NEW BRUNSWICK
DEPARTMENT OF ENVIRONMENT

GUIDELINES TO THE

WATER SUPPLY SOURCE ASSESSMENT

PROCESS

July 2004

WATER SUPPLY SOURCE ASSESSMENT

Introduction

These guidelines have been developed to assist both the public and private sectors in the construction of and/or modification of municipal and other large-scale water supply sources. Under the Water Quality Regulation of the Clean Environment Act, all waterworks in the Province of New Brunswick using greater than 50 cubic meters of water daily require a permit to operate except in the case of a domestic well not connected to a distribution system.

The primary objective of these guidelines is to promote the proper testing and construction of water supply sources so that they will give a long-term yield of adequate quality water. In doing this, information on groundwater will be collected, and the impacts on existing water sources assessed.

Examining the Source

These guidelines establish the general information requirements necessary to evaluate proposed water source development projects. These requirements are listed in the following sections under respective steps of the assessment process. It should be emphasized that incomplete or inadequate submissions or reports will be returned to the applicant for completion before any review is carried out.

The hydrogeological assessment and yield testing must be completed under the direct supervision of a qualified hydrogeologist registered as a professional engineer or geoscientist with the Association of Professional Engineers and Geoscientists of New Brunswick. All final work must be signed and professionally sealed.

Environmental Impact Assessment

The development of a waterworks with a capacity greater than 50 cubic meters of water daily is a trigger to register under the Environmental Impact Assessment Regulation (Section (s), Schedule A).

THE WATER SUPPLY SOURCE ASSESSMENT PROCESS

The Water Supply Source Assessment involves two steps aimed at first refining the groundwater exploration target sites, and then focusing on areas that are promising for water supply development.

Step One – The Initial Application

Prior to the commencement of any hydrogeological fieldwork, an EIA registration for the proposed project must be submitted to the Director of the Project Assessment (see Appendix A). Supplementary information pertaining exclusively to the water supply exploration is also required. An application form is attached in Appendix E to facilitate this step.

It should be stressed that when locating a new groundwater supply for a **municipality**, the ramifications of the Wellfield Protection Designation must be taken into consideration at the earliest planning stages. A policy is in place requiring that the owners of all new municipal production wells request wellfield protection designation within one year of bringing the well on-line. For more information on Wellfield Protection contact the Program Manager at 457-4846.

When dealing with the siting of municipal production wells, the proponent should examine and fully exhaust potential locations within the municipal boundaries prior to looking outside the municipal limits. Furthermore, should the proposed target site(s) be located within 30 m of a watercourse(s) (stream, brook, river, wetland, etc.) a Watercourse and Wetland Alteration permit will be required. For more information on Watercourse Alteration contact the Program Manager at 457-4850.

MILESTONE 1 – Technical reviewers will review the provided documentation (EIA Registration and Step One Application) and if necessary, hold discussions with the proponent and/or the proponent's consultant. If the proposal demonstrates the potential for developing a viable water source, a recommendation will be made by the EIA Project Manager to proceed to the field investigation.

Step Two – The Field Investigation

Following approval of the proposed work, development of the water supply source may proceed to the field investigation stage. The object of the investigation is to obtain sufficient data to permit final design of the water supply source and to define the intake structure, well or wellfield's long-term safe operating capacity, water quality and impact on neighbouring water users. The following Step Two items must be carried out or addressed (as applicable). All field data, information, conclusions and recommendations must be presented in the final report for a Step Two assessment. The report must be submitted to the Director of the Sciences & Reporting Branch.

Step 2 Items listed:

(a) Carry out the necessary hydraulic testing using methods acceptable to the Minister (see Appendix B). All drawdown and recovery data should be properly displayed in three graphical forms: time-drawdown, recovery and distance-drawdown.

(b) Determine the long-term safe yields and include an analysis of any boundary conditions indicated by the hydraulic testing. Climate data published by Environment Canada may be used in an assessment of the safe yield. Boundary conditions should be related to specific local geological conditions.

(c) Provide a representative water quality analysis, including as a minimum general chemistry, trace metals and bacteria. General chemistry and trace metal parameters must be equivalent to the *I package of the Department of Environment and Local Government (see Appendix C). A minimum of two bacterial analysis samples from each testing point must be collected at different times with as much time separation between samples as is practical. The supervising hydrogeologist should use their professional judgment in determining if other parameters require testing. This would be dependent upon the local conditions (eg. pesticide application in vicinity, past industrial use of land, etc.) and the end use of the water supply (eg. drinking water supply, industrial supply, aquaculture supply, etc.).

(d) Provide a brief, but complete environmental review of the proposed water supply source and identify any potentially adverse impacts on existing local water supplies including any existing private groundwater supplies.

(e) Provide final design drawings of the permanent well structure. It is recommended that a minimum land area of one acre be reserved for each production well and that the well be located toward the center of this land parcel.

(f) For an infiltration gallery provide a specific description and explanation of the testing methods used, as well as a description and analysis of the materials found or placed at the site.

