Water Resource Quality Monitoring

VOLUME 3

sampling protocol for

Toxic algae

the dwaf

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Volume 3: Toxic algae

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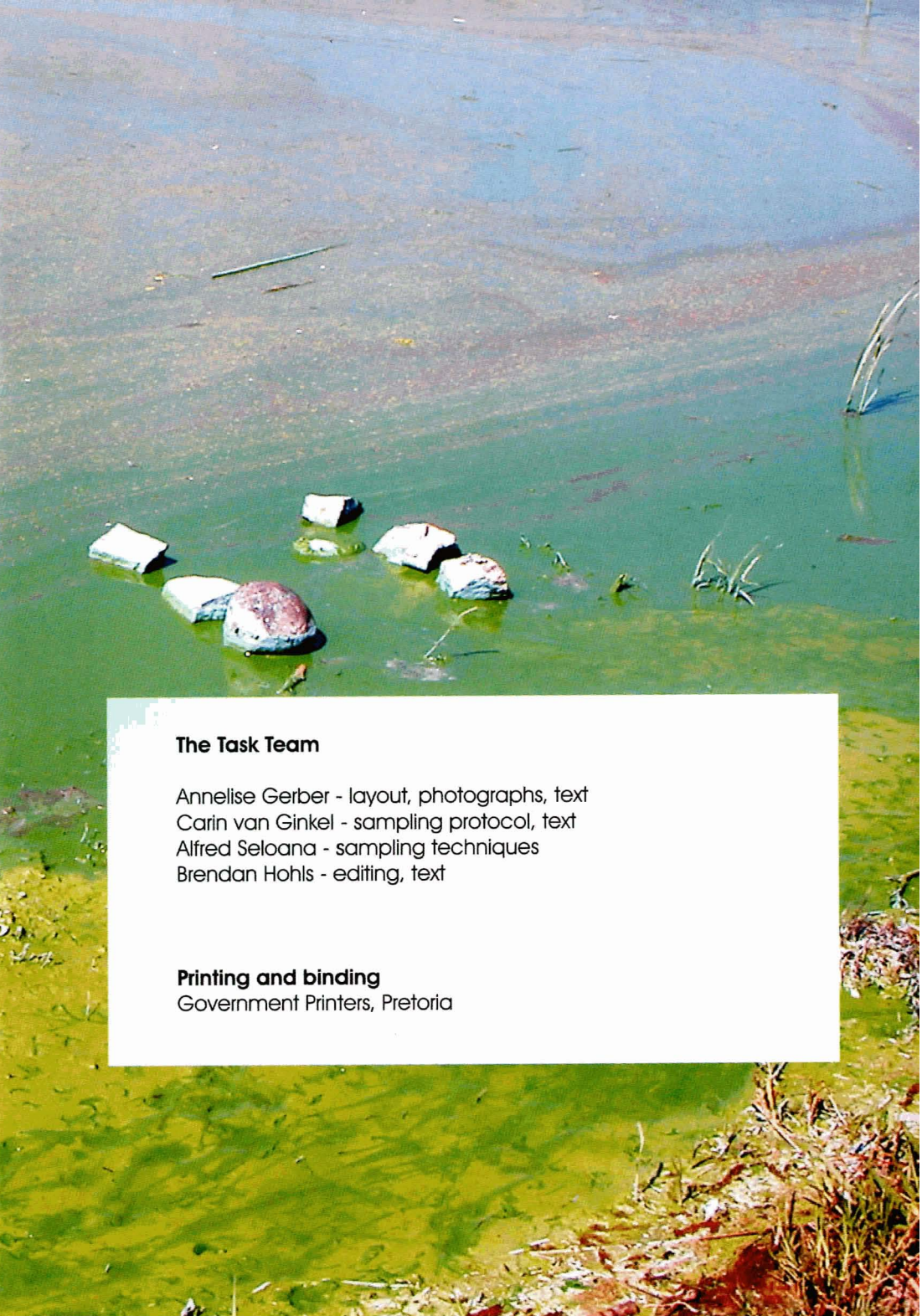

