

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
General	An integral part of the study is <i>Conceptual Understanding</i> of the groundwater and surface water flow systems, functions, and interlinkages. Since the MOE framework identifies specific deliverables of the <i>Conceptual Understanding</i> (GM#7, Section 2) and since many of its components were included in the Tier 2 Report but not referenced as the required water budget ‘conceptual understanding’ deliverables, they could be identified/inventoried in the Tier 2 Report sections concerning the “Scope of Work” (Section 1.3) and ‘Watershed Characterization’ (Section 2). Adding an <u>inventory of deliverables</u> would aid with the future Drinking Source Water Protection (DSWP) Assessment Report where referencing the primary water budget deliverables from each water budget phase/stage might be required.	Region of Peel (A. Korniluk)	Text has been expanded/rewritten. Inventory of deliverables has been provided for the Tier 2 phase.
General	Since a complex numerical model suitable for Tier 2 was developed at CVC prior to source water protection and then upgraded (laying the foundation for a more complex assessment), deliverables that would’ve otherwise constituted the Tier 1 outcomes (i.e. as per the GM#7 framework) became part of the Tier 2 work. Specific Tier 1 components carried at a more advanced level as part of the Tier 2 assessment should be inventoried as part of the Integrated Water Budget Report (e.g. as part of the “Scope of Work” and ‘Summary’ sections). <u>An inventory of Tier 1/Tier 2 deliverables</u> similar to ‘conceptual understanding’ deliverables should be built into the Report.	Region of Peel (A. Korniluk)	Text has been updated and expanded to address the comments, and a summary of Tier 2 deliverables has been included in the text.
General	Crucial considerations arising from the MOE GM#7 requirements could be listed in the Tier 2 ‘Scope of Work’ (Section 1.3) such as concerning the following: (i) estimation of the various water budget fluxes; (ii) calibrating the estimates to observed data; (iii) estimation of the percentage of the consumptive amount of a water supply source that is demanded by water users; (iv) validation of results to actual observations such as groundwater level fluctuations, pond or lake fluctuations, streamflow data or changes induced by water takings; (v) consideration of both current conditions as well as a 25-year future water demand scenario; (vi) verification that the results are physically reasonable prior to proceeding with the stress calculations; and (vii) verification of the stress level where the estimated it is near the threshold between low to moderate stress, etc.	Region of Peel (A. Korniluk)	The report text was updated as suggested.
General	The role of the Tier 2 is to re-assess and verify the earlier (i.e. Tier 1) study outcomes using complex numerical modeling for groundwater systems and a detailed time-continuous modeling for surface water systems; to refine the estimation of water budget components to facilitate a more reliable stress assessment, and since the three distinct phases of the water budget and water quantity risk assessment were rolled under the Integrated water Budget Report, <u>the Tier 2 framework and the MOE recommended process flow could explain how/why the CVC Integrated Water Budget approach was different from the distinct phased approach recommended in the MOE’s GM#7.</u>	Region of Peel (A. Korniluk)	Additional discussion outlining the deliverables of the Tier 2 Assessment were outlined, as well as the rationale as to why the CVC and other conservation authorities in Ontario were instructed by the Province to bypass the Tier 1 Assessment and move directly into the Tier 2 Assessment.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
General	<p>Are the simulated fluxes that are reported to cross over common boundaries (i.e. CVC-TRCA; CVC-NVCA, CVC-GRCA, etc) consistent with the interpretations/analyses of those neighboring agencies? This is particularly important where WHPAs cross over the boundaries such as is simulated to occur at Orangeville and Cheltenham. Also note that the TRCA have flux crossing from CVC Subwatershed 13 into their jurisdiction and the CVC model doesn't include this flux.</p>	Rick Gerber, CTC	<p>Cross-boundary fluxes with adjacent jurisdictions was not completed as part of this study as it was not part of the scope of this project. Other studies are on-going and being continually updated which poses a challenge for model flux comparisons. Also, if there are discrepancies with fluxes between two models, it is difficult to determine which predictions are 'correct' or more reliable than others.</p>
General	<p>Future demands have not been estimated and therefore %Demand for future conditions has not been estimated. This may be important for subwatersheds with municipal supplies having current %Demand values just under the 10% threshold for Groundwater takings.</p>	Rick Gerber, CTC	<p>Future conditions have been added to stress assessment and water budget chapters.</p>
General	<p>The report contains frequent indirect references to scale. Our impression is that these references are intended to help the reader gauge the level at which specific results of the analyses are reliable. For example, the root mean-squared error for the high quality wells is 4.7 m (for those wells for which data are available). In our opinion, although this error is relatively large in the context of an individual wellfield, it does not cast doubt on the reliability of interpretations developed for the subwatershed scale. However, as we read some sections of thereport we had to pause to ask ourselves, "Is a subcatchment the same asa subwatershed, or is catchment the same as a subwatershed?" and "Is a local scale groundwater analysis focused on a subwatershed, or on an individual wellfield within the subwatershed? In our opinion, it would be helpful for the general reader to be provided with definitions for the following terms that are used in the report, with examples drawn from the Credit River watershed: • Regional • Local • Watershed • Subwatershed • Catchment; and • Subcatchment.</p>	Chris Neville,S. S. P & Assoc, Inc.	<p>Comment acknowledged. A glossary has not been prepared, but additional explanation has been provided in places throughout the report.</p>

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
General	We recommend that the final version of the report include a map that synthesizes the multiple hypothesized buried valleys, with an indication of which valleys have been investigated in detail. Although Figures 2–6 and 2-7 are presented at the same scale it is difficult to check the degree to which the interpreted thalwegs are similar. The explanations in the figures also need to be supplemented so that the figures are self-contained.	Chris Neville,S. S. P & Assoc, Inc.	None of the valleys have been studied in detail within this assessment, and few studies have examined the valley infill sediments or infill for more than a local scale area (local areas studied by YPDT-CAMC group near Caledon East, and by P.Meyer south of Georgetown). Detailed characterization of the valleys, however, was outside of the scope of this study. Interpreted thalwegs have been updated on the figures and the explanations have been enhanced.
General	We recommend that the final version of the report include a map that shows only the high quality wells (dedicated monitoring wells with logs developed by a professional geoscientist) and municipal supply wells for which geologic logs are available.	Chris Neville,S. S. P & Assoc, Inc.	As suggested, a map of the high quality wells in the Watershed was added to the report.
General	There is a significant data gap in the analysis: the Tier 2 water budget analyses were not able to incorporate data from the Region of Halton groundwater monitoring wells. Fortunately, even without some potentially important data, areas of significant water takings in Halton Region (Black Creek and Silver Creek) have been identified as having the potential for moderate stress. These areas will be the subjects of Tier 3 assessments. If the locations of the Halton wells are known, they should also be incorporated in the figure of high quality wells, with an indication that the data from these wells will eventually be incorporated in the regional-scale analysis. We expect the regional-scale analysis to be used beyond this stress assessment.	Chris Neville,S. S. P & Assoc, Inc.	The Region of Halton data was added to the discussion in the report, and also to the model calibration figures. It was noted that the model was not calibrated to these data points, however they were added for completeness. It was recommended that the model calibration in the Georgetown area be updated to reflect the addition of high quality data.
General	We recommend that the final version of the report also include a map that shows only the differences between observed and calculated water levels at high quality wells.	Chris Neville,S. S. P & Assoc, Inc.	As suggested, a map of the residuals within the high quality wells (including those in Halton) was added to the report.
	Acknowledgments missing, and should be added	CVC	Acknowledgments were added to the report as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
TABLE OF CONTENTS	Chapter 1 not identified by name	CVC	Report text updated as suggested.
p i	"These communities include Acton....." (insert Acton)	Halton Reg	Report text updated as suggested.
p iii	Table showing bottled water as a consumptive use. Why is this category not discussed in the text at all?	Halton Reg	This category was not discussed as similar sectors were not discussed explicitly in the report. The water takings from water bottlers in the watershed does not warrant any additional changes. No additional changes were made to the report.
p v	PTTW: CVC should coordinate with the Region /Municipality to develop a comprehensive PTTW data set.	Halton Reg (Sudhakar Kurli)	Comment is acknowledged and this was noted in a few sections of the report including the recommendations.
p v	Future Water Demands: Population growth estimates are done by the municipalities , not by CVC.	Halton Reg (Sudhakar Kurli)	Acknowledged; the CVC was encouraged to compile the estimates from the municipalitie wherever possible.
	Groundwater monitoring: There should be common, centrally-shared database rather than CVC and others each doing the same thing	Halton Reg (Sudhakar Kurli)	Comment acknowledged
	Conceptual Geologic Model: Again this should be done together by CVC and the Region with a common shared conceptual and mathematical model , not a stand alone CVC FEFLOW model.	Halton Reg (Sudhakar Kurli)	Comment acknowledged

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p v	Agree with key recommendations, particularly No.4. To this we would add the recommendation that additional meteorological stations, capable of measuring at least hourly precipitation and temperature, should be considered within the Credit River Watershed. As a minimum, stations should be located above and below the escarpment in the upper watershed and in the lower watershed. This information will be useful for future refinement of the current study.	Kevin Mackenzie (Golders Assoc)	CVC set up three new climate stations at Orangeville Treatment Plant, Acton Sewage Treatment Plant and the Lakeview treatment Plant, respectively, during 2007 and monitoring has recently started. The information could be used for future refinements of the surface water model.
p iii, para 3	CVC and EbnFlow 2007 not in reference list	Rick Gerber, CTC	Reference updated as suggested.
Page iv, para5	Should state that SGRAs need to be prepared for a)municipal supply wells and b) hydrologic features such as wetlands and cold-water fisheries. This report only estimates SGRAs for a)	Rick Gerber, CTC	We followed instructions for delinating SGRAs in the draft directors rules documents.
Page iv, para 6	Is the Clean Water Act reference actually MOE 2006b in your reference list? You just have (2005).	Rick Gerber, CTC	Reference for Clean Water Act corrected throughout the text where appropriate, as suggested.
<b>CHAPTER 1</b>	<b>INTRODUCTION</b>		
	Indicates that the <i>Clean Water Act requires water budget models to be developed for watersheds across the Province</i> and that <i>the primary goal of the water budget assessment is to use these numerical models to understand and assess the sustainability of the Province's various drinking water sources.</i> It is noted that, based on the Guidance Module 7, <u>a tiered framework was developed to guide the degree of assessment consistent with local water quantity issues.</u> The MOE GM#7 indicates that in areas where the availability of water budget far outweighs the demand, a simplified approach (Tier 1) may be sufficient for decision making and further more complex methods may not be required. <u>The MOE-based framework could be incorporated into the report to better depict the MOE requirements versus that which was undertaken.</u>	Region of Peel (A. Korniluk)	The text of the report has been updated to better describe the MOE Water Budget framework and how the work undertaken by the Credit fits into this framework.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
	Reference to the overarching Source Water Protection legislation (most recent) and framework and the governing Guidance Module 7 should be made here, explaining how the tier 2 study meets the guidance The tiered nature of water budget studies described in the guidance should be discussed, briefly showing how this study fits in. Previous work done by the CVC, and the modelling studies of May '06 (surface water, groundwater) should also be referenced to give the reader a brief history of the work done as a precursor to this investigation, in lieu of conceptual and tier 1 levels of water budget studies required by the guidance.	CVC	The text of the report has been updated to better describe the MOE Water Budget framework and how the work undertaken by the Credit fits into this framework.
