GROUNDWATER RESOURCE INFORMATION PROJECT
EASTERN CAPE PROVINCE

GROUNDWATER INFORMATION SOURCE REFERENCE SHEET

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A: SOURCE DESCRIPTION

District Municipality:	Amatole		Chris Hani	X	O.R Tambo	
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Local Municipality: Lukhanji

Institution where Information is held: ATS Rural Development Services

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Lukhanji WSDP

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26 March 2002

PREPARED BY: ATS RURAL DEVELOPMENT SERVICES CC

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S A GEO CONSULTANTS

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1 INTRODUCTION

1.1 LOCATION

The study area of the Water Service Development Plan is the entire area of the newly demarcated Lukhanji Local Municipality. The area is shown on the Locality Map.

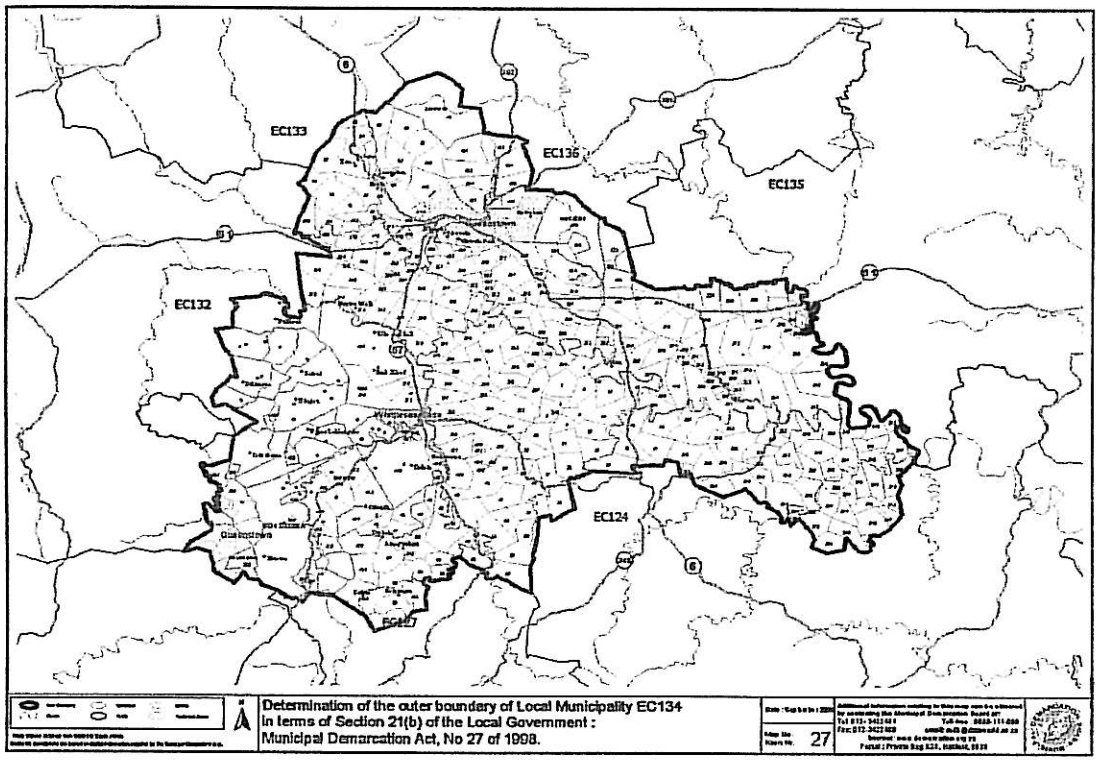


Figure 1: Locality Map

Lukhanji includes the following former areas:

- Queenstown TLC
- Queenstown TRC
- Whittlesea TLC
- Hewu TRC
- Portion of Cathcart TRC
- Portion of Cacadu TRC

1.2 *PHYSICAL PERSPECTIVE*

1.2.1 *Topography*

The topography varies from fairly rolling in the south to a fairly flat landscape in the central area with prominent "koppies" and hills. The altitude varies from 1000m to 1400m.

The major rivers, which drain the area, are the Klaas Smits and Heuningklip rivers in the north and the Klipplaat and Black Kei rivers in the south.

1.2.2 Geology

The Lukhanji Local Municipal area is underlain by three horizontally orientated formations forming part of the Karoo Super group of rocks. The three formations are:

- *Molteno Formation*
- *Burgersdorp Formation*
- *Katberg Formation*

The lower two of these formations, namely the Katberg and Burgersdorp formations are categorised under the Tarkastad sub-group of the Beaufort Group while the Molteno formation does not form part of any group or sub-group. The relative distribution of these formations is indicated in Annexure1, Fig.2 and 3.

The Katberg Formation consists of pale reddish grey, pebble bearing, fine to medium grained sandstone and sub-ordinate mudstone. It is characterised by thick horizons of yellowish-grey to light greenish-grey lithofeldspathic sandstones up to 30 m thick with subordinate bluish-grey and reddish-grey mudstones. The sandstones themselves consist of a repetition of mutually truncating, trough cross-bedded channel fill sand lenses, individually up to 1 m thick. Mud-pebble conglomerates are often present at the base. Penecontemporaneous deformation

structures are common, as shown by convolted laminae in some sandstones. The mudstones are generally thin and of limited lateral extent. Pebbles, usually well rounded, are found in the sandstones and include granite and quartzite casts. Palaeocurrent trends are usually to the north or northwest and the palaeoenvoronment was probably that of a braided river system. The Katberg formation is sandstone rich and is 500 to 1000m thick. Fine grained to medium grained, horizontally laminated, cross-bedded or massive sandstone comprises 90% of the total thickness on average.

The Burgersdorp Formation consists of greyish-red and greenish-grey mudstones with subordinate fine-grained, greenish-grey sandstones. The sandstone varies from light-brownish grey to olive-grey in colour while the mudstone is generally greyish red in colour. Mudstone dominates in this formation usually in the order of 70% versus the sandstone component. The lower boundary is gradational and defined as the horizon where the sandstone to mudstone ratio drops to less than 1:1. Upward –fining cycles of sandstone followed by mudstone, from 2 to 20 meters thick, are repeated throughout the succession. The sandstones are usually thick, but may range up to 5 m or more. Cut-and-fill structures are common. Palaeocurrent data indicate drainage to the north. Once again a fluviatile environment is indicated. The Burgersdorp Formation reaches a thickness of 600m.

Fossils in the Tarkastad Subgroup are uncommon, but include plant fragments and occasional terrestrial vertebrate remains.

A low angle unconformity exists between the underlying Burgersdorp Formation and the Molteno Formation. Mudstone and sandstone are the dominant rock types in this formation with sandstone content ranging from 30-50% but in some instances the sandstone component reaches 75%. Minor rock types are shale (2-10%), coal and conglomerated (each less than 1%). Sandstone lithosomes generally range from a few

meters to 20m in thickness with a maximum of 60m. The Molteno Formation is some 250m to 450m thick.

This horizontally layered sandstone and mudstone package has been intruded by dolerite during late Karoo volcanism. The extent of these intrusions can be seen in Annexure 1, Fig. 3. These intrusions occur as horizontal and sub-vertical tabular bodies and forms the capping of several of the higher lying mountains in the region. Dolerite dykes (sub-vertical structures) and sills (horizontal structures) occur in the study area. Complex dolerite ring-structures are common.

Alluvium is generally limited in thickness in the study area, rarely exceeding 2m. Alluvial cover is more extensive towards the north and north west of the Lukhanji area, underlain by the Burgersdorp formation where thicknesses of up to 10m have been noted. Colluvium deposits of up to 2m thicknesses are also found.

1.2.3 Soils

The dominant soils consist of shallow, stony soils with the only deep soils occurring in the waterways and next to drainage courses.

Generally, arable soils have a pH of 6+ and are high in plant nutrients. Phosphorous levels are however normally low. The dominant soil series are of the Sterkspruit and Mispah forms with Dundee and Oakleaf forms occurring next to rivers and watercourses.

Owing to the duplex nature of many of the soils (sandy A-horizon overlying a clay B-horizon) they are very susceptible to water erosion.

Gulley erosion has occurred in many of the watercourses due to poor veld management practices. Gulley erosion has also occurred due to poor run0off planning with regard to roads and cultivated lands.

1.2.4 *Climate*

Rainfall

The rainfall varies from 400mm in the west to 500mm in the higher lying areas in the north and south. The greater part of the area has an average rainfall of 440mmmm to 470mm per annum. The rain falls mostly in the summer with a peak in February and March.

Evaporation

The annual mean evaporation from a Class A pan is in the order of 1700mm and the potential evapotranspiration has been estimated at 700mm in the south and 850mm in the north.

Temperatures

The area experiences high summer temperatures and low winter temperatures. Maximum temperatures of 36 ^{0}C and higher are experienced in summer while night temperatures in winter drop to below freezing. There is a 80% chance of experiencing 0 ^{0}C between 25 May and 8 September.

There is a 50% chance of light frost from 1 April until 23 November. However, 80% chance of light frost exists between 19 April and 5 November.

The annual mean temperature is 17 ^{0}C with a mean maximum of 25 ^{0}C and a mean minimum of 9 ^{0}C.

Prevailing winds

Strong north-westerly to south-westerly winds are experienced from July to September.

2 SITUATIONAL ASSESSMENT

The situational assessment was done using mainly existing reports with limited field verification and interviews with relevant persons. The sources referenced are

- Municipal Demarcation Board web site
- Cencus, 96
- Lukhanji Technical Services status report
- Eastern Cape Water Resources Situation Assessment (1998)
- Upper Kei Basin Study (1993)
- Queenstown Regional Water Supply - Feasibility Study (1997)
- Chris Hani District Municipality Draft WSDP (September 2001)
- Lukhanji Local Municipality Interim IDP (April 2001)

2.1 CONSUMER PROFILE

2.1.1 DEMOGRAPHICS

According to figures based on Census'96 and projected to 2001 the estimated population for Lukhanji stands at 188273. It is estimated that the population will increase to a maximum of 198919 in 2005 after which there will be a decrease to 186894 in 2025. (Chris Hani D.M. – Draft Water Services Development Plan – September 2001) Table 1 give the estimated growth rates and population figures

Table 1: Growth rate and population

AREA	FORMER TLC AREA	GR 2005	GR 2015	GR 2025	POP 2001	POP 2005	POP 2015	POP2025
Hewu	Whittlesea	0.008504	0.001111	-0.00153	12386	13086	12580	11940
Queenstown	Queenstown	0.01611	0.008737	0.006097	56999	60222	64416	65981
Rural		0.007811	-0.00062	-0.00363	118888	125610	117857	108973
TOTAL					***188273***	***198919***	***194853***	***186894***

Figures 2 and 3 indicate the current population distribution and gender breakdown per Ward in Lukhanji. The average gender breakdown for Lukhanji is 46,6% male and 53,4% female

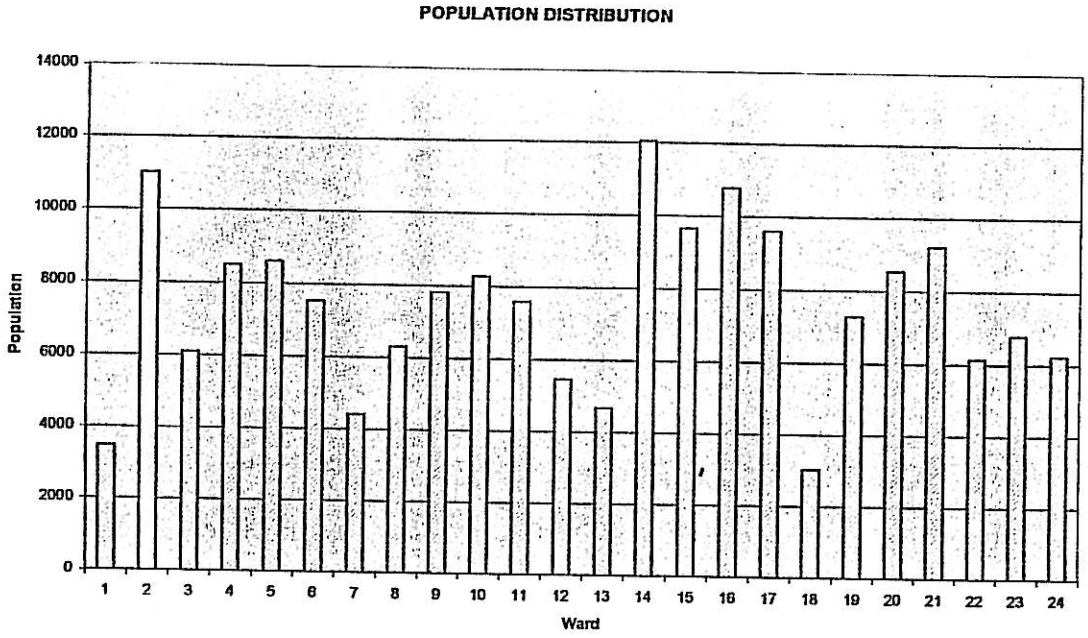


Figure 2: Population per Ward

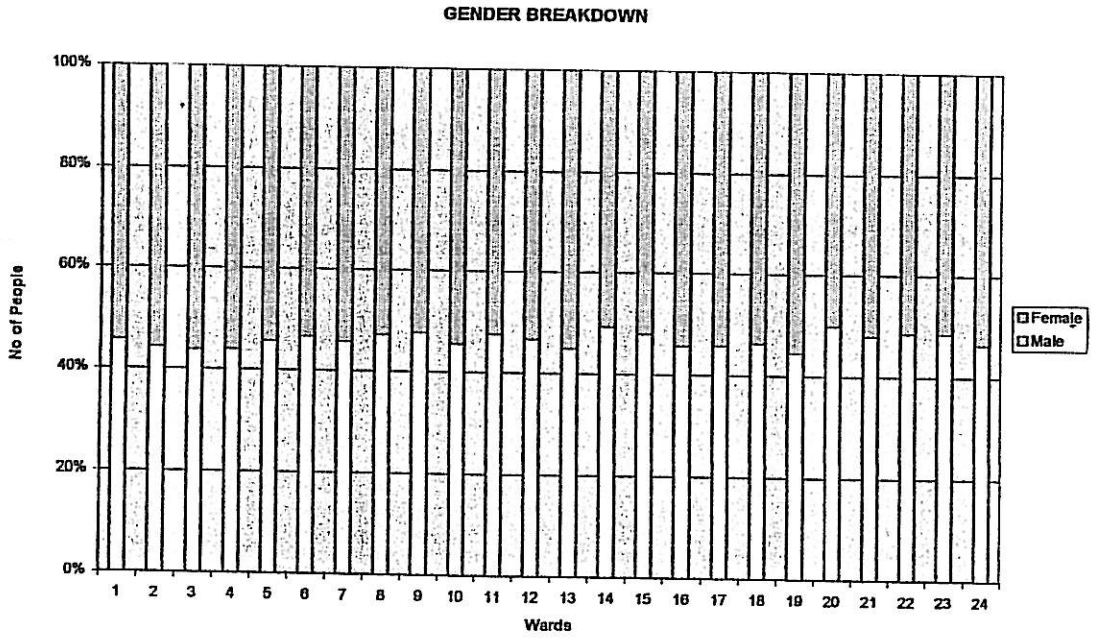


Figure 3: Gender breakdown per Ward

2.1.2 SOCIO-ECONOMICS

A large portion of the population lives in the rural areas where the employment rate tends to be lower and the household income is also very low. This has a major impact on the provision of services in Lukhanji. Most of the areas with low income and high employment rates still need basic services and the issue of affordability comes to mind. This issue will be dealt with later in the report.

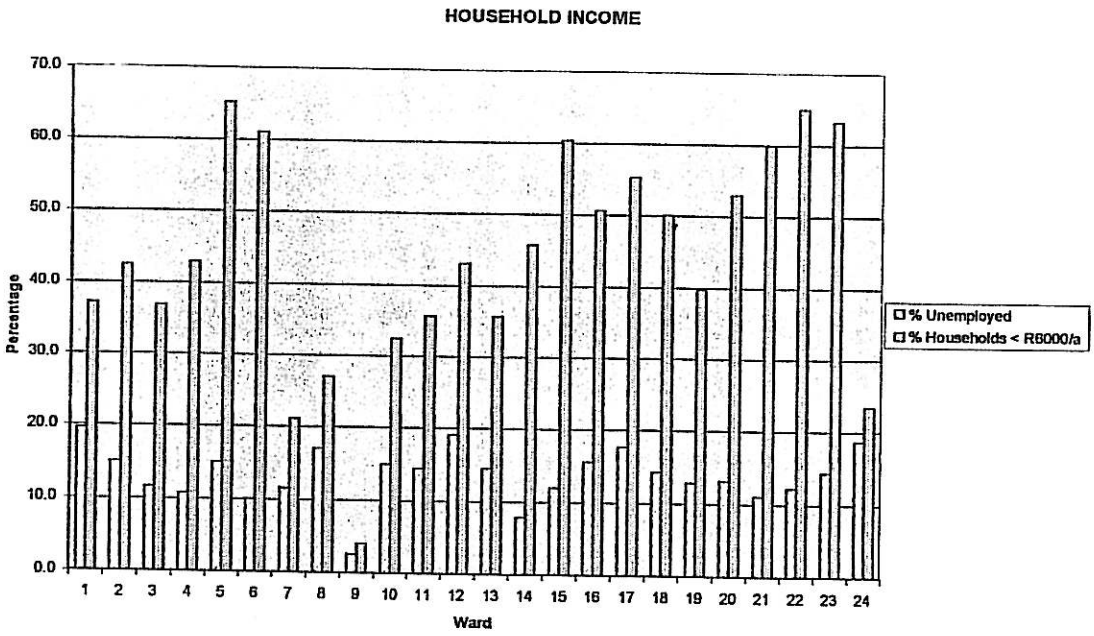


Figure 4: Unemployment and household income

The unemployment indicated in Figure 4 only refers to the people currently unemployed but looking for work. Table 2 shows the ratio of employed to not employed.

Table 2: Employment

Area	Employed	Unemployed-looking for	Not working-not looking for	Not working-not wishing to work	Not working-retired/disabled	Not working-non of the above	Total
Hewu TRC	8.56	23.68	4.07	38.28	20.5	4.85	100
Queenstown TLC	36.97	19.81	1.78	23.67	11.8	5.94	100
Queenstown TRC	26.76	19.02	5.78	29.96	14.5	3.97	100
Whittlesea/Sada TLC	18.65	21.41	2.33	39.47	12.6	5.52	100

Table 2 indicates that a very large number of people are not working which leads to the low household income as depicted Figure 4.

The main employment sectors in Lukhanji are listed in Table 3.

Table 3: Employment sectors

Area	Agriculture, hunting, forestry and fishing	Mining and quarrying	Manufacturing	Utility services	Construction	Wholesale and retail trade	Transport, storage and communication	Financial/ Business services	Private households	Social/ Government Services	Total
Hewu TRC	6.31	1.45	6.78	1.31	10.75	5.47	5.89	3.18	16.87	42.01	100
Queenstown TLC	1.48	0.10	6.53	1.09	7.17	20.94	4.93	6.67	16.88	34.13	100
Queenstown TRC	40.9	0.73	3.68	0.51	7.58	7.35	3.40	2.07	24.38	9.27	100
Whittlesea/Sada TLC	1.77	0.84	2.87	1.18	6.41	5.82	6.24	2.36	12.82	59.70	100

It can be seen that the Social/ Government Sectors are significant role players in the urban areas and Agriculture in the rural areas. Wholesale and retail trade also plays a significant role in the former Queenstown TLC.

Agriculture has been identified as the sector with the greatest potential for future economic development, as indicated in the Stormberg IDP. Agriculture is also one of the major users of water in Lukhanji and to ensure economic development water allocated to existing irrigation areas should be secured.

2.1.3 Industrial consumers

Queenstown/eZibeleni is the service and market center of a region of over 15 000 km^2, with a service area stretching to Molteno in the north, Cathcart in the south, Maclear in the east and beyond Tarkastad in the west. The projected area of these industries is 442 ha in 2005. The growth rate is estimated at 3.5% p.a.

The Sada industrial area is projected to be 8 ha in 2005. Although there is a great need for further job creation in Sada/ Whittlesea, the rate of industrial development is likely to be fairly low in the absence of decentrlisation incentives. Future water requirements are based on a growth rate of 1.0% p.a.

Industries in the Lukhanji area are classified as predominantly dry industries with a unit water consumption of 15 l/ha/d based on historical figures. Table 4 shows the projected water requirements for industrial use.

Table 4: Industrial water requirements

Area	Water requirements (Mm^3/a)					
	2000		2005		2010	
	Area (ha)	Req	Area (ha)	Req	Area (ha)	Req
Queenstown	310	1.70	368	2.01	437	2.39
EZibeleni	62	0.34	74	0.40	88	0.48
Sada	8	0.04	8	0.04	9	0.05
Total	***380***	***2.08***	***450***	***2.45***	***534***	***2.92***

2.1.4 Agricultural users

Water is mainly consumed by:

- dryland cultivation
- livestock
- irrigation.

Dryland cultivation is an indirect water user as cultivation results in different run-off and evaporation characteristics than would be the case with natural vegetation.

The consumption of livestock is taken as 45 l/day per large stock unit. Using the data from the 1994 livestock census (Dept of Agriculture 1994) and assuming no major increase in livestock numbers, the total consumption by livestock is estimated at 2.05 Mm^3/a.

There are a number of irrigated areas in Lukhanji. Some are part of specific schemes, while the remainder is only irrigated when water is available in the rivers and dams adjacent to cultivated land. Three categories of irrigation have been identified.

- Irrigated scheduled land
- Opportunistic irrigation adjacent to main rivers
- Opportunistic irrigation remote from main rivers

The scheduled areas under irrigation form part of formally recognised irrigation schemes, whereas the irrigation of "opportunistic" areas only takes place when water is available.

Table 5: Irrigation areas

River Reach	Irrigated "Scheduled" Land (ha)	Opportunistic Irrigation Adjacent to Main Rivers (ha)	Opportunistic Irrigation Remote from Main Rivers (ha)	Total (ha)
Upper Klipplaat	0	1457	780	2237
Middle Klipplaat	600	0	0	600
Lower Klipplaat	315	0	14	329
Middle Black Kei	192	671	192	
Lower Black Kei	817	0	417	1234
Upper Klaas Smits	0	359	648	1007
Heuningklip	0	128	399	527
Middle Klaas Smits	0	927	202	1129
Lesseyton	0	117	203	320
Lower Klaas Smits	0	638	466	1104
Bongolo	0	0	390	390
Komani	0	614	161	775
Upper Oxkraal	259	0	0	259
Lower Oxkraal	0	0	0	0
Upper Black Kei	0	342	554	896

Irrigation at the former Ciskei irrigation schemes like has virtually come to a standstill. Water demand to these schemes will be very low for the foreseeable future. It is however important to secure the water allocation to these areas as agriculture has been identified as a sector that can have a significant influence on the economic growth of the region.

2.2 SERVICE LEVELS

Table 6 gives the current level of water and sanitation services in the different Wards of Lukhanji.