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BACKGROUND INFORMATION

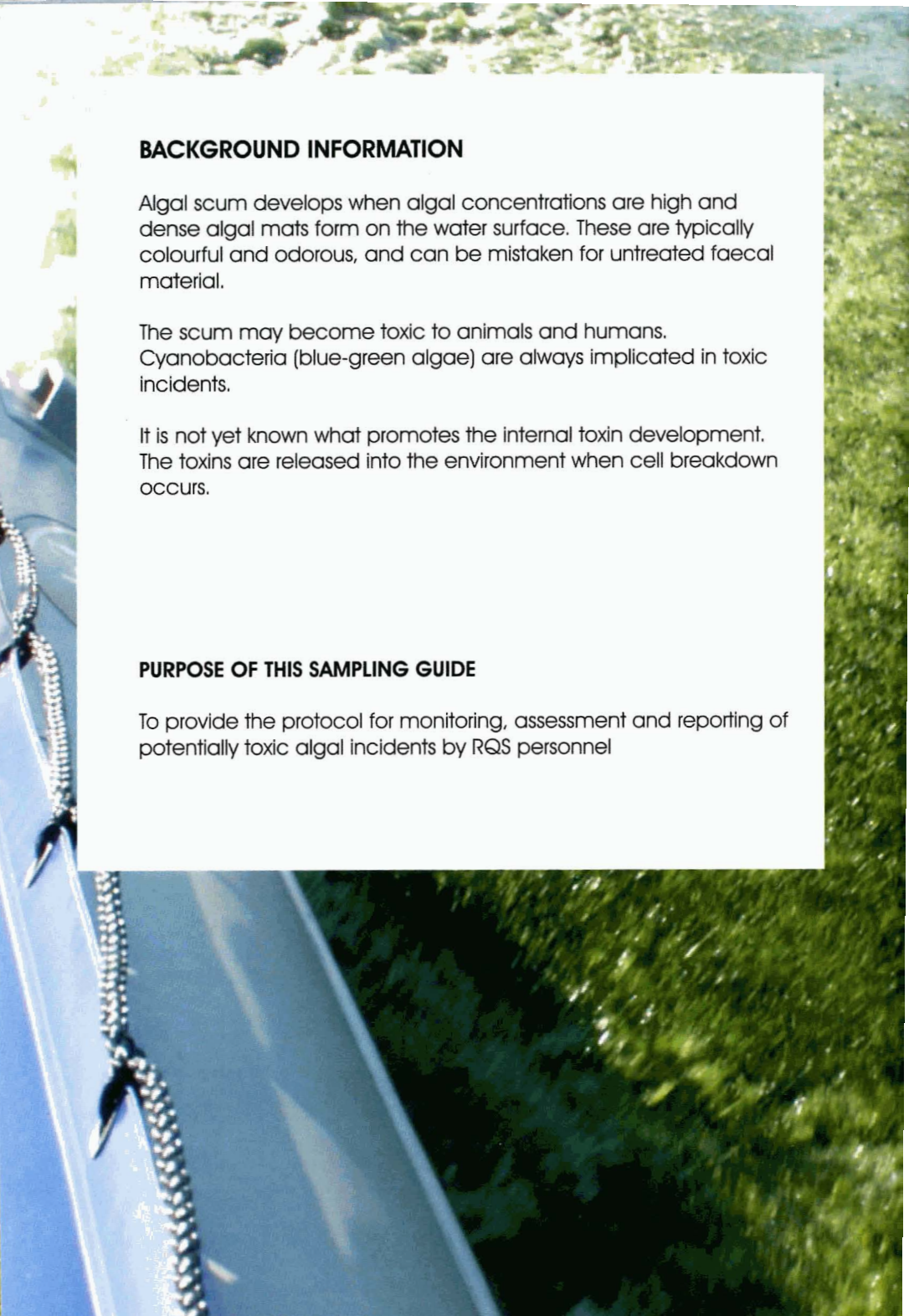
Algal scum develops when algal concentrations are high and dense algal mats form on the water surface. These are typically colourful and odorous, and can be mistaken for untreated faecal material.

The scum may become toxic to animals and humans. Cyanobacteria (blue-green algae) are always implicated in toxic incidents.

It is not yet known what promotes the internal toxin development. The toxins are released into the environment when cell breakdown occurs.

PURPOSE OF THIS SAMPLING GUIDE

To provide the protocol for monitoring, assessment and reporting of potentially toxic algal incidents by RQS personnel



TOXIC ALGAE

Contents

1. WHAT IS TOXIC ALGAE?

In water bodies that have a tendency towards eutrophic (nutrient enriched) conditions, we normally find cyanobacteria (blue-green algae),during summer which can produce toxins that are harmfull to humans and animals.

Cyanobacteria do not need to be present in high concentrations to be toxic.