1.1, p 1, para 2, pt4	Are <b>groundwater</b> levels or streamflows declining....?	Halton Cons	Report text updated as suggested.
Section 1.1.1.2, p 2; Para 2, last line	<b>This</b> methodologies used. Replace <i>This</i> with <i>the</i>	Halton Cons (D. Mohummad)	Report text updated as suggested.
Section 1.2, p 3	Bullet 5, Surface Water Discharge, should it be <i>Groundwater Discharge</i> ?	Halton Cons (D. Mohummad)	Report text updated as suggested.
Section 1.2.1,p 3 line 2	Should the sentence read ...to enhance the understanding of the <b>surface water and</b> groundwater flow....	Halton Cons (D. Mohummad)	Report text updated as suggested.
Introduction	Somewhere in the intro that you should include a couple of sentences explaining where this report fits into the assessment report picture for the CVC SPA. Maybe state that for SWP for the CTC there already exists: a. Watershed Characterization report (date); b. 2 water budget reports (HSP-F, April 2006 and FEFLOW, May 2006) that were peer reviewed in 2006-07; and c. This report. This would act as a reminder for the reader, particularly the SPC members who are trying to sort this out.	Rick Gerber	Report updated as suggested
Introduction	Does this report now replace the 2 earlier water budget reports? If so then state that the 2 earlier water budget reports were provided to give peer reviewers and partners some background information on the models that the CVC would be using, and then ultimately reporting on in this report. You would also need to state that comments received on the 2 earlier reports have been incorporated into this report.	Rick Gerber	This report replaces and supercedes the earlier water budget reports. The report text was updated to reflect this as suggested
Introduction, p1, line 1	I thought this report was to document the results of the SWP Tier 2 Water Budget analysis. <b>Maybe add something like “..... and application to SWP Tier 2 Water Quantity Stress Assessment.” at the end of first sentence.</b>	Rick Gerber, CTC	Report text updated as suggested.
Introduction, p1, para3	The reference to the Clean Water Act should be MOE 2006b from your reference list. I would change the second sentence to “The Clean Water Act requires that water budgets be developed....”. The Clean Water Act does not require that water budget models be developed for all watersheds. The third sentence would then be something like “The primary goal of more advanced water budget assessment is to use numerical models.....”.	Rick Gerber, CTC	Report text updated as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Introduction, p2, para2	Tier 1 is a Stress Assessment, not a Risk Assessment. - Text in Bold - ... the CVC has proceeded, not preceded.	Rick Gerber, CTC	Report text updated as suggested.
Introductn, p3, bullet 6	Do you mean various instead of vertical?, In para 3 – is there a reference for the previous GAWSER modeling?	Rick Gerber, CTC	Report text updated as suggested.
p2	Hydrogeologic modelling is not an exact discipline, and in general the results of the stress assessment seem to be qualified appropriately. However, referring to Page 2, in our opinion it may be more appropriate to refer to the stress assessment process as the “development of an index of potential stress” rather than “estimation of the level of potential stress”.	Chris Neville,	Report text updated as suggested.
Introduction, p3, bltt 6	last paragraph – should section 1.3.2 read 1.2.2?	Rick Gerber, CTC	Report text updated as suggested.
p5	YPDT database <i>last line</i> . Do you mean records >8? The MOE QA/QC codes generally only go to 9. Note that for much of the interpretive analyses conducted by the YPDT-CAMC group that generally only wells with QA/QC codes <6 have been used (e.g. hydrostratigraphic interpretation). Last paragraph – note that there are 2 CVC 2007a references in the reference list. Needs to fixed throughout text.	Rick Gerber, CTC	Report updated as suggested
p6, para 2	I think the second sentence needs a word such as “use” on the end.	Rick Gerber, CTC	Report text updated as suggested.
<b>CHAPTER 2</b>	<b>WATERSHED CHARACTERIZATION</b>		
Section 2.1.2.1 <i>Watershed Characterization</i>	Does not list ‘meltwater channels’ as major physiographic features in the Credit River watershed. Please note that these distinct features occupy significant areas in Peel and are also discussed by Chapman and Putnam (1984) in the <i>Physiography of Southern Ontario</i> . Since further sections in the Report refer to these features frequently and since a number of municipal wells in Peel are sited in these areas they should be identified as major physiographic features in Peel.	Region of Peel (A. Korniluk)	Meltwater channels are physiographic features and the text and figure refer to physiographic regions. The intent at this stage in the report was to discuss regions, and not specific features. Additional discussion of meltwater channels was added to the physiography section, and the features are discussed under the Quaternary geology section of the report.
Section 2.2.4	Figure referenced here often lack the appropriate identification of features being discussed thus making it difficult to cross-reference the issue with the specific locations on the maps.	Region of Peel (A. Korniluk)	These features have been added to several of the maps including surficial geology and overburden thickness.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 2.2.6	There is some mix-up of cross-section references (e.g. the text refers to Figure 2-11 as Georgetown while the actual cross-section title refers to Erin; Figure 2-12 is referenced as Orangeville while the actual cross-section is titled Georgetown, etc.).	Region of Peel (A. Korniluk)	Figure numbers clarified/ updated as suggested.
Section 2.2.2 <i>Geological Setting</i>	A table showing chronological stratigraphy for both bedrock and overburden could be included to define geo-environment both spatially and temporally.	CVC	A table was added to the report, and the text was updated as suggested.
Section 2.2.4, p 15, Para 1, line 6	“a limited amount of borehole data and correlation” – references on borehole sources should be indicated.	CVC	Report text updated as suggested.
Section 2.3.3, p 20, Para 2, line 3	“These units are observed only in a few very deep boreholes” – references should be indicated here (same to Page 15).	CVC	Report text updated as suggested with additional references.
Section 2.3.4, p 20	Discussion on aquifer complexes should be developed further to indicate how they are related to the regional hydrostrata.	CVC	Report updated as suggest. Table added to better summarize strata.
Section 2.4.2, p 25	“bullets” – Orangeville station, Guelph Turfgrass Institute and Georgetown WPCP not be shown on any figure.	CVC & R Gerber	Location of these stations were added to the monitoring locations figure.
Section 2.1.1 – p 7 ; Para 1, last line	“watershed into 3 regions; the upper (west), the middle and lower (east) watershed regions.	Halton Cons	Report text updated as suggested.
Section 2.2.5, p 16	Include ‘Sand & Gravel Thickness’, preferably with ‘Saturated Sand & Gravel Thickness’ map	Halton Cons (D. Mohummad)	As requested, Figure 2-10 (Sand and gravel thickness) was added to the report and discussed in the text.
Section 2.3, p 18	What is the rationale for selecting 25 m for shallow and deep groundwater levels? Are all streams with a Strahler stream order classification greater than 2, perennial? If not, include only the perennial streams as control points for shallow groundwater map.		The report text has been updated to rationale the use of 25 m to separate the deep and shallow water levels.
Section 2.3.2, p 19, Para 2	move this paragraph to the end of the preceding Section 2.3.1	Halton Cons (D. Mohummad)	Report text updated as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p 19, and elsewhere	Change “potentiometric” to “deep groundwater level”.	Halton Cons (D. Mohummad)	We feel that this report is a technical report and potentiometric surface is a common hydrogeology term; whereas the term 'deep groundwater level' may be confusing to some. Report was not updated as suggested.
Section 2.3.3, p 19	Hydrostratigraphy – Include isopach maps of Hydrostratigraphic Units (HUs), at least for aquifer units	Halton Cons (D. Mohummad)	Isopach maps were not within the scope of this study and as such were not included. It was understood that the discussion of the conceptual model in earlier CVC reports was sufficient and that this information did not need to be reiterated in this document.
Section 2.3.5, p 22	Include map showing (major/minor) aquifer complexes	Halton Cons (D. Mohummad)	Mapping of aquifer complexes is difficult as they often overlap and the division between major and minor is speculative.
Section 2.1.1, p 3	AMSL: Fully expand acronym at first occurrence. Applies to entire report	Halton Cons (D. Mohummad)	Report text updated as suggested.
p 21	Amabel Production Zone is not included in Table 3, p. 20	Halton Cons (D. Mohummad)	The presence of the Amabel production zone within the CVC watershed is poorly understood and speculative. A lack of high quality cored boreholes or logged outcrop exposures has prevented the delineation of this unit within the watershed.
p 25	Figure 2-17 is referenced for 5 climate stations (LBPIA, Orangeville MOE, GTI, Shand Dam MSC, and Georgetown WPCP); Figure 2-17 shows 3 climate stations. Caledon Station shown on Figure 2-17 is not mentioned in Section 2.4.2.	Halton Cons (D. Mohummad)	The climate stations were added to the monitoring stations map as requested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 2.4.4, p 27, Para 2, line 1	“instream flow requirements <b>are can</b> be classified...”	Halton Cons (D. Mohummad)	Report text updated as suggested.
	What is the consideration of wastewater treatment and quarry water discharges, reservoir releases and surface water takings in the baseflow analysis?	Halton Cons (D. Mohummad)	The analysis illustrated was based on measured streamflow, and as a result, it reflects all anthropogenic impacts.
Section 2.1.1, p 3	AMSL: Fully expand the acronym at its first occurrence. This applies to the entire report.	Halton Reg	Report text updated as suggested.
Section 2.2.3, p 13	The report indicates that the YPDT database was used to create the bedrock surface in Figure 2-6. What data, other than MOE water well records was used to construct Figure 2-6 in areas outside of the YPDT coverage? It would also be useful to see what wells in Figure 2-6 are push-down wells.	Halton Reg (Sudhakar Kurli)	Report clarified as requested.
Section 2.2.3, p 14 Para 2	the report indicates that the 2 conceptualizations of bedrock topography are useful for the water budget study and that when evaluated together the two surfaces create an upper and lower range of uncertainty. How do the differences in each conceptual scenario affect the water budget? Which of the 2 was used in the groundwater model and how does it impact the outcome of the water budget results, stress assessment and drought assessment?	Halton Reg	The YPDT bedrock surface was used in the model for consistency between CVC and TRCA; however the water levels associated with this system appear to be too low. A sensitivity analysis was not completed to assess uncertainty of bedrock layers.
Section 2.2.6, p 17	Reference is made to Figure 2-11 cross-section through Georgetown and that the static levels may not be representative of modern day pumped elevations. <i>To clarify, there is no active Halton/Georgetown municipal well in the vicinity of the cross-section</i>	Halton Reg	Report clarified as requested.
