THE CRYPTOSPORIDIUM (SCOTTISH WATER) DIRECTIONS 2003

The Scottish Ministers, in exercise of the powers conferred on them by section 56 (3) of the Water Industry (Scotland) Act 2002[(a)], and all other powers enabling them in that behalf, and after consultation in accordance with section 56(4) of that Act, hereby give Scottish Water, the following Directions:–

Citation and commencement

1. These Directions may be cited as the Cryptosporidium (Scottish Water) Directions 2003 and shall come into force on 31 December 2003.

Interpretation

2.- In these Directions, unless the context otherwise requires–

"appropriate health board" and "appropriate local authority" means a health board or local authority respectively, in whose area there is a supply of water by Scottish Water which may be affected by an incident involving *Cryptosporidium*.

"core functions" shall be construed by reference to section 70(2) of the Water Industry (Scotland) Act 2002;

“high risk supply” means a water supply where there is an enhanced risk from *Cryptosporidium*, as identified by the risk assessment carried out in accordance with article 4 of these Directions;

"the Hygiene Code of Practice" means the Principles of Water Supply Hygiene and Technical Guidance Notes published in June 1996 and October 1998 respectively by WaterUK.

“NTU” means Nephelometric Turbidity Unit;

“the Badenoch Report” means the second Report by the Group of Experts on Cryptosporidium in Water Supplies under the chairmanship of the late Sir John Badenoch, published in 1995;

“the Third Report” means the Third Report of the Group of Experts on *Cryptosporidium* chaired by Professor Ian Bouchier dated November 1998 and submitted to the Department of the Environment, Transport and the Regions and the Department of Health (ISBN 1 85112 131 5);

“turbidity event” means a significant deviation in the turbidity of the water ascertained in accordance with paragraph 3(13) of these Directions.

[(a)] 2002 asp 3

Obligations of Scottish Water

3.-(1) Scottish Water shall–

(a) monitor and continue to monitor its raw water sources for the presence of *Cryptosporidium* and, having due regard to the catchment risks at individual sites, the appropriate minimum sampling frequencies are set out in article 5 of these Directions; and

(b) ensure and continue to ensure that the design and operation of treatment plants is carried out in an efficient and effective way for the purpose of removing *Cryptosporidium* oocysts, taking into account the level of risk at each plant.

(2) When oocysts are detected in a raw water source used or likely to be used by Scottish Water to supply treated water, Scottish Water shall carry out an investigation as soon as reasonably practicable to establish whether any circumstances exist which may allow *Cryptosporidium* to enter the water supply. Such investigations shall include a review of recent treatment plant operational data.

(3) Scottish Water shall develop and maintain adequate local liaison arrangements with local authorities and health boards for the purpose of rapid appraisal of the potential health risks in connection with a water supply or from a source for which it is responsible, in particular where oocysts are detected in final water or in its distribution.

(4) Where Scottish Water supplies customers with water which has not been treated in a manner which is known to remove *Cryptosporidium* oocysts, Scottish Water shall discuss the potential risks with every appropriate health board and local authority, and shall assist the health board(s) in compiling advice to be given to customers if this is considered necessary by the board(s).

(5) Scottish Water shall ensure and continue to ensure that all persons operating assets owned by Scottish Water which produce drinking water, or perform core functions for or on behalf of Scottish Water in relation to the supply of drinking water–

(a) are aware of the types of circumstance which can potentially put water supplies at risk of *Cryptosporidium* contamination. All such staff shall receive training on an annual basis to ensure that they are aware of the impact that changes, including very small changes, on the catchment and to treatment process can have on the final water supplied.

(b) adopt procedures to ensure rapid recognition, appraisal and rectification of such risks. Scottish Water shall ensure that these procedures are periodically updated.

(6) Scottish Water shall ensure and continue to ensure that appropriate action procedures, based on the level of risk and previous experience of the water source and the water treatment works concerned, are in place in order to respond immediately to turbidity alarms.

(7) The procedures referred to in paragraph (6) above shall include provision, as appropriate, for commencing *Cryptosporidium* sampling as soon as practicable, isolation of the filter(s) or source, and consultation with the appropriate health board regarding the issue and withdrawal of advice to customers to boil water for domestic purposes such as drinking and cooking.

(8) Scottish Water shall provide the Consultant in Public Health Medicine at each Health Board with maps of the water supply zones serving the area of that Health Board and shall periodically review the maps in the event of changes in water supply zones.

(9) Scottish Water shall–

(a) assist health boards identify whether, in connection with past outbreaks, particular water sources were involved; and

(b) in connection with any future outbreaks shall similarly assist health boards to identify as early as possible whether particular water sources are involved and to allow trends to be assessed.

(10) Scottish Water shall liaise with health boards to develop high quality surveillance of *Cryptosporidium* in order to quantify background levels associated with different water supplies and facilitate identification of any unusual clusters of cases of cryptosporidiosis.

(11) Scottish Water shall ensure and continue to ensure that all new and refurbished water treatment works are designed to handle the typical peak turbidity and colour loadings occurring in the source water at such works.

(12) Scottish Water shall ensure and continue to ensure that–

(a) all water treatment works operate in a manner that minimises turbidity in the final water;
(b) due attention is given to the monitoring of colour and turbidity in raw water;
(c) due attention is paid to residual coagulant concentrations in filtered waters that have been chemically coagulated;
(d) there is continuous monitoring of turbidity on individual rapid gravity, slow sand and pressure filters and on the final water at such works ;
(e) slow sand filters are operated in accordance with best practice (including procedures for checking that filters are adequately matured before being put into service and that the under-drains are operating correctly);
(f) the integrity of membrane filters is checked in accordance with procedures agreed with the Scottish Ministers.

(13) In respect of each of its treatment works, where there is continuous monitoring of turbidity, Scottish Water shall specify the value and duration that constitutes a significant deviation in the turbidity of filtered (from individual filters and combined filtrate) and final water. The value shall be set regardless of its relationship to the standard specified in Schedule 2 to the Water Supply (Water Quality) (Scotland) Regulations 2001[(a)], in accordance with paragraph 5.4.4 of the Third Report. Turbidity meters shall be alarmed and the alarms shall be set below or at these levels and procedures shall be put in place to deal with such alarms. A copy of the relevant procedures shall be available at each treatment works.

(14) Scottish Water shall ensure that borehole linings and seals are maintained.

(15) Scottish Water shall, except in emergency circumstances, ensure and continue to ensure that–

(a) water treatment works are operated within the design capacity and without by-passing any solid-liquid separation processes;

(b) if coagulation is part of the treatment process, it should never be by-passed or compromised; and

(c) rapid changes in flow through filters are minimised.

