Sask Polytech Library Moose Jaw
3 2293 000867781

Prepared by Environment Canada on behalf of the
FEDERAL PROVINCIAL GROUNDWATER WORKING GROUP

GUIDELINES

GUIDELINES
GUIDELINES
GUIDELINES
GUIDELINES
GUIDELINES

NATIONAL SURVEY ON PRIORITY TOPICS FOR THE DEVELOPMENT OF GROUNDWATER GUIDELINES

GUIDELINES
GUIDELINES

GB
1029
.N53
1993

April 1, 1993

nvironment anada | Environnement Canada
Canada

[redacted]

National Survey on Priority Topics for the Development of Groundwater Guidelines

Prepared by:

E. Nicolson
Environment Canada
Hull, Quebec

LIBRARY
PALLISER INSTITUTE SIAST
MOOSE JAW SASKATCHEWAN

551
.490
971
Nic

Printed on paper that contains recovered waste

Published by authority of
the Minister of the Environment

© Minister of Supply and Services Canada 1993
Cat. N° En 37-105/1993E
ISBN 0-662-21212-6

CONTENTS

	Page
SUMMARY	1
INTRODUCTION	4
PROCESS	4
RESPONSE GROUPS	5
GENERAL COMMENTS ON THE RESULTS	6
SUMMARY OF RESULTS	
TOP THREE / TOP TEN PRIORITIES - by response group	11
RELATIVE NEED - by response group	13
RELATIVE NEED - all response groups	19
OVERALL PRIORITY (ALL TOPICS), based on relative need - all response groups	20
DETAILED RESULTS FOR RELATIVE NEED - by topic	
■ General	22
■ The activities of land based sectors in relation to groundwater protection	23
■ Data and information	23
■ Technical	24
■ Administrative	24
■ Technology transfer	25
■ Other information activities	25
AVERAGE SUPPORT FOR GUIDELINES - by response group	26
APPENDIX 1 - membership of the Federal Provincial Groundwater Working Group	27
APPENDIX 2 - distribution list	28
APPENDIX 3 - questionnaire	36
APPENDIX 4 - participants	41

SUMMARY

- To understand this summary it helps to refer to the pages in question.

- To put the significance of the opinions of each user group into perspective the reader should first refer to Page 5 "RESPONSE GROUPS and NUMBER OF RESPONSES"

TOP THREE PRIORITIES - by response group.....Page 11
TOP TEN PRIORITIES - by response group.....Page 12
RELATIVE NEED - by response group .....Page 13
RELATIVE NEED - all response groups .....Page 19
% SUPPORT FOR ALL 41 TOPICS - all response groups .....Page 20

RELATIVE NEED

Four topics were rated by more than 50% of all respondents as being in URGENT need of action: (PAGE 19)

- The development of a National Groundwater Strategy

- The allocation of $ and human resources by water management agencies to groundwater resource management in the context of;
  - other resource management allocations
  - the economic value of groundwater
  - the contribution made by groundwater to surface water supplies
  - the current understanding of the consequences for future generations of present day groundwater management practices

- The protection of recharge areas;
  - well head protection
  - identification of potential sources of groundwater pollution

- Dumpsite location in relation to groundwater protection

Three topics (including two of the above) were SUPPORTED by more than 90% of all respondents; (PAGE 19)

- The National Groundwater Strategy

- The protection of recharge areas

- Agricultural practices in relation to groundwater use and protection.

PRIORITY TOPICS; TABLE 1(Top 3 - p. 11) TABLE 2(Top 10 - p. 12)

One of the topics rated as being in URGENT NEED of action by at least 50% of all respondents (in the "relative need" section of the questionnaire);

- The National Groundwater Strategy

has been rated as being in the TOP THREE priorities by at least 50% of the following response groups;

- Other federal and provincial groundwater departments and agencies

- Municipal associations/officials

- Research community

35% of Consultants/private sector, and Federal and Provincial Resource Managers also rated the development of a National Groundwater strategy as one of their top three priorities.

- The development of a National Groundwater Strategy was rated in the TOP TEN priorities of at least 50% of respondents in the following groups:

- Federal and provincial resource managers

- Other federal and provincial departments and agencies

- Municipal associations/agencies

- Research community

- Consultants

Another topic which was rated as being in URGENT need of action by at least 50% of all respondents (in the "relative need" section of the questionnaire);

- the allocation of resources to groundwater management was rated in the TOP THREE priorities of at least 50% of respondents from the following groups:

- Federal and provincial resource managers

- Municipal associations/officials

35% of Researchers and 20% of Consultants also rated this topic as one of their top three priorities.

OTHER TOPICS WHICH WERE HIGHLY RATED by a significant number of respondents from several of the major user groups included;

- Aquifer mapping/groundwater availability studies
- Aquifer designation/sensitivity mapping
- Site remediation
- Protection of recharge areas
- Agricultural practices in relation to groundwater use and protection
- Industrial and manufacturing practices in relation to groundwater use and protection
- Municipal activities in relation to groundwater use and protection
- Dumpsite location in relation to groundwater protection
- Promotion of public awareness on groundwater matters
- Promotion of increased awareness at the senior official and political levels

---

The overall priorities of all response groups, based on the "relative need" section of the questionnaire, indicate at least 75% support for the development of Groundwater Guidelines on 22 of the 41 topics. (PAGE 20)

Two topics, (PAGE 19)

- Aquifer pumping tests

- The selection and use of Global Positioning Systems

were rated as NOT NEEDED by more than 33% of <u>all respondents</u> *

---

*
Topics of a narrow technical nature (e.g. the selection and use of Global Positioning Systems, and earth energy development) and those of limited application (e.g. protection against saline intrusion) inevitably receive low ratings, (and a high % "no comment"). This does not mean that guidelines should not be developed for these topics on a priority basis.

INTRODUCTION

The National Survey to identify priority topics for the development of Groundwater Guidelines, was undertaken by Environment Canada in support of the activities of the Federal Provincial Groundwater Working Group (FPGWG).

The FPGWG is an ad hoc committee, presently composed, for the most part, of groundwater managers representing all provinces and several federal departments. (See APPENDIX 1)

The committee evolved from a series of national groundwater management workshops held over the past three years and is currently the principal mechanism by which the federal government consults with the provinces on groundwater matters. It is considered a temporary arrangement while awaiting the establishment of an accredited federal/provincial body to address groundwater management needs at the national level.

Process

Approximately 300 "key" officials and interested parties were sent the questionnaire and supporting material as per Appendices 2 & 3. The list of recipients was compiled from a number of sources including Environment Canada's Groundwater Directory, the Corpus Almanac and Canadian Sourcebook, and from information provided by the members of the Federal Provincial Groundwater Working Group. The original response deadline was February 15, 1993. This was subsequently extended to March 5, by which time approximately 112 responses had been received.

With a response of approximately 40% and a total named participation of 152 (Appendix 4), the survey can probably provide some meaningful information for the use of federal and provincial groundwater managers.

The time taken by all of you in completing the questionnaire, in consulting with your colleagues and in many instances, by providing extensive and useful comments, is most appreciated. To participants listed in Appendix 4 - THANK YOU.

Confidentiality

While the questionnaires give no indication that the information contained therein will be treated as confidential upon completion, it would seem appropriate that all input be used only for the purpose identified.

RESPONSE GROUPS; (and responses received by March 5, 1993)

1) FEDERAL AND PROVINCIAL GROUNDWATER RESOURCE MANAGERS (26 Responses) including officials from Resource Management Departments, Environment Departments, and Natural Resources Departments.

2) OTHER FEDERAL AND PROVINCIAL DEPARTMENTS AND AGENCIES (7 Responses)

3) MUNICIPAL ASSOCIATIONS/OFFICIALS (4 Responses)

4) RESEARCH COMMUNITY (21 Responses) including federal, provincial, university and other research organizations.

5) CONSULTANTS/PRIVATE SECTOR (47 Responses). Many consultants described their interest and expertise as being "research" or "resource management" etc. All consultants have been put in the Consultant/Private Sector group.

6) GROUPS REPRESENTING SCIENCE, INDUSTRY etc. (3 Responses)

7) ENVIRONMENTAL/CITIZEN's GROUPS (3 Responses)

8) LATE ENTRIES - included in statistical summaries (5 Responses)
- not included in statistical summaries (8 Responses)

9) NO SUPPORT EXPRESSED FOR ANY TOPIC (2 Responses)

GENERAL COMMENTS ON THE RESULTS

The diversity of views is demonstrated by the fact that every potential guideline topic was at least in one person's top ten list.

There is not necessarily a direct comparison between the results of the "top ten" listings and the "relative need" listings. Some people have recognized the importance of having topics addressed by management, but have either not commented on the "relative need" or have stated that a guideline is "not needed". This may be because they do not consider a "guideline" as being the appropriate means of addressing that particular topic, - or because they are aware of existing guidelines or criteria on that subject.