Table 6: Current service levels

Ward	Town / Village / Suburb	Households	Current water supply							Current sanitation				
			In dwelling	On site	Public tap	Tanker	Borehole	Drawn from surface source	Other	Flush	Pit latrine	Bucket	None	Unnspecified
1	Part of Zone 1, Ezibeleni	731	712	17	0	0	0	0	2	728	1	0	0	2
2	Zone 2, Ezibeleni	2371	2153	116	45	5	0	0	52	2243	19	4	87	18
3	Part of Zone 3, Ezibeleni	1261	1170	13		0	0	0	78	1182	4	0	74	1
4	Part of Zone 3, Ezibeleni Zone D, Ezibeleni Part of Zone 1, Ezibeleni Unathi Mkefa, Ezibeleni Sithonjeni, Machibini Emmangweni, Machibini Koppies Mamfeneni Emampondweni, Machibini	1735	1141	55		0	2	412	125	1184	269	1	280	1
5	Roman Catholic Church Area, Lingelihle School area, Filgate Mzazi School area, Illinge Maloseni, Machibini Nontongwana, Machibini	1829	63	685		7	18	426	630	260	894	2	665	8
6	Mtebhele, Machibini Nontloko, Machibini Zenzwa, Machibini Tshungwini, Machibini Mchatha, Machibini Rayini, Machibini Mawmaw Tyutyutyu Nolukhanyo School area, Illinge Nomentyu	1482	341	545		5	52	337	202	369	881	8	216	8
7	Job Creation, Mlungisi Railway, Mlungisi Self Help, Mlungisi Nomzamo, Mlungisi	1021	889	31		0	0	0	101	919	1	0	95	6
8	Zwelitsha, Mlungisi Part of Westbourne, Queenstown	1446	686	264		25	3	1	467	981	11	3	467	4
9	Victoria Park, Queenstown Bergsig, Queenstown Van Coller Park, Queenstown Blue Rise, Queenstown Queendustria, Queenstown Laurie Dashwood Park, Queenstown Part of Komani Park, Queenstown Queensview Park, Queenstown Sabata Dalindyebo	1432	1377	42		1	2	1	9	1420	0	2	1	9
10	Queenstown Central Old Mlungisi, Queenstown	1931	1128	402		1	2	1	397	1673	0	0	250	8
11	Old Mlungisi, R Section, White City New Rest, Queenstown	1687	677	488		3	0	2	517	1153	9	7	510	8
12	Q Section, White City Old Mlungisi	1002	439	544		0	0	0	19	972	10	0	16	4
13	Unifound, Mlungisi Part of T Section, White City Part of S Section, White City	1025	544	394		2	0	0	85	931	1	0	90	3

Table 6: Current service levels (Continued)

Ward	Town / Village / Suburb	Households	Current water supply							Current sanitation				
			In dwelling	On site	Public tap	Tanker	Borehole	Drawn from surface source	Other	Flush	Pit latrine	Bucket	None	Unnspecified
14	Zingqutu Madeira Park, King's Park Nkonkobe, Zingqutu Tolsenkraal Reibron Lesseyton Ezola Xuma, Tabata	2817	1016	164		14	302	476	845	1134	801	14	809	59
15	Henderson Area Gwatyu Farms Wako Area, Cathcart Fairfield area, Queenstown District Tyiden Cairns Grafton Diphala Sibonile Thambo Village Imvani Thembani	2099	183	215		33	252	308	1128	148	558	110	1262	21
16	Part of Sada and Madakeni	2142	140	149		10	0	0	1843	77	1627	196	236	6
17	Part of Sada	1746	179	143		2	0	0	1422	37	1015	671	16	7
18	Whittlesea Shiloh	675	194	122		11	15	83	250	71	429	1	167	7
19	Part of Ekuphumleni Extension 4, Whittlesea Part of Ekuphumleni	1460	1280	15		1	0	1	163	1297	0	0	155	8
20	Part of Ekuphumleni Sada Nqobokeni Emtha Mabeleni Engojini Dyamala Madakeni and part of Sada Ngcamngeni Poplar Grove	1685	848	39		16	15	34	735	859	439	272	114	1
21	Embekweni Boldpoint Oxton Yonda Cimezile Sihlobeni Mtwakazi Zweledinga Hackney Tsitsikama Sisilane Muswa	1808	8	48		31	109	567	1045	21	1271	30	478	8

Table 6: Current service levels (Continued)

Ward	Town / Village / Suburb	Households	Current water supply							Current sanitation				
			In dwelling	On site	Public tap	Tanker	Borehole	Drawn from surface source	Other	Flush	Pit latrine	Bucket	None	Unspecified
22	Upper Hukuwa Lower Hukuwa Sawuteya Zululkama Eardley Upper Didimana Romanslaagte Lower Didimana Lower Lahlangubo Upper Lahlangubo	1354	1	6		82	65	331	869	3	1235	2	97	17
23	Kammastone Bulhoek/Ntabelanga Ensam Bothashoek Mceula Upper Zangqokwe Lower Zangqokwe McBride Brakkloof Merino Walk Who-can-tell	1474	1	21		7	5	142	1298	4	676	9	774	11
24	Mfungisi Condev Aloevale	1225	682	242		0	0	0	301	919	1	0	302	3

From Table 6 it is evident that large numbers of households have no access to basic water and sanitation services. The current Levels of Hardship (LOH) are shown in Figure 5. It indicates the percentage of households in each Ward that have to draw surface water and do not have basic sanitation services (pit latrines).

It is proposed that Figure 5 be used as a point of departure when formulating a strategy for the provision of services as it clearly points out the areas in need.

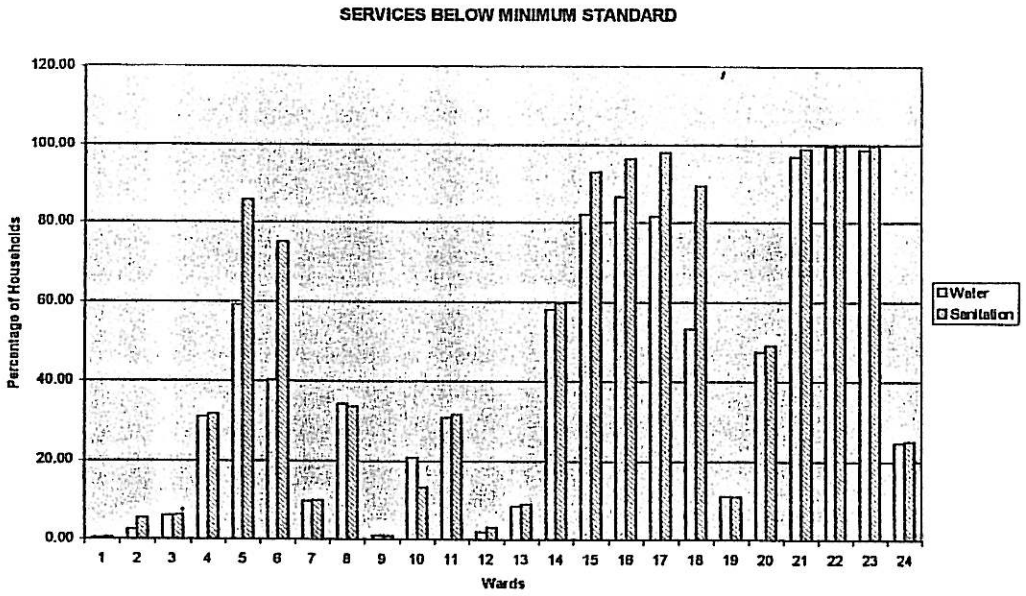


Figure 5: Current levels of hardship

The provision of sanitation services seems to lag behind the provision of water services. This is a general phenomenon as communities generally see water services as a higher priority than sanitation services. The lack of proper sanitation services is however a potential risk for the contamination of the water sources in the area.

The Wards with the highest levels of hardship also have large numbers of households earning less than R6000 p.a. This should add to the urgency of providing basic services to affected Wards.

2.3 *WATER BALANCE*

A water balance was done in 1998 for the "Eastern Cape Water Resources Assessment". The catchments data for catchments in Lukhanji was extracted from this water balance. Figures shown in the following table are for 2015 conditions. This data is useful to identify any key problems concerning the demand and supply for surface water sources.

The water balance will have to be re-assessed after decisions have been made on the future water services of the area.

Figure 6 shows the spare yield in each catchment with the existing dams. Refer to Annexure1, Figure 1 for the position of the catchments in Lukhanji.

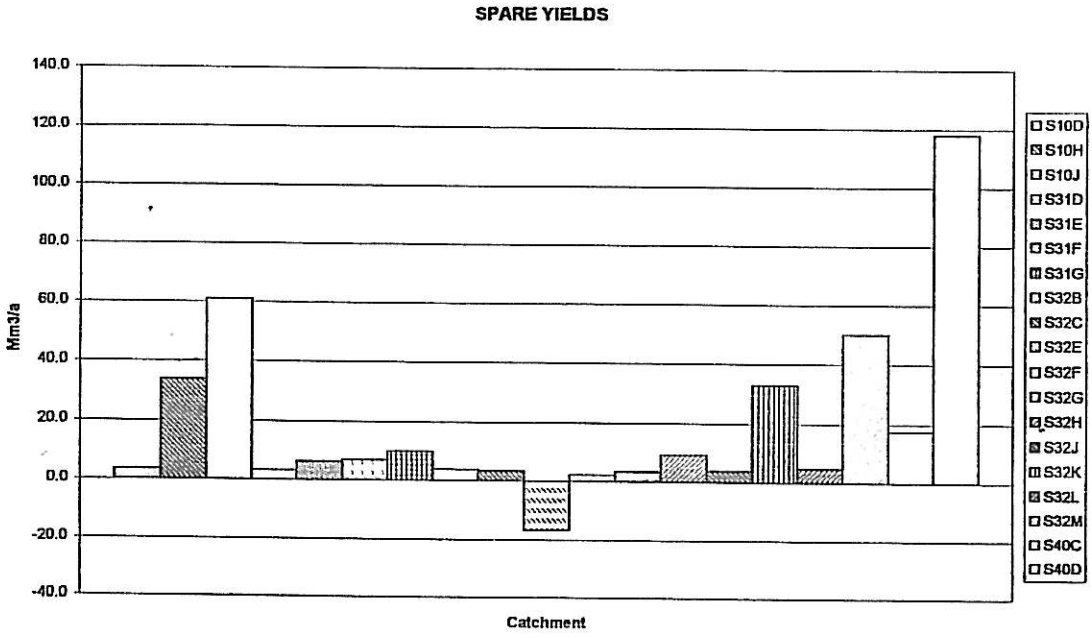


Figure 6: Spare yield (Surface water)

The catchment showing a negative spare yield is catchment S32E. The Waterdown Dam with the associated Klipplaat Government Water

Scheme is situated in this catchment. The projected water shortage in this catchment is well known and a number of studies have suggested solutions to augment water from other sources. This is discussed in more detail in Section 2.6.

Figure 6 show that there is a number of cathments where surface water spare yield will be very low in the future and development of new water schemes in these areas should therefore concentrate on others sources such as groundwater.

2.4 WATER SOURCE AND QUALITY

2.4.1 Water Quality Status

As part of the Upper Kei Basin Study, the water quality assessment provided a preliminary assessment of the water quality of the rivers and reservoirs in the Upper Kei Basin. The main findings are listed below.

Present water quality status: The major ion analysis data showed the rivers and reservoirs are suitable for domestic and agricultural use.

- ***Localised water quality problems***: In the lower reaches of rivers elevated chloride and conductivity values will influence the irrigation of sensitive crops. In all rivers high levels of suspended solids will influence the treatment of raw water.

Trends: No temporal trends were detected. Spatial trends were detected and are caused by input of non-point source drainage agricultural and settlement areas.

Sources of contamination: The point discharges have a localised influence on water quality but non-point sources dominate the quality of rivers and reservoirs in the area. Non-point source drainage is derived from (1) return flow from

agricultural areas resulting in the export of saline water with high turbidity and (2) storm water runoff from urban settlements resulting in the export of high turbidity water with faecial contamination.

Water quality projection: Based on analysis of historical water quality data, future development of agricultural, urban and informal settlements is expected to increase the suspended solids, dissolved solids and faecial bacteria content of rivers and reservoirs. Future population growth in urban areas will increase the return flow to rivers from point sources resulting in a considerable portion of the river flow comprising of treated wastewater. This will cause deterioration in water quality of rivers and reservoirs.

2.4.2 *Surface water sources*

The main reservoirs in Lukhanji are listed in Table 7.

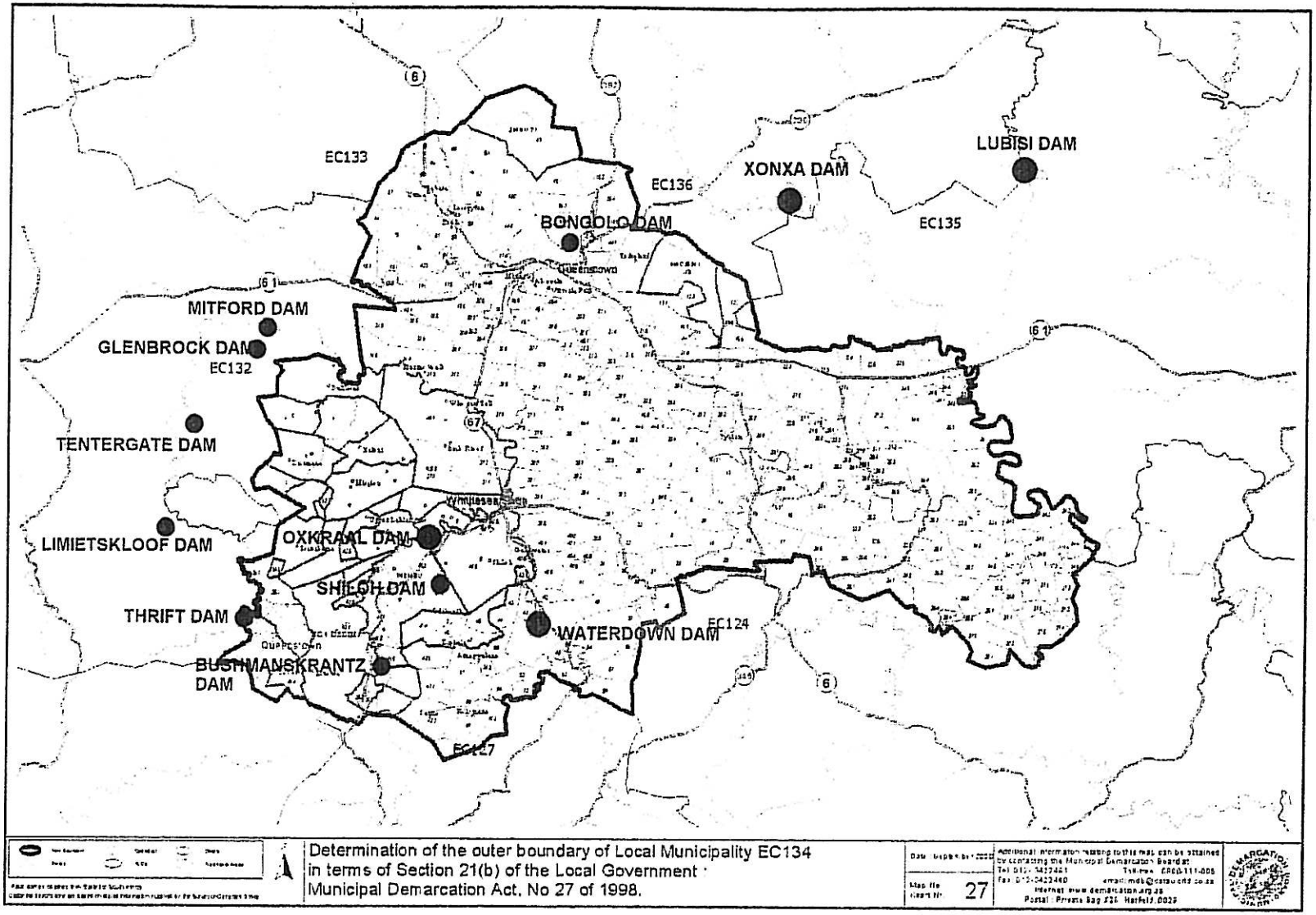
Table 7: Main dams in Lukhanji

Name	Live Storage	Firm Yield (Mm^3/a)	
		Domestic Supply	Irrigation
Waterdown	36.6	12.45	14.83
Bongolo	6.95	0.65	0
Bushmanskrantz	4.62	0.57	1.5
Oxkraal	17.8	Nil	6.18
Shiloh	0.52	Nil	0.34

The existing allocations from the Waterdown Dam, comprising 8.25 Mm^3/a to Queenstown, 4.2 Mm^3/a to Sada, and 14.83 Mm^3/a to irrigation cannot be supported at an acceptable level of assurance.

The water supply infrastructure associated with these dams is described in more detail in Section 2.6. Figure 7 shows the position of the main dams in the area.

Figure 7: Position of main dams



2.4.3 *Hydrogeology & Groundwater potential*

1:500 000 Queenstown Hydrogeological map describes the study area as being typified by the following lithologies:

- Alluvium (clay, silt, sand and gravel) associated with the upper drainage of the Swart Kei River in the north west of the municipal area.
- Predominantly arenaceous rocks (sandstone, felspathic sandstone, arkose sandstone becoming quartzitic in places).
- Predominantly argillaceous rocks (shale, carbonaceous shale, claystone, mudstone and siltstone).
- Mafic intrusive rocks (dolerite)

Groundwater is generally located intergranular and in fractured zones with expected yields varying from 0.5 to 2 l/s in general. Several areas with higher yielding boreholes have been noted as indicated in Annexure 1, Fig.6.

Annexure 1, Figures 5,6,7 & 8 give general hydrogeological information regarding groundwater occurrences in the study area, based on available data. These maps will have to be refined through detailed hydrogeological investigations such as the current hydrogeological investigation regarding source potential carried out for the Chris Hani District Municipality.

Harvest potential can be defined as the maximum annual volume of water that is available for abstraction on a long-term basis without exhausting the resource. It was calculated using methods broadly similar to the National Harvest Potential Map but with refinements to take into account local knowledge and more extensive data availability. The Harvest Potential is varies around 2 000 $m^3/km^2/a$ in the study area. The parameters used

were estimates, so the values depicted should be seen more as order of magnitude estimates, rather than as assured maximum supplies. Annexure 1, Figure 9 gives an indication of these estimates for the study area. The higher harvest potential indicated in the south of the study area does not correlate with groundwater potential studies and is not seen as indicative of possible well field development zones due to the topography and low recharge potential.

The dolerite-related aquifers typifying the study area are more productive than in other areas of the Chris Hani District Municipal area. The presence of abundant dykes and sheets indicate that significant regional structural disturbances must have taken place during intrusion. What makes this area stand out as being different from the other areas though is the presence of ring-shaped dolerite intrusions (Annexure 1, Figure 4) as well as the abundance of irregular intrusions displaying sharp variations in thickness and dip along their length.

The intrusion of the ring structures are likely to cause extension and fracturing of the overlying host rock, and could be responsible for a generally higher incidence of fracturing than in other areas. The irregularity of the dolerite sheet intrusions of this area provides an abundance of curved portions, which have been found to be productive drilling targets.

Another factor is the abundance of dolerite intrusions, which provide plentiful potential drilling sites. In addition the relatively flat terrain, particularly to the west of Queenstown, makes drilling access easier than the other areas, allowing more flexibility in the optimal positioning of a drill rig.

The relatively low incidence of dry boreholes in the study area indicates a generally higher degree of fracturing of the rock

matrix in this area. This could possibly be related to a higher degree of tectonism affecting this part of the Chris Hani area. This could well be the case if the abundance of dolerite dykes is taken as a reflection of the intensity of tectonism affecting the study area. Dolerite dykes are more abundant in the southern parts with NW being the dominant trend.

Ring-shaped dolerite intrusions and irregular sheets are found throughout the study area indicating that deformation related to their emplacement may have resulted in intense fracturing in host lithologies.

Annexure 1, Figure 10 indicates zones of high potential where well field development is feasible. This is especially the case concerning the area between Waterdown dam and Queenstown, where groundwater can supplement surface water along the pipeline route.

Table 8 indicates the harvest potential per catchment.

Table 8: Lukhanji harvest potential per quaternary sub-catchment

Quaternary Catchment Number	Groundwater (Mm³/annum)			Groundwater Use Data source
	Harvest Potential	Existing Use	Unutilised Potential	
S10D	4.693	0.294	4.399	Upper Kei Basin Study
S10H	8.378	0.31	8.068	Upper Kei Basin Study
S10J	5.74	0.15	5.59	Upper Kei Basin Study
S31D	5.533	0.816	4.716	Upper Kei Basin Study
S31E	7.766	1.633	6.133	Upper Kei Basin Study
S31F	3.946	1.554	2.392	Upper Kei Basin Study
S31G	4.25	2.296	1.954	Upper Kei Basin Study
S32A	5.745	0.02	5.725	Upper Kei Basin Study
S32C	9.31	0.873	8.437	Upper Kei Basin Study
S32D	5.442	0.031	5.41	Upper Kei Basin Study
S32E	5.226	0.109	5.117	Upper Kei Basin Study
S32F	5.793	0.32	5.473	Upper Kei Basin Study
S32G	4.213	0.07	4.143	Upper Kei Basin Study
S32H	6.105	0.04	6.065	Upper Kei Basin Study
S32J	4.227	0.231	3.995	Upper Kei Basin Study
S32K	7.067	0.437	6.63	Upper Kei Basin Study
S32L	5.08	0.103	4.977	Upper Kei Basin Study
S32M	7.205	0.109	7.096	Upper Kei Basin Study
S40C	5.79	0.424	5.366	Queenstown Geohydrological Map
S40D	2.14	0.03	2.109	Transkei Groundwater Schemes

Table 9 gives the groundwater development perspective per village. Where the recommendation is "Definite" serious consideration should be given to groundwater as a source for future water supply services. Where the recommendation is "Possible" groundwater is still a good option but the available data should be verified by means of field investigations before further development is planned.