(16) If, in the event of an emergency, it is necessary at a water treatment works to overload or by-pass any solid-liquid separation processes, Scottish Water shall–

(a) ensure that continuous sampling for *Cryptosporidium* is undertaken if the turbidity targets specified under paragraph (13) are exceeded. *Cryptosporidium* sampling shall be commenced as soon as reasonably practicable but within 12 hours of the turbidity target being exceeded. The minimum flow rate through each sampling unit shall be 40 litres per hour for a period of 12 hours. Results shall be made available as soon as practicable but within 36 hours of the sampling device being removed;

(b) as soon as reasonably practicable inform the appropriate health board where it appears to Scottish Water that the turbidity targets specified in paragraph (13) will not be (or are not likely to be) achieved;

(c) if required by the appropriate health board, take steps to advise its customers to boil all water used for domestic purposes, such as drinking and cooking, until further notice;

(d) agree clear criteria [established in accordance with paragraph (31)] with the health board for the withdrawal of any advice issued in accordance with sub-paragraph (c) of this direction. In the light of further advice given by the board in accordance with such criteria, Scottish Water shall take steps to

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[(a)] S.S.I. 2001/207.

advise its customers that it is no longer necessary to boil all water used for domestic purposes such as drinking or cooking.

(17) Where–

(a) a supply is identified as a high risk supply; and

(b) minimisation of the effects of filter start up on final water quality cannot be achieved through more easily implemented changes,

modifications to the water treatment works serving that supply shall be made by Scottish Water to allow the first flush from a filter after back washing to be run to waste or to be recycled to the works inlet.

(18) Scottish Water shall ensure that coagulation/flocculation processes at water treatment works are checked regularly by visual inspection of the processes and jar testing of raw and coagulated waters to ensure that the processes meet changing conditions of source water quality and other relevant environmental factors. The frequency of checks should be appropriate to the nature of the supply, and results should be recorded at the treatment works.

(19) Scottish Water shall ensure that only dedicated washwater mains are used at their treatment works to carry the returned washwater flow.

(20) Scottish Water shall ensure that at each treatment works –

(a) filters are operated and maintained under optimum conditions;

(b) a logbook ("the filter logbook") is kept for each filter containing-

(i) a record of all maintenance work and inspections carried out on the filter,

(ii) details of the media depth in accordance with paragraph (c) and the condition of the filter when it is drained down in accordance with paragraph (d),

(iii) where appropriate, details of the operation of the backwashing/air scouring systems and underdrains,

(iv) details of any changes or required changes to filters, the backwashing/air scouring systems or underdrains, and

(v) details of any trial work carried out on filters;

(c) routine inspections of media depth are made and recorded in the filter logbook against design criteria;

(d) at least once a year, each filter is drained down, or opened up as appropriate, for detailed inspection and maintenance; and

(e) all entries in the filter logbook shall be signed and dated.

(21) Scottish Water shall ensure and continue to ensure that process monitoring systems are in place and are appropriate to the risk potentially arising at each supply.

(22) Treatment works which, at December 2003, have a turbidity meter that monitors turbidity from several filters in sequence, shall have these meters replaced with dedicated turbidity meters by December 2006. Otherwise, each filter at rapid gravity, pressure and slow sand treatment works, shall have continuous (24 hours a day) turbidity monitoring on the outlet of each filter by December 2005. In addition, all rapid gravity, pressure and slow sand treatment works shall have a dedicated turbidity meter monitoring the final water by December 2005. Treatment works with simple sand filtration ("Inverness" type filters) shall have a dedicated turbidity meter monitoring the final water by December 2010. All turbidity meters shall be alarmed, capable of detecting changes of less than 0.1 NTU and recording at least 1 month's data.

(23) Scottish Water shall carry out an assessment of raw water quality to determine which raw water supplies have, over the past two years, experienced rapid variations in quality. This assessment shall be completed by 31 March 2004 and shall identify works where, in the judgement of Scottish Water, rapid variations in raw water quality over the past two years have resulted in problems with the treatment process. At treatment works identified by the assessment that are already alarmed 24 hours a day, and which are covered by telemetry when the works is not manned, Scottish Water shall install raw water turbidity monitors. These raw water turbidity monitors shall also be alarmed 24 hours a day and linked to the telemetry system.

(24) At sites where automatic coagulant dose control units are in use, if raw water quality can vary such that alteration of the set point of the unit may be required, on-line raw water colour and turbidity monitoring equipment shall be provided and it shall be appropriately alarmed. Such alarms shall be connected via telemetry to control rooms manned 24 hours a day.

(25) Scottish Water should consider the use of particle count monitors to provide additional information to that provided by turbidity measurements, when there is a known or suspected problem with turbidity or *Cryptosporidium*.

(26) If there has been an event at a catchment that may significantly increase the possibility of *Cryptosporidium* oocysts entering the raw water supply, then continuous sampling of final water for *Cryptosporidium* shall be undertaken. The minimum flow rate through each sampling unit shall be 40 litres per hour for a period of 12 hours. Results shall be made available as soon as practicable but within 36 hours of the sampling device being removed.

(27) Continuous sampling for *Cryptosporidium* should be triggered by any deviation of turbidity as specified in paragraph (13). Sampling for *Cryptosporidium* shall be started as soon as possible and the minimum flow rate through each sampling unit shall be 40 litres per hour for a period of 12 hours. All samples taken as a result of this paragraph shall be analysed and the results made available as soon as practicable but within 36 hours of the sampling device being removed.

(28) All *Cryptosporidium* samples taken as a result of these Directions shall be continuous samples. Any other types of sampling, such as small volume 'grab' samples, shall only be used for sampling water which cannot be continuously filtered, such as supernatant return water.

(29) Scottish Water shall provide alarmed flow monitoring devices on all backwash air and water systems used on rapid gravity and pressure filters.

(30) Scottish Water shall–

(a) review and keep under review their working relationships with health boards and the environmental health officers of local authorities, in the form of Incident Management Teams; and

(b) establish (and keep under review) procedures for participating in Outbreak Control Teams activated by health boards.

(31) Scottish Water shall discuss the interpretation of results of analysis for Cryptosporidium with Health Boards. In consultation with Health Boards, Scottish Water shall establish criteria for decision-making on the issue and the withdrawal of notices advising customers to boil water for domestic purposes such as cooking or drinking. These discussions should take place outwith an emergency situation and the criteria established should be reviewed periodically.

(32) In the event of an outbreak of cryptosporidiosis, Scottish Water, as a member of the Outbreak Control Team, shall encourage the use of good epidemiology as recommended in the Third Report to establish the source of the outbreak, including whether or not illness is associated with the drinking water supply.

(33) Scottish Water shall encourage Incident Management and Outbreak Control Teams to review and rehearse regularly the response procedures to incidents and outbreaks of cryptosporidiosis. In order to ensure that such teams are aware at the outset of the scope and purpose of their brief and that there is a clear understanding of the roles, responsibilities and standing of each member of such Incident Management and Outbreak Control Teams, such awareness and understanding shall be regularly reviewed and rehearsed.

(34) Scottish Water shall from time to time ensure, as far as possible, that any of its staff involved, or likely to be involved, in an Incident Management or Outbreak Control Team establishes a working dialogue and trust with all other parties involved. This should preferably take place outwith an emergency situation thereby allowing any incident involving *Cryptosporidium* to be dealt with more effectively.

(35) In order to rehearse emergency procedures, Scottish Water shall–

(a) regularly simulate incident and outbreak events involving *Cryptosporidium*, and

(b) involve all relevant parties in the simulation of such events and review its procedures in light of the results of such simulations.

(36) Scottish Water shall ensure that all recycled streams from treatment processes have a settlement stage prior to the recycled water being reintroduced at the head of the works.

