

Table 3.5 List of land cover in the vicinity of national assessment sample sites selected, grouped per WMA

No.	Sample Site Number	Location of the Site	Land Cover in the Vicinity of the Site
Limpopo WMA			
9	A4H013Q01	Mokolo River at Moorddrift/Vught	Bush and Forest
10	A5H006Q01	Limpopo River at Botswana/Sterkloop	Bush and Degraded land
11	A5H008Q01	Palala River at Ga-Seleka/Bosche Diesch	Bush
12	A7H001Q01	Sand River at Waterpoort	Bush and Forest
Luvuvhu and Letaba WMA			
13	A9H011Q01	Luvuvhu River at Pafuri/Kruger National Park	Forest
14	A9H012Q01	Luvuvhu River at Mhinga	Cultivated land and Forest
15	B8H008Q01	Great Letaba River at Letaba Ranch	Forest and Cultivated land and Bush
16	B9H003Q01	Shingwidzi River at Kanniedood Dam/Kruger National Park	Bush
Crocodile (West) and Marico WMA			
1	A2H019Q01	Roodekopjes Dam on Crocodile River: Down Stream Weir	Bush and Cultivated land
2	A2H021Q01	Pienaars River at Buffelspoort	Forest and Cultivated land
3	A2H059Q01	Crocodile River at Vaalkop/Atlanta	Bush and Cultivated land
4	A2H094Q01	Bospoort Dam on Hex River: Down Stream Weir	Bush
5	A2H111Q01	Vaalkop Dam on Elands River: Down Stream Weir	Bush
6	A2H116Q01	Paul Hugo Dam on Crocodile River: Down Stream Weir	Cultivated land and Bush
7	A3R003Q01	Kromellenboog Dam on Little Marico River: Near Dam Wall	Bush and Cultivated land
8	A3R004Q01	Molatedi Dam on Great Marico River: Near Dam Wall	Bush and Degraded land
Olifants WMA			
17	B1H010Q01	Witbank Dam on Olifants River: Down Stream Weir	Grass, Cultivated land, Urban and Mining
18	B1H015Q01	Middelburg Dam on Little Olifants River: Down Stream Weir	Grass, Cultivated land and Urban
19	B2H015Q01	Wilge River at Zusterstroom	Grass, Cultivated land and Urban
20	B3H001Q01	Olifants River at Loskop North	Degraded land and Cultivated land
21	B3H021Q01	Elands River at Scherp Arabie	Cultivated land and Forest
22	B4H011Q01	Steelpoort River at Alverton	Bush and Cultivated land
23	B6H004Q01	Blyde River at Chester	Bush and Cultivated land
24	B7H009Q01	Olifants River at Finale/Liverpool	Cultivated land, Degraded land and Bush
Inkomati WMA			
150	X1H003Q01	Komati River at Tonga	Forest and Cultivated land
151	X1H014Q01	Mlumati River at Lomati	Forest, Plantation and Cultivated land
152	X2H013Q01	Krokodil River at Montrose	Plantation
153	X2H016Q01	Krokodil River at Tenbosch/Kruger National Park	Cultivated land and Forest
154	X2H022Q01	Kaap River at Dolton	Bush, Cultivated land and Plantation
155	X2H032Q01	Krokodil River at Weltevrede	Bush and Cultivated land
156	X3H008Q01	Sand River at Exeter	Forest, Bush and Degraded land
Usutu to Mhlatuze WMA			
143	W1R004Q01	Lake Msingazi at Arboretum	Cultivated land and Plantation
144	W2H005Q01	White Mfolozi River at Overloed/Ulundi	Bush, Grass and Degraded land
145	W3H015Q01	Hluhluwe River at Valsbaai/St Lucia Inflow	Bush, Plantation and Cultivated land
146	W4H004Q01	Bivane River at Welgelegen/Pivaansbad	Grass and Plantation
147	W4H006Q01	Phongolo River at M'Hlali	Forest and Cultivated land
148	W4H009Q01	Phongolo River at Ndume Game Reserve	Forest, Bush and Cultivated land
149	W5H022Q01	Assegai River at Zandbank	Grass and Plantation
Thukela WMA			
135	V1H001Q01	Tugela River at Tugela Drift/Colenso	Grass and Bush
136	V1H010Q01	Little Tugela River at Winterton	Cultivated land and Grass