In very high concentrations, the algae/cyanobacteria can form a thick scum on the water surface. When this scum dies off, due to exposure to sunlight or some other factor, the scum turns blue-green to whitish. During this maturation process, gases are released resulting in the extremely foul smell present in the vicinity of the algal mass.

The scum finally turns black and then sinks. At this stage it can be mistaken for untreated faecal material.
Flies are frequently present on the algal scum.

WHEN TO GET WORRIED?

When large amounts of green algae are visible on the surface of the water

WHEN TO TAKE ACTION?

When the following symptoms occur:

- Livestock deaths in the vicinity of surface water
- Tastes and odours in surface or treated water
- Raw sewage-like material in recreational water
- Skin rashes
- Eye irritations
- Vomitting
- Fever
- Pains in muscle and joints

2. PROCEDURES

- It should be assumed from the outset that the algae are toxic
- Valid records of incidents should be kept for future reference
- The investigating official should follow the flow diagram on page 8 in order to conduct the investigation and assessment

The following **PHYSICAL PROPERTIES** should be measured during an investigation

- Temperature
- Dissolved oxygen
- pH

The following SAMPLES should be collected during an investigation

A sample for major inorganic ions

(Volume 1, page 15)

A sample for algal identification

(*Volume 2, page 20*)

A sample for chlorophyll *a* concentration

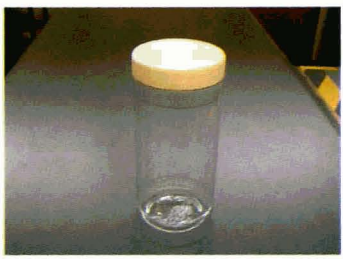
(Volume 2, page 16)

Algal scum for toxicological test

(Volume 3, page 9)

How to collect an algal scum sample

Use a wide necked liter bottle



Hold the bottle horizontal to the water and collect the upper layer of scum from the water

Fill the bottle to the top

Add a tag and store bottle in a cooler

3. PROCEDURES FOR TOXIC ALGAL ASSESSMENT

PROBLEM IDENTIFICATION

SITE ASSESSMENT

- Desk-top study
- Regional information collected from completed form

DETERMINE SAMPLING SITES

- Visit contaminated area & identify most affected area
- Identify upstream site
- Identify downstream site
- Identify site at dam wall (if in an impoundment)

VARIABLES TO BE SAMPLED

***In situ* (in the field)**

- Temperature
- Dissolved oxygen
- pH

Laboratory analysis

- Algal identification
- Chlorophyll a concentration
- Algal scum for toxicological test
- Macro chemicals (including KN & TP)