TABLE 9: Groundwater development perspective

User Nr.	Village	Population	Demand l/s 8 hrs pump cycle 10 l/c/d	Demand l/s 8 hrs pump cycle 30 l/c/d	Prod. Bholes Required 10 l/c/d	Prod. Bholes Required 30 l/c/d	Nr. Siting Required 10 l/c/d	Nr. Drilling Required 10 l/c/d	Nr. Testing Required 10 l/c/d	Nr. Siting Required 30 l/c/d	Nr. Drilling Required 30 l/c/d	Nr. Testing Required 30 l/c/d	Recommendation to develop	Expected water Class
02S32E001	ALLANWATER - A	517	0.178882	0.538541667	1	1	5	3	2	5	3	2	Possible	Not known
02S32E007	ALLANWATER - B	135	0.04671	0.140625	1	1	5	3	2	5	3	2	Possible	Not known
02S32H001	AMAQOLOMBA	80	0.02768	0.083333333	1	1	5	3	2	5	3	2	Possible	Not known
02S32F030	ANVIL	178	0.061588	0.185416667	1	1	5	3	2	5	3	2	Possible	Not known
02S10J021	BESETI	143	0.049478	0.148958333	1	1	5	3	2	5	3	2	Possible	Not known
02S32C028	BOTHA'S	565	0.19549	0.588541667	1	1	5	3	2	5	3	2	Definite	Not known
02S32H013	BRAKKLOOF - A	109	0.037714	0.113541667	1	1	5	3	2	5	3	2	Definite	Not known
02S32H016	BRAKKLOOF - B	70	0.02422	0.072916667	1	1	5	3	2	5	3	2	Definite	Not known
02S32C012	BULHOEK - A	304	0.105184	0.316666667	1	1	5	3	2	5	3	2	Possible	Not known
02S32C027	BULHOEK - B	103	0.035638	0.107291667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F018	BUSHY PARK	65	0.02249	0.067708333	1	1	5	3	2	5	3	2	Possible	Not known
02S32E002	CAIRNS	374	0.129404	0.389583333	1	1	5	3	2	5	3	2	Possible	Not known
02S32F016	CIBINI - C	310	0.10726	0.322916667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F015	CIMEZILE - B	563	0.194798	0.586458333	1	1	5	3	2	5	3	2	Definite	Not known
02S32E003	CLAREMONT	49	0.016954	0.051041667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F032	CLINIC - B	144	0.049824	0.15	1	1	5	3	2	5	3	2	Possible	Not known
02S32G010	DYAMALA - B	400	0.1384	0.416666667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F005	EHEWU	600	0.2076	0.625	1	1	5	3	2	5	3	2	Possible	Not known
02S32C007	ELUQOLWENI - G	539	0.186494	0.561458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32F011	EMAMPHONDWANA	620	0.21452	0.645833333	1	1	5	3	2	5	3	2	Possible	Not known
02S32G005	EMTHA	400	0.1384	0.416666667	1	1	5	3	2	5	3	2	Possible	Not known
02S32G012	ENGOJINI - B	509	0.176114	0.530208333	1	1	5	3	2	5	3	2	Possible	Not known
02S32H009	ENQOBOKENI 1	139	0.048094	0.144791667	1	1	5	3	2	5	3	2	Possible	Not known
02S32C002	ESIHLABENI - C	417	0.144282	0.434375	1	1	5	3	2	5	3	2	Possible	Not known
02S31F004	EVERTON	617	0.213482	0.642708333	1	1	5	3	2	5	3	2	Possible	Not known
02S31F002	EZIBEWENI	28179	9.748934	29.353125	6	6	20	18	17	20	18	17	Definite	Not known
02S32C020	FALENDABA	2123	0.734558	2.211458333	1	2	5	3	2	8	6	5	Possible	Not known
02S10D024	GCINA - AA	485	0.16781	0.505208333	1	1	5	3	2	5	3	2	Possible	Not known
02S10D030	GCINA - L	131	0.045326	0.136458333	1	1	5	3	2	5	3	2	Possible	Not known
02S10D023	GCINA - M	286	0.098956	0.297916667	1	1	5	3	2	5	3	2	Possible	Not known
02S10D019	GCINA - N	525	0.18165	0.546875	1	1	5	3	2	5	3	2	Possible	Not known
02S10D018	GCINA - O	525	0.18165	0.546875	1	1	5	3	2	5	3	2	Possible	Not known
02S10D017	GCINA - P	440	0.15224	0.458333333	1	1	5	3	2	5	3	2	Possible	Not known
02S32J001	GERMISTON - A	11289	3.905994	11.759375	2	4	8	6	5	14	12	11	Definite	Not known
02S32K005	GLEN GARRY	874	0.302404	0.910416667	1	1	5	3	2	5	3	2	Possible	Not known
02S32J010	GLEN THORN	376	0.130096	0.391666667	1	1	5	3	2	5	3	2	Definite	Not known
02S10H023	GLENCOE - A	177	0.061242	0.184375	1	1	5	3	2	5	3	2	Possible	Not known
02S32E009	GRAFTON	87	0.030102	0.090625	1	1	5	3	2	5	3	2	Possible	Not known
02S10J026	GWATYU - A	0	0	0	1	1	5	3	2	5	3	2	Possible	Not known
02S32F028	HARKNEY	3475	1.20235	3.619791667	1	3	5	3	2	11	9	8	Possible	Not known
02S32H010	HLAMBOTENI	291	0.100686	0.303125	1	1	5	3	2	5	3	2	Possible	Not known
02S32M001	HOOROSH CRAIG - A	617	0.213482	0.642708333	1	1	5	3	2	5	3	2	Possible	Not known
02S32M007	HOOROSH CRAIG - B	35	0.01211	0.036458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32L001	HOPEWELL - A	143	0.049478	0.148958333	1	1	5	3	2	5	3	2	Possible	Not known

TABLE 9: Groundwater development perspective (Continued)

User Nr.	Village	Population	Demand l/s 8 hrs pump cycle 10 l/c/d	Demand l/s 8 hrs pump cycle 30 l/c/d	Prod. Bholes Required 10 l/c/d	Prod. Bholes Required 30 l/c/d	Nr. Siting Required 10 l/c/d	Nr. Drilling Required 10 l/c/d	Nr. Testing Required 10 l/c/d	Nr. Siting Required 30 l/c/d	Nr. Drilling Required 30 l/c/d	Nr. Testing Required 30 l/c/d	Recommendation to develop	Expected water Class
02S32J011	IMVANI	400	0.1384	0.416666667	1	1	5	3	2	5	3	2	Definite	Not known
02S32K006	IXWORTH	261	0.090306	0.271875	1	1	5	3	2	5	3	2	Definite	Not known
02S32M008	JABBERSIDE	61	0.021106	0.063541667	1	1	5	3	2	5	3	2	Possible	Not known
02S32M002	JABBERSIDE-A	58	0.020068	0.060416667	1	1	5	3	2	5	3	2	Possible	Not known
02S10J020	JOHN FARM	0	0	0	1	1	5	3	2	5	3	2	Possible	Not known
02S32C003	KAMASTONE - A	1800	0.6228	1.875	1	2	5	3	2	8	6	5	Possible	Not known
02S32F023	KATBERG - A	1612	0.557752	1.679166667	1	2	5	3	2	8	6	5	Possible	Not known
02S32F025	KATBERG - B	388	0.134248	0.404166667	1	1	5	3	2	5	3	2	Possible	Not known
02S10J014	KEI BRIDGE FARM	9057	3.133722	9.434375	3	6	11	9	8	20	18	17	Possible	Not known
02S32J004	KOPPIES	1679	0.580934	1.748958333	1	2	5	3	2	8	6	5	Possible	Not known
02S32C026	KUZANGQOKWE	858	0.296868	0.89375	1	1	5	3	2	5	3	2	Possible	Not known
02S32F002	KWAMAREPULA - A	1124	0.388904	1.170833333	1	1	5	3	2	5	3	2	Possible	Not known
02S32F004	KWAMAREPULA - B	333	0.115218	0.346875	1	1	5	3	2	5	3	2	Possible	Not known
02S32F001	KWAMASOKA	1087	0.376102	1.132291667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F033	KWAMDINGI - B	153	0.052938	0.159375	1	1	5	3	2	5	3	2	Possible	Not known
02S32H011	KWAMKWANE	478	0.165388	0.497916667	1	1	5	3	2	5	3	2	Possible	Not known
02S32J003	KWANKCWA	1901	0.657746	1.980208333	1	2	5	3	2	8	6	5	Possible	Good
02S32F014	KWASISILANE	226	0.078196	0.235416667	1	1	5	3	2	5	3	2	Possible	Not known
02S32L002	LANGERWACHT	101	0.034946	0.105208333	1	1	5	3	2	5	3	2	Possible	Not known
02S31D001	LESSEYTON	1361	0.470906	1.417708333	1	1	5	3	2	5	3	2	Definite	Not known
02S32G013	LONGDRAAI	371	0.128366	0.386458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32C024	LOWER DIDIMANA	1300	0.4498	1.354166667	1	1	5	3	2	5	3	2	Possible	Not known
02S32M003	LOWER HENDHAM	425	0.14705	0.442708333	1	1	5	3	2	5	3	2	Possible	Not known
02S32H004	LOWER HUKUWA 1	83	0.028718	0.086458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32C021	LOWER MERINO WALK	82	0.028372	0.085416667	1	1	5	3	2	5	3	2	Definite	Not known
02S32K001	LOWER WELLINGTON	90	0.03114	0.09375	1	1	5	3	2	5	3	2	Possible	Not known
02S32C013	LOWER ZANGQOKWE	283	0.097918	0.294791667	1	1	5	3	2	5	3	2	Possible	Not known
02S32G007	MABALENI - B	500	0.173	0.520833333	1	1	5	3	2	5	3	2	Possible	Not known
02S32J012	MACHIBINI - AA	931	0.322126	0.969791667	1	1	5	3	2	5	3	2	Possible	Good
02S32J002	MACUBENI - D	453	0.156738	0.471875	1	1	5	3	2	5	3	2	Possible	Not known
02S32J013	MAMFENENI - B	702	0.242892	0.73125	1	1	5	3	2	5	3	2	Possible	Good
02S32F031	MAMPONDWENI - B	82	0.028372	0.085416667	1	1	5	3	2	5	3	2	Possible	Not known
02S32M004	MANDALAY	364	0.125944	0.379166667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F012	MANQONDWANE	208	0.071968	0.216666667	1	1	5	3	2	5	3	2	Possible	Not known
02S32H002	MANZIKRAKRA	400	0.1384	0.416666667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F026	MANZINI	86	0.029756	0.089583333	1	1	5	3	2	5	3	2	Possible	Not known
02S32J007	MAUMAU	365	0.12628	0.380208333	1	1	5	3	2	5	3	2	Possible	Not known
02S32F003	MBEKWENI - A	4005	1.38573	4.171875	1	3	5	3	2	11	9	8	Possible	Not known
02S32C019	MCEULA	900	0.3114	0.9375	1	1	5	3	2	5	3	2	Possible	Not known
02S32H005	MISSION - B	124	0.042904	0.129166667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F021	MOUSA	900	0.3114	0.9375	1	1	5	3	2	5	3	2	Possible	Not known
02S32J008	MTEBELE	2798	0.968108	2.914583333	1	2	5	3	2	8	6	5	Possible	Not known
02S32J005	MTHONJENI - D	1513	0.523498	1.576041667	1	2	5	3	2	8	6	5	Possible	Good
02S32F027	MTWAKAZI	1087	0.376102	1.132291667	1	1	5	3	2	5	3	2	Possible	Not known
02S10D012	NDUMANGENI - A	365	0.12629	0.380208333	1	1	5	3	2	5	3	2	Possible	Not known
02S31D002	NEW BEKA	625	0.21625	0.651041667	1	1	5	3	2	5	3	2	Definite	Not known
02S32G006	NGCAMNGENI - A	483	0.167118	0.503125	1	1	5	3	2	5	3	2	Possible	Not known
02S32G003	NGCENI - A	1359	0.470214	1.415625	1	1	5	3	2	5	3	2	Possible	Not known
02S32H003	NGXOVU NGXOVU	141	0.048786	0.146875	1	1	5	3	2	5	3	2	Possible	Not known

TABLE 9: Groundwater development perspective (Continued)

User Nr.	Village	Population	Demand l/s 8 hrs pump cycle 10 l/c/d	Demand l/s 8 hrs pump cycle 30 l/c/d	Prod. Bholes Required 10 l/c/d	Prod. Bholes Required 30 l/c/d	Nr. Siting Required 10 l/c/d	Nr. Drilling Required 10 l/c/d	Nr. Testing Required 10 l/c/d	Nr. Siting Required 30 l/c/d	Nr. Drilling Required 30 l/c/d	Nr. Testing Required 30 l/c/d	Recommendation to develop	Expected water Class
02S10D013	NKONKOBE	868	0.300328	0.904166667	1	1	5	3	2	5	3	2	Possible	Not known
02S31F003	NONESI - A	5145	1.78017	5.359375	1	2	5	3	2	8	6	5	Definite	Not known
02S32J006	NONTLOKO	206	0.071276	0.214583333	1	1	5	3	2	5	3	2	Possible	Not known
02S32C011	NTABELANGA - C	219	0.075774	0.228125	1	1	5	3	2	5	3	2	Possible	Not known
02S10J016	OATHAY	69	0.023874	0.071875	1	1	5	3	2	5	3	2	Possible	Not known
02S32F009	OXTON	755	0.26123	0.786458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32L003	PAPKUILSFONTEIN - A	95	0.03287	0.098958333	1	1	5	3	2	5	3	2	Possible	Not known
02S32L006	PAPKUILSFONTEIN - B	49	0.016954	0.051041667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F029	PAVET	114	0.039444	0.11875	1	1	5	3	2	5	3	2	Possible	Not known
02S32H006	PESHEYA	328	0.113488	0.341666667	1	1	5	3	2	5	3	2	Possible	Not known
02S31F001	QUEENSTOWN	37316	12.911336	38.87083333	4	6	14	12	11	20	18	17	Definite	Not known
02S32C010	QWABI	400	0.1384	0.416666667	1	1	5	3	2	5	3	2	Possible	Not known
02S10J011	QWATYU	439	0.151894	0.457291667	1	1	5	3	2	5	3	2	Possible	Not known
02S31D003	REINBRON	792	0.274032	0.825	1	1	5	3	2	5	3	2	Definite	Not known
02S32M013	ROCKLANDS - D	113	0.039098	0.117708333	1	1	5	3	2	5	3	2	Possible	Not known
02S32G001	SADA	5670	1.96182	5.90625	2	4	8	6	5	14	12	11	Possible	Not known
02S32H007	SAUTANA	150	0.0519	0.15625	1	1	5	3	2	5	3	2	Possible	Not known
02S32H012	SAWATIYE	1087	0.376102	1.132291667	1	1	5	3	2	5	3	2	Possible	Not known
02S32G011	SHILO 1	1400	0.4844	1.458333333	1	1	5	3	2	5	3	2	Possible	Not known
02S32G002	SHILO 2	1700	0.5882	1.770833333	1	2	5	3	2	8	6	5	Possible	Not known
02S32G014	SIBONILE	347	0.120062	0.361458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32F006	SISILANE	224	0.077504	0.233333333	1	1	5	3	2	5	3	2	Possible	Not known
02S10J027	STARTIC	57	0.019722	0.059375	1	1	5	3	2	5	3	2	Possible	Not known
02S32L005	SURREY	112	0.038752	0.116666667	1	1	5	3	2	5	3	2	Possible	Not known
02S10J023	T D C - A	0	0	0	1	1	5	3	2	5	3	2	Possible	Not known
02S31D004	TABATA	468	0.161928	0.4875	1	1	5	3	2	5	3	2	Definite	Not known
02S32H014	TAMBO - B	625	0.21625	0.651041667	1	1	5	3	2	5	3	2	Definite	Not known
02S32F024	THOBOSHANE	120	0.04152	0.125	1	1	5	3	2	5	3	2	Possible	Not known
02S32K002	THORN PARK	262	0.090652	0.272916667	1	1	5	3	2	5	3	2	Definite	Not known
02S31D005	TOISEKRAAL	2136	0.739056	2.225	1	1	5	3	2	5	3	2	Definite	Not known
02S32J009	TSHAMEHLO	445	0.15397	0.463541667	1	1	5	3	2	5	3	2	Possible	Not known
02S32F007	TSITSIKAMA	1400	0.4844	1.458333333	1	1	5	3	2	5	3	2	Possible	Not known
02S32K004	TYLDEN - A	541	0.187186	0.563541667	1	1	5	3	2	5	3	2	Definite	Not known
02S32G004	TYLDEN - B	461	0.159506	0.480208333	1	1	5	3	2	5	3	2	Possible	Not known
02S32K003	TYLDEN - C	315	0.10899	0.328125	1	1	5	3	2	5	3	2	Possible	Not known
02S32F022	UMTWAKAZI	419	0.144974	0.436458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32C006	UPPER DIDIMANA	600	0.2076	0.625	1	1	5	3	2	5	3	2	Possible	Not known
02S32M005	UPPER DUBUGALER	154	0.053284	0.160416667	1	1	5	3	2	5	3	2	Possible	Not known
02S32M006	UPPER HENDHAM	167	0.057782	0.173958333	1	1	5	3	2	5	3	2	Possible	Not known
02S32H008	UPPER HUKUWA 2	435	0.15051	0.453125	1	1	5	3	2	5	3	2	Possible	Not known
02S32K007	UPPER THORN PARK	59	0.020414	0.061458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32C015	UPPER ZANGQOKWE	900	0.3114	0.9375	1	1	5	3	2	5	3	2	Possible	Not known
02S32K009	WELLINTON	69	0.023874	0.071875	1	1	5	3	2	5	3	2	Possible	Not known
02S32C022	WHO-CAN-TELL	205	0.07093	0.213541667	1	1	5	3	2	5	3	2	Definite	Not known
02S10J025	WILLOW BROOK	148	0.051208	0.154166667	1	1	5	3	2	5	3	2	Possible	Not known
02S32C023	XALENI	300	0.1038	0.3125	1	1	5	3	2	5	3	2	Possible	Not known
02S31D007	XUMA - A	1734	0.599964	1.80625	1	1	5	3	2	5	3	2	Definite	Not known
02S31D006	XUMA - B	620	0.21452	0.645833333	1	1	5	3	2	5	3	2	Definite	Not known
02S32F017	YONDA	1222	0.422812	1.272916667	1	1	5	3	2	5	3	2	Possible	Not known
02S32C025	ZIBELENI	155	0.05363	0.161458333	1	1	5	3	2	5	3	2	Possible	Not known
02S32F020	ZWELIDINGA - C	1023	0.353958	1.065625	1	1	5	3	2	5	3	2	Possible	Not known

Aquifer management

To ensure that a borehole can be used on a sustainable basis it is necessary to estimate the sustainable yield of the groundwater unit in which the borehole is situated. The storage capacity of this unit needs to be known, as well as all water inputs to, and outputs from the unit. Commissioning an additional borehole means that some of the losses from the unit will now be diverted to this borehole. Losses include base-flow, evapotranspiration and abstractions from other boreholes.

Good aquifer management includes ensuring that diversion of losses is acceptable, and ensuring that net losses do not exceed net gains on a long-term basis for the groundwater unit as a whole, i.e. that the groundwater abstraction is balanced by groundwater recharge in the long-term. In addition a practical pumping rate needs to be determined, based on the local hydrogeological conditions.

This is a specialized task requiring the expertise of a geohydrologist, entailing test pumping of the borehole, and an evaluation of the hydrogeology of the aquifer unit. On the basis of this information recommendations on the pumping rate, and correct pump size are made.

The fractured aquifers in the Lukhanji area are highly heterogeneous, making it very difficult to make accurate estimates of sustainable yield. The best way to determine what these aquifers can yield is to monitor groundwater abstractions and water level behaviour so that the sustainable yields can be refined.

This approach used by the groundwater scientists might seem back to front to those who are used to surface water where it is possible to reach greater degrees of certainty before embarking on a supply scheme. In the case of surface water direct water flow measurements can be made beforehand, and this information used to design dams of specific dimension. However, given the very low start-up costs of groundwater schemes the initial lower level of certainty should not and need not be used as an excuse to ignore groundwater.

Armed with this information it is possible to manage the resource, adjusting pumping rates to sustainable levels (reduce the rate if continuous declining trend in water levels is detected, or even increase rates if trend indicates impact is limited).

Conclusions & Recommendations

The following is important to note throughout the development of the WSDP in the Lukhanji area. Important preliminary management information is given in the following tables.

- Annexure3, Table 1 gives preliminary information gathered during a brief field verification exercise to evaluate certain important aspects used in defining high potential zones and certain hydrogeological parameters. This table should be updated as part of a follow up study to provide important management information.

- Table 9 gives a complete list of all villages located within the Lukhanji area with important management information regarding the extent of drilling, pump testing that can be budgeted for using different scenarios.

- Table 8 gives indication of harvest potential per quaternary catchment delineated in Annexure 1,Figure 1. Existing usage

and available surplus is indicated. This information can be used in conjunction with Table 9 when assessments are made for individual villages. This serves as the foundation for future detailed groundwater balance calculations to be calculated per catchment. This can only be done once more information is obtained from more detailed studies.

- Geohydrological data presented in this study is based on available information only, which in most cases are seen as insufficient. This points to the importance to carry out a comprehensive geohydrological investigation in each of the local municipal areas, adding onto these findings and refining recommendations per village.

- It is extremely important that this investigation is linked up to the more detailed hydrogeological potential evaluation study that is currently undertaken by the Chris Hani District Municipality.

The following groundwater studies are recommended to be carried out in the Lukhanji area:

- *Detailed hydrocensus & water quality monitoring*
- *Geophysical surveys in identified target areas*
- *Selective pump testing of boreholes in high potential zones*
- *Water balance calculations once survey results are known*
- *Exploration drilling to define potential*

Although the studies indicate significant groundwater potential, representatives at the workshops felt that if there is a viable surface water option, this should be adopted and the groundwater options retained as a reserve.

2.5 *WATER CONSERVATION AND DEMAND MANAGEMENT*

The Waterdown Dam is operated on DWAF Operation Rules. Bongolo Dam is operated on informal Municipality Rules that stops abstraction at the 40% level. This allows the Bongolo to serve as an emergency source in case of problems with the Waterdown pipeline. The Bongolo is also used to supply water to Queenstown during peak demands when the Waterdown pipeline, even with boosting, cannot sustain the demand.

Unaccounted for water in the two main supply schemes i.e. Queenstown and Sada seems to be a point of concern.

In the Queenstown water supply system only part of the system has yard meters. The rest of the area has zone meters. WSSA reports monthly on water demand and unaccounted for water as well as treated water and treated sewerage. With the limited number of zone meters they do have a fairly good indication of water losses. The water loss including water treatment work losses for the past 6 months varied from 54784 kl to 193010 kl. This is equivalent to a 10% to 25% loss. An extract showing unaccounted for water is attached in Annexure 2.

At Sada no zone meters are installed. It is suggested that the installation of zone meters be given priority to assist in the system management as well as isolating areas of high water losses.

The installation of meters is a capital-intensive action. The cost of water does not always justify the installation of meters. It is however important from a strategical point of view to have an adequate metering system to assist with demand management and prevention of water wastage.

2.6 *WATER SERVICES INFRASTRUCTURE*

All the major water supply schemes are discussed in this section with a brief description of problems and possible solutions. These schemes are:

- Upper Klipplaat irrigation Scheme
- Klipplaat Government Water Scheme
- Queenstown Water Supply Scheme
- Sada-Whittlesea Water Supply Scheme
- Klaas Smits River Irrigation Scheme
- Zweledinga Irrigation Scheme
- Oxkraal Irrigation Scheme
- Ilinge Water Supply Scheme

The major sewer treatment plants are also discussed. These are

- Sada sewer treatment works
- Queenstown sewer treatment works
- Ilinge oxidation ponds.

2.6.1 UPPER KLIPPLAAT IRRIGATION SCHEME

Existing Scheme

Some 1,460 ha of irrigated lands situated adjacent to the Klipplaat River upstream of Waterdown Dam are irrigated using water abstracted from the river by pumping into small storage dams.

Problems

The scheme does not experience water supply problems.

Possibilities

Although it is not necessary to harness additional water to satisfy current water needs and no growth in water requirements

is projected, some of the irrigators have expressed a desire to construct a dam on the upper Klipplaat River for irrigation purposes. Such a dam would reduce the yield of Waterdown Dam, which is already hard pressed to meet its commitments. For this reason the Department of Water Affairs and Forestry has notified the irrigators concerned that permission to construct such a possible dam will not be granted.

Conclusions

No further consideration of water supply possibilities to meet the future water needs of this scheme is considered necessary at this stage.

2.6.2 KLIPPLAAT RIVER GOVERNEMENT WATER SCHEME

Existing Scheme

The main water source for the scheme is the Waterdown Dam on the Klipplaat River.

Water for irrigation is released from the dam into the river channel to supply a scheduled area of 1,905 ha along the Klipplaat River to its confluence with the Black Kei, and along the Black Kei to its confluence with the White Kei. The current unit irrigation quota is 6,100 m^3/ha/a.

There are also allocations to supply domestic and industrial water needs in Queenstown, Sada-Whittlesea, Tylden and to SAR (now Spoornet).

Problems

The main problems can be summarized as follows:

- The sum of the allocations from the dam exceeds the yield of the dam.

- The river distribution losses are high.
- The unit field-edge irrigation quota is less than the water requirement of the crops currently grown.

Possibilities

1. Raise Waterdown Dam by 3,2m
2. Raise Waterdown Dam by 7,0m
3. Provide a Compensation Release from Oxkraal Dam
4. Reduce the Sada-Whittlesea allocation (Supply from another source)
5. Reduce the Queenstown allocation (Supply from another source)
6. Reduce or Eliminate the Tylden/SAR allocation
7. Supply Lower Irrigation Lands from another source
8. De-schedule Lower Irrigation Lands
9. Return Queenstown's Treated Effluent to the Klipplaat River
10. Increase the Unit Field-edge Irrigation Quota
11. Improve Operating Rules

Conclusions

Based on this preliminary assessment of the eleven possibilities described it appears that the following warrant further more detailed consideration:

1 Raise Waterdown Dam by 3,2m
2 Raise Waterdown Dam by 7,0m
3 Provide a Compensation Release from Oxkraal Dam
6 Reduce (Eliminate) the Tylden/SAR allocation
7 Supply Lower Irrigation Lands from another source
8 De-schedule Lower Irrigation Lands
11 Improve Operating Rules

2.6.3 QUEENSTOWN WATER SUPPLY SCHEME

Existing Scheme

The scheme comprises the domestic/industrial supply to Queenstown, Mlungisi and eZibeleni. The raw water sources for the scheme are the Bongolo Dam which is owned by Queenstown Municipality and has a firm yield of 0,65 million m^3/a, and an allocation of 8,25 million m^3/a from Waterdown Dam, totaling 8,90 million m^3/a.

The Municipality draws the maximum available supply from Bongolo Dam, in excess of the firm yield, secure in the knowledge that Waterdown Dam is available as a backup. The total available raw water supply available to Queenstown is therefore in excess of 8,90 million m^3/a (a system analysis would be required to determine an accurate estimate of the system yield).

Problems

Although the available water supply from Bongolo and Waterdown Dams is theoretically in excess of 8,90 million m^3/a, this is only the case if Waterdown Dam is able to supply the full 8,25 million m^3/a allocation. This is probably not the case as the sum of the current allocations from the dam exceeds the yield of the dam.