No.	Sample Site Number	Location of the Site	Land Cover in the Vicinity of the Site
137	V1H038Q01	Klip River at Ladysmith Townlands/Army Camp	Grass, Urban and Bush
138	V2H008Q01	Mooi River at Keate's Drift	Grass, Cultivated land and Degraded land
139	V3H010Q01	Buffalo River at Tayside	Grass, Cultivated land and Plantation
140	V5H002Q01	Tugela River at Mandini	Cultivated land, Bush and Grass
141	V6H002Q01	Tugela River at Tugela Ferry	Grass, Cultivated land and Degraded land
142	V7H012Q01	Little Boesmans River at Estcourt	Grass and Bush
Upper Vaal WMA			
25	C1H002Q01	Klip River at Sterkfontein/Delangesdrift	Grass and Cultivated land
26	C1H017Q01	Vaal River at Villiers (Flood Section)	Cultivated land and Grass
27	C2H004Q01	Suikerbosrand River at Uitvlugt (RW S2)	Cultivated land, Grass and Urban
28	C2H005Q01	Riet Spruit at Kaal Plaats (RW RV2)	Cultivated land, Urban and Grass
29	C2H071Q01	Klip River at Kookfontein/Vereeniging Rail Bridge	Cultivated land and Urban
30	C2H085Q01	Mooi River at Hoogekraal/Kromdraai	Cultivated land and Grass
31	C8H001Q01	Wilge River at Frankfort	Grass and Cultivated land
32	C8H027Q01	Wilge River at Ballingtomp	Grass and Cultivated land
Middle Vaal WMA			
33	C2H007Q01	Vaal River at Pilgrims Estate/Orkney	Cultivated land and Grass
34	C2H073Q01	Skoon Spruit at Goedgenoeg/Orkney Bridge	Grass and Urban
35	C4H004Q01	Vet River at Fizantkraal/Nooitgedacht	Cultivated land and Grass
36	C4R001Q01	Allemanskraal Dam on Sand River: Near Dam Wall	Grass, Cultivated land and Bush
37	C4R002Q01	Erfenis Dam on Great Vet River: Near Dam Wall	Cultivated land and Grass
38	C6H003Q01	Vals River at Mooifontein/Bothaville	Cultivated land, Grass and Urban
39	C7H006Q01	Renoster River at Arriesrust	Cultivated land and Grass
Lower Vaal WMA			
		No sites met the selection criteria	
Mvoti to Umzimkulu WMA			
123	T5H007Q01	Mzimkulu River at Bezweni/Island View	Cultivated land, Grass, Plantation and Degraded land
124	U1H006Q01	Mkomazi River at Delos Estate	Bush and Cultivated land
125	U2H001Q01	Mgeni River at Howick	Cultivated land, Grass, Plantation and Urban
126	U2H006Q01	Karkloof River at Shafton	Cultivated land, Grass and Plantation
127	U2H011Q01	Msunduze River at Henley Dam	Grass and Cultivated land
128	U2H014Q01	Albert Falls Dam on Mgeni River: Down Stream Weir	Cultivated land and Grass
129	U2H022Q01	Msunduze River at Inanda/Nomfihlelo	Grass, Bush and Cultivated land
130	U2H041Q01	Msunduze River at Hampstead Park/Moto-X (Darville)	Grass and Urban
131	U2H043Q01	Mgeni River at Inanda/Mgeni Confluence (Mngs)	Grass, Cultivated land and Degraded land
132	U3H005Q01	Hazelmere Dam on Mdloti River: Down Stream Weir (Hmro)	Cultivated land and Urban
133	U4H008Q01	Canal (Left) from Mvoti River at Hlazane/Glendal	Cultivated land and Bush
134	U8H003Q01	Mpambanyoni River at Umbeli Belli	Cultivated land and Bush
Mzimvubu to Keiskamma WMA			
107	R1H015Q01	Keiskamma River at Farm 7/Howard Shaw Bridge	Bush and Grass
108	R2R003Q01	Bride Drift Dam on Buffalo River: Near Dam Wall	Shrub and Bush
109	R3H001Q01	Gqunube River at Outspan	Bush and Grass
110	R3H003Q01	Nahoon Dam on Nahoon River: Down Stream Weir	Bush, Urban and Grass
111	R3H004Q01	Nahoon Dam on Nahoon River: Pipe to Purification Works	Grass and Bush
112	S1R001Q01	Xonxa Dam on White Kei River: Near Dam Wall	Grass, Bush, Cultivated land and Degraded land
113	S3H006Q01	Klaas Smits River at Weltevreden/Queenstown	Grass, Bush and Degraded land
114	S5H002Q01	Tsomo River at Wyk Maduma/Tsomo	Degraded land, Cultivated land and Grass
115	S7H001Q01	Gcuwa River at Butterworth	Bush, Grass and Degraded land
116	S7H004Q01	Great Kei River at Area 8 Sprigs B/Transkei Border	Bush and Grass
117	T1H004Q01	Bashee River at Bashee Bridge	Degraded land and Cultivated land
118	T3H004Q01	Mzintlana River at Slangfontein/Kokstad	Grass and Cultivated land

