This document is written primarily for Water Services Authorities, Water Services Providers, implementing agencies and Catchment Management Agencies in order to provide guidelines and tools to help protect rural community water supply sources from potential contamination.
Foreword

Toolkit for Water Services

Groundwater has historically been given limited attention, and is not perceived as an important water resource, in South Africa. This is reflected in statistics showing that only 13% of the nation’s total water supply originate from groundwater. Because of the highly distributed nature of the water demand in rural and informal peri-urban settlements, regional schemes are, in most instances, not economically feasible. And because of decreasing available river and spring flows during low flow and drought periods, as well as wide-spread problems of surface water pollution in rural areas, groundwater will be the most feasible option for a large part of the new water demand.

The NORAD-Assisted Programme for the Sustainable Development of Groundwater Sources under the Community Water and Sanitation Programme in South Africa was managed by the Department of Water Affairs and Forestry (DWAF) between 2000 and 2004. The Programme undertook a series of inter-related projects aimed at enhancing capacity of water services authorities and DWAF to promote and implement sustainable rural water supply schemes based on groundwater resources and appropriate technologies.

Page 2 has a full list of the Programme outputs. The formats for these range from documents to software programmes and an internet portal, to reference sites where communities have implemented appropriate technologies. For more information on the “package” of Programme outputs contact your nearest DWAF Regional Office or Head Office in Pretoria.

It is our sincere hope that this Programme will contribute to the body of work that exists to enable more appropriate use and management of groundwater in South Africa.

Guidelines for Protecting Springs is Number 3.2 in the Toolkit for Water Services. This document is written primarily for Water Services Authorities, Water Services Providers, implementing agencies and Catchment Management Agencies in order to provide guidelines and tools to help protect rural community water supply sources from potential contamination.
## Toolkit for Water Services

1. **Overview documentation**
   1.1 A Framework for Groundwater Management of Community Water Supply
   1.2 Implementing a Rural Groundwater Management System: a step-by-step guide

2. **Descriptors**
   2.1 Standard Descriptors for Geosites

3. **Groundwater Protection**
   3.1 Involving community members in a hydrocensus
   3.2 Guidelines for protecting springs
      3.3 Guidelines for protecting boreholes and wells
      3.4 Guidelines on protecting groundwater from contamination
         3.4.1 Animal kraals, watering points and dipping tanks
         3.4.2 Burial sites
         3.4.3 Informal vehicle servicing, spray painting and parts washing facilities
         3.4.4 Pit latrines
         3.4.5 Runoff water
         3.4.6 Subsistence agriculture
         3.4.7 Informal waste disposal

4. **Maps**
   4.1 Thematic Groundwater Maps

5. **Software**
   5.1 Sustainability Indexing Tool (SusIT)
      5.1.1 SusIT User Guide
      5.1.2 SusIT Field Data Capturer’s User Manual
      5.1.3 SusIT Questionnaire
      5.1.4 SusIT Information Brochure
   5.2 AquiMon Management System
      5.2.1 AquiMon Information Brochure
   5.3 Geohydrological Data Access System (GDAS)
      5.3.1 GDAS Information Brochure

6. **Monitoring**
   6.1 Groundwater Monitoring for Pump Operators

7. **Sustainability**
   7.1 Sustainability Best Practices Guidelines for Rural Water Services
   7.2 Introductory Guide to Appropriate Solutions for Water and Sanitation
   7.3 Decision Making Framework for Municipalities

8. **Reference Sites**
   8.1 Genadendal Information Brochure
   8.2 Kammiesberg Information Brochure
   8.3 Maputaland Information Brochure

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Groundwater Protection: Guidelines for Protecting Springs
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## Acronyms

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<tr>
<td>CBO</td>
<td>Community-Based Organisation</td>
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<td>CMA</td>
<td>Catchment Management Agency</td>
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<tr>
<td>CWSS</td>
<td>Community Water Supply and Sanitation</td>
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<tr>
<td>DPLG</td>
<td>Department of Provincial and Local Government</td>
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<td>DWAF</td>
<td>Department of Water Affairs and Forestry</td>
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<td>O&amp;M</td>
<td>Operation and Maintenance</td>
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<tr>
<td>SABS</td>
<td>South African Bureau of Standards</td>
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<tr>
<td>SANS</td>
<td>South African National Standards</td>
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<td>SSA</td>
<td>Support Services Agent</td>
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<td>WMA</td>
<td>Water Management Area</td>
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<td>WRM</td>
<td>Water Resource Management</td>
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<td>WSA</td>
<td>Water Services Authority</td>
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<tr>
<td>WSDP</td>
<td>Water Services Development Plan</td>
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<td>WSP</td>
<td>Water Services Provider</td>
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<tr>
<td>WSDP</td>
<td>Water Services Provision Contract</td>
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<tr>
<td>WUA</td>
<td>Water User Association</td>
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Introduction

Guidelines for protecting springs

A spring is a place on the earth’s surface where groundwater emerges naturally. The water source of most springs is rainfall that seeps into the ground uphill from the spring outlet.

Spring water moves downhill through soil or cracks in rock until it is forced out of the ground by natural pressure. Like shallow wells, springs may be contaminated by surface runoff or other contamination sources on or below the ground surface. Potential contamination sources include livestock gathering points, pit latrines and waste disposal sites located upslope from the spring outlet.

Decision aids in the form of a set-back distance decision chart and a flowchart have been developed to help guide decision makers on the most appropriate courses of action to follow in protecting springs. Recommendations on possible actions are also presented. These decision tools are applicable for sources of pathogenic contamination such as cattle kraals, stock watering points and pit latrines.

