SOURCE WATER PROTECTION

QUINTE
Source
Protection
Region

Cataraqui / Mississippi-Rideau / Quinte Source Protection Regions

WATER BUDGET

PEER REVIEW RECORD

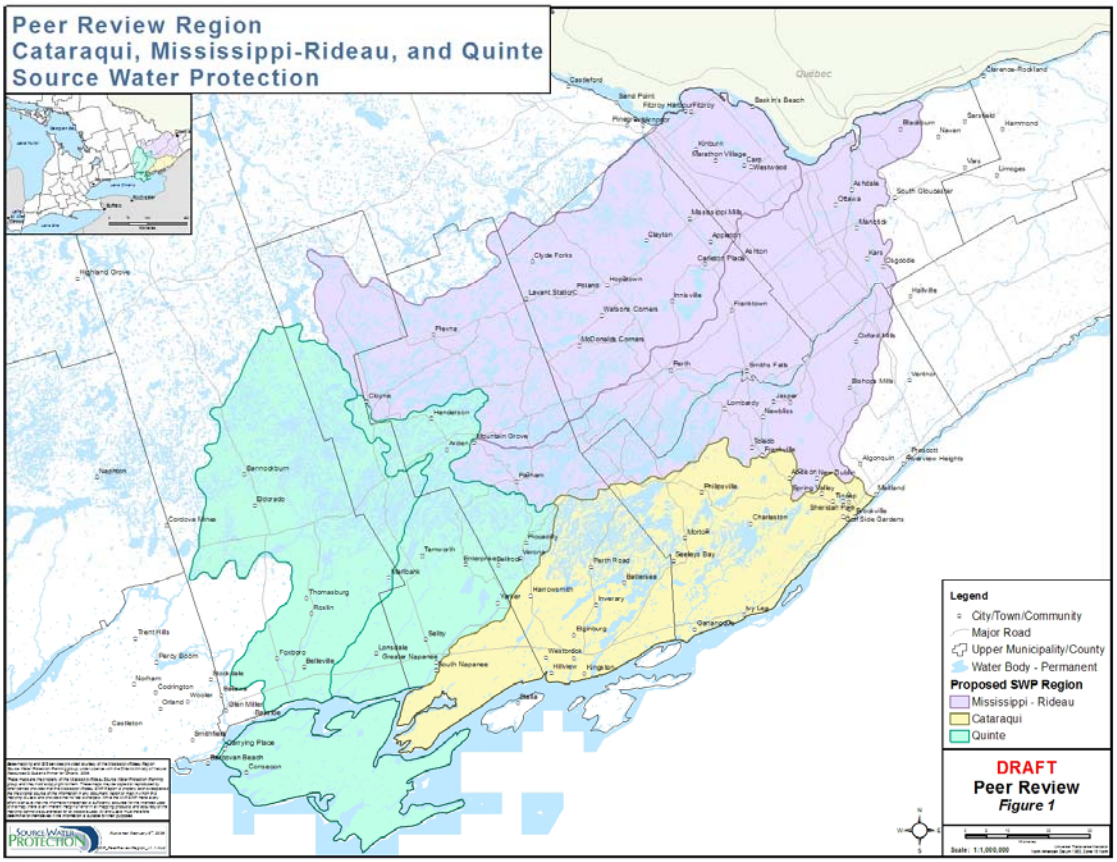
(MARCH – DECEMBER 2006)

January 2007

Modified by Quinte Conservation as originally prepared by staff of the Mississippi - Rideau Region.

Summary of Peer Review to Date

In the fall of 2005, the proposed Cataraqui Source Protection (SP) Area and the proposed Mississippi-Rideau and Quinte Source Protection Regions worked together to form a joint team for peer review of their conceptual water budget reports. The purpose of working together was to learn from each other and to have an efficient process with shared resources. The three SP Area/Regions are shown below in Figure 1.



A "Water Budget Peer Review Team Terms of Reference" was developed based on the Province's "Peer Review Interim Direction Version 2.0". The Terms of Reference outlined a statement of work for the peer review team including the purpose and overview of the process, roles and responsibilities, and logistical information. The Terms of Reference were distributed to members of the peer review team and to provincial representatives for review and feedback. Several revisions of the Terms of Reference have occurred since then.

The six member core peer review team was chosen by staff from the three SP Region's based on the person's expertise and local knowledge. The members of the core peer review team are listed below in Table 1.

In addition, the peer review meetings were attended by representatives from the Ministry of Natural Resources, Conservation Ontario, and neighbouring Source Protection Regions including South Nation/Raisin Source Protection Region and the proposed Trent Source Protection Region.

Table 1 Members of the Peer Review Team

Name	Expertise	Affiliation
Dr. W.E. Watt	Surface Water	Professor Emeritus, Queen's University
Bill Hogg	Climate	Retired from Environment Canada
Dr. Michel Robin	Hydrogeology, Academic	Professor, University of Ottawa
Dr. K. Novakowski	Hydrogeology, Academic	Professor, Queen's University
Darin Burr	Hydrogeology, Consultant	Dillon Consulting
Michel Kearney	Infrastructure Planning	City of Ottawa

Seven peer review meetings were held between March and December 2006. Three of the meetings were focused on the Mississippi-Rideau SP Region and the Quinte SP Region and two meetings were focused on the Cataraqui SP Area. At each meeting, presentations were given by the focus Area/Region on their work to date. The minutes from these meetings are given in **Appendix A**. A summary of the meetings is given below in Table 2.

Table 2 Schedule of Peer Review Meetings

Meeting	Date	Time	Purpose of Meeting	Status
Meeting #1	March 10, 2006	10am-3pm	Introduction to Peer Review Process **Quinte** Conceptual Water Budget	Complete
Meeting #2	April 21, 2006	10am-3pm	Presentation by Jennifer Havelock of Conservation Ontario **Cataraqui** Conceptual Water Budget	Complete
Meeting #3	May 26, 2006	10am-3pm	**Mississippi-Rideau** Conceptual Water Budget	Complete
Meeting #4	June 16, 2006	10am-3pm	**Quinte** Conceptual Water Budget	Complete
Meeting #5	September 26, 2006	10am-3pm	**Cataraqui & Mississippi-Rideau** Conceptual Water Budgets	Complete
Meeting #6	November 3, 2006	10am-3pm	**Quinte** Conceptual Water Budget (final draft). Tier 1 Water Budget proposal.	Complete
Meeting #7	December 15, 2006	10am-3pm	**Mississippi-Rideau** - Conceptual Water Budget (final draft). **Cataraqui** – status update.	Complete
All the peer review meetings are held at the offices of the Cataraqui Region Conservation Authority except the December 15, 2006 meeting, which was held at Rideau Valley Conservation Authority.				

Conceptual water budget reports were distributed by the focus Region to the peer review team prior to each meeting. Quinte has distributed three versions of their report (March 2006, June 2006, and November 2006), Cataraqui has distributed two versions (April 2006, and September 2006), and Mississippi-Rideau has distributed three versions (May 2006, September 2006, and December 2006), plus a point-form methodology handed out at the second meeting.

Peer reviewers were asked to provide written comments on the reports. Verbal comments were also recorded during meetings. Comments were provided by either inserting them directly into the Word document, by emailing them to the peer review leader, or verbally during discussions over the telephone and at peer review meetings. Comments were entered into a peer review database, which has been developed to track comments, associated responses by the relevant Area/ Region(s), the required action, and action date. A copy of this database can be found in **Appendix B**.

Status Update for Quinte

As of January 2007, Quinte Conservation has completed their peer review and is submitting their Final Draft Conceptual Understanding report (January 2007). The report has been completed with peer review comments incorporated from March through December 2006 have been entered into the database. The list of attached appendices is given below:

Appendix	Name	Components
Appendix A	Agendas and Minutes	Meeting #1 Agenda & Minutes
		Meeting #2 Agenda & Minutes
		Meeting #3 Agenda & Minutes
		Meeting #4 Agenda & Minutes
		Meeting #5 Agenda & Minutes
		Meeting #6 Agenda & Minutes
		Meeting #7 Agenda & Minutes (DRAFT)
Appendix B	Peer Review Record	Includes Snapshot Report of database containing comments from peer reviewers.

Appendix “A”

Peer Review Minutes

Cataraqui / Mississippi-Rideau / Quinte Source Protection Regions
WATER BUDGET PEER REVIEW TEAM

Inaugural Meeting - March 10, 2006

Cataraqui Region Conservation Authority Office
Kingston, ON
Telephone: (613) 546-4228

Minutes of March 10, 2006 meeting between Cataraqui Region Conservation Authority (CRCA), Mississippi Valley and Rideau Valley Conservation Authorities (M-R), Quinte Conservation (QC) source protection regions and the Water Budget Peer Review Team, held at the CRCA administration office.

CRCA Staff Present:	Rob McRae; SWP Project Manager, Sean Watt; SWP Engineer, Sheri Burke; Water Resources Technician,
M-R Staff Present:	Sean Sterling; Intera Engineering Hydrogeologist, Sobhalatha Kunjikutty; SWPP Engineer, Karyn Cornfield; Water Resources Engineer, Ferdous Ahmed; Sr. Water Resources Engineer
QC Staff Present:	Bryon Keene; Water Resources Engineer, Mark Boone; Hydrogeologist, Julie Schulenburg; Surface Water Specialist
South Nation CA and Raisin Region CA Staff Present:	Anne-Marie Chapman; Project Engineer
Trent Conservation Coalition Staff Present:	Ali Sajid; Water Resources Engineer
Peer Review Team Present:	Ed Watt; Queen's U Hydrologist, Bill Hogg; Climatologist Ex-Environment Canada, Michel Robin; U of Ottawa Prof. of Hydrogeology, Darin Burr; Dillon Consulting Hydrogeologist, Michael Garraway ; MNR, Rob Brown; MNR Water Budget Project Analyst

Handouts: Agenda with a map on the reverse, Water Budget Peer Review Team Draft Terms of Reference (Feb 2006), 5 QC GIS maps, M-R GIS maps

1) Welcome

Rob McRae called the meeting to order at 10:05 a.m.

2) Introductions

Introductions were done around the table each stating their name, position and what organization they represent. An attendance sheet was passed around.

3) Method of Review (three regions)

Rob McRae presented options on the style of proceedings that can be followed for the Peer Review Team meetings. He recommended a casual, organic style that allows for flexibility during meetings, meaning everything said does not have to be run through the Chair. All present agreed with this casual-organic style of proceedings.

4) Review of the Terms of Reference (TOR)

Rob McRae presented a slide show reviewing the goals, purpose, considerations, and a map of the three regions, the process and the timing of deliverables for the Water Budget Peer Review. The duration of the conceptual Water Budget work and review runs from January 2006 to June 2006. The numerical Water Budget work and review is anticipated to run from July 2006 into 2007 and beyond.

Michael Garraway was concerned with the term "local peer review team" in the Terms of Reference (TOR). He indicated that his concern was that local peer reviewers should not review the peer review team. The review of the Water Budget should come from experts in the discipline and the reviewers should consist of the core peer review team. In addition, decisions being made at the individual peer review (local team) meetings of the three regions may differ from the core peer review teams. Mark Boone indicated that this was a suggestion made by the group to deal with the large geographic area and inconvenience of people traveling for meetings. However the wording local peer review team may not be appropriate and maybe it should be advisory group instead. Michel Robin asked that the review process with local vs. core review teams be explained. Core Team will pull in the appropriate local people to meet when focusing on the various watershed regions. In response to Michael Garraway's concerns Bryon Keene explained that there will not be separate meetings between the local peer reviewers and the core peer review team as they will be meeting together. The reason for the local assistance is to add local knowledge to the core peer review without gardening the meeting with too many local representatives. The idea of changing the term "local peer review teams" in the TOR was discussed. A consensus was made that the term should be changed to

"local assistant" as a way to describe the local vs. core peer review team. Rob McRae stated that in response to this change the TOR will need to be updated to embrace this change.

Sean Sterling asked about the scheduling of the peer reviewer meeting. Mark Boone explained that the first meeting today is only an initial introductory meeting of the draft conceptual Water Budget and that there will be another meeting later on for the review of the final product. Rob McRae questioned that perhaps 3 meetings per region outlined in the TOR is too few a number and 9 is too many. Michael Garraway mentioned that he sees this process as an on-going, value added, and continuous process. Karyn Cornfield asked whether the schedule in the TOR is realistic; March (Quinte), April (CRCA), and May (M-R). Michel Robin agreed that this process is interactive and there should be some lead time given to reviewers of a couple of weeks to review. After some discussion Rob McRae summed up the idea that the Peer Review Team can aim to meet monthly May to August taking into account summer vacations with a total of 6 meetings. He questioned whether it would be useful to have a topic of the day to focus each meeting. Ed Watt indicated that to start out by backing off at the first meeting was not a good idea and could lead to a slippery slope. People respond better with deadlines in place. After some discussion it was decided that a time scale for each region should be specified in the TOR.

Ed Watt suggested a change in Section 2.1 of the TOR. In Section 2.1 he suggested the word climate be added after "A conceptual understanding of the geology," and before "hydrogeology" on line 3 and 4. Michel Robin suggested a change in Section 7.1 of the TOR. In the box on page 6 add the aspect of the human process in the 5th bullet point under "Description of Hydrologic Features and Processes".

ACTION: Peer Review Leaders to revise the TOR document for circulation to the Team and adoption at the next meeting.

5) Provincial Perspective – Mike Garraway

Michael Garraway from MNR presented an overview of the Draft Water Budget Guidance Document; the process, the trends, and the elements of the conceptual understanding of the Water Budget vs. Watershed Characterization. He reported that the guidance document is to be used only as a guide. There is a new guidance document that is under review. There are questions that need to be answered by each region as the answers will be different. Some questions that are dealt with in the new version are

1) Is the water from a large water body?
2) What is the required level of modeling?
3) Are both groundwater and surface water modeling needed?
4) Are there water quality threats that need modeling?

MNR hopes that the new Water Budget Guidance document will be finalized by April. MNR hopes to have the second reading of the Clean Water Act completed in April. The

SWPP schedule is to complete the Water Budget Exercise in 2008 to 2009 and to put the plan into place in 2009 to 2010.

Rob McRae posed a question to Michael Garraway; is there an option to group stream into study areas and having sub-documents? Ed Watt answered by stating that one would have to look at the water systems. You can split up to have a number of documents, but there will be overlap. One could have a single document for a particular topic, e.g. climate, as it is the same for all sub-watershed groups. Could also tack on other regions to these documents that overlap regions e.g. climate. Bill Hogg agreed that all 3 regions should have the same document for overlapping topics, e.g. climate. Bill will forward a website address of Forestry Canada to everyone as there are climate maps that can be used by the 3 regions.

Michel Robin asked how the reviewers should comment regarding the function of circulations to the team, it was agreed that items would be circulated via email (MS Word text) and hardcopy (11 x 17 inch maps), with the possible use of an FTP site as a supplement. He also indicated that the reviewers should take at least two weeks to review the Water Budget documents. Comments on the Word document are to be made using either Track Changes or Comments as directed by the Peer Review Leaders at the time of circulation. Comments should be prepared prior to the meeting collected in one document and shared so that the comments can be discussed at the next meeting. At the meeting each comment should be addressed and the chair makes the final decision. Michael Garraway stated that he or Rob Brown will be the Provincial representative present at the Peer Review Team meetings.

ACTION: M-R staff to confirm their ability to post items for the team on the RVCA FTP site.

ACTION: Peer Review Leaders to update Terms of Reference to reflect circulation and comment methods.

6) Quinte Conservation Conceptual Water Budget to Date & Discussion

Rob McRae handed over the Chair to Quinte Conservation. Bryon Keene presented an overview of the surface water components of the Conceptual Water Budget document that Waterloo Hydrologic Inc. prepared for QC. A set of 5 GIS maps of the Quinte region was handed out to the group at the meeting and Bryon Keene and Mark Boone explained their contents. The surface water components of the water budget explained were precipitation, runoff and evapotranspiration. Mark Boone reported that the annual precipitation map was developed using data from climate stations classified as World Meteorological Organization (WMO) or level A. Bill Hogg indicated that we are depriving ourselves by not using all stations as there may be good data from other stations as well. However, he indicated that this mapping should be done together for all three regions (perhaps by also including the Raisin Region as well) as opposed to each

individual conservation authority doing their own mapping. Ed Watt suggested adding isolines to the precipitation maps (800, 900, and at 1000 mm/yr) as Quebec has done. Bill Hogg suggested that the GIS technicians from the three regions be consistent in mapping. In addition, Bill Hogg and Michael Garraway mentioned that temperature maps should be displayed using annual extreme temperatures even if the federal temperature maps use annual mean. The last 30 years of data, e.g. temperatures, flows, etc., should be analyzed at 5 year intervals and normal values and departures from the norm (lows and highs) should be looked at to explain long-term trends, e.g. dry vs. wet years. Ed Watt stated that using annual means as Environment Canada has done for over 25 years may be a good start and may be good enough for the effort. He indicated that new climate stations may not give better data than old stations, therefore all stations and their data should be considered.

Rob McRae announced a break for lunch. The meeting was reconvened at 12:38 PM.

Bryon Keene continued to present the surface water components of the Water Budget. He reported that he is looking for guidance on the process from the reviewers in the room as he explains what Waterloo Hydrologic Incorporated (WHI) has prepared. Presented annual numbers, low flow periods, and monthly/annual changes e.g. average precipitation and low and high precipitation. Precipitation and evapotranspiration is given while the surplus is then determined as water may be moving out of the watershed. To describe where this water goes three components were analyzed: land cover, slope, permeability (soil type) with three classes describing low / medium / high resulted in 27 different permutations. Comment from the reviewers was regarding table 4 and that some classes are not represented, e.g. vegetation cover, and table 5 was described by a reviewer as not having good scientific justification as it is based partially on personal judgment. He identified that QC is open to comments as table 5 is a simple representation.

He continued by describing the map in Section 6.3 that used data from the Southern Ontario Hydrogeology Study by Singer on how much water is lost in evapotranspiration. A decision issued on the definition of base flow and what is measured at the gauge. Further, the term ground water recharge was discussed and how best to determine what component of the flow measurement at the gauge is ground water discharge. Ed Watt identified that the term baseflow separation is not accurate to use here as baseflow is defined as including both long term surface storage and groundwater discharge. He continues to explain that the Baseflow Index (BFI) was developed by UK Institute of Hydrology, it is a monthly index. Ideally daily flows should be used to describe flows, not monthly. Ed Watt defined runoff as what is measured at the stream gauge. Michel Robin asked what the scale was in the graph in section 6.2 and suggested QC to use a smaller geographic scale and time scale. Perhaps a large scale is acceptable for now and some areas should be looked at a smaller scale where there are seasonal shortages. Darin Burr commented on the use of shallow recharge and Bryon Keene that there is also a deeper aquifer that is not potable and not well understood since most wells are completed in the upper aquifer.

Darin Burr suggested identifying areas in the region that are sensitive to long term impacts and that this could be answered at the geology scale. Mark Boone's response was that none of the geographical areas are isolated and one needs to quantify how to identify the geologic boundaries. Mark Boone suggested that QC could use the hydrographs from the Provincial Groundwater Monitoring Network (PGMN) wells to help scientifically justify the groundwater recharge component of the Water Budget by correlating groundwater recharge with precipitation events. Bill Hogg suggested the use of existing climate station data instead of setting up more precipitation gauges.

Bryon Keene continued by describing Section 6.5 table 6 of the conceptual Water Budget document. Since evapotranspiration was not measured Bill Hogg mentioned that there should be some calculations in the table to confirm the estimated values.

Bryon Keene indicated that historic documents, e.g. Moira Report, could be used, but Bill Hogg mentioned that this may not help answer the questions on what and where are the stressors over the long term. To calculate evapotranspiration using temperature Bill Hogg suggested QC use the Thornthwaite formula. Both Bryon Keene and Mark Boone indicated that QC has asked Environment Canada to provide evapotranspiration data for the QC watershed. Bill Hogg suggested that Environment Canada's model of evapotranspiration is worthwhile to use because it incorporates mean monthly temperatures, snow, and elevation. He further identified that QC should not worry about the soil moisture holding capacities as in his experience it does not make a significant difference to the end result. Ed Watt talked about modeling evapotranspiration and simulations. Karyn Cornfield stated that Agriculture Canada has data available on water holding capacity of soils. Ali Sajid from Trent Conservation Coalition (TCC) stated that their Peer Review Team encouraged TCC to use Penman formula as opposed to the Thornthwaite formula. Bill Hogg highly recommends using the Thornthwaite formula. As the data required is readily available, which is not the case for Penman.