No.	Sample Site Number	Location of the Site	Land Cover in the Vicinity of the Site
119	T3H005Q01	Tina River at Mahlungulu	Degraded land and Cultivated land
120	T3H006Q01	Tsitsa River at Xonkonxa/Tsitsa Bridge	Degraded land, Cultivated land and Grass
121	T3H008Q01	Mzimvubu River at Kromdraai/Inungi	Grass, Cultivated land and Degraded land
122	T7H001Q01	Mngazi River at Mngwenyana 22/Mngazi	Grass, Cultivated land and Degraded land
Upper Orange WMA			
40	D1H001Q01	Wonderboom/Stormboom Spruit at Diepkloof/Burgersdorp	Shrub and Bush
41	D1H003Q01	Orange River at Aliwal North	Grass, Cultivated land and Shrub
42	D1H005Q01	Orange River at White Hill (Lesotho G4)	Grass
43	D1H006Q01	Kornet Spruit at Maghaleen	Grass and Cultivated land
44	D1H009Q01	Orange River at Oranjedraai	Grass, Cultivated land and Degraded land
45	D1H011Q01	Kraai River at Roodewal	Grass and Cultivated land
46	D2H012Q01	Little Caledon river at the Poplars	Cultivated land and Grass
47	D2H036Q01	Caledon River at Kommissiedrift	Shrub, Grass and Cultivated land
48	D2R004Q01	Welbedacht Dam on Caledon river: Near Dam Wall	Grass and Cultivated land
49	D3H013Q01	Orange River at Roodepoort	Shrub and Bush
50	D3R003Q01	Vanderkloof Dam on Orange River: Near Dam Wall	Shrub and Cultivated land
Lower Orange WMA			
51	D3H008Q01	Orange River at Marksdrift	Shrub, Bush and Cultivated land
52	D5H021Q01	Sak River at De Kruis/Williston	Shrub
53	D7H008Q01	Orange River at Boegoeberg Reserve/Zeekoebaart	Shrub, Bush and Cultivated land
54	D7H015Q01	South Canal from Orange River at Kakamas/Neusberg	Shrub, Bush and Cultivated land
55	D8H003Q01	Orange River at Vioolsdrift	Herb
56	D8H008Q01	Orange River at Pella Mission	Shrub and Grass
Fish to Tsitsikamma WMA			
81	K8H001Q01	Kruis River at Farm 508 Pineview	Cultivated land and Bush
82	K8H002Q01	Elands River at Kwaai Brand Forest Reserve/Witelbos	Cultivated land, Bush and Urban
83	L3R001Q01	Beervlei Dam at Windheudel	Shrub and Degraded land
84	L6H001Q01	Heuningklip River at Campherspoort	Shrub and Bush
85	L7H006Q01	Groot River at Grootrivierspoort	Shrub, Bush and Cultivated land
86	L8H005Q01	Kouga River at Stuurmanskraal	Shrub, Bush and Cultivated land
87	N1H013Q01	Mackiesputs Eye at Graaf-Reinet/Van Reyneveldspas	Bush, Grass, Urban and Cultivated land
88	N2H007Q01	Sundays River at De Draay	Shrub
89	N3H002Q01	Voël River at Rietvley	Shrub and Bush
90	N4H003Q01	Sundays River at Addo Drift East/Addo Bridge	Bush, Shrub and Cultivated land
91	P1H003Q01	Boesmans River at Donkerhoek/Alicedale	Bush, Grass, Shrub and Cultivated land
92	P3H001Q01	Kariega River at Smithfield/Lower Waterford	Bush, Grass and Forest
93	P4H001Q01	Kowie River at Bathurst/Wolfscrag	Bush, Grass and Cultivated land
94	Q1H012Q01	Teebus River at Jan Blaauws Kop/Beaconsfield	Shrub and Cultivated land
95	Q1H017Q01	Right Canal from Great Fish River at Katkop/Zoutpansdrift	Shrub and Cultivated land
96	Q1H022Q01	Grassridge Dam on Great Brak River – Outlet to River	Shrub and Cultivated land
97	Q2H002Q01	Great Fish River at Zoutpansdrift	Shrub and Cultivated land
98	Q4H013Q01	Tarka River at Bridge Farm/Tarka Bridge (New Weir)	Shrub, Grass and Cultivated land
99	Q4R002Q01	Kommandodrift Dam on Tarka River at Kommandodrift	Shrub
100	Q6H003Q01	Baviaans River at Botmangat/De Klerkdal	Shrub, Bush and Cultivated land
101	Q7H003Q01	Great Fish River at Leeuwe Drift	Shrub, Cultivated land and Forest
102	Q8H011Q01	Little Fish River at Rietfontein/Junction Drift	Shrub and Bush
103	Q9H001Q01	Great Fish River at Fort Brown Peninsula	Bush and Shrub
104	Q9H002Q01	Koonap River at Adelaide	Bush and Shrub
105	Q9H018Q01	Great Fish River at Matomela's Reserve/Outspan	Shrub, Bush and Cultivated land
106	Q9H029Q01	Kat River at Fort Beaufort	Bush, Degraded land and Cultivated land
Gouritz WMA			