However, if appropriate possibilities for addressing the problems on the Klipplaat River Government Water Scheme are implemented, and Queenstown can be assured of its 8,25 million m^3/a allocation from Waterdown Dam, Queenstown should be able to meet all its projected water requirements up to about 8,86 million m^3/a, which is expected to occur in the year 2003.

By that stage it will be necessary to have secured an additional supply of about 1,9 million m /a to meet the projected water requirements to the year 2010 by which time total demand is expected to have reached 10,79 million m^3/a.

If the full 8,25 million m^3/a allocation from Waterdown Dam cannot be secured, it will be necessary to obtain an additional supply before the year 2003.

Possibilities

1. Secure the existing allocation from Waterdown Dam
2. Obtain an additional allocation from Waterdown Dam
3. Obtain an allocation from the existing Xonxa Dam
4. Obtain an allocation from a new Waklyn Dam
5. Obtain an allocation from a new Stichel Dam
6. Recycle effluent
7. Improve Operating Rules
8. Implement Water Demand Management

2.6.4 SADA-WHITTLESEA WATER SUPPLY SCHEME

Existing Scheme

The Sada-Whittlesea Scheme utilizes water allocated from Waterdown Dam to supply Sada-Whittlesea, the associated peri-urban areas and four rural villages. The allocation is 4,20 Mm^3/a.

Raw water is drawn from the main Waterdown Dam – Queenstown pipeline and conveyed by pipeline to the Sada Water Treatment Works, from where it is distributed to consumers.

Problems

The allocation of 4,2 million m^3/a from Waterdown Dam is more than adequate to meet projected water demands, which are expected to increase from 1,45 million m^3/a in 1992 to 2,41 million m^3/a in 2010.

However, it should be borne in mind that Waterdown Dam is not capable of meeting all the current allocations from the dam.

Possibilities

1. Secure the current allocation from Waterdown Dam
2. Obtain an alternative allocation from Oxkraal Dam

Conclusions

Based on the preliminary assessment of the two possibilities described in the appendix, it appears that only Possibility No. 1 warrants further more detailed consideration. There seems little point in attempting to reduce the demand on Waterdown Dam

by using Oxkraal water to supply Sada-Whittlesea's allocation (via new infrastructure), when any surplus Oxkraal water available can easily be used to augment supplies to the Klipplaat Government Water Scheme in the form of a compensation release.

2.6.5 KLAAS SMITS RIVER IRRIGATION SCHEME

Existing Scheme

This scheme consists of 2,780 ha of opportunistic irrigation land adjacent to the Klaas Smits River and its tributaries, the Heuningklip, Hex, Lesseyton and Komani Rivers.

There are no bulk water storage dams in the Klaas Smits Catchment except Bongolo Dam which supplies Queenstown. The water resources available to the irrigators are the low flow in the rivers; the groundwater resource and the return flow from the Queenstown Sewage Treatment Works.

Problems

- The main problem facing this scheme is that the water requirements of the lands currently irrigated (16,43 million m^3/a) exceed the currently available water resource.

The three components of the available water resource are as follows:

- The 1:10 year and 1:5 year low flow contributions are 0,6 million m^3/a and 1,8 million m^3/a respectively. As this is not a formal irrigation scheme it may be appropriate to consider the 1:5 year low flow (1,8 million m^3/a) as the available surface water resource.

- The available groundwater resource of the entire Klaas Smits River catchment is estimated to be about 14,2 million m^3/a could be made available to irrigators adjacent to the main rivers (More detailed investigation would be required to confirm this). It appears that the current rate of groundwater use is about 3,5 million m^3/a.

- The return flow from Queenstown Sewage Treatment Works is about 4,9 million m^3/a. This could possibly increase to about 9 million m^3/a by the year 2010 as Queenstown's water usage increases.

Based on the above, the total available water resource is currently 10,2 million m^3/a and could possibly reach 18,7 million m^3/a by the year 2010, as outlined in the Table 10.

Table 10: Klaas Smits River Irrigation Schemes: Available Water Resources

Water Source	Water Resource 10^6 m^3/a	
	Currently Available	Upper Limit
Low Flow (1:5 year)	1,8	1,8
Ground Water	3,5	8,0*
Return Flow from Queenstown Sewage Treatment Works	4,9	9,0**
TOTAL	**10,2**	18,8

* Preliminary Estimate

** By the year 2010

Possibilities

1. Construct a new dam
2. Make optimum use of the groundwater resource
3. Use the possible future increase in the return flow from the Queenstown Sewerage Treatment Works

Conclusions

Based on the preliminary assessment of the three possibilities described in this appendix, it appears that only two, which are listed below, warrant further more detailed consideration.

1 Make optimum use of groundwater

2 Use the possible future increase in the return flow from Queenstown Sewerage Treatment Works.

2.6.6 ZWELEDINGA IRRIGATION SCHEME

Existing Scheme

The bulk water source for the scheme is the Bushmanskrantz Dam on the upper reaches of the Oxkraal River. The dam has a firm yield of 2,07 million m^3/a and 1:10 year and 1:5 year yields of 2,52 million m^3/a and 3,08 million m^3/a respectively. These yields are expected to change very little over time as the sediment yield of the catchment is low ($100t/km^2/a$).

The dam supplies 259 ha of irrigated land downstream of the dam via a 17km long bulk pipeline. It also augments the existing groundwater supplies to the villages of Yonda and Mbekweni which have a limited water requirement of 0,04 million m^3/a.

Problems

The scheme does not experience water supply problems as the yield of the dam exceeds the water requirements of the users supplied from the dam.

Possibilities

1. Increase the irrigation quota
2. Increase the irrigated area

Conclusions

Depending on whether the irrigators would prefer to expand the irrigated area with the same crop mix or change to a crop mix with greater water requirements, one or other of the two possibilities described in this section would warrant further more detailed consideration.

2.6.7 OXKRAAL IRRIGATION SCHEME

Existing Scheme

The scheme consists of the Oxkraal and Shiloh Dams and the lands that are intended to be irrigated downstream of these dams.

Oxkraal Dam has a firm yield of 6,18 million m^3/a and 1:10 year yield of 7,96 million m^3/a. By the year 2010 these yields are expected to have been slightly reduced to 5,71 million m^3/a and 7,06 million m^3/a respectively, as a result of sedimentation. Oxkraal Dam is intended to supply water to 481 ha of irrigable land downstream of the dam and 60 ha on the upstream bank of the dam.

Shiloh Dam's 1:10 year yield is expected to reduce from the current 0,4 million m^3/a to 0,28 million m^3/a by the year 2010. This scheme already has a pipeline from the dam to the intended 25 ha of irrigable land.

Problems

At this stage only the two dams and the Shiloh pipeline have been constructed. As the irrigation lands have not yet been

developed the scheme does not experience operational problems.

One of the reasons that the Oxkraal irrigation lands have not been developed has been the difficulty experienced by Ciskei Government in acquiring funds to construct a pipeline from the dam to the lands.

One problem that has been created by the construction of the Oxkraal Dam is the cutting of a significant portion of the low flow contribution from the Oxkraal River that was originally available to the irrigators on the Klipplaat River Government Water Scheme prior to the damming of the Oxkraal River.

It is also questionable whether or not it is justifiable to use Oxkraal Dam to impound and store surplus water, which is in excess of what is currently beneficially used

Possibilities

1. Supply the proposed Oxkraal irrigation lands by pipeline
2. Supply the proposed Oxkraal irrigation lands via the river channel
3. Provide a compensation release from Oxkraal Dam
4. Provide an allocation to Sada-Whittlesea

Conclusions

Based on the preliminary assessment of the four development possibilities described in this appendix it appears that the following three warrant further more detailed consideration.

1 Supply the proposed Oxkraal irrigation lands by pipeline (This possibility becomes less attractive if Oxkraal Dam is to provide a compensation release.

2 Supply the proposed Oxkraal irrigation lands via the river channel.

3 Provide a compensation release from Oxkraal Dam.

2.6.8 ILINGE WATER SUPPLY SCHEME

Existing Scheme

Ilinge is at present supplied from six boreholes. A small earth dam, situated 11 km north west of Ilinge which has a storage capacity of 0,22 million m^3 and an estimated yield 0,06 million m^3/a supplements the supply via a 75 mm diameter pipe.

Problems

The existing borehole scheme is capable of meeting projected demands to the year 2010. The main problems facing the scheme are operational problems.

Possibilities

Introduction

Although the existing scheme is capable of satisfying the projected water demands to the year 2010, four possible ways of extending the water supply, should the need arise, are outlined below:

Possibility No. 1: Develop Additional Groundwater Resources as Required

When the water requirements of Ilinge approach the yield of the existing boreholes, additional boreholes can be developed. Investigations into the provision of a reliable water supply to Ilinge (SSP, 1987) have shown that the local groundwater resources are good and borehole yields are higher than the average for neighbouring areas.

Possibility No. 2: Construct Imvani Dam

The Imvani Dam is capable of providing sufficient water to supply Ilinge however, the very high sediment yield of the catchment (1000 t/km^2/a) results in the dam having a relatively short economic life. This dam should only be considered if adequate groundwater resources couldn't be found.

Possibility No. 3: Transfer Water from Xonxa Dam

Water could be pumped via a pipeline from the Xonxa Dam. However, the range of hills and the distance between the dam and Ilinge would result in high pipeline and pumping costs. This possibility is therefore not considered to be a suitable scheme.

Possibility No. 4: Pump Water from the Black Kei River

Once wither a Stitchel or Waklyn Dam is constructed it will be possible to supply Ilinge from the Black Kei River. The river alone cannot provide an assured supply of water from run of river flow. However, even with a dam in place, the pumping costs will be high. This possibility is therefore not considered to be a suitable scheme.

Conclusions

Of the four possibilities considered only Possibility No. 1 (Develop Additional Groundwater Resources as Required), is considered worthy of further consideration. In the interim the operational problems should be addressed.

2.6.9 Sada sewer treatment works

The capacity of the treatment plant is 5 Ml/day. It is currently running near full capacity. There is provision in the capex budget for the upgrading and extension of the existing collector network.

The effect on the plant capacity is not known but it is presumed that the treatment plant will require upgrading or expansion.

2.6.10 Queenstown sewer treatment works

The capacity of the Queenstown treatment plant is 16 Ml/day. It currently operates at 9 Ml/day in dry weather conditions. During wet weather the flow increases to more than double the plant capacity. This results in sub-standard effluent being disposed.

The increase in wet weather flow is due to the bad condition of the joints in the vitro clay sewer collector pipes. As the water table rises, the groundwater infiltrates the sewer system. It also introduces sand particles in the system, causing blockages in the collector network and congesting the treatment plant.

A secondary effect is that pipe backfilling is cavitated, resulting in the collapse of surface infrastructure such as roads and pavements.

Another concern is that during dry weather conditions, sewer might infiltrate the soil profile via the leaking pipe joints and result in contamination of the groundwater.

2.6.11 Ilinge oxidation ponds.

The capacity of the Ilinge oxidation ponds is not known. The impact of the planned upgrade and extension of the sewer collector system should be investigated.

2.7 INSTITUTIONAL AND ORGANISATIONAL ARRANGEMENTS

2.7.1 INSTITUTIONAL FRAMEWORK

Department of Water Affairs and Forestry

In the Lukhanji area DWAF are responsible for catchment management, and up till recently has been responsible for water service authority (WSA) functions. This has included the ownership and management of a large number of irrigation dams.

DWAF have also played an important role in water services provisions. This has largely focused on services in the rural areas, and has included establishing a number of stand alone schemes services from boreholes, management of the legalities of irrigation schemes, as well as the operation and maintenance of the water treatment works at Sada, and the sewerage treatment works at Whittlesea. The intention is that these two works units will be transferred from DWAF's responsibility, either to Chris Hani or Lukhanji.

- DWAF do not have an office in the Lukhanji area. Policy and project related issues are managed from King William'stown. The works units are managed from King William's Town directly as well.

Chris Hani District Municipality

Chris Hani is currently the Water Services Authority for the Lukhanji area. The Municipality completed its Water Services Development Plan in September 2001.

In terms of the District Municipalities WSDP the following goals are of relevance for Lukhanji:

- Define the role and functions of the CHDM and the local authorities within its area of jurisdiction.
- Define the roles and responsibilities between CHDM and potential or current Water Service Providers.
- CHDM must put in place an appropriate operational and infrastructure policy to achieve a tolerable degree of sustainability of water and sanitation services
- Define roles and responsibilities between CHDM and customers during the scheme transfer process
- Enter into all contractual agreements as stipulated in the Water Services Act.

The CHDM WSDP acknowledges the need for a transition period for it to properly establish itself in terms of its role. In this period it acknowledges that:

- Water services in the former TLC areas will remain the category B local authority's responsibility
- Water services in the former TRC areas will remain DWAF responsibility until CHDM develops capacity to take over such schemes.
- A capacity building audit of all local authorities within the CHDM area of jurisdiction is required.

The strategic foci for the CHDM in 2002 are:

- Establishment of a Water Services Unit. The orientation of this Unit appears to be capital project implementation. A small Operations and Maintenance section is added on, but the role of this proposed section needs clarifying as it appears inadequate to carry out rural operational & maintenance functions.
- Assignment of relevant water service management functions between DWAF, CHDM and the category B local authorities.

In 2003 and beyond the strategic foci is planned to shift to:

- Capacity building of the category B local authorities and Water Service Providers,
- A demand Management Programme
- Developing an integrated management team for water services within the CHDM

Lukhanji Municipality

In terms of the Water Services Act and the Municipal Structures Act the powers and functions of water services are the responsibility of the District Municipality unless devolved to Lukhanji. The process of finalizing such division of responsibilities is still under discussion between the two authorities.

The main issue for consideration has been the issue of capacity to service the rural areas, as neither authorities have existing staff dedicated to such needs.

However, subsequent to Chris Hani completing its WSDP, Lukhanji has decided to apply to become a Water Service Authority in its own right. If approved this will imply Lukhanji will have responsibility for:

- Planning and management of water sources and to ensure such sources are sufficient to meet needs equitably
- The protection of water sources and conservation of water use
- Planning for the delivery of such water services across its area
- Planning for the organizational transfer of DWAF water infrastructure assets

- The identification and establishment or appointment of water service provider arrangements and required contractual arrangements
- Setting of tariffs and financial sustainability of water service operations and maintenance.

If approved as a WSA, Lukhanji will legally report directly to DWAF in terms of its WSA functions. This has advantages in terms of direct access to DWAF resources and support. However such coordination between DWAF and Lukhanji has been limited up to now, and appropriate liaison mechanisms will have to be established. Discussions with Chris Hani will have to take place, so as to ensure a disjunction with regard to regional planning does not occur.

Water Services South Africa (WSSA)

WSSA were appointed in 1992 by the Queenstown municipality on a 25-year contract, ending 2017. While the initial contract only covered the then Queenstown municipality, the townships of Ezibeleni and Mlungisi were subsequently added to the scope of responsibility for WSSA.

The functions of WSSA include the operations & maintenance of:

- Berry Dam (works)
- raw water pipes
- the water treatment works
- the water reticulation system (including the reservoirs, pump station, piping, and the consumers meter).
- the sewerage treatment works
- the sewerage reticulation system

Besides operation and maintenance the contract stipulates that WSSA must carry out 2.5 km of water pipe replacement work per annum. This stipulation is not applied to the sewerage network. Upgrade of the system is not covered by WSSA and remains a local authority responsibility. WSSA maintains a complaints office in Queenstown and Ezibeleni, and has an after hours repair service. However the municipality still plays a support role in receiving complaints.

This is a management contract, and the local authority stipulates that they retain ultimate authority. WSSA does not have any functions in regard to billing or service charge collection.

While there is no formal evaluation system in place for the contract, WSSA are required to submit monthly reports and attend monthly meetings with the local authority. Water and effluent quality tests are carried out according to legal specifications and WSSA is required to maintain a stipulated level of water pressure for consumers.

Klipplaat Water Users Association

The Users Association has its roots in the establishment of the Klipplaat Irrigation Scheme by the government in 1962. The scheme was to become a water board, but this was never implemented and is now in the process of becoming a registered User Association.

The Association has about 40 members including both white and black commercial farmers, the Shiloh Irrigation Scheme, and other irrigation schemes on communal land.

The members of the association have a permit to draw 6100m^3/per hectare per annum from the Klipplaat River. The water is released from the Waterdown Dam. All usage is

metered individually. Payments and other legal arrangements are made directly with DWAF.

The Association members have been trying to get an increase in water allocation for many years, as they feel their allocation is insufficient and limits agricultural potential. However the current over utilization of the Waterdown Dam has meant it is impossible to expand such usage until this situation is resolved.

Other Local Agents

During the course of establishing stand alone schemes in rural communities a number of Water Committees have been set up. These institutions currently fall outside of the planning or maintenance processes of Lukhanji. Neither is their any formal mechanism for interacting with these committees. Information regarding the functionality of such committees is not available.

2.7.2 Organizational Framework

Local Authority Reorganization

While the Lukhanji Municipality is the political amalgamation of the former:

- Queenstown TLC
- Whittlesea TLC
- Queenstown TRC
- Hewu TRC
- and portions of the Cathcart and Cacadu TRCs

However the TRC areas were serviced by the District Councils (now District Municipalities) and employed no staff directly. Therefore the current situation for Lukhanji is that all staff

originates from the two former TLC administrative areas and the Municipality only has capacity to service these areas.

Amalgamation

An administrative amalgamation plan has been drafted and is in the process of finalization.

Appointments of senior managers have taken place in terms of this plan. However further staffing appointments still have to be discussed and approved. The manner in which new sections and posts will be funded also still has to be finalized and it is likely that such issues may take some time. It is therefore envisaged that new sections will be only be established over a number of years.

The New Organizational Structure

The plan proposes to establish a new Directorate of Technical Services with the following divisions:

- Public works
- Electrical
- Projects
- Administration

The Public work and Projects divisions will have a direct bearing on water services delivery.

Within the Public Works division the aim is to establish the following operational units:

- Queenstown Works Section (municipal plumbing only)
- Whittlesea Works Section (waterworks, sewerage, general maintenance)
- Village Water Works Unit (water service maintenance)
- Ilinge Works Unit (water service maintenance)

- Rural Roads Section
- Building Control Office
- In addition there are a number of specialist support personnel, covering hydraulics, drawing services, and technical support services.

The (to be established) Project Division will be responsible for the implementation of new capital projects for the municipality.

Staffing Levels

Table 11 reflects the current water service related staffing situation in sections that have water service functions. Note that some sections are not simply water services related, but only staff with water services functions has been counted. Supervisors of such sections have been counted as water service staff even if carrying out work on a range of tasks. Administrative staff has not been included.

Table 11: Current Waters Services Staffing

Section	Number Posts	Posts Filled	Post Unfilled		Percentage Vacancies
			Funded	Unfunded	
Snr Management	2	2	0	0	0
Specialist Support	3	3	0	0	0
Queenstown Maintenance[1]	6	6	0	0	0
Whittlesea	16	13	3	0	19%
Ilinge	6	0	0	6	100%
Village Works	6	0	0	6	100%
Totals	39	24	3	12	38.5%

Staffing vacancies are almost entirely related to the responsibilities of the municipality in the rural areas.

[1] This section is so small due to most functions been carried out by WSSA.

Non-Lukhanji Staff

DWAF staffing at the SADA / Whittlesea works are currently as follows:

Table 12: DWAF Staffing at SADA Whittlesea

Section	Number Posts	Posts Filled	Post Unfilled		Percentage Vacancies
			Funded	Unfunded	
Sada Water Works	13	5	8	0	61%
Whittlesea Sewerage Works	19	9	10	0	52%
Totals	32	14	18	0	56%

In addition there are a number of pump operators in village stand alone schemes, who are unpaid and not part of any formal organization. A decision will have to be made as to formalize such individuals' responsibilities within Lukhanji or not.

Internal Management Processes

The key decision making body in terms of budgeting, planning and implementation is the Mayoral Committee. Needs and issues are identified through Ward Councilors and Ward Committee structures on the one hand, on by officials on the other. Each directorate holds monthly meetings. From these meetings motivated proposals to the Mayoral Committee are made, which then discusses the proposal and makes decisions on the matter[2]. The Mayoral Committee meets once a week.

There is a separate Tender Committee, which meets, fortnightly or as necessary.

The internal project approval process is therefore relatively quick. Problems that do arise usually derive from external agent

[2] Obviously major matters such as the annual budget are referred to full Council meetings.

needs (such as rapid time frames for submission of proposals, or processing requirements for funding applications).

The only potential weakness identified in internal processes was the fact that planning & budgeting tends to happen on identified or existing resource allocations and is not necessarily focused around planning for full needs (the 'high road'). However it is expected that the WSDP will contribute to addressing this issue.

2.8 FINANCIAL ARRANGEMENTS

The financial profile for water & sanitation services largely focuses on the former Queenstown TLC area. Billing for Whittlesea has only just been introduced and the inadequate financial records from the previous TLC makes it difficult for Lukhanji to put a clear report together.

2.8.1 Water and Sewerage Tariffs

Lukhanji has implemented a free basic water policy, which applies to the first 6 KL per month. Pensioners also receive a discount of water rates.

The basic domestic charge for water starts at R17,50 for consumption above 6 KL. Tariff rates increase for consumption over 20 KL and again for over 50 KL.

Business rates start at R25,00, and are charged at R2,10 per KL.

Different flat rates are applied for irrigation at schools (using purified water), for the Golf Club, and at Enkululekweni.

Sewerage tariffs are set at R9,89 for Enkululekweni, at R22,74 for pensioners, and R29,82 for other domestic users. Business pays R29,82 per sewerage point.

The full list of tariffs are attached as an annexure.

2.8.2 Payment levels

Payment levels are been monitored for the former Queenstown TLC area. The Whittlesea area has only begun to receive accounts since January 2002, so payment levels cannot be determined as yet. No accounts are rendered for the rural areas. The various irrigation schemes make payment directly to DWAF at present.

The following payment levels are reported in regard to the former Queenstown TLC area:

Queenstown	68%
Ezibeleni	48%
Mlungisi	52%

The Municipality has adopted a Credit Control Policy, and appointed consultant support for the Directorate of Finance to implement the policy.

2.8.3 Operating Budget – Income & Expenditure

Lukhanji Municipality has managed to generate financial surpluses through the sale of water and sewerage services, despite inadequate cost recovery percentages.

A significant part of the operational cost is the payment to WSSA for the management of the water services in the Queenstown area.