(37) Scottish Water shall ensure that–

(a) recycled streams are monitored for turbidity using turbidity monitors with appropriate alarms,

(b) turbidity monitors and their alarms are operational whenever water is being recycled,

(c) the importance of maintaining monitors is emphasised to treatment works staff, and

(d) recycle streams are introduced and blended into the bulk flow prior to the coagulant dosing point over as long a period as is practicable.

(38) Scottish Water shall confirm regularly, with the appropriate environmental authorities, contingency arrangements for the disposal of contaminated sludge and process waste waters.

(39) Scottish Water shall identify the location of sewage outfalls and septic tanks to determine the risk of sewage contamination of drinking water sources, irrespective of the risk assessed in Annex A of these Directions. The studies shall cover all Scottish Water catchments and aqueduct routes and shall be completed by 30 June 2004.

(40) Scottish Water shall ensure that detailed logbooks, in a standard format, are kept during incidents, and that all information that may be required is promptly recorded and maintained. These logbooks shall include dates, times, key facts, summaries of telephone calls, and the actions taken by named staff.

(41) Scottish Water shall ensure that all notices of advice to boil water issued to customers shall make it clear that it is only necessary to bring the water to the boil and then to allow it to cool before use.

(42) Where an incident involving *Cryptosporidium* occurs, Scottish Water shall, as soon as reasonably practicable after such an incident, prepare a report setting out–

(a) the cause of the incident (in the opinion of Scottish Water); and

(b) the steps (if any) which could reasonably have been taken by any party to have avoided the incident or minimised the effect of the incident or the failings (if any) in any system of working of any party which caused the effect of the incident,

and Scottish Water shall make that report available to the Scottish Ministers forthwith.

(43) Scottish Water shall ensure and continue to ensure that its "Water Supply Hygiene Code of Practice" is followed in respect of the potential risk of *Cryptosporidium* contamination during the repair and maintenance of distribution systems.

(44) Scottish Water shall inspect all water storage tanks at treatment works and in distribution systems, and all treated water aqueducts to identify any points that could be vulnerable to infiltration by *Cryptosporidium* contaminated water. A report showing the results of the inspections and outlining any remedial measures shall be made available to Scottish Ministers on or before 31 December 2004.

Assessment of Risk of *Cryptosporidium*

4.-(1) Scottish Water shall, by 1 March 2004, carry out a risk assessment for each of its water supplies, using the scoring system in Annex A1 or A2 of these Directions as appropriate, and report the results of that assessment to Scottish Ministers as soon as reasonably practicable but no later than 31 March 2004. Thereafter, a report shall be submitted on an annual basis to Scottish Ministers on or before 31 March each year as detailed in article 7 of these Directions. The Scottish Ministers may, if they consider that the particular risk assessment has not been satisfactorily carried out, by notice (which shall set out their reasons for considering that the assessment has not been satisfactorily carried out) direct Scottish Water, by such date as shall be specified in the notice, to carry out the assessment again and submit a report to them of that further assessment, and Scottish Water shall comply with that direction by the date specified.

(2) A report to the Scottish Ministers of an assessment carried out by Scottish Water pursuant to this article shall set out the results of the assessment, including a statement of the action being taken or intended to be taken by Scottish Water in consequence of the assessed risk and the appropriate action (in accordance with the results in terms of the Annex A risk assessment score) shall be as identified in accordance with Annex B of these Directions.

(3) Where a report is submitted to the Scottish Ministers pursuant to paragraph (1) above, Ministers shall, unless notice (or further notice) under paragraph (1) above is given requiring a further assessment–

(i) notify Scottish Water that they are satisfied on the basis of the report that the risk assessment has been satisfactorily carried out in respect of the water supply concerned; and

(ii) confirm that the action proposed is appropriate.

(4) Where Scottish Water implements continuous monitoring of treated water for *Cryptosporidium* at a particular supply as a result of the assessed risk, and at any time thereafter carries out a further risk assessment in respect of that supply to establish whether there continues to be a significant risk of *Cryptosporidium* in the water supplied, Scottish Water shall submit a report of the further risk assessment to the Scottish Ministers.

(5) Where–

(a) a report submitted to the Scottish Ministers pursuant to paragraph (4) above indicates a reduction in the risk of *Cryptosporidium* in the water supplied; and

(b) the Scottish Ministers are satisfied, on the basis of that report, that the risk assessment has been satisfactorily carried out,

the Scottish Ministers shall notify Scottish Water that they are so satisfied, and subject to paragraph (7) below, Scottish Water shall, with effect from the date one working day after the date on which notification is given (or from such other date as the Scottish Ministers may in that notification specify), cease to be required to comply with the action previously confirmed as appropriate by the Scottish Ministers.

(6) Where a report is submitted to the Scottish Ministers pursuant to paragraph (4) above, but where paragraph (5) above does not apply, Scottish Water shall continue to be required to carry out the action previously confirmed as appropriate by the Scottish Ministers.

(7) The Scottish Ministers may by notice direct Scottish Water, by such date as shall be specified in the notice–

(a) to carry out a risk assessment for one or more water supplies; and

(b) to submit to the Scottish Ministers a report of the assessment,

and Scottish Water shall comply with the direction by the date so specified.

(8) Paragraphs (1), (2) and (3) above shall apply to the submission of any report pursuant to paragraph (7) above as they apply to the submission of any report pursuant to paragraphs (1) or (2) above.

(9) Scottish Water, in carrying out a risk assessment under this article, shall have regard to any guidance issued by the Scottish Ministers with respect to the carrying out of such an assessment.

(10) Scottish Water shall make the detailed results of any risk assessment under this article available to domestic or non-domestic customers. In addition, Scottish Water shall make the results of *Cryptosporidium* monitoring available on request.

Monitoring for *Cryptosporidium*

5.-(1) Notwithstanding any undertakings submitted to Scottish Ministers, the minimum annual sampling frequency for *Cryptosporidium* shall be as prescribed in the tables set out in sub-paragraphs (a) and (b). Unless agreed otherwise with Scottish Ministers, samples shall be taken at regular intervals throughout the year.

(a) Raw Water

The raw water monitoring frequency for surface waters shall be based on the catchment risk assessment score determined from Annex A1(1) of these Directions.

		WTW Maximum Design Flow (Ml/day)			
		≤ 1	**>1 ≤ 10**	**>10 ≤ 50**	**> 50**
Catchment Risk Score	**> 55**	12	26	52	52
	35 – 54	0	12	12	26
	< 35	0	0	12	12

(b) Final Water

The final water monitoring frequency for surface waters or groundwaters shall be based on the combined catchment and treatment and supply score determined from Annex A1 or A2 of these Directions as appropriate.

		WTW Maximum Design Flow (Ml/day)			
		≤ 1	**>1 ≤ 10**	**>10 ≤ 50**	**> 50**
Catchment + Treatment Risk Score	**> 55**	52	104	365	365
	35 – 54	12	52	52	104
	< 35	12	12	52	52

(2) All samples taken as part of the above sampling programme shall be collected using an appropriate continuous sampling technique at a rate of 40 litres per hour. The Scottish Ministers shall publish details of appropriate sampling techniques. Where less than 365 samples are required per annum, each continuous sample shall be taken for a minimum period of 24 hours and a maximum period of 36 hours.