Bryon Keene asked Mark Boone to discuss the groundwater section of conceptual Water Budget. Mark Boone referred to Section 6.6 of the conceptual Water Budge document prepared by Waterloo Hydrologic Inc. Ed Watt commented to leave off the decimal places for readers to recognize the uncertainty in the numbers. Mark continued by explaining table 4 and 5 and stated that similar methodology is found in MOE guidelines (1995) for the determination of ground water recharge. Bill Hogg suggested describing the rational for partitioning in this section of the document, e.g. examining the gauge. Ali Sajid from TCC listed 3 approaches available to classify evapotranspiration: Ontario Ministry of Agriculture and Food (OMAF), Ministry of Transportation of Ontario (MTO), and International Standard Classification. He reported that no classification has been chosen for TCC's purpose and suggests that Ministry of the Environment (MOE) classification is most suitable. Ed Watt suggested looking at what others have used in literature and instead of using low / medium / high for vegetation cover perhaps QC can use classes 1, 2, and 3. Ed mentioned a reference for classifying vegetation called Chow (1964) Handbook of Hydrology. Mark Boone explained the groundwater in flows / out

flows where WHI looked at groundwater gradients across watershed boundaries, Michel Robin explained that it is integrated flux that is presented in table 7. Ed Watt's comment was that usually net influx and outflux is used in studies and should be used in table 7. Mark Boone continued by explaining the map of the water table gradients.

Bryon Keene asked the peer reviewers to advise QC on partitioning where water goes and on the questions that the conceptual water budget asks. Karyn Cornfield suggested that only a simple model can be used in areas with low use, low population densities, and large water supplies. Mark Boone agreed. Darin Burr added to this discussion by stating that when considering simple models QC should consider when future growth will occur in these low density populated areas. Michel Robin had a couple of points to make. The first point was that he felt that the diagrams were good in their detail, but could use GIS to create a simple model to depict vulnerable areas on a pixel by pixel basis. This model can analyze vulnerable areas by tweaking the precipitation, etc. to consider seasonal changes. Michel has a report that uses this technique from a study done at the University of Ottawa, which he can send to the group. The second point Michele made was that potential loading should estimate water quality that is being returned. Ed Watt had a question as to how extreme of an event will QC use in their water budget modeling. Michel Robin suggested using the 80th percentile of the year to see how responsive the system can be. This technique is also explained in the U of Ottawa report he mentioned earlier. Michel suggested that the next step QC should take is to examine the sensitivity of the model. Bryon Keene mentioned that QC will come up with some stressors for the next step on the review.

The position of Chair was returned to Rob McRae.

7) Other Business

Rob McRae had an administrative point to make. The 3 regions had previously decided to evenly share the costs of the process of the Water Budget Peer Review. QC will act as the "bank" and anyone else will pay QC later on. Rob asked everyone associated with the peer review process to please keep track of their costs (travel costs, per diems as negotiated) and to direct any invoices to Keith Taylor for processing. Invoices should be submitted after each meeting. He identified that he will give out Keith Taylor's e-mail address later (ktalyor@quinteconservation.ca).

8) Next Meeting

Rob McRae opened the floor for the discussion of when to hold the next meeting. Sean Watt updated that CRCA is ready for a peer review of their conceptual Water Budget in March. Karyn Cornfield updated that M-R can be ready for a peer review of their conceptual Water Budget in May.

By next meeting Bill Hogg stated that he would like to see point form comments along the way and would like to see an overview of the conceptual Water Budget e.g.

objectives, methodology, etc. by region from the three separate regions. Ed Watt added that he would like to see a 1 page summary of evapotranspiration mean annual runoff (partition of what came from runoff) and the range of values for the three regions to determine the variability from one extreme to the other. Michel Robin suggested to do a qualitative assessment of the certainty in a table format or geographically. Ali Sajid suggested doing a sub-watershed comparison of runoff and Sobhalatha Kunjikutty suggested to also doing a comparison on climate. Sobhalatha handed out GIS maps of the M-R region on temperature, precipitation, evapotranspiration. In response to the M-R maps Bill Hogg and Michel Robin were concerned about the variability and uncertainly of the data that should be noted in the maps, e.g. elevation was not taken into account in the evapotranspiration map. Ed Watt stated that mean annual should not be used and would like to see the accuracy demonstrated at a 99% confidence level of significance.

Rob McRae stated that the peer review team can meet on a monthly basis as outlined in the TOR and suggested that Sean Watt present the conceptual Water Budget for CRCA at the next meeting. CRCA should send out their document prior to the next meeting to be reviewed at the next meeting. Methodology will be the focus to be reviewed at the next meeting. The next meeting will be on Friday, April 21 at the CRCA office from 10:00 AM to 3:00 PM.

ACTION: CRCA (Sean Watt) will send out their document at least two weeks prior to the next meeting for review.

ACTION: The next meeting will be held on Friday, April 21 at the CRCA office from 10:00 AM to 3:00 PM. Review of the CRCA document and methodology will be the focus of the next meeting.

9) Adjournment

Rob McRae adjourned the meeting at 2:53 PM.

JS

Minutes of Meeting
Source Protection Peer Review
Quinte, Cataraqui, MVC-RVC

Held at Cataraqui Conservation Authority
April 21, 2006, 10:00 AM to 3:00 PM

Present:

Name	Agency	Name	Agency
Bryon Keene	Quinte Conservation	Mark Boone	Quinte Conservation
Ferdous Ahmed	RVCA	Jim Beal	MNR
Anne-Marie Chapman	SNC/RRIA	Sobhalatha Kunjikutty	MVC
Karyn Cornfield	M-R SWP Region	Sean Stirling	M-R SWP Region / Interra Engineering
Michel Robin	U of Ottawa	Bill Hogg	Reach Consulting
Ed Watt	XCG Consulting	Sean Watt	CRCA
Keith Taylor	Quinte Conservation	Jennifer Havelock	Conservation Ontario
Rob Brown	MNR	Darin Burr	Dillon Consulting

Absent:

Name	Agency	Name	Agency
Mike Garroway	MNR	Kent Novakowski	

Introductions were heard

Motion
To approve the agenda. Moved by Mark Boone, seconded by Michelle Robin, carried.

Motion
To approve the agenda from the previous meeting. Moved by Michelle Robin, seconded by Bill Hogg, carried.

Presentation by Jennifer
Jennifer provided a presentation overview of the conceptual budget process and the peer reviewers' roles. She indicated the guidelines offer flexibility and also provide standardization. Peer reviewers role is to challenge, advise, and assist with outreach into the community. She clarified that we are at a conceptual water budget stage.

Question from the peer review committee – can we have the guidance modules to see where we are going.
Action Point – Jennifer to get permission to pass along all the guidance modules to the committee members soon as possible.

Some concern was expressed by the peer reviewers that the conceptual budget process may not be an effective use of the reviewers' time. Is this process simply to decide which model to use?

General consensus was that the long term water budget (annual) based on normal conditions won't help us identify water problems. Low water periods present stress conditions that will reveal the areas of concern. Major outcome will be identification of the issues and determining the next steps. Decisions on details are not needed yet.

Summary thought on water budget – 1) Do we have a problem?, 2) Do we have the tools?

It was noted that there was no clear line between what a conceptual water budget is versus a Tier1.

Question – How do we document the review process?
It was agreed that comments can be submitted by reviewers electronically. A final signoff at the end of the process by reviewers is requested. Minutes will be the most important documentation of the peer review process.

Business Arising from the Minutes – none.

Terms of Reference for Peer Reviewers.
Karyn reported that all comments were conveyed in the minutes and these were incorporated in the revised ToR.
Action – New draft is to be posted on FTP site (**Karyn**). Karyn also posted a summary of comments.

Ed Watt requested that 'diversions in and out' should be included in section 2.1

Jennifer requested she be listed as an 'Observer in the Terms of Reference. Keith discussed Jim Beal's presence on behalf of MNR as a liaison with the local and regional offices.

It was requested that PDF versions of maps with less resolution be prepared to keep file size down. **Action –** all SP teams.

Cataraqui's Presentation of Draft Conceptual Water Budget
A 12-page handout was circulated for the power point presentation. Climate normals were used, but a problem was noted with Glenburnie. Bill Hogg suggested we contact Dan McKenny at Forestry Canada for the digital climate normal data used to prepare the Canada mapping.
Action – Keith Taylor to forward this website to all teams. (Mark Boone since offered to contact Dan McKenny and will report on the availability of the digital data.)

There was some discussion on the applicability of the statistical methods and the usefulness of the results. While precipitation is important it was recognized that this is the conceptual stage and that we must move on knowing that the long term water balance will show no stress regionally. Monthly time sequence will need to be looked at.

Bryon Keene discussed the importance of the conceptual in that it leads the group to a decision point on the level of effort needed for a Tier 1 water budget. It must therefore have sufficient detail to direct the group to further study. He also noted the role of Jennifer as a liaison with Conservation Ontario not to be confused with a directing role.

Some general comments during the Cataraqui presentation

- Regulation does not factor into the annual water budget.
- Hartington pan evaporation data can be referenced to help with lake evaporation measurements.
- Sean's ET numbers (600mm) may be too high. There is more water accounted for than the actual precipitation – approx. 1050 mm vs 950 mm of measured precipitation.
- Precip numbers may be low due to undercatch in the gauges.

There was some discussion on using permitted water takings vs. actual water takings. It was the consensus that permitted uses be considered as a worst case. Actuals can be used depending on the scale of the study area and type of use.
Action. Rob Brown will circulate a report by Aqua Resource that looks at PTTW analysis of use.

Sean was looking at methods to estimate private usage. It was agreed the group would continue to research methods to better estimate usage from domestic wells. Darin Burr suggested well locations can be used as surrogates for spatial reference on population density.

A discussion again ensued on what is meant by 'Runoff'. Runoff is what is measured at the gauge. It is not simply surface flow, but is a combination of what moves through the unsaturated zone and overland that discharges to the creeks and rivers.

Sean noted that groundwater in and out of his watershed is unknown. Groundwater was noted to be an important resource in the Cataraqui region. Groundwater is the largest source of drinking water after takings from the St. Lawrence.

Information available in the Cataraqui region is covered by two separate studies . Darin Burr noted this was done using two different methodologies and the results may not mesh. It was agreed the best approach was for the entire eastern region to use consistent data to work out the groundwater flow patterns.
Action. Water table and piezometric surface to be regenerated based on common MOE ToR.

Sean wants to collect some field data this summer – flows, water temp, soil moisture, water levels in lakes. It was agreed there would be some value in collecting flows and water temp for later use in the Tier 1 budget.

General response by the committee to the Cataraqui presentation was there was not enough emphasis on the groundwater component and too much emphasis on statistical analysis.

A summary comment was provided by Ed Watt on a simple water budget. Using the analogy of a bucket over a 30 year period, the terms become: $P - Q_{out} - ET = 0$. Precipitation is measured and provided by Environment Canada, Flow is measured and provided by Water Survey of Canada and ET is the result to balance the equation. This is refered to as derived ET. ET may also be calculated and cross checked with the derived value.

Based on the above discussion, uncertainties in the terms can be 5 to 10% for the measured values and easily 10% for the ET. Therefore, trends may be difficult to analyze with the scatter. Trends should be looked at later. It is appropriate to think ahead for the next steps, but we need to also focus on what is needed now for conceptual stage.

Quinte Presentation
Mark Boone presented a gridded methodology for Quinte's conceptual water budget. This is a GIS exercise that can account for accumulating or discretizing impacts. General reaction from the committee was that this would work well, but may be closer to a Tier 1 simple model. Michel Robin inquired about storage and discharge of groundwater; however, this is a simple static model that does not account for this.

MVC – RVC Presentation
Karyn Cornfield presented their methodology for climate data. The general response was suggestion to use the standard climate normal methodology.

Future Meetings
Next meetings will follow the schedule included in the peer review ToR and included on the back of the Agenda for today's meeting.

Other Business – None.

Motion
To adjourn. Moved by Karyn Cornfield, Seconded by Darin Burr

Chair : Keith Taylor
Secretary: Bryon Keene

Minutes of Meeting
Source Protection Peer Review
Cataraqui, Mississippi-Rideau, Quinte

Held at Cataraqui Conservation Authority
May 26, 2006, 10:00 AM to 3:00 PM

Present:

Name	Agency	Name	Agency
Brian Stratton	M-R SWP Region	Karyn Cornfield	M-R SWP Region
Sobhalatha Kunjikutty	MVC	Sean Sterling	M-R SWP Region / Intera Engineering
Ferdous Ahmed	RVCA	Bruce Reid	RVCA
Paul Lehman	MVC	Anne-Marie Chapman	SN-RR SWP Region
Bryon Keene	Quinte Conservation	Mark Boone	Quinte Conservation
Sean Watt	Cataraqui Region CA	Clyde Hammond	Trent Conservation Coalition
Jennifer Havelock	Conservation Ontario	Gary McLaren	MNR- Kemptville
Rob Brown	MNR	Darin Burr	Dillon Consulting
Kent Novakowski	Queen's University	Bill Hogg	Reach Consulting
Ed Watt	XCG Consulting	Michel Robin	U of Ottawa
Michel Kearney	City of Ottawa		

Absent:

Name	Agency	Name	Agency
Mike Garroway	MNR	Jim Beal	MNR

Brian Stratton (M-R SWP) was chairing the meeting, and he started by welcoming everyone.

Introductions were heard around the table.

Agenda
The agenda prepared for the meeting was passed out. There were no additions.

Previous Minutes
A motion was put forward to approve the minutes from the previous meeting (April 21, 2006). There was no discussion.
Moved by Michelle Robin, seconded by ?, carried.

Terms of Reference Review by Karyn Cornfield (M-R SWP)
Karyn reviewed the modifications as agreed at the previous meeting.

- Draft reference was removed in the title
- Reference to the Guidance Module was changed from Version 2 to Version 3.
- 'Diversions in and out' was included in section 2.1.
- Section 6.1 (Team) was modified to reflect representatives from both local MNR offices, a change to the representative from the City of Ottawa, as well as noting Jennifer Havelock as an 'observer', as opposed to an official member of the Peer Review Team.

- The meeting schedule was also updated.

There was no discussion of the changes as noted.

Mississippi-Rideau's Presentation of Draft Conceptual Water Budget

2 powerpoint presentation handouts were circulated, a 13-page handout covering general topics, climate, streamflow, and water use, and a 9-page handout covering the physical description of the watershed, including geology and hydrogeology.

Karyn started with a general introduction to the watersheds. It was noticed that the fourth slide seemed to have inconsistent drainage areas between the overall area (8,591 km^2) and the Mississippi River (3,747 km^2) and the Rideau River (3,872 km^2). The missing area is covered by tributaries draining directly to the Ottawa River. It was also suggested that perhaps the major lake names should be added to the Base Map (Figure 1.2).

Sean Sterling then took over to present the SWP Region's Physical Description information.

There were a number of discussions about the way the data was presented, where it came from, and what analyses were done to create the maps.

There was a question as to whether the Shallow Groundwater Elevation Surface (Figure 3.1) was tied to surface water levels. The data came from the Rideau/Mississippi/Renfrew County Groundwater Study prepared by Dillon (2005), and Darin Burr confirmed that the created surface did include ties to the surface water levels.

It was noted that the shallow and deep groundwater surfaces were very similar. Consensus was that this was not surprising, as the data is based on open hole wells, and could very well be connected via fractures, and there was no way to accurately distinguish specifically where the water was coming from, and therefore whether it was deep or shallow, so no judgment along those lines could be made. The known issues with the water wells database were brought up here, and it's limitations for making judgments on the groundwater system.

There was a question about the recharge/discharge map, and it was noted that what was provided in the report was actually the wrong map. A new version was presented here. There was a question relating to simple subtraction between the shallow and deep water surface maps. It was also noted that an overlay of the surficial geology map showed that the simple recharge/discharge map was not necessarily correct.

Comment [SW1]: What was the question, how did it relate?

The method to identify recharge vs. discharge areas, and a difference in head of 5 m, was questioned. It was noted that the error of the data was possibly larger than the 5 m increment used.

It was also noted that with the geologic structure missing from the analysis (recharge/discharge based purely on head) the analysis would not necessarily be complete, and that head alone is not a good indicator of recharge.

Figure 3.12 was noted to be only ½ of a depth to water table map, based on the way it was created. It is a map of the DEM minus the water table, which in itself is tied to the DEM, making a number of locations equal to zero, when they should not necessarily be zero. For that reason, that version of the map is not necessarily useful.

It was noted that a higher head in a deeper well did not necessarily represent a discharge feature.

Figure 3.13 - Depth to Water Table Map (GS Elevation – Shallow WT elevation) - should only be used as a regional picture, and should not be tied to specific locations, as the data it is based on is not good enough to give fine grained detail. As such, it should be noted in the text, and on the map, that this limitation exists. Possible future use needs to be "foolproof." Some ground truthing was recommended perhaps on the Tay River. It was recommended to add the comment "Do not use on local scale" to the map.

It was also noted that in general, class sizes of maps need to be larger than the error associated with the data. As well, the scales and general breakdowns of the classes should be consistent across the map sets. Also, with the expectation of the maps being photocopied for use in the future, consideration for the usefulness of the colour scheme in black and white should occur. As an addition, the scale issues of enlarging or reducing the maps may also need to be considered.

There was a suggestion to add the data points in the background (in this case well locations) of the map, so it could be known what locations the map data was based on.

The aquifer table on the upper right of page 6 of the handout (Aquifer Unit/Use/Yield/K/Porosity) resulted in considerable discussion. The consensus was that the term yield was not to be used, and something like "Driller's Estimate" would be a better representation of the values. Included in that, some qualification of the numbers would be preferred to be added at the bottom of the table. Another suggestion was to use the terms "poor, good, or excellent" (with definitions) in place of an actual number. Or perhaps use the productivity instead of the term yield. A range of K values may also be useful. In addition, the sources of the data, whether taken from well records, previous reports, or calculated, should be included on the table.

It was noted that a precambrian rock porosity (specifically) of 1% was too high by 3 orders of magnitude. The use of 1% by volume of void space for modeling purposes would be acceptable from a fracture pathway perspective. It was explained later that this value (1% bulk porosity) was derived from porous media modeling approach and therefore accurate. Further footnotes explaining data sources would clear this up.

It was noted that on Figure 2.3 the fractures and cuts were not overlain properly on the geology. There were two different scales of the maps.

There was some discussion on faults and other linear features, and whether these are permeable links, or rather impermeable planes due to filling and packing of material. The literature has not yet provided a consensus on this topic.

A series of new cross-sections (not included in draft report) were presented to the team.

It was suggested that the cross-sections should include a general direction of flow and that all cross sections should be at the same scale or make note of the different scales.

The Rideau River was missing from cross-section A-A'.

There was a question about the structural geology, and where the fractures were located. This was brought up in relation to modeling, and that the location was needed to do proper modeling. But fracture locations are generally not known, and therefore large scale modeling will not be worthwhile, as not enough information can be gathered to make the modeling worthwhile. However, localized modeling may be worthwhile, and acceptable.

There was discussion about flow of groundwater through faults. Faults are not "avenues" for flow. More likely to be gauge filled, and less permeable. There's probably fairly good connection in the shallow subsurface over bedrock. It was noted that Fred Michaels at Carleton U. has noticed a lot of infilling. There was general consensus that there was a lack of hard information available.

There was discussion regarding the clay cap at Carp (Cross Section E-E') and whether that was a GUDI well or not. It's still very unclear. A GUDI study may be needed.

It was noted that groundwater discharge from precambrian rock is very localized. For modeling purposes, bedrock should be treated as "lumped" for the discharge term to surface water models.

A slide with 2 questions was presented. There was a suggestion to move question 1 to 1B, and have a new question, 1A, which was essentially worded the same, with the exception of "why" instead of "how".

Therefore the questions, "Why measure groundwater flux?" and "Is a numerical GW model required?"

There was considerable discussion about the quantity of groundwater flux, when compared to the values of the other parameters, and whether it is so small to be negligible. It was agreed that for the long term conceptual water budget, groundwater flux is probably zero.