Table 13: Sewerage (Disposal Works)

Items	1999/2000	2000/2001	2001/2002
Expenditure	4,033,730	4,462,540	5,817,300
Income	6,703,790	7,500,680	11,603,300
Surplus	2,670,060	3,038,140	5,786,000

Table 14: Water

Items	1999/2000	2000/2001	2001/2002
Expenditure: Total	9,877,575	10,970,680	13,820,120
▪ Distribution	556,120	651,830	1,599.930
▪ Kliplaat	8,720,570	9,735,900	11,629,670
▪ Purification	514,670	511,980	511,750
▪ Bongolo	86,215	60,970	78,770
Income: Total	10,736,590	10,904,240	16,791,450
Surplus/(Deficit)	859,015	(66,440)	2,971,330

Water services shows a marked increase in surplus budgeted for in 2001/2002. This is largely due to a R3,000,000 increase in central government subsidies. Income through service charges has also increased, but rising operational costs have paralleled this income increase. Most notable cost items that increased in 2001/2002 are:

- Cost of water purchases
- Repairs to mains

2.8.4 Capital Works Budget

The total current capital works budget is R126,175,000 of which 89,714,220 is funded for 2001/2002. Total Water & sanitation component of this budget is 27.7%, and total percentage of the 2001/02 funded budget is 24.9%. The largest component of the capital works budget is towards new housing (R40,000,000 or 31.7% of the total budget)

Table 15: Capital Projects/Funding Table – Water

Project	Funder	Total Amount	Amount 2001/02
Upgrade water – Ekuphumleni and Sada	CCDLF	5,525,000	1,500,000
Inlet meter – Berry Reservoir	CCDLF	40,000	40,000
Whittlesea bulk water meter	CCDLF	40,000	40,000
Reduction of water loss	CCDLF	105,000	105,000
Water meter replacement	CCDLF	500,000	300,000
Prepaid water meters – Condev & Unathi Mkefa	CCDLF	3,000,000	3,000,000
Contingency: Assessment and supply of water	CCDLF	200,000	200,000
Upgrade chlorination system	CCDLF	170,000	170,000
Pre-paid meter – Ilinge	CMIP	3,333,330	3,333,330
Upgrade reticulation – Tylden	Other	120,000	120,000
Water – Hewu	CMIP – PR	3,207,000	3,207,000
Water – Tembani	CMIP – PR	100,000	100,000
Water – Thambo Village	CMIP	2,567,450	2,567,450
Water – Imvani	CMIP	826,870	826,870
Water mains – Sada Unit 2	CMIP – PR	1,315,780	1,315,780
Total		**21,048,000**	**16,823,000**

Table 16: Capital Projects/Funding - Sewerage

Project	Funder	Total Amount	Amount 2001/02
Incinerator at sewerage	CCDLF	65,000	0
Upgrade main pump station	CMIP	1,000,000	1,000,000
Internal sewer lines – Ekuphumleni and Sada	CCDLF	5,525,000	900,00
Sewer reticulation – pipe replacement	CCDLF	250,000	100,000
Elimination of combined sewers	CCDLF	100,000	50,000
Berry Park Outfall sewer-diversion	CCDLF	250,000	0
Connect town sewers to Ezibeleni main sewer	Ex- revenue	30,000	30,000
Sada sewer	CCDLF	5,300,000	2,000,000
Sanitation – Lesseyton	CMIP – PR	380,000	380,000
Sanitation – Zingquthu	CMIP – PR	75,000	75,000
Enkululukweni pump station & rising main & access	CMIP	526,310	526,310
Sabata Dalindyebo outfall	CMIP	420,000	420,000
Toilets - Tembani	CHDM	60,000	60,000
Total		**13,981,000**	**5,541,000**

Sources for the capital budget include the following:

- Consolidated Capital Development and Loan Fund (CCDLF)
- Funds from surplus from operating revenue (ex-revenue)
- Consolidated Municipal Infrastructure Programme (CMIP and CMIP – PR)
- Chris Hani District Municipality allocation (CHDM)

This Lukhanji capital works budget excludes projects approved by DWAF for the rural areas, and implemented either directly or through other service providers.

2.9 *Situational Analysis Summary*

The situational analysis can be summarised by looking at the key characteristics and problems or issues for each sphere of the analysis as is indicated in Table 17.

Table 17: Situation Assessment Summary

SPHERE	KEY CHARACTERISTICS	PROBLEMS OR ISSUES
Consumers Profile	• High percentage unemployment (esp. Hewu) • Low income • Employment in Social & Agricultural sectors • Industry: low water needs • Predictions on population growth - domestic demand expected to peak in 2006	• IDP identifies agricultural sector for growth • Need to secure allocations & expand water for agriculture • Service charges will be difficult to recover in rural areas • Uncertainty in planning for pop. numbers
Water Sources	• Surface / underground sources adequate for needs • Some catchment areas underutilized, others over-utilized • Good underground sources underutilized	• Waterdown over-utilized • Oxkraal underutilized • Potential to develop underground sources, but lack of information / confidence in sustainable yield for detailed planning
Bulk Services (Water)	• Both domestic and irrigation infrastructure in good condition & operational • Q/Town capacity is good, but Whittlesea treatment works near full capacity • Information on DWAF schemes limited	• Some refurbishment work needed, e.g. Shiloh • Need to expand bulk capacity with 2006 population as target •
Bulk Services (Sewerage)	• Q/town operated at 60% of capacity, but over during rains • Sada plant operated at full capacity	• Upgrade of Sada works needed • Problems exacerbated by extension of networks in Ekuphumleni, etc.
Reticulation (Water)	• Condition of Q/town system is good • Q/town managed by WSSA • Large number of rural stand alone schemes	• High level of water losses (in Q/town & also presumed in Whittlesea) • Lack of information on condition & operational status of stand alone schemes
Reticulation (w/b sewerage)	• Storm water problems, infiltration of groundwater • Major extension of network planned for Ekuphumleni/Sada & Ilinge	• Cost of development of network • Upgrade system in Q/town (leaking pipes) • Affordability / sustainability concerns?

Table 17: Situation Assessment Summary (Continued)

SPHERE	KEY CHARACTERISTICS	PROBLEMS OR ISSUES
Sanitation Services (Pit Latrines)	• 10152 households served by pit latrines	• Lack of clarity of how many are up to RDP standards or are VIP, and % needing upgrade.
New service development needs (basic services)	• Overwhelmingly a rural problem, but also needs in Ilinge/Sada	• Total HH needing water is 16700 • Total HH needing sanitation is 7300
Institutional	• DWAF manages operations & maintenance of rural schemes • Lukhanji WSA application pending • Reorganization due to hand down of powers and functions in terms of new laws/policy.	• Still lack of clarity over roles between CHDM and Lukhanji • Uncertainty over who will receive DWAF infrastructure • Limited institutional coordination, especially with DWAF • Rural water committees don't have an institutional place in the new system.
Organizational	• Lukhanji Amalgamation plan drafted • Well established staffing for former TLC areas	• Posts for rural op & maintenance staff not funded • Question on the future of rural stand alone scheme pump operators • Staffing implications affected by WSA application's approval or not. – has this been assessed? • IDP identified skills upgrade need
Finances	• Billing just started in Whittlesea • Service charges covering operating costs • Insufficient funding	• Existing payment levels still low • Payment levels in Whittlesea? • Funders capacity & declining grants from traditional sources • Total capex needs not quantified (?)
Consumer engagement	• Domestic water used for irrigation in rural areas • Desire for water borne sewerage in 'urban' areas • Interaction through Ward Committees	• Expressed need for consumer education • Level of service policy not linked to affordability

2.10 *Situational Analysis Conclusion*

The Lukhanji municipal area comprises the former Queenstown and Sada/Whittlesea TLC areas as well as the former Hewu and Queenstown TRC areas.

The population is 179000, consisting of 37500 households. Of these households, 45% earns less than R6000 per annum. This will have an impact on the provision of services as cost recovery will be low.

The water balance indicates that Lukhanji has sufficient surface water sources to meet the expected future demand. The hydrogeological investigations also indicate certain areas with high groundwater potention. The current utilisation of groundwater in Lukhanji is well below the potential. It is essential that a new water source be developed for the Queenstown Water Supply System, as the current allocation from Waterdown Dam will not be sufficient to meet future demand.

Agriculture has been identified as a key economic growth sector. Water allocation towards irrigation should be increased where possible to support the development of this sector.

Water services infrastructure in the former TLC areas are reasonably well developed and provides above RDP standard services to the majority of households in these areas. There is however a great need for services in the rural areas and the provision of clean domestic water should be addressed as a matter of urgency.

The sanitation services in the urban areas need some attention. The Sada sewer treatment plant is currently running near full capacity and will need some form of upgrade if the planned upgrade and extension of the sewer collector system is carried out.

The Queenstown sewer treatment plant has 43% spare capacity but water seepage into the collector system during wet weather conditions is a major concern. It results in overloading of the treatment plant as well as environmental pollution.

The institutional arrangements depend on the approval of the Lukhanji WSA application. There is still a lot of uncertainty around issues such as control over infrastructure, the roles between CHDM and Lukhanji and the future of the rural water committees. Interim arrangements will need to be made between the current institutions to ensure uninterrupted service delivery during this interim period.

Lukhanji has drafted an amalgamation plan and the former TLC areas are well staffed. Most of the posts in the rural areas are not filled, as there is no funding for these posts. The eventual staffing implications will be affected by the outcome of the WSA application.

Payment levels for services are still low. Billing has just started in certain areas and payment levels cannot be quantified as yet. Current payment levels do cover the basic cost of services but does not allow for any major upgrading or maintenance works. The capex needs for Lukhanji is not quantified, making it difficult to source funding for the provision of services. Current budget levels for capex is not adequate to provide services within an acceptable time frame.

3. DEVELOPMENT FRAMEWORK

From the situational analysis the following priority issues has been identified:

- The inefficient use of existing water resources
- Inadequate water resources for future domestic and agricultural use
- High water losses and lack of information related to these losses
- Inadequate sewer treatment works capacity and ageing reticulation system
- Uncertainty on the accuracy of existing population data and expected growth
- Lack of understanding of the current status of rural water supply, service infrastructure, and operations/maintenance activities and needs
- A lack of community education and communication around a range of water service issues
- There is a lack of integrated water services planning and management in the Lukhanji area
- The existing backlog of new domestic water services infrastructure for households without a safe water supply
- Inadequate recovery levels for water services

For each issue objectives and strategies has been identified to address the issue. This was done by first looking at the scope, causes and effects of each issue.

Priority Issue [1]
The inefficient use of existing water resources.
Scope of Problem:
The two main storage dams in Lukhanji, the Waterdown Dam and the Oxkraal Dam are not operated optimally.
Causes:
• The Waterdown Dam and Oxkraal Dam used to be in two countries i.e. South Africa and Ciskei. • Since the re-incorporation of Ciskei into South Africa the operational Rules of the two dams were not revised. . • Water was allocated to the Oxkraal Irrigation Scheme but due to monetary constraints the Ciskei Government never developed the scheme. • Increasing water demand from Queenstown.
Effects:
• Limited water supply to the Shiloh Irrigation Scheme, Klipplaat Irrigation Scheme and water supply to Sada/Whittlesea and Queenstown. • The Oxkraal Dam cuts off a significant portion of the low flow contribution of the Oxkraal River; with the result that Waterdown dam must provide for the loss of low flow contribution from Oxkraal. The Oxkraal Dam has a safe yield of 6 Mm^3/a that is not currently utilised. • Water allocation from the Waterdown Dam exceeds the safe yield. • Water in the Oxkraal Dam not fully utilised. • The Waterdown/Oxkraal storage not optimally used. • In terms of the current water allocations Queenstown can end up with a water crisis. An additional 1.9 Mm^3/a will be sufficient to supply in the water needs up to 2010.
Objective:
• Re-organise water allocation to reduce the load on Waterdown dam and utilise water from Oxkraal Dam.

Strategies

Lukhanji has a positive overall water balance. Water resources are however over utilised in certain catchments. This mainly affects the water supply to the urban areas of Sada, Whittlesea and Queenstown as well as to the irrigation areas at Shiloh and along the Klipplaat River. The two main storage dams i.e. Waterdown and Oxkraal, are not operated optimally.

Changing the operating rules can alleviate the short-term shortage of water to Queenstown while measures are taken to develop a new water source for Queenstown. The way in which water is allocated from the Oxkraal dam is dependent on the future development of irrigation schemes under the Oxkraal Dam.

1. Develop new operating rules for the Waterdown/Oxkraal/Bongolo storage

   The yield of the Oxkraal Dam is currently not used. If the Oxkraal Dam is used to sustain the required low flow of the Klipplaat River instead of the Waterdown Dam, water allocation to the Queenstown water supply can be increased.

2. Develop short and long term irrigation development scenarios from the Oxkraal Dam.

   Irrigation has been identified in the IDP as the sector with the greatest growth potential. The outcome of this strategy will have a significant influence on the allocation of water from the Oxkraal Dam to alleviate the water need in Queenstown. The development of the new operating rules will therefore have to run parallel to the development of future irrigation scenarios.

Priority Issue [2]: Inadequate water resources for future domestic and agricultural use.
Scope of Problem: The scope of the problem can be defined in terms of the following: • Domestic water is required to supply the rural areas with basic water services. • The Queenstown Water Supply Scheme needs additional water sources to ensure secure water supply for future needs. • Agriculture has the largest growth potential of all employment sectors and providing adequate irrigation water will support the growth of the agricultural sector.
Causes: • Surface water sources are remote and the infrastructure to bring the water to the villages is costly. • Lack in research and development of groundwater potential. • Historically the development of bulk water infrastructure to rural areas for domestic and agricultural use was neglected.
Effects: • Tension between water users over water allocations • At least 16700 households, mainly in the rural areas have no access to clean domestic water. • Current allocation to Queenstown will only be adequate to 2003. • After 2003 the Queenstown Water Supply Scheme will require additional water sources. An additional 1.9 million m^3/a will secure water supply to Queenstown to the year 2010. • Existing irrigation schemes face limitations of limited water allocation • The development of new irrigation schemes as part of a LED strategy is severely hindered by limited water resources.
Objective: A clear planning framework must be set out and agreed within a period of twelve months. •

Strategies

The strategies focus on the development of water sources for three main areas i.e. rural water, urban water and agricultural water. The outcome of these strategies will have an impact on the planning for future water demands and it should therefore be completed within twelve months.

1. For rural areas, identify the most appropriate water sources. Where groundwater is not a reliable source, identify existing or potential surface water sources with the associated bulk water services required. Emphasis should be put on regional schemes rather than stand-alone schemes.

2. Set up a monitoring programme for existing and new groundwater sources.

   There is not adequate data to assess the level of utilisation of existing boreholes. It is very important to know the level of utilisation to ensure that it is used sustainable and effective.

3. For Queenstown, identify the source that can provide the additional water required.

   There are a number of possibilities as detailed in the Situational Assessment. There is a strong preference towards the development of a pipeline from Xonxa Dam. A detailed planning and costing of the proposed Xonxa dam pipeline should be done.

4. Determine sustainable targets for domestic (water and water borne sewerage) and agricultural needs with the most cost effective water source development strategy.

   Lukhanji do not have unlimited water resources. Waterborne sewer systems in particular will impact on the available water resources. This development should take cognisance of available water. Water source development for domestic and agricultural use must be done in the most cost effective way e.g. it might be more cost effective to develop one source for a regional scheme than several smaller sources for local schemes.

5. For agricultural development a development plan must be developed that is matched with the sustainable water yields.

   This development plan will be affected by the outcomes of the development scenarios for the Oxkraal Dam.

6. Adopt appropriate technology and levels of infrastructure standards.

   To ensure that the maximum number of people are serviced with the available natural and monetary resources, it might be necessary to design infrastructure with smaller safety factors and lower the standard of specifications. The aim should be to deliver services to as many people as possible, without sacrificing too much on the standard of infrastructure.

Priority Issue [3]: High water losses and lack of information related to these losses.
Scope of Problem: Unaccounted for water in the Queenstown area varies from 10% to 31% over a period of four months. No water loss figures are available for Sada/Whittlesea or Ilinge. .
Causes: • Existing metering and billing is not accurate. • There is not adequate provision of bulk water zone meters. • In Sada/Whittlesea there is no zone meters. • Low maintenance budget for bulk and reticulation services. • Consumers not informed regarding water saving. • Meters have only recently been installed in Sada/Whittlesea.
Effects: • Unaccounted for water cannot be pinpointed i.e. system losses or inaccurate measurement and billing. • Large volumes of water seem to be wasted, adding pressure to the existing water sources. • Consumers do not participate in active water loss prevention. • The Municipality cannot accurately determine the extent of the problem and therefore cannot accurately recover the cost of services.
Objective: • A water loss management strategy should be developed to minimise water loss and ensure that the infrastructure is properly maintained.

Strategies

For effective water loss management the extent of water losses should be known as well as where it occurs. The strategies focus on the installation of equipment to record water losses in zones as well as a maintenance program to upgrade the after infrastructure in zones where high water losses occur.

1. The provision of adequate zone metering and other data collection systems.

   This will simplify the identification and management of water losses.

2. Securing funds for continued upgrading of bulk and reticulation systems.

   Areas with high water losses should be targeted. Continuos upgrading will eventually help to reduce water losses.

3. Education programs to educate consumers in water usage and saving.

   This strategy can be incorporated in the annual community education programme.

Priority Issue [4]: Inadequate sewer treatment works capacity and ageing reticulation system.
Scope of Problem: The Queenstown sewer collector system and the effect of the proposed expansion of sewer collector systems at Sada and Ilinge on the treatment plants.
Causes: For Queenstown: • The joints of the vitro clay pipes have disintegrated over time, allowing groundwater to enter the sewer system in wet weather when the groundwater table is high. . • Due to the low profile of the problem (not visible) the budget for replacing of sewer pipes has been cut frequently in the past. • Storm water enters the system via some of the manholes. For Sada: • Major extension of collector network planned at Ekuphumleni/Sada. For Ilinge: • Planned upgrade of collector network.
Effects: For Queenstown: • Groundwater entering the sewer system is overloading the sewer treatment plant and poses an environmental and health hazard. • High flow velocities during wet weather cavitates backfill, increasing the silt loading on the treatment plant and causing secondary failure of other infrastructure such as roads and pavements. For Sada: • The additional loading on the treatment plant will necessitate upgrading of the plant. For Ilinge: • The effect of the additional loading on the current oxidation ponds is not certain.
Objective: Rehabilitate and upgrade the sewer system to meet expected requirements for the next 5 years.

Strategies

1. A rehabilitation programme for the Queenstown collector network should be agreed on and the necessary funds budgeted for.

The infiltration of groundwater during wet weather is a major concern as it overloads the treatment plant and results in sub-standard effluent being released. There is also a concern that during dry weather sewer leaks can cause extensive pollution of the groundwater. This is a serious matter but due to the low profile of the problem (not visible) the budget for replacing of sewer lines were cut on numerous occasions.

2. The effects of proposed and future development on the Sada and Ilinge treatment works should be established and any upgrade or expansion of the works must be budgeted for.

   It is important to know what the effect will be and address any capacity problems before the actual upgrading and expansion of the collector network commences.

3. Investigate the possibility of using sub-standard effluent for irrigation to address capacity problems of the sewer treatment plants.

   Sub standard effluent can be used for irrigation in certain cases. This can be an interim measure to address the capacity issue at the Sada sewer treatment plant and the wet weather problems at the Queenstown sewer treatment plant.

Priority Issue [5]: Uncertainty on the accuracy of existing population data and expected growth.
Scope of Problem: Absolute current population figures, migration trends and natural growth rates.
Causes: • Census data not detailed enough • Lack of confidence in census data, due to perceived inaccuracies • Impact of HIV/AIDS on population growth
Effects: • Uncertainty as to the total population of Lukhanji • Uncertainty as to where population pressures will grow • Accurate long term planning of bulk services not possible
Objective: Up to date population data with a high level of accuracy/confidence.

Strategies

This issue is really an issue affecting all sector plans within the broader IDP. While various figures from different sources can be cross – checked as a interim measure, it is clear that only a proper social survey will provide accurate longer term planning confidence.

1. Conduct a population survey among all communities of Lukhanji covering total numbers, migration/movement trends, and growth rates.

   The survey should be completed in the first half of the WSDP planning period so as to be able to refine planning and development initiatives.

2. Re-evaluate planning assumptions for water service needs within the Lukhanji area.

This is particularly important in regard to raw water needs, and bulk services. The re-evaluation should impact on the planning work proposed for the Xonxa Dam project, as well as on the regional or stand alone borehole water schemes.

Priority Issue [6]: Lack of understanding of the current status of rural water supply, service infrastructure, and operations/maintenance activities and needs.
Scope of Problem: This affects existing domestic water schemes, and sanitation infrastructure
Causes: • Lack of written and up to date information available • Lack of historical understanding of the issues, due to this been a new area of jurisdiction for Lukhanji
Effects: • Inability to plan and cost effectively for the upgrading of services and the operations/maintenance of the rural areas.
Objective: Detailed information and a clear plan in place regarding the upgrading and maintenance of rural water supply and infrastructure, as well as sanitation infrastructure.

Strategies:

The strategies are essentially focused around research and planning. This information should have been available to guide the WSDP process, but was not available. It therefore becomes critical to affect this further research and planning in the rural areas within the first year of the WSDP in order to facilitate effective delivery and management in the following years.

1. An evaluation of the existing water services in the rural areas.

   This strategy would involve both the gathering of existing information and the collection of new information for evaluation. It would cover water quality, yield sustainability, infrastructure, operational and maintenance arrangements, and cost recovery arrangements.

2. Development of an operational and maintenance plan for the rural areas.

   Based on the outcome of the evaluation a plan must be drafted which will deal with putting in place a management framework, staffing capacity,

maintenance programmes, fault reporting and complaint systems, cost recovery mechanisms, etc. The plan will have to deal with historical situations and new servicing targets.

3. Development of an upgrading plan and programme for services below minimum standard

   Based on the outcome of the evaluation an upgrading plan must be drafted to ensure water quality is acceptable, supply usage is sustainable, infrastructure operates at acceptable standards, and levels of reticulated services are at least at the minimum level as per the Level of Service Policy. This plan will lead to the implementation of a programme of upgrade work over the next 5 years of the WSDP.

Priority Issue [7]: The existing backlog of new domestic water services infrastructure for households without a safe water supply
Scope of Problem: There are some 16700 households identified has lacking a safe domestic water supply. The vast majority of these are in the rural areas.
Causes: • Historically there has been a lack of attention to servicing these areas • Limits on capital finances available for such developments • Lack of integration between settlement planning and development and water services planning and development.
Effects: • Health and Hygiene risks to the population • Peoples ability to function as effective social and economic entities is limited • Resentment caused by a perception of neglect

Strategies:

This achievement of this objective has to occur within the five year period of the WSDP with the focus on starting in the areas where the Municipality already has servicing capacity and knowledge, and spreading to the rural areas once this work has been completed.

1. An agreed level of service policy for all consumers in the Lukhanji area.

   This is a requirement for all Water Service Authorities. It will determine what level of service must be delivered as a minimum, and clarify on what basis communities receive services above the minimum. The Level of Service policy has to be sustainable from a delivery, maintenance, financial, and water balance point of view.

2. An immediate priority programme for areas currently under Lukhanji water services administration in order to link them into the existing bulk network. – Target completion within 2 years.

3. A rural water services programme planned and funding applications submitted within 6 months, and the programme implemented within 5 years.

   A system of prioritizing projects will have to be set out and agreed upon before projects can be programmed. The programme will set out annual targets from year two to five of the WSDP

Priority Issue [8]: A lack of community education and communication around a range of water service issues
Scope of Problem: The problem affects all communities, and interest groups, and has to do with issues such as service charges, levels of service, wastage of water, maintenance, and future planning and delivery of services.
Causes: • No clear local authority policy and goals/targets in place regarding community education and communication • Different approaches adopted by different authorities towards community participation and education • A lack of funding available, or lack of funds allocated, for education/communication
Effects: • Communities and local stakeholders don't always understand or buy-in to local authority initiatives or policy. • Repayment levels are negatively affected • Wastage of water • The local authority and Councilors tend to be reactive to community related problems, instead of proactive.
Objective: • To ensure the communities in Lukhanji are educated about relevant water service issues, and are appropriately involved in planning, implementation and maintenance activities.

Strategies:

The Council already engages in a periodic community consultation process though local Mayoral meetings. These strategies aim to build on this initiative. While these strategies are proposed specifically to meet water service related needs, they can be implemented as part of a broader education initiative covering a range of municipal services and issues.

1. A uniform policy on community participation and education which clarifies the motivation, goals, and scope and mechanisms of participation and education in terms of the different water service issues.

This policy should clarify participation and education in regard to water service planning, delivery, and operations/maintenance issues. This is to ensure clarity and consistency throughout the area and from year to year. This will also ensure that adequate funding is set aside for such functions, but on the other hand, funds will not be wasted on `excessive' or `aimless' participation.

2. A consumer survey to determine consumer's attitudes and perceptions to a range of water service issues.

   Such a survey will assist in structuring community participation, annual priority setting, as well as the annual education campaign. It will also provide a tracking mechanism to evaluate the impacts of service delivery, and should preferably be carried out twice in the 5 year period of the WSDP. The full range of water service issues should be covered in the survey.

3. An annual education and information campaign plan aimed at new and existing consumers.

   This should focus on the priority issues as determined from year to year.