No.	Sample Site Number	Location of the Site	Land Cover in the Vicinity of the Site
68	H8H001Q01	Duiwenhoks River at Dassjes Klip	Shrub and Cultivated land
69	H9H005Q01	Goukou River at Farm 216 (SWQ 4A-11) D/S River	Cultivated land
70	J1H019Q01	Groot River at Buffelsfontein/Van Wyksdorp	Shrub
71	J2H010Q01	Gamka River at Huisrivier	Shrub, Bush and Cultivated land
72	J2H016Q01	Gamkapoort Dam on Gamka River: Down Stream Weir	Shrub and Bush
73	J2R004Q01	Gamka Dam on Gamka River: Near Dam Wall	Shrub
74	J3H011Q01	Olifants River at Warm Water	Shrub, Cultivated land and Plantation
75	K1H005Q01	Moordkuil River at Banff	Shrub, Cultivated land and Plantation
76	K2H004Q01	Great Brak River at Vishoek	Shrub
77	K3H001Q01	Kaaimans River at Upper Barbiers Kraal	Bush and Plantation
78	K3H003Q01	Maalgate River at Knoetze Kama/Buffelsdrift	Cultivated land, Shrub and Bush
79	K4R002Q01	Swart Vlei at Ronde Valley/Hoogekraal	Bush, Plantation and Cultivated land
80	K7H001Q01	Bloukrans River at Lottering Forest Reserve	Forest, Plantation and Bush
Olifants/Doom WMA			
57	E1R001Q01	Bulshoek Dam on Olifants River: Near Dam Wall	Shrub and Cultivated land
58	E2H002Q01	Doring River at Elands Drift/Aspoort	Shrub
59	E2H003Q01	Doring River at Melkboom	Shrub, Cultivated land and Bush
Breede WMA			
63	G4H007Q01	Palmiet River at Farm 562- Welgemoed/Kleinmond	Shrub and Herb
64	H4H024Q01	Robertson Canal from Bree River at De Goree	Shrub and Cultivated land
65	H5H005Q01	Bree River at Wagenboomsheuvel/Drew	Cultivated land and Shrub
66	H6H009Q01	Riviersonderend at Reenen	Cultivated land and Shrub
67	H7H006Q01	Bree River at Swellendam	Cultivated land and Shrub
Berg WMA			
60	G1H031Q01	Berg River at Misverstand/Die Brug	Cultivated land
61	G1H036Q01	Berg River at Vleesbank/Hermon Bridge	Cultivated land and Shrub
62	G2H015Q01	Eerste River at Faure	Cultivated land, Urban and Shrub

