slopes or where surface water is collected from slopes.

The drain is shaped in the subsoil and covered with 150mm of clean crushed stone. Large stones of uniform size are hand placed snugly over the base with their sharpest side up and stabilized with wooden stakes. Live fascines are placed along both sides of the drain if the work is completed during the dormant (Nov. or April) period. Otherwise, bare root planting of shrubs can be used. The fascines or plantings will root into the surrounding soil, stabilizing and binding the drain base into the soil. (A fascine is a long bundle (approx. 2 - 5 metres long) of dormant branch cuttings of dogwood or willow, tied together into a tight roll). A fascine is usually staked into the ground and 75% covered with soil. (Harrington and Hoyle Ltd. 1993. Soil Bioengineering: Seminar Summary.)

Step(2): Once the area at the top of the outflow is stabilized it will be beneficial to reduce the force of the water draining downhill. This can be done by incorporating weirs/check dams into the drain. This techniques will be most successful if combined with plantings to stabilize the banks of the ditch.
Check Dams:

**Choice Number One:** A relatively inexpensive option for the steep ditch on the Honey property could involve a series of small dams constructed with large rocks/small boulders to "check" the force of the water.

The exact placement of each check dam should have the benefit of expert advice. The placement of these dams will serve two purposes. First, it will slow the force of the water such that erosion of the ditch is reduced. Second it will create ponded areas which will allow sediments to settle out and promote stabilizing plant growth.

**Installation:**

i) dig a 12 inch deep trench across the base of the ditch

ii) place large rocks or small boulders in the trench such that they extend at least a third of the way up the sides of the ditch
   (a double or triple row of rock is better than one)

iii) make sure that the lowest point of this rock check dam is in the centre of the ditch to direct the flows

iv) both uphill and downhill of the check dam there will be required a "rock apron". A rock apron is constructed by lining the ditch with smaller rock for 2-3 metres uphill and downhill of the dam to prevent the water from eroding underneath. It may also be advisable to line the entire base of the check dam and rock curtain with filter cloth to aid in reducing erosion around the edges the dam.

v) strong wooden stakes should also be used to aid in securing the boulders in place

vi) each check dam ideally will be constructed such that there is no more than a 2 foot drop of the flow of water

vii) each check dam ideally will be constructed such that the upper end of the pool of water which is created, backs up to the next check dam
Choice Number Two: Commercial Barriers

Commercial barriers (weirs, check-dams) are also available in place of the conventional straw bale technique. These products (geo-textiles, gabion baskets etc.) are specifically designed to slow down the flow of the water, reduce the force of the water, and capture sediments. There is however, a significant cost involved compared to the use of locally sourced rock.

Replaces strawbale and rock ditch checks. Conforms to uneven ground surfaces.
(B): ADDRESSING PROBLEMS POSED BY CREEK MEANDERING

The issue of the meandering of the lower reaches of Salt Creek (the winding of the creek so much so, that it cuts back upon itself), has been raised as a point of concern by landowners. Owing to the relatively low gradient present in the lower reaches of the creek, a certain amount of meandering is natural. However, once the natural vegetation cover is removed (forest and shrub cover), the force of the water will be better able to cut into the stream banks and new channels will be opened up through the "necks" of land over a much shorter number of years. The input of sediments from upstream sources will also have an impact, as they tend to fill in the deep pool areas and deposit at the "inside bends" of the creek, thereby forcing more erosion energy towards the "outside bends".

If the erosion of these sites becomes a problem, then it can be reduced using relatively simple techniques. In most cases these will entail relatively modest use of shrub and tree plantings, anchored at the base (low water level) with small boulders. If the bank is severely undercut, then it may require some regrading, to achieve a more gentle slope.

MEANDERING CREEK

EROSION → IN-FILLING OF POOLS

SEDIMENT ACCUMULATION → FUTURE CHANNEL
REMEDICATION OF ERODING CREEK MEANDERS

Regrade eroded slope if necessary, then plant with deep-rooting shrubs such as dogwood, anchor the base of the slope with rock or small boulders, and reinforce the neck of land with plantings of shrubs and trees. If the bank is hardened too much then the force of the water will simply be transferred downstream to the next erosion site. If the creek is straightened too much then the force of the water downstream will be greatly increased, as will problems with erosion.
(C): ADDRESSING PROBLEMS POSED BY EROSION &/ OR SLUMPING OF STREAM BANKS DUE TO UNDERCUTTING

Most often this situation is either the result of, or exacerbated by a lack of adequate stream bank vegetation cover. Basic site remediation would include a regrading of the slope, and subsequent reinforcement using a combination of seeding/planting &- or bio-engineering. Deep rooted stream bank vegetation not only acts as a buffer against erosion but it aids in the absorption of excess ground moisture which may promote slumping.
(D): ADDRESSING PROBLEMS POSED BY STEEP OUTSIDE BENDS SUSCEPTIBLE TO EROSION

Reinforce slopes with plantings (tree and shrub), increase buffer zone at top of slope by up to 3 metres from the top of the bank if possible, add a moderate use of rock at the base of the slope.

