Exert from Draft Report

4.5 AQUATIC RESOURCES

The location of surface monitoring, benthic invertebrate and fish inventory and/or habitat assessment stations are provided in Figure 6. The results of the electrofishing inventories conducted in late June 2004 are presented in Appendix F. Additional electrofishing inventories were conducted for on-site Mountsberg tributaries B, C and D and in Flamboro Creek on June 1, 2005 to supplement 2004 results. Stream discharge and standing water levels in 2005, were higher than noted during the 2004 surveys.

Detailed aquatic habitat descriptions at each location are provided in Appendix F. The following sections describe each watercourse on or adjacent to the subject lands.

4.5.1 Flamboro Creek

Conservation Halton (2002) determined in the Bronte Creek Watershed Study that the headwaters of Flamboro Creek between the CPR tracks and 10th Concession, one concession south of the Subject Lands, is supported by significant groundwater discharge and provides suitable coldwater habitat for brook trout (see North Carlisle Swamp location on Figure 3).

There are no sampling records for brook trout in this reach, however anecdotal reports from local anglers suggest their presence in the headwater area. Just upstream of Carlisle Road, south of the subject lands, the creek flows into a large on-line pond within a golf course.

Conservation Halton (2002) found that with the exception of a warmwater fish community below the Carlisle Golf and Country Club pond, coldwater fish community and temperature regimes throughout most of the subwatershed are consistent with the expectations for first and second order streams on the limestone plain and glacial spillway features. Conservation Halton (2002) has designated the creek at 10th Concession as marginal coolwater habitat with high aquatic ecosystem health.

The other branch of Flamboro Creek headwaters, which flows through the eastern corner of the Subject Lands, is designated as warmwater, forage fish with high aquatic ecosystem health at the 10th Concession (Conservation Halton, 2002). Anecdotal reports from landowners report that brook trout have also been caught in this reach in an on-line pond located between the 10th and 11th Concessions (south of the subject lands). Through communication with local residents it was also determined that a potential barrier to fish migration may exist in the form of a falls.

In 2004, aquatic surveys were conducted within this reach at the 11th and 10th Concession road crossings. Three benthic sampling locations, four fisheries inventory/habitat locations and a temperature logger were located on this watercourse (Figure 6). In 2005, additional electrofishing was conducted in reaches F3 and F4. Only one fish, a single blacknose dace, was captured north of the 11th Concession (F4). Immediately south of 11th Concession (F3), blacknose dace (94 in 2004 and 20 in 2005, including some gravid females) and brook stickleback (5 in 2004) were captured. Slightly downstream (F2), 8 blacknose dace and brook stickleback were captured, but no fish were present at 10th Concession (F1).

Diffuse groundwater seepage was observed entering the wetlands surrounding Flamboro Creek in the southeast portion of the Subject Lands (Figure 7). Some plant species with special habitat requirements, such as calcareous seeps, were present in this portion of the wetland. Additional ecological work is planned for 2006 in this area.

4.5.2 Mountsberg Creek and Tributaries

Mountsberg Creek supports a diverse fish community. Within the vicinity of the subject lands, which is below the Mountsberg Reservoir, the creek is classified as warmwater sportfish. The presence of the reservoir and other on-line ponds has had a warming effect on the creek, with summer temperatures in the approximate range of 28°C to 13°C. This has allowed for the introduction of some centrarchid species (sunfish family) more typical of lake environments (Conservation Halton, 2002). A single brown trout was captured by Conservation Halton, in 1999, at the 11th Concession road crossing and anecdotal reports indicated that small pockets of brook trout and brown trout might persist in this reach (Conservation Halton, 2002).

Mountsberg Creek is associated with the site in a few different locations. A tributary originates in the PSW at the north end of the Subject Lands as a diffuse flow through the wetland and then

consolidates into a more defined watercourse (Tributary A on Figure 6) as it leaves the site. At the extreme west corner of the site Mountsberg Creek crosses the property boundary at the confluence with Tributary A. Conservation Halton (2002) reports that groundwater is added to the system throughout this section resulting in a marginal cooling of Mountsberg Creek, which is classified as warmwater as it leaves Mountsberg Reservoir. However an on-line pond downstream of Concession 11 contributes to further warming. Approximate summer temperatures of Mountsberg Creek range from 28°C to 17°C.

Three benthic sampling locations, three fisheries inventory/habitat locations and two temperature loggers were surveyed on Mountsberg Creek in 2004 (Figure 6). Nineteen different species of warmwater fish were caught during the field inventory (Appendix F).

