

# 9

## Groundwater



## 9.1 Introduction

Groundwater is the water that occupies or moves through openings, cavities or spaces in geological formations under the ground. It is an important resource to many of Otago's communities, where it serves a number of recognised uses. These uses include domestic and public water supply, stock drinking water, irrigation and industrial uses. Groundwater and associated springs are valued by Kai Tahu, who find discharges containing human sewage to such water culturally offensive.

The effects of inappropriate land and water use and development on groundwater quantity and quality are often long term, and in some cases may be permanent. It is therefore important that particular consideration be given to the protection of aquifers for the continued benefit of present and future generations.

There is often a hydrological connection between surface water and groundwater. Where the connection is significant, there needs to be recognition of the fact that the use of either surface water or groundwater can affect the other. For this reason, water quantity issues are addressed in Chapter 6.

The Regional Policy Statement for Otago requires that water quality be maintained or enhanced (Policy 6.5.5), in order to provide for the present and future needs of Otago's people and communities. This chapter applies the direction given by the Regional Policy Statement to the management of water and land use activities affecting groundwater, to achieve the above outcomes.

Note: The provisions in this chapter are in addition to those in Chapter 5, which seek to maintain or enhance the natural and human use values supported by lakes and rivers.

## 9.2 Issues

**9.2.1** *[Repealed – 1 March 2012]*

**9.2.2** *[Repealed – 1 March 2012]*

**9.2.3** **Groundwater resources can become contaminated as a result of:**

- (a) **Point source discharge of effluent onto or into land;**
- (b) **Land use activities which result in non-point source discharge of effluent, nutrients or other contaminants;**
- (c) **The accidental spill of a hazardous substance, when they occur in groundwater recharge areas, and**
- (d) **Excavation of any protective soil mantle or impervious strata overlying an aquifer.**

### **Explanation**

Groundwater quality is at risk of being degraded by the infiltration of contaminants into aquifers. The contaminants may be sourced from the land application of effluent, land use activities which create non-point source

discharges, or from accidental spills. The discharge of these contaminants can undermine all efforts previously made to maintain or enhance groundwater quality.

As well as the nature and quantity of the substance involved, the risk of contamination from any of the above activities is determined by hydrology, soil and geological characteristics of the aquifer and overlying material, and therefore varies from place to place. Some groundwater resources are protected from the infiltration of contaminants by a relatively thin layer of soil or impervious sediment, which excavation can remove or compromise.

*Objectives: 9.3.3*

*Policies: 9.4.2, 9.4.18 to 9.4.21*

*See also: Chapter 7*

**9.2.4 The siting, construction and operation of groundwater bores and other drill holes can lead to the contamination of groundwater resources.**

**Explanation**

Bores and other drill holes may be located, constructed or operated in a manner that allows contaminants to enter groundwater. The greatest risk of contamination occurs where bore heads or drill holes are not protected from surface drainage, potentially allowing contaminants in runoff to enter the aquifer. This may be exacerbated by the use of potential contaminants close to the bore or drill hole. The bore or drill hole may also be constructed or operated in a manner which allows the movement of poor quality water between aquifers when they are penetrated by the same hole. Since groundwater contamination can be long term, threatening public health and the current uses of the groundwater, it is important that such contamination be avoided.

*Objectives: 9.3.3*

*Policies: 9.4.14 to 9.4.17*

**9.2.5 Over-use of poor quality groundwater for irrigation may degrade soil resources.**

**Explanation**

Groundwater in certain parts of Otago may be of poor quality. The groundwater of the Waiareka Volcanic Tuff formation (within the western part of the North Otago Volcanic Aquifer), for example, is naturally high in sodium. There is potential for long term degradation of soil health through application of this water for irrigation. While the affected communities are usually aware of this problem and are taking measures to address it, there is a need to evaluate the potential for soil degradation in the granting of any consent to use groundwater for irrigation purposes.