(E): ADDRESSING PROBLEMS POSED BY CULVERTS CAUSING EROSION

The erosional forces created by funnelling water through a culvert are most easily dealt with by absorbing some of this force, while adding extra reinforcement to the stream banks. A simple combination of bio-remediation / revegetation and regrading of eroding slopes will often be sufficient for small culvert outflow areas. For larger culverts it may be necessary to also reinforce the banks with some rip-rap of stone. However, it is best to keep the hard materials to a minimum as the force of the water will simply "bounce off" the rocks and be transferred downstream where more erosion will occur. Avoiding the transfer of the force of the water down-stream may be aided by mixing plantings in between the rip-rap of stones.

(F): ADDRESSING PROBLEMS POSED BY EROSION OF TRIBUTARIES FLOWING DOWN STEEP HILLSIDES

As noted in the remediation measures for steep ditches, a combination of reinforcing stream banks and slowing the flow / force of the water is the best technique to utilize here. In many cases, if buffers of natural vegetation are enhanced along these tributaries and combined with additional planting at sites of erosion, the problem should be significantly reduced over time, and at minimal cost. Check dams may be added if slopes are particularly steep and eroding into the hillside.
(G): ADDRESSING PROBLEMSPOSEDBY HEAVY DEBRIS IN THE CREEK

Several landowners on Salt Creek have expressed their concern with excessive debris in the creek. This debris usually consists of fallen trees and floating logs. Generally speaking, a lot of tree-fall into the creek is natural (historically speaking). Logs and branches provide shade, shelters for fish, sunning spots for turtles and traps for sediments washed into the creek. The removal of this debris is not necessary, but if a landowner has found that a fallen log is causing undue erosion of the bank or is blocking the migration of fish, then careful removal of the debris would be up to their discretion. *Please see attached page for aid in identifying problems with stream debris.


EROSION AROUND OBJECTS IN THE STREAM
Definition of Stream Obstruction Conditions

Condition One
These stream segments have acceptable flow and no work would be required. They may contain various amounts of instream debris and fine sediment, such as silt, sand, gravel, rubble, boulders, logs and brush. In certain situations flow may be impeded, but due to stream and land classification or adjacent land-use, this is not a problem.

Condition Two
These stream segments currently have no major flow impediments, but existing conditions are such that obstructions are likely to form in the near future, causing unacceptable problems. This condition is generally characterized by small accumulations of logs and/or other debris which occasionally span the entire stream width. Accumulations are isolated, not massive and do not presently cause upstream ponding damages.

Condition Three
These stream segments have unacceptable flow problems. Obstructions are generally characterized by large accumulations of lodged trees, root wads, and/or other debris that frequently span the entire stream width. Although impeded, some flow moves through the obstruction. Large amounts of fine sediment have not covered or lodged in the obstruction.

Condition Four
These stream segments are characterized by major blockages causing unacceptable flow problems. Obstructions consist of compacted debris and/or sediment that severely restricts flow.

Condition Five
These stream segments possess unique, sensitive, or especially valuable biotic resources and should be dealt with on a case-by-case basis. Examples include, but are not limited to: Areas harboring rare or endangered species, shellfish beds, fish spawning and rearing areas, and rookeries.
PART 5: POTENTIAL PROJECTS ON THE LOWER REACH OF SALT CREEK

PLEASE SEE ATTACHED MAP OF LOWER REACH OF SALT CREEK

Project #1:
Reinforcement of eroding ditch: Lot 19 / Concession 2 (Honey Property).
* Please see page for direction on ditch remediation.

Project #2:
Reinforcement of eroding meanders of the creek: Lot 19 / Concession 2
* Please see page for direction on erosion remediation.

Project #3:
Pine Ridge Golf Course

Remediation Site (A):
Tributary #4: Working with local landowners along this tributary would be a small, workable and valuable step towards improving conditions in the lower reach of Salt Creek. Any combination of enhancing buffer strips of trees/shrubs (especially at the juncture with the main channel) with the addition of grassed water-ways in the upland fields would be of significant benefit with relatively little effort or expense required. A more intensive effort could entail the use of drop structures along the steeper areas of this tributary in order to reduce the force of the water and the erosion problems it may cause.

Remediation Site (B):
Buffer Zone Enhancement Along Steep Hillside (adjacent to woodlot): At the upstream end of the Pine Ridge Golf Course, Salt Creek is protected by a good quality woodlot. As the creek exits this area however, the banks are rather steep and some slumping and erosion is occurring. This situation could be halted or moderated however with a limited amount of strategic tree/shrub planting. Specifically, the slope of land between the woodlot and the adjacent fairway would be an ideal place to add some buffering vegetation. The key here would be to simply add enough of a "no mow zone", supplemented with plantings such that the stream bank is stabilized and run-off down the back of the hill (ie. well out of play), is better absorbed. Please see page 66
Project # 4:
Tributary #2 : Cattle in Salt Creek: On one small branch of Tributary number two, there may remain some issues with cattle having direct access to part of the water-way. It may be a costly exercise to fence cattle out of the creek, and provide an alternate water supply. Being that it is not always financially possible for some landowners, it would be beneficial if two or more sources of funding could be combined to aid in restricting cattle access from this site (depending upon landowner interest).

Project #5:
Buffers on tributaries 7, 8, and 9: It would be very beneficial for the Landowner Association to approach the issue of reducing erosion and the impact of high flows of water coming from the upland end of these tributaries. Any enhancement of natural buffers, the addition of grassed water-ways in areas of obvious sheet or rill erosion would allow for the reduction of sediments entering the main channel of the creek.