Priority Issue [9]: There is a lack of integrated water services planning and management in the Lukhanji area
Scope of Problem: This affects everything from supply sources, to bulk infrastructure, and reticulation services.
Causes: • Effectively the area is still managed in a divided way with DWAF managing the former TRC areas, and part of the Whittlesea TLC services, with Lukhanji managing the former Queenstown TLC and part of Whittlesea TLC services. • Lukhanji does not have a formal input into the allocation of water from main supply sources. • Lack of clarity of roles between Lukhanji and CHDM for the future management of water services in the area. • Uncertainty as to whether Lukhanji's WSA application is going to be approved. • No formal coordination mechanisms between Lukhanji and DWAF.
Effects: • Lukhanji unable to effectively plan, raise funds, or implement projects or water systems in the rural areas (where the greatest need is). • Lukhanji is unable to take final decisions about staffing for water services or formalize roles with rural water committees, etc. • Both Lukhanji and CHDM appear to be planning for a service delivery role in the rural areas. • It is not possible to put in place new institutional agreements with the range of authorities and delivery agents until roles and functions have been assigned.
Objective: A clear planning and management framework is set out and agreed within a period of six months, and required WSP arrangement decisions made within the year.

Strategies

While a WSDP is essentially meant to provide direction on management arrangements and contractual agreements, this is not possible in a situation where roles and responsibilities between authorities are not resolved. Strategies therefore focus on inter-institutional liaison, coordination, and negotiation, while strategies related to contractural arrangements will follow.

1. Joint negotiations and compilation of a management framework between DWAF, CHDM and Lukhanji within 6 months.

   Lukhanji can't wait for a response on its WSA application and needs to establish agreements with DWAF and CHDM on how to proceed with management responsibilities. The framework must set out:

   - roles and responsibilities for the medium to long term future,
   - transitional arrangements in the interim,
   - and processes and responsibilities on how this transformation is to occur.

2. Establishment of a formal on-going coordination forum for water service authorities in the Lukhanji area, once the management framework agreement is in place.

   This should initially be to manage the transitional & transformational arrangements, but as progress is made on these matters the forum can be used to coordinate planning and make inputs in regard to each other's activities. Initially the forum could meet once per quarter.

3. The status of Water Committees in rural stand alone schemes is evaluated and a policy decision made on their future.

   The evaluation should look at the Water Committees current roles as set up by DWAF, their operational functionality, the value of their work in each area, and the viability or otherwise of integrating such committees into a Lukhanji operating framework.

   ONCE DECISIONS ARE FINALIZED CONCERNING ROLES AND FUNCTIONS, AND ASSUMING LUKHANJI'S ROLE AS A WSA IS AGREED TO, THE FOLLOWING STRATEGIES MUST BE IMPLEMENTED.

4. Review and Structure Water Service Provision arrangements.

   Lukhanji will have to make decisions regarding WSP arrangements for bulk and retail functions related to areas that fall outside WSSA's contract. Essentially Lukhanji has to decide on whether to contract out certain functions (and if so on what basis) or to build in-house capacity.

   Legal and contractural arrangements with the Klipplaat Water Users Association and other potential organizations managing bulk Irrigation networks will also have to be reviewed.

5. Establish Lukhanji capacity to fulfill agreed roles and responsibilities.

   While there is a draft organogram for the reorganized technical committee, exact staffing needs will become clearer once roles and functions have been finalized. This review should cover staffing needs, skills required, organizational structuring, training proposals for existing staff, and job descriptions for new posts.

6. Draft and adopt water service by-laws as set out in section 21 of the Water Services Act (1997)

   Such by-laws must cover: conditions for the provision of services; levels and technical standards of services; limits on services; tariffs, collections, and disconnection; various matters as related to industrial services.

Priority Issue [10]
Inadequate recovery levels for water services
Scope of Problem: Payment levels in the former Queenstown TLC range between 48% and 68%. Payments levels in the Whittlesea/Sada area are unknown. This problem will be extended should Lukhanji take over operational functions in the rural areas.
Causes: • Low household income levels • Costs related to higher level of services unaffordable for poor families • Consumer history of defaulting on payments • A Billing system only just implemented in Sada/Sada • Data base of information on consumers is not up to date and in inaccurate • Concerns about the accuracy of meters and meter readings.
Effects: • Currently the level of payments only just covers operational costs, making sustainability an ongoing concern, particularly with the expansion of responsibilities. • Maintenance, upgrading and expansions of service budgets have to be limited to funds raised, resulting in longer term problems. • Resentment from consumers who do pay for services, which continually places cost recovery levels at risk. • Additional expenses continually have to be set aside for credit control measures. • Conflicts/tensions within low income communities (in particular) due to service disconnections.
Objective: Achieve, on average, a consumer payment level increase of 5% per area per year.

Strategies

The Municipality has adopted a credit control policy and has appointed outside skills to assist with implementing the policy. The `free basic water' policy should also have a positive effect on payment levels. The following strategies aim to build on these measures. In addition to the strategies set out below, the following strategies listed elsewhere in this framework are also seen as mechanisms to facilitate this objective:

- The annual education and information campaign
- The level of services policy

1. Extend credit control mechanisms to areas not covered by such mechanisms

   As new areas receive services, and the Municipality takes over responsibility for the former TRC areas, credit control mechanisms should be put in place from the beginning.

2. Develop internal systems, information and capacity

   Where appropriate internal systems need to be upgraded, consumer information verified and updated, and staff capacity build. Councilor capacity should also be build to assist with this process as per the credit control policy.

4. PROJECTS

4.1 Project Description

Strategy 1: Develop new operating rules for the Waterdown/Oxkraal/Bongolo storage.

Project: Interim Operating Rules for the Queenstown Water Supply System

Scope of project: Waterdown, Oxkraal and Bongolo dams

Project Activities: Convene all stakeholder authorities.
Quantify existing and short-term demands from the said reservoirs.
Calculate and agree on new allocations and draw up operating rules.
Implement new rules.

Timeframes: Year 1, 4 months

Responsibility: Municipal Manager

Strategy 2: Develop short and long term irrigation development scenarios from the Oxkraal Dam.

Project: Irrigation development scenarios from the Oxkraal Dam

Scope of project: Oxkraal irrigation area

Project Activities: Convene all stakeholders and establish the need for development.
If the need exists, do feasibility study for the required development.
Determine the cost of development and identify possible funders.
Draw up the development plan.

Timeframes: Year 1, 4 months

Responsibility: Municipal Manager

Strategy 3: Identify the most appropriate water sources for rural areas.

Project: Water sources for rural areas

Scope of project: Whole of Lukhanji rural areas

Project Activities: Identify existing sources that can be utilised for rural water supply.

Where existing sources can not meet the demand, identify what water sources can be developed to meet the demand.

Timeframes: Year 1, 4 months

Responsibility: Municipal Manager

Strategy 4: Set up a monitoring programme for existing and new groundwater sources.

Project: Groundwater monitoring programme

Scope of project: Whole of Lukhanji

Project Activities: Update database on existing boreholes.
Sampling and testing of boreholes.
Add new boreholes to database.
Annual report on the status of groundwater sources.

Timeframes: Year 1, on-going

Responsibility: Municipal Manager

Strategy 5: Identify a new water source for the Queenstown Water Supply System.

Project 1: Identify new water source for Queenstown

Scope of project: Queenstown

Project Activities: Review the possible sources as described in previous studies.

Determine if the Xonxa pipeline that is currently the favored option is in fact the best option.
Do a prelim design and costing of the chosen option.
Budget for the proposed works.

Timeframes: Year 1, 6 months

Responsibility: Municipal Manager

Project 2: Develop new water source for Queenstown

Scope of project: Queenstown

Project Activities: Survey, design, working drawings, tenders, tender adjudication and appointment of contractor.
Construction phase
Commissioning

Timeframes: Implementation depending on the availability of funds, Year 3,4&5

Responsibility: Municipal Manager

Strategy 6: Determine sustainable targets for domestic and agricultural needs with the most cost effective water source development strategy.

Project: Lukhanji Water Balance

Scope of project: Whole of Lukhanji

Project Activities: Develop the Water Balance.

Taking into account all proposed development scenarios, determine safe allocations towards different sectors.

Timeframes: Year 2, 4 months

Responsibility: Municipal Manager

Strategy 7: Develop an agricultural development plan that is matched with the sustainable water yields.

Project: Agricultural development plan (Irrigation)

Scope of project: Whole of Lukhanji

Project Activities: Identify potential development areas
Draw up development scenarios that are compatible with the available water yields.

Timeframes: Year 2, 4 months

Responsibility: Municipal Manager

Strategy 8: Adopt appropriate technology and levels of infrastructure standards.

Project: Appropriate technology and standards

Scope of project: Whole of Lukhanji

Project Activities: Identify the types of infrastructure where alternative technology or standards can reduce costs.
Identify design parameters that can be altered to reduce costs
Adopt alternative technology and design parameters where feasible.

Timeframes: Year 2, 4 months

Responsibility: Municipal Manager

Strategy 9: The provision of adequate zone metering and other data collection systems.

Project: Zone meter installation

Scope of project: Queenstown Water Supply System including Sada/Whittlesea

Project Activities: Identification of Zones that must be individually metered.
Budgeting for the required number of meters
Installation of meters

Timeframes: Year 1, 2 months

Responsibility: Municipal Manager

Strategy 10: Securing funds for continued upgrading of bulk and reticulation systems.

Project 1: Water infrastructure upgrading plan

Scope of project: Queenstown Water Supply System including Sada/Whittlesea

Project Activities: Identify and quantify annual upgrading requirements
Draft upgrade needs report and implementation programme
Draft project funding applications

Timeframes: Year 1, 4 months

Responsibility: Senior Manager - Civil Engineering

Project 2: Water Infrastructure Upgrading Project No1, No2, etc.

Scope of project: As per the Water Infrastructure Upgrading Programme

Project Activities: Identify beneficiary PSC and carry out social tasks
Appoint Project Managers and Contractors
Implementation and monitoring

Timeframes: Year 2,3,4,5

Responsibility: Senior Manager - Civil Engineering

Strategy 11: Education programs to educate consumers in water usage and saving.

This strategy can be incorporated in the annual community education programme

Strategy 12: A rehabilitation programme for the Queenstown sewer collector network should be agreed on and the necessary funds budgeted for.

Project 1: Queenstown sewer collector upgrading plan

Scope of project: Queenstown

Project Activities: Quantify the upgrading work required
Draw up a rehabilitation programme setting out the annual work to be done and the associated cost.
Budget for the work to be done

Timeframes: Year 1, 2 months

Responsibility: Senior Manager - Civil Engineering

Project 2: Queenstown sewer collector upgrading programme

Scope of project: As per the rehabilitation programme

Project Activities: Appoint Project Managers and Contractors
Implementation and monitoring

Timeframes: Year 2,3,4,5

Responsibility: Senior Manager - Civil Engineering

Strategy 13: The effects of proposed and future development on the Sada and Ilinge treatment works should be established and any upgrade or expansion budgeted for.

Project: Sada and Ilinge sewer treatment plant investigation

Scope of project: Sada and Ilinge

Project Activities: Establish plant capacity and current operating capacity
Determine future loading on the plant
Propose and cost any upgrade/expansion required

Timeframes: Year 1, 3 months

Responsibility: Municipal Manager

Strategy 14: Investigate the possibility of using sub-standard effluent for irrigation to address capacity problems of the sewer treatment plants.

Project: Sewer effluent irrigation investigation

Scope of project: Queenstown, Sada and Ilinge sewer treatment plants

Project Activities: Determine the legal requirements.
Planning and conceptual design
Costing of proposed works
Quantify advantages over conventional plant upgrades if any. .

Timeframes: Year 2, 4 months

Responsibility: Municipal Manager

Strategy 15: Conduct a population survey among all communities of Lukhanji covering total numbers, migration/movement trends and growth rates.

Project: Lukhanji Population Survey

Scope of project: Whole of Lukhanji

Project Activities: Household count
Area sampling for household densities
Area sampling for migration trends
Review of population birth and death statistics over the last 5 years.

Timeframes: Year 2, 4 months

Responsibility: Municipal Manager

Strategy 16: Re-evaluate planning assumptions for water service needs within the Lukhanji area.

Project: Annual WSDP Review & Year Planning

Scope of Project: All water service related activities.

Project Activities: Review of WSDP implementation of year past
Re-evaluation of targets and priorities
Confirm programme & budget for the following year
Obtain Council approval
Draft business plans (where outstanding)

Timeframes: Every year, 3 months

Responsibility: Task Team under the Director of Technical Services.

Strategy 17: An evaluation of the existing water services in the rural areas

Project: Rural Water Services Evaluation

Scope of Project: All former TRC areas of jurisdiction

Project Activities: Compile existing documentation & carry out on-site assessments
Water quality testing
Assessing local system yield versus consumption
Bulk & reticulation infrastructure evaluation
Evaluate operational, maintenance & cost recovery frameworks.

Timeframes: Year 1, 6 months

Responsibility: Senior Manager – Civil Engineering

Strategy 18: Development of an operational and maintenance plan for the rural areas.

Project: Rural Areas Water Services Operational & Maintenance Plan

Scope of project: All former TRC areas

Project Activities: Assess organizational and technical implications from outcome of report on `Rural Water Services Evaluation'
Draft operational & maintenance programme
Liaise with Directorate Finance
Assign capacity & source budget.

Timeframe: Year 1, 3 months

Responsibility: Senior Manager – Civil Engineering

Strategy 19: Develop and upgrading services below minimum standards

Project: Rural Water Services Upgrade Plan

Scope of project: All former TRC areas

Project Activities: Assess level and quality of services from report on `Rural Water Services Evaluation'
Draft upgrade needs report & implementation programme
Draft project funding applications for first year of programme.

Timeframes: Year 1, 3 months

Responsibility: Senior Manager – Civil Engineering

Project: Upgrade Project No 1, No2, etc.

Scope of project: As per Rural Water Service Upgrade Programme

Project Activities: Establish beneficiary PSC & carry out social tasks
Appoint project managers & contractors
Implementation and monitoring

Timeframes Years 2 to 5

Responsibility Senior Manager – Civil Engineering

Strategy 20: Establish an agreed level of service policy

Project: Level of Service Policy

Scope of Project: For water and sanitation services to consumers

Project Activities: Draft policy proposals
Consultation with consumers
Finalize & approve policy
Consumer notification and education

Timeframes: Year 2, 3 months

Responsibility: Director Technical Services

Strategy 21: A water services priority programme for households without a service in former TLC areas

Project: Water Delivery Plan (former TLC areas)

Scope of project: Areas of former TLC jurisdiction without proper water supply

Project Activities: Assess areas of need & confirm extent of problem
Group households into projects and prioritize

Set out 5 year programme
Draft funding applications.

Timeframes: Year 1, 3 months

Responsibility: Senior Manager – Civil Engineering

Project: Water Delivery Programme (former TLC areas)

Scope of project: As per Water Delivery Programme (former TLC areas).

Project Activities: Establish beneficiary PSC & carry out social tasks
Appoint project managers & contractors
Implementation and monitoring

Timeframes Year 1, 2, 3, 4, 5

Responsibility Senior Manager – Civil Engineering

Strategy 22: A water services priority programme for households without a service in former TRC areas

Project: Water Delivery Plan (former TRC areas)

Scope of project: Areas of former TRC jurisdiction without proper water supply

Project Activities: Assess areas of need & confirm extent of problem
Group households into projects and prioritize
Set out 4 year programme
Draft funding applications.

Timeframes: Year 2, 3 months

Responsibility: Senior Manager – Civil Engineering

Project: Water Delivery Programme (former TRC areas)

Scope of project: As per Water Delivery Programme (former TRC areas).

Project Activities: Establish beneficiary PSC & carry out social tasks
Appoint project managers & contractors
Implementation and monitoring

Timeframes Years 2, 3, 4, 5

Responsibility Senior Manager – Civil Engineering

Strategy 23: A uniform policy on community participation and education

Project: A Community Participation Policy

Scope of project: Policy in relation to water services activities

Project activities: Consultation workshop with all councilors/ward committees
Drafting of policy
Council approval
Communication of policy to broader community

Timeframes: Year 2, 3 months

Responsibility: Senior Manager – Civil Engineering

Strategy 24: A consumer survey to determine consumer attitudes and perceptions to water service issues

Project 1: Baseline Consumer Survey

Scope of Project: All consumers/interest groups

Project activities: Sample consumer survey
Community leadership/Interest group interviews
Assessment of outcome in regard to community education & annual priorities.

Timeframes: Year 2, 3 months

Responsibility: Senior Manager – Civil Engineering

Project 2 : Follow Up Consumer Survey

Scope of Project: All consumers/interest groups

Project activities: Sample consumer survey
Community leadership/Interest group interviews
Assessment of outcome in regard to previous surveys with recommendations for community education & annual priorities.

Timeframes: Year 4, 3 months

Responsibility: Senior Manager – Civil Engineering

Strategy 25: An annual education and information campaign

Project: Education & Information Campaign

Scope of Project: For all consumers & interest groups, with a focus on new consumers and consumers with particular education needs identified.

Project Activities: Identify needs & draft materials/methodology
Distribute information, hold meetings, etc.
Draft report

Timeframes: Annual.

Responsibility: Municipal Manager (if campaign covers issues broader than water services)

Strategy 26:Joint negotiations and compilation of a management framework between DWAF, CHDM and Lukhanji

Project: Water Services Management Framework

Scope of project: Roles and responsibilities of each party in the medium to long term; transitional arrangements; transformational processes & responsibilities.

Project Activities: Establish agreement of process & objectives with CHDM and DWAF
Assess own position in regard to roles & responsibilities
Discussions with CHDM and DWAF
Draft Management Framework as agreed by all parties.
Cost transformational processes

Timeframes: Key priority for year 1, within 6 months

Responsibility: Municipal Manager / Director Technical Services.

Strategy 27: Establishment of a formal on-going coordination forum for water service authorities in the Lukhanji area

Project Water Services Coordination Forum

Scope of project: All water services authorities and providers operating within Lukhanji

Project Activities: Discuss & obtain buy-in from role players
Draft terms of reference for forum
Establish forum administrative support
Convene forum

Timeframes: Year 1, after Water Services Management Framework completed. Frequency: every 4 months or as deemed necessary.

Responsibility: Senior Manager – Civil Engineering

Strategy 28:Status of Water Committees Reviewed and a policy decision made on their future

Project: Water Committee Review

Scope of Project: All Water Committees established by DWAF and other agents.

Project Activities: Evaluation and report on each committee
Integrated report on overall findings and recommendations.
If necessary – new terms of reference and management arrangements for such committees.

Timeframes: Year 1, 3 months, after roles and functions have been confirmed.

Responsibility: Senior Manager – Civil Engineering

Strategy 29: Review and implement new Water Service Provider arrangements

Project: WSP Options Feasibility (presuming Lukhanji has WSA responsibilities)

Scope of Project: All bulk & retail water service arrangements for former TRC areas

Project Activities: Identify & evaluate potential options & their implications
Draft recommendations and obtain council approval

Timeframes: Year 1, after *Water Services Management Framework* completed.

Responsibility: Director Technical Services

Project: Contractual & legal WSP arrangements

Scope of project: Implement recommendation from Options Feasibility process for any WSP arrangement that Lukhanji is not affecting itself.

Project Activities: Appoint WSPs through required appointment process
Draft and sign contractual agreements

Timeframes: Year 2, 12 months

Responsibility: Director Technical Services

Strategy 30: Establish Lukhanji capacity to fulfill agreed roles and responsibilities.

Project: Staffing and Resource Plan

Scope of project: Staffing and resource requirements within the Directorate of Technical Services, Directorate Administration, and Directorate Finance to assume agreed responsibilities (as a WSA and/or WSP).

Project Activities: Evaluate new tasks / skills / workloads
Assess new pressures against existing staffing capacity & structure
Draft new staffing organogram
Assess existing resources and draft resource development requirements.

Timeframes: Year 2, 4 months

Responsibility: Director Technical Services

Project: Work Study Exercise

Scope of project: All new staffing or staffing with envisaged changes to responsibilities.

Project Activities: Drafting of the following for each post: detailed job descriptions, performance criteria, recruitment parameters, job grading for salary purposes, training programme for existing staff in affected posts.

Timeframes: Year 2, 6 months

Responsibility: Director Technical Services

Strategy 31: Draft and adopt water service by-laws (Should Lukhanji take on WSA responsibilities)

Project: Water Service By-Laws

Scope of project: Laws as required by section 21 of Water Services Act

Project Activities: Take policy decisions for issues where policies don't exist
Draft by-laws
Consumer consultation
Council approval
Consumer notification & education

Timeframes: Year 3

Responsibility: Director Technical Services

4.2 Project Programme

The proposed projects can be rolled out as indicated in the following project implementation programme. The intention of the programme is not to give specific start and stop dates for projects but rather to indicate the timing of projects in relation to the overall implementation programme.

Project Implementation Programme overleaf.

4.3 Cost Implications

The estimated cost implications for the identified projects are shown in Table 18.

TABLE 18 : WSDP Project Costing

Project Name	Capital Total	Capital Budget					Operating Total	Operating Budget				
		2002/03	2003/04	2004/05	2005/06	2006/07		2002/03	2003/04	2004/05	2005/06	2006/07
Interim Operating Rules for Queenstown WSS	35,000	35,000					0					
Irrigation development scenarios for Oxkraal Dam	20,000	20,000					0					
Water sources for rural areas	35,000	35,000					0					
Groundwater monitoring programme	0						220,000	60,000	40,000	40,000	40,000	40,000
Identify new water source for Queenstown	40,000	40,000					0					
Develop new water source for Queenstown	0	To be determined					0	To be determined				
Lukhanji Water Balance	60,000		60,000				0					
Agricultural development plan	25,000		25,000				0					
Appropriate technology and standards	18,000		18,000				0					
Zone meter installation	220,000	220,000					0					
Water infrastructure upgrading plan	18,000	18,000					16,000		4,000	4,000	4,000	4,000
Water infrastructure upgrading programme	0	To be determined					0	To be determined				
Queenstown sewer collector upgrading plan	12,000	12,000					0					
Queenstown sewer collector upgrading	0	To be determined					0	To be determined				
Sada and Ilinge sewer treatment plant investigation	40,000	40,000					0					
Sewer effluent irrigation investigation	24,000	24,000					0					
Lukhanji Population Survey	120,000		120,000				0					
Annual WSDP Review	0						31,000	5,000	5,000	6,000	7,000	8,000
Rural Water Services Eval.	120,000	120,000					0					
Rural Water Services O&M Plan	20,000	20,000					0					
Rural Water Services Upgrade Plan	20,000	20,000					0					
Rural Water Services Upgrade Programme	10,919,000		1,094,000	3,275,000	3,275,000	3,275,000	480,520	0	21,880	87,380	152,880	218,380
Level of Service Policy	15,000	15,000					0					
Water Service Delivery Plan - former TLC	20,000	20,000										
Water Service Delivery Prog. - former TLC	33,360,000	3,336,000	6,672,000	6,672,000	6,672,000	10,008,000	1,734,720	66,720	200,160	333,600	467,040	667,200
Water Service Delivery Plan - former TRC	30,000	30,000										
Water Service Delivery Prog. - former TRC	42,410,500		4,241,050	12,723,150	12,723,150	12,723,150	1,866,062	0	84,821	339,284	593,747	848,210
Community Participation Policy	12,000	12,000					0					
BaseLine Consumer Survey	30,000		30,000				0					
Follow Up Consumer Survey	35,000				35,000		0					
Annual Education Campaign	160,000	40,000	30,000	30,000	30,000	30,000	0					
Water Services Management Framework	30,000	30,000					0					
Coordination Forum	0						12,000	2,000	2,000	2,500	2,500	3,000
Water Committees Evaluation	25,000	25,000					0					
WSP Options Feasibility	25,000	25,000					0					
WSP Contractural & Legal	15,000	15,000					0					
Staffing & Resource Plan	20,000	20,000					0					
Work Study Exercise	25,000		25,000				0					
By-Laws	40,000		20,000	20,000			0					
Credit Control Programme Extention	0	To be determined					0	To be determined				
Update Consumer Data Base	0	To be determined					0	To be determined				
	87,451,500	3,728,000	12,232,050	22,720,150	22,735,150	26,036,150	4,124,302	73,720	313,861	768,764	1,223,167	1,744,790