(3) To ensure adequate volumes of water pass through *Cryptosporidium* sampling filters, flow-regulating fittings shall be provided with the sampling units, and, where necessary, sample pumps shall be fitted. The sampling programmes shall be implemented by 30 June 2004.

(4) Scottish Water shall ensure that each of its treatment works has suitable, identified sample points for the monitoring of *Cryptosporidium*. These sample points shall be clearly marked as such.

(5) Where the appropriate continuous sampling equipment is unable to sample raw waters at a flow rate of 40 litres per hour for more than 12 hours, Scottish Water may use one-micron (10 inch) cartridge filters. Scottish Ministers must be notified where any one-micron cartridge filters are to be used and Scottish Water must ensure that a common standard of cartridge is adopted. One-micron (10 inch) cartridge filters may only be used on raw waters.

(6) Notwithstanding the risk assessment process, Scottish Water shall ensure that it carries out its functions in or under the Water (Scotland) Act 1980 in respect of the supply of

wholesome water sufficient for the domestic purposes of all owners and occupiers of premises within its limits of supply.

(7) For the purposes of testing for compliance with its duties in paragraph (1) above, Scottish Water shall ensure that the requirements in paragraphs (8) and (9) are satisfied.

(8) Continuous final water samples shall be collected at a rate of at least 40 litres per hour from the combined filtrate/permeate from each treatment stream and steps shall be taken to ensure that the sample is not contaminated when being taken or transported.

(9) For the purpose of the requirement in paragraph (8) above, where there is a requirement to sample a treatment works 365 days a year, no account shall be taken of any interruption in the taking of a sample that occurs during the changing of collection devices, which is less than one hour and no account shall be taken of an interruption during a period when water is not being supplied from the treatment works.

(10) A sample of water taken pursuant to paragraph (8) above shall, as it is taken and without any further treatment, be passed through an appropriate collection device contained in appropriate sampling equipment which records the volume of water sampled. The Scottish Ministers shall give further guidance about appropriate collection devices and sampling equipment which, Scottish Water must have regard to.

(11) Subject to paragraph (12) below, where Scottish Water is required to monitor a supply 365 days a year, Scottish Water shall change the collection device in accordance with paragraph (10) above, at least once a day. The collection device shall be removed from the relevant sampling equipment and replaced with a clean collection device. A record shall be made of the volume of water passed through the collection device that has been removed, and that record shall be retained by Scottish Water for a period of not less than one year.

(12) If interruptions to the flow of water through a treatment works results in the volume of water passing through a collection device being less than 200 litres, then the collection device need not be changed until the volume of water passed through the device exceeds 200 litres unless a period of 72 hours has elapsed since the collection device was fitted.

(13) Scottish Water shall ensure that any collection device removed from sampling equipment for analysis in accordance with paragraph (10) above shall, prior to being analysed, be kept in such conditions as will ensure that there is no material alteration of the state of the device which is likely to affect the results of the analysis.

(14) Scottish Water shall ensure that any final water collection device shall, subject to paragraph (16) below, be analysed at an appropriate laboratory within three days of the date on which the device is removed from the sampling equipment, for the purpose of establishing whether it contains *Cryptosporidium* oocysts. This applies to all samples that are taken from treatment works that are feeding water into the water supply. Raw water samples shall be analysed at an appropriate laboratory within five days or sooner if required. Appropriate laboratories must have demonstrated, and continue to demonstrate, to Scottish Ministers that the laboratory analyses for *Cryptosporidium* are in accordance with the protocols established by the Scottish Ministers and use appropriate equipment and analytical systems and methods.

(15) Scottish Water shall ensure that samples taken as a result of an event outlined in paragraphs (26) and (27) of article 3 of these Directions shall be analysed at an appropriate laboratory and the results made available as soon as practicable but within 36 hours of the device being removed from the sampling equipment.

(16) At sites where continuous monitoring is taking place, if there is a significant increase in the turbidity of water being sampled or some other indication that *Cryptosporidium* oocysts may be present, Scottish Water shall, as soon as practicable, change the collection device through which the water is being passed. The removed device shall be analysed at an appropriate laboratory and the results made available as soon as practicable thereafter but in any case within 24 hours of the removal of the device.

(17) If any oocysts are detected in final water, Scottish Water shall notify the appropriate Health Board, the appropriate local authority and the Scottish Ministers as soon as possible but in any case within 24 hours, unless agreed otherwise. Scottish Water shall investigate the likely cause of *Cryptosporidium* oocysts being present in the final water and take all possible steps to prevent further contamination of the final water. All raw water and final water monitoring results shall be submitted to the Scottish Ministers on a monthly basis.

(18) Following the analysis of a collection device, Scottish Water shall ensure that the person by whom or under whose supervision the analysis has been carried out shall, within the applicable time limit for the analysis set out in paragraphs (14), (15) or (16) above, certify the results of the analysis, setting out the average number of *Cryptosporidium* oocysts per 10 litres of water contained in the water sampled, as indicated by the level of *Cryptosporidium* oocysts contained in the collection device.

(19) During an event or incident involving *Cryptosporidium*, there shall be a prioritisation of samples in the analysing laboratory, with samples required by the Incident Control Team or Outbreak Control Team taking priority over routine samples taken as part of the sampling programme in paragraph (1) above. Routine samples that can not be analysed at the appropriate laboratory normally used for analysis within the timescales required by paragraph (14) above shall be sent to another appropriate laboratory and Scottish Water shall inform Scottish Ministers of their action. Routine samples sent to another appropriate laboratory shall be analysed within the timescales required by paragraph (14) above.

(20) Scottish Water shall ensure that the analysis of collection devices for the purposes of this article shall be carried out by suitably trained staff at a appropriate laboratory, which participates in an external quality assurance scheme that is recognised by Scottish Ministers.

(21) Scottish Water shall ensure that the analysing laboratories used by them to analyse water for *Cryptosporidium* are capable of dealing with the increased numbers of samples taken during emergency situations.

Performance of core functions on behalf of Scottish Water by other persons

6.-(1) Where Scottish Water makes arrangements for another person to carry out on its behalf any of its core functions relating to the production and supply of drinking water, it shall ensure that those arrangements require that person to carry out those functions subject to the same requirements as must be complied with by Scottish Water under these Directions.

(2) Notwithstanding paragraph (1) above, Scottish Water remains responsible for compliance with the requirements of these Directions in the exercise of those core functions.

Information

7.-(1) On or before 31st March each year, Scottish Water shall provide to Scottish Ministers a detailed report setting out the degree of compliance or otherwise with these Directions in respect of the immediately preceding calendar year, and, to the extent to which they have complied, the cost of doing so. The report shall include a Risk Assessment in a standard format for each of its supplies as carried out in accordance with article 4 of these Directions. The Risk Assessment shall take account of land use, farming practices and treatment works performance for an entire year. The risk assessment information shall include–

(a) the score for the catchment (or the highest scoring catchment if there is more than one source),
(b) the score for treatment and supply (using the highest scoring treatment process if there is more than one),
(c) the combined catchment and treatment and supply score (either (A1(1) + A1(2)) or (A2(1) + A2(2), as calculated in accordance with Annex A of these Directions),
(d) the final, population weighted score.