All of the remaining watercourses on and adjacent to the subject lands are much more diffuse with poorly defined channels and seasonal flows, including the outlet from the pond at the south end of the property. These are described below.

Tributary A contained two benthic sampling stations, two fisheries inventory/habitat stations and a temperature logger. Three species of fish were captured during the inventory, white sucker, pearl dace and central mudminnow in 2004. Groundwater seeps were observed which seasonally direct flow to the wetlands on the Subject Lands surrounding Tributary A (Figure 7). These are the subject of ongoing monitoring.

Tributary B contained one benthic sampling station and three fisheries inventory/habitat stations. Most of tributary B (stations B2 and B3) contained no water during the 2004 survey; as a result sampling was restricted to an area immediately upstream of the 11th Concession (station B1). Noticeable, although shallow, flow was present during the 2005 survey. No fish were captured or observed in this tributary.

Tributary C contained one benthic sampling station and one fisheries inventory/habitat station. No fish were captured in this tributary. Despite higher water levels in 2005, the two culverts and the land draining into them were completely dry.

Tributary D contained two benthic sampling locations, three fisheries inventory/habitat locations (including the on-line pond) and a temperature logger. One fish species, brook stickleback, was captured during the 2004 inventory. Hundreds of brook stickleback of all age classes were observed in the pond in 2005. Damp areas were the only signs of water upstream of the pond in 2005.

4.5.3 Benthic Macroinvertebrates

A summary of the benthic macroinvertebrate community analysis is provided in Table 4, and explained below. Raw data are included in Appendix G. Where appropriate, the results of the fisheries surveys and habitat assessments were taken into consideration when describing the results of the benthic community indices. All aquatic survey station locations are illustrated on Figure 6.

The benthic community data range from indicating good quality habitat conditions in the main channel of Mountsberg Creek (Stations M1, M2, and M3) to fairly poor habitat conditions in Flamboro Creek and tributaries to Mountsberg Creek (most notably, Stations A2, B1, C1, and D2). Further details follow.

The total abundance of organisms was highest at the Mountsberg Creek Stations M2 and M3 (i.e., with a mean of 987 and 1,077 organisms at Stations M2 and M3, respectively) and was lowest at Stations B1 and F1 (i.e., 109 organisms at both stations). While a low abundance of organisms is generally indicative of limited habitat potential, it should be noted that a high abundance of organisms only indicates good water quality if the community composition is diverse and the species present are generally pollution intolerant. The relative abundance of major taxonomic groups is summarized in the last five columns in Table 4. As discussed below, Stations M2 and M3 support diverse benthic macroinvertebrate communities.

Stations A2 and B1 are dominated by molluscs, with > 55% of these communities belonging to this group. Approximately 60% of the community at B1 comprises mollusc organisms. Benthic communities may be indicative of environmental stress when a single species or group comprises > 60% of the total community assemblage. Therefore, given that these stations are both dominated by tolerant, filter feeding molluscs, they are clearly stressed communities. The fisheries habitat assessment field investigations confirm these findings; only two tolerant warmwater fish species were captured within Tributary A (i.e., pearl dace, brook stickleback), and Tributary B is an intermittent watercourse where no fish were captured.

Stations C1, F1, F3, and M1 are dominated by the pollution tolerant chironomid family (i.e., comprising 56.4%, 56.2%, 51.0% and 44.6%, respectively). With the exception of station M1 (which is co-dominated by sensitive benthic organisms, as discussed below), aquatic habitat is deemed to be limited in these reaches on the basis that the dominant organisms at these stations are among the most tolerant benthic macroinvertebrates. These data also correspond with the fisheries data. Tributary C is an intermittent tributary to Mountsberg Creek and is not known to support fish habitat, while Tributary F is the main channel of Flamboro Creek where only two tolerant warmwater baitfish species were captured (i.e., blacknose dace, brook stickleback).

Stations D2 and F4 are both dominated by organisms grouped as “other” in Table 4. These species include a combination of tolerant nematodes, annelids, ostracods, and amphipods. All of these groups are considered to be relatively insensitive organisms that can tolerate degraded habitat conditions. As described above, the fisheries catch results for Flamboro Creek support these data. Similarly, only one tolerant warmwater baitfish species (i.e., brook stickleback) was captured in Tributary D at Station D1, while no fish were captured at Station D2.