Therefore the top ten results should be considered as an indication of the perceived priority for management interest in that particular topic and not as an indication of the need to develop a guideline on that topic. Conversely a low level of support on the "relative need" chart may not necessarily mean that there is no need for management consideration for that particular topic.

Another factor which may influence the results is a probable lack of knowledge of some of the more specialized topics. This may result in a higher than normal number of "no comments". For this reason Table 3 provides a direct comparison between % SUPPORT and % NO COMMENT.

The 41 topics chosen for this survey were thought to represent many of the subjects which could perhaps be addressed by the development of "guidelines", or documented in some other manner. As discussions proceed the list will no doubt be ammended through additions, deletions and regroupings.

The responses to this National Survey will, to some extent, reflect the views of those who generally support the idea of consolidating available knowledge and expertise (not necessarily by the use of guidelines) for the use of resource managers. The 60% of questionnaire recipients who did not respond may have greatly differing views. Hopefully their views will become known. The results therefore do not represent a consensus amongst the groundwater community as to the desireability of developing guidelines or of their priorities, but rather give some small indication of possible areas for priority consideration.

Analysis

With regard to multiple author questionnaires, such input presumably represents a consensus. While these represent a "survey within a survey" and should therefore be given more attention than

input from an individual, the weighting factor would be difficult to determine. In view of the intended uses for the information gathered, it was not thought necessary to incorporate such a refinement.

Analysis on a regional basis has not been done due to the small sample size within each of the seven occupation groups.

SUMMARY OF RESULTS

TOP THREE/TOP TEN PRIORITIES - By response group

NOTE:

WHEN CONSIDERING THE RESULTS IN TABLES 1 AND 2 PLEASE NOTE THAT SOME RESPONSE GROUPS HAVE VERY FEW PARTICIPANTS.

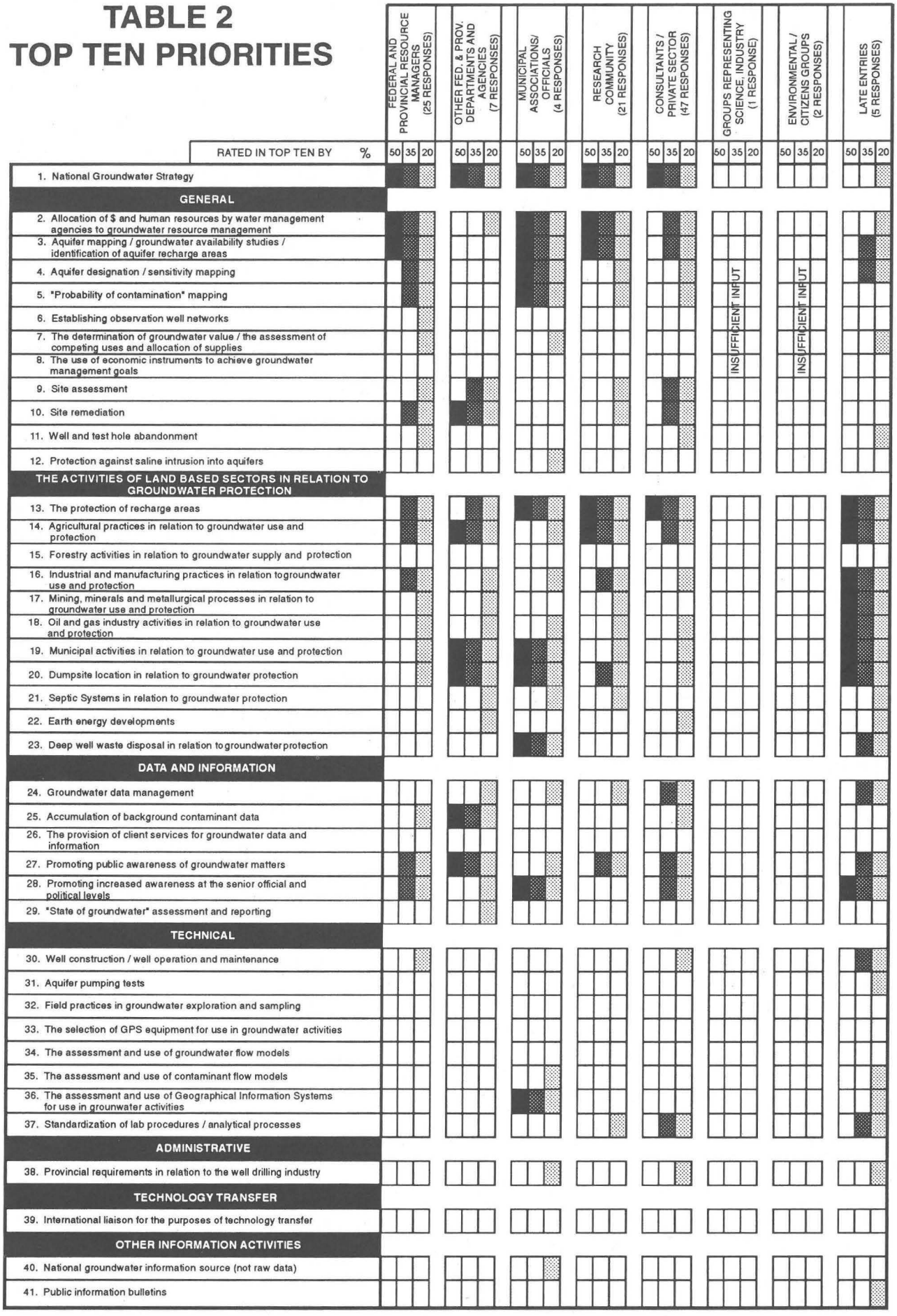
TABLE 1
TOP THREE PRIORITIES

	FEDERAL AND PROVINCIAL RESOURCE MANAGERS (25 RESPONSES)			OTHER FED. & PROV. DEPARTMENTS AND AGENCIES (7 RESPONSES)			MUNICIPAL ASSOCIATIONS/ OFFICIALS (4 RESPONSES)			RESEARCH COMMUNITY (21 RESPONSES)			CONSULTANTS / PRIVATE SECTOR (47 RESPONSES)			GROUPS REPRESENTING SCIENCE, INDUSTRY (1 RESPONSE)			ENVIRONMENTAL / CITIZENS GROUPS (2 RESPONSES)			LATE ENTRIES (5 RESPONSES)		
RATED IN TOP THREE BY %	50	35	20	50	35	20	50	35	20	50	35	20	50	35	20	50	35	20	50	35	20	50	35	20
1. National Groundwater Strategy																								
GENERAL																								
2. Allocation of $ and human resources by water management agencies to groundwater resource management																								
3. Aquifer mapping / groundwater availability studies / identification of aquifer recharge areas																								
4. Aquifer designation / sensitivity mapping																								
5. "Probability of contamination" mapping																								
6. Establishing observation well networks																								
7. The determination of groundwater value / the assessment of competing uses and allocation of supplies																								
8. The use of economic instruments to achieve groundwater management goals																								
9. Site assessment																								
10. Site remediation																								
11. Well and test hole abandonment																								
12. Protection against saline intrusion into aquifers																								
THE ACTIVITIES OF LAND BASED SECTORS IN RELATION TO GROUNDWATER PROTECTION																								
13. The protection of recharge areas																								
14. Agricultural practices in relation to groundwater use and protection																								
15. Forestry activities in relation to groundwater supply and protection																								
16. Industrial and manufacturing practices in relation to groundwater use and protection																								
17. Mining, minerals and metallurgical processes in relation to groundwater use and protection																								
18. Oil and gas industry activities in relation to groundwater use and protection																								
19. Municipal activities in relation to groundwater use and protection																								
20. Dumpsite location in relation to groundwater protection																								
21. Septic Systems in relation to groundwater protection																								
22. Earth energy developments																								
23. Deep well waste disposal in relation to groundwater protection																								
DATA AND INFORMATION																								
24. Groundwater data management																								
25. Accumulation of background contaminant data																								
26. The provision of client services for groundwater data and information																								
27. Promoting public awareness of groundwater matters																								
28. Promoting increased awareness at the senior official and political levels																								
29. "State of groundwater" assessment and reporting																								
TECHNICAL																								
30. Well construction / well operation and maintenance																								
31. Aquifer pumping tests																								
32. Field practices in groundwater exploration and sampling																								
33. The selection of GPS equipment for use in groundwater activities																								
34. The assessment and use of groundwater flow models																								
35. The assessment and use of contaminant flow models																								
36. The assessment and use of Geographical Information Systems for use in grounwater activities																								
37. Standardization of lab procedures / analytical processes																								
ADMINISTRATIVE																								
38. Provincial requirements in relation to the well drilling industry																								
TECHNOLOGY TRANSFER																								
39. International liaison for the purposes of technology transfer																								
OTHER INFORMATION ACTIVITIES																								
40. National groundwater information source (not raw data)																								
41. Public information bulletins																								

INSUFFICIENT INPUT

INSUFFICIENT INPUT

TABLE 2
TOP TEN PRIORITIES



RELATIVE NEED - by response group

NOTE:

WHEN CONSIDERING THE FOLLOWING RESULTS PLEASE NOTE THAT SOME RESPONSE GROUPS HAVE VERY FEW PARTICIPANTS.