## 9.3 Objectives

### 9.3.1 To sustain the recognised uses of Otago's groundwater.

#### **Explanation**

Groundwater is an important resource in certain areas of Otago as it provides water for domestic and public water supply, stock drinking water, industry and irrigation. The recognised uses of specific aquifers are identified in Schedule 3 of this Plan. This objective seeks to sustain these consumptive uses for the continued benefit of present and future generations.

#### **Principal reasons for adopting**

This objective is adopted to ensure that present and future generations can continue to benefit from Otago's significant groundwater resources.

*Policies: 9.4.1, 9.4.2*

*See also: Objective 9.3.1*

### 9.3.2 *[Repealed – 1 March 2012]*

### 9.3.3 To maintain the quality of Otago's groundwater.

#### **Explanation**

It is important to maintain the existing groundwater quality of Otago's aquifers in order to provide for the existing and potential uses of water. Groundwater can be contaminated through inappropriate land use, discharge or accidental spill of contaminants, over-abstraction of water, and inappropriate siting, construction and operation of bores.

#### **Principal reasons for adopting**

This objective is adopted to avoid the irreversible or long term contamination of groundwater caused by the discharge of contaminants or by the excessive taking of groundwater. This will ensure that the quality of the groundwater is sufficient for existing and future users.

*Policies: 9.4.1, 9.4.2, 9.4.4 to 9.4.6, 9.4.10, 9.4.14, 9.4.17 to 9.4.21*

### 9.3.4 *[Repealed – 1 March 2012]*

### 9.3.5 To avoid degradation of soils arising from the inappropriate application of poor quality groundwater.

#### **Explanation**

Groundwater is used for irrigation in several parts of Otago. Where the quality of groundwater used is likely to lead to the long term degradation of soil health, the management of irrigation practices may need to be modified to avoid this adverse effect.

**Principal reasons for adopting**

This objective is adopted to ensure the productive capacity of soil is not compromised, for present and future generations, as a result of irrigation by poor quality groundwater.

*Policies: 9.4.2, 9.4.23*

**9.4 Policies**

- 9.4.1 In managing any activity involving the taking of groundwater or the discharge of contaminants, to ensure that the suitability of aquifers to support the recognised uses of groundwater identified in Schedule 3 is maintained.**

**Explanation**

The recognised uses of certain aquifers, identified in Schedule 3 of this Plan, can be adversely affected by the taking of water, or the discharge of contaminants to land or directly into groundwater. When considering these activities, regard must be had to avoiding adverse effects on the identified uses. Where uses are identified for other aquifers, they can still be given recognition when considering individual resource consents.

**Principal reasons for adopting**

This policy is adopted to ensure that the recognised uses of certain aquifers, identified in Schedule 3 of this Plan, are maintained. It is important to retain the ability of the groundwater to meet the present needs of groundwater users due to their reliance upon the water.

*Rules: 12.2.3.1 to 12.2.4.1, 12.A.2.1, 12.B.3.1, 14.2.2.1, 14.2.3.1*

*Other methods: 15.2.2.1, 15.3.1.1, 15.4.2.1, 15.4.2.2*

- 9.4.2 In managing the taking of water from any groundwater aquifer, to give priority to avoiding, in preference to remedying or mitigating irreversible or long term degradation of soils arising from use of the water for irrigation.**

**Explanation**

The use of poor quality groundwater can degrade soil resources. When considering the taking of water from any groundwater aquifer, priority will be given to avoiding the adverse effects identified. If the adverse effects of the taking are considered to be unavoidable, the adverse effects must be remedied or mitigated.

**Principal reasons for adopting**

The policy will assist to maintain soil quality where it may be adversely affected by the application of groundwater.