Advancement of Efforts to Restore the Whole of Salt Creek : Expand the efforts of the Association to include key areas of concern

Salt Creek encompasses a rather sizable area, and it would be difficult to focus upon the whole water-way at once. It may make sense in the long run to form smaller working groups of landowners along the creek.

This would be especially useful in terms of some of the larger tributaries such as #13 and #18 (please see map). Again, the scale of projects could be such that they are small, inexpensive and easily manageable by a focused group of landowners. Even by gaining important insight from landowners on these tributaries as to where problems may exist would be an important first step in expanding the long-term efforts of the Salt Creek Landowners Association.

Long-term Project Suggestion:
Old Norham Dam Site: please see page 46 (recommendations)

Future Activities:
Increased involvement on the part of landowners within the headwater tributaries would aid considerably in expanding the activities of the association as a whole. The Teleki family has expressed a keen interest in becoming more involved in this process. Geza Teleki, in particular, while out of town frequently, has indicated a willingness to offer any technical support he can to restoration activities on the creek.
SALT CREEK ASSESSMENT: NORHAM TO HWY. #30

Excellent upland buffers / main channel of the creek is in very nice condition: prime example of what the creek can look like with wide natural buffers / only suggestion here might be to consider pulling fencing back from the very edge of the creek if the fence ever needs to be replaced.

Wide buffers of natural vegetation at the downstream end of this property are very beneficial to the creek.

It would be very beneficial to pull back ploughing activities and vehicle use from the edge of the creek in the low floodplain fields / & always have a cover crop in place over winter.

Rip-rap & plant material reinforcement ditched tributary with complementary weirs or drop structure installment to slow the flow and force of the water.

Meandering of the creek is natural but excessive / it can be slowed by reinforcing worst erosion points with tree / shrub planting, reshaping of banks and modest use of rip - rap (rock) where extra stability is required.

Buffers a good here but some tree-fall into the creek can be removed if resulting in a lot of erosion.

Erosion on steep outside bends of the creek is severe in a number of spots / landowners is actively working to replant these areas / if this replanting is complemented with buffers of trees and shrubs along as much of the channel as possible and rip-rap (rocks) are used moderately where extra stability is required, then this reach of the creek should slowly begin to improve.

Very healthy looking stretch of creek where the addition of some shrubs / trees would add beneficial shading to the creek and improve fish habitat.

Naturalizing the banks of this little cold - water tributary in areas which are not in play would prevent future erosion and add valuable shade to the water - course.

Expand shrub and tree planting from rock wall to stretch where cart path is slumping / even "decorative" plantings of deep rooted shrubs will aid in stabilizing the stream bank.

Wideening buffers of trees or even reducing area of cut grass on the back of this hill-side will help rainfall to be absorbed and reduce erosion along this stretch of steep stream bank.

Adding a stronger buffer of trees and shrubs to the outflow of steep flowing tributaries with complementary buffer of shrubs on opposite bank will absorb some of the force of the water and reduce erosion.

Adding of small "drop structures" & reinforcement with 'shock rock' in steepest areas will aid in slowing the force of the water.
PART 6: IMPORTANT POINTS TO CONSIDER WHEN UNDERTAKING RESTORATION PROJECTS

ENVISIONING THE FUTURE OF SALT CREEK

The key to success in the restoration of Salt Creek will be, adaptive management. That is to say, restoration efforts must be flexible, they must take into account changes in landuse activities, changes in impacts upon the creek from new sources, and they must find a compromise between the environment and the needs of members of the community.

(A) : METHODS FOR ADDRESSING ISSUES AND IMPACTS

Consider the Entire Sub-watershed:
There is a strong interconnectedness between the watercourse and the entire sub-watershed. (Daigle J.M. and Havinga D. 1996. Restoring Nature's Place. Ecological Outlook Consulting.)

Tributaries and Headwaters:
The farther upstream that impacts (pollutants, sediments etc.) are introduced into the creek, the greater the likelihood of effecting the rest of the system. This holds true for any activities taking place in upland areas. For this reason it is best to develop a whole, sub-watershed strategy, beginning with uplands and headwaters and moving steadily towards lowlands and the mouth of the creek. A key point to be made here is that localized erosion problems are often caused, or worsened by sediments accumulating locally, which have been washed there from upstream sources. If these upstream problems are not addressed then it will be all the more difficult to fix the local downstream areas of bank erosion.

Other Considerations:
At both the sub-watershed and restoration site scale, one must also take into account, local hydrology, water quality, soils, vegetation and fish / wildlife habitat needs.
Riparian Zones:
The areas immediately adjacent to rivers and streams are inhabited by diverse plant communities adapted to the hydrology, nutrient-rich soils, and microclimates found in the transition between land and water. The blend of wet and dry conditions, plant communities, and natural debris creates habitat, protection, and movement corridors for a wide variety of fish, birds, and animals.

(B): Taking Natural Processes Into Account
Given that riparian ecosystems represent transition zones, their boundaries are somewhat fluid, like the water with which they are associated. Riparian communities are found within valleys, floodplains and groundwater discharge areas along rivers and streams.

One of the more complex aspects of river restoration involves distinguishing between healthy changes and those that signal instability or degradation. *Because streams and rivers are literally on the move, watercourses may undergo relatively rapid changes as part of their natural processes.* For example, naturally occurring sediments are carried downstream, altering stream beds and water chemistry on an on-going basis.