Section 2.2.6, p 17	There appears to be a mix up in Figure Numbers for the cross-sections. E.g. Figure 2-11 is referred to in the report as Georgetown, but on Figure 2-11 title is Erin. Check Figures 2-11, 2-12 and 2-14 as they do not seem to match with body of report.	Halton Reg	Figure numbers clarified/ updated as suggested.
Section 2.5.10, p 34, Para 4, line 1	Urban development <b>within the approved urban boundary</b> in the Town of.....	Halton Reg	Report text updated as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 2.4.2, p 25, last para	The mean annual (potential) evapotranspiration is reported as about 540mm. <i>How does this estimate compare to the potential evapotranspiration modelled using the Jensen and Haise method in HSPF?</i>	Kevin Mackenzie	The Jensen and Haise method was not considered in this study.
p7, para1	Is Chapter 2 simply a summary of the Watershed Characterization report (and 2 earlier water budget reports?) or has some information been updated since the earlier reports were released? It should be stated which because if it is simply a summary then the reader may want to skip this chapter and be confident that they aren't missing anything new. <i>There are 2 CVC 2007a references in reference list.</i>	Rick Gerber, CTC	Report text updated as suggested.
p7, para2	Orangeville (Hillsburgh Sandhills) and Paris (Horseshoe Moraines) moraines aren't explicitly shown on Figure 2-3. Maybe refer to Figure 2-2 where these three moraines are labelled.	Rick Gerber, CTC	Report text updated as suggested.
p7, para3	Which direction are the drumlins elongated	Rick Gerber, CTC	Report text updated as suggested.
p7, last line	"permeability" should be "permeable"	Rick Gerber, CTC	Report text updated as suggested.
p8, para3	Norval is not labelled on Figure 2-3. Places referred to in text should be shown on a figure.	Rick Gerber, CTC	Figure updated as requested.
p8, para7	Sentence should read something like "This zone is currently highly urbanized with a growing population."	Rick Gerber, CTC	Report text updated as suggested.
p9, bullet2	Guelph Drumlin <i>Field</i> , not Moraine.	Rick Gerber, CTC	Report text updated as suggested.
p9, para6	"et al" should be italicized. This will apply throughout text.	Rick Gerber, CTC	Report text updated as suggested.
p10, para3	I think the Oak Ridges Moraine is about 13,400 years old, not 12,000 according to Karrow and I believe Peter Barnett in the Geology of Ontario, Volume 2.	Rick Gerber, CTC	Report text updated as suggested.
p10, para5	Karrow 1968 not in reference list	Rick Gerber, CTC	Reference added to reference list as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p11, para3	The land classification map shown on Figure 2-4 is believed to be representative of or current to what year? 2004?	Rick Gerber, CTC	Report text clarified as suggested.
P13, para6	Karrow 1973 not in reference list	Rick Gerber, CTC	Reference added to reference list as suggested.
p14, para3	The last sentence I think is a good summary. I would change it slightly to “Figure 2-6 may not define the maximum depth of bedrock valleys, while Figure 2-7 may over-estimate the depth of bedrock valleys.” I am also wondering if it would be much work to come up with a common bedrock surface to be used in both the FEFLOW (CVC) and MODFLOW (TRCA) models, particularly where the models overlap? Having two surfaces or interpretations still leads to a bit of awkwardness.	Rick Gerber, CTC	Report text is updated as suggested. It is recognized that having two interpretations is not ideal. CVC adopted the YPDT surface used in the TRCA area and the depth and width of the valley in the CVC Watershed appears to be overestimated.
p14, para4	Statement “..., and on Town of Orangeville....” should be ....., and a Town of.....	Rick Gerber, CTC	Report text updated as suggested.
p15, para1	Kassenaar spelled wrong. Check this throughout text	Rick Gerber, CTC	Report text updated as suggested.
p15, para4	The Thorncliffe Fm. is characterized by dramatic facies changes over short distances. Much of the unit is considered to represent lacustrine deposition with both near shore (coarser) and deeper water (finer grained) facies. It is also expected that a fluvial component to this unit will exist outside of the lake extents such as occur on the rising bedrock surface east of Lake Simcoe and perhaps above the Niagara Escarpment. Course sand and gravel would occur in these fluvially dominated areas; however, coarser material fans or debris flow facies occur surrounded by lacustrine sediments in areas such as north Markham and perhaps reflect proximity to a coarser sediment supply into a lake delivered fluvially/glaciofluvially from the north. Are you meaning to say that where it occurs within the CVC that it is characterized as coarse sand and gravel?	Rick Gerber, CTC	Yes. We have interpreted the Thorncliffe where it occurs to consist of sandy aquifer material. This unit is often combined hydrostratigraphically with the basal aquifer unit that lies on top of bedrock in some areas of the watershed. There are no outcrop exposures of this unit (to our knowledge) within the watershed and the distribution of these sediments remains poorly understood.
p15, para5	Barnett 1992 not in reference list	Rick Gerber, CTC	Reference corrected in the text of report (Barnett, 1991).

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p16, para2	White 1975 not in reference list.	Rick Gerber, CTC	Reference added to reference list as suggested.
p16, para7	The Singhampton Moraine should be labeled on Figure 2-9 so the reader can follow the text easier.	Rick Gerber, CTC	Figure has been updated to label the Moraine as suggested.
p19	Does the surface water divide for the Credit River watershed generally also function as a groundwater divide for both the shallow and deep flow system? Perhaps this is discussed later in text, but maybe a sentence or two could be added here	Rick Gerber, CTC	Discussion has been added to discuss groundwater divides in context of surface water divides.
p20, para1	The hydrostratigraphic units from Table 3 are not shown, or at least not labeled, on the sections on figures 2-10 to 2-14. The text talked about hydrostratigraphic units; however, the sections just show aquifers or aquitards. This sentence talks about the 12 hydrostratigraphic units present and then says that the relationship to hydrostratigraphic units is shown on the sections. I'm not quite sure what this means.	Rick Gerber, CTC	Text has been updated, and the cross-sections have been annotated to reflect the various overburden hydrostratigraphic units.
p25, bullets	Is the Orangeville climate station on Island Lake shown by the snow symbol? Guelph climate station not shown on Figure 2-17. The Caledon Climate Station is shown on Figure 2-17 but is not mentioned in text. Were data from this station used?	Rick Gerber, CTC	Discussion regarding the Caledon climate station was added to the report, and the figure was updated to include all climate stations.
p25, para3 & 4	CVC 2002 not in reference list. Referenced again in paragraph 4. Thornthwaite & Mather 1955 not in reference list	Rick Gerber, CTC	Reference added to reference list as suggested, and CVC reference corrected as suggested.
p26, Table 9	Note that BFLOW consistently provides the lowest estimates of baseflow out of 9 methods compared in the CAMC-YPDT estimates (6 methods) and Neff <i>et al</i> 2005 (6 methods) analysis (3 methods between the 2 datasets overlap; LSRCA and CLOCA HYDAT data have been analysed). Neff et al. (USGS Scientific Investigations Report 2005-5217) also concluded the same for their 6 method comparison for streams in the Great Lakes Basin. I'm not sure which of 3 BFLOW passes that Neff et al used. This report uses average of max and min. I have the Neff et al estimates provided as text files on the web in a database if anyone is interested. Perhaps a figure should be provided to illustrate a years worth of observed total streamflow (daily), and the max, min and average BFLOW estimated baseflow so the reader can get a feel for how the hydrograph is separated. <u>If the estimates of baseflow were too low, would it significantly affect your calibration? Have the baseflow estimates been corrected for WWTP discharges?</u> The CVC WC report has discharges for 2001 which sometimes are higher than in this report (e.g. for Grgtown and Oville).	Rick Gerber, CTC	Text is updated with clarification of the purpose of baseflow recession. Figure illustrating three passes has been added to the report.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p27, para5	Remove “are” from first sentence	Rick Gerber, CTC	updated
p29, para8	I don’t see the Caledon Meltwater Channel labeled on any of the figures. My guess is it could be the Glaciofluvial Gravel shown on Figure 2-8. Remember that many readers are not going to know where the places and features referred to in the text are located.	Rick Gerber, CTC	Figure has been updated to label the meltwater channels and other physiographic features as suggested.
2.2.3	Figure 2-6 shows “bedrock valleys that host municipal aquifers” and “interpreted buried bedrock valley thalwegs” [the dashed line is missing from the legend]. Are the interpretations of “bedrock valleys that host municipal aquifers” drawn from Singer and others (2003), or have they been developed during the current study? Are we correct in understanding that the “interpreted buried bedrock valley thalwegs” have been inferred from the bedrock surface developed for the current study?	Chris Neville,	Report text updated as suggested, and the figures were also updated to clarify interpretations.
2.2.3	Figure 2-7 shows “bedrock valleys that host municipal aquifers” and “interpreted buried bedrock valley thalwegs”. The “bedrock valleys that host municipal aquifers” are the same as those shown in Figure 2-6. Are we correct in understanding that the “interpreted buried bedrock valley thalwegs” shown in Figure 2-7 are those inferred in the Kassenaar and Wexler (2006) study?	Chris Neville,	Report text updated as suggested.
<b>CHAPTER 3</b>	<b>CONSUMPTIVE WATER DEMANDS</b>		
Section 3.2.2	Add reference to the MOE process for determining consumptive water use from PTTW database as per Appendix D, Figure 1 of MOE’s GM#7; October 2006.	Region of Peel	Report text updated as suggested.
Section 3.2.2	Table 11; <i>Consumptive Use Factors</i> – add reference to Appendix D, Table 2 –Default Consumptive Use Factors; GM#7; MOE; October 2006.	Region of Peel	Report text updated as suggested.
Section 3.2.2	Table 10. Inglewood wells 2 and 3 are identified as Bedrock aquifers when they should be Overburden aquifers consistent with their descriptions throughout the rest of the report.	Region of Peel	Report text updated as suggested.
Section 3.2.2.1	Table 12: <i>Monthly Demand Adjustments</i> - add reference to Table 1 – Default Monthly Demand Adjustment;GM#7; MOE, October 2006.	Region of Peel	Report text updated as suggested.
Section 3.2.2	Figure 3.1 – it would be prudent to add names of communities and municipal well systems to the map	Region of Peel	
p43, table 12	Again, state that the monthly demand adjustments are those recommended in the March 2007 provincial guidance	Region of Peel	Report text updated as suggested.
p48, para2	The guidance (March 2007) suggests using 335 L/p/day, not 175 L/p/d. So in table 15 for Loyalist Creek Subwatershed the unserved demand would be 5.4 m3/d, compared to 2.6 m3/d which is rounded to 3 m3/d in the table. Is this significant in the % Water Demand calculations to follow? Also, please include Subwatershed numbers in this table to be consistent with text, figures and other tables	Region of Peel	The calculations were updated to assume 335 L/day per person, and a consumptive use factor was applied in the calculation. The Percent Water Demand values were also updated in the text.