(g) Write a report summarizing the work carried out. This report shall include the methods, field data and relevant information used to arrive at the conclusions stated in the report and should be written in such a way that it satisfies the reporting requirements as discussed in Appendix B of these guidelines. Variations from the approved plan submitted in Step 1 should be identified, explained and justified.

(h) Provide a detailed discussion of long-term sustainable yield of the well(s) as it relates to the geological and hydrogeological characteristics of the aquifer (develop a relationship between the geology and sustainable yield). Also, discuss the relationship between the well(s) and other water users in the area (private water wells, industry, commercial, etc.) and the cumulative effect of these water withdrawals on the aquifer.

(i) In the report provide a clear compilation of all data, geology, background information from previous work, explanations and interpretations of all analyses, recommendations with respect to source protection and monitoring and discussions of unusual site conditions.

Milestone 2 - Technical reviewers will evaluate the final report and, if necessary, hold discussions with the proponent and/ or the proponent's consultant. Once the final report has been reviewed, recommendations will be sent to the EIA project manager. An EIA Determination will be issued for the project. Conditions to the determination may include maximum pumping rates, monitoring requirements, treatment requirements, etc.

*Important: If at any time the proponent requires an **additional** water supply, a new EIA and WSSA registration will be required.*

Appendix A
Contacts

Mailing address:

Paul Vanderlaan P.Eng., Director
Project Assessment Branch
NB Department of the Environment and Local Government
Marysville Place, 20 McGloin Street, 2nd Floor
Fredericton, New Brunswick
E3A 5T8

phone: 444-5382
fax: 453-2627

For questions pertaining to:

Water Quality:	Todd Arsenault Sciences & Reporting Branch	457-4844
	Don Fox Sciences & Reporting Branch	457-4844
Hydraulic Testing:	Gina Giudice (municipal) Sciences & Reporting Branch	457-4844
	Annie Daigle (industrial) Sciences & Reporting Branch	457-4844
Wellfield Protection:	Shawn Hamilton Sustainable Planning Branch	457-4846
Watercourse and Wetland Alteration:	Joanne Glynn Watercourse Alterations & Wetlands Program	457-4850
Property Searches:	Samantha Schaffer Remediation Branch	444-5955
Land Use Zoning:	Gary Mersereau Sustainable Planning Branch	453-2171

Appendix B
Testing & Reporting Guidelines

Field Tests

Test wells, holes or pits (referred to below as wells) should be located on a 1:10,000 scale map and the PID given for the property. All test wells should be numbered in a consistent and standard way with no two wells having the same number. The standard for this shall be the year drilled followed by the sequential number of the well drilled on this project. For example, the fifth well in a project occurring in 1990 would be 90-5. All test wells should be constructed to standards detailed in the Construction and Testing Procedures for Drilled Water Wells (N.B. Department of the Environment, 1978) and in the Water Well Regulation.

Wells should be logged at the time of drilling by the hydrogeologist. Any samples must have a date, time and location associated with the results. Depths should refer to the depth below top of casing (BTOC).

Pump test data reports should be legible and show clearly the testing location, well log and construction details, time, observer and water level measuring device.

In general, pumping tests which have been carried out in an unconfined aquifer within 10 days of 40 mm of rain or during a month of abnormally (>130 % normal) high rainfall may be considered unsuitable for the approval process. In such aquifers well-pumping tests should not be conducted during the normal recharge seasons of October to December, or mid-March to the end of May, unless it can be clearly documented that recharge has not begun. It is the consultant's responsibility to ensure that testing is carried out under suitable conditions. The above conditions would not apply to fully confined aquifers.

As a general rule, wells should be fully developed before yield tests are performed. A minimum of two hours of development should be carried out. The improvement in the well development can be estimated by the change in specific capacity at a fixed pumping rate. These observations should be included with the raw data submitted to the Department.

A step test is recommended (with a minimum of three steps). In addition, a constant rate test with a minimum duration of 24 hours is required. For unconfined, unconsolidated aquifers a 72 hour pump test is required. For bedrock aquifers a 72 hour pump test is required. Drawdown and recovery measurements must be taken in at least one observation well (exclusive from the production well) within the drawdown cone. The recovery measurements must be continued until the original static water level is reached or a period equal to one-half the length of the constant rate test is completed (whichever occurs first).

Constant rate tests shall only be considered to be constant rate if the measured flows fall within $\pm$ 5 % of the average flow over the entire test.

Reports submitted to the Department must include a complete description of the methods used and must explain in specific terms any variations from accepted practice. Copies of the original data sheets from the pump tests should be appended to the report. Please also indicate whether a well video was taken.

Presentation

Standard geological cross-sections should be included. Whenever possible, the soils or geological information generated by the investigation should be described graphically.

Logs should be presented in tabular and columnar format including any geophysical logs, which may have been made. Well construction details and information of hydrogeological interest should be combined in a similar way.