Topics rated as URGENT by more than 50% of respondents

FEDERAL AND PROVINCIAL GROUNDWATER RESOURCE MANAGERS 26 RESPONSES
(combined "national priorities" and "agency priorities")

- Allocation of resources
- Aquifer mapping
- Aquifer designation
- Protection of recharge areas
- Agricultural practices
- Dumpsite location
- Public awareness
- Awareness at senior official and political level

THER FEDERAL AND PROVINCIAL DEPARTMENTS AND AGENCIES 7 responses
(combined "national" and "agency" priorities)

- National grounwater strategy
- Site assessment
- Site remediation
- Agricultural practices
- Municipal activities
- Dumpsite location
- Promoting awareness at senior official and political levels

MUNICIPAL ASSOCIATIONS/OFFICIALS 4 responses
(Rated as urgent by at least 3 of the 4 respondents)

- National groundwater strategy
- Allocation of resources
- Aquifer mapping
- "Probability of contamination" mapping
- Establishing observation well networks
- Awareness at senior official and political levels

RESEARCH COMMUNITY 21 responses

- National Groundwater Strategy
- Allocation of resources
- Aquifer mapping
- "Probability of contamination" mapping

- Protection of recharge areas
- Agricultural practices
- Municipal activities
- Dumpsite location
- Public awareness

CONSULTANTS/PRIVATE SECTOR — 47 responses

- Protection of recharge areas

GROUPS REPRESENTING SCIENCE, INDUSTRY etc., — 3 responses
(rated as urgent by at least 2 of the 3 respondents)

None

ENVIRONMENTAL/CITIZEN'S GROUPS — 3 responses
(Rated as urgent by at least 2 of the 3 respondents)

- Protection of recharge areas
- Mining, minerals and metallurgical processes
- Oil and gas industry activities

LATE ENTRIES (2 management, 1 research, 1 mining, 1 consultant)

- Protection of recharge areas
- Municipal activities
- Awareness at senior official and political levels

Topics rated as URGENT, or NEEDED (not urgent) by more than 90% of respondents

FEDERAL AND PROVINCIAL GROUNDWATER RESOURCE MANAGERS
(combined "national" and "agency" priorities)

- National Groundwater Strategy
- Aquifer mapping
- Aquifer designation
- Protection of recharge areas
- Dumpsite location

OTHER FEDERAL AND PROVINCIAL DEPARTMENTS AND AGENCIES
(Combined national and agency priorities)

- National groundwater strategy
- Site assessment
- Site remediation
- Agricultural practices
- Oil and gas industry activities
- Promoting public awareness
- National groundwater information source

MUNICIPAL ASSOCIATIONS/OFFICIALS
(Rated as urgent or needed by at least 3 of the 4 respondents)

- 28 topics - All except 8, 11, 15, 17, 22, 23, 25, 26, 31 to 34, and 37.

RESEARCH COMMUNITY

- Allocation of resources
- Aquifer mapping
- "Probability of contamination" mapping
- Protection of recharge areas
- Agricultural practices
- Dumpsite location

CONSULTANTS/PRIVATE SECTOR

- National Groundwater Strategy
- Protection of recharge areas
- Agricultural practices
- Industrial and manufacturing practices

GROUPS REPRESENTING SCIENCE, INDUSTRY etc.,
(Rated as urgent or needed by at least 2 of the 3 respondents)

- National groundwater strategy
- Site remediation
- Saline intrustions
- Protection of recharge areas
- Agricultural practices
- "State of groundwater" reporting
- Lab. procedures/analytical processes
- Provincial requirements re well drilling industry
- National information source

ENVIRONMENTAL/CITIZEN'S GROUPS
(Rated as urgent or needed by at least 2 of the 3 respondents)

- National groundwater strategy
- Aquifer mapping
- Aquifer designation
- Site remediation
- Protection of recharge areas
- Agricultural practices
- Forestry activities
- Industrial and manufacturing practices
- Mining, minerals and metallurgical processes
- Oil and gas industry activities
- Municipal activities
- Public awareness
- Awareness at senior official and political levels

- "State of groundwater" reporting
- Groundwater flow models
- Contaminant flow models

LATE ENTRIES (2 management, 1 research, 1 mining, 1 consultant)
(Rated as urgent or needed by at least 4 of the 5 respondents)

- 31 topics - all except 6, 8, 9, 22, 23, 29, 33, 39, 40, 41.

Topics rated as NOT NEEDED by more than 33% of respondents

FEDERAL AND PROVINCIAL GROUNDWATER RESOURCE MANAGERS
(combined national and agency priorities)

- Pumping tests

OTHER FEDERAL AND PROVINCIAL DEPARTMENTS AND AGENCIES
(Combined national and agency priorities)

None

MUNICIPAL ASSOCIATIONS/OFFICIALS
(Rated as not needed by at least 2 of the 4 respondents)

- Earth energy
- Background contaminant data
- Pumping tests
- Field practices
- Selection of GPS equipment
- Lab. procedures/analytical processes

RESEARCH COMMUNITY

- Determination of groundwater value
- Pumping tests
- GPS equipment

CONSULTANTS/PRIVATE SECTOR

- Determination of groundwater value
- Use of economic instruments
- Earth energy
- Pumping tests
- GPS equipment

GROUPS REPRESENTING SCIENCE, INDUSTRY etc.,
(rated as not needed by at least 2 of the 3 respondents)

- Well construction

ENVIRONMENTAL/CITIZEN'S GROUPS
(Rated as not needed by at least 2 of the 3 respondents)

- Data management
- Client services

LATE ENTRIES (2 management, 1 research, 1 mining, 1 consultant)
(Rated as not needed by at least 2 of the 5 respondents)

- Establish observation well networks
- Earth energy
- International liaison
- National information source
- Public information bulletins

Topics rated as DO NOT DEVELOP, POTENTIAL NEGATIVE IMPACT by more than 20% of respondents

FEDERAL AND PROVINCIAL GROUNDWATER RESOURCE MANAGERS
(combined national and agency responses)

None

OTHER FEDERAL AND PROVINCIAL DEPARTMENTS AND AGENCIES
(Combined national and agency priorities)

None

MUNICIPAL ASSOCIATIONS/OFFICIALS
(Rated as potentially harmful by at least 2 of the 4 respondents)

None

RESEARCH COMMUNITY

- Groundwater flow models
- Contaminant flow models

CONSULTANTS/PRIVATE SECTOR

None

GROUPS REPRESENTING SCIENCE, INDUSTRY etc.,
(Rated as potentially harmful by at least 2 of the 3 respondents)

None

ENVIRONMENTAL/CITIZEN'S GROUPS
(Rated as potentially harmful by at least 2 of the 3 respondents)

None

LATE ENTRIES (2 management, 1 research, 1 mining, 1 consultant)
(Rated as potentially harmful by at least 2 of the 5 respondents)

None

RELATIVE NEED - All response groups

Topics rated as URGENT by more than 50% of respondents

- National groundwater strategy
- Allocation of resources
- Protection of recharge areas
- Dumpsite location

Topics rated as URGENT, or NEEDED (not urgent) by more than 90% of respondents

- National groundwater strategy
- Protection of recharge areas
- Agricultural practices re groundwater use and protection

Topics rated as NOT NEEDED by more than 33% of respondents

- Aquifer pumping tests
- Selection of GPS equipment

Topics rated as DO NOT DEVELOP, POTENTIAL NEGATIVE IMPACT by more than 20% of respondents

None

TABLE 3

OVERALL PRIORITY BASED ON "RELATIVE NEED"
All response groups

Note:

There is, to some extent, a relationship between the "% Support" and the "% No comment" columns. This is particularly apparent in instances where topics have received relatively little support. It should be kept in mind when considering the need for the development of guidelines on some of the more technical and consequently less well known topics.