3.3 Data Collection and Availability

The water quality data that were used in the assessment of the fitness for use of South Africa's surface water resources for domestic and irrigated agricultural use were collected as part of the so-called National Chemical or Salinity Monitoring Programme. This programme has been in operation since the early 1970's and samples are regularly collected at approximately 1 600 monitoring stations at a frequency that varies from weekly to monthly sampling. The samples collected for this programme are analysed at the laboratories of the Institute for Water Quality Studies and the data is stored on DWAF's database, namely, the Water Management System (WMS).

The number of sample records per sample site for the study period (1996 to 2000) is presented in Table 3.6. The value is based on the number of Total Dissolved Salts (TDS - which is approximately equivalent to Dissolved Major Salts "DMS" in WMS terminology) results per sample site over the review period of five years. There is some variability as regards the number of records for other constituents, but TDS was considered to be an adequate indicator of the availability of data per sample site.

3.3.1 Trophic status

The only information that was available from other projects covering a national scale was that of the Trophic Status Project (van Ginkel *et al.*, 2001). The Trophic Status Project (TSP) considered the trophic status of selected impoundments across South Africa, specifically those impoundments managed by DWAF.

The trophic status of an impoundment refers to its level of enrichment with plant nutrients (van Ginkel *et al.*, 2001), that is, how productive the system is. An impoundment may be described as being *oligotrophic* (low productivity), *mesotrophic* (moderate productivity), or *eutrophic* (very productive).

The relative desirability of the various trophic status classes is influenced by the intended use of the impoundment. From a water resources perspective, the *oligotrophic* state is most desirable since it reflects the cleanest water (requiring the lowest level of purification so that it is suitable for domestic use). At the opposite end of the spectrum, the water in a *eutrophic* impoundment is the least desirable from a domestic use perspective because it will need a much higher level of purification before it is suitable for drinking purposes. The *mesotrophic* state is situated between the two extremes.

The study conducted by van Ginkel *et al.* (2001) included the following impoundments across the country, subdivided into the following WMAs:

The Luvuvhu and Letaba WMA

- the Ebenezer Dam; Magoebaskloof Dam and Tzaneen Dam.

The Crocodile (West) and Marico WMA

- the Bon Accord Dam; Buffelspoort Dam; Hartbeespoort Dam; Klipvoor Dam; Kosterrivier Dam; Lindleyspoort Dam; Rietvlei Dam; Roodekopjes Dam; Roodeplaat Dam and Vaalkop Dam.