These decision tools assume the existence of a spring catchment protection structure. If such a structure does not exist or there is reason to believe it is not performing as it should, the advice of a specialist should be sought. To obtain detailed information on the design and building of spring catchment protection structures and on related protection zones, please refer to Pearson et al. (2003) and Meule and Wehrle (2001).
Set-back distances for springs

The recommended set-back distances for springs in different hydrogeological regions are presented in the set-back distance decision chart below. The minimum set-back distance specification of 100 metres for a waste disposal site from a surface water body has been adopted from government regulations (NWA, 1998). This is designated as “Protection Zone 1” in these guidelines. Protection zones 2, 3 and 4 are based on the concepts presented in the World Bank /GW-MATE Briefing Note No: 8 (Foster et al, 2002) and on ARG OSS (2001) – See the General User Guide document of this series for more information.

- **Protection zone 1:**
  This represents a no-go area, where no potential contaminating activity should be allowed, upslope of a spring. It has been set equal to 100 metres. Any potentially contaminating activities located within this distance, such as cattle kraals, stock watering points and pit latrines should preferably be closed down.

- **Protection zone 2:**
  This is the distance outwards, upstream of the spring box, beyond 100 metres, for which the travel time of groundwater is less than 25 days.

- **Protection zone 3:**
  This is the distance outwards, upstream of the spring box, beyond protection zone 2, for which the travel time of groundwater is between 25 days and 50 days.

- **Protection zone 4:**
  This is the distance outwards, upstream of the spring box, beyond protection zone 3, for which the travel time of groundwater is more than 50 days.
The actions that are recommended for each protection zone are listed below:

**Protection zone 1**

**Recommended Action:**
Stopping the contamination source / activity, or moving it to a safer zone, should be given high priority. If in doubt, seek the advice of a specialist. There should be regular monitoring of the water supply for indicator organisms and / or related contaminants, and the water abstracted for potable purposes should be disinfected.

**Protection zone 2**

**Recommended Action:**
Alternative options are available:
1. Stop the contamination source / activity, or else move it to a safer zone.
2. Install protective measures.
3. Obtain the input of a specialist.
There should be regular monitoring of the water supply for indicator organisms and / or related contaminants, and the water abstracted for potable purposes should be disinfected as a precautionary measure.

**Protection zone 3**

**Recommended Action:**
Alternative options are available:
1. If feasible, move the contamination source / activity to a safer zone.
2. Install protective measures.
3. Obtain the input of a specialist.
The water abstracted for potable purposes should be disinfected as a precautionary measure.

**Protection zone 4**

**Recommended Action:**
Disinfect water used for drinking, especially if sanitary conditions in the home warrant it. If in doubt, install protective measures or obtain the input of a specialist.

**Note:**
The set-back distance decision chart for springs is not recommended for use with heavy contaminant loads, and neither is it suitable when the contaminant source is located over karstic / fractured dolomites or limestone, shallow or non-existent soils over bedrock or fault zones and dykes. In the latter cases, there is potential for contamination of the groundwater resource irrespective of how far set back the contaminant source is. Seek the advice of a geohydrologist and/or sanitation expert.
**An example of how to use the decision chart:**

A household pit latrine is located at a distance of 110m (measured from the edge of the pit) upstream of a community water supply springbox. The aquifer material is a weathered granite basement aquifer.

**Problem:** Is the community water supply spring safe from household pit latrine contamination?

**Answer:** The symbol for weathered granite is GW. The point of intersection for GW and 110m as shown by the dotted arrows in the chart falls in the protection status 3, so consult actions for protection zone 3.


Flowchart: On-site Test for spring protection
**Groundwater Protection: Guidelines for Protecting Springs**

**Spring location:** Make a rough sketch of the site plans and (i) mark the location of the spring; (ii) highlight positions of potential sources of contaminants such as pit latrines, animal kraals, burial sites, sullage disposal sites, roads, crop fields, etc.; (iii) mark the general slope of the land using arrows indicating the direction of rainfall runoff; (iv) indicate on the sketch whether the potential source of contamination is on the up slope side or the down slope side, and (iv) measure and compare the separation distances of the spring from potential pollution sources to minimum recommended setback distances presented in the setback distance chart for springs.

**Unsatisfactory location - why?**

- Spring is too close to animal kraals, latrines, sullage disposal sites and/or waste disposal sites.
- Spring is too close to burial sites.
- Spring is too close to road.
- Spring is too close to agriculture and related activities.
- Drainage arrows show that drainage is towards the spring.
- Spring is too close to deep-rooted trees.

Encourage the relocation of the potential contamination source in question. Regular water quality monitoring is recommended. Burial activities should be stopped. Main contaminants from a road are oils and suspended solids. To prevent stormwater runoff from the road from reaching the spring, construct a stormwater diversion ditch/berm. Prevent any runoff from fields from reaching the spring. Educate field owners on the importance of wise fertilizer and manure application. See guidelines on subsistence agriculture. Conduct diversion ditches and cutoff berms to divert runoff water away from the spring and its immediate protection zone. Consult an expert. Trees and bushes in the immediate vicinity may need to be cut down.

Look for any signs of contamination, e.g. turbidity, oil films, debris, dead animals such as rodents, etc. Smell the water. Is there noticeable change in colour, taste, flow rate, or odour after rainfall events? (This information can be gathered from spring users or by monitoring.) If contamination is evident, take a sample for analysis and/or consult an expert.

**Satisfactory location**

Locate and open the spring entrance chamber (if there is one) or else examine the water collection point.

Go to the section: **Set-back Distances for Springs**