(2) The detailed report prepared for 31 March 2004 shall include a programme of work outlining the steps to be taken to ensure compliance with these Directions.

Reports

8. Where an obligation is imposed in these Directions to make a report or provide information to the Scottish Ministers, such report or information shall be submitted to the Drinking Water Quality Unit of The Scottish Executive, Victoria Quay, Edinburgh EH6 6QQ.

Review of Cryptosporidium Directions

9. Scottish Ministers shall review these Directions on or before 30 June 2006.

Revocation

10. The Cryptosporidium (Scottish Water) Directions 2002 are hereby revoked.

These Directions, together with the two annexes attached and signed as relative hereto, are subscribed as follows:–

It is signed by: ……..

……..

Signature of witness: ……..

Full name of witness: ……..

Address of witness: ……..

……..

ANNEX A

Cryptosporidium Risk Assessment

(1) A key element in providing appropriate treatment to minimise the risk from *Cryptosporidium* is the assessment of the risk to a supply from *Cryptosporidium*. It is important that any risk assessment process considers all the relevant factors. The methodology considers factors that include: the degree of exposure of the catchment to oocysts, agricultural practices, sewage inputs, water source type, river and intake management, water treatment, treatment works monitoring, performance and operational factors, and *Cryptosporidium* monitoring. Every effort was made to take into account the recommendations in the Third Report as the risk assessment process was developed. The methodology is based on a simple scoring system that assesses the risk by identifying the potential for *Cryptosporidium* to be present in the water. The higher the score the higher the potential risk.

(2) It is important that once the risk assessment scoring is complete, a process is put in place to update the assessment if there are any changes to the supply. This will ensure that maximum benefit is derived from the risk assessment scoring process. Any changes in the risk assessment score should be notified to the Scottish Ministers within 10 working days of the new score being produced.

(3) It is essential that the risk assessment is carried out with a view to assessing the risk throughout the year, and not just for the period of the assessment.

(4) Surface water should be scored using the Risk Assessment in Annex A1, and groundwaters using the Risk Assessment in Annex A2. For the purpose of this Annex and these Directions, the definitions for surface water and groundwater are as follows:

(a) Surface water

Water which is open to the atmosphere and subject to surface runoff.

(b) Groundwater definition:

(i) Water which has no significant occurrence of insects or other macroorganisms, algae or large diameter pathogens, and
(ii) Water which is below the surface and which has no significant or relatively rapid shifts in water characteristics such as colour, turbidity, temperature, conductivity or pH that correlate to climatological or surface water conditions.

ANNEX A1 – SURFACE WATER RISK ASSESSMENT

This risk assessment shall only be carried out on water supplies that are from, or are influenced by, surface water, i.e. rivers, reservoirs, springs and shallow underground sources (such as river gravels).

A1(1) – Surface Water Catchment Score

Where there is more than one source supplying a treatment works, each source should be assessed individually and the highest score used to calculate the combined catchment and treatment and supply score, and the final, population weighted score.

1 Animals on the Catchment

Sheep and cattle on the catchment represent a potential source of *Cryptosporidium*. There is a particular risk where there is lambing or calving. Deer are also carriers of *Cryptosporidium* parvum and may cause contamination of water supplies if they are present in high numbers or if they are farmed near raw water sources. In addition, pigs can be a source of the parasite and may cause problems if they are farmed close to drinking water sources. While there is always a risk of contaminated faeces entering supplies after periods of heavy rain, the risk is higher if animals have direct access to the water. The density of animals on a catchment is significant – the higher the density the higher the potential risk. Forage areas are defined as grass, open woodland, rape for stock feed, rough grazing, turnips/swedes for stock feed, or other crops for stock feed. The entire year should be considered, and risk assessments should take account of seasonal farming practices and seasonal variations in wild animal and bird populations.

Section Score = (1.1 or 1.2) + (1.3 or 1.4) + (1.5 or 1.6) + 1.7 +1.8 + 1.9 + 1.10

		Score
1.1	Density of cattle/calves on catchment less than or equal to one animal per hectare of forage area(1)	6
1.2	Density of cattle/calves on catchment greater than one animal per hectare of forage area(1)	12
1.3	Density of sheep/lambs on catchment less than or equal to six animals per hectare of forage area(2)	6
1.4	Density of sheep/lambs on catchment greater than six per hectare of forage area(2)	12
1.5	Animals have direct access to water source (including feeder streams)	4
1.6	Fencing (complete) prevents access to water source (including feeder streams)	-1
1.7	Deer	2
1.8	Pig Farms	2
1.9	High numbers of Birds	2
1.10	Any other farmed animal/bird	1

Notes: (1) if the density of cattle/calves is unknown, 1.2 should be chosen rather than 1.1
(2) if the density of sheep/lambs is unknown, 1.4 should be chosen rather than 1.3

2 Agricultural Practices on the Catchment

Slurry spraying on agricultural land poses a high risk of *Cryptosporidium* contamination. Although well kept middens and slurry stores can be effective at killing oocysts, there is no way of knowing how effectively they are being operated and should therefore be assumed to be posing a risk.

If more than one activity is taking place on the catchment, the scores should be added together.

		Score
2.1	Slurry Spraying	6
2.2	Dung Spreading	3
2.3	Dung or Slurry Stores	3
2.4	Sheep pens or cattle byres	6
2.5	Lambing or calving on the catchment	8

3 Discharges into the Catchment/Water Source

Sewage works and septic tanks may not remove *Cryptosporidium* so disease in the community could lead to oocysts, with specific pathogenicity to humans, in sewage works or septic tank effluent. If the water then enters a raw water source, contamination has occurred. The impact of sewage works is scored on the basis of the population served by the sewage works. Account is also taken of any storm water outlets or abattoir/livestock markets that may occasionally impact on an individual catchment.

Storm water outlets and abattoir/livestock markets should be scored once, even if there is known to be more than one discharging into the catchment. For sewage works and septic tanks, the score which best reflects the cumulative total population served by all of the sewage works should be used, e.g. if there are two sewage works which serve a population equivalent of 500, the score for sewage works should be 5, as the population banding would fall into the 500 - 5,000 category.

Section Score = (score from 3.1 - 3.2) + (score from 3.3 - 3.7) + 3.8 + 3.9

		Score
3.1	Septic Tanks serving population of ≤100	4
3.2	Septic tanks serving population of >100	6
3.3	Sewage Works – Population equivalent <500	4
3.4	Sewage Works – Population equivalent 500 to 5,000	5
3.5	Sewage Works – Population equivalent 5,001 to 20,000	6
3.6	Sewage Works – Population equivalent 20,001 to 50,000	7
3.7	Sewage Works – Population equivalent >50,000	8
3.8	Storm Water Outlets	2
3.9	Abattoir/Livestock Market	2

4 Water Source Type

Surface water and vulnerable shallow underground sources are considered to be at the highest risk from *Cryptosporidium*. Rivers represent a higher risk than reservoirs since rivers can pass through larger areas, are subject to greater mixing and have little chance of settlement. Springs are classed as surface waters and are considered to be a lower risk, however if there is any possibility of them being contaminated along their length, their risk score increases.