		Topic #	% Support	% No comment
1)	PROTECTION OF RECHARGE AREAS	13	95	4
2)	NATIONAL GROUNDWATER STRATEGY	1	95	1
3)	AGRICULTURAL PRACTICES RE RE GROUNDWATER USE AND PROTECTION	14	95	4
4)	DUMPSITE LOCATION RE GROUNDWATER PROTECTION	20	89	4
5)	INDUSTRIAL AND MANUFACTURING PRACTICES RE GROUNDWATER USE AND PROTECTION	16	89	4
6)	ALLOCATION OF RESOURCES BY WATER MANAGEMENT AGENCIES	2	88	4
7)	AQUIFER MAPPING	3	88	4
8)	MUNICIPAL ACTIVITIES RE GROUNDWATER USE AND PROTECTION	19	86	6
9)	AQUIFER DESIGNATION/ SENSITIVITY MAPPING	4	86	5
10)	MINING, MINERALS AND METALLURGICAL PROCESSES RE GROUNDWATER USE AND PROTECTION	17	86	6
11)	PROMOTING PUBLIC AWARENESS	27	85	2
12)	OIL AND GAS INDUSTRY ACTIVITIES RE GROUNDWATER USE AND PROTECTION	18	85	9
13)	SITE REMEDIATION	10	84	6
14)	AWARENESS AT SENIOR OFFICIAL AND POLITICAL LEVELS	28	81	3
15)	SITE ASSESSMENT	9	81	4
16)	SEPTIC SYSTEMS RE GROUNDWATER PROTECTION	21	81	5
17)	WELL AND TEST HOLE ABANDONMENT	11	81	8
18)	NATIONAL GROUNDWATER INFORMATION SOURCE	40	81	4
19)	BACKGROUND CONTAMINANT DATA	25	79	9
20)	PUBLIC INFORMATION BULLETINS	41	78	4

		Topic #	% Support	% No comment
21)	FORESTRY ACTIVITIES RE RE GROUNDWATER SUPPLY AND PROTECTION	15	77	9
22)	"PROBABILITY OF CONTAMINATION" MAPPING	5	75	4
23)	GROUNDWATER DATA MANAGEMENT	24	74	11
24)	"STATE OF GROUNDWATER" ASSESSMENT AND REPORTING	29	74	7
25)	DEEP WELL WASTE DISPOSAL	23	73	11
26)	STANDARDIZATION OF LABORATORY PROCEDURES	37	72	9
27)	OBSERVATION WELL NETWORKS	6	71	7
28)	PROVINCIAL REQUIREMENTS RE WELL DRILLING INDUSTRY	38	70	13
29)	PROVISION OF CLIENT SERVICES	38	68	11
30)	INTERNATIONAL LIAISON	39	68	7
31)	ASSESSMENT AND USE OF GISs	36	65	7
32)	PROTECTION AGAINST SALINE INTRUSION	12	65	11
33)	ASSESSMENT AND USE OF CONTAMINANT FLOW MODELS	35	65	7
34)	WELL CONSTRUCTION	30	64	6
35)	ASSESSMENT AND USE OF GROUNDWATER FLOW MODELS	34	63	6
36)	DETERMINATION OF GROUNDWATER VALUE	7	62	7
37)	FIELD PRACTICES	32	59	8
38)	AQUIFER PUMPING TESTS	31	54	9
39)	EARTH ENERGY DEVELOPMENT (HEAT PUMPS)	22	53	18
40)	USE OF ECONOMIC INSTRUMENTS	8	50	7
41)	SELECTION OF GPS EQUIPMENT FOR USE IN GROUNDWATER ACTIVITIES	33	42	22

TABLE 4

DETAILED RESULTS FOR "RELATIVE NEED" All response groups

(Combined "national" and "agency" priorities)

	URGENT	NEEDED	NOT NEEDED	HARMFUL?	NO COMMENT
	95 %				
National groundwater strategy	56	39	3	2	1
GENERAL					
	88 %				
Allocation of $ and human resources by water management agencies to groundwater resource management	51	37	8	0	4
	88 %				
Aquifer mapping/groundwater availability studies/identification of aquifer recharge areas	38	50	6	2	4
	86 %				
Aquifer designation/sensitivity mapping	37	49	7	2	5
	75 %				
"Probability of contamination" mapping	38	37	18	4	4
	35 %				
Establishing observation well networks	20	15	20	1	7
	62 %				
The determination of groundwater value/the assessment of competing uses and allocation of supplies	20	42	25	5	7
	50 %				
The use of economic instruments to achieve groundwater management goals	11	39	27	5	17
	81 %				
Site assessment	38	43	13	2	4
	84 %				
Site remediation	40	44	8	2	6
	81 %				
Well and test hole abandonment	28	53	11	0	8

	URGENT	NEEDED	NOT NEEDED	HARMFUL?	NO COMMENT
		65 %			
Protection against saline intrusion into aquifers	9	56	24	0	11
THE ACTIVITIES OF LAND BASED SECTORS IN RELATION TO GROUNDWATER PROTECTION					
		95 %			
Protection of recharge areas	60	35	2	0	4
		95 %			
Agricultural practices in relation to groundwater use and protection	46	49	2	0	4
		77 %			
Forestry activities in relation to groundwater supply and protection	26	51	11	3	9
		89 %			
Industrial and manufacturing practices in relation to groundwater use and protection	42	47	6	1	4
		86 %			
Mining, minerals and metallurgical processes in relation to groundwater use and protection	36	50	6	1	6
		85 %			
Oil and gas industry activities in relation to groundwater use and protection	37	48	5	1	9
		86 %			
Municipal activities in relation to groundwater use and protection	41	45	8	0	6
		89 %			
Dumpsite location in relation to groundwater protection	51	38	7	0	4
		81 %			
Septic systems in relation to groundwater protection	35	46	12	1	5
		53 %			
Earth energy developments	17	36	27	2	18
		73 %			
Deep well waste disposal in relation to groundwater protection	35	38	9	8	11
DATA AND INFORMATION					
		74 %			
Groundwater data management	35	39	13	2	11
		79 %			
Accumulation of background contaminant data	22	57	11	2	9

	URGENT	NEEDED	NOT NEEDED	HARMFUL?	NO COMMENT
		68 %			
Provision of client services for groundwater data and information	16	52	14	6	11
		85 %			
Promoting public awareness of groundwater matters	43	42	10	4	2
		81 %			
Promoting increased awareness at the senior official and political level	48	33	13	4	3
		74 %			
"State of groundwater" assessment and reporting	25	49	18	2	7
TECHNICAL					
		64 %			
Well construction/well operation and maintenance	22	42	26	4	6
		54 %			
Aquifer pumping tests	13	41	34	4	9
		59 %			
Field practices in groundwater exploration and sampling	12	47	28	4	8
		42 %			
The selection of GPS equipment for use in groundwater activities	3	39	34	3	22
		63 %			
The assessment and use of groundwater flow models	4	59	22	8	6
		65 %			
The assessment and use of contaminant flow models	7	58	19	8	7
		65 %			
The assessment and use of Geographical Information Systems for use in groundwater activities	13	52	19	9	7
		72 %			
Standardization of lab procedures/analytical processes	31	41	15	4	9
ADMINISTRATIVE					
		70 %			
Provincial requirements in relation to the well drilling industry	25	45	15	2	13

	URGENT	NEEDED	NOT NEEDED	HARMFUL?	NO COMMENT
TECHNOLOGY TRANSFER					
	68 %				
International liaison for the purposes of the transfer of technology	16	52	22	3	7
OTHER INFORMATION ACTIVITIES					
	81 %				
National groundwater information source (not raw data)	16	65	14	1	4
	78 %				
Public information bulletins	17	61	18	1	4

LIBRARY
PALLISER INSTITUTE SIAST
MOOSE JAW SASKATCHEWAN

TABLE 5

AVERAGE SUPPORT FOR GUIDELINES

GROUP	URGENT	NEEDED	NOT NEEDED	POTENTIALLY HARMFUL	NO COMMENT
FED/PROV RESOURCE MANAGERS	32%	45%	13%	1%	9%
OTHER FED/PROV. OFFICIALS	insufficient input				
MUNICIPAL ASSOC./OFFICIALS	insufficient input				
RESEARCH COMMUNITY	31%	46%	14%	4%	5%
CONSULTANTS/PRIVATE	27%	47%	17%	4%	5%
REP. GROUPS SCIENCE, INDUSTRY ETC.	insufficient input				
ENV/CITIZENS GROUPS	insufficient input				

APPENDIX 1

GUIDELINE PRIORITY SURVEY DISTRIBUTION LIST 6/1/93

MEMBERS OF THE FEDERAL/PROVINCIAL GROUNDWATER WORKING GROUP

Provinces:

Newfoundland: Env. and Lands	K. Guzzwell	(709) 729 5733
Prince Edward Island: Environment	G. Somers	(902) 368 5046
Nova Scotia: Environment	H. Doane	(902) 424 5300
New Brunswick: Environment	D. Pupeck	(506) 457 4848
Quebec: Environment	R. McCormack	(418) 644 3561
Ontario: Environment	S. Singer	(416) 314 4166
Manitoba: Natural Resources	L. Gray	(204) 945 7403
Saskatchewan: Water Corporation	N. Shaheen	(306) 694 3963
Alberta: Environment	R. Hardick	(403) 427 6231
British Columbia:Env,Lands & Parks	R. Zimmerman	(604) 387 9464
Prairie Provinces Water Board	R. Kellow	(306) 522 5571

Municipalities:

Regional Municipality of Waterloo	J. Robinson	(519) 885 9424
Cumberland District Planning Commission, Nova Scotia	J. Sponagle	(902) 667 5141

Federal:

Environment Canada	J. Gilliland (Chairman)	(819) 953 1521
	E. Nicolson (Secretary)	(819) 994 6621
	J. Gibb - Atlantic reg.	(902) 426 1698
	D. McNaughton-W & N reg.	(403) 468 8029
	H. Leibscher -P & Y reg.	(604) 666 0807
	K. Novakowski - NWRI	(416) 336 4610
	G. Grove - NHRI	(306) 975 5741
Agriculture	J. Lebedin (PFRA)	(306) 780 5207
INAC	V. Schilder	(819) 997 9623

DISTRIBUTION LIST **APPENDIX 2**

FEDERAL DEPARTMENTS AND AGENCIES

Atomic Energy of Canada, Ltd.	C. Davison
Atomic Energy Control Board	P. J. Duport
Agriculture/NCR	C. Beaubien
Energy, Mines and Resources/HQ	G. McGuire
Energy, Mines and Resources/GSC	J. Scott
Energy, Mines and Resources/Energy	E. Morofsky
Environment (Ontario Region)	T. Wagner
Environment (Quebec Region)	L. Cleary
Environment (Centre St. Laurent)	D. Brûlé
Environment/Conservation and Protection/HQ	
- Economics and Conservation	T. D. Ellison
- Eco Health Branch	J. Davies
- Surveys and Information Systems Branch	H. Lerer
- Strategic Coordination Branch	A. M. Sahagian
- Environmental Protection/Yellowknife	L. Johnston
Finance	J. Beausoleil
Health and Welfare (Ottawa)	J. R. Hickman
Health and Welfare (Halifax)	T. Humes
International Joint Commission	R. Koop
National Defence	A. T. Downs
Public Works (constr. standards)	R. Vogan
Transport	D. Fairbairn
Waste Water Technology Centre	B. Jenk

PROVINCIAL DEPARTMENTS AND AGENCIES (See also members of FPGWG)

Prince Edward Island	
Environment	C. Murphy/D. E. Jardine
New Brunswick	
Environment	N. Brinsmead/D. Craig
Natural Resources and Energy	R. Irrinki/A. Seaman
Nova Scotia	
Lands, Revenues and Trusts	W. H. Lane
Environment	A. D. Cameron
Ontario	
Environment	K. Roberts
Manitoba	
Rural Development	E. Sawatsky/R. Menon
Urban Affairs	C. Toudin
Environment	D. Brown/L. Strachan
Agriculture	D. Small
Saskatchewan	
Environment and Public Safety	R. Ruggles/R. Stewart

Alberta	
Environment	H. A. Kerr/M. Zubel R. Chandler
British Columbia	
Environment, Lands and Parks	L. Hubbard/ D. A.Kasianchuk
Northwest Territories	
Renewable Resources	S. Lewis
Yukon	
Community and Transportation	A. Dell

MUNICIPAL ASSOCIATIONS/OFFICIALS

Canadian	
Federation of Canadian Municipalities	J. W. Knight
Newfoundland	
Newfoundland and Labrador Federation of Municipalities	D. Smith
Quidi Vidi-Rennies River Development Foundation (St. John's, Nfld)	
Prince Edward Island	
Federation of P.E.I. Municipalities	L. B. Doyle
Nova Scotia	
Atlantic Health Unit	F. Rockwell
Cape Breton Health Unit	M. MacLeod
Cobequid Health Unit	D. Reid
Fundy Health Unit	C. MacKinnon
Northumberland Health Unit	Director
South West Health Unit	C. MacKinnon
Union of Nova Scotia Municipalities	K. Simpson
New Brunswick	
Six Cities Organization	F. Martin/K. Frenette
Quebec	
Union des municipalités du Québec	Rep.
Ontario	
Association of Municipalities of Ontario	Rep.
Organization of Small Urban Municipalities of the A.M.O.	Rep.
Northwestern Ontario Municipal Association	J.A. MacDonald
Manitoba	
Union of Manitoba Municipalities	Rep.
Manitoba Association of Urban	Rep.

Municipalities

Saskatchewan	
City of Regina, Saskatchewan	D. Calam
City of Yorktown, Saskatchewan	M. Bernat
Saskatchewan Association of Rural Municipalities	Rep.
Saskatchewan Urban Municipalities Association	Rep.
Alberta	
Alberta Association of Municipal Districts and Counties	Rep.
Alberta Urban Municipalities Association	J. Maddison
British Columbia	
Union of B.C. Municipalities	R. Taylor
The North	
Association of Yukon Communities	J. R. Couture
Northwest Territories Association of Municipalities	Rep.

CODES AND STANDARDS ORGANIZATIONS

Canadian Standards Association	J. Dixon
National Research Council (Codes)	Rep.
DSS Canadian General Standards Board	P. C. Cameron

UNIVERSITIES AND OTHER RESEARCH ORGANIZATIONS

University of British Columbia	J. Atwater
University of British Columbia Westwater Research Centre	M. Healey
University of Alberta	J. Toth
Alberta Research Council	S. Moran
University of Lethbridge	J. Byrne
Saskatchewan Research Council	B. Schreiner/ D. van Stempfort
Saskatchewan Research Council	H. Maathuis
University of Regina	Y. chun Jin
University of Saskatchewan	J. Gillies
University of Saskatchewan	S. Kulshreshtha
University of Waterloo	R. Thomas
University of Waterloo	J. Cherry
University of Ottawa	I. Clark
Carleton University	F. Michael
University of Western Ontario	R. Quigley
University of Windsor	M. Sklash
Université Laval	P. Gélinas
INRS-Eau	M. O. Banton

University of New Brunswick	D. Bray/K. McQuarrie
Nova Scotia Community College	J. Kerr
Technical University of Nova Scotia	D. Waller
Technical University of Nova Scotia, Advisory Panel on Groundwater Quality and Quantity	T. Hennigar
Memorial University, Newfoundland	J. Gale

CONSULTANTS / PRIVATE SECTOR

British Columbia

C. Dunwoody	Morrow Environmental Conslts Inc., Burnaby
R. Dickin	Gartner Lee, Burnaby
Rep.	HBT Agra Ltd., Burnaby
M. Moncur/P. Blackett	HBT Agra Ltd., Kamloops
I. Mitchell	HBT Agra Ltd., Prince George
Rep.	HBT Agra Ltd., Victoria
B. Bosdet	Golder Associates, Kamloops
G. Patrick/D. Burnett	Golder Associates, Vancouver
Rep.	EBA Engineering Ltd., Nanaimo
S. Sylte	EBA Engineering Ltd., Vancouver
G. W. Stevenson	CBA Engineering Ltd., Vancouver
H. G. Harris	Environmental Resources Management (Canada), Vancouver
M. I. Payne	Environmental and Groundwater Geology, Sidney
W. Brown	Brown, Erdman and Associates Ltd., Vancouver
D. P. Harpley	Dames and Moore, Vancouver
M. Parsons	Klohn Leonoff Consultants Ltd., Vancouver
M. Kubaslewicz/W. Gaherty/ D. Berwanger/J. Malick/ D. E. Karwandy	Norecol Environmental Conslts, Vancouver
E. Livingston/A. Badry	Pacific Hydrology Conslt. Ltd., Vancouver
D. P. Harpley	Steffen, Robertson and Kirsten (BC) Ltd., Vancouver
R. Dakin/A. Holmes	Piteau Associates Engineering Ltd., North Vancouver
A. Smith	Adrian Smith Consulting, North Vancouver
B. Ingimundson	Thurber Engineering Ltd., Victoria
Rep.	Thurber Engineering Ltd., Vancouver
G. Wilson	Gordon Wilson Associates Inc., Vernon
Rep.	K.P.A. Engineering Ltd., Victoria
D. A. Lowen	Terracon Geotechnique Ltd., Victoria
W. Turner	Turner Groundwater Consultants, Victoria
J. Jaudrew	B.C. Aquifer Testing/Equipment Co., Victoria
R. A. Freeze	R. Allen Freeze Engineering Inc., White Rock

Alberta

R. O. van Everdingen	Calgary
U. W. Roeper	Calgary
L. Panek/L. Pitts/ C. Robertson/S. Sumer	Momenco Ltd., Calgary
T. L. Dabrowski/ P. E. Hardisty/ L. S. Lyness	Piteau Engineering Ltd., Calgary
K. Campbell	Sub-Tech Ltd., Calgary
F. Z. Khan/L. Nichols	Terracon Geotechnique Ltd., Calgary
A. Vonhof	Vonhof Consulting Ltd. Calgary
D. Y. Ho	EBA Environmental Ltd. Edmonton

Saskatchewan

W. Clifton/D. Kent	Clifton Associates Ltd., Regina
V. Beckie/M. Famulak/ G. Pasloske	Beckie Hydrogeologist Ltd., Regina
J. Mollard	J. D. Mollard and Associates Ltd., Regina
W. Meneley	W. Meneley and Associates, Saskatoon