This will of course need to be dealt with in a more detailed fashion for the subwatershed, monthly, or drought period scale models. In that case, the value may not be zero, and may be large enough to need to be accounted for.

It was agreed that in general, a regional 3D groundwater model was probably not needed for the studies, as that is outside the capabilities of the model with the information available. A more likely scenario is something simpler like a GIS model.

However, for small localized areas, a 3D model may be the proper approach, perhaps for the lida clays around the valley area and its feature (e.g. eskers) because there the vertical component of groundwater is not up and down.

After lunch, Sobha presented the climate analyses for the region.

There was some discussion of a "rain shadow" in the general area created by the highlands near Algonquin Provincial Park, but it could not be substantiated.

When looking at the long term average, it was felt that using the data from just one station was probably reasonable. However, the existing climate analysis by Forestry Canada was again mentioned as a resource that has already been scrutinized, and would be worthwhile to use for this project. The Quinte SP Region has received this information, and found it very useful.

The use of standard deviation, standard error, as well as error bars on the graphs was questioned, and it was felt to be redundant, only one type of variability estimation should be used. The mean and the y-error bars are really the only stats that mean anything. It was also felt that the sample size may be too small to make good use of the statistics.

The metadata of the climate stations came up, and what methods and equipment were used to collect the climate data (airports vs. volunteer sites), as that will have an effect on the uncertainties associated with the data. One way to get this information is to talk to the collectors of the data, and find out the answers, or failing that, to use a climate database that contains the metadata for the sites.

The type of error associated with some measurements was noted, snow measurements can be as much as 50% undercatch, and a shielded nipher gauge is a reasonable gauge setup, with close to actual catch. Volunteer sites use the ruler measurement which is fairly reasonable.

There was a note about the report and how $P<0.05$ was noted to mean that the difference is not significant, though the report specified the opposite.

The word "trend" was suggested removed from the graph, as not being appropriate, and to just say "Precip over 1974-2003".

It was suggested that the y-axes of graphs be set to start at zero, to show the relative variation over the scale of the measurement.

It was noted that the Kemptville climate station had been automated in 2001, hence the CS suffix on the station number after that time. The two datasets are therefore no longer homogenous, and should not be treated as such. The original data set could be extended with the ratio to the normal from the surrounding stations.

There was a question about why 30 years of data were used instead of the entire period of record. That shifted to a discussion about stationarity of the data, and whether using more data would result in a shift due to non-stationary data. However, it was pointed out that some research had been done for Eastern Ontario stations, and that 80 years (1915-1995) of data was in fact stationary.

It was mentioned that extensive work has been done in Ontario looking for statistical trends in climate data, and none can be found, save for a slight increase in the spring and winter minimum temperatures.

There was discussion of Figure 4.18, and taking the term "total" from the title. The 0.5 degree variation in class was also discussed, but found reasonable for the error, and the range across the region.

Karyn then took over again to present streamflow data and analyses.

It was noted that a strict interpolation of BFI from stream gauge to stream gauge was not necessarily acceptable, and if it were to be needed, a relation to the surficial geology should also be included.

There was a question about the difference (~67 mm) between calculated and derived ET (Precipitation – Streamflow) and whether it was consistent across the watershed.

It was also noted that using only one climate station's ET, but comparing it to the mean annual flow at multiple stream gauge sites may result in skewed data, and perhaps the ET or precipitation values for that particular watershed area should be used instead. As well, the comparison of derived ET (Precipitation – Streamflow) should be compared with the calculated ET (EC Thornthwaite). In addition, it was thought that the Soil Water Holding Capacity variation across the watershed could be used, and compared to the ET values, to ensure a proper distribution across the watershed.

The runoff map (Figure 6.3) was thought to need some changes; in particular, the runoff depth was shown in individual subwatersheds, but in some cases actually reflected the runoff depth of the entire watershed to that point.

There was discussion of the PTTW database, and usefulness of the numbers as presented there. It is accepted that the values shown in the database are maximum daily permitted takings, which is not necessarily what is taken every day. In general, permit applications include more than what is needed, so there is always extra water available if needed. This practice is changing due to the new Regulations, and over the next 10 to 15 years, as

permits come up for renewal, they will be adjusted to reflect actual need. In addition, well it has been a requirement in the past, records of withdrawals have not necessarily been kept, and there will be much stiffer requirement for the future with the new Regulation.

The Grand River CA (and AquaResource Inc.) has prepared some correction factors for a variety of PTTW sectors. This list can help differentiate withdrawals on a monthly basis.

It was noted that the location of the PTTW withdrawals (page 8) and the Municipal Systems (page 9) did not necessarily correspond. Presumably this is due to location errors in the PTTW database.

The water use value used for the residential well withdrawals was thought to be too low at 130 litres per capita per day, somewhere between 170 and 230 L/c/d was thought to be more acceptable.

The municipal water withdrawals table (Section 7.2 - page 9) shows annual withdrawals, not daily withdrawals, as referenced.

It was noted that if asked for, better agricultural water use data is available.

Comment [SW2]: Who do we ask?

There should be consideration of consumptive uses (removed from the water cycle) and those uses that withdraw the water but then put it back into the system. But also for those uses that withdraw the water in one place and return it to another (withdraw from groundwater, release to surface water).

The discussion turned to illegal unpermitted takings (those that exceed 50,000 L per day and have no permit) and whether they should be accounted for, and how. It is accepted that they exist, but that there is generally very little information on where they are, or how much they may be withdrawing. The suggestion was to estimate how much they may be withdrawing, and use that as a guide. Presumably, some sensitivity analysis of the value would show whether it is significant within the watershed or not, and if it is found to be significant, better estimates would be needed.

The discussion turned to snow data, and the snow courses across the region. At one time, Ontario Hydro measured snow at a number of stations, but this is generally no longer done. Bill Hogg mentioned he has a CD up to 1996 of all snow course data, and would be willing to share it.

There was discussion of areas that do not drain out to a lake or stream, and whether they may be recharge areas, or areas of such tight geology that the water collects and then evaporates out.

Discussion of “groundwater flux” (Page 12) sparked considerable debate about accounting for a variety of variables. It was decided that the term “flux” was a misnomer to what was intended, and rather this portion of the presentation was referring to the

partitioning of precipitation to the groundwater system. Essentially it is the leftover term when all measured values (streamflow, withdrawals, lake storage, etc. are accounted for within the precipitation value).

It was again noted that looking at the flows generated between stream gauge stations would help to identify the volume of water going to groundwater or coming from groundwater.

Other Business

Keith Taylor asked that all invoices to date be submitted to the Quinte before June 15, 2006, to be accounted for by the June 30, 2006 funding period deadline.

Sean W. asked if there were any more comments to be received on the CRCA Water Budget document. There were none.

Future Meetings

Next meetings will follow the schedule included in the peer review Terms of Reference. The next scheduled meeting is June 16, 2006. That meeting will focus on the Quinte SP Region water budget.

The meeting was adjourned at 3 pm.

Chair: Brian Stratton
Secretary: Sean Watt (lead)/Karyn Cornfield/Sobha Kunjikutty/Sean Sterling

Minutes of Meeting
Source Protection Peer Review
Quinte, Cataraqui, MVC-RVC

Held at Cataraqui Conservation Authority
June 16, 2006, 10:00 AM to 3:00 PM

Present:

Name	Agency	Name	Agency
Rob McRae	CRCA	Jim Beal	MNR - Kingston
Sean Watt	CRCA	Rob Brown	MNR
Bryon Keene	Quinte Conservation	Darin Burr	Dillon Consulting
Mark Boone	Quinte Conservation	Bill Hogg	Reach Consulting
Hui Wei	Quinte Conservation	Michel Kearney	City of Ottawa
Ferdous Ahmed	RVCA	Michel Robin	U of Ottawa
Sean Stirling	M-R SWP Region / Interra Engineering	Ed Watt	XCG Consulting

Absent:

Name	Agency	Name	Agency
Mike Garroway	MNR	Gary McLaren	MNR
Jennifer Havelock	Conservation Ontario	Sobhalatha Kunjikutty	MVC
Karyn Cornfield	M-R SWP Region	Anne-Marie Chapman	SN-RR SWP Region
Clyde Hammond	Trent Conservation Coalition	Kent Novakowski	Queen's University
Keith Taylor	Quinte Conservation	Brian Stratton	M-R SWP Region

Rob McRae (Cat SWP) chaired the meeting, and opened by welcoming everyone.

Introductions were heard around the table.

Agenda
Copies of the agenda were circulated to those who needed them. There were no additions.

Previous Minutes
A revised version of the minutes from the previous meeting (May 26, 2006) had been circulated via email by Mississippi-Rideau SWP staff (June 13, 2006). There were no changes suggested, and they were declared adopted.

Invoices
Rob mentioned that invoices were to be submitted to Keith Taylor a.s.a.p. as the current funding period ends June 30th.

Quinte's Presentation of Draft Conceptual Water Budget
Bryon started with an outline of the Quinte's planned presentation, and then re-introduced the 4 questions to be answered by the Water Budget work.

- Where is the water?
- How does the water move?
- What and where are the stresses on the water?

- What are the trends?

Mark took over to describe the geology and hydrogeology of the Quinte watershed, as well as the water use.

Figure 13 of the Water Budget document (Groundwater Vertical Hydraulic Gradient) came up specifically. It was created based on the difference in elevation between the shallow and deep well water surface data. Mark mentioned that it was only one of a number of methods they have used to try to identify these areas. Mark felt that this map is a good representation of recharge vs. discharge areas, as it corresponds to the areas he would expect to be recharge or discharge.

Looking at water use, it was found that within the watershed the source of water was evenly divided between surface and groundwater.

The estimation of water use by residential wells was done using population census and water well databases. On a municipality basis, the number of residents was divided by the number of wells, which yielded a number of approximately 3 persons per well in each of the municipalities but Prince Edward County. This municipality averaged 6 persons per well, though in most cases that would appear much too high for the general population of the municipality. This discrepancy is explained through local knowledge that there are many shorewells in the municipality, which are generally not included in the water well database. The volume of use estimated for residential wells was 175 L/capita/day.

The Permit To Take Water (PTTW) database was used to estimate the water use in other sectors across the watershed. The maximum takings were used for the estimates. It was noted that when comparisons of the maximum takings were done with the actual taking data, that municipalities in the watershed were taking only 15% of their maximum allowable.

The discussion turned to knowledge of the permits outside the PTTW database, such as knowing that while a permit is issued, it is not being used, or even though the permit has expired, water is still being withdrawn. It appears that the Guidance Module instructs to assume the maximum takings for the Conceptual Budget, with more refinement at later stages. It was also discussed that during times of stress (i.e. dry years) in most cases the maximum withdrawal is what will need to be considered. It was noted that some permits (quarry de-watering) would probably be minimal during dry years. Expired permits posed a different problem, and the Quinte has completed a pilot study covering this topic which found that even though the permit is expired, the withdrawal is very likely still occurring, with the exception of one time use permits such as pump testing or pressure testing.

In any case, it was decided that the work with the PTTW database needs to have a number of caveats and assumptions noted to ensure they are not used directly and blindly for every situation.

The agricultural water use estimates were based on the work of Rob DeLoe for the Ministry of Natural Resources.

The recharge/discharge mapping was presented in more detail at this time. Figure 13 was again discussed. It comes from the Quinte Groundwater Study, and was created because the MOE Terms of Reference directed it to be done in this manner. There was some discussion about the general detail of the map, and how it could be so precise considering the data it is based on. It was recommended that a disclaimer be added to inform viewers of the "issues" with the data and therefore the mapping. In addition, it was felt that in areas with little data (in this case only a small number, or no wells at all) that the area be blanked out and no grouping be shown at all.

In general, it is felt that given the fracturing of the bedrock, and the shallow soil overlain, that almost all the watershed could be a recharge area.

With the general uncertainty of the data being used, and knowing the ultimate goal of the work, and even though in some cases the data is very good, it was thought that smaller scale maps would be better for some of the information, as this would give less weight to the product being shown.

There are a number of maps that can be used to help estimate recharge and discharge, including topography, depth to the water table, etc. Perhaps a combination of these maps can be compiled in a hand drawn version to best represent the recharge discharge areas.

Bryon took over again to discuss climate.

He started with the Canadian Forestry Service climate mapping based on Environment Canada station data. This is information we have been recommended to get since the first peer review meeting, and has now been received and distributed to the five Eastern Ontario SWP regions. There was a question of whether the data received included time series data. It does. The mapping was prepared using all the EC stations and U.S. Meteorological Service stations. It was recommended, however, that an inventory of all EC stations be included in the report as per the guidance documents.

There was some discussion about the precision of the CFS mapping, in that it appears to show precipitation changes in stream valleys. This is probably not true in reality, but rather an artefact of the elevation routine of the mapping algorithm. However, it was noted that a weak relation between precipitation and elevation has been found in Ontario.

It was also noted that the CFS mapping does not necessarily agree with individual station data. It is unclear which one may be specifically correct, or whether they are both "correct" based on the interpretation methods.

There was discussion about using "classes" to show precipitation, but isolines were thought to be a better option, and are recommended for the maps.

It was also noted that the Hydrologic Atlas of Canada (1978) has some ET maps that will serve as good comparison to the numbers calculated in this project. They were estimated based on the stations available at the time (precipitation and runoff) as well as some correction assumptions and analyses.

Mark then took over again to present the Quinte's GIS model linking the various aspects of the data together.

A table was shown (Table 8 in the report) which outlined all the data used for the model. It was noted that Environment Canada should be added as the source of the climate data, as CFS created their mapping based on this data.

There was some discussion on the term "rock" and its stated water holding capacity (WHC) of 25 mm. The term is used to represent thin soil over rock, as opposed to rock proper (which should have a WHC of zero). This terminology will be changed.

A good terminology for this type of land was suggested as "shallow soil over bedrock" though the definition for what that constitutes (relating to depth of soil) has apparently varied over the years.

There was a question about how the GIS model dealt with snow in the Thornthwaite model. The answer was 'not very well at this point'.

There was a further question about how vegetation was considered in the model. At this point, it is considered through application of water holding capacities assigned to soil types by Agriculture Canada (CANSIS). This method is in agreement with the distribution of agricultural lands within the watershed. Forested lands in the north were assigned a water holding capacity based on shallow soil conditions (MOE Hydrogeology Study of Northern Ontario).

It was also noted that a professor at Queen's (Dr. McCaughey, Geography, http://geog.queensu.ca/faculty/mccaughey.asp) has been measuring ET in the Petawawa area, and comparing it to the Penman-Monteith method of calculating ET. It was suggested we further compare that to the Thornthwaite values for the Petawawa station.

It was also noted that on a long term average basis, Thornthwaite estimates are OK, but when looking at individual months, or specific months of a drought condition, they may not be as accurate, as they look only at the mean average temperature of the month. March was used as an example. The mean temperature would probably not show any ET, though there probably are some days when it is occurring.

It was thought, specifically with ET, though perhaps with other aspects as well, that the use in the model had been pushed too far, and that there are implications of the great precision being construed as great accuracy, when that is not necessarily the case.

The discussion then turned to “infiltration/recharge” and defining that parameter based on the MOE recommendations of their 1995 Hydrogeological Investigation document. The document gives some parameters which are used to partition the portion of precipitation that is not sent back to the atmosphere through ET into two components, that which reaches the streams, and that which reaches the water table.

First, the term “infiltration” and how it was being used came into question. “Infiltration” is that water from precipitation which crosses the air/soil boundary, some going to the vegetation for ET, some going to “interflow”, some going to the water table. In the context of the report, this is the original quantity of water not lost to ET. What is being sought is the “recharge” instead, that water which reaches the water table. The definition from Freeze and Cherry (1979) was referenced. Those definitions are (page 211): “Groundwater recharge can be defined as the entry into the saturated zone of water made available at the water-table surface, together with associated flow away from the water table within the saturated zone”. Infiltration is defined as “the entry into the soil of water made available at the ground surface, together with the associated flow away from the ground surface within the unsaturated zone.” This terminology will be cleared up in the report.

The other term of the partition “runoff” was also discussed with the specific definitions as well. This term was further defined as “rapid” or “direct” runoff, which is what goes into interflow, and comes out in surface water bodies. The term “surface” runoff has been deemed a misnomer, as very rarely is there ever actually runoff visible on the surface, other than on hard surfaces. The Handbook of Hydrology (Maidment, 1993) defines infiltration as (page 5.1) “the process of water entry into a soil from rainfall, snowmelt, or irrigation.” The Handbook also states (page 8.1): “Streamflow is generated by a combination of (1) baseflow (return flow from groundwater),(2) interflow (rapid subsurface flow through pipes, macropores, and seepage zones in the soil), and (3) saturated overland flow from the surface of poorly permeable or temporarily saturated soil, or from permanently saturated zones near the channel system. Interflow and saturated overland flow together comprise quickflow, the rapid runoff during and after rainfall of “new” water.” It also goes on to state that while partitioning of baseflow and quickflow is done, isotope analysis indicates “that there is not, in practice, a clear separation between quickflow and baseflow.”

It was suggested that a list of definitions of the various terms being used would be useful to ensure they are being used correctly.

The stress condition was then discussed; the guidance recommends that if 25% or more of the recharge is used, that represents a stressed condition. The question was whether that number was indeed reasonable (especially at the average annual scale). It was suggested that the worst month (perhaps July, August, September) would be more representative.

There was then some discussion on how closely the guidance documents need to be followed, given that they are "guidance" documents. It was suggested that as long as the intent of the guidance is maintained, and the work is defensible, that variation is fine.

"Municipal Systems" were discussed, and what they are, and how they govern the water budgeting work. At this time, the Tier 1 analysis is only to be completed for areas that have a "municipal system", a drinking water system run by the municipality. Without a "municipal system" there is to be no additional work done.

The MNR is advocating for changing this, and being more inclusive, as are the SWP region staff, as they feel that the vast number of people who rely on residential wells (groundwater and surface water) should also be including in the work to protect their drinking water.

SWP Region	Population	Population Serviced by Private Wells
Cataraqui	55,000	201,000
Mississippi-Rideau	126,000	786,000
Quinte	57,000	118,000

There was a question related to the overall concept of the work, and what is to be done, and how it is to be done. There was a suggestion that part of the water budget work should include a general listing of what is planned to be done, and then that can be reviewed by the committee, with input on where to find data, how to analyze, etc., and then the numbers can be added to the work. Perhaps this should be done at the beginning of the Conceptual Report, as a preamble to the work, and then can be added as part of the Next Steps section of the report, moving towards Tier 1 work.

Bryon then took over again to discuss the Water Budget, specifically the numbers of the budget.

It was suggested that at the beginning a paragraph be added to the effect that differences seen in the data do not necessarily mean an actual difference in the long term true values of the data, but rather take into account the range over the period of record of the data, as well as the uncertainty of the measurement of the data itself. Given that in many cases, 30 years of data is the longest available, it is not enough to absolutely determine what the actual ranges may be.

From a streamflow perspective, knowing that the Moira River record at Foxboro is 90 years, a comparison of the full record with a shorter record (30 years of less) is not necessarily proper, and perhaps only those years that coexist should be directly compared.

There is also a problem with the streamflow vs. the climate data periods of record, which do not necessarily overlap either. Again, it is thought that comparison of the overlapping years of record should be considered.

Coming back to previous discussions on net groundwater flux, the data for Consecon Creek are such that there may be a groundwater contribution to this creek that does not follow the general assumption that flux equals zero over the long term.

There was a question about ground-truthing relating to the drainage area of the streams to the gauge stations. They have not been ground-truthed, but they have been recalculated using GIS, and the GIS estimates are very similar to the Hydat values. Several years prior, Quinte Conservation staff field verified the new drainage layer for the provincial GIS database. This included visiting sites to determine drainage divides. Further work could be completed to add certainty to the areas assigned to each catchment area.

There was also a question about error of the data. This is presented "crudely" in Table 11 and Table 12 of the report.

With respect to the estimation of "recharge" vs. "rapid runoff", based on the MOE 1995 Hydrogeological Investigation document, there was a question about the justification of adding the three coefficients together to get an infiltration coefficient. No one knew why the system was set up in that way. This led to additional discussion about the terminology used for partitioning precipitation that does not go to ET into water that gets to the streams vs. water that gets to the water table. Essentially it was decided (and this appears to be in concert with the definitions as stated previously) that this partitioning method actually distinguished between "recharge" which is water that gets to the water table, and "direct runoff" which is water which makes it to surface water bodies. In the report, Figure 25 ("recharge") and Figure 26 ("direct runoff").