Section 3.2.2, p 42, Para 2, line 7	“Dewatering operations that extract groundwater to lower the local water table, and subsequently discharge water to a local surface water feature would be assigned a consumptive factor specific to dewatering operations’. If local surface water feature means off-line pond(s), then it is okay. Clarify the term <b>local surface water feature</b> .”	Halton Cons	Report has been updated to clarify

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Table 11, p 42	For the municipal wells with sewage servicing facility, use consumptive factor of one (1). Text is not consistent with table.	Halton Cons	Report has been updated to clarify
	What about non-permitted agricultural water use? Agricultural water requirements can be estimated by the De Loe methodology	Halton Cons	Non-permitted agriculture water use is assumed to be very small. An agriculture survey of the upper watershed noted that agriculture is non-intensive, there are no large livestock operations and hobby farms and pasture lands dominate the agricultural land use.
	Domestic water use: MOE recommended using 335 L/d/c for SWP water budget work. Also, use of population estimates is better than 'number of septic systems' for the unserved domestic water demand	Halton Cons	Population estimates do not follow watershed boundaries and therefore average population densities need to be applied to estimate populations. In our opinion, detailed analysis of aerial photos across the non-served portions of the watershed is a more reliable method to estimate populations. 335 L/day was used in the calculations and the report was updated as such.
Section 3.4 p 49	Why are non-permitted agricultural and unserved rural domestic water demands excluded from the water use estimates?	Halton Cons	Unserved rural water demand was calculated, but non-permitted agriculture water use is assumed to be very small (see Beatty and Assoc, 2003; MacDonald, 2006). An agriculture survey of the upper watershed noted that agriculture is non-intensive, there are no large livestock operations and hobby farms and pasture lands dominate the agricultural land use.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
CHAPTER 4	<b>SURFACE WATER MODEL</b>		
	Surface Water Model – Are reservoir releases, wastewater treatment input, surface water takings, and tile drains considered in the model?	Halton Cons	Section 4.0 outlines the inputs to the model and notes that Island Lake Reservoir inputs, and waste water treatment plant discharges were simulated. Surface water takings and tile drains are negligible and therefore were not simulated.
	Surface Water Model – Was model calibrated using storm events?	Halton Cons	Section 4.0 outlines the model calibration efforts. The model was not calibrated to storm events directly.
	Groundwater Flow Model – Why is the Amabel Production Zone specifically not being considered as a model layer?	Halton Cons	The presence of the Amabel production zone within the CVC watershed is poorly understood and speculative. A lack of high quality cored boreholes or logged outcrop exposures has prevented the delineation of this unit within the watershed.
Table 10, p 39	Summary of Municipal Pumping Wells: Georgetown wells, Princess Ann Well 6 and Lindsay Court well are allocated to the bedrock aquifer and Prospect park well. All these wells are overburden wells. Change them to Overburden wells. Also change the foot note.	Halton Reg	Report text updated as suggested.
Sec 3.1.2, p 40 Para 2,	Line 3 - Remove sentence " and additional wells (Hufnagel.....) serve as standby wells."	Halton Reg	Report text updated as suggested.
Section 3.1.2, p 40, Para 3,	Line 2 -"The Region...eight pumping wells..." We have only <b>six</b> pumping wells not eight. Also Cedervale wells are 1A,3A and 4A. The Tenth Line well is abandoned..	Halton Reg	Report text updated as suggested.
Section 3.1, p 39, Table 10	Parts of the Region of Halton summary are incorrect. Princess Anne 6, Lindsay Court and Prospect Park Wells are all overburden wells. Permitted pumping rate for Cedarvale 3 is 3931 m3/day not 4582 m3/day. Davidson well 1 and well 2 are each permitted for 1250 m3/day. Reported actual pumping rates for the 4th Line well and Davidson well appear reversed.	Halton Reg	Report text updated as suggested.
Section 3.1.2, p 40	In Acton, the Hufnagel and Warren Grove wells are not operated as standy-by wells. They have been decommissioned. There is a standy well at Propsect Park. In Georgetown, the 10th Line well is not in service.	Halton Reg	Report text updated as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p 49 & 50 Table 16, 17	Do blank cells indicate no demand?	Kevin Mackenzie	Report text updated with ND
p38, table 10	There are discrepancies in this table compared to the CVC Watershed Characterization and AquaResource Peel WHPA reports referenced with respect to the Aquifer designations for Inglewood 2 and 3, Erin 7 & 8, Hillsburgh 2 & 3, Princess Anne 6, Lyndsay Court, Prospect Park, Mono Island Lake 2, Orangeville 5-5A and Orangeville 8B. I also think there are discrepancies in the permitted rates listed for Peel Wells between this report and the GW Vulnerability report (AquaResource, April, 2007) for Caledon 3, Inglewood 3 and Cheltenham 1 and 2	Rick Gerber, CTC	The rates have been revised somewhat since the watershed characterization report through new reporting from municipalities and accounting for the fact that backup wells do not add to consumptive demand. Report text has been updated to reflect comments and the pumping rates are now consistent.
p42, table 11	I assume that these consumptive use factors are exactly the same as those suggested in the Guidance from March 2007. This should be stated somewhere – perhaps in the table title.	Rick Gerber, CTC	Report text updated as suggested.
p49, para 1, line 2	States that unserviced domestic water demand is not included in estimates yet these numbers appear, and rightly so, in Table 16. Note that the total rural unserviced demand in Table 16 totals 4046 m3/d (I think this is right), yet it totals 4112 m3/d in Table 15. Also, if 335 L/p/d (number included in guidance) were used instead of 175 L/p/d, then rural unserviced demand would total 7872 m3/d. This does not include a consumptive factor of 0.2 as also recommended in the guidance for unserviced private supply. It appears as though you are assuming 100% consumption for the unserviced private supplies. Do these 2 factors (335 L/p/d; and 0.2 consumptive factor) have repercussions on the %Demand numbers? How were permitted uses listed as both handled?	Rick Gerber, CTC	Calculations have been updated to use 335 L/s per person and consumptive factor of 0.2
p43, table 12	Again, state that the monthly demand adjustments are those recommended in the March 2007 provincial guidance	Rick Gerber, CTC	Report text updated as suggested.
p48, para2	The guidance (March 2007) suggests using 335 L/p/day, not 175 L/p/d. So in table 15 for Loyalist Creek Subwatershed the unserviced demand would be 5.4 m3/d, compared to 2.6 m3/d which is rounded to 3 m3/d in the table. Is this significant in the % Water Demand calculations to follow? Also, please include Subwatershed numbers in this table to be consistent with text, figures and other tables	Rick Gerber, CTC	Calculations have been updated to use 335 L/s per person and consumptive factor of 0.2

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
	In our opinion, the estimates of the groundwater demand terms are appropriate and robust. Consumptive demands are estimated using approaches that are consistent with those applied for other source protection regions. No subwatersheds are identified as potentially stressed on the basis of demand estimates that are highly uncertain, and no subwatersheds in which municipal demands are significant are identified as having a low potential for stress. As summarized on Table 10 of the report, 7 of the 22 subwatersheds in the Credit River watershed have groundwater takings for municipal supplies. As shown in the plot below (Can't reproduce, please see original letter –KM), in the three watersheds with the largest municipal takings, Subwatersheds 10, 11, and 19, these takings comprise between 70% and 100% of the total demand. The values assumed for the municipal takings are reliable, as they are based on reported rates rather than rates taken from Permits to Take Water. The water budget analysis effectively identifies those subwatersheds with the most significant municipal water takings.	Chris Neville,	Comments are acknowledged.
	We have two small comments on the demand side of the groundwater stress assessment. It is our understanding that the aquifers for some of the wells listed on Table 10 may not be correct. We do not have logs for these wells, but these are some of the details that hydrologists intimately familiar with this area may focus on. We recommend that the well logs for all of the municipal wells be reviewed, and that the FEFLOW model be checked to ensure that the open intervals are in the appropriate model layers. In general, the reported rates for municipal pumping are internally consistent. However, there appear to be discrepancies between the information listed on Table 10 and Table 16. The differences are tabulated below (Can't reproduce, please see original letter –KM) . We recommend that these discrepancies be resolved.	Chris Neville,	The well information for Table 10 was updated as suggested with the correct aquifer information and permitted pumping rates to the best of our knowledge.
Section 3.3.1, p 48	The per capita water use for non-serviced, residential was estimated at 175L/day per person. This value is lower than that used in the MOE Guidance Document. Was sensitivity analysis performed to assess the use of this number? Also, it is not stated if a consumptive factor was used. CLOCA has suggested using 0.2, which TRCA has adopted. This value corresponds to "water supply - other" in the Guidance Module table of consumptive use factors	Don Ford, TRCA	Calculations have been updated to use 335 L/s per person and consumptive factor of 0.2
Surface Water Model; Section 4.2.6	This section describes the surface model methodologies and discretization employed. The question is in terms of the 'unit response functions' (URFs) applied across the entire watershed considering that no municipal surface water taking occurs or is planned for the future. What is the rationale for using 'event mean concentrations (EMCs)' to predict water quality in runoff? Are the above components assumed to be part of the Tier 2 water budget objectives? Based on the GM#7, examples of the Tier 2 water budget improvements for the representation of the surface and subsurface conditions include the following: (i) calibrated continuous flow model at a scale smaller than or equal to subwatershed and capable to simulate daily flow data, (ii) must incorporate groundwater taking into its discharge calculations, (iii) should use adjusted PTTW values, (iv) should consider surface water supply for both current and future scenarios, and (v) the outputs should include 'estimates of surface water source supply from surface water model for current and future conditions'. Also, the Tier 2 framework largely refers to the (re)assessment of: water su	Region of Peel	The document has been clarified. References to EMC's have been removed as noted, as they are not relevant for the water budget work. Table 2 outlines the deliverables that need to be outlined in the Tier 2 Water Budget.
Section 4.1.	Does not list 'flow in'/'flow out' hydrologic cycle components.	Region of Peel	Additional figure was added, and the flow in and flow out was discussed.
Section 4.1.3	Refers to model capability for 'water quality simulations' and to 'explicitly represent and simulate the impacts of future urban growth and intensification within the watershed and explicitly represent and simulate the effects of various rural land use management practices across the watershed' . Are these assumed to be part of the Tier 2 water budget objectives?	Region of Peel	The discussion relating to water quality has been clarified in the document.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 4.2.4, p 58, Para 4, line 2	“These 4 land use types” – not clear which land use types are being referred to	CVC	Report text updated as suggested.
Section 4.2.7, p 61, para 4	Manning Equation – the unit for each variable is not specified; S should be the slope of the water surface rather than channel slope.	CVC	Report text updated as suggested.
Section 4.3.1, p 62, last par	“at three locations”: - which three locations?	CVC	Report text updated as suggested.