When determining restoration strategies for river channels you will need to allow for such natural changes, which are relatively benign, while addressing those changes that have had a major impact on the system.

Signs of Instability or Degradation:

- serious or excessive erosion or sedimentation
- lack of diverse native vegetation along edges
- dying, diseased or absent fish or other aquatic species
- overly rapid flows during moderate rainstorms, frequent or prolonged flooding during moderate rainfall
- extensive periods of drought when water would normally still be flowing

Healthy rivers and streams, on the other hand:

- support a diversity of species
- remain relatively stable in the face of on-going changes, such as flooding and sediment loading
(C): DIRECT AND INDIRECT RESTORATION

Restoration can be approached from a direct or indirect means, but it is better to combine the two. Direct restoration can include everything from tree planting, to bio-remediation of stream banks, to the installation of nesting boxes for birds. It will not be nearly as successful however, if the underlying causes are not first addressed. This is often where indirect restoration comes into play. This may include changing landuse practices, no longer mowing or ploughing to the edge of a watercourse and fencing cattle out of a creek.

(Daigle J.M. and Havinga D. 1996. Restoring Nature's Place.)

INDIRECT METHODS OF RESTORATION

As a result of their adaptations to the intense changes in conditions that occur regularly in their environments, riparian communities tend to be relatively hardy and resilient. For this reason, restorationists have found that indirect restoration is especially effective with these communities. In fact, research indicates that re-vegetating riparian communities without addressing the causes of degradation is largely ineffective. Indirect methods of restoration within the Salt Creek sub-watershed probably play the most important role in rejuvenating the creek. Principal among these would be:

- the creation and, or widening of buffers of natural vegetation along the creek, its tributaries, ditches, ponds and wetland areas
- restricting cattle from the creek
- reducing pesticide, herbicide and fertilizer use in close proximity to the creek
- land retirement
- soil conservation tillage
- maintain cover crops

ALTERNATIVE AGRICULTURAL PRACTICES

Most changes in agricultural and landscaping activities designed to improve the health of a local watercourse can be included within the category of Indirect Restoration, such as conservation tillage, contour cropping and cover crops. Other practices require more direct actions however. These would include the installation of drainage tiles, grassed water-ways, wind-breaks and manure storage systems. Other causes of degradation clearly require more complex and longer-term strategies such as public education, and legislation.
DIRECT RESTORATION

Direct methods of restoration are often added to those which are more indirect, and usually include:
Structured changes / bio-engineering or planting on stream banks / in-stream improvements / or any combination of these.
APPENDIX A: ADDITIONAL RESTORATION TECHNIQUES

Buffer Zones: Buffer zones should be wide enough to protect rivers and streams from the impacts of surrounding human activities, and flexible enough to accommodate other natural features such as wetlands or woodlots.
**Brush Mattressing:** Example of a "soft engineering" technique to be used in repairing eroding stream banks.

To be used when the soil surface must be protected from the impact of heavy precipitation, running water, wind or other broad forms of erosion.

Live branches are placed on the ground very close together so that a complete cover is established. The butt ends are imbedded in the soil and are usually secured and protected by poles, or fascines (bundles of tied branches), or rock fill. The matting is secured to the ground with stakes and cross laid branches or wire. Stakes should be no more than 1 metre apart. Cover the entire matting with a light layer of soil to promote rooting. Work must be executed during the dormant period.

The high flows of spring should aid in the collection of excess sediments by this layer of brush. It may also be beneficial to supplement this work with a mix of bare root shrub planting to add allow for greater soil stability.
**Brushlayer (Cut Slope):**

Used to stabilize steep slopes quickly.

Trenches are dug as shown. The platform of the terrace should slope at an angle so that the branches can root along their entire length. Branches are placed in the trenches butting into the soil. Longer branches are placed on angles so that only 25% of their total length is exposed. Lower ditches are progressively filled with excavated material from higher trenches. Distance between trenches varies with slope and soil type. *Work to be executed in the dormant period.*
APPENDIX B: Salt Creek Landowner Association Contact List