Semi-log plots of pumping tests should be constructed so as to make the slope of the graph easily measurable in the trend-setting region. The trend line drawn for analysis should be clearly marked. All graphs should include the test information (date, time, observation point, pumped well, and pumping rate) and should have clearly and understandably titled axes.

Analysis

For all projects the analytical method should be described or referenced. Non-standard analyses should be described in full detail, including the theoretical basis.

The common analyses of the constant rate tests include the Cooper-Jacob straight line or Theis curve matching techniques. The step test should be analyzed to estimate the well efficiency using methods described by Walton or equivalent.

Distance-drawdown and time-drawdown plots of the test data should be included with an analysis of any boundaries that are discovered. Safe yield calculations should be made based on the test data using representative field values of transmissivity and storativity.

In areas that already have substantial water use, a numerical groundwater model may be required to assess safe yield, potential for interference and water balance.

Appendix C
Department of the Environment and Local Government's Analytical Services Package Information
(*I package – Potable Water Package)

*I Package (Potable Water Package)

=NO3
=TH
Al
Alkalinity
As
B
Ba
Br
Ca
Cd
Cl
Dl
Conductivity
Cr
Cu
F
Fe
K
Mg
Mn
Na
NO2 (Nitrate)
Nox (Nitrate/Nitrite)
NO3 (Nitrate)
Pb
pH
Sb
Se
SO4
Tl
Turbidity
U
Zn
Hardness

Appendix D
Useful references

British Columbia Ministry of the Environment. 1999. Evaluating Long-Term Well Capacity for a Certificate of Public Convenience and Necessity. **http://wlapwww.gov.bc.ca/wat/gws/gwdocs/eval_well/toc.html**

Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Guidelines, Book One, Chapter Four - Canadian Water Quality Guidelines for the Protection of Aquatic Life. Canadian Council of Ministers of the Environment, Winnipeg.

Driscoll, F.G. 1986. Groundwater and Wells. Johnson Division, Minnesota. 1089 pp.

Environment Canada, Atlantic Climate Centre**. http://atlantic-web1.ns.ec.gc.ca/climatecentre/default.asp?lang=En&nav=238E6A17-11**.

Fetter, C.W. 1994. Applied Hydrogeology. Prentice Hall, New Jersey. 691 pp.

Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice Hall. 604 pp.

Health Canada. 1996. Guidelines for Canadian Drinking Water Quality, Supply and Services Canada, Ottawa.

Kruseman, G.P. and N.A. DeRidder. 1970. Analysis and Evaluation of Pumping Test Data, International Institute for Land Reclamation and Improvement, Wageningen, the Netherlands, 200 pp.

N.B. Department of the Environment, 1978. Construction and Testing Procedures for Drilled Water Wells. 23 pp.

N.B. Department of the Environment, 1995. Environmental Impact Assessment Registration Guide. http://www.gnb.ca/elg-egl/0377/0002/0001-e.html

N.B. Department of the Environment and Local Government, Watercourse Alteration Program. **http://www.gnb.ca/0009/0373/0001/0004-e.html**

N.B. Department of the Environment and Local Government, 2000. Wellfield Protection Program. **http://www.gnb.ca/0009/0371/0001/index.html**

Patton, F.D. and J.D. Mollard. 1961. Science and System in Groundwater Investigations. Canadian Municipal Utilities.

Robinson, J.W. 1986. Guidelines for Aquifer Pumping Tests. Dept. of Environment, Government of Newfoundland & Labrador, 25 pp.

Various authors, Wellfield Protection Study documents.

Appendix E
Step One Application Form

Water Supply Source Assessment
Step One Application

Pursuant to Section 3(5) of
The Water Quality Regulation 82-126
Clean Environment Act

Please answer the following questions:

1) Name of proponent:_____

2) The proposed water supply is to be used for what purpose?_____
_____
_____
_____

3) Required water quantity (in m^3/day):_____

4) List alternate water supply sources in area (including municipal systems):_____
_____
_____

5) Outline proposed work schedule: _____
_____
_____
_____
_____
_____

6) Discuss area hydrogeology as it relates to the project requirements:_____
_____
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7) Identify any existing pollution or contamination hazards within a (minimum) 500 m radius of the proposed drill targets. If groundwater use problems (quantity or quality) have occurred in the past, then these should be identified. Historical land use that might pose a contamination hazard (i.e. tannery, industrial, disposal, etc.) should also be flagged._____
_____
_____
_____
_____
_____
_____
_____
_____
_____

8) Identify any watercourse(s) (stream, brook, river, wetland, etc.) within 30 m of the proposed drill targets.
_____
_____
_____
_____

9) Identify site supervisory personnel involved in the source development (municipal officials, consultants and drillers)._____
_____
_____
_____

10)Attach a 1:10000 map and/or recent air photo clearly identifying the following:
- proposed drill targets
- domestic or production wells within a 500 m radius from the drill target
- any potential hazards identified in question 7.

11) Attach a land use/ zoning map of the area (if any). Superimpose drill targets on this map.

Mail or deliver, along with EIA Registration to:

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