Section 4.3.1.1, p 63, last par	“long term normal” and “long term average” are not defined; how long, what the average period is should be indicated.	CVC	Report text updated as suggested.
Section 4.3.3.2, p 68, Para 1	Incorrectly references Table 11. It seems to be Table 27, but streamflow rate is not shown in the table.	CVC	Report text updated as suggested.
Section 4.3.3.2, p 69, Para 2, line 3	“various degrees of correspondence” Should this be “correlation”. Unclear as written	CVC	Report text updated as suggested.
4.3.4, p 73 Para 2, ln 2	“close balance at Norval”. Please include statement showing why Norval has been taken as a reference	CVC	Report text updated as suggested.
Section 4.3.4, p 74, Para 1, 2, 3	Reviews peakiness and unit baseflow, and their relations to the heath of the watershed. Does not seem relevant to discussion on model validation. Perhaps a statement should be included to demonstrate how these paragraphs support the simulation results.	CVC	Report text updated as suggested.
Section 4.3.1.2, p 65, Table 24	Daily Discharge Units should m3/day	Halton Reg	Report text updated as suggested.
p 52, para 2, line 3	Does the more detailed outlet modelling include the operating rule curve associated with assimilative flow for the Orangeville WPCP?	Kevin Mackenzie	Report text updated as suggested.
p 61, Section 4.2.7 para 4	Cross sectional area of flow is missing from the cited Manning’s Equation. The equation should either read “ $Q=A*S^{1/2}*R^{2/3}*n^{-1}$ ” or “ $V = s^{1/2}*R^{2/3}*n^{-1}$ ”, where A is the cross sectional area of flow (L <sup>2</sup> ) and V is the mean cross sectional flow velocity (L/T)	Kevin Mackenzie	Report text updated as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 4.2.8, p 62, Para 1, line 4	The estimates of cross subwatershed groundwater flow derived from calibration of the models do not necessarily support buried bedrock valleys as the conduit for this flow. While buried bedrock valleys are one plausible mechanism for moving groundwater from one subwatershed to another, comprehensive measured field data are currently not available to draw this conclusion. <i>Editing line 4 by removing "via a buried valley system" would be less speculative.</i>	Kevin Mackenzie	Report text updated as suggested.
Section 4.3.1.2, p 65, Para 1, line 3	The report states that there are a number of exceptions to the assumption that lake Ontario supplied water is returned to Lake Ontario via WPCPs, including watering of lawns and gardens. While we agree that the amount of water lost from Lake Ontario based domestic water supplies is likely to be insignificant compared to the water budget over the whole Credit River watershed, it is likely to be much more significant within the heavily urbanised subwatersheds in the southern portion watershed. Continuous losses of 10% or 15% from distribution systems are not uncommon. <i>More discussion of this source of error would be useful, including a discussion of the percentage of the watershed area affected by this issue? Note: while water is lost from distribution systems, water is also gained in storm and sanitary sewers.</i>	Kevin Mackenzie	Report text updated as suggested.
Section 4.3.1.2, p 65, Para 2, line 2	The report states that this connectivity scheme is believed to be rare in the Credit Watershed. What is this belief based on? <i>Were appropriate municipal service personnel interviewed or old development plans reviewed? A statement supporting this belief would be useful.</i>	Kevin Mackenzie	Report text updated as suggested.
Section 4.3.2, p 66	The reported sensitivity analysis is a useful inclusion in the report and helps to illustrate the limitations of modelling, which relies on sensitivity parameters, which in turn are difficult to quantify in situ. <i>A discussion of the sensitivity of model results to potential and actual evapotranspiration estimates would be useful.</i>	Kevin Mackenzie	A sensitivity analysis to ET estimates was not conducted, but this has been added as a recommendation.
Chap 4.0	In general, what is different in this chapter than what was already reported on (CVC & EBNFLO, April, 2006), and peer reviewed in 2006-07? Does it incorporate suggested edits from this earlier report? Were there any changes to the calibration necessary since last reported on? If there are any changes from the previous report then this should be stated. If it is the same as reported on and peer reviewed earlier then this should be stated so that the reader could skip this chapter and not worry about missing anything.	Rick Gerber, CTC	A section was added to the introduction explaining change to this report a) peer review comments b) lower watershed calibration/recharge and c) multiple climate stations.
p 65, Section 4.3.1.2 para 3, line 1	Readability – It is suggested that a new sentence be started after "...rely on groundwater supply."	Kevin Mackenzie	Report text updated as suggested.
Chap 4.0, p52, para1	CVC & EBNFLO 2007 not in reference list.	Rick Gerber, CTC	Report text updated as suggested.
p52, para2	Walker 2008 not in reference list	Rick Gerber, CTC	Report text updated as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p52, para3	TSH 2003 is for the TWWFMMP (Toronto), not the CVC WQS	Rick Gerber, CTC	Incorrect reference was omitted.
p55, para3	So Subwatersheds #21 and #22 were not modeled in the HSP-F model? These are the two that flow directly into Lake Ontario	Rick Gerber, CTC	Yes, this is correct.
p55, Section 4.2.3	Is the land use mapping described and used for HSP-F the same as was described earlier on page 11 and shown on Figure 2-4? ESRI 2002 not in reference list.	Rick Gerber, CTC	Report text updated as suggested.
p61, para7	CVC 1986 not in reference list	Rick Gerber, CTC	Reference added to reference list as suggested.
p62, para4	I think that some of these numbers are inconsistent with those in Table 42	Rick Gerber, CTC	Table 42 (now Table 46) will not agree with Table 24, as they represent a different period of averaging. There's a note following table 46 to that effect.
p63, last para	Does table 23 summarize from 1996-2000 or from 1997 to 2000? The text says both. The caption for Table 23 could include the period analysed (1996?-2000) and the units (mm/yr).	Rick Gerber, CTC	Report text updated as suggested.
p64, para 2	You note that the Pearson annual averages are consistently lower than surrounding stations to the west. I have found that Pearson annual averages are also consistently lower than stations to the north and east. Do you think Pearson data may be anomalous/erroneous or does it reflect a physical phenomenon such as shielding by the Escarpment?	Rick Gerber, CTC	Report text updated as suggested.
p66, last para	It would be interesting to see the HSP-F predictions on Figures 4-10a and 4-10b	Rick Gerber, CTC	Simulated flows have been added and referenced in the text.
	The key parameters in the supply calculation are the estimated recharge rates for each subwatershed. In our opinion, the estimates of the groundwater recharge are internally consistent and within realistic bounds. The recharge estimates obtained from the surface water model are supposed to match the rates specified for the groundwater. The values are not identical, but a comparison of Table 32 and Table 48 confirms that in general the values match closely ( $\pm 5\%$ ). The only differences in excess of $\pm 5\%$ are tabulated below. Given the close match between values for all other subwatersheds, are there reasons why the ( <b>again, please see original letter –KM</b> ) differences are more significant for Subwatersheds 4, 8b, and 11? We have plotted the cumulative recharge for each subwatershed against the cumulative precipitation. The distribution of recharge appears to be reasonable. The recharge rates lie between 5% and 40% of the precipitation. This is a reasonable reflection of the fact that the northwestern portion of the Credit River watershed is hummocky, with coarse-grained sediments at surface, while the southeastern portion of the watershed is flat lying, with fine-grained materials at surface.	Chris Neville,	The difference between the recharge rates in the two tables have been rectified.
<b>CHAPTER 5</b>	<b>GROUNDWATER FLOW MODEL (FEFLOW)</b>		

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
<i>Groundwater Flow Model</i>	The groundwater model appears to meet the objectives of the model objectives of the Tier 1 and Tier 2 assessment. The inventory of expected deliverables as per the MOE GM#7 could be added to the Report for easy follow up. The issue that remains unclear is the attempt to delineate significant recharge areas (SRA) as part of the Tier 2 study. Also, it is not clear what the term 'capture area' represents in reference to the SRA for municipal wellfields. This could be further defined in the report for better clarity.	Region of Peel	Report text updated to better define the study objectives.
Section 5.2.4, p 81, Para 2	A 10:1 ratio of horizontal and vertical hydraulic conductivity is usually cited for stratified bedrock. For loose sediments this ratio might be dubious because they usually have not undergone apparent diagenesis (cementation, deformation, consolidation and alteration). Please explain rationale for use of this ratio here.	CVC	Report text updated <u>with further discussion of anisotropy.</u>
Sections 5.2.3 & 5.2.4, p 80, 81	Table 34 and 35 does not appear to be consistent. This may lead to confusion when trying to relate assigned hydraulic conductivity to each model layer. Please clarify	CVC	Table 35 updated as suggested to allow for more direct comparison of the two tables.
Section 5.2.4, p 82, Para 6	This is a duplication of the first paragraph of page 81. Please explain the relevance of repetition	CVC & R Gerber	Report text updated as suggested.
Section 5.4.3.1, p 94, para 2	Please clarify which of Caledon Village's two well fields tap from the bedrock and from the overburden.	CVC	Both of the wells extract water from overburden aquifers. Report text was updated and clarified.
Section 5.3.1, p 89, par 3	Second and third bullets. Groundwater seems to flow out of the watershed (Sub19) rather than into it, as demonstrated in Page 101 and on Figure 5-10a and Figure 6-2. Please clarify	CVC	Report clarified/ updated as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Chap 5 P 84	Why can the groundwater not be recharged from the perennial streams wetlands, lakes and reservoirs, if the groundwater level is lower than the surface water level?	Halton Cons	In the FEFLOW model, groundwater is simulated to flow into the streams, but water is not simulated to flow out of the rivers, into the groundwater flow system. The contribution of flow from streams into the groundwater flow system on the watershed basis was considered to be relatively insignificant on from a regional water budget perspective, however it is recognized these flows may be significant on a local basis.
Table 38, p 88	Are observed baseflow values adjusted for STP input, reservoir releases, and water takings?	Halton Cons	Report clarified/ updated as suggested.
Section 5.3.3.3, p 90, Para 2, line 7	Use title heading “Vertical Hydraulic Gradient” rather than “Vertical Potentiometric Difference”	Halton Cons	No changes made. The figure is the vertical potentiometric difference, not gradient as the values were not divided by the thickness.
Section 5.3.3.3, p 91, Para 1	“There is a large area with upward...” The statements in this paragraph seem contradictory.	Halton Cons	Report text updated as suggested.
Section 5.3.3.4, p 91, Para 1	change “vertical potentiometric surface difference’ to ‘vertical hydraulic gradient’	Halton Cons	No changes made. The figure is the vertical potentiometric difference, not gradient as the values were not divided by the thickness.
Section 5.4.2, p 93, Para 1, line 2	recharge rate of 115% is for high volume recharge areas (HVRAs), not for the SRAs	Halton Cons	SGRAs have been delineated based on draft technical rules. Text has been updated accordingly.