Annexure 1: Hydrogeological maps and data

PROJECT: LUKANJI MUNICIPALITY – GROUNDWATER STATUS ASSESSMENT

FIGURE 1: Quaternary Sub-catchments

GeoCon

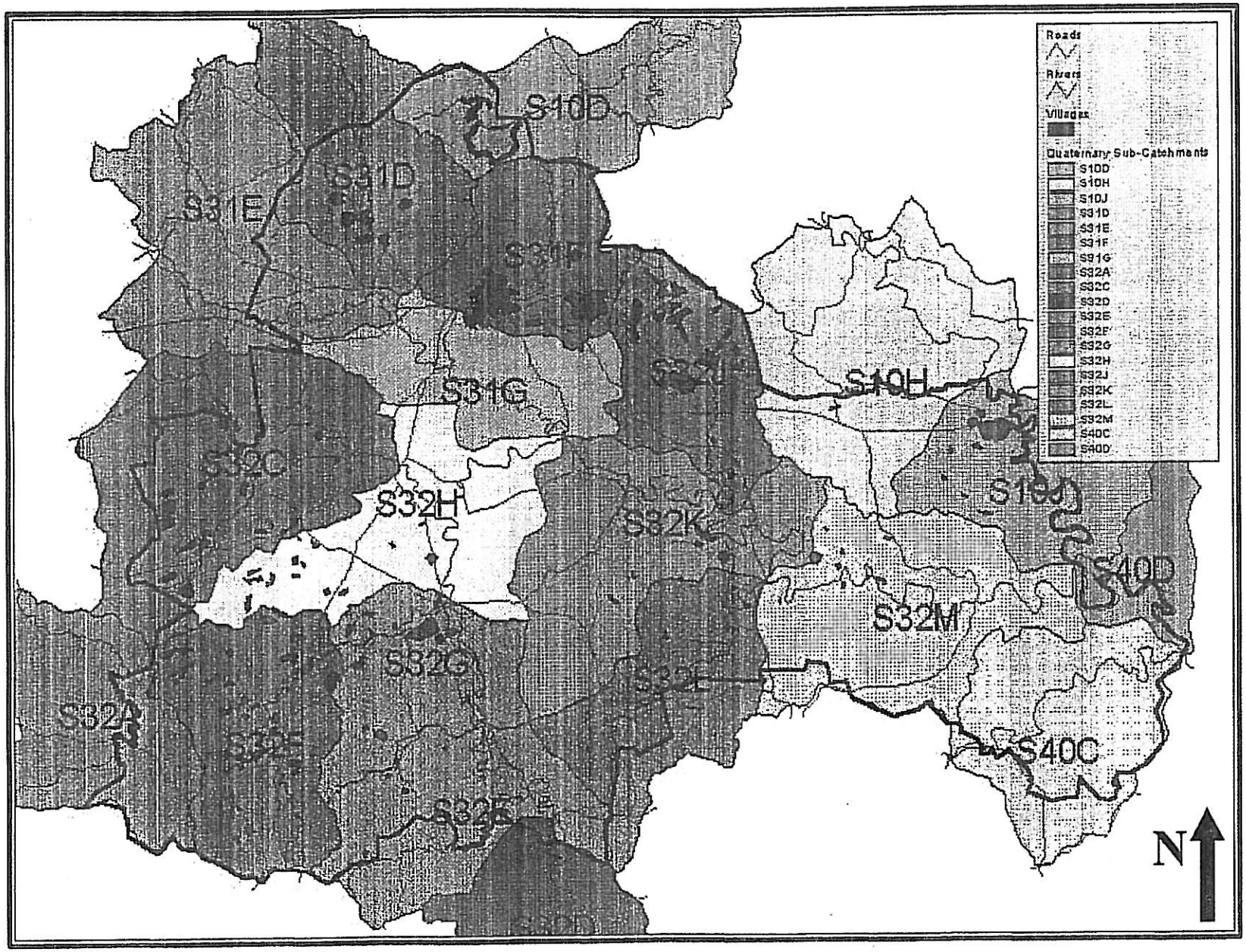


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FIGURE 2: Regional Geology

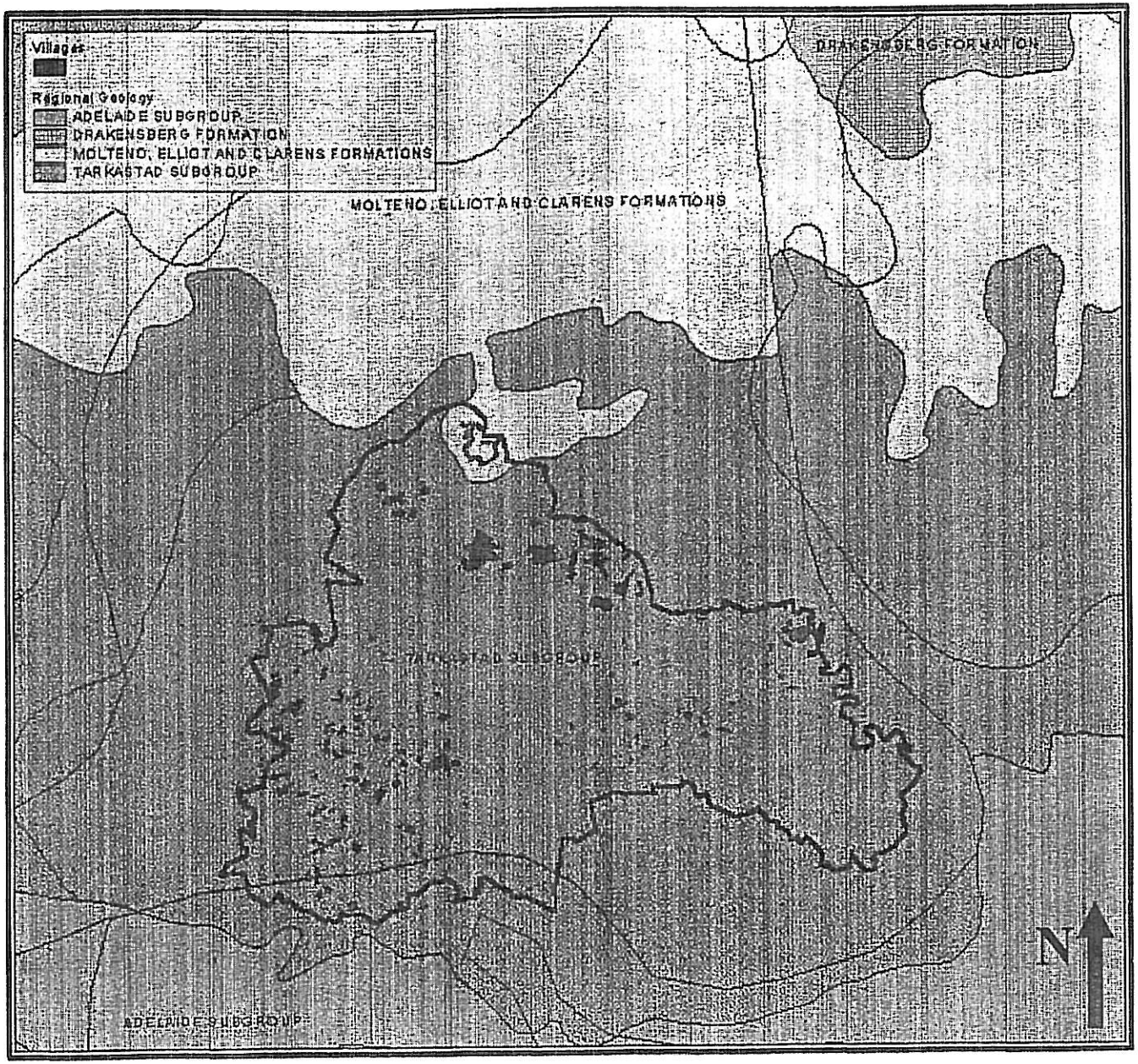

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FIGURE 3: Regional Geology – Subdivision / Sedimentary Formations

GeoCon

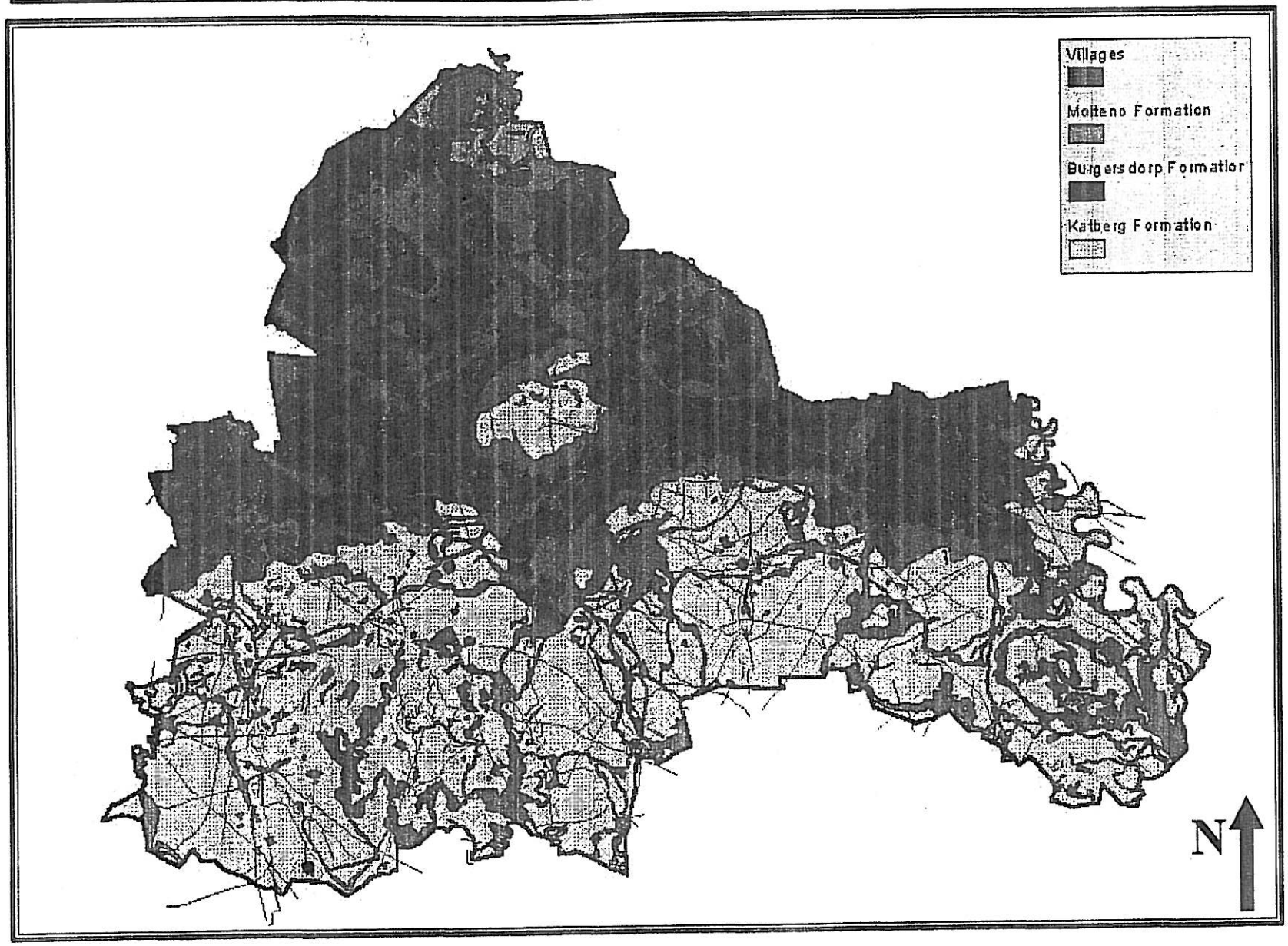

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FIGURE 4: Dolerite intrusion

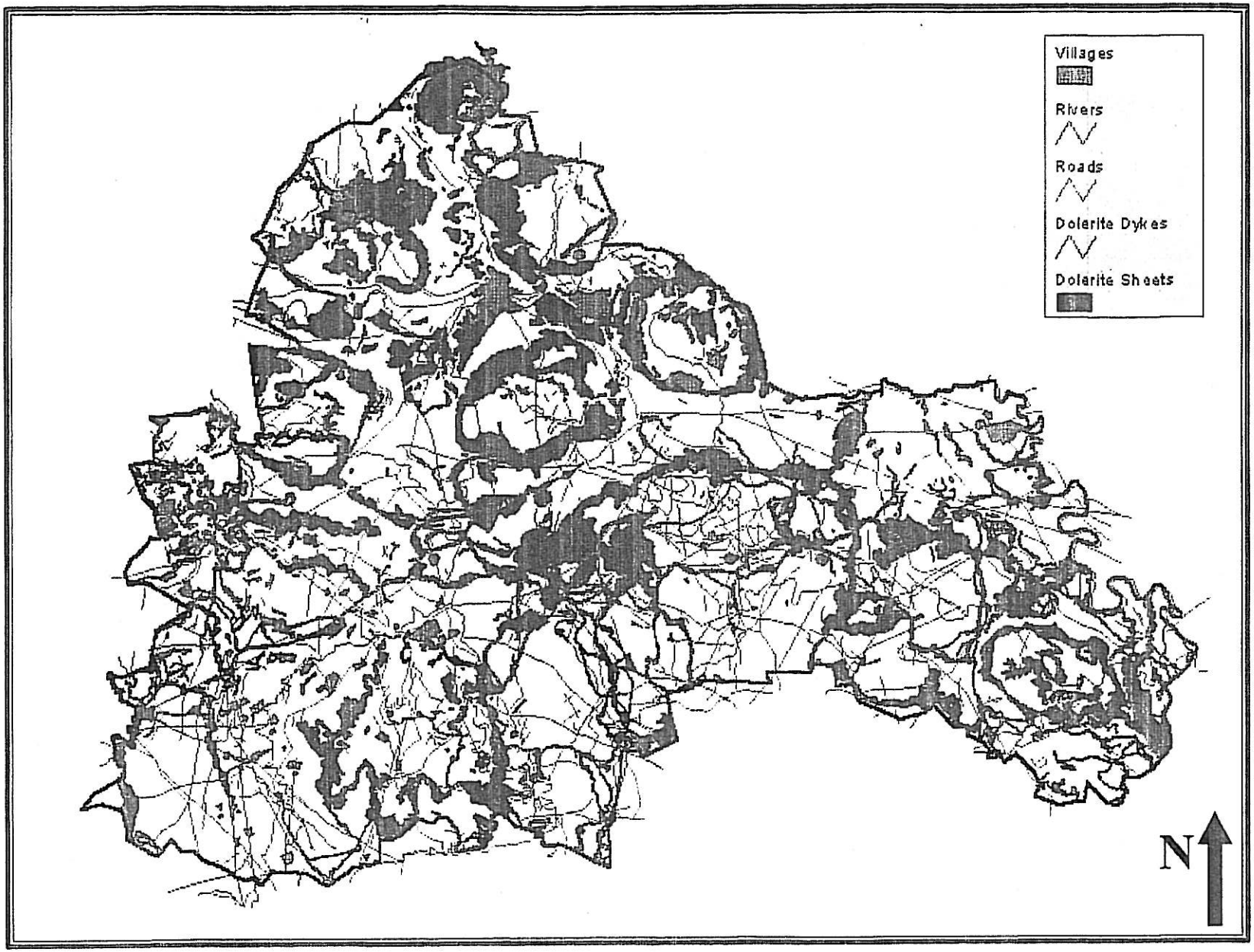

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FIGURE 5: Borehole Distribution