BRIAN FINDLAY, RR #1 CAMBELFORD, ONT., K0L 1LO
HOWARD MCCANN, RR#1 CODRINGTON, ONT., K0K 1R0
BILL & JOHN SEGUIRE, RR#3 WARKWORTH, ONT., K0K 3K0
PINE RIDGE GOLF COURSE RR#3, WARKWORTH, K0K 3K0
WAYNE DUCIE, RR#4 WARKWORTH, K0K 3K0
JOHN HUTCHISON, WARKWORTH GOLF COURSE, RR#4, K0K 3K0
DON LAVER, SALT CREEK GOLF LINKS, RR#4, K0K 3K0
PETER HUYCKE, RR#4, WARKWORTH, K0K 3K0
ALVIN LOWE, RR#4, WARKWORTH, K0K 3K0
KEVIN LOWE, RR#4, WARKWORTH, K0K 3K0
DENNIS LAVER, RR#4, WARKWORTH, K0K 3K0
JACK HONEY, RR#2, WARKWORTH, K0K 3K0
BILL HONEY, RR#2, WARKWORTH, K0K 3K0
NORMAN GUMMER, RR #2, WARKWORTH, K0K 3K0
TERRY GREENLY, RR#2, WARKWORTH, K0K 3K0
RANDY NEWMAN, RR#2, WARKWORTH, K0K 3K0
EARL HARREN, RR #2, WARKWORTH, K0K 3K0
RON GRANT RR#2, WARKWORTH, K0K 3K0
HOWARD MITCHELL, RR#2, WARKWORTH, K0K 3K0
BILL O'GRADY RR#1, CASTLETON, K0K 1M0
GEORGE RYKEN RR#1, CASTLETON, K0K 1M0
JIM MCKAGUE, RR#1, CASTLETON K0K 1M0
BUD LECKEY RR#1, CASTLETON, K0K 1M0
DOUG WELLAND, RR# 2 WARKWORTH, K0K 3K0
ROBERT MCEWAN, RR#2 WARKWORTH, K0K 3K0
PHILLIP OGDEN, RR#2, 133 NORHAM, RD. K0M 2K0 (postal code correct?)
VERNON VOSBURG RR#2, WARKWORTH, ONT., K0K 3K0
FRANZ WEILANDT RR#2, WARKWORTH, ONT., K0K 3K0
G. McEWAN RR#2 WARKWORTH, ONT. K0K 3K0
DARCY MCKAGUE RR#1 CASTLETON, ONT., K0K 1M0
DON DUCIE RR#1 CASTLETON, ONT. K0K 1M0
DEL BIRD RR#1 CASTLETON, ONT. K0K 1M0
DAVID McCOMB RR#1, CASTLETON, ONT., K0K 1M0
DOUG CARR RR#1 CASTLETON, ONT., K0K 1M0
MARIO BENEDETTI RR#1, CASTLETON, ONT., K0K 1M0
K. McDONALD RR#1 CASTLETON, ONT., K0K 1M0
CHARLES (& Geza)TELEKI RR#2, WARKWORTH, ONT. K0K 3K0
EXTENDED LANDOWNER LIST FROM PERCY TWP. (December 1999)

(Concession #1, Lot #8): Vernon and Ruth Ellison RR#2 Warkworth, K0K 3K0
(Con. 1, Lot 8): Martin and Susan Grendel, RR#3 Wark.
(Con. 1, Lot 10): John Weatherson RR2 Wark.
(Con. 1, Lot 10): Helen Carswell, 17 Valloncliff Rd., Thornhill Ont., L3T 2W6
(Con. 1, Lot 11): Donald and Irene Murphy, 51 Winthorpe Rd. Toronto M4E 2Y5
(C1, L12): Aarne Einari Henriksson Suite 5-111, 50 Old Kingston Rd. Scarborough
(Con. 1, Lot 13): Harold Scott, 261 Sidney St., Trenton, K9V 2T5
(Con. 1, Lot 14): Robert Hope RR2, Warkworth
(Con. 1, Lot 16): Ronald Grant RR2 Warkworth, Ont. K0K 3K0
(Con. 1, Lot 16): Janetta Lawson RR2 Warkworth
(Con. 1, Lot 17): Gordon Partirdge RR#1 Castleton K0k 1M0
Walter Dushko, c/o A Benevides QA 37 Blue ridge Rd., Willowdale On, M2K 1R8
(Con. 1, Lot 18): Brenda Taylor RR2 Warkworth, Ontario

Village of Norham
Kenneth and Anna Carruthers RR2 Warkworth
Beatrice Weatherup group Box 31 RR2 Wark.
Ernest Button RR2, Box 49 Wark.
Ignac Meglic RR4 Campbelleford On K0L 1L0

Downstream of Norham
(Con. 1, Lot 19): Grant and Heather Clarke, RR4 Wark.
Norman McCubbin RR4 Wark. K0K 3K0 Doreen McCubbin RR #4 Wark.
(Con. 1, Lot 19): (south end) Newman farms Inc. PO Box 62 Wark.
(Con. 1, Lot 20): Dwayne Philip and Laurie Brenton RR4 Wark.
(Con. 1, Lot 22): Kevin and David Poole PO Box 291 Wark.
(Con. 1, Lot 22): Larry Greenly RR4 Wark. K0K 3K0
Ronald and Donna McGee RR#2, Codrington, Ont. K0K 1R0
NEW NEIGHBOURHOOD 2nd OF PERCY AND HWY. 30
(just south of Pine Ridge Golf Course)
(ALL Concession 1, LOT(s) 1-23 approx.)

William McNeil RR4 Wark K0K 3K0
Kenneth DaFoe RR4
Eleanor Murfin, 475 The West Mall apt. 1511 Etobicoke M9C 4Z3
Leonard and Joan Hanesiak 8 Ebvers Dr. Etobicoke M9C 3E5
Taisto and Gloria Havimaki 477 Concession 2 East RR4 Wark.
Richard and Donna Edwards RR4 Wark.
James Van Meer 23 Ramsay Ave. Trenton K8V 2P6
Wayne Emino RR4 Wark
William Schloen 521 Percy 2nd Line, Codrington K0K 1R0
David Haywood RR4 Brighton K0K 1H0
Garry and Marie Wilson RR2 Wark.
Russel Stelnicki and Joan Hanesiak c/o 8 Embers Dr. Toronto M9C 3E5
Mark Hutchinson RR2 Wark.
Enid Schloen (GD) Codrington Ont., K0K 1R0
Alan and Mavis Quaile RR4 Wark.