*Rules: 12.2.3.1 to 12.2.4.1*

*Other methods: 15.2.2.1*

9.4.3 *[Repealed – 1 March 2012]*

9.4.4 *[Repealed – 1 March 2012]*

9.4.5 *[Repealed – 1 March 2012]*

9.4.6 *[Repealed – 1 March 2012]*

9.4.7 *[Repealed – 1 March 2012]*

9.4.8 *[Repealed – 1 March 2012]*

9.4.9 *[Repealed – 1 March 2012]*

9.4.10 *[Repealed – 1 March 2012]*

9.4.11 *[Repealed – 1 March 2012]*

9.4.12 *[Repealed – 1 March 2012]*

9.4.13 *[Repealed – 1 March 2012]*

**9.4.14 To require appropriate siting, construction and operation of new groundwater bores, to prevent:**

- (a) Contaminants from entering an aquifer; and**
- (b) The contamination of groundwater in any aquifer from the groundwater in another aquifer; and**

**to promote such management for existing bores.**

**Explanation**

Bores may be located, constructed or operated in such a manner that allows contaminants to enter groundwater. For new bores, the opportunity exists to avoid such adverse effects by requiring:

- Their siting in an area where runoff cannot enter them; or
- Bunding, so that runoff or accidental spills cannot enter them; and
- Bore casings which prevent movement of poor quality water between aquifers.

The opportunity to upgrade existing bores to meet these same standards will be taken through promotion programmes.

**Principal reasons for adopting**

This policy is adopted to ensure that bores are sited, constructed and operated in a manner that maintains the water quality within an aquifer. This is important so that present and future uses can be supported by the aquifer. Appropriate measures can be required through a condition on a resource consent for any new bore, while promotion will be most effective in achieving these standards with existing bores.

**9.4.15** *[Repealed – 1 March 2012]*

**9.4.16** *[Repealed – 1 March 2012]*

**9.4.17** **To require new drill holes to be appropriately sealed to prevent contaminants entering any aquifer.**

**Explanation**

Drill holes can be located where runoff containing contaminants may enter groundwater. For new drill holes, this can be avoided by requiring that the drill hole be sealed before the hole is abandoned. Sealing would be considered appropriate if it prevents runoff from entering the hole, and prevents water moving between aquifers.

**Principal reasons for adopting**

This policy is adopted to ensure that inadvertent contamination of aquifers does not occur through new drill holes intercepting groundwater and being left in a way that allows aquifer contamination. This is important so that present and future users can utilise the aquifer.

*Rules: 14.2.2.1, 14.2.3.1*

**9.4.18** **To identify land of high risk in terms of the vulnerability of underlying groundwater to leachate contamination and to manage, with respect to this land:**

- (a) **Change in land use to activities which have the potential to result in leachate discharges, so that the activities are, where practicable, located elsewhere, or contaminants are contained;**
- (b) **Existing land use activities so that any potential for groundwater contamination is monitored and, where necessary, corrective action is taken;**
- (c) **Point source discharges of water or contaminants to land or groundwater; and**
- (d) **Excavation, so that any protective soil mantle or impervious stratum is retained, replaced, or alternative groundwater protection is provided.**

**Explanation**

The vulnerability of aquifers to leachate contamination is determined by the depth of the aquifer and the permeability of the overlying soil or rock. Any area of land, over parts of aquifers which are considered to be high risk in this regard, is identified as Zone A of the Groundwater Protection Zones on the C-series maps.

In this zone, change of land use to activities likely to generate leachate should, where practicable, be avoided. Where it is not considered possible to do so,

provision must be made to contain any leachate generated. City and district councils will manage such land use change within Zone A in accordance with the direction provided by this policy.

The groundwater beneath existing land use activities in Zone A will be monitored by the Otago Regional Council. Where land use in this zone is observed to be adversely affecting groundwater quality, actions will be required to avoid the effect, such as appropriate storage and handling of hazardous substances, or adequate spills containment.

Discharges of water or contaminants to land or directly into groundwater also have the potential to degrade groundwater quality in Zone A.

Excavation of the land in Zone A may further increase the vulnerability of the aquifer by removing the protective soil mantle or impervious stratum. As such, city and district councils will manage excavation within Zone A in accordance with the direction provided by this policy.

It is recognised that development for primary production including increased use of irrigation will lead to intensification of land use which, in turn, may increase the risk of the contamination of water, but that in some cases land use practices can lead to improved health of the soil mantle and a subsequent decreased risk to underlying aquifers.