Conversely, stations M1, M2 and M3 indicate good habitat conditions, as many of the taxa are the pollution sensitive mayflies (from the order Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) (i.e., ranging from means of 12 to 14 EPT taxa). EPT taxa richness at all other stations is poor, ranging from 0 to 4. However, while only 4 EPT taxa occur at station D1, they account for 48.8% of the total community. These sensitive EPT organisms

characterize the study reaches of Mountsberg Creek in particular as an intolerant benthic community that is vulnerable to potential environmental impacts. Similarly, station M3 demonstrates the highest taxa richness (i.e., mean of 54 taxa) and, therefore, supports a well balanced community, with good representation by many benthic groups. This observation is supported by the fisheries data, where the main channel of Mountsberg Creek is known to provide habitat for warmwater sportfish species.

4.5.4 Surface Water Quality

General trends within the historical Provincial Water Quality Monitoring data for the Bronte Creek watershed suggest that total phosphorus concentrations regularly exceeded (51% of the time) the Provincial Water Quality Objective (PWQO) for total phosphorus of 0.03 mg/L (Conservation Halton 2002). High concentrations of *E. coli* and other fecal coliforms were found throughout the watershed. Non-point surface runoff from agricultural operations is believed to contribute to elevated bacteriological levels (Conservation Halton 2002). Although metal concentrations were generally found to meet PWQOs, aluminum, iron, and zinc concentrations exceeded PWQOs at several points within the watershed.

Historical mean water quality for Mountsberg Creek reflects the water quality trends of the Bronte Creek watershed. Mountsberg Creek water quality generally met PWQOs, with the exception of *E. Coli* (135 counts per 100 ml) and zinc (0.025 mg/L) at Highway 401, and total phosphorus (0.032 mg/L) at County Road 18. No Provincial Water Quality Monitoring data are available for Flamboro Creek (Stantec, 2006. in preparation). However, Conservation Halton (2002) collected data in Mountsberg and Flamboro Creek at stations M1 and F1 over the period 1999-2001. Mean water quality at these Flamboro Creek locations met PWQOs with the exception of aluminum (0.102 mg/L) and total phosphorus (0.069 mg/L).

Surface water samples were collected at stations A1, M2, M3 and F4 and were analyzed for quality. The results are provided in Appendix G and Table 5. The following discussion is summarized from Stantec (2006. in preparation).

On-site water quality sampling results demonstrate that average water quality at stations M2 and M3 in 2004 and 2005 along Mountsberg Creek was similar to that observed at the historical Provincial Water Quality Monitoring station at County Road 18. Similar nutrient and total suspended solids levels were also noted between all three stations. This suggests that the upstream Provincial Water Quality Monitoring station at County Road 18 can serve as a long-term monitoring station for background water quality characterization.

Total dissolved solids are greater in groundwater than in surface water (Gartner Lee Ltd., 2005). The patterns observed in total dissolved solids levels from November 2004 to September 2005 suggest that Tributary A receives a greater proportion of groundwater input than Mountsberg or Flamboro Creek. The seasonal pattern of change in total dissolved solids levels suggests that groundwater input to Tributary A occurs from fall to spring, as levels remained above 400 mg/L. However, by September, total dissolved solids levels in Tributary A (168 mg/L) were similar to those at M2 in Mountsberg Creek (190 mg/L). The pattern of decreasing total dissolved solids

levels from spring to summer was also observed at the two Mountsberg Creek stations. The pattern observed for Flamboro Creek appears to suggest that the creek is maintained by shallow groundwater into the spring until flows are no longer observed during summer.

Although groundwater discharged from the Badenoch Moffat Swamp Complex sustains coldwater conditions upstream of the Mountsberg Reservoir, it is recognized that warm water discharged from the Mountsberg Reservoir during the summer results in significant degradation of coldwater habitat in reaches downstream of this point (Conservation Halton 2002). On Flamboro Creek, the tributary crossing at the 10th Concession provides permanent coolwater flow extending downstream to the on-line pond on the Carlisle Golf Course. Warmwater conditions are present downstream of this pond, with groundwater inputs from the downstream valley slopes allowing for gradual regeneration of coolwater conditions (Conservation Halton 2002).

The temperature data collected on-site suggest that Flamboro Creek is most responsive to ambient air temperatures, while Tributary A and Mountsberg Creek demonstrate slightly different daily maximum temperatures, but considerably different daily minimums. Observed temperatures in Mountsberg Creek demonstrate a lower degree of variability than temperatures in Tributary A or Flamboro Creek, likely a result of the larger flow volumes.

The maximum temperatures reached in Tributary A appear to be buffered as a result of some groundwater input during the summer months. Flamboro Creek is characterized by the greatest temperature fluctuations as a result of the very low flow rates, which allow its waters to be influenced by ambient temperatures (Stantec, 2006. in preparation).