Manitoba

J. Parry/E. Wolowich	Wardrop Engineering Inc., Winnipeg
T. Wingrove	UMA Engineering Ltd., Winnipeg
Rep.	Acres International Ltd., Winnipeg
Rep.	J. R. Cousin Consultants Ltd., Winnipeg
Rep.	D. E. Cross and Associates Inc., Winnipeg
Rep.	Delcan Western Ltd., Winnipeg
Rep.	M. M. Dillon Ltd., Winnipeg
Rep.	DS-Lea Consultants Ltd., Winnipeg
Rep.	Dyregrov Consultants, Winnipeg
Rep.	Hardy BBT Ltd., Winnipeg
Rep.	I. D. Engineering Canada Inc., Winnipeg
Rep.	KGS Group, Winnipeg
Rep.	Poetker Maclaren Lavalin Inc., Winnipeg
Rep.	Reid Crowther & Partners Ltd., Winnipeg
Rep.	Shawinigan Consultants Inc., Winnipeg
Rep.	Solmundson Engineering Group Inc., Winnipeg
Rep.	UMA Engineering Inc., Winnipeg
Rep.	Wardrop Engineering, Winnipeg

Ontario

B. Whitehead	Rural Development Consultants Ltd., Aurora
R. Thomson	Zenon Environmental Laboratories, Burlington
G. A. Kuehl	International Water Consultants Ltd., Barrie

L. J. Davis/ J. R. Rossiter	Canpolar Inc., Downsview
A. Parker	Barringer Laboratories, Mississauga
J. Nunan	Dames and Moore (Canada), Mississauga
R. C. Ostry	Monenco Ltd., Mississauga
P. J. Beck	Raven Beck, Markham
K. Raven	Raven-Beck Associates, Ottawa
R. Leech	Gartner Lee, Markham, Ontario
G. Felio	ADAMAS Engineering Inc., Nepean
D. W. Lafleur/ L. Sabourin	Intera Kenting, Nepean
G. M. Ritcey	G. M. Ritcey and Associates, Nepean
A. W. Panko	Arcturus Environmental, Niagara Falls
R. Walker	R. L. Walker and Partners Ltd., Ottawa
W. Trusty	Wayne Trusty and Associates, Ottawa
G. W. Jordan	Gamsby and Mannerow Ltd., Owen Sound
L. Bryck	Hydroterra Ltd., Thornhill
A. Lotimer/ D. W. Belanger	CH2M Hill Engineering Ltd., Waterloo
F. Rovers	Conestoga-Rovers and Associates, Waterloo
W. S. Clarke	Waterloo Geoscience Conslts Ltd., Waterloo
N. Guiguer	Waterloo Hydrogeologic, Waterloo

Québec

P. H. Rosenberg	Lupien, Rosenberg and Assocs Inc., Lachine
F. E. Parkinson	LaSalle Consulting Group Inc., LaSalle
R. St-Germain	Roche-Envirobec, Laval
M. R. Chapuis	Mont-Royal, Québec
T. Hawke	Groundwater Technology, Montréal
Président/ente	Donat Bilodeau, Ing., Brossard
C. Denis	Experts-Conseils Hydrogéo-sol, Chicoutimi
M. Drolet	Fondatec, Longueuil
I. Najjar	Hydrosult Consultant Inc., Montréal
P. Bellavance	Pluritec Ltée, Trois-Rivières
C. Schneeberger	Tecsult Inc., Montréal
A. Bélanger	Comp. Internationale Des Eaux, Saint-Mathieu-de-Beloeil
R. Des Rosiers	Arrakis Consultants Inc., Sainte-Foy
M. P. Boyer	Westinghouse Canada Inc. (Service Environnemental), Ville Saint-Laurent
R. Rouillard	Candiac, Québec
Président/ente	Techmat Inc., Jonquière
Président/ente	Laboratoires Normatec Inc., Chicoutimi
J. Verge, A. Béland	Hydrogéo Canada, Montréal
Y. Tardif	Laboratoire d'Expertise de Québec Inc., Qué.
V. Fournier	Fournier Paquin Consultants, Sainte-Foy
R. Drouin	Fondex, Hull
M. Caron	Consultants H.G.E. Inc., Sainte-Foy
A. D'Astous	Envir-Eau Inc., Hull

R. Desbiens	Daragon, Desbiens, Halde, Montréal
Président/ente	Les Consultants Michel Ayotte et Associés, Pincourt
Président/ente	Amenatech Inc., Longueuil
Président/ente	Les Laboratoires Outaouais, Gatineau
Président/ente	Groupe Tecknika Inc., Sherbrooke
Président/ente	Golder and Associés, Pointe-Claire
P. Hudon/ D. Desaulniers	Biogéo Environnement Inc., Longueuil
P. Lefrançois	Technisol Inc., Québec
P. Hansbury	Ageos Sciences Inc., Longueuil
Président/ente	Sanexen International Inc., Anjou
D. Chabot	Monterval Inc., Broisbriand
H. Sommelet	Géomines Ltée., Montréal
M. Poulin	Groupe Conseil Ads Inc., Montréal
D. Croteau	Géohydrotek Inc., Saint-Nicolas
J. Tremblay	Coop Envirotecheau, Dorval
R. Bilodeau	Consultants BPR, Québec
L. Samson	Cogemat Inc., Sainte-Thérèse

New Brunswick

Rep.	A. D. I. Limited, Fredericton
V. Nowicki	ARC Associates Ltd., Fredericton
Rep.	Fundy Eng and Consulting. Ltd., Saint John
G. Dickinson	Gemtec Ltd., Fredericton
Rep.	Geocon Inc., Fredericton
G. Violette	Jacques Whitford Env Ltd., Fredericton
J. Hart	Maritime Groundwater Inc., Fredericton
M. Riley	Nolan Davis and Assoc. (NB) Ltd., Fredericton
A. Gregory	Roy Consultants, Bathurst
S. Downe	Washburn & Gillis Assoc. Ltd., Fredericton
J. Wahl	Wahl Consulting Ltd.

Nova Scotia

D. S. MacFarlane	Jacques Whitford Environment Ltd., Dartmouth
S. Hattie	Porter Dillon Ltd., Halifax
T. Hennigar	Washburn and Gilles Assocs Ltd., Halifax
F. Baechler	Nolan Davis and Associates Ltd., Sydney

Prince Edward Island

J. C. Baglole	Delcom Consultants Inc., Summerside

Newfoundland

G. G. Bursey	Fracflow Consultants Inc., St. John's
B. R. LeDrew	LeDrew, Fudge and Associates Ltd., St. John's

GROUPS REPRESENTING SCIENCE, INDUSTRY etc.

Agricultural Institute of Canada	Rep.
Canadian Geoscience Council	Rep.
Canadian Pest Management Society	J. A. Scott
Canadian Water Resources Assoc.	R. W. Coley
Canadian Federation of Agriculture	A. P. Pollard
Canadian Manufacturers Association	Rep.
Canadian Petroleum Association	Rep.
Canadian Association of Oilwell Drilling Contractors	Rep.
Canadian Water Well Association	J. Wilson
International Assoc. of Hydrogeologists	Rep.
Mining Association of Canada	Rep.

ENVIRONMENTAL/CITIZEN'S GROUPS

Canadian Environmental Law Association	T. Vigod
Canadian Environmental Network	E. Schacherl
Canadian Nature Federation	J. Prescott
Conservation Council of New Brunswick	J. Harvey
Conservation Council of Ontario	D. R. Hardy
Ecology Action Centre	President
Energy Probe - Energy Probe Research Foundation	A. Turner
Fondation québécoise en environnement	L.-P. Allard
Island Nature Trust (PEI)	President
Pollution Probe Foundation	G. Love
Société pour vaincre la pollution	D. Green
The Rawson Academy of Aquatic Science	P. A. Larkin

APPENDIX 3

SURVEY TO IDENTIFY PRIORITY TOPICS FOR GROUNDWATER GUIDELINES

DEFINITION; Websters New World Dictionary

Guideline A standard or principle by which to make a judgement or determine a policy or course of action.

PLEASE CONSULT THE ATTACHED LIST OF RECIPIENTS AND DECIDE IF YOU WILL COORDINATE YOUR RESPONSE WITH OTHERS IN YOUR ORGANIZATION.

Please send the completed questionnaire BY DECEMBER 1, in the enclosed envelope to;

E. M. Nicolson
Groundwater Management
Economics and Conservation Branch
Ecosystem Sciences and Evaluation Directorate
Conservation and Protection Service
Environment Canada
Ottawa K1A OH3

Tel: (819) 997 2324 Fax: (819) 997 8701

THIS RESPONSE REPRESENTS THE VIEWS OF;

NAME: (individual or organization)_____
ADDRESS:_____
_____

TELEPHONE: (____)_____ FAX:(____)_____

If this is a coordinated response, please indicate those individuals contributing to this response.