EXTENDED LANDOWNER LIST UPSTREAM OF NORHAM (CRAMAHE TWP.)

Vernon and Sylvia Vosburgh, 494 Red Cloud School Rd., RR#2 Warkworth, K0K 3K0
John and Rita Leppiko, 8 Scarborough Golf Club Rd., Scarborough Ont., M1M 3C5
Douglas Welland, 458 Red Cloud School Rd., RR#2 Warkworth, K0K 3K0
Edward Dudek, RR#2 Warkworth, Ont., K0K 3K0
Roman and Helen Juknevicus, 20 Leland Ave., Toronto, Ont., M8Z 2X5
Brian Shaw, 261 Pacific Ave., Toronto Ont., M6P 2P7
Alan and Judith Barker, 407 Colborne St. West, Whitby, Ont. L1N 1X5
Kenneth Clark, Suite 510, 80 Front Street East, Toronto Ontario, M5E 1T4
Stephen Hagarty, Group Box 79, Site 6, RR#1 Castleton, K0K 1M0
Derek Paul, 122 Hilton Ave., Toronto, Ontario, M5R 3E7
Bruno Iaboni and Domenic Asturo, 1 Sheffley Cr., Etobicoke, Ont., M9R 2W2
John and bonne Bunyan, 401 Clarkson Rd. RR#1 Castleton
James McKague, 778 Morganston Rd. RR#2 Castleton, Ont. K0K 1M0
Rober and Muriel Lecky, 344 Kelly Drive, RR#1 Castleton, Ont. K0K 1M0
James McKague, RR#2 Haynes Rd., Castleton, Ont.
Mr. G. Allchurch, 429 Morganston Rd., RR#1 Castleton, Ont. K0K 1M0
Barry Churches, & Janet Blohm, 350 Morganston Rd., Castleton, Ont., K0K 1M0
APPENDIX C: Landowner Survey

Know your property:

One of the first steps in expanding landowner involvement, on a wider scale on Salt Creek, should ideally include an assessment of conditions on each property adjacent to the creek. Included with each copy of the management plan for the creek is a basic survey form. Each form has been drawn directly from the Environmental Farm Plan. Taking an afternoon to fill out this assessment, each landowner will gain valuable insight into the conditions on their reach of the creek. Sharing this information with other members of the Salt Creek Landowners Association will better enable the group, as a whole, to move forward in their efforts to restore Salt Creek. It would be highly beneficial for the Landowner Association to "match-up" these landowner surveys with a map of the creek in order to best determine where work needs to be done. *Please see following pages for stream assessment questionnaire.
Stream, Ditch and Floodplain Management

Why should you be concerned?

Water is one of our most important resources. Good management of streams, ditches and floodplains improves the quality of the water for the landowner and the people downstream who use the water. Fish and wildlife that depend on the stream will also benefit.

Good management methods protect streams, ditches and floodplains from soil erosion and water contamination. Stable, well vegetated streambanks and buffer strips reduce the amount of sediment and nutrients that reach the watercourse. They reduce the amount of time and energy needed to clean out drains and maintain tile outlets. Natural overhanging vegetation also provides excellent habitat for a variety of wildlife.

Good management practices also discourage livestock from spending time in, or immediately adjacent to, the watercourse. Herd health problems may be reduced if livestock wastes do not enter the water. Water quality will be maintained or improved.

The presence of a diverse fish and wildlife community in your stream is an indicator of good quality water. Like the “miner’s canary”, declining fish populations provide an early warning signal of environmental damage. Good stream, ditch and floodplain management results in long term economic and environmental advantages to you and your downstream neighbours.

What can you do?

1. Check the condition of stream banks and tile outlets regularly for soil erosion damage.

2. Protect your streams from contamination by livestock waste. Keep animals away from the water as much as possible.

3. Maintain a good continuous cover of natural vegetation on flood plain areas. Do not intensively crop floodplains.

4. Use the worksheets to rate your methods for managing streams, ditches and floodplains.
Glossary

Stream, Ditch and Floodplain Management

Terms you need to know for Worksheet #21

**Bed level stream crossing**: A structure for livestock and machinery to cross a stream. It is constructed at the bottom of the stream or ditch and has an erosion resistant surface. All water flows over the structure, and livestock and machinery must cross through the water.

**Berm**: An elevated strip of vegetated land next to a ditch or stream that helps to prevent erosion by directing surface water to a safe outlet, such as a surface water entry structure.

**Buffer strip**: A permanent strip of vegetation along side a watercourse. It helps prevent soil erosion and water pollution and may provide wildlife habitat.

**Ditch**: A watercourse constructed to carry water which may require regular maintenance. Includes both private and municipal drains and may include existing natural watercourses if they are classified as drains under the Drainage Act.

**Drop structure**: An structure to control erosion by directing water from a high level to a lower level. May include rock chute spillways or drop pipe inlets.

**Extensive livestock production system (low density)**: Providing a large enough pasture area for grazing animals such as cattle, sheep, horses, etc., to supply all of their nutrient requirements.

**Floodplain**: Lands next to streams, ditches and wetlands that may flood each year.

**Intensive livestock production system (high density)**: Pasture area does not provide all the nutrient requirements for grazing animals. Supplemental feeding completes the animals' diet. The pasture area may also be used mainly as a holding area.