This partitioning was compared to the work done by the USGS and NWRI on baseflow in the Great Lakes basin, and was found to be quite comparable to the Bflow method of baseflow estimation.

Another consideration came up regarding the colour scheme of the watersheds in relation to baseflow values. The baseflow value applies specifically to that point on the watershed where it was measured. It should in general not be extrapolated to other points on the watershed. Therefore, a watershed should not necessarily be coloured with a varying colour, but rather a solid colour, to indicate that the entire watershed contributes to that particular point baseflow measurement.

In Figure 27 (Spatial Dist. Of Annual GW Usage), given the data that is being shown, it was suggested that the legend units be changed to m^3/year/km^2 rather than just mm, as it explains more of what the map is representing.

It was also felt that Figure 28 (Spatial Dist of SW Usage) was probably pushing the usefulness of the GIS model, and was probably not right to include. It was suggested it would be better to look at just one month's flow (stressed month – July, August, September) than the full year as a whole. In this manner, comparing the lowest flow month with all the water takings should show the worst case scenario.

A general discussion ensued about the report, and the water budget work.

The question of whether the groundwater usage could be used for evaluation of future PTTW applications came up. It was thought that it could be used as a screening tool, and to identify whether the new application was for an area of already high or low water use. This could not, however, be discretely applied to determine the acceptability of a proposed taking.

It was noted that the climate data, as presented, was more precise than it was accurate, and that there should be consideration for notes on the drawings and tables, or consideration of changing the presentation of the data to change the implied accuracy and precision.

The question of looking at monthly comparisons was asked, and that is detailed in the Next Steps portion of the report. The plan is to look at the monthly data for the Tier 1 analyses, including setting up the GIS model on a monthly basis as well. However, consideration for the storage of water (lakes/reservoirs, snow) may mean that it would be easier to look at on a seasonal basis (summer) rather than specific months.

It was noted that perhaps not all the data available has been presented in the report for consideration. It was thought that adding this would strengthen the report. Not necessarily to include the data itself, but rather that it exists, and where it can be found, or how to get it. And then it can be gathered for inclusion as it is received. In particular, data such as low flow conditions, when wells went dry, newspaper articles of drought times, etc. For instance, the period of record for the Moira River dates back to around 1915, as does the South Nation River, the times of low flow quite possibly coincide with periods of low flow across Eastern Ontario. It may be established that a particular climate condition created the low flow condition, and then this can be used to extrapolate for other areas. In particular, possibly low snow years or low precipitation years may correspond to dry years in general.

Bryon had also done some work comparing the Moira at Foxboro gauge to other upstream gauges on the Moira River, and found that there were reasonable differences that were not necessarily expected. He expected much closer agreement between stations. However, those stations are short period of record stations, and were run by the MOE as opposed to the WSC. So perhaps they were run to different standards, or the time period was too short to establish a decent rating curve. The disagreement in the data made him wonder whether the data was useful for the project at all.

Back toward the groundwater side of the project, it was suggested that a map of those wells that are more vulnerable (sand point, shallow, etc.) may help to define the vulnerable areas.

It was also noted that there may be additional data for groundwater monitoring wells in the region from a previous MOE program, and this data could be useful.

The topic of "trends" came up, and the work done by EC (noted by Bill Hogg at the May meeting, and since found and passed out to the SWP regions) was also mentioned. It was thought that we may be able to just quote the previous works findings from a trend perspective. It was further noted that any trends found may be used to extrapolate for the future, and what future scenarios may need to be considered.

It was noted that the Peer Review Record is due June 30th, which is to include comments from the committee. It was hoped that as many comments as possible can be received prior to that date for inclusion in this version of the record.

The question was asked, who will be receiving copies of the reports at the Province. Mike Garroway, Rob Brown, and Jennifer Havelock will receive copies, at least.

The GIS approach by the Quinte was discussed, and its merits vs. a simple spreadsheet model. It was noted that in part of the Mississippi-Rideau watershed, the GIS model may not work well.

Other Business

The issue of water quality came up, and whether the water budget work was to consider it. Specifically, times of low flow, or times of high intensity rain events, may have an impact on water quality. Specifically, looking at loadings in relation to the water budget work may be important.

There was some discussion of the planning phase of the SWP work, and how the water budget work will fit into the plans. There was discussion about how to deal with the uncertainty of the data and subsequent mapping, and how to make it credible. There were concerns with what form the data and maps would take, and whether a municipality could easily transfer that information into their planning documents. And further, whether ensuring that easily transferable information was in fact one of the goals of the project, as that may dilute the information to the point of not being useful.

Future Meetings

The next meeting was originally schedule for Friday August 11th. However, given that it was vacation-time, there was a request to move it to the Thursday (August 10th). In addition, Sean W felt that given the timelines (and the need to do hydrogeology work for the conceptual budget, which will not be started until a new staff person starts in August) that a new version may not be ready for that meeting. There was also a suggestion to cancel the August meeting, and have the September meeting include presentations by both the Cataraqui and Mississippi-Rideau SWP Regions. Given that it will be the second go round, and much has been discussed on details and interpretations, it was felt two presentations in one day was achievable.

In the end, it was decided that the August meeting would be rescheduled to the 10th, and would be a general technical meeting, as opposed to a specific Region's time to present their work. The September meeting would be rescheduled to Tuesday the 12th, and

would include presentations by both the Cataraqui and Mississippi-Rideau SWP Regions. And the October meeting would be rescheduled to Tuesday October 10th as well.

The meeting was adjourned at 2:45 pm.

Chair: Rob McRae
Secretary: Sean Watt

Minutes of Meeting
Source Protection Peer Review
Quinte, Cataraqui, MVC-RVC

Held at Cataraqui Conservation Authority
September 26, 2006, 10:00 AM to 3:00 PM

Present:

Name	Agency	Name	Agency
Rob McRae	Cat. SWP Region	Jim Beal	MNR - Kingston
Titia Praamsma	Cat. SWP Region	Gary McLaren	MNR - Kemptville
Sean Watt	Cat. SWP Region	Mike Garraway	MNR - Peterborough
Mark Boone	Quinte SWP Region	Laura Landriault	MNR - Peterborough
Ferdous Ahmed	RVCA	Darin Burr	Dillon Consulting
Karyn Cornfield	M-R SWP Region	Bill Hogg	Reach Consulting
Sobhalatha Kunjikutty	M-R SWP Region	Michel Kearney	City of Ottawa
Sean Sterling	M-R SWP Region / Intera Engineering	Michel Robin	U of Ottawa
Brian Stratton	M-R SWP Region	Elyse Bustros	U of Ottawa – Grad Student
Clyde Hammond	Trent Conservation Coalition	Coralie Charland	U of Ottawa – Grad Student

Absent:

Name	Agency	Name	Agency
Keith Taylor	Quinte Conservation	Jennifer Havelock	Conservation Ontario
Anne-Marie Chapman	SN-RR SWP Region	Kent Novakowski	Queen's University
Phil Barnes	SN-RR SWP Region	Ed Watt	XCG Consulting

Brian Stratton (Mississippi-Rideau SWP) chaired the meeting, and opened by welcoming everyone.

Introductions were heard around the table.

Agenda

Copies of the agenda were circulated to those who needed them. There were no specific additions, however Brian mentioned that if there was additional time, we would make a quick presentation of the Peer Review Record to make sure the Team knew how we were tracking their comments.

Previous Minutes

A draft version of the minutes from the previous meeting (June 16, 2006) had been circulated via email by Cataraqui SWP staff (June 23, 2006). Given the time elapsed since the first circulation, there was a request to recirculate these minutes. (This was done Sept. 26 2006.)

Cataraqui Presentation of Draft Conceptual Water Budget

Sean introduced the presentation and presented a general description of the study area.

Two revised maps were distributed (Fig. 2.14 Stream Gauge Locations and Fig. 2.20 Provincial Groundwater Monitoring Network). The figures were modified to include the names of the stream gauge stations, and groundwater wells.

Titia presented the geology section including Precambrian geology, Palaeozoic geology, surficial geology and implications on water budgeting.

Titia also presented a well hydrograph from Frontenac Park that showed the well levels responding to precipitation.

It was noted that small amounts of precipitation can cause substantial increases in groundwater levels. This could have huge implications for infiltration. The water appears to infiltrate very quickly, but it appears that little storage is available, so it fills quickly, which could then result in flooding. It was noted that the low specific yield (storage) can also be estimated reasonably easily with the existing data.

It was further noted that there does not appear to be any "aquifer mining" going on near the wells (as their levels rebound each year), and therefore no general loss or gain of groundwater volume is occurring. This would appear to indicate no issue to the annual water budget. However, it was also noted that even if there was a rising or falling trend seen, there is too little data (four years maximum) to make the assumption that it is continuous, as it could just be a series of dry or wet years causing the rise or fall. There are also seasonal fluctuations, and there could be other effects in areas with more wells, and more water use.

Well hydrographs can be valuable pieces of information, particularly for the Cataraqui Region and Mississippi-Rideau Region because of the geology. Long term records may be helpful to see if there are any annual trends. Well records should be used in combination with empirical/anecdotal information to fill in data gaps.

Sean took over again and presented the data sources used for the water budget analysis.

No significant precipitation differences were found between the Canadian Forestry Service data (Dan McKenney's study) and an average of the local climate stations. The selected precipitation value also compares well to previous studies (MNR 1984 , Moin & Shaw 1985, Hydrologic Atlas of Canada 1978).

Calculated evapotranspiration (ET) values were presented using 3 methods: Derived (500mm), Turc (554 mm), & Thornthwaite (595 mm). The average of the three was selected for the water budget analysis. It was suggested that given the geology in the study area, the Thorn Waite estimate was likely to be the most appropriate method for this Region (though it was noted that the Thornthwaite method is much like assuming the watershed acts like a bucket). Again, the ET values compared well to previous studies (MNR 1984, Hydrologic Atlas of Canada 1978). A correlation analysis between soil water holding capacity and ET was suggested as potentially helpful for future

assessments in subwatersheds. It was noted that the Queen's Biological Station may have better estimates of ET. The variation in the calculated ET values may require further investigation.

Pan evaporation values were also presented. There is a discrepancy in the values presented in the report, they are presumed to equal lake evaporation. However, this is not the case. There are coefficients available from Environment Canada to estimate lake evaporation from pan evaporation data. It is thought to be somewhere around 90%. The pan evaporation data did compare well to the Hydrologic Atlas of Canada lake evaporation mapping.

The MOEE 1995 method was used to estimate infiltration, groundwater recharge, and direct runoff. A combined infiltration coefficient of 0.44 was found for the Region (Quinte was 0.46, Mississippi-Rideau was 0.47). The infiltration coefficient was seen as too high (as much as an order of magnitude too high for bedrock). The MOEE approach has several limitations, which were discussed, one of which is that it doesn't account for soil thickness. The applicability of this method was questioned as it appears that it was originally intended for lot/subdivision design and now it is being used for an entire watershed region. The original methodology needs to be found, to make sure it is being used in the proper context, and if not, a new method needs to be found, or this method needs to be adapted to fit the use. (Note: Michel Kearney has a copy of the MOEE 1989 report.)

There are 9 WSC stream flow gauges in the Region (8 active, 1 historic). The mean annual flow is 453 mm. This was thought maybe to be a little high, especially when compared to the larger, longer period of record rivers in adjacent watersheds (which are closer to 360 mm). But, the stream flow numbers appear reasonable, when compared to previous studies (Moin & Shaw 1985, Hydrologic Atlas of Canada 1978, MNR 1985). There are questionable estimates of flow for urban streams (generated by the stage discharge curves), though removing these stations had little effect (3 mm) on the overall average. Low flows were typically observed in late summer/early fall and the stress times will presumably be the same or similar.

The seven PGMN wells were reviewed, and showed a quick response to rain and snowmelt. Most show an annual recovery, which points to a steady state with respect to storage. The wells were located specifically to show general background conditions of the aquifers. Due to this, it will not represent location specific problems with rising or declining water levels.

The modified map of PGMN wells (Figure 2.20) was also presented. It showed the well names and the associated precipitation stations used for comparison.

Sean then presented a summary of the water use data. There are approximately 250 Permits to Take Water (PTTW) in the Region allocated for a variety of water uses. About 2/3 of the withdrawal volume is allocated to groundwater and 1/3 to surface water.

Maps of the PTTW locations, GW vs. SW, sector of use, and volume of withdrawal, were shown. The legend on the PTTW map is shown as "m3 per day", however the numbers relate to "litres per day". This has been changed, and the total range should now be from 0 to 988,482 m^3/day.

Ducks Unlimited projects have been removed from water use estimates as they are an intermittent or one-time use, not a continuous, permanent use. However, these uses are still shown in the three PTTW maps, and most of the largest uses on Figure 2.36c are DU permits, and therefore the map may be misleading.

Private well consumption was estimated using 200 Lpcd (this is the same value used for Mississippi-Rideau Region as recommended by the City of Ottawa).

Agriculture water use estimates were presented using data from deLoe's study (2002). More detailed breakdowns of this data may be available for the subwatershed work.

Industrial and commercial water uses with their own wells are not included specifically in the water budget as there is no data available to estimate their water use. However, those uses that are connected to municipal systems are included in the estimates for those systems.

It was suggested that some of the maps could be condensed (to letter format), combined together, or even eliminated, as they don't necessarily benefit the report.

The value of producing a "consumptive use" map was mentioned.

Comment [SW1]: Consumptive or actual?

Comment [KC2]: Clyde Hammond suggested producing this (e.g. a "consumptive use" map). If you'd like more clarification, I suggest sending him an email. The discussion about "actual vs. allocated" was also by him but came about later so I've broken it out as a new paragraph.

Comment [SW3]: Actual?

The actual uses versus allocated (permitted) should be accounted for or acknowledged in the report as not all permitted takings are used, and in many cases the allocated use is not fully used in average conditions. It was mentioned that there are reports available for determining "allocated" versus "consumed" amounts.

The Cataraqui water budget used permitted volumes for water use calculations. These numbers will be conservative when evaluating stresses in the Region in the conceptual budget, though are likely to be closer to the reality during a drought condition. Mike Garraway commented that these numbers are appropriate at the conceptual stage. MNR will be providing a tool in the future for estimating consumptive demand in the Tier 1 water budget. At this stage, it was felt that it was more important to understand permit locations and types of users, etc. as opposed to the exact volume of withdrawal. It was suggested that in some cases, the actual water use may be as little as 10% of the allocated use.

Sean presented ranges for data error:

- Precipitation – 10%
- Stream flow – 5%
- ET error – should be about 100mm (rather than 125 mm as noted in the report)

- Derived ET error = square root of (square of precipitation error + square of stream flow error), $Error_{ET} = \sqrt{Error_P^2 + Error_Q^2}$

- Other data – largest error probably is from PTTW data
- Thornthwaite error is unknown.
- Soil water holding capacity error is unknown.

It was mentioned that the annual error on precipitation might be less than 10%. It was recommended to check Dan McKenney's study for standard error of estimates.

It was recommended to use the word "uncertainty" instead of "error".

The importance of estimating error or showing uncertainty in the results was discussed. Keeping track of cumulative error is important to gauge reliability of the calculations. Levels of uncertainty are important to decision makers. Uncertainty can help us gauge risk and measure our confidence in assessing situations such as water supply versus demand.

Sean continued with data correlation results. There was minimal correlation found. However, it was suggested that more correlation may actually be present, and a modified method to find it should be used. In particular, regression relationships between each parameter. It was also requested that the correlation exercise include the ET data.

It was also noted that Mark Peacock (Ganaraska CA) has an extensive groundwater discharge monitoring program, and has looked at some relations between streamflow, baseflow, and groundwater discharge.

Water budgeting results were then presented.

The groundwater inputs and outputs are largely unknown and the only element of the water budget that was not quantified. It was assumed at the beginning of the report that "groundwater in" is equal to "groundwater out" for a simple water budget such as that required for the Conceptual model, covering average annual conditions, and a watershed size scale. The merit in making such an assumption was questioned given the possible large areas of recharge in the Region. For known recharge areas such as bedrock outcrops, estimates of horizontal fluxes would be valuable. Lateral fluxes to and from neighboring regions should be estimated as well.

Cataraqui is predominantly a surface water driven system with small amounts of infiltration, therefore fluxes are likely to be a relatively small amount. It was finally suggested that at this stage it is probably more important to account for the groundwater movement more qualitatively rather than quantitatively and to have a good understanding of the surface water/ground water interactions. The interaction between groundwater (recharge and discharge) with lakes, swamps and wetlands should be commented on. There was a question about whether the Lake and wetlands may also feed deep groundwater. The significance of groundwater storage should also be discussed. Small

changes in ground water levels can be highly influential on groundwater storage. Groundwater volumes are much greater than what is seen in surface water.

Discrepancies in the water budget were presented:

Water Budget IN (953 mm) and Water Budget OUT (1,089mm)

The cumulative error was noted.

It was suggested that as the infiltration estimates were thought to be too high, this could also apply to the SWHC estimates. If the SWHC estimates are too high, this would further mean that the ET estimates are too high, which could account for some of the discrepancy between the "water in" and "water out".

It was suggested that showing the surface water and ground water separately on the water budget schematic (Figure 4.1) would give a better representation of their interaction.

Finally, the next steps for Cataraqui in the water budget process were presented. The proposed approach for Tier 1 is to do monthly water budgeting and stress calculations on a watershed/subwatershed based approach.

Areas of concern were noted including areas that are dense with private wells (Figure 6.1, e.g. Sydenham & Lansdowne).

Sean presented a list of things already noted to be fixed for the final report. They include:

- Modification to the Dingman ref.
- Statistical modifications (time series analysis/correlations)
- Snow data – add source description
- ET estimates – add a sentence that these are old methods and newer are available
- Include ET/Evap. comparison maps
- Pan Evap./Lake Evap. – add coefficient
- Soil – make reference to County maps
- Infiltration estimation method – best option? – modifications or different method.
- GW Levels – include storage estimation
- Geology section – include citations and possibly cut large chunks
- Include Well water domestic use estimate source
- WB Inputs/Outputs figure – Figure 4.1, make arrow size relational to volume, divide into 2 connected pieces for SW/GW interactions

Sean inquired whether or not another draft report needed to be sent out. Mike Garraway stated that all the elements were mainly presented in this version of the report. It was not necessary to quantify all water budget elements (e.g. groundwater) although points made regarding the groundwater fluxes were valid. He suggested that finalizing the report along with specific responses to the screening questions and interim criteria provided by

the Province in the guidance modules would be worthwhile. (Note: He also later suggested revisiting the groundwater recharge map.)

The suggested next step for the report was to prepare a 3rd (final?) draft to be sent to the peer review team for review, with a list of changes that note the specifics of where the change was made. This will enable review of specific sections that have been questioned. A meeting to then finalize conceptual budgets from all three Regions was suggested.

It was recommended that prior to issuing the reports to the public, a disclaimer should be added stating that these are regional annual estimates and that stress may change at a local scale or a shorter temporal scale. This is to make sure that readers do not jump to the conclusion that there are no problems at all, as this is a very broad scaled report. Future work will be better suited to reveal specific problems.

One reviewer asked whether there is any additional hydrogeological data. Titia stated that they are working on compiling and adding additional information and it will likely be included in the Watershed Characterization document

Adjourn for Lunch

Mississippi-Rideau Presentation of Draft Conceptual Water Budget

Karyn started the Mississippi-Rideau presentation with an outline of the presentation and the general changes for the second draft of the report from the first draft. A listing of corrections to some errors in the report that had found since circulating it as also shown. The corrections include the following:

1. Page 12, Evaporation section: 2nd line
   - should be 1974 instead of 1947
2. Page 48, Section 5.3.3.2, bottom paragraph, second line
   - Table 5-3 should read Table 5-4
3. Page 54, Section 5.3.6, second line
   - Table 5-5 should read Table 5.6
4. Page 58, Section 6.1
   - first paragraph - "upstream of the Merrickville gauge" should read "downstream of the Smiths Falls gauge"
   - Table 6-1 – "Downstream Flow Gauge" should be "Nearest Flow Gauge"
5. Figures 3.10 through 3.13 (the corrected graphs were shown as slides)
   - Graphs should be based on total drainage area and total flows to the gauge (not on local drainage areas and local flows)

Sobha then took over for an update to the climate data/analyses. It was noted that the wording referring to maximum and minimum temperatures needs to be changed. They should be referred to as winter and summer monthly means rather than minimum and maximum temperatures. It was also noted that the lake evaporation estimates as presented on the slide appear to be the monthly averages, rather than the annual averages as stated. The report appears to note them correctly as monthly data. It was noted that

there appears to be something off with the data, but it was not clear whether that was interpretation or extraction from the database.