**Principal reasons for adopting**

This policy is adopted to minimise and, as far as possible, avoid the potential for long term contamination of groundwater resources from leaching liquid contaminants. It is important to maintain existing groundwater quality in Otago’s aquifers to provide for the existing and potential uses to which that water can be put by the region’s people and communities.

*Rules: 12.A.2.1, 12.B.2.1, 12.B.3.1*

*Other methods: 15.2.7.1, 15.3.2.1, 15.4.2.2*

- 9.4.19 To identify land which protects underlying aquifers from leachate contamination and to manage excavation, with respect to this land, so that any protective soil mantle or impervious stratum is retained or replaced, or alternative groundwater protection is provided.**

**Explanation**

Some aquifers are protected from leaching contaminant discharges by a layer of soil or impervious sediment. Zone B of the Groundwater Protection Zones is of generally low risk in terms of groundwater vulnerability, provided these protective soils or sediments are not compromised by inappropriate excavation. As such, city and district councils will manage excavation within Zone B in accordance with the direction provided by this policy. Zone B of each Groundwater Protection Zone is identified on the C-series maps.

**Principal reasons for adopting**

This policy is adopted to ensure that the protection from leachate contamination provided by the soil mantle or impervious strata is maintained. This will assist to avoid the long term contamination of groundwater resources from leaching liquid contaminants.

*Other methods: 15.2.7.1*

**9.4.20 To require that all practical alternative locations for the storage of hazardous substances have been considered before such storage occurs over Zone A of any Groundwater Protection Zone identified on the C-series maps.**

**Explanation**

Although the use of hazardous substances may provide benefits to the community, the storage of such substances over aquifers vulnerable to leachate contamination also represents a risk of contamination through spillage. Any person intending to store hazardous substances in Zone A of a Groundwater Protection Zone will require land use consent from the relevant city or district council. The C-series maps show the land to which the above requirements will apply. The applicant will have to demonstrate that there are no practical alternative locations to store the substance.

**Principal reasons for adopting**

This policy is adopted to avoid the discharge into groundwater where hazardous substances are inappropriately stored. There is increased likelihood of such contamination where the storage occurs in land over a vulnerable part of an aquifer. Such discharges will adversely affect water quality and the ability of Otago's people and communities to use the resource.

*Other methods: 15.2.7.1, 15.4.2.2*

**9.4.21 To support appropriate codes of practice and management guidelines for land use activities which may result in contaminants entering groundwater.**

**Explanation**

The Council supports codes of practice and management guidelines that reduce the adverse effects of land use activities on groundwater quality. This will involve:

- (a) Working with relevant industry and community groups to identify how land use activities can be carried out in ways which minimise contaminants leaching to groundwater; and
- (b) Working with those who take groundwater to ensure that activities which have the potential to contaminate groundwater are located at safe distances from bores.

**Principal reasons for adopting**

This policy is adopted to encourage voluntary action by landholders to improve land management practices in terms of their effect on groundwater quality.

*Other methods: 15.5.1.1.*

**9.4.22** *[Repealed – 1 March 2012]*

**9.4.23** **To support the voluntary efforts of landholders in their management of the effects of poor quality groundwater on irrigated soils.**

**Explanation**

Communities using groundwater for irrigation need to be aware of the potential for soil degradation where that water is of poor quality, and manage their irrigation accordingly.

**Principal reasons for adopting**

This policy is adopted to ensure appropriate action is taken to avoid reduction of the productive capacity of soil resources for present and future generations, resulting from irrigation using poor quality groundwater.

**9.5 Anticipated environmental results**

**9.5.1** *[Repealed – 1 March 2012]*

**9.5.2** **Groundwater is protected from long term contamination caused by the leaching or direct entry of contaminants.**

**9.5.3** *[Repealed – 1 March 2012]*

**9.5.4** **The use of groundwater for irrigation does not result in the contamination of soils.**

Monitoring of the achievement of these anticipated environmental results will be carried out as outlined in Chapter 19.
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