The Olifants WMA

- the Bronkhorstspruit Dam; Loskop Dam; Middelburg Dam and Witbank Dam.

The Usutu to Mhlatuze WMA

- the Klipfontein Dam.

The Upper, Middle and Lower Vaal WMAs

- the Allemanskraal Dam; Bloemhof Dam; Boskop Dam; Erfenis Dam; Grootdraai Dam; Koppies Dam; Sterkfontein Dam and Vaal Dam.

The Mvoti to Umzimkulu WMA

- the Albert Falls Dam; Inanda Dam; Midmar Dam; Nagle Dam; Hazelmere Dam and Shongweni Dam.

The Mzimvubu to Keiskamma WMA

- the Bridledrift Dam and Laing Dam.

The Upper and Lower Orange WMAs

- the Gariep Dam; Cook's Lake; Disaneng Dam; Lotlamoreng Dam and Setumo Dam.

The Fish to Tsitsikamma WMA

- the Bo-Lang Vlei; Groen Vlei; Onder-Lang Vlei; Ronde Vlei; Sedgefield Lagoon; Swart Vlei and Wilderness Lagoon.

The Berg WMA

- the Misverstand Weir; Voëlvlei Dam and Wemmershoek Dam.

The assessment of the trophic status at each of these impoundments is presented later in the report (Section 4.4).

3.4 Sample Site Selection

To simplify the assessment and to present the information in such a way that it would be useful for water resource management purposes, data from suitable sampling sites were selected from each of the 19 Water Management Areas (WMAs).

As far as sample site selection for this report is concerned, two levels of sampling sites were selected from the chemical water quality database, namely:

- a national level sample site set
- a more comprehensive site set selected for each WMA.

The WMAs are (see Map 2):

1. the Limpopo,
2. the Luvuvhu and Letaba,
3. the Crocodile (West) and Marico,
4. the Olifants,
5. the Inkomati,
6. the Usutu to Mhlatuze,
7. the Thukela,
8. the Upper Vaal,
9. the Middle Vaal,
10. the Lower Vaal,
11. the Mvoti to Umzimkulu,
12. the Mzimvubu to Keiskamma,
13. the Upper Orange,
14. the Lower Orange,
15. the Fish to Tsitsikamma,
16. the Gouritz,
17. the Olifants/Doorn,
18. the Breede, and
19. the Berg WMA.

The rationale behind the sample site selection was based on the overall sample site selected for a national assessment of surface chemical water quality, with the addition of all other suitable water quality sample sites within the various WMAs. A suitable water quality sample site is considered to be one with an adequate level of sampling (not too infrequent or sparse) over the chosen study period. An adequate and regular frequency of samples is necessary to ensure that

the statistical analyses of the data set provide results that are representative of the study period. The selection of suitable sample sites is a qualitative process.

Since the intention is to make the best use of the available data, sample site selection may be more rigorous in those WMAs with a large number of frequently sampled sites than those WMAs that do not have a high density of sample sites with regular samples having been taken.

For the national assessment:

For the national assessment, a sample site is selected for each tertiary drainage region, ideally as close to the outflow point of the tertiary drainage region as possible, as a descriptor of the water quality within that drainage region. In those cases where no suitable site exists, the next closest site with a suitable data record is selected.

For the WMA-level assessment:

For the WMA-level assessment, sample sites in the national assessment sample site set are used together with additional sites with sufficient data throughout each tertiary drainage region in order to better be able to link land use types and activities with the water quality sampled in the rivers.

Map 2 presents the location of the national assessment sample sites as listed in Table 3.6.

Table 3.6 contains a list of all of the sample sites selected for the national assessment of chemical surface water quality. Both the WMS code and the older DWAF sample site number of each site are given. Refer to Map 2 for the geographical location of the sample sites throughout the country. The number in the first column in Table 3.6 corresponds with the sample site number on Map 2.

Map 2 The location of the national assessment sample sites