Karyn then continued with the general water budget details. It was noted that the MOEE 1995 approach to estimating infiltration/recharge is best suited to unconfined aquifers, and there are some aquifers in the area (between paleozoic formations) that exhibit qualities of confined or semi-confined aquifers. It was also noted that the deeper groundwater in these confined formations may come from lateral flow, rather than infiltration recharge from the surface. The upper layers receive the infiltration from precipitation in the area, while the deeper layers receive water that has infiltrated in another area, and has flowed laterally from there. This was mentioned during the Cataraqui presentation, that water may in fact be entering these deeper layers at the precambrian/paleozoic interface, where the formations are exposed at the surface.

The method to estimate the infiltration was customized for the watershed including modified slope categories and more representative land cover and soil permeabilities (in particular, rock). Given the large area of rock outcrop in the watershed, it was felt that it was necessary to have rock as a variable so infiltration factors for Palaeozoic and Precambrian bedrock were assigned. However, it was also noted that the factors for rock appeared to be too high. It was hard to tell whether the estimation method worked for the whole watershed, it appeared that there were some problems with the sand and clay areas, as the combined estimates (recharge/runoff) were greater than the total amount of available water.

The upper right (north-east) corner of Figure A44 (GW recharge) is a sand area, which is calculated to have high recharge. However, given that it also has a low topography, it would be expected to instead be a discharge area.

Another problem with this method is that it gives no distinction between thin and thick overburden. It is generally felt that it works well in some areas, and not in others. The problem is knowing which areas it works well for. The answer may be to use multiple methods, and use all the methods to come up with a consensus answer.

Figure A45 (runoff) has the same problems as Figure A44 relating to overestimation of the runoff. [It was later confirmed that the colour distribution on the mapping was the issue. This has since been corrected. An email explaining this was sent to the peer review team on October 17, 2006.]

The MNR has since suggested that it may be premature to include the resultant recharge (infiltration) and runoff maps in the report.

Table 5-6 compares "surplus water" (P-ET) to "calculated direct runoff". There was considerable discussion around this topic. The thought is that "surplus water" can be compared to flow at the gauge as an indication of differences in major water budget components, but that a comparison to the calculated "direct runoff" was not correct. The "direct runoff" is that volume of water that moves from infiltration to streamflow

reasonably quickly, rather than that water that may move to the water table, and then to streamflow. It is not easily quantifiable, and was calculated by subtracting the infiltration values calculated using the MOEE 1995 method from the surplus. The solution was to remove the columns that put a percentage on their comparison values and just compare surplus (P-ET) to gauge runoff..

Table 5-4, which summarizes calculated and derived ET values, was found to be acceptable. ET was calculated using data from the Ottawa Airport climate station (1974-2003) and Thornthwaite & Mather (from Environment Canada) for 14 soil water holding capacity values found in the Region. ET was derived by calculating "Precipitation - Gauge Runoff". It was later discussed by the Quinte and Cataraqui teams that ET should be calculated using the Forestry Canada data for consistency purposes and compared to the calculations using the climate station data.

There was also thought that there should be a distinction between deep groundwater and shallow groundwater that discharges to streams. The measurement at the stream gauge is the combination of rapid runoff, shallow and deep groundwater discharge.

Further, the definition of "surplus water" is that water which is available for recharge or runoff to streams, once evapotranspiration was considered (P-ET = surplus water).

Again it was noted that baseflow is not necessarily equivalent to groundwater discharge, especially in Eastern Ontario, where there are many reservoirs, as well as bedrock close to the surface. The geology of the area means there are minimal groundwater discharge points, and the reservoirs create additional storage water stored in their banks through backwater effects, and can therefore throw off baseflow interpolation techniques.

The gauge measurement is a specific measurement, and is therefore felt to be a more accurate number to use than the estimated ET numbers. The M-R report states a 20% error to flow measurements, but that is probably too high, and closer to 5% instead.

The precipitation (P) is divided into 4 pieces, some goes to evapotranspiration (ET), some to (Q), and some to recharge (both shallow GW, and deeper GW, but most to shallow).

The best way to separate out baseflow is to measure it directly, and account for any storage aspects in the system. By quantifying the storage and structure discharge data, the rest can be assumed to be GW discharge. For this report, baseflow was estimated by using the USGS Base Flow Index (BFI) method discussed below.

There appears to be a discrepancy between the BFI numbers of the M-R and the Quinte. This could be due to the way the numbers were estimated, as the M-R used flow data from between gauge stations (removing upstream data) and the Quinte used everything upstream from the gauge station.

There appears to be a need to account for GW, which contradicts our general consensus that it can be deemed negligible for the conceptual model. The equation P-Q=ET ignores

the deeper GW which may be present in the area, and may come from outside the surface watershed. All three SWP regions are using a partitioning method to divide Q into direct runoff and recharge, which does not agree with the possibility that water may be coming from deeper GW.

It is possible that we can use vertical gradient estimations to quantify deep GW recharge.

Another comparison relating to baseflow is comparing the mean annual low flow to the baseflow values. This will put the baseflow values in perspective to the flow records.

Next we talked about water use. The surface water use was summarized per plant (not including Ottawa River withdrawals).

For GW withdrawals - the recommendation is to look at aquifer capacity and demand.

Table 6-1 shows the maximum monthly water withdrawals by the municipal drinking water systems in comparison to lowest monthly flows at the nearest gauge. Percent demand was calculated for each system. No water supply stresses were found using this data. This looked at the actual monthly use data, rather than the maximum allocated by the permit. It was suggested that the daily data might be useful, but it is not sure whether daily data has been provided. This data would be used for Tier 1 calculations.

It was also suggested that MNR has "consumptive" ratios for water use of different industries.

Table 6-2 includes data only from inland water plants (not those taking from the Ottawa River). The total withdrawal is less than 1% of the surplus water (P – ET)

It was again suggested that a cautionary note needs to be included in these reports stressing that the conclusions only apply on a regional, average annual scale.

It was suggested that the surface water and groundwater percent demand estimates be separated into two distinct pieces.

Tier 1 will have a different temporal scale, and could use a predictive model, or could use the data itself to showcase specific issues.

The conditions supported by Tier 1 are included in the Guidance Document, but essentially continue with the Conceptual scaling of average conditions, but on a monthly temporal scale, and a subwatershed spatial scale.

The discussion of the specifics of the report concluded, things turned to what was needed to wrap up the Conceptual Report. It was agreed that both reports (Cataraqui and Mississippi-Rideau) were close to being finished, with some additional clarification issues, and some larger methodology issues to be cleared up. It was agreed that the best

way to wrap up the issues was to prepare a third (final?) draft to be reviewed, which would cover the changes coming out of this review, and received comments. Accompanying this would be a listing of the changes with reference to their location, for ease of review.

MNR thought the front end and back end of the reports should look similar, and specifically that the wrap-up for the M-R report was a good model.

It was agreed that 2 weeks (to October 10th) would be sufficient to provide feedback to the 2 SWP regions on the submitted reports.

There was talk of some missing maps, specifically a map specifically locating the municipal systems, and a map locating "points of interest" from a water budget perspective.

Peer Review Record Presentation

Sean gave a quick overview of the Peer Review Record, what it looks like, and what information it holds. This was primarily to ensure the team that we are keeping track of their comments, and are relying on them to ensure we make the necessary changes to our document.

Quinte Presentation of Tier 1 Water Budget Considerations

Mark gave a quick presentation of some of the issues that the Quinte has already come up against with respect to the Tier 1 water budget.

They are continuing to work with their 1 km x 1 km gridded GIS model, and are having problems with specific components such as snow storage and melt. This is partially due to the temporal scales of the data. The CFS temperature data is in a monthly form, but snow melt models generally require daily temperature data, and there has been no method found as of yet to integrate the two together.

It was felt that there may be a reasonable work around that will not introduce too much error into the estimates. Possibly some specific degree day data is available from heating supply companies, or another source.

Some sort of relationship between melt and/or flow and/or storage could be found to estimate the snow parameters.

It was pointed out that the GIS programs being used may be able to make a rough estimate of GW flux using Darcy's equation.

It was suggested that the relationship between precipitation and GW well water level and storage could be found by graphing precipitation vs. rise in water level, and the slope would equal the aquifer yield.

It was also pointed out that the Tier 1 work will continue to look at average conditions, but on a monthly scale.

Other Business

There was no other business to discuss.

Future Meetings

The next meeting is scheduled for Thursday October 28th. However, there was discussion about whether there was enough to present at that meeting. Both Cataraqui and Mississippi-Rideau felt there was not enough time to get comments on the 2nd draft, make the necessary changes, and redistribute 2 weeks prior to the next meeting. Though Quinte felt that they may be in a position to present their Tier 1 work so far. This will be discussed further, and a decision will be forwarded to the Peer Review team.

The meeting was adjourned at 3:05 pm.

Chair: Brian Stratton
Secretary: Karyn Cornfield and Sean Watt

Note: The presentations from the meeting will be posted on the ftp site.

Minutes of Meeting
Source Protection Peer Review
Quinte, Cataraqui, MVC-RVC

Held at Cataraqui Conservation Authority
November 3, 2006, 10:00 AM to 3:00 PM

Present:

Name	Agency	Name	Agency
Rob McRae	Cat. SWP Region	Gary McLaren	MNR - Kemptville
Titia Praamsma	Cat. SWP Region	Laura Landriault	MNR - Peterborough
Sean Watt	Cat. SWP Region	Darin Burr	Dillon Consulting
Mark Boone	Quinte SWP Region	Bill Hogg	Reach Consulting
Bryon Keene	Quinte SWP Region	Michel Kearney	City of Ottawa
Sobhalatha Kunjikutty	M-R SWP Region	Michel Robin	U of Ottawa
Sean Sterling	M-R SWP Region / Intera Engineering	Ed Watt	XCG Consulting

Absent:

Name	Agency	Name	Agency
Keith Taylor	Quinte Conservation	Jennifer Havelock	Conservation Ontario
Clyde Hammond	Trent Conservation Coalition	Kent Novakowski	Queen's University
Anne-Marie Chapman	SN-RR SWP Region	Jim Beal	MNR - Kingston
Phil Barnes	SN-RR SWP Region	Mike Garraway	MNR - Peterborough
Karyn Cornfield	M-R SWP Region		
Brian Stratton	M-R SWP Region		
Ferdous Ahmed	RVCA		

Rob McRae (Cataraqui SWP) chaired the meeting, and opened by welcoming everyone.

Introductions were heard around the table.

Agenda
Copies of the agenda were circulated to those who needed them. There were no specific additions.

Previous Minutes
A draft version of the minutes from the 5th meeting (June 16, 2006) had been re-circulated via email by Cataraqui SWP staff (Sept 26, 2006). There were no changes suggested.

The minutes of the 6th meeting (Sept 26, 2006) were also circulated via email by Cataraqui SWP staff (Oct. 31, 2006). There was a suggestion for clarification with respect to the note on degree-days, and have they may be obtained.

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Quinte Presentation of Draft Conceptual Water Budget

Bryon introduced the presentation and presented a general description of the changes to the "final draft" of the report. In particular, the analysis of data in two strict period of record, 1931-2000 and 1971-2000.

There were general edits of the report, as well as the removal of the surface water stress map, which was recommended at the previous meeting.

The stream gauge data (Table 11) appeared to compare closer with a change in drainage area that reflected the use of the MNR DEM, rather than WSC Hydat number.

The mean annual flow values are within 2% of each other, which is better then the uncertainty of the individual measurements

It was also noted that four significant figures with respect to the drainage area is not justifiable. Further, between the 1:50000 scale mapping used by the WSC to estimate drainage area, and the 10 m DEM used in the GIS program, the actual drainage area may still not be calculated. A field survey is the best method to establish the actual drainage area, especially if there are flatter areas which are not easily distinguished with the 1:50000 mapping or 10 m DEM.

It was also noted that the uncertainty of the drainage area, in such large watersheds as in the Quinte region, is expected to be reasonably small compared to the uncertainty of the other data sets.

The Napanee River station shown in the table is a "newer" station. There was an older station a short distance downstream which has almost the same drainage area. The suggestion was that the two stations could be used for one longer record. While this is true, there is also a substantial (~15 yr) gap in the older station's record, and it was decided not to create a long record with the two shorter records.

The question was asked, "Did you expect to see the mean annual flows so close?" It was not necessarily expected that they would be as close as they were, as there are areas of high ET that would therefore reduce the amount of water available for stream flow. It was then noted that in this area, much of the annual flow volume comes form spring freshet, when the ET is minimal, and this could account for the equalization of mean annual flow across the watershed.

It was also noted that in general, larger drainage areas have more averaging effects on conditions such as soil type and geology, and therefore compare closer together. Small watershed can be dominated by particular features which have a large influence on flow characteristics.

Table 12 shows the comparison of mean annual flow to mean precipitation over two time periods, 1931-2000 and 1971-2000. This comparison appears to show that both mean annual precipitation and runoff have increased in the later period.

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Table 13 shows comparisons between precipitation, runoff, and evapotranspiration across the three large watersheds in the Quinte Region, as well as the smaller Consecon Creek watershed in Prince Edward County. The values compare well, with the Consecon Creek calculated ET (Thornthwaite) being considerably higher than the other watersheds. This is thought to be due to a high Soil Water Holding Capacity (SWHC) estimate for the watershed. There is a high wetland percentage in the watershed.

It was suggested that this table include footnotes related to the two ET numbers, noting the method of calculation.

The question was asked, "Was the SWHC tweaked to make the ET estimates closer together?" It was noted that the Thornthwaite method is not accurate enough to predict that closeness in ET values. The SWHC estimates were not changed to better fit the numbers, but it was suggested that perhaps the averaging effects across the larger watersheds is also the cause of the estimates being very close together.

It was suggested that perhaps this would then lead to a problem with looking at site specific data with the GIS model. This then lead to a short discussion on whether there was a better method for estimating ET, something more up to date than the work of Thornthwaite in the 1950s. It was then further noted that most of the up to date methods require additional climate data that is generally not available. It was also noted that for the Conceptual model, the Thornthwaite method appears adequate, but that the Tier 1 or further work may require better ET estimation techniques.

Mark then took over to discuss the groundwater aspects of the Conceptual report. Table 14 shows the gauged runoff, with the USGS (2005) estimated BFI, the resulting baseflow values, and the calculated recharge using the MOE (1995) method. The USGS provides two BFIs; one is the G index which represents the ground water component of base flow and the other is the G-SW index which represents both ground and surface water baseflow. The index used in this comparison is the G index. Again, the watersheds appear very similar with the exception of the Consecon Creek watershed, which has a higher BFI, but a lower estimated recharge. The wetland area of the watershed, and the fact that those may not have been taken into account by the USGS method was suggested as a reason for the difference. And, the previous mention of the higher SWHC estimate, meaning higher actual ET estimate, and lower runoff estimate, may also play a part in the difference. It was also suggested that Quinte contact the USGS to discuss the work. Quinte is developing a groundwater hydrograph method, adding that they didn't know how much faith that can be put into the base flow method.

It was also noted that just because the average conditions in the watershed are correct, that specific places within the watershed displays the same criteria.

It was suggested that discussing details at great length, such as extrapolating for each small watershed, does not help us complete the conceptual water budget. It was agreed that the completed work is adequate for a conceptual water budget on an annual time scale.

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Bryon took over again to talk about Table 15, and the uncertainty of the data sets. The uncertainty of the precipitation and runoff measurements was estimated based on the literature, as 10% and 5%, respectively. The derived ET uncertainty (*Uncty*) is then calculated from those values.

$$Uncty_{ET} = \sqrt{Uncty_P^2 + Uncty_Q^2}$$

It was noted that a paragraph explanation of the uncertainties, how they were estimated, and what the causes were, should be included in the report. In this case, the uncertainty of the precipitation values is due in part to location, and specific gauge measurement.

It was suggested that a note on interpretation of the uncertainty also be included. This would explain that the uncertainty means that the true value over all time could be higher or lower than the measured value by as much as the uncertainty. It was suggested that the paragraph could point towards a specific example placed in an appendix.

It was also suggested that the table as presented be changed such that the precipitation, runoff, and ET uncertainties not traverse both rows and columns, but just one or the other, for ease of understanding. For examples,

Watershed	Parameter	Mean Annual (mm)	Uncertainty (%)	Uncertainty (mm)
Moira	Precipitation	905	10	90.5
	Runoff	393	5	19.6
	Evapotranspiration			93

It was also noted that the percentage uncertainty noted for runoff should be 5, not 51.

Next up was a discussion of the stress estimates of the watershed. The Quinte watershed shows minimal stress, based on the annual average condition, and that therefore leads to a simple Tier 1 second phase.

It was noted that in Michel Robin's graduate class which discussed the Guidance modules, they have compared water use to water supply, and there appears to be no consideration for storage in the guidance modules. His concern is that storage is very important to the "small bank accounts" of water storage across much of Eastern Ontario. There is little capacity to absorb larger uses in that minimal storage. His suggestion is that a paragraph should be included on the storage aspects to this effect, and that the area is vulnerable from that perspective.

The team agreed that Tier 1 work should include consideration of storage aspects.

It was also noted that on page 59 of the report, where stress is discussed, there should be a clarification that there is no stress according to the MOE guidance.

It was also noted that the long term average condition is a poor indicator of stress.

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This essentially wrapped up the Conceptual Water Budget report discussions.

Bryon mentioned at the beginning that he envisioned this document as a "final draft", and was planning to only do minimal edits to it for final submission to the province.

There was a question about who wrote the guidance, and who reviewed it. The team has been critical about some specific portions of the guidance, particularly how it fits (or rather how it does not fit) with the actualities of conditions in Eastern Ontario.

The report was accepted by the committee and the final report may be submitted to the province with the edits as suggested.

Quinte Presentation of Tier 1 Water Budget Considerations

Mark started the presentation with an outline of the Tier 1 work, considering the water budget on a monthly basis and consideration to storage, and specifically snow storage and snow melt.

Bryon presented his method for accounting for the fact that much of the precipitation that falls during the winter months accumulates as storage on the ground surface, and therefore does not contribute to streamflow, or groundwater recharge.

He has used the EC climate station data as provided from the ET calculations to create a new parameter, which he calls "liquid available water" (LAW). The daily measurements of rainfall and snow melt are added together to form monthly values of "liquid available water". This then gives a volume of water that is useable for each month, which can then be compared to use data to estimate the stress.

The reasoning was that the precipitation and temperature data sets from the Great Lakes Forest Research Centre was good data, and had been used and accepted by the Peer Review Team. But, the snowmelt aspects needed could not be done on a monthly basis with this data, as it needs to be calculated on a daily basis. It was felt that using the EC rain and melt data would be the next best option to keep the data sets comparable.

The peer review team was amenable to the use of this method (at least to start, with dependence on the rest of the process).

At this point there was considerable discussion about what months to use. The Quinte has started by using the average conditions of the month. That is, using the average of the monthly values from the period of record. There was feeling that this may not be the best method, as it does not take into account specific problem years, and the averaging will blur the numbers such that no stress is expected to be found.

It was pointed out that the "Guidance" recommends average conditions. It was also pointed out that the "Guidance" is only that, and that if it is felt that different conditions should be considered for the good of the watershed, that is acceptable.

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It was suggested that specific dry years could be considered, in addition to the "average of averages" condition.

Also, it was noted that the memory of the systems appear to be less than 1 year. Michel Robin noted that in some of his research (in Eastern Ontario), they had used a 2 year time span, and saw that the watershed returned to steady state in that time.

Using a 2 year time span will also take into account the issue with water year vs. calendar year, where some precipitation that falls during a calendar year is not available to the watershed until the following calendar year.

Bryon passed out a graph of monthly LAW at the Belleville station (Belleville Station Snow Storage Effects), as well as tables of monthly ratios of precipitation and LAW at four Eastern Ontario climate stations.