	Preliminary Significant Recharge Areas – the definition of SGRAs needs to be revised here; areas with < 300 mm recharge within the steady-state WHPA should be considered as SGRAs, if those areas are contributing water to the well. Within a WHPA, low recharge areas may contribute more water to a well than the high recharge areas, depending upon the hydrogeology of the area. There is a need to determine the area of contribution within the WHPA; it may be done with forward particle tracking. For the municipal wells, recharge contribution areas should be considered as SGRAs to the wells.	Halton Cons	SGRAs have been delineated based on draft technical rules. Text is updated accordingly.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 5.2.5.3, p 83	Check the units for 'Transfer Coefficient'. It should be $8.6 \times 10^{-6}$ m/s.	Halton Reg	Transfer coefficients are appropriate for FEFLOW
Section 5.3, p 85	In Section 4.0, the report discusses the importance of both model calibration and validation for the surface water model. However, for the groundwater model, only calibration was discussed. Was the groundwater model validated?	Halton Reg	The model was not validated, and the report was updated to state this.
Section 5.3, p 85, Table 36	identifies specific data sources used to evaluate groundwater model calibration and that monitoring data from Orangeville/Mono, Peel and the PGMN monitoring network are considered to be the most accurate water level calibration targets. These are outlined in Appendix D. Higher quality data does not appear to have been used to evaluate calibration in the western part of the model (for example, Halton high quality data in the Acton and Georgetown was not used for the calibration targets). How does this affect the model's ability to represent conditions in the subwatersheds where higher quality data was not used?	Halton Reg	The text has been updated as suggested.
Section 5.3.3.3, p 91	the report indicates that "there is a large area of upwards gradients near the Forks of the Credit and that the results are consistent with observations of groundwater discharge from the overburden into the bedrock". If the gradients are upward, would not the groundwater discharge from the bedrock into the overburden?	Halton Reg	Report text updated/ clarified as suggested.
Para 2 Section 5.3.3.4, p 91	The report indicates that Figure 5-13 shows a strong correlation between very high and high groundwater discharge areas and coldwater fisheries. Although correlation between high discharge rates and coldwater fisheries makes sense, why does this Figure appear to show many stretches of stream that have low simulated groundwater discharges, but that support coldwater fisheries?	Halton Reg	Coldwater fisheries can be supported by low groundwater discharge as well as high groundwater discharge. Clarification added to the text.
Section 5.4.3.2, p 94	Halton Region has mapped capture zones of its production wells as part of its regional model. They are somewhat different than presented in Figure 5-14, especially in Georgetown.	Halton Reg	This comment is acknowledged.
Chapter 5.0	In general, what is different in this chapter than what was already reported on (AquaResource, May, 2006), and peer reviewed in 2006-07? Does it incorporate suggested edits for the previous report? Were there any changes to the model necessary since the last report? Any differences to the model that were necessary between this report and the previous document should be stated	Rick Gerber, CTC	The document text now puts this report in context of the previous reports, indicating that peer review comments have been addressed and also identifies new work that has been complete.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Chap 5.0, p77, Table 33	AquaResource 2006 not in reference list. In paragraph 3 I think the CVC 2002 reference should be 2002a.	Rick Gerber, CTC	Reference added to reference list as suggested.
p78, points 1 and 2	Can we “precisely simulate” anything? In paragraph4, the sentence “... significant and advantage,.....” should be something like “and an advantage” or “advantageous”	Rick Gerber, CTC	Report clarified as requested.
p79, para5	The Quaternary hydrostratigraphic units listed on Figure 5-2 are a bit different than those listed in Table 3. Table 3 has 12 hydrostrat units while the legend on the figure has 10. Also note that Hydrostratigraphic is spelled wrong in the figure legend	Rick Gerber, CTC	Figure was updated and clarified.
p79, para6	The text refers to CVC 2002 for water budget projects yet CVC 2002 is listed as a fisheries management plan in the reference list. Is this the correct reference?	Rick Gerber, CTC	Reference updated to WHI, 2002 not CVC, 2002.
p80, Table 34	This table lists 11 model layers (but 10 hydrostratigraphic layers because the Queenston is split into two layers). The text on page 79 said there were 12 model layers (13 slices). The terminology used in this table is a bit different than the legend of Figure 5-2. Again we are also a bit different than the hydrostratigraphy presented in Table 3 which contains 12 hydrostratigraphic layers. I think we need to try to be consistent. The last sentence of section 5.2.3 has already been stated in the paragraph situated above Table 34.	Rick Gerber, CTC	Report and figures clarified as requested.
p81, para1, line 2	Ends with “(see references).” Do you mean see references in Table 35?	Rick Gerber, CTC	Report clarified as requested.
p81, para1, last line	Ends with “.. are listed in the references.” I think you should actually state which references were used so the reader will have an idea of which reports were deemed to be most useful for information regarding hydraulic conductivity.	Rick Gerber, CTC	Report clarified as requested.
p83	Recharge – The recharge rates for each HRU are listed in Appendix C. I’m still trying to wrap my head around the 25 mm/yr recharge for the Halton Till plain. Initially it seems a little low and may explain why the simulated water table is lower than observed values shown on Figure 5-10b.	Rick Gerber, CTC	Comment is noted.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p83	Wetlands – Do the wetlands store sufficient water in the spring and fall-winter when groundwater recharge occurs?	Rick Gerber, CTC	Wetlands within the Credit River watershed are highly variable; some are discharge features year round, while the rise and fall of the watertable causes some wetlands to act as recharge and discharge features at various times of the year. Riparian wetlands have a different function than non-riparian wetlands, but in general, most function to improve water quality and attenuate stream flows.
p83	Streams – why weren't all Order 1 streams modeled? Are some intermittent? Too memory intensive? Too much effort for their hydrologic importance within the watershed? Does this effect the simulated spatial distribution of discharge to streams such that it is different than observed from low flow surveys. If lower stream orders are not included, and are hydrologically important, then discharge from the model may be simulated to occur further down-gradient than is actually occurring which may affect the amount of groundwater flow into and out of subwatersheds, which in turn will affect the % Demand calculations.	Rick Gerber, CTC	Report clarified as requested. First order streams were not simulated as they were not perceived to be important from a regional water budget perspective. The routing from a first order stream to a higher second order stream is not perceived to cause impact to the groundwater flow into/out of subwatersheds, or on the percent demand calculations. Testing of the impact of the first order streams could only be undertaken with detailed information the headwaters streams in the watershed, which is currently unavailable on a watershed or subwatershed scale.
p84	Model Perimeter- have simulated fluxes across external boundaries (CVC Watershed) been checked versus estimates of neighbours for certain select locations? Candidate areas would be Cheltenham where the WHPA now extends into the TRCA, perhaps Orangeville where some WHPAs extend in the GRCA jurisdiction and Subwatershed 13 where a bedrock valley is interpreted to extend east towards Caledon East and Bolton. This is something that I think needs to be done	Rick Gerber, CTC	The comment is noted; however, the fluxes between CVC and TRCA or GRCA have not been examined, and are out of scope for this project.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p87	Kassenaar and Wexler 2007 should be Kassenaar and Wexler 2006. The latter is how it occurs in the reference list. This mistake continues on subsequent pages (e.g. p90).	Rick Gerber, CTC	Reference to Kassenaar and Wexler was updated throughout; Other questions needs to be addressed.
p91, para2	In the second sentence do you mean consistent with observations of discharge from the bedrock to the overburden? Do you mean eastern flank of the Escarpment? "drains" should be "that drain".	Rick Gerber, CTC	Document text was clarified as suggested.
p92, para5	What do you mean by "modified" HSP-F recharge rates?	Rick Gerber, CTC	The confusing term 'modified' was removed for clarification
p93, para3	bullet 2 – capture zones should be capture areas to be consistent with paragraph above. 2nd sentence after 2 bullets – capture zones should be capture areas. Also add "of" to end of 2nd sentence – "... A high level of uncertainty"	Rick Gerber, CTC	The document was ammended as suggested.
p93	On Figure 5-14 there is no SRA for the Cheltenham wells. I think this underlines a fundamental problem with the methodology outlined. For SRAs with respect to municipal wells, do we not send reverse particle traces from the screen, and the area where these traces intersect the ground surface then possibly becomes the SRA for the well or wellfield. In this case we have to define significant as that area which contributes recharge to a well, whether or not the unit rate is <300 mm/year. I guess one way to look at is that there is a WHPA zone with an outer boundary delineated by the 25-yr TOT and then I guess there could be a larger steady state capture area within which the steady state recharge to the well is simulated to occur. My thoughts would be that perhaps we want to look at what is significant, if anything, within the capture area on top of within the WHPA where we already are setting up policies to protect this recharge area. I think we need to clarify the philosophy within the guidance for significant recharge with respect to municipal wells (and hydrologic features) and whether this includes or is separate from high	Rick Gerber, CTC	The SGRAs have been updated to reflect the average recharge rates in the Upper, Middle and Lower Watershed regions to resolve the challenges outlined in this comment.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 5.2.3, p 79	<p>The Thorncliffe and Scarborough aquifers are lumped together with the Sunnybrook Till into Model Layer 4. Although this may be appropriate in areas with thinner overburden, in other areas, this may be an oversimplification (i.e., the Alton-Cataract Meltwater Channel). What is the potential effect of this on groundwater flow through this “meltwater channel” into the TRCA’s Humber River watershed?</p>	Don Ford, TRCA	<p>The Alton- Cataract Meltwater channel does not extend into the TRCA watershed; the Caledon and Caledon East Meltwater Channels flow into TRCA, and the meltwater deposits are surficial in nature (i.e. stratigraphically lie above the Lower Sediments (model layer 5) and are represented in the model using model layer 1. The sediments that underlie the Caledon East Meltwater Channel within the buried valley were grouped together (e.g. Lower Sediments), and one bulk K was applied. There is insufficient deep borehole information available to adequately characterize the aquifer/aquitard geometry of the individual units, or their conductivities. There is uncertainty with the bulk K applied, and a higher degree of uncertainty associated with the subdivision of the Lower Sediments into discrete units, with respective conductivities.</p>
Section 5.2.5.4, p 83	<p>Streams of Strahler Order 2 and above were included. What is the potential effect of not including Strahler Order 1 streams, and was this assessed via sensitivity analysis?</p>	Don Ford, TRCA	<p>Report clarified as requested. The impact of including first order streams has not been assessed via sensitivity analysis; however, in the absence of local information, it is our opinion that most first order streams are dry, and not regionally significant.</p>

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 5.3.1, p 87	The modelled water levels in the bedrock valleys was noted to be generally lower than the observed values. Could this be the result of blending the aquifers/aquitards in this area? What effect does this have on the estimated groundwater flux out of the Credit into the Humber?	Don Ford, TRCA	Report clarified; the low hydraulic head trend associated with the buried bedrock valley may be due to overestimation of the depth and continuity of the valleys, or of the transmissivity of the lower valley infill sediments.