Groundwater sources such as deep wells and boreholes should be assessed using the risk assessment methodology in Annex A2.

One score should be allocated from the list for source type.

		Score
4.1	Natural Springs – Vulnerable Soil/Geology	4
4.2	Natural Springs – Non-Vulnerable Soil/Geology	1
4.3	Other Shallow Underground Sources –Vulnerable Soil/Geology	4
4.4	Other Shallow Underground Sources - Non-Vulnerable Soil/Geology	2
4.5	Upland Reservoir	2
4.6	Lowland Reservoir	4
4.7	Upland River or Burn – Direct Abstraction	6
4.8	Lowland River or Burn – Direct Abstraction	8

5 Raw Water Aqueducts

If raw water is transferred to the treatment works in an aqueduct, this section should be scored.

One score should be allocated for this section.

		Score
5.1	Raw water aqueduct known or suspected to be vulnerable to contamination from farmland	8
5.2	Raw water aqueduct proven to be secure from contamination from farmland within the past five years.	0

6 Catchment Inspections

Section Score = (6.1 or 6.2) + 6.3

		Score
6.1	Catchment inspections carried out monthly	-3
6.2	Catchment inspections not carried out monthly	6
6.3	Procedures in place to deal with irregularities on the catchment	-3

7 Raw Water Intake Management

This section should only be scored if the raw water is directly abstracted from a river or burn source.

Risk is reduced where turbidity monitors are used on a river or burn intake. If the monitors are alarmed and the intake is shut under poor water quality conditions the risk is reduced further.

Total = (score from 7.1 - 7.2) + (score from 7.3 - 7.5)

		Score
7.1	No turbidity monitor on the intake	3
7.2	Turbidity monitor on the intake which is alarmed and connected to telemetry	-2
7.3	Intakes shut automatically under poor water quality conditions	-4
7.4	Intakes shut manually under poor water quality conditions	-1
7.5	Intakes not shut under poor water quality conditions	3

A1(1) – Surface Water Catchment Score = Σ Sections (1 - 7)

A1(2) – Surface Water Treatment and Supply Score

If there is more than one water treatment process on-site, each process should be scored individually. The highest scoring process should then be used to calculate the combined catchment and treatment and supply score and the final, population weighted, score.

8 Water Treatment

It is well established that some treatment processes are more effective at reducing the risk posed by *Cryptosporidium* than others. The most effective treatment processes are those that use membrane filtration or a coagulant followed by DAF/sedimentation and filtration. Simple disinfection and microstraining pose the highest risk and are scored accordingly.

There should be one score from this section.

		Score
8.1	Disinfection only	10
8.2	Microstraining	10
8.3	Simple Sand Filtration (Not Slow Sand)	8
8.4	Coagulation followed by DAF/Sedimentation and Filtration	-10
8.5	Coagulation followed by Rapid Gravity or Pressure Filtration only	-7
8.6	Slow Sand Filtration	-9
8.7	Membrane Filtration (membrane on the Scottish Executive's list of products capable of removing or retaining particles greater than one micron diameter)	-16
8.8	Membrane Filtration (membrane not on the Scottish Executive list)	-2
8.9	Cartridge/Kalsep filtration	-2
8.10	Filtamat or equivalent	-2

9 Treatment Works Monitoring

For rapid gravity and pressure filters, treatment works that have turbidity and residual coagulant monitors with alarms receive the best negative score, and a lack of instrumentation receives a positive score to reflect the increased risk. With slow sand filters, the process of adequately maturing the filters after cleaning is recognised. Membrane filters that are integrity tested according to agreed protocols are given a negative score.

Section 9 should be scored only where filtration is part of the water treatment process.

Rapid Gravity and Pressure Filters:
Section Score = (9.1 - 9.5) + (9.6 - 9.8) + 9.9 +(9.10 - 9.12) + (9.13 - 9.14) + (9.15 -9.16)
Slow Sand Filters:
Section Score = (9.17 - 9.21) + (9.22 - 9.24) + 9.25 + (9.26 - 9.28)
Membrane Filters:
Section Score = (9.29 - 9.31) + 9.32

			Score

Rapid Gravity and Pressure Filters	9.1	Each filter has a turbidity meter with an alarm on telemetry	–5
	9.2	Each filter has a turbidity meter but without an alarm on telemetry	0
	9.3	One turbidity meter is shared over several filters with an alarm on telemetry	-2
	9.4	One turbidity meter is shared over several filters but without an alarm on telemetry	2
	9.5	No turbidity meter monitoring filter performance	10
	9.6	Final water turbidity meter with an alarm on telemetry	-2
	9.7	Final water turbidity meter without an alarm on telemetry	2
	9.8	No final water turbidity meter	5
	9.9	Particle counter used to continuously monitor filter performance	-5
	9.10	Alarmed residual coagulant monitor continuously monitoring combined filtrate or works outlet	-5
	9.11	Residual coagulant monitor continuously monitoring combined filtrate or works outlet but not alarmed	-1
	9.12	No residual coagulant monitor continuously monitoring works outlet	5
	9.13	Routine sampling and analysis of the water quality process carried out at the WTW for residual coagulant	-2
	9.14	No routine sampling and analysis of the water quality process carried out at the WTW for residual coagulant	2
	9.15	Turbidity of backwash supernatant monitored when recycled	-2
	9.16	Turbidity of backwash supernatant not monitored when recycled	2
Slow Sand Filters	9.17	Each filter has a turbidity meter with an alarm on telemetry	–5
	9.18	Each filter has a turbidity meter but without an alarm on telemetry	0
	9.19	One turbidity meter is shared over several filters with an alarm on telemetry	-2
	9.20	One turbidity meter is shared over several filters but without an alarm on telemetry	2
	9.21	No turbidity meter monitoring filter performance	10
	9.22	Final water turbidity meter with an alarm on telemetry	-2
	9.23	Final water turbidity meter without an alarm on telemetry	2
	9.24	No final water turbidity meter	5
	9.25	Particle counter used to continuously monitor filter performance	-5
	9.26	Slow sand filters matured and filtrate analysed for turbidity, total coliforms and *Cryptosporidium* during maturation	-4
	9.27	Slow sand filters matured but no analysis carried out on filtrate	5
	9.28	Slow sand filters not matured	15
Membrane Filters	9.29	Membrane plant monitored and alarmed for integrity	-3
	9.30	Membrane plant monitored for integrity but not alarmed	0
	9.31	Membrane Plant not monitored for integrity	10
	9.32	Alarmed particle counter used to continuously monitor membrane performance	-5

10 Rapid Gravity and Pressure Filter Works Performance

This section deals with the performance of rapid gravity and pressure filter works taking into account analytical and process data. Factors such as the impact of filter washing on final water turbidity, filter media loss and filter condition are also taken into account. Where the process is bypassed or is known to be problematic due to residual coagulant or coliform failures at the works outlet, then positive scores are given.