It was suggested that the graph also include snow storage and depletion lines to complete the comparison of available water.

An average P to LAW ratio from the climate stations was thought to be reasonable for large scale (whole watershed) use, but would probably not be acceptable for smaller areas.

The question was also asked, would it be better to calculate the melt for each grid square.

Adjourn for Lunch

Bryon continued with his presentation of the Tier 1 Quinte work, and showed a comparison graph of monthly LAW and runoff (Belleville Station – Surplus vs. Runoff (Ave)). This graph shows a lag between the two, where the runoff peak appears after the LAW peak. However, this graph appears to show a lag of one month (which his not true), presumable because the data is grouped by month. If weekly data were used, the graph would show a lag much closer to reality. It was suggested that the cross-correlation of LAW to flow be examined (this can be done in Systat) which will give an idea of the true lag. And in this case, using actual weekly data rather than average weekly data will work best.

It was also noted that the lines connecting the monthly values gave the impression that the data was of a continuous nature, rather than individual monthly average points. The line should instead be something other than solid, or the graph should be a bar graph. In addition, the blue line is generally used to denote the "true" variable.

There is another consideration for the snowmelt, which is that melt on day J is mostly refrozen on day K, rather than being released from storage to move to surface or groundwater. It is noted that the proper consideration of snowmelt is a very complex part of the Hydrologic cycle. It was noted that during cold weather, all precipitation enters

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into surface storage. There is possibly some infiltration in the winter, but mostly there is none as the ground is frozen. It was also noted that Donald Gray (University of Saskatchewan) was the reigning expert on infiltration on frozen ground (he passed away in 2005).

Mark then took over to present the groundwater aspects of the Tier 1 work so far.

The Quinte is developing their GIS model with the Darcy flux routine in ArcView, to calculate the flux of groundwater between cells or pixels. The data needed for this process are the geology of the aquifers, thickness of the aquifers, hydraulic conductivity and gradient. The layer information was estimated using Ontario Water Well Records, and the Quinte Regional Groundwater Study (2004).

Through use of the GIS model, watershed catchment areas, and the water table elevation map the lateral movement of ground water into and out of the individual watersheds can be determined. A map of the Conseocn watershed was presented to illustrate areas of ground water flow in and out of this watershed with flow as calculated by the Darcy equation. Consideration for significant figures was also mentioned again with respect to the recharge tables, and the sample map or a subwatershed and the GW movement direction and flow.

The importance of the water table map as taken from the Quinte Regional Ground Water Study was discussed. It was indicated that this map gave consideration to surface water levels, however for comparison it was suggested that a map of just using the ground water levels from well records be prepared. The water level data from PGMN monitor wells could also be used to assist in preparation of this map.

A map of the location of PGMN well locations in the Quinte watershed was presented including distribution of these wells in respect to bedrock and overburden geology. Ground water hydrographs from two of these PGMN wells were presented; one from the unconfined limestone aquifer and the other in the overburden. Based on these hydrographs a method for calculating ground water recharge was presented using the change in ground water level on a monthly basis and an assumed porosity for the aquifer. It was felt that the porosity was maybe too high for bedrock. The specific yield was thought to be a better estimate of the volume of water available in the bedrock. This can be estimated with pumping test and observation well data. The porosity estimate is an important component to this work, but it could range anywhere from 1% to 20%. Looking at daily event data could help estimate a better porosity number. If you ignored porosity, you would get a general temporal relation of the water movement over the course of the year.

It was noted that the Hydrographs for the GW wells should probably not use precipitation, but possibly the LAW parameter, or use both LAW and storage.

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It was also suggested that perhaps monthly is not the right temporal parameter for breakdown, but possibly something such as “snow on ground and temperature less than zero”, “wet season (soil water deficit is low)” and “dry season”.

There was also a suggestion that perhaps the type of rain event may also influence the GW recharge/infiltration/volume values. By looking at the response of water levels for different types, durations, and time of day rains, there could be a greater variability in the relationships.

It was noted that the tables of recharge for Well 132 showed that recharge was zero for October, and that this is probably wrong. It was felt that this was due to the fact that the data was grouped into monthly pieces, and that averages the data such that the recharge in October is not seen. Perhaps a more detailed temporal scale is needed.

It was also felt that a histogram was a better representation of the data than the line graph, as was noted previously, the line graph implies continuous data, when it is really just a monthly average. Perhaps a dotted line is a better representation.

Mark provided an overview of the math behind determining recharge from groundwater levels using the water table fluctuation method and indicated its relevance to overburden aquifers but of limited applicability to fractured bedrock. It was postulated that specific yield could be inferred from hydrographs or could be estimated in the fractured bedrock environment.

Finally, there was discussion about the Water Quantity Risk Assessment portion of the Tier 1 work.

It was felt that using the specific yield to identify stress may be too high. It was felt that when the stress was too low, that was the definition of a stress level.

From a surface water perspective, it was felt that the median of the month was a poor statistic to use to represent a stress. It was noted that the MOE uses the $7Q_{20}$ statistic for many Permits to take Water or Certificates of Approval.

This wrapped up the Quinte’s presentation of what they have been working on for the Tier 1 work, and what questions they were looking for the Peer Review Team to help with in these beginning stages.

Mississippi-Rideau Progress

Sean Sterling gave an overview of the Mississippi-Rideau water budget progress since the last meeting.

The recharge/runoff maps presented at the last meeting had some colour errors, and are being redone with new ET data, and bedrock infiltration factors. However, the maps themselves map not be part of the final version of the report, as per the suggestion or the Peer Review Team.

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The new ET calculations were using the Great Lakes Forestry Research Centre data.

There was also a question about slope data for infiltration, whether the bins were the same across the 3 SWP regions, and how sensitive the data were to modifications of the bin boundaries. Also, whether a seamless map across the 3 regions could be created with only 3 slope bins. It was suggested that the 3 SWP regions agree on a specific set of bins to use.

Cataraqui Progress

Sean noted that the Cataraqui was in a similar place to the M-R, working on changes from the last Peer Review meeting. In addition, he had compiled a list of comments, and accompanying ways to achieve the recommended changes. This was to help identify exactly what needed to be done, and possibly to spur other team members to add comments.

Sean and Titia also noted that they had been given a presentation the previous day by Dr. Kent Novakowski and one of his students, Tom Gleeson. The presentation was about their work in the Tay River watershed. They found some interesting things in the fractured Gneissic bedrock in the area. The most pertinent to the water budget at this point was that the recharge into the bedrock from precipitation was on the order of 2%, and that the surface water and groundwater were 2 entirely separate systems, not linked at all.

Other Business

There was no other business to discuss.

Future Meetings

The next meeting has not yet been scheduled. However, it was suggested that December was not a good time for a meeting, from a scheduling perspective. It was also suggested that perhaps "final" drafts of the Cataraqui and Mississippi-Rideau reports could be made available in mid-December, with a meeting in early January. This was to be discussed further by the SWP staff, with the choices sent out to the Peer Review team via email.

The meeting was adjourned at 2:50 pm.

Chair: Rob McRae
Secretary: Sean Watt

Note: The presentation from the meeting will be posted on the ftp site.

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Appendix “B”