GeoCon

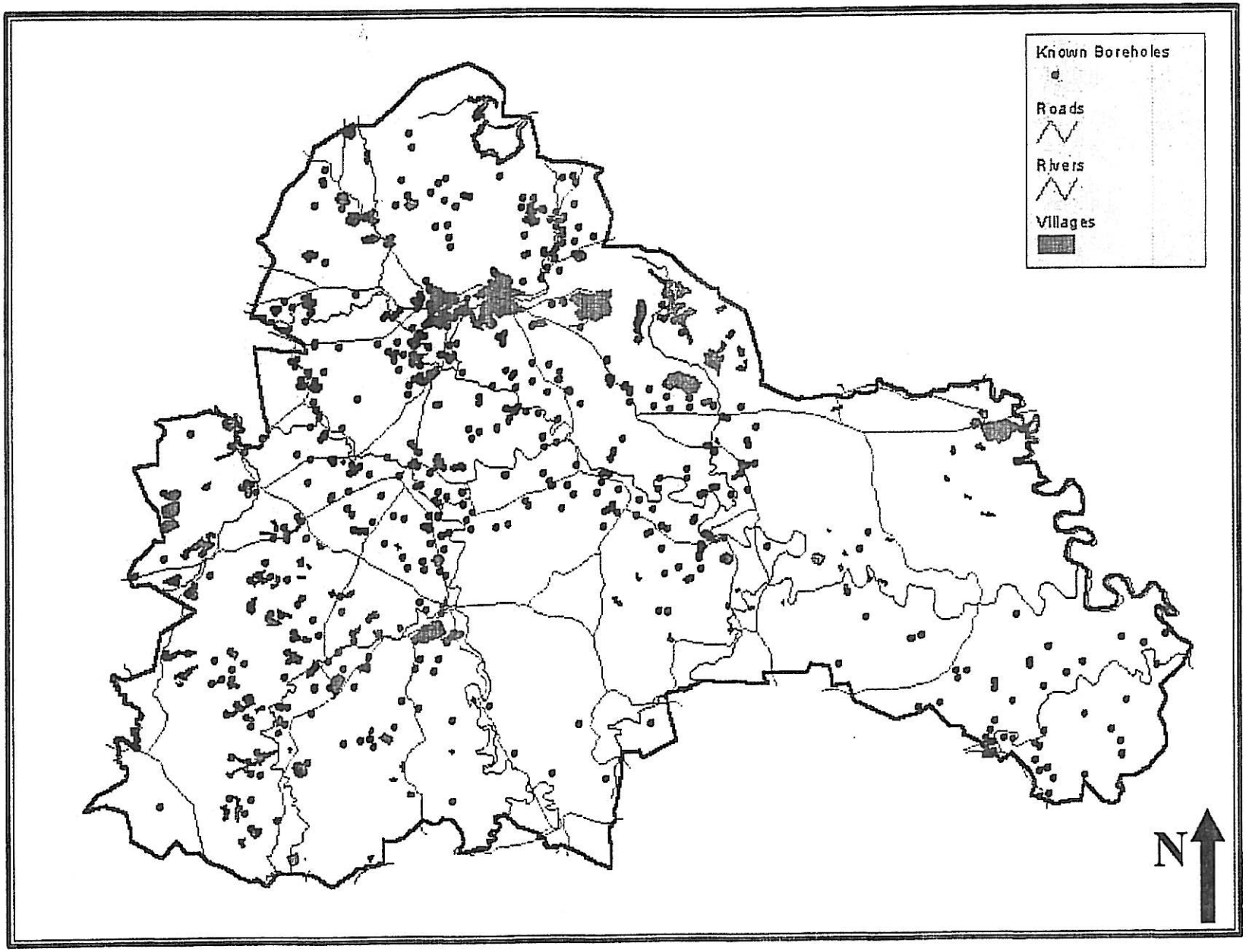

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FIGURE 6: Borehole Yield

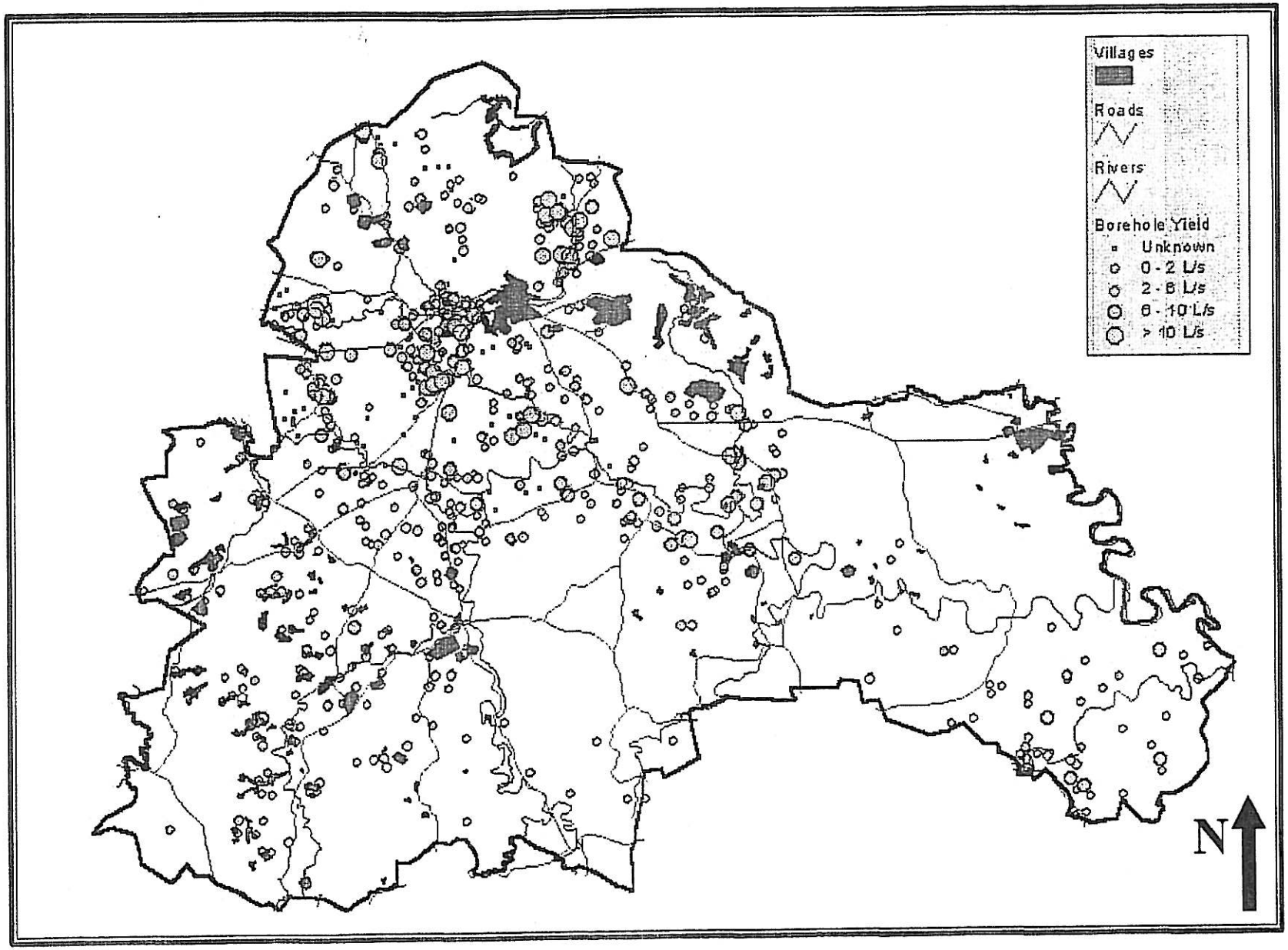

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FIGURE 7: Water Quality

GeoCon

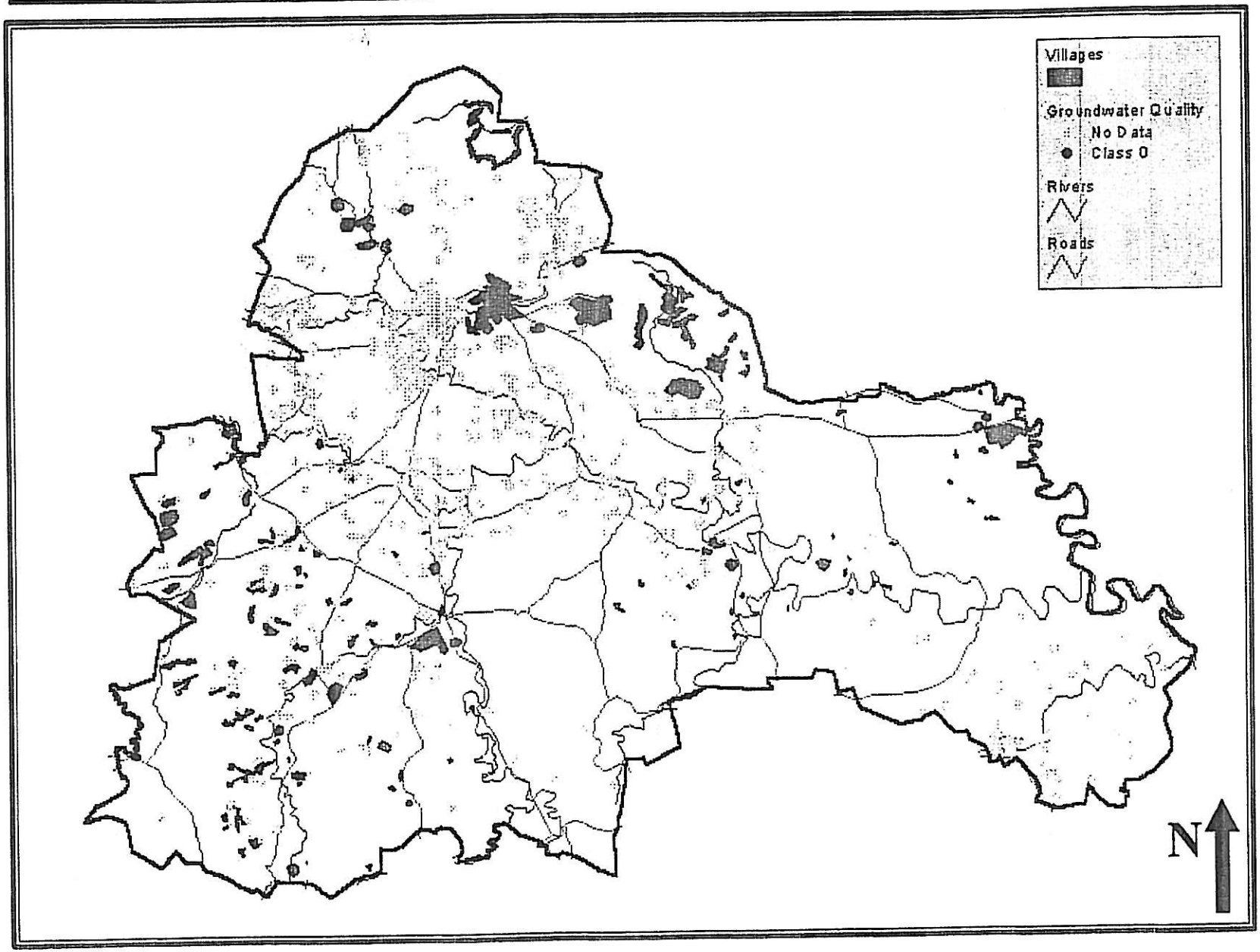

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FIGURE 8: Aquifer Class

GeoCon

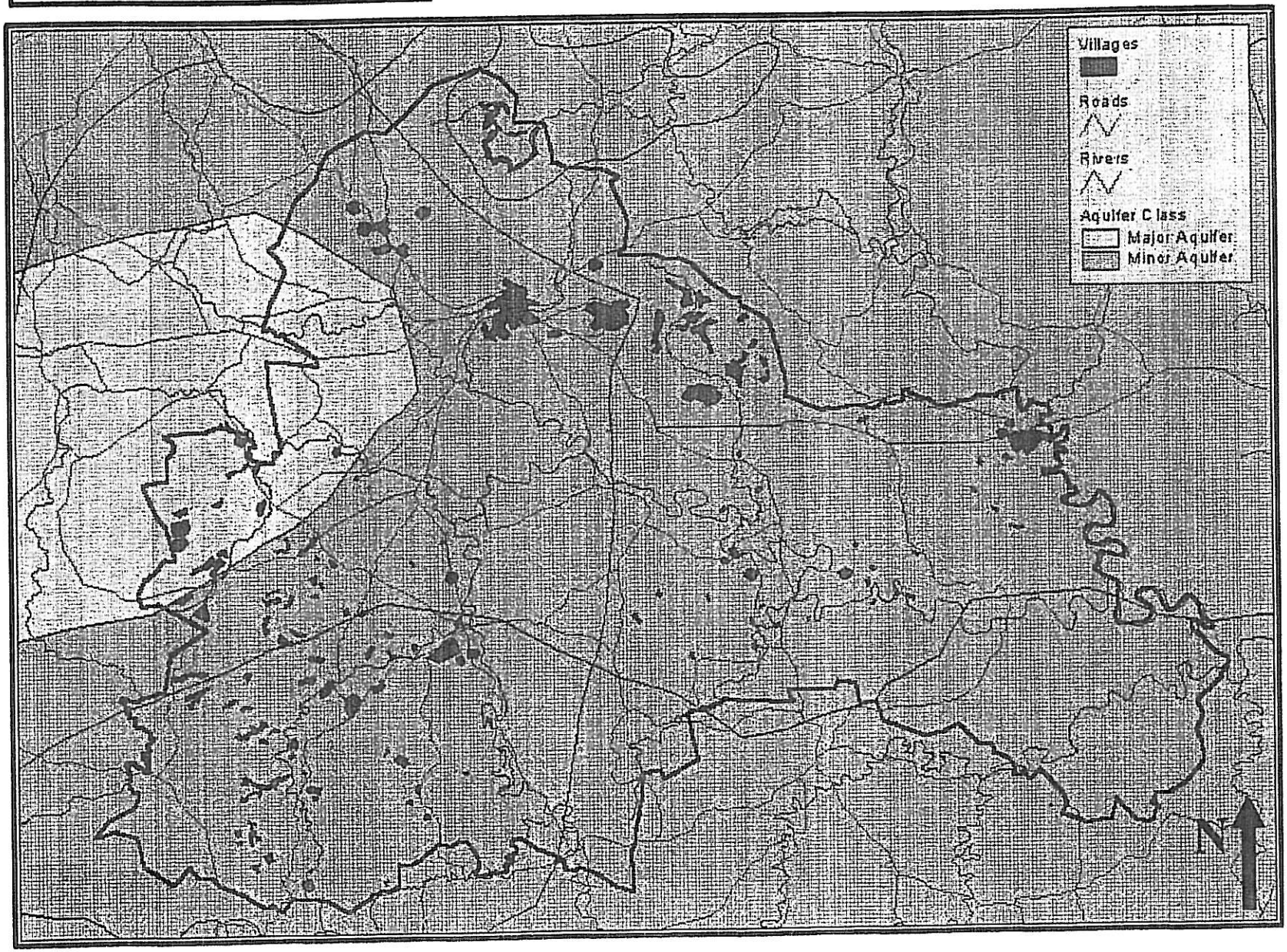

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FIGURE 9: Harvest Potential

GeoCon

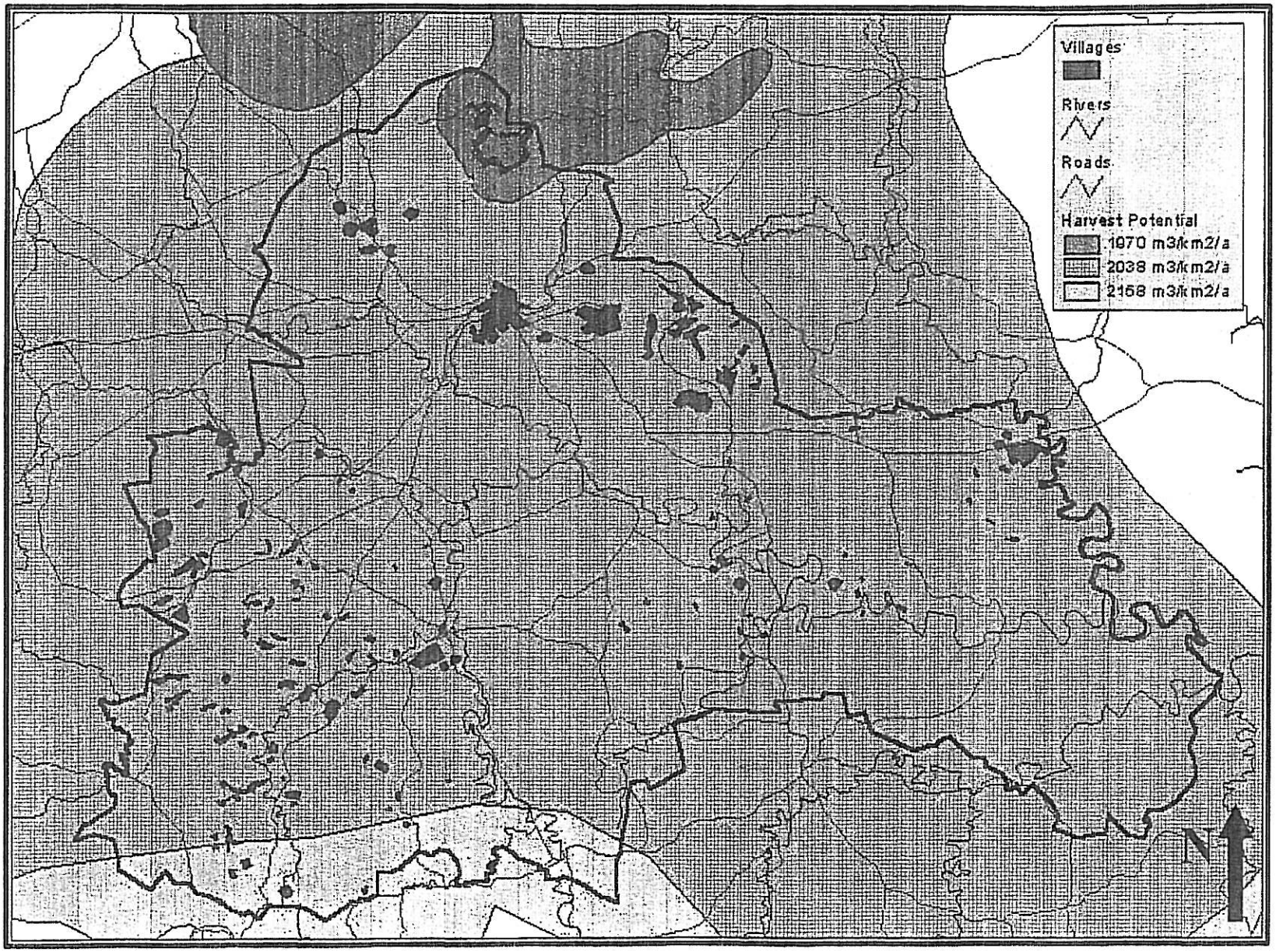

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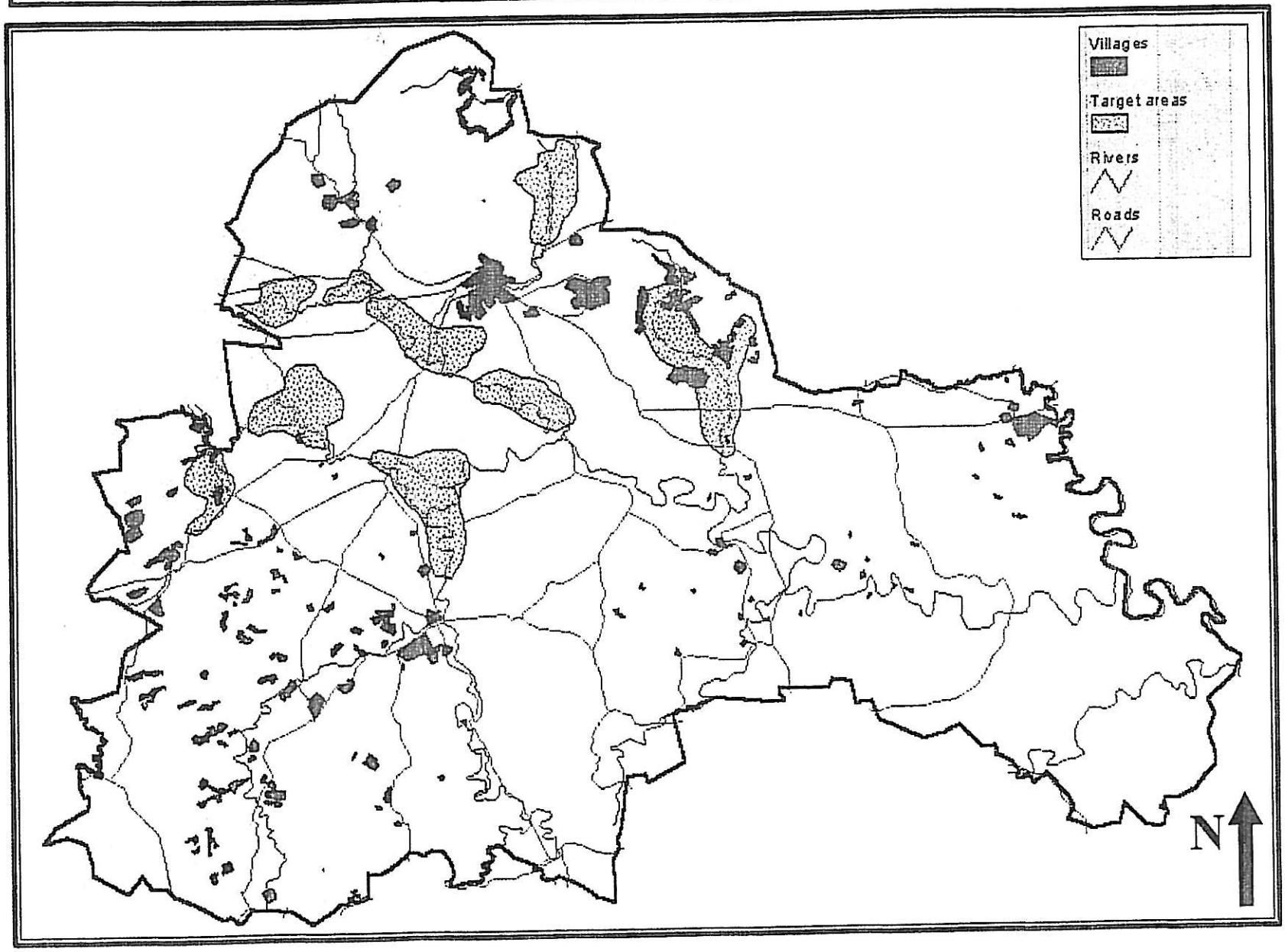
FIGURE 10: High potential target areas / Wellfield development potential

GeoCon

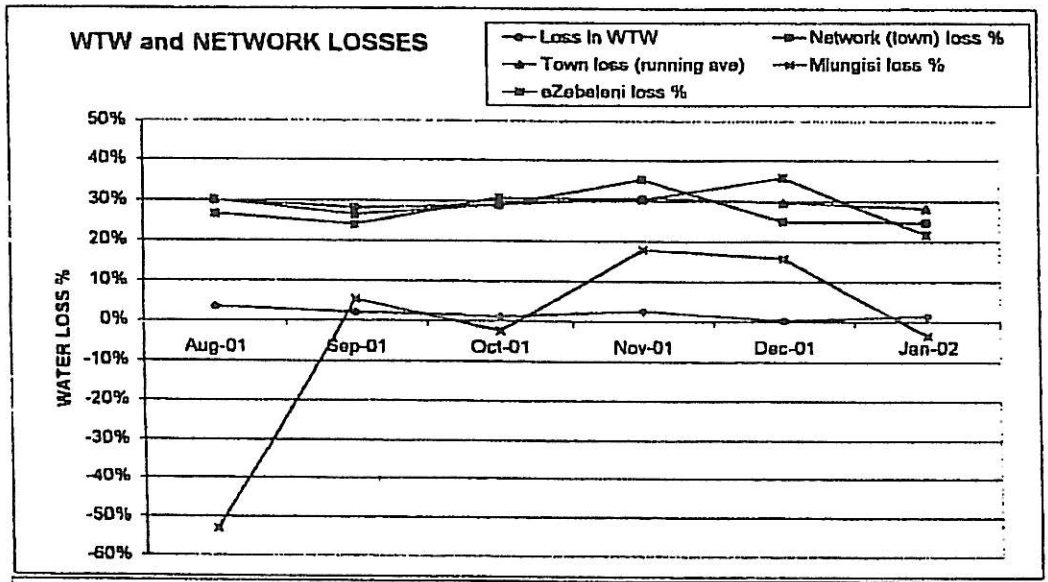


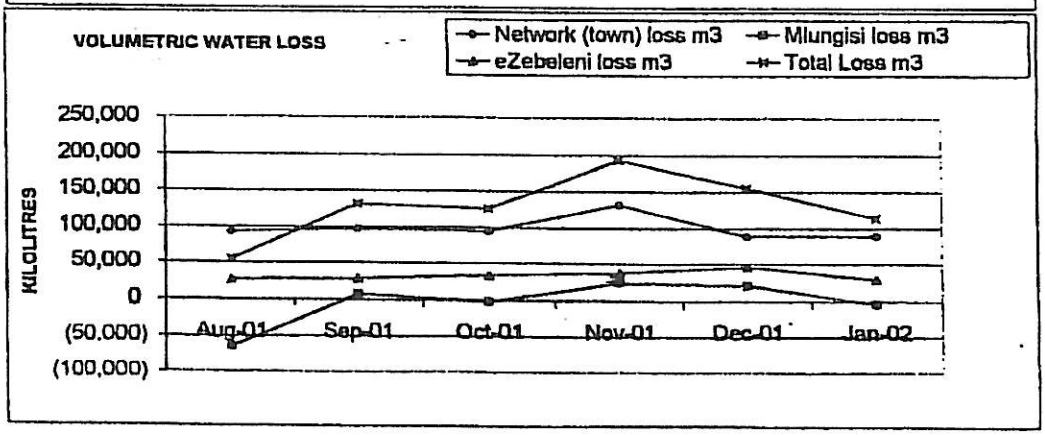
Annexure 2: Extract from WSSA report on unaccounted for water in the Queenstown water supply system

Table 4.5

WATER AND SANITATION SERVICES - QUEENSTOWN
UNACCOUNTED FOR WATER REPORT UPTO
January 2002

	January 02	December 01	November 01	October 01	September 01	August 01
Water volumes (kl):						
Water importation	621,017	*617,912*	649,038	577,650	619,579	565,786
Raw Water into WTW	633,057	*614,000*	647,198	549,131	596,506	550,572
Water Treated	624,262	612,888	630,413	542,571	584,167	531,535
Town (metered)	272,355	264,202	241,951	232,507	248,163	216,774
Mlungisi (bulk)	129,970	131,460	133,360	107,690	124,100	121,740
Mlungisi (metered)	134,482	110,839	109,434	110,356	117,513	186,486
eZebeleni (bulk)	132,390	128,960	123,420	107,960	115,010	100,210
eZebeleni (metered)	103,658	82,898	86,018	74,678	87,352	73,491
Total water sold	510,495	457,939	437,403	417,541	453,028	476,751
Water losses (%):						
Loss in WTW	1%	0%	3%	1%	2%	3%
Loss upto WTW	-2%	1%	0%	5%	4%	3%
Network (town) loss m3	89,547	88,266	131,682	94,414	96,894	82,811
Network (town) loss %	25%	25%	35%	29%	28%	30%
Town loss (running ave)	28%	30%	31%	29%	27%	30%
Mlungisi loss m3	-4512	20621	23926	-2666	6587	-64746
Mlungisi loss %	-3%	16%	18%	-2%	5%	-53%
eZebeleni loss m3	28,732	46,062	37,402	33,282	27,658	26,719
eZebeleni loss %	22%	36%	30%	31%	24%	27%
Total Loss m3	113767	154949	193010	125030	131139	54784
Total network loss %	18%	25%	31%	23%	22%	10%



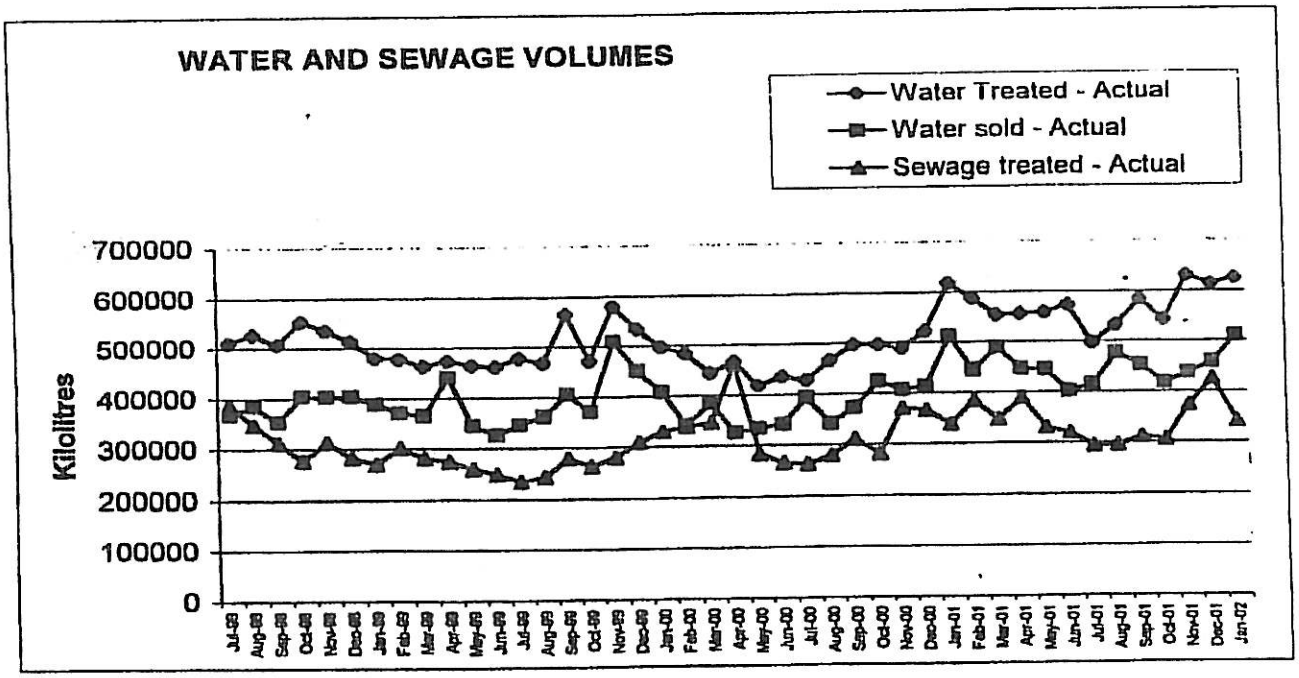


WATER AND SANITATION SERVICES - QUEENSTOWN

VOLUMES

January 2002

	January 2002			To date		Dec-01	Nov-01	Jan-01
	Budget	Month	Daily	Budget	Accum	Month	Month	Month
Dam levels (%)								
Raw water (m³)								
Waterdown	341,000	301,098	9,124	2,352,000	6,253,603	309,993	324,113	349,838
Bongola	200,000	*320,000*	10,667	1,271,000	1,969,000	308,000	0	300,000
Raw water sold	0	81	3	0	2,161	81	75	2,420
Total raw imported	541,000	621,017	20,698	3,623,000	8,222,603	617,912	324,038	647,418
Water treated (m³)								
Raw water to WTW	535,590	621,057	20,702	3,586,770	4,130,561	614,000	647,198	636,967
Water Treated	524,878	624,262	20,809	3,515,035	4,022,876	612,888	630,413	618,145
Zone meters (m³)								
Low level	47,239	80,820	2,694	316,353	439,550	85,760	73,600	59,070
High level	152,215	137,052	4,568	1,019,360	981,376	127,378	153,533	160,935
Finchams Nek	83,981	110,310	3,677	562,406	730,450	109,670	115,000	116,910
eZebeleni	110,224	166,110	5,537	738,157	1,002,400	158,620	154,920	140,820
Mlungisi	131,220	129,970	4,332	878,759	869,100	131,460	133,360	140,410
Total	524,878	624,262	20,809	3,515,035	4,022,876	612,888	630,413	618,145
Water sold (m³)								
Town (metered)	228,742	272,355	9,079	1,576,397	1,698,556	264,202	241,951	307,574
Mlungisi (bulk)	101,039	129,970	4,332	676,644	869,100	131,460	133,360	140,410
eZebeleni (bulk)	84,873	132,390	4,413	568,381	799,380	128,960	123,420	110,905
Total water sold	414,654	534,715	17,824	2,821,422	3,367,036	524,622	498,731	558,889
Sewage treated (m³)								
Biofilter plant	251,942	278,233	9,274	1,687,217	1,900,679	338,775	287,885	232,638
Activated plant	62,985	63,419	2,114	421,804	443,100	87,212	84,924	105,579
Total plant	314,927	341,652	11,388	2,109,021	2,343,779	425,987	372,809	338,217



Annexure 3: Field verification Data