The stated priorities represent the respondent's view of
(__) national (__) agency priorities.

PRIMARY ACTIVITY OF ABOVE RESPONDENT;
Resource management _____( )
Research _____( )
Advocacy (e.g.interest group etc.) _____( )
Professional Association _____( )
Specific interest USER (e.g. industrial and manufacturing, government sector, etc.) _____( )
Other_____

"GUIDELINES" FOR GROUNDWATER MANAGEMENT AND DEVELOPMENT
Potential Topics (Not in order of priority)

A. RELATIVE NEED 1 2 3 4 5 use an "x"

1 = urgent
2 = needed, not urgent
3 = not needed
4 = do not develop guidelines - potential negative impact on groundwater management
5 = not rated

B. LIST YOUR TOP 10 TOPICS (FROM THE 41 SUGGESTED), IN ORDER OF PRIORITY
1 = most important

		A. RELATIVE NEED	B. TOP 10	COMMENTS
1	**National Groundwater Strategy**	1 2 3 4 5		
	- policy, legislation, regulations, institutional arrangements, private sector and public involvement, interjurisdictional cooperation, management mechanisms, education and communications, etc.			
	GENERAL			
	Guidelines for:			
2	**Allocation of of ₰ and human resources by water management agencies to groundwater resource management**	1 2 3 4 5		
	in the context of;			
	- other resource management allocations			
	- the economic value of groundwater			
	- the contribution made by groundwater to surface water supplies			
	- the current understanding of the consequences for future generations of present day groundwater management practices			
3	**Aquifer mapping / groundwater availability studies / identification of aquifer recharge areas**	1 2 3 4 5		
4	**Aquifer designation / sensitivity mapping**	1 2 3 4 5		
5	**"Probability of contamination" mapping**	1 2 3 4 5		
6	**Establishing observation well networks**	1 2 3 4 5		
7	**The determination of groundwater value / the assessment of competing uses and allocation of supplies**	1 2 3 4 5		
8	**The use of economic instruments to achieve groundwater management goals**	1 2 3 4 5		
9	**Site assessment**	1 2 3 4 5		
	- criteria for selection of sites for assessment and cleanup / monitoring procedures, etc.			
10	**Site remediation**	1 2 3 4 5		
	- cleanup methods, objectives, etc.			
11	**Well and test hole abandonment**	1 2 3 4 5		
	- criteria for requiring site cleanup			
	- cleanup/containment procedures, materials and equipment			
12	**Protection against saline intrusion into aquifers**	1 2 3 4 5		

"GUIDELINES" FOR GROUNDWATER MANAGEMENT AND DEVELOPMENT
Potential Topics (Not in order of priority)

A. RELATIVE NEED [1][2][3][4][5] use an "x"
1 = urgent
2 = needed, not urgent
3 = not needed
4 = do not develop guidelines - potential negative impact on groundwater management
5 = not rated

B. LIST YOUR TOP 10 TOPICS (FROM THE 41 SUGGESTED), IN ORDER OF PRIORITY
1 = most important

COMMENTS

THE ACTIVITIES OF LAND BASED SECTORS IN RELATION TO GROUNDWATER PROTECTION

Guidelines for:

13 **The protection of recharge areas** _____ [1][2][3][4][5] ☐
- well-head protection
- identification of potential sources of groundwater pollution

14 **Agricultural practices in relation to groundwater use and protection** _____ [1][2][3][4][5] ☐
- intensive livestock practices
- pesticide and fertilizer use
- wellsite in relation to barnyard waste
- irrigation by groundwater
- etc.

15 **Forestry activities in relation to groundwater supply and protection** _____ [1][2][3][4][5] ☐
- harvesting
- pesticides

16 **Industrial and manufacturing practices in relation to groundwater use and protection** _____ [1][2][3][4][5] ☐

17 **Mining, minerals and metallurgical processes in relation to groundwater use and protection** _____ [1][2][3][4][5] ☐

18 **Oil and gas industry activities in relation to groundwater use and protection** _____ [1][2][3][4][5] ☐

19 **Municipal activities in relation to groundwater use and protection** _____ [1][2][3][4][5] ☐

20 **Dumpsite location in relation to groundwater protection** _____ [1][2][3][4][5] ☐

21 **Septic systems in relation to groundwater protection** _____ [1][2][3][4][5] ☐

22 **Earth energy developments** _____ [1][2][3][4][5] ☐
- technology / construction practices / closed-loop fluids, etc.
- promotional material prepared by the Energy Sector
- limitations/restrictions

23 **Deep well waste disposal in relation to groundwater protection** _____ [1][2][3][4][5] ☐

DATA AND INFORMATION

Guidelines for:

24 **Groundwater data management** _____ [1][2][3][4][5] ☐
- electronic data capture at wellhead and direct data entry to provincial data bases
- data exchange between existing data bases through the use of standardized terminology
- data compatability through agreement on aspects of accuracy and precision

"GUIDELINES" FOR GROUNDWATER MANAGEMENT AND DEVELOPMENT
Potential Topics (Not in order of priority)

A. RELATIVE NEED 1 2 3 4 5 use an "x"

1 = urgent
2 = needed, not urgent
3 = not needed
4 = do not develop guidelines - potential negative impact on groundwater management
5 = not rated

B. LIST YOUR TOP 10 TOPICS (FROM THE 41 SUGGESTED), IN ORDER OF PRIORITY
1 = most important

COMMENTS

25 **Accumulation of background contaminant data** 1 2 3 4 5 ☐

26 **The provision of client services for groundwater data and information** 1 2 3 4 5 ☐

- charging for data / cost recovery (raw data / interpretive services)
- implications of "access to information" legislation
- implications of provincially approved private sector data monopolies
- provision of on-line information
- interaction with well drilling industry

27 **Promoting public awareness of groundwater matters** 1 2 3 4 5 ☐

28 **Promoting increased awareness at the senior official and political levels** 1 2 3 4 5 ☐

29 **"State of groundwater" assessment and reporting** 1 2 3 4 5 ☐

TECHNICAL

Guidelines for:

30 **Well construction / well operation and maintainance** 1 2 3 4 5 ☐

- water supply wells / monitoring wells

31 **Aquifer pumping tests** 1 2 3 4 5 ☐

32 **Field practices in groundwater exploration and sampling** 1 2 3 4 5 ☐

33 **The selection of GPS equipment for use in groundwater activities** 1 2 3 4 5 ☐

34 **The assessment and use of groundwater flow models** 1 2 3 4 5 ☐

35 **The assessment and use of contaminant flow models** 1 2 3 4 5 ☐

36 **The assessment and use of Geographical Information Systems for use in groundwater activities** 1 2 3 4 5 ☐

37 **Standardization of lab procedures / analytical processes** 1 2 3 4 5 ☐

ADMINISTRATIVE

Guidelines for:

38 **Provincial requirements in relation to the well drilling industry** 1 2 3 4 5 ☐

- the education and licensing of well drillers
- the role of drillers vis-a-vis the provincial need for the collection of data that may not be of direct use to the well driller - eg. certain water quality parameters.

"GUIDELINES" FOR GROUNDWATER MANAGEMENT AND DEVELOPMENT
Potential Topics (Not in order of priority)

A. RELATIVE NEED 1 2 3 4 5 use an "x"
1 = urgent
2 = needed, not urgent
3 = not needed
4 = do not develop guidelines - potential negative impact on groundwater management
5 = not rated

B. LIST YOUR TOP 10 TOPICS (FROM THE 41 SUGGESTED), IN ORDER OF PRIORITY
1 = most important

COMMENTS

TECHNOLOGY TRANSFER

39 **International liaison** for the purposes of; _____ 1 2 3 4 5 ☐

- the transfer of Canadian technology and expertise to other countries
- encouraging Canadian industry and science to keep abreast with the latest developments in other countries

(See also **"National Groundwater Information Source"**)

OTHER INFORMATION ACTIVITIES

40 **National groundwater information source** (not raw data) _____ 1 2 3 4 5 ☐

- publications, software availability, conferences, expertise, courses, technical information
- central repository of groundwater information
- means of achieving international input/output

41 **Public information bulletins** _____ 1 2 3 4 5 ☐

"How to" bulletins

- test well water
- get information on groundwater
- have a well installed
- have a heat pump installed
- obtain groundwater supply for the home
- etc.