SAMPLE ANALYSIS

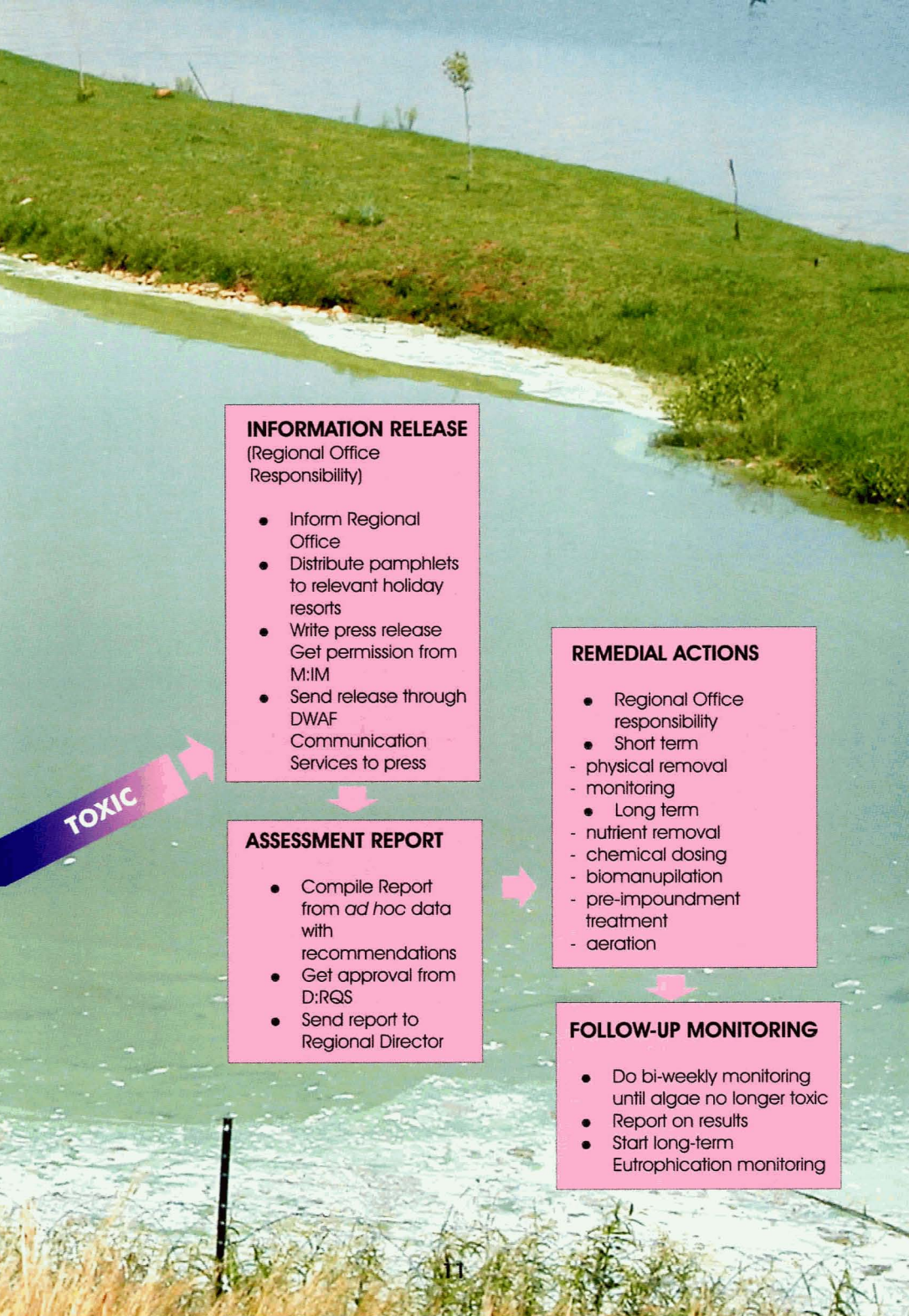
- At RQS laboratories (all variables)
- Onderstepoort Toxicological laboratory

DATA ASSESSMENT

NOT TOXIC

ASSESSMENT REPORT

- Inform Regional office (telephonically or short report)
- Send report to Regional Director



INFORMATION RELEASE
(Regional Office Responsibility)

- Inform Regional Office
- Distribute pamphlets to relevant holiday resorts
- Write press release Get permission from M:IM
- Send release through DWAF Communication Services to press

TOXIC

ASSESSMENT REPORT

- Compile Report from *ad hoc* data with recommendations
- Get approval from D:RQS
- Send report to Regional Director

REMEDIAL ACTIONS

- Regional Office responsibility
- Short term

- physical removal
- monitoring

- Long term

- nutrient removal
- chemical dosing
- biomanupilation
- pre-impoundment treatment
- aeration

FOLLOW-UP MONITORING

- Do bi-weekly monitoring until algae no longer toxic
- Report on results
- Start long-term Eutrophication monitoring

Problem Identification

- Notification of possible existing algal problem
- Determine nature of problem
- Notify D:RQS
- Notify relevant Regional Office
- RQS assist Regional Office in investigation (if there is capacity to do so)

Site Assessment

- Complete Toxic Algal Incident form (end of document)
- Undertake a desktop study
- Collect all available regional information on the location
- Utilise 1:50 000 map to get exact location of incident

Determine Sampling Sites

- In collaboration with the regional personnel, visit the affected area
- Determine upstream and downstream sites in the vicinity of the affected area
- If the incident is situated in a dam, one sample should be taken near to the dam wall in addition to the other sites
- This will facilitate the inclusion of the dam in the National Eutrophication Monitoring Program, and represent the start of sampling at the dam for the determination of reference or future conditions

Sampling Variables

Variables

- Temperature
- Dissolved oxygen
- pH
- Algal identification
- Algal scum for toxicological test
- Chlorophyll *a* determination
- Major inorganic constituents
- Total phosphorus
- Total nitrogen

Equipment

Ensure that the RQS laboratory staff has the capacity to conduct all of the required analyses. Ensure that enough sampling bottles are taken to the site, so that samples can be taken at all the appropriate places. The following equipment should be taken to the sampling point:

- Oxygen, temperature and pH meters
- Major inorganic constituent (macro) bottles
- $HgCl_2$ ampoules (for macro sample preservation)
- Algal identification sampling bottles (with Lugol's preservative)
- 1 liter wide-necked algal scum sampling bottles
- 1 liter chlorophyll *a* sampling bottles