Section Score = (10.1 or 10.2) + (10.3 or 10.4) + 10.5 + 10.6 +10.7

10.1	Final water turbidity increases by greater than 50%, excluding normal backwash period.	4
10.2	Final water turbidity increases by less than 50%, excluding normal backwash period.	0
10.3	Signs that media loss from any rapid gravity or pressure filters has brought media depth below design criteria level	6
10.4	Depth of sand on filters at or above minimum design level with audit trail maintained	-2
10.5	Signs of cracking of any rapid gravity or pressure filters	4
10.6	All rapid gravity filters and pressure filters on treatment works have been drained, inspected, and necessary remedial work carried out as needed within last year	-2
10.7	Air scour and backwash maintained and operating efficiently as per maintenance manual	-2

11 Treatment Works Operation

The importance of good operating practice and quality assured procedures cannot be over emphasised. Negative scores are given for slow starts on filters, filters run to waste for a period after backwash, stable flow through plant, and alternative disposal routes for backwash and/or sludge supernatant. Conversely, where these facilities are absent, positive scores are recorded. The availability of works process control manuals and auditable action plans for dealing with deviations in water quality are also scored appropriately.

Section Score = (11.1 or 11.2) + (11.3 or 11.4) + (11.5 or 11.6)* + (11.7 - 11.9)* + (11.10 - 11.11)* + (11.12 or 11.13) + (11.14 or 11.15) + (11.16 or 11.17)

*If appropriate

		Score
11.1	Treatment Works Process Control Manuals specific to the works available	-1
11.2	Treatment Works Process Control Manuals specific to the works not available	1
11.3	Auditable Action Plans for dealing with deviations in quality available	-1
11.4	Auditable Action Plans for dealing with deviations in quality not available	1
11.5	Slow Start facility on rapid gravity or pressure filters operational	-4
11.6	No Slow Start facility on rapid gravity or pressure filters, or Slow Start facility not operational	4
11.7	Rapid gravity or pressure filters run to waste for an appropriate period after backwash	-6
11.8	Filters run to head of works for a period after backwash	-4
11.9	Filters not run to waste or head of works for a period after backwash	4
11.10	Backwash and/or sludge supernatant has to be recycled	2
11.11	Alternative disposal route available for backwash and sludge supernatant	-2
11.12	Water flow through plant whilst in operation has increased by > 10% in < 30 minutes during last 12 months	2
11.13	Water flow through plant whilst in operation has not increased by > 10% in < 30 minutes during last 12 months	-2
11.14	Plant run above design capacity > 10% of time in last 12 months	4
11.15	Plant run above design capacity ≤ 10% of time in last 12 months	0

A1(2) – Surface Water Treatment and Supply Score = Σ Sections (8 - 11)

A1(3) – Population Weighting

A1(3) – Population Weighting = 0.4 x Log_{10}(population served by supply)

Final Weighted Surface Water Risk Assessment Score = [A1(1) +A1(2)] x A1(3)

ANNEX A1 – GROUNDWATER RISK ASSESSMENT

This Risk Assessment shall only be carried out on water supplies that are from groundwater sources, i.e. boreholes and deep wells.

A2(1) – Groundwater Catchment Score

Where there is more than one source supplying a treatment works, each source should be assessed individually and the highest score used to calculate the combined catchment and treatment and supply score, and the final, population weighted score.

1 Animals on the Catchment

Sheep and cattle on the catchment represent a potential source of *Cryptosporidium*. There is a particular risk where there is lambing or calving. Deer are also carriers of *Cryptosporidium* parvum and may cause contamination of water supplies if they are present in high numbers or if they are farmed near raw water sources. In addition, pigs can be a source of the parasite and may cause problems if they are farmed close to drinking water sources. While there is always a risk of contaminated faeces entering supplies after periods of heavy rain, the risk is higher if animals have direct access to the water. The density of animals on a catchment is significant – the higher the density the higher the potential risk. Forage areas are defined as grass, open woodland, rape for stock feed, rough grazing, turnips/swedes for stock feed, or other crops for stock feed. The entire year should be considered, and risk assessments should take account of seasonal farming practices and seasonal variations in wild animal and bird populations.

Section Score = (1.1 or 1.2) + (1.3 or 1.4) + 1.5 + 1.6 + 1.7 +1.8 + 1.9 + 1.10

		Score
1.1	Density of cattle/calves on catchment less than or equal to one animal per hectare of forage area(1)	6
1.2	Density of cattle/calves on catchment greater than one animal per hectare of forage area(1)	12
1.3	Density of sheep/lambs on catchment less than or equal to six animals per hectare of forage area(2)	6
1.4	Density of sheep/lambs on catchment greater than six per hectare of forage area(2)	12
1.5	Animals have direct access to water source (including feeder streams)	4
1.6	Fencing (complete) prevents access to water source (including feeder streams)	-1
1.7	Deer	2
1.8	Pig Farms	2
1.9	High numbers of Birds	2
1.10	Any other farmed animal/bird	1

Notes: (1) if the density of cattle/calves is unknown, 1.2 should be chosen rather than 1.1
(2) if the density of sheep/lambs is unknown, 1.4 should be chosen rather than 1.3

2 Agricultural Practices on the Catchment

Slurry spraying on agricultural land poses a high risk of *Cryptosporidium* contamination. Although well kept middens and slurry stores can be effective at killing oocysts, there is no way of knowing how effectively they are being operated and should therefore be assumed to be posing a risk.

The scores should be added together in this section as appropriate.

		Score
2.1	Slurry Spraying	6
2.2	Dung Spreading	3
2.3	Dung or Slurry Stores	3
2.4	Sheep pens or cattle byres	6
2.5	Lambing or calving on the catchment	8

3 Discharges into the Catchment/Water Source

Sewage works and septic tanks may not remove *Cryptosporidium* so disease in the community could lead to oocysts in sewage works or septic tank effluent. If the water then enters a raw water source, contamination has occurred. The impact of sewage works is scored on the basis of the population served by the sewage works. Account is also taken of any storm water outlets or abattoir/livestock markets that may occasionally impact on an individual catchment.

Each of septic tanks, sewage works, storm water outlets and abattoirs/livestock markets should be scored once, even if there is known to be more than one discharging into the catchment. For sewage works and septic tanks, the score which best reflects the cumulative totals should be used, e.g. if there are two sewage works which serve a population equivalent of 500, the score for sewage works should be 5, as the population banding would fall into the 501 - 5,000 category.

Section Score = (3.1 or 3.2) + (3.3 - 3.7) + 3.8 + 3.9

		Score
3.1	Septic Tanks serving population of ≤100	4
3.2	Septic tanks serving population of >100	6
3.3	Sewage Works – Population equivalent <500	4
3.4	Sewage Works – Population equivalent 501 to 5,000	5
3.5	Sewage Works – Population equivalent 5,001 to 20,000	6
3.6	Sewage Works – Population equivalent 20,000 to 50,000	7
3.7	Sewage Works – Population equivalent >50,000	8
3.8	Storm Water Outlets	2
3.9	Abattoir/Livestock Market	2

4 Geology/Hydrogeology

Sand and gravel boreholes with a free draining or restricted mineralogy soil cover would allow *Cryptosporidium* to flow easily into drinking water supplies, and therefore are considered to be at risk from contamination from *Cryptosporidium*. This risk is reduced if the drainage at the site or if there is a rich mineralogy soil cover. Limestone is also at risk as there can be significant fissures in the rock that could allow *Cryptosporidium* to pass through. Igneous and metamorphic are dense rock formations and water carrying fissures are likely to be near the surface thereby exposed to short circuiting. Sandstone is at a lower risk from *Cryptosporidium* as the pore sizes are smaller and are less susceptible to fissures. They are better barriers to *Cryptosporidium* if they have an impeded drainage or rich mineralogy soil cover.