Section 5.3.3.1, p 90	The third bullet at the top of the page references the “Caledon East Meltwater Channel”. This feature is not apparent on Figure 2-9. Is it the same as the Alton-Cataract Meltwater Channel?	Don Ford, TRCA	Figure updated to clarify. The Caledon East Meltwater Channel is different from the Alton Cataract Meltwater channel.
	<p>The groundwater supply quantity also requires an estimate of the rate at which groundwater flows into each subwatershed. In our opinion, there are some areas of the Credit River watershed where this quantity is the least certain component of the water budget calculations. These are the subwatersheds that are located along the boundaries with the TRCA and the Grand River watershed. There are two source of potential concern in the groundwater modeling. First, our expectation is that the limits of the Credit River watershed should generally be reflected as subtle divides in the groundwater flow system. If the perimeter of the watershed is a regional divide, we would expect there to be no-flow boundary conditions assigned along the outer edges of the bounding subwatersheds.</p> <p>However, as shown in Figure 5-1 of the report, significant portions of the boundaries of the groundwater model are set as specified-head boundaries. Second, the heads that are assigned along these boundaries are derived from relatively low-reliability information in MOE water well records. Sufficient information is presented on Table 42 of the report to assess whether flows between the watersheds are significant.</p>	Chris Neville,	Comments are acknowledged in new uncertainty section
	We have conceived of another way to assess the significance of the “Flow in” component of the subwatershed water budgets. On the table below ( <b>again, please see original letter –KM</b> ), we have calculated the stress assessments two ways: including and excluding the “Flow in” component. As indicated on the table, the stress assessments are not significantly different. The only significant change is for Subwatershed 11, which changes from a moderate to significant stress level. The results presented on this table confirm that the stress assessments are relatively insensitive to the “Flow in” component for the Credit River watershed.	Chris Neville,	Comments are acknowledged.
	The final element of the stress assessment is the groundwater reserve. In our opinion, the approach for estimating the groundwater reserve is appropriate. The reserve for each subwatershed is calculated as 10% of the cumulative groundwater discharge to surface water features estimated with the groundwater model. Although a value of 10% is consistent with Assessment Report Guidance Module 7, it is important to note that the reserve has relatively little impact on the outcomes of the stress assessments. To illustrate this point, we have tabulated stress assessments calculated with and without the reserve. As indicated on the table below ( <b>again, please see original letter –KM</b> ), the stress assessments are not changed if the reserve is excluded from the calculation.	Chris Neville,	Comments are acknowledged.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
<b>CHAPTER 6</b>	<b>INTEGRATED WATER BUDGET RESULTS</b>		
<i>Results, Section 6</i>	The closing summary might reference MOE-mandated deliverables and how these were met as part of the Tier 2 assessment.	Region of Peel	Introduction has been expanded to better address MOE requirements
Section 6, p 96	as stated earlier, recharge from the surface water bodies should be considered	Halton Cons	Comment has been addressed in document
Table 42, p 100	the values in the ‘wells’ columns are probably only for the permitted/actual municipal wells; domestic wells should be accounted for in the water budget summary	Halton Cons	Difference between the two has been acknowledged in the report. The groundwater flow model does not simulate domestic wells, and the water budget summary was calculated using the modelling results.
P 101	2 <sup>nd</sup> bullet – Does net groundwater discharge mean recharge minus discharge?	Halton Cons	Clarification was made in document
Section 6.3.2.2, p 101, Para 2, line 2	the quantity 21,050 m <sup>3</sup> /day is probably 22,550 m <sup>3</sup> /day.	Halton Cons & Reg	Report text updated as suggested.
Section 6.3.1, p 98	This section would benefit from a discussion of the iterative process by which the surface and groundwater models were brought into agreement with respect to recharge. It is our understanding that the initial estimates of recharge from the surface water model seemed unrealistically high, in some areas, when they were used as input to the groundwater model. <i>A discussion of the differences in hydraulic conductivity between the surficial soils and the underlying overburden and bedrock layers and the effects of these differences on interflow with fluctuating seasonal groundwater levels in these areas should also be included.</i>	Kevin Mackenzie	Iterative process is discussed. Document has been updated.
Table 41, p 99	This table could benefit from inclusion of the drainage area for each subwatershed as we could not find a summary of this information elsewhere in the report. A comparison of the average annual water budget components for runoff and recharge to observed streamflow at the Water Survey of Canada gauges would also be helpful. In particular, a comparison of Runoff plus Recharge (for subs upstream of each gauge) to total flow at each gauge would be useful. A comparison of recharge to baseflow as reported in Table 38 would also be useful to highlight groups of subwatersheds which are subject to trans-boundary flows.	Kevin Mackenzie	Update made as recommended.
Chap 6.0, p97	Rural and Urban Land Elements; The long term climate dataset was 1961-2004 in previous text. These longer term groundwater recharge estimates are not in Appendix D. Do you mean Appendix C?	Rick Gerber, CTC	Reference has been changed to appendix C
p99, last para	This qualifying paragraph regarding subwatersheds 10 and 11 begs the question – Do these “inconsistent” water budget results significantly affect the % Demand calculations in Chapter 7.0?		This has been addressed in Section 7.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p100, Table 42	Note b) of this table states that pumping rates are slightly different than final water demands presented in Section 3.0 of this report. Why is this?	Rick Gerber, CTC	The reason for this inconsistency has been outlined in the text.
p100, Table 42	Some of these areas of high Inter-Watershed flow correspond to high head residual areas, particularly Orangeville and Acton. So therefore flow out through Orangeville could theoretically be higher. I assume Orangeville is, or has, been sorted out by the Tier 3 study. I am not sure because I haven't seen any results from this work. Regarding Acton, the western boundary is shown to be receiving a net influx of flow and the residuals show simulated heads are < 15m of observed heads so more could be flowing in across this boundary. Does this have significant implications to the %Demand calculations, particularly Subwatershed 10 that is coming out as stressed?	Rick Gerber, CTC	Impacts to stress calculations addressed in Section 7
p100, Tables 41 & 42	The recharge values in Table 41 and 42 do not match. Subwatershed 8b has different recharge values between tables 42 and 48. Subwatershed 9 has different discharge values between tables 42 and 48	Rick Gerber, CTC	The discrepancies noted have been addressed in the report
<b>CHAPTER 7</b>	<b>WATER QUANTITY STRESS ASSESSMENTS</b>		
Water Quantity Stress Assessment; Section 7	(i) Peel municipal water supplies are listed in Table 49 as Caledon municipal water supplies; and (ii) Drought Scenario 'A' that eliminates groundwater recharge for a multi-year period is not in line with the GM#7 where the historical long-term drought scenario is being recommended for the purpose.	Region of Peel	Report text was updated as suggested for Region of Peel wells. The methodology used in this study is consistent with the methodology laid out in Guidance Module 7.
Section 7.0, p 103, Para 1	"These tiered studies and their objectives were summarized in Section 1.2.1,". But no relevant information can be found in Section 1.2.1. <i>Similar to Peel's overriding concerns</i> .	CVC	Section 1 has been updated to better describe the tiered structure.
Section 7.1.1, p 104, last Paragraph, sec to last line	Last Paragraph and last sentence: The word quality is repeated, one should be <b>quantity</b> .	Halton Reg	Report text updated as suggested.
	We would like to see a comprehensive table in Section 7.0 showing the column headings such as Name of Watershed ( which will be subdivided into Upper,Middle and Lower Watersheds), Area, GW Recharge (Qrecharge), GW Discharge (Qd) (to streams); GW Takings (Demand);GW Inflow (Qin); GW Outflow (Qout); Qnet (Qin-Qout); % Water Demand; Stress Calculation ; Stress Thresholds; Stress Category.	Halton Reg	Tables have been updated as requested.
	Also, same level of description is expected for the Surface water.	Halton Reg	Tables have been updated as requested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 7.3, p 109, Table 48	Table 48: Why the "Flow In" term for 10 subwatersheds is blank? Is it "0" or not calculated? It does not seem right to say that Flow In is zero. Please clarify.	Halton Reg	Report text updated as requested.
Section 7.4.3, p 112, Table 50	Table 50: Change Halton Prospect Park Well as "OB", overburden well.	Halton Reg	Report text updated as requested.
Section 7.3, p 109, Table 48	column 7 is labelled "Supply". It should be labelled "Difference" (Supply-Reserve)	Halton Reg	Tables have been updated as requested.
Section 7.3, p 109, Table 48	column 7 is labelled "Supply". It should be labelled "Difference" (Supply-Reserve)	Halton Reg	Tables have been updated as requested.
Section 7.4.3, p 112, Table 50	drawdown is the Lindsay Court Well is listed as "dry". What is the predicted drawdown at Lindsay Court? In looking at Figure 7-5, Lindsay Court appears to be in a drawdown zone of between 2 and 5 meters, which would not result in Lindsay Court being dry as there is significantly more than 5 meters of available drawdown in the well under pumping conditions. Therefore it is unclear why Lindsay Court is classified as dry. Further details should be provided in the report on how it was determined the well becomes dry within the 2 year drought period.	Halton Reg	The model was updated and the results have been updated. The well is no longer listed as 'dry' in the table.
Chapter 7.0, p104	Are the HSP-F output numbers used for the surface water assessment from the period 1961-2004? Do we need to be concerned with %Demand calculations for Subwatersheds 21 and 22?	Rick Gerber, CTC	There is no estimated water demand occurring in Subwatersheds 21 and 22. These watersheds lie within municipally serviced (lake based) areas of the watershed.
p108	Groundwater supply is stated to be recharge plus <u>net</u> groundwater flow in. This is different than recharge plus groundwater flow in as stated in the guidance and in earlier sections of this report.	Rick Gerber, CTC	The discussion in the report has been clarified.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
p110, Discussion	Do the results of “stressed” watersheds agree with historical water quantity problems, potential future supply and growth considerations, declining groundwater levels, declining streamflows, etc? I think it is very important to stress these historical observations of problems or potential for future supply problems, if they occur, given the uncertainty of cross-watershed fluxes and the water level calibration residuals that exist. There has been a lot of discussion of uncertainty in the text up to this point and stressing that results agree with operational histories or observations (groundwater and/or streamflow) will provide further confidence in the results. Table 42 shows discharge to Surface Water/Wetlands in Subwatershed 8b as 400 m3/d. Should this be a negative value because I believe you said earlier that surface water bodies were not allowed to recharge groundwater in the FeFlow model. Also, on Table 48, the GW Discharge for this subwatershed should be 400 m3/d. Table 48 seems to be a mix of Qin and Qnet without any explanation.	Rick Gerber, CTC	While we have not added explicit links to observation data, we have referenced more broad known hydrological stresses in the subwatersheds.
p110, Discussion	Perhaps the simulated/estimated Qin, Qout and Qnet should be summarized in separate columns so the reader knows what is being used for the %Demand calculation. Also some subwatersheds are shown to have zero Qin but on Figure 6-2 there are both Qin and Qout estimates, and also values for net Inter-Catchment and Inter-Watershed in Table 42. Let’s look at Subwatershed 19 as an example. The flow in totals 6,350 m3/d. The flow out totals -18,500 m3/d. The net flow is -12,150 as groundwater flowing north (with a little bit flowing south). The supply (R plus Qin) would be equal to 54,200 m3/d. Theoretically Orangeville could pump all of this meaning that no groundwater would discharge to streams or to adjacent watersheds/subwatersheds. The thresholds say that you can’t do this (i.e. >10% Demand is stressed). The reserve adds another factor of safety. I’m not sure why you chose to only use 3700 m3/d as Qin.	Rick Gerber, CTC	While we have not added explicit links to observation data, we have referenced more broad known hydrological stresses in the subwatersheds.