Additional important information

- Samples should be registered in the formal way at Sample Reception
- Mark samples *"Urgent"* and inform personnel at Sample Reception of the urgency of analysis of all samples taken during the investigation of a toxic algal incident

- Laboratories must be informed of the expected samples, where possible, at least 1 day before the arrival of the samples
- The laboratories prefer that samples be collected early in the week, to enable them to conduct the necessary analysis

Sample analysis

- RQS biology, major inorganic and organic laboratories will do the analysis of all the necessary samples on an *ad hoc* basis
- Onderstepoort can do toxicological studies (mouse test) when the organic laboratory (ELISA kit and RQS apparatus) is not in working order

Data Assessment

- Data assessment should be done as soon as possible after the samples were analysed and results received
- Determine whether the algal bloom was toxic or non-toxic
- Inform the Regional Office telephonically as soon as the information is available

Information Release

- It is the Regional Office's responsibility to conduct the press release
- Get permission of M:IM for press release
- Work through DWAF Communication Services
- If the algal problem is toxic in nature, assist the Regional Office in informing all affected people (holiday resorts, etc)
- Official can assist Regional Office in writing a press release to inform the relevant affected communities
- The correct procedures for such a press release are indicated in the flow diagram

Assessment Report

- Compile a written report of the assessment of the incident
- Process the report through the D:RQS to the relevant Regional Director/CMA

Remedial Actions

- The Regional Office/CMA is responsible for all remedial actions

Follow-up monitoring

Short term - physical removal
- monitoring

Long term - nutrient removal
- chemical dosing
- biomanupilation
- pre-impoundment treatment
- aeration

- RQS will assist, where capacity is available
- Do bi-weekly (every two weeks) monitoring at the affected areas until the algae are no longer toxic
- Do a final data assessment
- Assessment report will be sent to the Regional Office/CMA

TOXIC ALGAE INCIDENT QUESTIONAIRE

GENERAL INFORMATION

WHO IS THE INFORMANT?

NAME: _____ TEL_____

ADDRESS: _____

_____

AFFILIATION/ORGANISATION: _____

DATE & TIME REPORTED: _____

REPORTING SOURCE(If different to the informant)

NAME OF OFFICIAL/INVESTIGATOR: _____

ORGANISATION: _____

ADDRESS: _____

_____

TEL: (W) (_____) _____ (H) (_____) _____

DATE & TIME OF INVESTIGATION: _____

RQS STAFF MEMBERS/S CO-ORDINATING: _____

SITE INFORMATION

Details of site of algal scum:

Type of water body: Stream ☐ Reservoir ☐ Wetland ☐
Coastal waters ☐ Estuary ☐ Other ☐

Name of water body: _____

Coordinates: _____

Have incidents of algal scum been observed at this site before?
Yes ☐ No ☐ Unsure ☐

Date that algal bloom was noticed: _____

Extent of algal bloom (area covered, where is water body affected (eg. At dam wall or within tributaries) etc): _____

_____

_____

Did any livestock deaths occur?
Yes ☐ No ☐ Unsure ☐

Livestock affected	Number
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Behaviour of affected livestock?

_____

_____

Did a vet conduct an autopsy on the dead livestock?

Yes ☐ No ☐ Unsure ☐

What was the outcome of the autopsy?

_____

_____

Name & contact details of the vet

_____

_____

Did the farmer send liver samples to Onderstepoort?

Yes ☐ No ☐ Unsure ☐

Have people in the area complained of the following symptoms?

Skin rashes ☐ Eye irritations ☐ Vomiting ☐

Fever ☐ Pains in muscles & joints ☐ Liver diseases ☐

HISTORICAL SITE INFORMATION

Known recent activities in the catchment area? (eg. Fertilisation, rain storms, etc) _____

_____

Do you know of any potential effluent spills? _____

_____

SAMPLES AND OBSERVATIONS

VARIABLE	UPSTREAM	IN AFFECTED AREA	DOWNSTREAM
Algal scum?			
Colour of scum?			
Temperature			
pH			
Dissolved Oxygen			
Conductivity			
Odour / taste in water reported			
SAMPLES COLLECTED:			
Major inorganic			
Algal scum?			
Algal identification			

GENERAL REMARKS

Was the Regional DWAF Office informed? _____

_____

_____

_____

PLEASE FAX COMPLETED FORM TO:

The Director: Resource Quality Services
Department of Water Affairs and Forestry
Private Bag X313
PRETORIA
0001

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