Peer Review Log

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Peer Review Log

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Bryon Keene indicated that historic documents e.g. Moira Report, could be used, but bill Hogg mentioned that this may not help answer the questions on what and where are the stressors over the long term.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**
10-Mar-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Since evapotranspiration was not mentioned Bill Hogg mentioned that there should be some calculations in the table in the table to confirm the estimated values.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Bill Hogg suggested that the GIS technicians from the three regions be consistent in mapping	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
10-Mar-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Karyn Cornfield indicated that Agriculture Canada has data available on water holding capacity of soils.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Ali Sajid from TCC stated that their Peer Review Tem encouraged TCC to use Penman formula as Thornthwaite formula. Bill Hogg highly recommended using the Thornthwaite formula as the data required is readily available, which is not the case for Penman.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
10-Mar-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Ed Watt suggested adding isolines to the precipitation maps (800, 900, and at 1000 mm/yr) as Quebec has done.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Bill Hogg and Michael Garraway indicated that the temperature maps should be displayed using annual extreme temperature even if the federal maps use annual mean.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
10-Mar-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Ed Watt commented that using the annual means as Environment Canada has done for over 25 years may be a good start and may be good enough for the effort. He indicated that new climate stations may not give better data than old stations, therefore all stations and their data should be considered.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Bill Hogg suggested the use of existing climate station data instead of setting up more precipitation gauges.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
10-Mar-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Bill Hogg suggested using the Thornthwaite formula for calculating evapotranspiration using temperature. He recommended using Environment Canada's model of evapotranspiration as it incorporates mean monthly temperatures, snow and elevation.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Bill Hogg indicated that QC should be using all climate stations for mapping as good data would be missed only using the WMO and he suggested that mapping should be done for all three conservation authorities rather than each individual conservation authority doing their own.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Comments from the reviewers was regarding table 4 and that some classes are not presented, e.g. vegetation cover, and table 5 was described by a reviewer as not having good scientific justification as it is based partially on personal judgment.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Michel Robin had a couple of points to make. The first point was that he felt that the diagrams were good in their detail, but could use GIS to create a simple model to depict vulnerable areas on a pixel by pixel basis. This model can analyze vulnerable areas by tweaking the precipitation, etc. to consider seasonal changes. Michel has a report that uses this technique from a study done at the University of Ottawa, which he can send to the group.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Darrin burr suggested identifying areas in the region that are sensitive to long term impacts and that this could be answered at the geology scale. Mark Boone indicated that none of the geographical areas are isolated and one needs to quantify how to identify the geologic boundaries.	High Medium **Low** None	Completed To Be Completed Declined **Undecided** No Action Required
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Ed Watt suggested looking at what others have used in literature and instead of using low / medium / high for vegetation cover perhaps QC can use classes 1, 2, and 3. Ed mentioned a reference for classifying vegetation called Chow (1964) Handbook of Hydrology.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	WHI looked at groundwater gradients across watershed boundaries, Michel Robin explained that it is integrated flux that is presented in table 7. Ed Watt's comment was that usually net influx and outflux is used in studies and should be used in table 7.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Darin Burr added to this discussion by stating that when considering simple models QC should consider when future growth will occur in these low density populated areas.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Ed Watt identified that the term baseflow separation is not accurate to use here as baseflow is defined as including both long term surface storage and groundwater discharge.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Michel Robin suggested using the 80th percentile of the year to see how responsive the system can be. This technique is also explained in the U of Ottawa report he mentioned earlier. Michel suggested that the next step QC should take is to examine the sensitivity of the model.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Bill Hogg suggested describing the rational for partitioning in this section of the document, e.g. examining the gauge.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Ali Sajid from TCC listed 3 approaches available to classify evapotranspiration: Ontario Ministry of Agriculture and Food (OMAF), Ministry of Transportation of Ontario (MTO), and International Standard Classification.	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Ed Watt had a question as to how extreme of an event will QC use in their water budget modeling.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
10-Mar-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	The second point Michele made was that potential loading should estimate water quality that is being returned.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
10-Mar-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Ed Watt commented to leave off the decimal places for readers to recognize the uncertainty in the numbers.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
19-Apr-06	**Climate** Hydrology Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Are there data gaps/flags in the climate data?	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**
19-Apr-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The groundwater well graphs should include mention of the well number and location.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	ET numbers appear too high, as there is excess water accounted for with these numbers (100 mm of extra water above precipitation value). This could be taken into account via uncertainty of the data.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
21-Apr-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The uncertainty of precipitation data (5 to 10%) should be noted and accounted for.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Pan evaporation data may be valuable to estimate lake evaporation and general ET values.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
21-Apr-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Use the Canadian Forest Service climate data mapping product across Eastern Ontario so consistency is maintained across the watersheds. This was mentioned at each of the first 3 meetings.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	The precipitation values may be lower than actual due to undercatch at the gauges.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
21-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The uncertainty of all data should be noted and accounted for.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
21-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Water course regulation does not factor into the annual water budget, as any variation should be accounted for in the averaging of the data.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	At the conceptual stage, the water budget equation should be reconfigured as follows: Precipitation - Streamflow = Evapotranspiration, a basic equation, to see if it balances. This provides a very simple exploration of the data.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
21-Apr-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Field season measurements should include low flows and water temperature, to help identify groundwater recharge areas.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	A possible relation between groundwater well levels and climate data (precipitation and snowmelt) should be explored. Possibly the IYHGLD Wilton Creek report deals with this. In addition the geometry of the wells and geology around wells should be described. Recharge events may be found through this method.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
21-Apr-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The 2 CRCA groundwater studies do not mesh together. Work is needed to do this.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The term soil water holding capacity (SWHC) should be defined.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
21-Apr-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	More groundwater and hydrogeology information is needed in the report.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
21-Apr-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	New water table and peizometric surfaces should be regenerated, possibly across Eastern Ontario.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	Climate Hydrology Hydrogeology **Water Use** Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The residential water use estimate is too high, it should be revised.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
21-Apr-06	Climate Hydrology Hydrogeology **Water Use** Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	More information is needed about groundwater. It is the largest source of water after the Great Lake system.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
21-Apr-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	For consideration of permitted (maximum) vs actual takings in PTTW, permitted values will give the worst case scenario.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	While statistical analysis is useful, they are used here with too little data to make it appropriate, or in the wrong way.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
21-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The definition of "Water Budget" should be found from a good text.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
21-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	At the conceptual budget stage, monthly values of data are not the goal, but rather annual values. The monthly values would be expected to come later.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
21-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	At the conceptual water budget stage, there is probably no need to consider groundwater in and out of the watershed, as it should equal zero over the long term.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
21-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Once precipitation minus streamflow is calculated, which represents derived evapotranspiration, it should be compared with the calculated evapotranspiration from Environment Canada. The uncertainty of the data should also be considered.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Based on a comparison of the QC report with the new guidance modules, the following specific comments are made: Spatial changes in climate should be considered in the analysis.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	I believe that this method is similar to applying the "Safe Yield" concept to aquifer sustainability, but at a grid scale. This approach assumes that sustainability is based solely on recharge. Note that the guidance module on pg 24, bottom paragraph discusses problems associated with the safe yield concept. Nevertheless, this approach may be useful to provide input into a conceptual understanding of infiltration and water demand, and could be used to help focus a more detailed Tier 1 assessment that could include aquifer storage. This conclusion is supported by the often fairly rapid response of water levels in wells in many areas after a rainfall. I do suggest that the input parameters of P, ET and I be calculated at a finer resolution than 1 km, as this information is available and the additional effort would be minimal. The higher resolution data could then be averaged at the 1 km scale for the analysis, but will still be available at the more detailed level for future studies. This method could be "ground truthed" by comparing predictions with actual water levels. The method will have difficulty in areas where the aquifer is confined, and aquifer recharge will be more influenced by recharge outside the 1 km grid square.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table 6: It is recommended that spatial annual changes of precipitation be included in the analysis. For bulk values at the watershed level, an average P, ET, R and recharge values could then be produced by integrating the values over the whole watershed. The results of this analysis could then be interpreted for significance. For example, is there any real difference between the bulk recharge rates for the entire watersheds? Since geology and land slope are different, I expect that there would be some differences.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table 2 of the QC report lists low, medium and high classifications for different land use covers; however, it is not clear what these classifications refer to. I suggest that rationale be provided on how the classifications were produced.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	During the April 20, 2006 peer review meeting, Quinte Conservation briefly outlined a grid based water budget approach. I understand that the approach involves griding the study area into 1 km x 1 km zones, and calculating infiltration and runoff using as input information on precipitation, slope and land cover. A secondary grid layer of water takings will be superimposed on this grid surface. Areas where the water takings will exceed a certain percentage of the infiltration will be flagged. Note that a similar approach was used in the Renfrew-Mississippi - Rideau Groundwater study; however the analyses of infiltration was performed at the 100 m x 100 m scale and then integrated over the quaternary watershed scale. Total water takings at the quaternary scale were then compared to infiltration to identify quaternary watersheds of high or low water use. It is also noted that a similar approach (minus the inclusion of water taking volumes) is outlined in Appendix A of the April 10, 2006 Module 2 to calculate significant recharge areas (Method 1).	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The QC report was based on technical requirements made in the Interim Water budget Technical Direction (April, 2005). Since this time, an updated Guidance Module 2 has been released dated April 10, 2006. Significant changes have been made in the revised document, as well as detailed instructions and list of deliverables that are recommended by the MOE to appear in the conceptual budget. These deliverables are identified in Section 4.2 of the April 10, 2006 guidance module. Part of the deliverables are 26 maps. It is expected that many of these maps can be reproduced from the Quinte Regional Groundwater Study; however, it is suggested that the maps be presented at a larger scale. It would also be very useful to construct a series of geological cross-sections through some of the major features of the watersheds, to enable identification of regional flow patterns, areas of local recharge, as well as a study of the depth of active groundwater flow.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Overall, the QC report provided a good review of the bulk water budget components at the watershed level, and should provide a good starting point to assemble a conceptual water budget.	High Medium **Low** None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table 7: For Prince Edward County, the water budget suggests that there is no groundwater flow from other watersheds. For the shallow flow regime, this is likely true; however, the deeper flow regime may receive groundwater from Hastings County, with flow underneath the fairly shallow Bay of Quinte. Perhaps a more detailed look at the potentiometric surface in deeper wells may help confirm groundwater flow directions. However, it is realized that modeling at the Peats Point municipal well field that is located along the northern edge of Prince Edward County did suggest that groundwater flow is from elevated areas to the south.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table 7: Further detail is needed on how interflows were calculated. For example, if the flows were determined by measuring hydraulic gradients across the watershed boundaries, the source of information, and the methodology should be provided. Similarly, the rationale for the depth of active flow in the bedrock and the hydraulic conductivity should be referenced. Uncertainty in the estimates and the significance of the uncertainty should be discussed. For example, the Moira Watershed shows that more groundwater is flowing out of the watershed, and then is flowing into it. Is this observation real, or is it within the error of the analysis?	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table 5: Further elaboration is required on how the percentages were calculated, and references made where needed.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**
26-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	My initial thoughts on what a conceptual water budget could contain include a) providing the 26 maps that MOE has requested in their guidelines, b) an inventory of existing data, and the current understanding of the water budget components, c) a list of what the overall concerns/issues are in the watershed, and c) the data gaps that need filling to address the issues.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	As a general comment, I suggest that it would be most useful if Quinte Conservation provide specific objectives on what they wish the conceptual water budget to achieve, and what questions it should answer. Information on the specific objectives would allow the peer reviewers to focus efforts on determine if the technical approach will adequately meet the objectives. The more complex and demanding the objectives are, the more detail will be needed in the analysis.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	For the conceptual water budget, the MOE recommends that annual averages be used; however, as discussed during the peer review meeting, temporal changes should be considered during subsequent Tier 1 efforts.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
27-Apr-06	**Climate** Hydrology Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The correlation between rain and snow would be more interesting to see.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
27-Apr-06	**Climate** Hydrology Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	An ANOVA analysis is not necessarily the best option for statistical analysis of the data when there is high variability of the data, time series analysis is better.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
27-Apr-06	**Climate** Hydrology Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	There is confusion with the statement of analysis of the temperature data using Anova analysis and standard error.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
27-Apr-06	**Climate** Hydrology Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Time series analysis of the climate data should be done to determine what time scale is best for the analysis. Systat can be used.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
27-Apr-06	**Climate** Hydrology Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The correlation of rain to precipitation is spurious, as one is part of the other.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
27-Apr-06	**Climate** Hydrology Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The climate analysis is too detailed for the scope of the current objectives.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
27-Apr-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	There is also a small spurious correlation between snow and precipitation.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
27-Apr-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Regarding the correlation of precipitation to flow, it is recommended to show the correlation coefficients or regression data in order to test the hypothesis that they are not zero.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
27-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	An infiltrometer tests for hydraulic conductivity (K) vs. water content, but not necessarily the infiltration. It is better to measure the average moisture content, where the K value would be approximately the darcy flux in steady state vertical flow.	High Medium **Low** None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
27-Apr-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Very well written text (simple and to the point). Not enough detail at this stage to review properly. Yearly time scale is too coarse: a highly unbalanced monthly water budget may well average out to a balance yearly budget - analysis should be done with monthly values at least. Integrating (in the mathematical sense) the water budget at the scale of a basin is not very informative: the lager the scale of integration the less likely we are to discover water issues; and more importantly, problems occur at the local scale. Water budget can be calculated at the pixel level in a GIS (and on a monthly basis). This will provide a spatial distribution areas with possible water quantity issues and the time of year when they occur. Maps can then be produced to determine areas where water quantity is an issue part of the year or most of the year, which will help focus further work. Previous work in Eastern Ontario showed that the year water budget balanced (even in unusually dry years) and that water shortages issues depended on time of year; and that some areas had seasonal issues, others chronic issues (most of the year), and others yet had no issue (the largest portion of the territory). Impact of returning water was not examined. Integrated wastewater	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
			return flux can be used to estimate potential contaminant loading. This should be calculated and included in the report. The impact of groundwater and surface water storage needs to be included or at least discussed. A balanced budget when the storage is adequate is fine; but if there is little storage a balanced budget may mean being in the red half the time. The storage term in the transient water budget gives an indication of the ability to absorb peak demands without causing shortages. I feel this is an essential issue to discuss		
27-Apr-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	More detail is needed on the hydrogeology.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
27-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Information on bedrock and surficial geology, soils and physiography are needed for the conceptual document.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required
27-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The confidence intervals, based on what appendix shows, is not 95%, but 68%.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
27-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	There is a statement that rain is not normally distributed. The question arose, is that a spatial or temporal issue?	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
27-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The text refers to the tests done by the local health units in septic systems tests as a t-test, is a perc-test meant?	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required
27-Apr-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	There is not enough information in order to recommend modeling software or methods.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
02-May-06	**Climate** Hydrology Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The infiltration/recharge (I/R) term does not apply in water budget equation as shown, it is included in the other terms.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
02-May-06	Climate **Hydrology** Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	One reviewer sees a correlation between high precipitation years and high flow years? This would suggest that more precipitation means more streamflow, and needs to be checked.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
02-May-06	Climate **Hydrology** Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The field work should include low flow monitoring, and monitoring for cold water streams.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
02-May-06	Climate **Hydrology** Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Low flow monitoring information should be included to identify losing and gaining streams.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
02-May-06	Climate **Hydrology** Hydrogeology Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Urban areas have less evapotranspiration, therefore more precipitation is available for runoff, which helps to explain higher runoff values of the urban creeks.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
02-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There is a difference between how a hydrologist and hydrogeologist defines baseflow, this should be noted.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
02-May-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The water level trends in groundwater wells should be examined.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
02-May-06	Climate Hydrology **Hydrogeology** Water Use Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The groundwater well graphs should have an x-axis related to date or month rather than just day of the year (i.e. Sept 1 rather than Day 240).	High **Medium** Low None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
02-May-06	Climate Hydrology Hydrogeology **Water Use** Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	For future conditions, full buildout according to the Official Plan could be assumed, and the water use could be recalculated.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**
02-May-06	Climate Hydrology Hydrogeology **Water Use** Other	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	In communities with septic systems, that is water being added to the groundwater, especially important if the water came from a surface source.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
02-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	A survey of PTTW users can be used to quantify actual takings, as they may be much less than maximum permitted.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
02-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	MNR has agricultural water use data at the Township or smaller level, which is better than PTTW data.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
02-May-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The objectives as listed are not met.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
02-May-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	A list of the specific objectives of the conceptual water budget and how they fit into the overall objectives of the project should be included.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
02-May-06	Climate Hydrology Hydrogeology Water Use **Other**	**Cataraqui** Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	One reviewer would rather see precipitation, evapotranspiration, infiltration and runoff mapped spatially across the watershed rather than an estimate of bulk use across the watershed.	High **Medium** Low None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
02-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The MOE guidance should be followed specifically, with the creation of all 26 recommended maps.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
02-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	With relation to the term "area of stress" in section 4, is there not enough information to map the stress, or is the stress not known?	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: It was noted that the analyses and plots of snow fall vs total precipitation were actually spurious (or induced) correlations and should not be used at all.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Was there any reason why the Arnprior station was not used? Whether there is any rain shadow effect because of the highlands areas to the northwest?	High Medium **Low** None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Ontario Climate Centre is part of Ontario Region of Environment Canada	High Medium Low **None**	**Completed** To Be Completed Declined Undecided No Action Required
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Monthly values are available from archive file	High Medium Low **None**	Completed To Be Completed **Declined** Undecided No Action Required
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	1.4 Scope of Work: Include collection of “existing climate analyses” in scope of work.	**High** Medium Low None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Why is 30 years of data were used instead of the entire period of record?	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: The Kemptville climate station was automated in 2001, hence the CS suffix on the station number after that time. The two datasets are therefore no longer homogenous, and should not be treated as such. The original data set could be extended with the ratio to the normal from the surrounding stations.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Y-axes of climate graphs should be set to zero to show relative variation over the scale of the measurement.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Difference between 4.16 and 4.17 (in fact, I'm not sure what an isohyetal line is)	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: T-test assumes the data are normally distributed, however not the case with monthly precipitation, So, 95% confidence interval analysis can be used to conclude one station selection	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Page 53, 3rd paragraph not clear	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Rearrange and organize the introductive paragraph:	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Not sure of the wisdom in culling out months that are missing some information. Explain the rational?	High **Medium** Low None	Completed To Be Completed Declined **Undecided** No Action Required
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Why were the MVC and RCVA dealt with separately?	High Medium **Low** None	Completed To Be Completed Declined **Undecided** No Action Required
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Fig 4.3 is not clear; why both the standard error of the mean and the standard deviation are presented	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Refrain from using the word "trend".	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Fig. 4.2 Plot the 95% conf interval as a band (use area plot in excel) same comment applies to other graphs below. Legend should read upper 95% confidence limit and lower 95% confidence limit (same for other graph: Fig 4.4)	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Page 53, 3rd paragraph: Standard deviation of what? Standard error of what? Why the fig 4.5 shown?	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: Comment about representation of P≥0.05	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	4 Climate: It doesn't mean that 95% of monthly values at other stations are within the confidence bands, only the monthly means	High Medium Low **None**	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	4 Climate: Use of the Great Lakes Forest Research Centre maps would produce superior results	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
26-May-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	1.3 Objectives: Include “seasonal or annual extremes of climate” in the list of stresses.	High **Medium** Low None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	6.3 Evapotranspiration Data: The Soil Water Holding Capacity variation across the watershed could be used, and compared to the ET values, to ensure a proper distribution across the watershed.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	6.3 Evapotranspiration Data: The comparison of derived ET (Precipitation – Streamflow) should be compared with the calculated ET (EC Thornthwaite).	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	5.2 Baseflow Estimates: A strict interpolation of BFI from stream gauge to stream gauge is not necessarily acceptable, and if it were to be needed, a relation to the surficial geology should also be included.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	6.3 Evapotranspiration Data: This paragraph is not clear; it should also be more specific	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	6.3 Evapotranspiration Data: The runoff depth was shown in individual subwatersheds, but in some cases actually reflected the runoff depth of the entire watershed to that point.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	6.1 Evapotranspiration - Background: Background section should introduce the concepts that follow – expand	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	5.2 Baseflow Estimates: It would be very useful to back out infiltration rates for different types of terrains. This can be done by identifying catchment areas that fall within a similar terrain (eg, sand plain, bedrock plain etc), and modeling (GAWSER, MIKE) the gauged stream flow to calibrated recharge rates. This number can then be used as input into future Tier 1 modelling	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	5.1 Stream Flow Data: Delete the square root of R2	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	6.3 Evapotranspiration Data: How will the monthly ET maps be calculated? More details of the calculations should be given (I would not be able to reproduce your work based on what is given).	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	8 Surface Water Storage Data: Bill Hogg mentioned he has a CD up to 1996 of all snow course data, and would be willing to share it.	High Medium Low **None**	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Groundwater modeling considerations: "Why measure groundwater flux?" - There was considerable discussion about the quantity of groundwater flux, when compared to the values of the other parameters, and whether it is so small to be negligible. It was agreed that for the long term conceptual water budget, groundwater flux difference across the area is probably zero (resulting in no change in groundwater storage). This will of course need to be dealt with in a more detailed fashion for the subwatershed, monthly, or drought period scale models. In that case, the value may not be zero, and may be large enough to need to be accounted for.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	1.2 Components of the Water Budget: Where the net losses and gains to groundwater are unknown or cannot be estimated, the resultant output from the above equation would equal the groundwater flux. I don't understand this last sentence (underlined). The change in storage is the combined storage of surface water and groundwater. Since we want to separate out the surface from the groundwater then we need to look at the surface water storage, the groundwater storage and the exchange (seepage or leakage) between them. This should be made explicit in the equation above or in a separate equation.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	General: There was discussion regarding the clay cap at Carp (Cross Section E-E') and whether that was a GUDI well or not. It's still very unclear. A GUDI study may be needed.	High Medium **Low** None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Groundwater modeling considerations: There was a question about the structural geology, and where the fractures were located. This was brought up in relation to modeling, and that the location was needed to do proper modeling. But fracture locations are generally not known, and therefore large scale modeling will not be worthwhile, as not enough information can be gathered to make the modeling worthwhile. However, localized modeling may be worthwhile, and acceptable.	High Medium **Low** None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Groundwater modeling considerations: "Is a numerical GW model required?" - It was agreed that in general, a complex regional 3D groundwater model was probably not needed for the study area, as that is outside the capabilities of the model with the information available. A more likely scenario is something simpler like a GIS model. However, for small localized areas, a 3D model may be the proper approach, perhaps for the Leda clays around the valley area and its features (e.g. eskers).	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.2 - Groundwater Flow Direction - It was noted that the shallow and deep groundwater surfaces were very similar. Consensus was that this was not surprising, as the data is based on open hole wells, and could very well be connected via fractures, and there was no way to accurately distinguish specifically where the water was coming from, and therefore whether it was deep or shallow, so no judgment along those lines could be made. The known issues with the water wells database were brought up here, and it's limitations for making judgments on the groundwater system.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 2.3 - Bedrock Geology (Figure 2.3) - It was noted that on Figure 2.3 the fractures and cuts were not overlain properly on the geology. There were two different scales of the maps.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.3 - Groundwater Recharge and Discharge - It was also noted that with the geologic structure missing from the analysis (recharge/discharge based purely on head) the analysis would not necessarily be complete, and that head alone is not a good indicator of recharge; it will only give an indication of the direction of the flux. To estimate recharge/discharge both the hydraulic gradient and the hydraulic conductivity must be considered.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.4 - Bedrock Aquifers and Aquitards - The aquifer table on the upper right of page 6 of the handout (Aquifer Unit/Use/Yield/K/Porosity) resulted in considerable discussion. The consensus was that the term yield was not to be used, and something like "Driller's Estimate" would be a better representation of the values. Included in that, some qualification of the numbers would be preferred to be added at the bottom of the table. Another suggestion was to use the terms "poor, good, or excellent" (with definitions) in place of an actual number. Or perhaps use the productivity instead of the term yield. A range of K values may also be useful. In addition, the sources of the data, whether taken from well records, previous reports, or calculated, should be included on the table.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Groundwater modeling considerations: It was noted that groundwater discharge from precambrian rock is very localized. For modeling purposes, bedrock should be treated as "lumped" for the discharge term to surface water models.	High Medium **Low** None	Completed To Be Completed Declined Undecided **No Action Required**
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	General: It was suggested that the cross-sections should include a general direction of flow and that all cross sections should be at the same scale or make note of the different scales.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.3 - Groundwater Recharge and Discharge - It was noted that a higher head in a deeper well did not necessarily represent a discharge feature - it simply indicates a potential for discharge. The conductivity is needed to complete the picture.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.3 - Groundwater Recharge and Discharge - The method to identify recharge vs. discharge areas, and a difference in head of 5 m, was questioned. It was noted that the error of the data was possibly larger than the 5 m increment used.	High **Medium** Low None	Completed To Be Completed **Declined** Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.5 - Depth to Water Table - It was pointed out that a simple subtraction of the piezometric surface at depth from the water table elevation could provide a map of potential recharge/discharge. This map coupled with approximate depths of measurements and estimated conductivities could be used as a crude approximation of the recharge and discharge fluxes. It was also noted that an overlay of the surficial geology map showed that the simple recharge/discharge map was not necessarily correct and that hydarulic conductivies must also be incorporated.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.5 - Depth to Water Table (Figure 3.13) - Depth to Water Table Map (GS Elevation - Shallow WT elevation) - should only be used as a regional picture, and should not be tied to specific locations, as the data it is based on is not good enough to give fine detail. As such, it should be noted in the text, and on the map, that this limitation exists. Possible future use needs to be "foolproof." Some ground truthing was recommended perhaps on the Tay River. It was recommended to add the comment "Do not use at a local scale" to the map.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.3 - Hydrogeology (Figure 3.6) - The Rideau River was missing from cross-section A-A'.	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.3 - Groundwater Recharge and Discharge - Figure 3.12 was noted to be only ½ of a depth to water table map, based on the way it was created. It is a map of the DEM minus the water table, which in itself is tied to the DEM, making a number of locations equal to zero, when they should not necessarily be zero. For that reason, that version of the map is not necessarily useful.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	General: There was discussion about flow of groundwater through faults. Faults are not "avenues" for flow. More likely to be gouge filled, and less permeable. There's probably fairly good connection in the shallow subsurface over bedrock. It was noted that Fred Michel at Carleton U. has noticed a lot of infilling. There was general consensus that there was a lack of hard information available.	High Medium **Low** None	Completed To Be Completed **Declined** Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	General: There was some discussion on faults and other linear features, and whether these are permeable links, or rather impermeable planes due to filling and packing of material. The literature has not yet provided a consensus on this topic.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.1 PTTW Users: It was noted that the location of the PTTW withdrawals (page 8) and the Municipal Systems (page 9) did not necessarily correspond. Presumably this is due to location errors in the PTTW database.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.5 Sewage Treatment Plant Discharges: There should be consideration of consumptive uses (removed from the water cycle) and those uses that withdraw the water but then put it back into the system. But also for those uses that withdraw the water in one place and return it to another (withdraw from groundwater, release to surface water).	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.4 Agricultural Water Use: Provide an estimate unpermitted takings as a guide. Presumably, some sensitivity analysis of the value would show whether it is significant within the watershed or not, and if it is found to be significant, better estimates would be needed.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.6 OMYA: What do the 3 lines mean in Figure 7-8 “Trends in OMYA Water Takings”?	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.5 Sewage Treatment Plant Discharges: There is a disconnect here (in the paragraph regarding private well and septic discharges) with the previous section.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.4 Agricultural Water Use: Does the OMYA section require its own section or should it be described as part of commercial takings in Section 7.1?	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.3 Private Groundwater Well Consumption: Stream gauges cannot be used for this calculation (calculation of private well consumption for water budgeting) because water withdrawals from private wells are returned to the system through the septic system	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.3 Private Groundwater Well Consumption: Domestic consumption rate of 130 Lpcd seems quite low for private wells. City of Ottawa metered water rates are 200-225 Lpcd (no losses). 1999 AWWA Residential End Uses of Water report found median flows varied from 204 to 253 Lpcd (total median of 229 Lpcd). Michel Kearney recommends between 180 and 220 Lpcd based on his experiences.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	7.5 Sewage Treatment Plant Discharges: Richmond may also have a municipal well.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	7.4 Agricultural Water Use: MNR also has agriculture water use data by enumeration area. They took this data and superimposed subwatersheds; however, the raw data would be more useful, and then you could group as you see fit. There may however be confidentiality issues.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	9 Water Budgeting: We need to distinguish between a flux and a flow rate or discharge rate.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	9 Water Budgeting: The general water budget equation and its terminology need to be discussed	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	1.6 Study Area: Add major lake names to the Base Map.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	1.3 Objectives: In the context of this report, “flux” is understood to a mass transfer per unit time	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	1.5 Scale: Why not use a WMO standard "normal" period (i.e. 1971-2000)?	High **Medium** Low None	Completed To Be Completed **Declined** Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	1.6 Study Area: It was noticed that the fourth slide seemed to have inconsistent drainage areas between the overall area (8,591 km2) and the Mississippi River (3,747 km2) and the Rideau River (3,872 km2). The missing area is covered by tributaries draining directly to the Ottawa River	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	General: Reference the regional groundwater study as “Golder et al (2003)”.	High **Medium** Low None	Completed To Be Completed Declined **Undecided** No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	General: In general, class sizes of maps need to be larger than the error associated with the data.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	1.4 Scope of Work: Include “low flow monthly water budget calculations” in scope of work.	**High** Medium Low None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	General: There was a suggestion to add the data points from which the surfaces are inferred in the background (in this case well locations) of the map, so it could be known what locations the map data was based on, and also the sampling density of the geostatistical support.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	General: The scale issues of enlarging or reducing the maps may also need to be considered.	High Medium **Low** None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	General: With the expectation of the maps being photocopied for use in the future, the colour scheme should be selected such that it reproduces well in black and white for photocopying purposes.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required
26-May-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	General: The scales and general breakdowns of the classes should be consistent across the map sets.	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.4 - Bedrock Aquifers and Aquitards - Where are each of the aquifers outcropping and where are they confined?	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.4.1 - Upper Precambrian Aquifer / Lower Precambrian Aquitard - "yield" is a poorly defined term, please define and preferably transform into a quantity that is useable for modeling purposes, such as specific yield. This comment applies to a number of other aquifer descriptions below.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.4.1 - The storage capacity of these rocks is a huge issue. A (generous) porosity of 1% in the upper Precambrian will yield only 1 cm of water per m of draw down. The net result is that this system can only support sparsely distributed domestic wells.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.4.1 - Upper Precambrian Aquifer / Lower Precambrian Aquitard - A porosity value of 0.001 for Precambrian rock is way to high for a primary porosity (by 3 orders of magnitude). The use of 1% by volume of void space for modeling purposes would be acceptable but only for fracture pathways. It was explained later that this value (1% bulk porosity) was derived from porous media modeling approach. Further footnotes explaining data sources would clear this up.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.3 - Hydrogeology (Figure 3.5) - Aquifer Being Pumped - I don't understand how fig 3.4 is being constructed.	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.5 - Depth to Water Table - The deep Precambrian wells are probably deep, not because they are confined, but because they are located in areas that are less fractured and/or where the fractures are more vertical (and harder to encounter).	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.5 - Depth to Water Table - "Therefore the depth to the shallow water table is informative from both a water supply perspective as well as from a source water protection perspective." - this line of thought is only valid in areas of groundwater recharge or in areas adjacent to a large pumping well, and in non-fractured systems. In the Precambrian shield area, I would argue that depth is no protection because the flow system is dominated by fractures. Travel times can be very short, even at great depths. On the other hand, domestic wells are generally safe in areas of groundwater discharge or in areas with no vertical component of flow (provided the pumping rate is not too high), which ,in this case, would be associated with the shallow water table wells..	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.3 - Groundwater Recharge and Discharge - Figure 3.2 does not show groundwater contours indicating flow direction towards the Mississippi R from three directions.	High Medium **Low** None	Completed To Be Completed **Declined** Undecided No Action Required
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.2.2 - Local Groundwater Flow - Much more needs to be said about the local flow systems; for example the esker system south of Ottawa is a major feature; the sand plains; etc.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.2.1 - Regional Groundwater Flow - Disagree with the statement that the data is insufficiently detailed to calculate vertical hydraulic gradients. It will give you similar accuracy as your horizontal estimates. At the very least it will give you a direction of flow.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.5.3 - Sand and Gravel Esker Deposit Aquifer - Personal communication with George Gorrell (May, 2006) indicated that hydraulic conductivity of sand and gravel esker cores can be as high as 10-2 m/s or10-1 m/s.	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3 needs to be re-organized. Many topics are discussed multiple times in various sections (i.e. vertical groundater gradients, groundwater flow directions, etc.)	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.3 - Groundwater Recharge and Discharge - It should be pointed out that some surface water bodies can also be found in areas of groundwater recharge?	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Figures 3.1 and 3.2 - The two different classifications for the 3.1 and 3.2 makes comparisons difficult - should use the same scale.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Figures 3.1 and 3.2 - Show the points where the measurements were obtained from on figs 3.1 and 3.2, to get a feel for what is real and what is interpolation.	High Medium **Low** None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
30-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.2 - Groundwater Flow Direction (Figures 3.1 and 3.2) - Shallow and Deep Water Elevations - How were the water level surfaces drawn? Were surface water elevations incorporated into the Shallow Groundwater Elevation Surface (Figure 3.1)?	High **Medium** Low None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Groundwater modeling considerations: I suggest that a simply GIS based waterbudget will suffice for the majority of the watersheds; however, a more detailed approach that can incorporate boundary conditions, multi-layers and lateral groundwater flow will be needed in areas where significant overburden aquifers are present, and where the bedrock aquifer is confined by clay and silt. In these areas, recharge to the pumped bedrock aquifer will not be from vertical infiltration, but rather upgradient infiltration, therefore, a simple vertical accounting for P, ET, I, R, will not be realistic. I understand that a modified GIS approach may work as long as lateral flow in multi-layer systems is incorporated. A more detailed numerical model may be appropriate for select features such as understanding the groundwater flow systems of the buried eskers, and the interrelation between the exposed drumlins and recharge to the bedrock aquifer.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.3 - Groundwater Recharge and Discharge - I realize that Fig 3.3 is a problematic map; however, I still think it is of some use as it essentially identifies areas where the water level in the well is lower than the average water table in the area. The problem being of course that the data density is very poor, and it is not reflected in the map. Nevertheless, in areas where there was data, the recharge areas did correspond with the upstream boundaries of quaternary watersheds, while discharge areas corresponded with the downstream portions of the watersheds, which makes sense. Perhaps this map should be replaced with a hand drawn map that has been interpreted from other data sources such as depth to water (Figure 3.12), local experience, potential recharge areas in bedrock (Kent discussed this during the last meeting as areas that were elevated, thin overburden and deep watertables).	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	General: For many of these maps derived from the regional groundwater study, it may be useful to have an appendix dealing with where the data came from, how they were constructed and the data limitations.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 2.3.2 : Paleozoic Geology - would limestone also form in shallow warm waters where terrigenous input is low?	High Medium **Low** None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 2.3.4 : Bedrock Faults - Grenville Orogeny occurred 1 billion years ago after the Paleozoic Era - C (Cambrian started around 570 million years ago, so it would have been before Paleozoic; however, if I remember correctly, faulting reactivated many times, so may have occurred both before and after Paleozoic)	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.2 - Groundwater Flow Direction - Disagreement with the statement, "The similarity of the shallow and deep aquifer maps may indicate that the deeper aquifers are hydraulically connected to the shallower aquifers". Topography is the controlling factor on the two maps, and therefore they will both look similar at this scale.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.2.1 - Regional Groundwater Flow - As for groundwater flow east across South Nations watershed it is difficult to use the watertable map to justify this direction, as the map was created using surface water elevations that by definition would mimic surface water drainage directions. It would be useful to look closely at the boundary between Rideau and South Nations watersheds at a detailed scale with a water table or potentiometric surface map that is not tied to stream bodies to see if cross-basinal flow is observed.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Groundwater modeling considerations: I also suggest that M-R await the results of the South Nation modeling exercise so that the benefits of modeling, if any, can be assessed. I expect that a lot can be learned from South Nations experience and detailed conceptual flow modeling that will benefit the M-R region	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.2.5 - Depth to water table - Figure 3.4 and Figure 3.12 can be combined as they are the same thing, other then Figure 3.12 shows where the watertable is near surface (or above surface which is really not possible) which is a subset conditions of Figure 3.4. For more detailed scale maps, it would be useful to plot the water wells and water level depths. Overall, I think the depth to watertable map will be a key map to identify potential recharge areas.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.3 - Hydrogeology - It would be very useful to construct more cross-sections through key hydrogeological terrains, especially those involving overburden such as sand plains, eskers, drumlin fields etc. Perhaps these sections could be built through areas of major groundwater use such as hamlets and additional well fields.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.5.1 - Surficial Sand Aquifer - I expect that the surficial sand aquifer may transmit water to the bedrock aquifer where it directly overlay's it or through windows in the clay such as eskers, outwash fans and drumlins.	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	General: A map of the confined and unconfined aquifers would be useful. It would also identify locations where lateral flow is more important than vertical recharge, and visa-versa.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	General: Identification of stress on aquifer could be investigated through plotting historical water level data at municipal well fields or historical monitoring well locations.	High Medium **Low** None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
31-May-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Section 3.5.4 - Silt, Clay and Clay Till Aquitard - The tills can also be aquifers in some areas where permeability is higher.	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required
16-Jun-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table 1 label to include watershed average ET based on GIS model.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	A table was shown (Table 8 in the report) which outlined all the data used for the model. It was noted that Environment Canada should be added as the source of the climate data, as CFS created their mapping based on this data.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
16-Jun-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Using the GIS grid we have great precision for climate i.e. ET however the accuracy would not be as great as the precision.	High **Medium** Low None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	The topic of “trends” came up, and the work done by EC (noted by Bill Hogg at the May meeting, and since found and passed out to the SWP regions) was also mentioned. It was thought that we may be able to just quote the previous works findings from a trend perspective. It was further noted that any trends found may be used to extrapolate for the future, and what future scenarios may need to be considered.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	It was noted that the Hydrologic Atlas of Canada (1978) has some ET maps that will serve as good comparison to the numbers calculated in this project. They were estimated based on the stations available at the time (precipitation and runoff) as well as some correction assumptions and analyses.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	It was started with the Canadian Forestry Service climate mapping based on Environment Canada station data. This is information we have been recommended to get since the first peer review meeting, and has now been received and distributed to the five Eastern Ontario SWP regions. There was a question of whether the data received included time series data. It does. The mapping was prepared using all the EC stations and U.S. Meteorological Service stations. It was recommended, however, that an inventory of all EC stations be included in the report as per the guidance documents.	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	When comparing ET rates check out the Hydrological Atlas of Canada as a good reference.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
16-Jun-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	It was also noted that a professor at Queen's (Dr. McCaughey, Geography, http://geog.queensu.ca/faculty/mccaughey.asp) has been measuring ET in the Petawawa area, and comparing it to the Penman-Monteith method of calculating ET. It was suggested we further compare that to the Thornthwaite values for the Petawawa station.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	There was discussion about using “classes” to show precipitation, but isolines were thought to be a better option, and are recommended for the maps.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
16-Jun-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Incorporate snow pack into the ET calculation.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There was some discussion about the precision of the CFS mapping, in that it appears to show precipitation changes in stream valleys. This is probably not true in reality, but rather an artefact of the elevation routine of the mapping algorithm. However, it was noted that a weak relation between precipitation and elevation has been found in Ontario. It was also noted that the CFS mapping does not necessarily agree with individual station data. It is unclear which one may be specifically correct, or whether they are both "correct" based on the interpretation methods.	High Medium **Low** None	Completed To Be Completed Declined Undecided **No Action Required**