P87	Kassenaar and Wexler 2007 should be Kassenaar and Wexler 2006. The latter is how it occurs in the reference list. This mistake continues on subsequent pages (e.g. p90). <b>Do you think any of these uncertainties or discrepancies between simulated and observed water levels significantly affect the Supply estimated for the %Demand analysis?</b>	Rick Gerber, CTC	Reference to Kassenaar and Wexler updated throughout; Uncertainty in the model was addressed in the document.
p111	How was this 2-year drought (no recharge) handled in the model? Was the model run in transient mode? If so were there other parameters necessary (e.g. Specific Storage)? Coincidentally, what were the estimated recharge values from the long-term HSP-F output (1961-2004) for the drought period (1961-1970) analysed? Stating what they were estimated to be will give an idea of how conservative the assumption of two years without recharge is.	Rick Gerber, CTC	Additional clarification was added to the report.
Section 7.3, pg 108	The text indicates that “net groundwater flow in” was used for the stress calculations. In the peer review meeting, it was stated that the net value was not used. Please clarify the methodology used	Don Ford, TRCA	The report has been clarified.
Section 7.3, Table 48, pg 109	Nine of the 21 stress-assessment subwatersheds have no groundwater flow in, and the numbers do not agree with those on Figure 6-2. Please clarify the discrepancies.hj If “net” values were not used, how are these values zero? Also, the “Flow In” numbers are also significantly lower than found within TRCA’s jurisdiction. Also, providing the area of the subwatersheds would be helpful here.	Don Ford, TRCA	The calculations have been updated using the sum of all positive flows into the subwatershed.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
<b>CHAPTER 8</b>	<b>CONCLUSIONS AND RECOMMENDATION</b>		
Section 8 – <i>Conclusions and Recommendations</i>	For subwatersheds with low stress a need for further studies should be justified. Recommendations to enhance the understanding of the deep bedrock valley system should be linked to the future water supply investigations by municipalities <i>rather than</i> non-specific scientific studies to increase model understanding where there are no current municipal water taking and no current impact on water budget statistics. The recommendations concerning further surface water model enhancements, including incorporation of results of physical surveys, urban infrastructure and stormwater are questionable since this insinuates a need for an endless model improvement where no surface water taking occurs and where the potential future groundwater taking would occur from deeper and well protected systems.	Region of Peel	Comment is acknowledged and the value of these recommendations to the municipalities and their water supply studies was noted.
Section 8.1.1, p 115 , Top page, first bullet	Consumptive demand.....8.6%. I think it should be 86%.	Halton Reg	8.6% is the correct value in the report.
Section 8.1.2, p 115 , Second to last bullet	:"Other major data gaps .....accurate WPCP .....volumes". This can not be a data gap as this data is readily available with the municipalities.	Halton Reg	At the time of the model development, the CVC had difficulty obtaining these values from the municipalities and as such, it was noted as a data gap.
Section 8.1.3, p 121, Last bullet	"Studies should be undertaken to compile monthly and annual summaries of sewage treatment plant flows to the Credit River". Municipalities already have this data and no further studies are necessary.	Halton Reg	Comment is acknowledged and the text was updated accordingly.
Section 8.2.4, p 122, fifth bullet	Georgetown/Acton: Focus should on a common shared groundwater model . The last sentence should be removed or reworded to reflect that additional monitoring data should used to refine the model during Tier 3 process.	Halton Reg	Comment is acknowledged and recommendation that the CVC model be updated with additional data from the Tier 3 project in Halton was updated in Section 8.2.5.
Section 8.2.5, p 123, second bullet	Second Bullet: Tier 3 Water Quantity Risk Assessment: The recommendations under this section are no more recommendations ,they are actually CWA requirements. Objective should be a common , shared conceptual geologic model rather than a stand alone CVC Regional Model. of the annual groundwater budget for recharge in these subwatersheds	Halton Reg	Comment regarding the recommendation vs requirement is acknowledged and text was revised accordingly. Comment regarding developing a joint conceptual model was also added to the text.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Section 8.1.2, p 115 , Bullet five	The report states that each soil type, land use and slope combination were not tested in the model calibration due to insufficient runoff data. However, in bullet one on page 116, the report states that the water balance terms are highly dependent on land use, soil classification and slope. It is understood from the report that the simulated water balance provides a reasonable estimate of average conditions across the watershed, however at what scale do the estimates become unreasonable/questionable? How much error is expected at the sub-watershed level for each water budget term?	Halton Reg	Text was updated to stress that confidence is higher at the subwatershed scale, as this is scale of calibration.
Section 8.2.3, p 120, Para 2, bullet 2	We agree that streamflow monitoring should be improved throughout the watershed. In our opinion, the ultimate goal should be to include continuous streamflow monitoring at the outlet of each of the subwatersheds, however, as a minimum, a few additional strategically placed stream gauges would be useful to improve our understanding of the water budget at the subwatershed level and to better identify where and how much groundwater moves into and out of the watershed and between subwatersheds. In particular, those subwatersheds believed to be affected by cross boundary flow should be given first priority for development of new stream gauges.	Kevin Mackenzie	Comment is acknowledged and recommendation was added to the report.
Chapter 8.0, p115, bullet 2	This was commented on before but I will repeat here. The consumptive use factor recommended in the guidance is 0.2 and no factor was applied here. Also, the number of tile beds were counted and multiplied by 3.2 people per tile bed times 175 L/p/d. The guidance suggests to assume 335 L/p/d. This won't make a difference for the three stressed watersheds which come out, largely, because of municipal use (10, 11 and 19). It may make a difference for watersheds that are just under the 10% threshold, particularly if future municipal takings increase.	Rick Gerber, CTC	Water use updated to 335 L/person with consumptive use estimate of 0.2
p123, bullet3	“capture zones” should be “capture areas”	Rick Gerber, CTC	Report text updated as suggested.
<b>CHAPTER 9</b>	<b>REFERENCES</b>		
	References: There is only one reference about Groundwater Studies in the Region of Halton (Holysh 1995) , Infact there were many groundwater studies conducted by the Region. The reference list should be updated.	Halton Reg	Comment is acknowledged. Information and report sharing between the CVC and the Region of Halton is encouraged.
p 126	Tenth reference – This Golder Associates Report has been finalised and published	Kevin Mackenzie	Comment is acknowledged; reference has been updated in the report.
	Check that all references in text, tables and figures are in this list, and vice-versa. For example, many of the sources listed on Figure 2-8 are not in the reference list.	Rick Gerber, CTC	Comment is acknowledged.
	Page 1: line 18 from above ( <i>mode l s</i> ), line 7 from below ( <i>as soils</i> ).	CVC, Halt C&Reg	Report updated as suggested.
	Page 56: title of table 18, <i>Urban and Rural Land Use Categories</i>	CVC	Report updated as suggested.
	Page 64: title of table 23, <i>Annual Precipitation of Five Meteorological Monitoring Sites</i>	CVC	Report updated as suggested.
	Page 74: line 26 from above, <i>poor conditions instream</i> , should be written <i>poor instream conditions</i>	CVC	Report updated as suggested.
	Page 82: line 14 ( <i>Layer 5</i> should be <i>Layer 4</i> ) and 21 ( <i>Layer 5</i> should be <i>Layer 6</i> ) from above.	CVC	Report updated as suggested.

RESPONSES TO PEER REVIEWERS COMMENTS ON INTEGRATED WATER BUDGET REPORT

Section / Page #	Comment	Raised by	Response to Peer Reviewer Comments
Chapter 9.0	Page 88: line 13 from above, <i>range of range of</i> . Delete second range of	CVC & R Gerber	Report updated as suggested.
	Page 97: line 7 from above. ( <i>section 4</i> should be <i>section 74</i> )	CVC	Report is correct as written - Section 4 (i.e. Chapter 4) refers to Surface Water chapter of report.
	Page 101: line 2 from below, ( <i>22,550</i> , not <i>21,050 m<sup>3</sup>/day</i> ).	CVC, and others	Report updated as suggested.
	Page 108: line 9 from below, <i>is expressed</i> – remove <i>is</i> .		Report updated as suggested.
	Page 111: line 13 from below, insert word <i>during</i> , between <i>evaluated and stage</i> .		Report updated as suggested.
	Page 113: line 4 from above, <i>identified has being</i> – replace <i>has</i> with <i>as</i> .		Report updated as suggested.
	Page 118: line 7 from above, <i>have be more uncertain?</i>		Report updated as suggested.
	Page 121: line 3 from below, <i>subsurface movement</i> should be <i>subsurface movement of water</i>		Report updated as suggested.
	p i , last paragraph, line 3- “best management practices under a variety of scenarios <i>win</i> the report Replace win with <i>within</i> .	Kevin Mackenzie	Report updated as suggested.
	p2, Section 1.1.1.2 para 2, line 2 - Replace “this..” with “these”		Report updated as suggested.
	p4, Table 1, Row 1, column 2, last line – “..since the time <i>is</i> ...” Replace <i>is</i> by <i>are</i>		Report updated as suggested.
	p8 para 2, last line – “...close proximity <i>of</i> ...” Replace <i>of</i> with <i>to</i>		Report updated as suggested.
	p9, fourth line – “The Lake Iroquois <i>lake</i> plain...” delete the second lake		Report updated as suggested.
	p10, para 2, line 3- “The Morains <i>acts</i> a...” insert “as” after acts		Report updated as suggested.
	p23, Section 2.3.5.3, line 1 – “...there <i>is</i> limited...” Replace <i>is</i> with <i>are</i>		Report updated as suggested.
	p49, Section 3.4.1, para 1 , line 3 – “Approximately 66% of this <i>is</i> demand is...” Delete the first <i>is</i>		Report updated as suggested.
	p49, Section 3.4.1, para 3, line 2 – “...and <i>as</i> result...” Insert <i>a</i> after <i>as</i>		Report updated as suggested.
	p 65, Section 4.3.1.2 para 3, line 2 – “...and <i>the</i> Orangeville’s WPCP..” delete <i>the</i> before “Orangeville’s”		Report updated as suggested.
	p 67, para 5, line 3 – as above		Report updated as suggested.