**Mid level stream crossing**: A structure for livestock and machinery to cross a stream. It is constructed above the normal water level so animals and machinery do not go through the water.

**Slumping**: A downward movement of the slope of the ditchbank leaving an exposed soil surface behind.

**Stream**: A natural watercourse that may carry water for all or part of the year. Does not include streams classified as drains under the Drainage Act.

**Surface water entry structure**: A structure to control erosion by conveying concentrated flows of surface water from the top of the streambank to the watercourse. May include rock chute spillways, drop pipe inlets or grade control structures.

**Tile outlet protection**: The use of an erosion resistant material, such as rock riprap (angular stone) on top of a filter cloth, to protect the stream or ditchbank area where water exits a tile drain.

**Watercourse**: A channel for water. Includes ditches and streams.
Worksheet #21  Stream, Ditch and Floodplain Management: How do you rate?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Best 4</th>
<th>Good 3</th>
<th>Fair 2</th>
<th>Poor 1</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STREAMS AND DITCHES</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1 Buffer strips</td>
<td>More than 10 feet of natural vegetation (trees, shrubs, grasses) in the buffer strip. Requires little maintenance.</td>
<td>More than 10 feet of any type of permanent vegetation - can be planted and maintained.</td>
<td>1-10 feet of any type of permanent vegetation.</td>
<td>No buffer strip</td>
<td>OR area is tilled to the bank of stream or ditch.</td>
</tr>
<tr>
<td>2 Entry of surface water</td>
<td>No bank damage from entry of surface water.</td>
<td>Bank damage caused by entry of surface water. Protection at entry points not adequate to prevent damage.</td>
<td>Severe bank damage due to entry of surface water.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR minimum number of washouts protected by drop structures.</td>
<td>Numerous washouts protected by drop structures.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berms direct water to erosion protection structures.</td>
<td>No berms to direct water.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Tile outlets</td>
<td>No erosion.</td>
<td>Some erosion.</td>
<td>Soil is eroding around outlets.</td>
<td>Soil is eroding around the outlets and/or in the stream bed.</td>
<td></td>
</tr>
<tr>
<td>Minimum number of tile outlets (eg. header tile collects water from several tile runs). Good protection against erosion.</td>
<td>Numerous tile outlets - one outlet for each tile run. Good protection against erosion.</td>
<td>Minimum number of tile outlets but not protected against erosion.</td>
<td>Numerous tile outlets - no protection against erosion.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### STREAMS AND DITCHES CONTINUED

<table>
<thead>
<tr>
<th>Rating</th>
<th>Best 4</th>
<th>Good 3</th>
<th>Fair 2</th>
<th>Poor 1</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bank conditions</strong> (streams and ditches)</td>
<td>No evidence of erosion.</td>
<td>Banks are slumping in a few spots.</td>
<td>Some slumping in a few spots.</td>
<td>Many places where bank is slumping.</td>
<td>[ ] [ ] [ ] [ ] [ ]</td>
</tr>
<tr>
<td>Bank is covered with vegetation.</td>
<td>Most of bank is covered with vegetation.</td>
<td>Banks not covered with vegetation.</td>
<td>Banks not covered with vegetation (bare soil).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No maintenance required.</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Stream and ditch inspection**
Streams or ditches are inspected in the spring and fall each year for signs of erosion. Inspection includes:

- condition of banks
- tile outlets
- surface water entry points
- quality of tile outlet water

Streams and ditches are not inspected for signs of erosion.

**Bold italic type:** These conditions violate provincial legislation.

Worksheet #21
### STREAMS AND DITCHES CONTINUED

<table>
<thead>
<tr>
<th>Rating</th>
<th>Best</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Sites</th>
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<tbody>
<tr>
<td><strong>6 Extensive livestock production system (low density)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banks have good cover of vegetation.</td>
<td>Banks have good cover of vegetation.</td>
<td>Banks have little vegetation.</td>
<td>Banks have no vegetation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No damage to stream bank.</td>
<td>Little damage to stream bank.</td>
<td>Some damage to stream bank.</td>
<td>Severe damage to stream banks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock spend little time near stream.</td>
<td>Livestock spend little time near stream.</td>
<td>Livestock spend a lot of time near stream. Some muddy areas and fouling of water.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water supply available away from watercourse.</td>
<td>Stream is only water supply.</td>
<td>Stream is only water supply.</td>
<td>Stream is only water supply.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shade, salt located well away from stream.</td>
<td>Shade, salt located well away from stream.</td>
<td>Shade, salt located near stream.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>7 Intensive livestock production system (high density)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All livestock completely fenced from stream.</td>
<td>All livestock completely fenced from stream.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffer zone is wide enough to prevent manure from entering stream.</td>
<td>Buffer zone is wide enough to prevent manure from entering stream.</td>
<td></td>
<td>Livestock free to enter stream.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water supply available away from watercourse.</td>
<td>Water supply available away from watercourse.</td>
<td></td>
<td>No buffer zone.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-level stream crossing with culverts is used any time livestock cross stream.</td>
<td>Bed level structure is used any time livestock cross stream.</td>
<td></td>
<td>Effect of animals obvious: • fouling of water • trampling of banks • destruction of vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No structure available for animals to cross stream.</td>
<td></td>
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</tbody>
</table>