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	It was noted that on a long term average basis, Thornthwaite estimates are OK, but when looking at individual months, or specific months of a drought condition, they may not be as accurate, as they look only at the mean average temperature of the month. March was used as an example. The mean temperature would probably not show any ET, though there probably are some days when it is occurring. It was thought, specifically with ET, though perhaps with other aspects as well, that the use in the model had been pushed too far, and that there are implications of the great precision being construed as great accuracy, when that is not necessarily the case.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	It was suggested that a map of those wells that are more vulnerable (sand point, shallow, etc.) may help to define the vulnerable areas.	High **Medium** Low None	Completed To Be Completed Declined **Undecided** No Action Required
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	It was also felt that Figure 28 (Spatial Dist of SW Usage) was probably pushing the usefulness of the GIS model, and was probably not right to include. It was suggested it would be better to look at just one month's flow (stressed month – July, August, September) than the full year as a whole. In this manner, comparing the lowest flow month with all the water takings should show the worst case scenario.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table 11 have derived ET come after Runoff.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table 11 add potential error section.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	In Figure 27 (Spatial Dist. Of Annual GW Usage), given the data that is being shown, it was suggested that the legend units be changed to m3/year/km2 rather than just mm, as it explains more of what the map is representing.	High **Medium** Low None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Consecon check the ground water flux, ground truth watershed boundary etc.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Ground water vertical gradient map labeled to indicate areas of low confidence. Ground water vertical gradient map labeled to indicate areas of low confidence.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Gauge data – differences are not necessarily true differences between watersheds but more differences between period (add to table interpreted according to this qualification).	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There was a question about ground-truthing relating to the drainage area of the streams to the gauge stations. They have not been ground-truthed, but they have been recalculated using GIS, and the GIS estimates are very similar to the Hydat values. Several years prior, Quinte Conservation staff field verified the new drainage layer for the provincial GIS database. This included visiting sites to determine drainage divides. Further work could be completed to add certainty to the areas assigned to each catchment area.	High Medium **Low** None	Completed To Be Completed Declined **Undecided** No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	From a streamflow perspective, knowing that the Moira River record at Foxboro is 90 years, a comparison of the full record with a shorter record (30 years of less) is not necessarily proper, and perhaps only those years that coexist should be directly compared.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There was also a question about error of the data. This is presented “crudely” in Table 11 and Table 12 of the report.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	It was suggested that at the beginning a paragraph be added to the effect that differences seen in the data do not necessarily mean an actual difference in the long term true values of the data, but rather take into account the range over the period of record of the data, as well as the uncertainty of the measurement of the data itself. Given that in many cases, 30 years of data is the longest available, it is not enough to absolutely determine what the actual ranges may be.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There was then some discussion on how closely the guidance documents need to be followed, given that they are "guidance" documents. It was suggested that as long as the intent of the guidance is maintained, and the work is defensible, that variation is fine.	**High** Medium Low None	Completed To Be Completed Declined Undecided **No Action Required**
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	The stress condition was then discussed; the guidance recommends that if 25% or more of the recharge is used, that represents a stressed condition. The question was whether that number was indeed reasonable (especially at the average annual scale). It was suggested that the worst month (perhaps July, August, September) would be more representative.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	It was suggested that a list of definitions of the various terms being used would be useful to ensure they are being used correctly.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There are a number of maps that can be used to help estimate recharge and discharge, including topography, depth to the water table, etc. Perhaps a combination of these maps can be compiled in a hand drawn version to best represent the recharge discharge areas.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	The discussion then turned to "infiltration/recharge" and defining that parameter based on the MOE recommendations of their 1995 Hydrogeological Investigation document. The document gives some parameters which are used to partition the portion of precipitation that is not sent back to the atmosphere through ET into two components, that which reaches the streams, and that which reaches the water table. First, the term "infiltration" and how it was being used came into question. "Infiltration" is that water from precipitation which crosses the air/soil boundary, some going to the vegetation for ET, some going to "interflow", some going to the water table. In the context of the report, this is the original quantity of water not lost to ET. What is being sought is the "recharge" instead, that water which reaches the water table. The definition from Freeze and Cherry (1979) was referenced. Those definitions are (page 211): "Groundwater recharge can be defined as the entry into the saturated zone of water made available at the water-table surface, together with associated flow away from the water table within the saturated zone". Infiltration is defined as "the entry into	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
			the soil of water made available at the ground surface, together with the associated flow away from the ground surface within the unsaturated zone." This terminology will be cleared up in the report.		

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	The question of looking at monthly comparisons was asked, and that is detailed in the Next Steps portion of the report. The plan is to look at the monthly data for the Tier 1 analyses, including setting up the GIS model on a monthly basis as well. However, consideration for the storage of water (lakes/reservoirs, snow) may mean that it would be easier to look at on a seasonal basis (summer) rather than specific months.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There was some discussion on the term "rock" and its stated water holding capacity (WHC) of 25 mm. The term is used to represent thin soil over rock, as opposed to rock proper (which should have a WHC of zero). This terminology will be changed. A good terminology for this type of land was suggested as "shallow soil over bedrock" though the definition for what that constitutes (relating to depth of soil) has apparently varied over the years.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	It was recommended that a disclaimer be added to inform viewers of the "issues" with the data and therefore the mapping. In addition, it was felt that in areas with little data (in this case only a small number, or no wells at all) that the area be blanked out and no grouping be shown at all.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	It was also noted that there may be additional data for groundwater monitoring wells in the region from a previous MOE program, and this data could be useful.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	Look at low conditions have section to deal with drought conditions do similar for ground water. I.e. when do the wells dry up and where are the wells etc.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	It was noted that perhaps not all the data available has been presented in the report for consideration. It was thought that adding this would strengthen the report. Not necessarily to include the data itself, but rather that it exists, and where it can be found, or how to get it. And then it can be gathered for inclusion as it is received. In particular, data such as low flow conditions, when wells went dry, newspaper articles of drought times, etc. For instance, the period of record for the Moira River dates back to around 1915, as does the South Nation River, the times of low flow quite possibly coincide with periods of low flow across Eastern Ontario. It may be established that a particular climate condition created the low flow condition, and then this can be used to extrapolate for other areas. In particular, possibly low snow years or low precipitation years may correspond to dry years in general.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There was discussion about how to deal with the uncertainty of the data and subsequent mapping, and how to make it credible. There were concerns with what form the data and maps would take, and whether a municipality could easily transfer that information into their planning documents. And further, whether ensuring that easily transferable information was in fact one of the goals of the project, as that may dilute the information to the point of not being useful.	**High** Medium Low None	Completed To Be Completed Declined **Undecided** No Action Required
16-Jun-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui Mississippi-Rideau **Quinte** Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Add caveat to water use table to indicate that it does not include Great Lakes water supply	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate Hydrology Hydrogeology **Water Use** Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	It was decided that the work with the PTTW database needs to have a number of caveats and assumptions noted to ensure they are not used directly and blindly for every situation.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	There was a question related to the overall concept of the work, and what is to be done, and how it is to be done. There was a suggestion that part of the water budget work should include a general listing of what is planned to be done, and then that can be reviewed by the committee, with input on where to find data, how to analyze, etc., and then the numbers can be added to the work. Perhaps this should be done at the beginning of the Conceptual Report, as a preamble to the work, and then can be added as part of the Next Steps section of the report, moving towards Tier 1 work.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
16-Jun-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ **All**	With the general uncertainty of the data being used, and knowing the ultimate goal of the work, and even though in some cases the data is very good, it was thought that smaller scale maps would be better for some of the information, as this would give less weight to the product being shown.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-Sep-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Other	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Sep-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Error in Monthly minimum and maximum temperature data shown in Table 3.2.	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required
26-Sep-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Legends of figures 3.3 and 3.4. should indicate that water equivalent is plotted for snowfall	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required
26-Sep-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Error in lake evaporation results (Section 3.1.3; Figure 3.9); Measurement is for pan evaporation, not the lake evaporation	**High** Medium Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Sep-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Peer review Minutes-Sept-26- Table 5-4 ET should be calculated using the Forestry Canada data for consistency purposes and compared to the calculations using the climate station data	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Sep-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	More discussion is required on estimating baseflow using hydrograph data (Section 3.5.3.5). In the literature, there are numerous approaches to estimate the groundwater contribution to surface water. While several methods are noted in the text, the underlying assumptions and differences between the methods are not presented. Another question is whether the base-flow estimates include interflow or not. Interflow does not really recharge the aquifers, and therefore the baseflow indices would overestimate recharge. The reason why this discussion is important is that the baseflow estimates from hydrographs compared with GIS based calculated groundwater recharge. When there are differences in the underlying assumptions, there will be discrepancies in the comparison.	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Sep-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Peer review Minutes-Sept-26- The gauge measurement is a specific measurement, and is therefore felt to be a more accurate number to use than the estimated ET numbers. The M-R report states a 20% error to flow measurements, but that is probably too high, and closer to 5% instead	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Sep-06	Climate **Hydrology** Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Peer review Minutes-Sept-26 - Table 5-6 compares “surplus water” (P-ET) to “calculated direct runoff”. There was considerable discussion around this topic. The thought is that “surplus water” can be compared to flow at the gauge as an indication of differences in major water budget components, but that a comparison to the calculated “direct runoff” was not correct. The “direct runoff” is that volume of water that moves from infiltration to streamflow reasonably quickly, rather than that water that may move to the water table, and then to streamflow. It is not easily quantifiable, and was calculated by subtracting the infiltration values calculated using the MOEE 1995 method from the surplus.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Sep-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Peer review Minutes-Sept-26- The surface water and groundwater percent demand estimates should be separated into two distinct pieces	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
26-Sep-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Peer review Minutes-Sept-26- For GW withdrawals - the recommendation is to look at aquifer capacity and demand	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
26-Sep-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Peer review Minutes-Sept-26- A cautionary note needs to be included in these reports stressing that the conclusions only apply on a regional, average annual scale	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required
29-Sep-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	A high-low-close diagram may be better for figures 3.5 and 3.6 (they are found in Excel)	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
29-Sep-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Not sure of the usefulness of the 5-yr moving average infigures 3.7 and 3.8	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required
11-Oct-06	Climate Hydrology **Hydrogeology** Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Infiltration - Michel Robin indicated that the MOE methodology to estimate recharge does not work well for confined or semi-confined aquifers. Given the limitations to the MOE approach identified on pages 50, 51 and 60 of the report and the resulting confidence in the findings, it might be premature to include the maps from this analysis. The written results, with the disclaimers about the methodology and results, can be left as they are.	**High** Medium Low None	Completed **To Be Completed** Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
11-Oct-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Writing - On page 60, you indicate the subwatersheds that will move forward into Tier 1. Provide a map that shows what subwatersheds will be evaluated in Tier 1	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
11-Oct-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Part of the purpose statement page 2 states that 'The Tier 1 analysis will include an evaluation of the stress on the municipal water supply systems using a simple water budget model on a monthly basis". The purpose of the Tier 1 analysis is really to estimate the hydrologic stress of subwatersheds in order to screen out areas that are unstressed from a water quantity perspective. As an example, the purpose of the conceptual understanding provided by Mattagami states: "...Mattagami…has prepared this water budget 'conceptual understanding' on a watershed basis. The conceptual understanding provides an overview of how the groundwater and surface water interact and the movement of water through the watershed. This understanding has enabled the MRCA to determine the level of water budget assessment required to select the appropriate groundwater and surface water models."	High **Medium** Low None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
11-Oct-06	Climate Hydrology Hydrogeology Water Use **Other**	Cataraqui Mississippi-Rideau Quinte **Cataraqui/Mississipp** Cataraqui/Quinte Mississippi-Rideau/ All	Writing - The MNR would like to see similar front and back ends to the Mississippi-Rideau and Cataraqui documents. Section 7 of the Mississippi-Rideau document can be used as a back end example.	High **Medium** Low None	Completed **To Be Completed** Declined Undecided No Action Required
19-Oct-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Year should add to references, e.g main and Shaw, MNR etc	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
19-Oct-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Reference table/figure should give for rainfall/snowfall percentages	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required
19-Oct-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Use capital “C” for Drummond Centre	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required
19-Oct-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Difference in low precipitation values in table 3.1 and 3.2	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
19-Oct-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Use “rain gauges” instead of “rain gauge stations”	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required
19-Oct-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Table3.1- Change 0 in degreecetigrade-0C- to superscript	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required
19-Oct-06	**Climate** Hydrology Hydrogeology Water Use Other	Cataraqui **Mississippi-Rideau** Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Remove word “monthly gauge-wise”	High Medium **Low** None	**Completed** To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
19-Oct-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Change title of table 3-2 from “ Summary of “ to “Monthly average”	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
19-Oct-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Suggested to use “long-term annual precipitation” for “annual precipitation”	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required
19-Oct-06	Climate Hydrology Hydrogeology Water Use Other	Cataraqui Mississippi-Rideau Quinte Cataraqui/Mississipp Cataraqui/Quinte Mississippi-Rideau/ All	Punctuation error in reference: McKenney et al.,	High Medium Low None	Completed To Be Completed Declined Undecided No Action Required

DATE	CATEGORY	APPLIES TO	COMMENT	PRIORITY	ACTION
19-Oct-06	Climate	Cataraqui	Snowfall is one word	High	Completed
	Hydrology	Mississippi-Rideau		Medium	To Be Completed
	Hydrogeology	Quinte		Low	Declined
	Water Use	Cataraqui/Mississipp		None	Undecided
	Other	Cataraqui/Quinte			No Action Required
		Mississippi-Rideau/			
		All			
19-Oct-06	Climate	Cataraqui	Precipitation “deficit”-questioned word “deficit”	High	Completed
	Hydrology	Mississippi-Rideau		Medium	To Be Completed
	Hydrogeology	Quinte		Low	Declined
	Water Use	Cataraqui/Mississipp		None	Undecided
	Other	Cataraqui/Quinte			No Action Required
		Mississippi-Rideau/			
		All			