PARTICIPANTS **APPENDIX 4**

SEPARATE QUESTIONNAIRES RECEIVED	**NAMED CONTRIBUTERS**
FEDERAL DEPARTMENTS AND AGENCIES	
Agriculture Canada/PFRA	LEBEDIN J.
Agriculture Canada/PFRA	ROHDE H.
Environment Canada/Centre St.Laurent	BOUDREAULT P.
Environment Canada/Ontario Region	WAGNER E.T.
Environment Canada/Ottawa-Hull	GAUTHIER R./ BAWEJA A./ STEWART K.
Health and Welfare Canada	TOBIN R.S./ TROTTER W.
Public Works Canada	MOROFSKY E.
Public Works Canada	VOGAN R.W.
Transport Canada	FAIRBAIRN D.
PROVINCIAL DEPARTMENTS AND AGENCIES	
Prince Edward Island	
ISLAND NATURE TRUST Charlottetown, Prince Edward Island	
PEI Environment	JARDINE D.
PEI Environment	ROBINSON A.M.
New Brunswick	
New Brunswick Environment	CRAIG D.
New Brunswick Environment	PUPEK D.A.
New Brunswick/Geological Surveys Branch	RUITENBERG A.A.
New Brunswick Natural Resources	SEAMAN A.A.
New Brunswick Natural Resources	no name
New Brunswick Natural Resources	BUTLER R./McEWAN S.
Nova Scotia	
Nova Scotia Environment	CAMERON A.
Nova Scotia Health	ROWE R.
Nova Scotia Health	REID D.M.
Quebec	
Quebec Environment	OUELLET M.
Quebec Environment	LACOULINE R.
Quebec Environment	CHAMPAGNE L.
Ontario	
Ontario Environment	SOO CHAN G.
Ontario Environment	SINGER S.

Manitoba

Manitoba Water Services Board	PEDERSON A.

Saskatchewan

Saskatchewan Environment	R.G.R./R.J.S.
Saskatchewan Water Corporation	SHAHEEN N.

Alberta

Alberta Environment	CHONG K.
Alberta Environment/Protection	ECKERT C./WINNER G./ DE LA CRUZ N.
Alberta Environment/Protection	ZUBEL M.
Alberta Geological Survey	LYTVIAK A.T.

British Columbia

British Columbia Environment	RINGHAM L.
British Columbia Environment	WIENS J./ JOHANSSON L./ JUNGSEN J./ ORD R.

MUNICIPAL ASSOCIATIONS/OFFICIALS

City of Bathurst/Utilities, New Brunswick	O'CONNELL O.
CAPE BRETON HEALTH UNIT Sydney, Nova Scotia	
Regional Municipality of Waterloo	ROBINSON J.W.
Union of Manitoba Municipalities	KNIGHT J.A.
Alberta Association of Municipal Districts and Counties	Board of Directors

RESEARCH COMMUNITY

Federal

Environment Canada/National Hydrology Research Institute	HENDRY J./ GROVE G./ KIRKLAND R./ KWONG J./ VANDERKAMP G./ WASSENAAR L.
Environment Canada/Western and Northern Region	McNAUGNTON D.
Geological Survey of Canada/EMR (Ottawa)	VINCENT J.S./ DYKE L.O. SCOTT J.S.
Geological Survey of Canada/EMR (Vancouver)	TEMPLEMAN-KLUIT D.

Provincial

Manitoba Urban Affairs	DODDS G.

University/Educational

University of New Brunswick, Groundwater Studies Group	BRAY D.I.
University of New Brunswick	MacQUARRIE K.
Institute of Technology, Halifax	KERR J.N.
TUNS Centre for Water Resource Studies	WALLER D.H./ HENNIGAR T.W.
Institut national de la recherche scientifique	BANTON O.
University of Ottawa	CLARK I.D.
University of Waterloo, Waterloo Centre for Groundwater Research	THOMAS R./SMYTH D.
University of Western Ontario, Geotechnical Research Centre	QUIGLEY R.M.
University of Windsor	SKLASH M.
University of Regina	YEE-CHUNG J.
University of Saskatchewan	GILLIES J.A.
University of Saskatchewan	KULSHRESHTHA S.N.
University of British Columbia, Westwater Research Centre	HEALEY M.C.

Private

Wastewater Technology Centre/Burlington	BOOTH R./LUDWIG R.

CONSULTANTS/PRIVATE SECTOR

Newfoundland

Fracflow Consulting Inc., St.John's, Newf.	BURSEY, G.G./ MacLEOD R.
Newfoundland Geosciences Limited, St.John's	SCHILLEREFF S.
Nolan, Davis and Associates, St.John's, Newf.	SARGENT N.

Prince Edward Island

Delcom Consultants Inc., Summerside, P.E.I.	BAGLOLE J.C.

Nova Scotia

Brunswick Mining and Smelting Corp., Bathurst, N.S.	no name
Halifax, Nova Scotia	HENNIGAR T.
Jacques Whitford Environment Ltd., Dartmouth, N.S	MacFARLANE D.S.
Nolan Davis and Associates Ltd., Sydney, N.S.	BAECHLER F.
Porter Dillon, Halifax, Nova Scotia	HATTIE S.S.

New Brunswick

Fredericton, New Brunswick	ROSE P.
Fundy Engineering and Consulting Ltd., St. John, New Brunswick	WARNER T.L.

Quebec

Brossard, Québec	BILODEAU D.
Compagnie Internationale des Eaux Québec Ltée St-Mathieu de Beloeil, Québec	BÉLANGER A.J.
Envirotecheau, Dorval, Québec	TREMBLAY J.J.
Fondatec Inc., Longueuil, Québec	MORIN R./AMOURS L.D.
Golder Associés Ltée., Pointe-Claire, Québec	VERGE M.J./DROLET M.
LaSalle Consulting Group Inc., LaSalle, Québec	PARKINSON F.E.
Le Groupe Teknika Inc., Sherbrooke, Québec	AUBIN Y.
Les Consultants H.G.E. Inc., Québec (Québec)	GRENIER C./CARON M.R.
Longueuil, Québec	HANSBURY P.
Lupien - Rosenberg and Associates Inc., Lachine, Québec	ROSENBERG P.
Monterval, Boisbriand, Québec	CHABOT D.
Roche Ltée, Laval, Québec	ST-GERMAIN R.
St-Laurent, Québec	MARINEAU L.
Ste-Foy, Québec	PINEAULT J.
Ste-Foy, Québec	DES ROSIERS R.
Québec, Québec	TARDIF Y.

Ontario

Arcturus Environmental, Niagara Falls, Ont.	OSBORNE M.
Gartner Lee Limited, Markham, Ontario	LEECH R.
HBT AGRA Ltd., Mississauga, Ontario	OSTRY R.C.
Hydroterra Limited, Thornhill, Ontario	BRYCK L.
Intera, Nepean, Ont.	LAFLEUR D.
International Water Consultants, Barrie, Ont.	KUEHL, G.A.
Merrickville, Ontario	TRUSTY W.
Nepean, Ontario	RITCEY G.M.
Nepean, Ontario	SABOURIN L.
Waterloo Geoscience Consultants, Waterloo, Ont.	no name
Waterloo Hydrogeologic Software, Waterloo, Ont.	GUIGUER, N.

Manitoba

Dyregrov Consultants, Winnipeg, Manitoba	no name
HBT AGRA Limited, Winnipeg, Manitoba	no name
KGS Group, Winnipeg, Manitoba	SMITH J.R.
Wardrop Engineering Inc., Winnipeg, Manitoba	THOMPSON B./ WOLOWICH E./ HORNING B./ WIEBE M./PARRY J./ ALLARD R.

Saskatchewan

Beckie Hydrogeologists, Regina, Saskatchewan	FAMULAK M.

Alberta

Calgary, Alberta	CAMPBELL K.
HBT AGRA Limited, Calgary, Alberta	PITTS L.V./SUMER S./ ROBERTSON C./HILLER J.
Terracon Geotechnique Ltd., Calgary, Alberta	NICHOLS L.

British Columbia

CBA Engineering Ltd., Vancouver, B.C.	no name
EBA Engineering Ltd., Vancouver, B.C.	SYLTE S.
Kea Pacific Holdings Inc., North Vancouver, B.C.	SMITH A.
Klohn Leonoff, Richmond, B.C.	SMITH R./QUINN O.
Payne Engineering Geology, Sidney, B.C.	no name
R.A.Freeze Engineering Inc., Whiterock, B.C.	FREEZE R.A.
Vernon, B.C.	WILSON H.G.
Victoria, British Columbia	TURNER W.R.

GROUPS REPRESENTING SCIENCE INDUSTRY ETC.

Canadian Association of Oilwell Drilling Contractors, Calgary, Alberta	no name
Canadian Association of Petroleum Producers Calgary, Alberta	WEBSTER G.
Canadian Water Resources Association Winnipeg, Manitoba	MacKAY G.H.
Canadian Water Well Association, Springfield, Ontario	WILSON J.R.

ENVIRONMENTAL/CITIZEN'S GROUPS

Conservation Council of New Brunswick, Fredericton	no name
Canadian Nature Federation	GELFAND J.
Cities of New Brunswick Association (Bathurst,Campbellton,Fredericton,Moncton,St.John)	no name

Compiled with the cooperation of 152 scientists, government officials, consultants and educators.