*Bold italic type: These conditions violate provincial legislation.*
<table>
<thead>
<tr>
<th>Rating</th>
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<th>Fair 2</th>
<th>Poor 1</th>
<th>Sites</th>
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<tbody>
<tr>
<td><strong>FLOODPLAIN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Extensive livestock production system (low density)</td>
<td>Floodplain has good cover of natural vegetation - no damage.</td>
<td>Floodplain has good cover of natural vegetation - little damage.</td>
<td>Little vegetation in floodplain area - some damage.</td>
<td>No vegetation on floodplain - severe damage.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Well managed grazing system in place.</td>
<td>Well managed grazing system in place.</td>
<td>Stream is only water supply.</td>
<td>Stream is only water supply.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water supply available away from stream and floodplain area.</td>
<td>Shade, salt located well away from floodplain.</td>
<td>Shade, salt located well away from floodplain.</td>
<td>Shade, salt located within floodplain.</td>
<td></td>
</tr>
<tr>
<td>9 Intensive livestock production system (high density)</td>
<td>All livestock completely fenced from floodplain.</td>
<td>Livestock free to enter floodplain area.</td>
<td>Livestock free to enter floodplain area.</td>
<td>Livestock free to enter floodplain area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Buffer zone is wide enough to prevent manure entering stream.</td>
<td>Severe trampling of floodplain and damage to vegetation.</td>
<td>Severe trampling of floodplain and damage to vegetation.</td>
<td>Severe trampling of floodplain and damage to vegetation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water supply available away from stream and floodplain area.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Use of floodplain area</td>
<td>Owner recognizes need to maintain floodplain area.</td>
<td>Owner recognizes need to maintain floodplain area.</td>
<td>Floodplain area is used for row crops in rotation with forages (with or without nutrients applied).</td>
<td>Floodplain area is used for row crops with or without nutrients applied.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area is used for woodlot, forage hay crop without nutrients applied, or remains idle.</td>
<td>Area is used for forage hay crop with nutrients applied.</td>
<td>Floodplain area is used for row crops in rotation with forages (with or without nutrients applied).</td>
<td>Floodplain area is used for row crops with or without nutrients applied.</td>
<td></td>
</tr>
</tbody>
</table>

**Bold italic type:** These conditions violate provincial legislation.
APPENDIX D: GLOSSARY OF TERMS

BIO-REMEDIATION / BIO-ENGINEERING: the practice of planning, designing, constructing or managing the revegetation and rehabilitation of soil through the use of plant materials.

BRUSHLAYER: a bio-engineering techniques which packs brush cuttings into a slope for stability against erosion.

BRUSH MATTRESSING: a bio-engineering technique which layers brush cuttings on top of a slope for stability against erosion.

BUFFERS: a buffer zone is a transitional area of natural vegetation designed to insulate and protect natural environments from human activities and land uses occurring in the surrounding landscape.

CHECK DAMS & DROP STRUCTURES: check dams are small dams meant to slow the flow and reduce the force of flowing water as opposed to stopping these flows altogether.

COLD WATER: cold water as used in this report generally refers to water which remains below 20 degrees Celsius throughout the warmest summer months, usually due to ground water input and shading. This is the key habitat requirement of a number of sensitive fish species such as trout.

COOL WATER: cool water generally refers to water which remains between 20 and 25 degrees Celsius during the warmest summer months. These waters are suitable for migration and spawning, but not suitable during the warmest summer months, for sensitive fish species.

CREEK SUBSTRATE: substrate refers to the material found upon the creek or stream bottom. Typically, in healthy creeks and streams there will be very little muck, clay or silt present.

CAROLINIAN: the zone of similar climate, plant and animal life which stretches from southern Ontario, to South Carolina.

DRUMLIN: drumlins are small hills of mixed till formed by glaciers.
HYDROLOGY: hydrology refers to the cycling of water through the air, land and drainage channels over time.

MIXED TILL: a mix of clay, sand, pebbles and boulders deposited directly by a glacier.

MICROCLIMATE: a small area with the same temperature, soil and moisture conditions.

MORAINE: a knobby ridge either of (a) boulder clay built by a thrust of glacier or a of (b) gravel and sand deposited at the edge of a glacier by escaping meltwater.

NATURAL AREAS LINKAGES: linkages refer to corridors of natural environment which connect two or more areas of wildlife habitat in terms of fish, bird and animal movements.

PHYSIOGRAPHY: the physical geography of the landscape.

REACH: a continuous stretch or expanse of a river or stream.

RESTORATION: ecological restoration consists of re-establishing biological diversity and resilience to land and its life processes that have been seriously disturbed or destroyed, usually by human intervention.

DIRECT RESTORATION: direct restoration refers to "hands-on" techniques such as planting and seeding.

INDIRECT RESTORATION: indirect restoration refers to techniques which involve the identification and elimination of sources of degradation.

RIFFLES & POOLS: a riffle is an area of a stream with fast flowing water over shallow rock / gravel beds. A pool is a deep, scoured-out area in a stream with slow flowing water. Both provide critical habitat to fish and other life within a stream.

RIPARIAN ZONE: this is the area occurring along the bank of a watercourse which is subject to flooding at least once every 2 to 20 years.

RIP-RAP: rip-rap refers to the use of rock or stone to form a stable barrier between the soil and erosion.
BIBLIOGRAPHY


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