One score should be allocated from the list for source type.

		Score
4.1	Sand and Gravel flow aquifer with free draining/restricted mineralogy soil cover	12
4.2	Sand and Gravel flow aquifer with impeded drainage/rich mineralogy soil cover	8
4.3	Sandstone and conglomerates flow aquifer with free draining/restricted mineralogy soil cover	8
4.4	Sandstone and conglomerates flow aquifer with impeded drainage/rich mineralogy soil cover	4
4.5	Limestone	12
4.6	Igneous and metamorphic	12

5 Rapid By-pass of Unsaturated Zone

Contamination of groundwater with surface water may increase the risk of *Cryptosporidium* entering supplies. One score should be given in this section. If the score is taken from 5.4, evidence must be available to demonstrate that there is no transmission of surface water.

		Score
5.1	Known rapid transmission of surface run-off to groundwater	20
5.2	Possible direct transmission of surface run-off to groundwater	15
5.3	Direct transmission of surface run-off unlikely	5
5.4	Proven that there is no transmission of surface run-off	-20

6 Induced Recharge from Surface Water Bodies

Contamination of groundwater with surface water may increase the risk of *Cryptosporidium* entering supplies. It is essential that at least a year's performance is considered with this section as it may be that surface water enters supplies under particular conditions - if this is the case then the worst case should be assumed and the highest score given.

One score should be allocated from the list for this section.

		Score
6.1	Significant proportion of groundwater abstracted derived from induced recharge from surface water	20
6.2	Small proportion of yield could be derived from induced recharge from surface water	15
6.3	No evidence of groundwater yield being derived from induced recharge from surface water	10
6.4	Proven evidence groundwater recharge is derived from groundwater	-20
6.5	Infiltration into spring pipework system	20

7 Site Drainage

Infiltration of water into the groundwater system can introduce contamination into the groundwater supply. Poor drainage at the site encourages water to collect and pond, and increases the risk from *Cryptosporidium*. The positioning of the headworks is important, as is its liability to flooding.

Section Score = (7.1 - 7.3) + (7.4 - 7.7)

		Score
7.1	Bad site drainage with run-off collecting and ponding	12
7.2	Good site drainage but contours tend to bring run-off towards the borehole	8
7.3	Good site drainage with contours falling away from borehole, or no possibility of run-off collecting	0
7.4	Headworks in outside chamber and/or below ground level, liable to flooding or leaking structure	12
7.5	Headworks in outside chamber, but sealed and dry	9
7.6	Flow headworks inside building with cover flush to the floor or Imperfectly sealed.	6
7.7	Headworks inside building with completely sealed raised cover	-4

8 Borehole Constructions/Integrity

Lack of integrity at a borehole can allow contamination into the water supply. Ensuring that the borehole is well constructed and has a good casing integrity can reduce the risk.

		Score
8.1	Borehole with known or suspected poor casing integrity	12
8.2	Borehole with suspected, but not proven, good casing integrity	4
8.3	Borehole with proven good casing integrity	-8

A2(1) – Groundwater Catchment Score = Σ Sections (1 - 8)

A2(2) – Groundwater Treatment and Supply Score

If there is more than one water treatment process on-site, each process should be scored individually. The highest scoring process should then be used to calculate the combined catchment and treatment and supply score and the final, population weighted, score.

9 Treatment Works Performance and Monitoring

Measurement of the turbidity of borehole water can show if there has been contamination of the borehole from surface water, with each abstraction point ideally having its own turbidity meter that is alarmed and linked to the telemetry system. If the treatment works shuts down when it measures a set increase in turbidity, this can reduce risk, assuming that the contaminated water is flushed to waste. Turbidity fluctuations can indicate that there has been contamination, and there is therefore an increased risk from *Cryptosporidium*.

Section Score = (9.1 – 9.5) + (9.6 or 9.7) + 9.8

		Score
9.1	Each abstraction point has a turbidity meter with an alarm on telemetry	-5
9.2	Each abstraction point has a turbidity meter without an alarm on telemetry	0
9.3	One turbidity meter covers several abstraction points with an alarm on telemetry	-2
9.4	One turbidity meter covers several abstraction points without an alarm on telemetry	2
9.5	No turbidity meter on abstraction point	10
9.6	Turbidity fluctuations detected in final water from continuous monitoring	4
9.7	No evidence of turbidity fluctuations from continuous turbidity monitoring	0
9.8	Treatment works shut down automatically by increases in turbidity	-4

10 Treatment Works Operation

The importance of good operating practice and quality assured procedures cannot be over emphasised. The availability of works process control manuals, action plans for dealing with deviations in water quality and records of actions/audits trails are also scored appropriately.
It is also very important that flow increases are controlled, and that the plant is not run significantly above capacity to avoid increases of turbidity of water from the borehole.

Section Score = (10.1 or 10.2) + (10.3 or 10.4) + (10.5 or 10.6) + (10.7 or 10.8) + 10.9

		Score
10.1	Treatment works process control manuals which are specific to the works are available	-1
10.2	Treatment works process control manuals which are specific to the works are not available	1
10.3	Action plans for dealing with deviations in water quality are available	-1
10.4	Action plans for dealing with deviations in water quality are not available	1
10.5	Record of actions/audit trails available	-2
10.6	Records of actions/audit trails not available	2
10.7	Flow increase not controlled (i.e. no variable speed drive or similar)	5
10.8	Flow increase controlled (i.e. variable speed drive or similar used)	-2
10.9	Plant run above design capacity >10% of time whilst in operation during last 12 months	4

A2(2) – Groundwater Treatment and Supply Score = Σ Sections (9 & 10)

A2(3) – Population Weighting

A2(3) – Population Weighting = 0.4 x Log_{10}(population served by supply)

Final Weighted Groundwater Risk Assessment Score = [A2(1) +A2(2)] x A2(3)

ANNEX B

Final Weighted Surface Water or Groundwater Risk Assessment Score	Supply Classification	Action to be taken by Scottish Water
>100	**High Risk**	If the appropriate health board has implicated the supply as the likely source of an outbreak of cryptosporidiosis within the last 5 years, then the raw and final water shall be continuously monitored (365 samples/year). Otherwise, final water monitoring shall be carried out at a rate of 104 samples per year or in accordance with article 5 of these Directions, whichever gives the greater number. Raw water sampling for supplies not implicated in an outbreak within the last 5 years shall be carried out as prescribed in article 5 of these Directions.
50 – 100	**Moderate Risk**	Raw and final water monitoring shall be carried out in accordance with article 5 of these Directions.
< 50	**Low Risk**	Raw and final water monitoring shall be carried out in accordance with article 5 of these Directions.