

Adaptive responses to Climate Change: Evaluating the Implementation and Effectiveness of Water Resource Management Strategies in Selected Hotels within the environs of Lake Naivasha

ABSTRACT

Aims: This study sought to evaluate the adoption of water resource management strategies in hotels in the attempt to attain water sustainability. Specifically, the research sought to assess the current structural and non-structural water resource management strategies adopted by selected hotels in the environs of Lake Naivasha; establish the perceived effectiveness of both the structural and non-structural water resource management strategies adopted to enhance water sustainability; and compare the structural and non-structural water management strategies in terms of their effectiveness in promoting water sustainability in hotels within environs of Lake Naivasha.

Study design: The study adopted a case study design.

Place and Duration of Study: This study was conducted in hotels within the environs of Lake Naivasha between May and December 2010.

Methodology: A census of 30 Class (A) registered hotels was conducted, and purposive sampling was used to select 120 respondents from the management staff within the selected hotels. Convenience sampling was used to select 8 managers of water management bodies who acted as key informants during personal interviews. Primary data was collected from the hotel management staff using questionnaires and from managers of water management through personal interviews. Data from questionnaires was analysed using the Statistical Package for Social Science (SPSS) to derive descriptive statistics on the implementation of WRM strategies.

Results: Findings revealed that a majority of the sampled hotels had embraced water resource management strategies through development of alternative water resources, use of water saving technology, treatment of recycled water and use of water saving manuals. Further, the structural water resource management strategies were perceived to be more effective as they impacted more on reducing the operating costs, promoted environmental conservation and were more preferred than the non- structural strategies despite being more expensive to implement.

Conclusion: It is concluded that water sustainability is however achievable through a combination of a variety WRM strategies.

Keywords: *Water sustainability, water resource management, structural and non-structural water management strategies*

1. INTRODUCTION

The United Nations Environment Program (UNEP) confirms that severe water shortage affects 400 million people today and is predicted to affect 4 billion people by 2050 [1]. Researchers assert the tourism sector which is one of the major users of fresh water in the world. Indeed, statistics reveals that water accounts for up to 15% of utility bills and that up to 95% of fresh water leave hotels as waste [2].

23 A Welfare monitoring survey by Republic of Kenya [3] indicates that Kenya is mainly an
24 agricultural country with an expanding economy whose basic element for development is
25 water. The annual quantity of renewable fresh water resources is estimated at 20.2 billion m³
26 comprising 19.59 m³ of surface water and 0.62 billion m³ of ground water. The amount of
27 water actually available for utilization in any one year (among other factors) depends on the
28 rate of run-off, the aridity of the catchment area and the methods of interception at various
29 points in the hydrological cycle. Precipitation across parts of Kenya is exceptionally variable
30 and unpredictable, and runoff is exceptionally low (varying from near zero in the north-
31 eastern part of the country to over 1600 mm/yr in the western part of the country). The
32 consequence of these two features is endemic drought in large parts of the country.
33 Throughout Kenya, even within the same districts, there is an enormous variance in water
34 amounts. Because of pronounced differences in average annual rainfall, evapo-transpiration,
35 and hydrogeology, there is high variability within the same season, between different
36 seasons i.e. twelve-month period, and over several years

37 Like many other highly visited areas worldwide, Lake Naivasha is a tourism destination of
38 international importance and biodiversity value and as such in 1995 it became Kenya's
39 second Ramsar wetland site. This shallow freshwater lake supports a high but uneven
40 biodiversity which includes rich in birds and plants [4]. Like many of the great East African
41 lakes, Lake Naivasha is an area of interest as it has a high economic value for Kenya since it
42 provides a wide range of opportunities for various economic activities in the area. Today,
43 the fertile soil around the lake is used for agriculture, particularly for the production of fruits,
44 flowers, vegetables and vineyards.

45 Besides, Lake Naivasha is renowned for its cool climate, peaceful surrounds and tranquil
46 waters thus an excellent holidaying spot for both international and local tourists. However,
47 over the years, the water levels in the lake have significantly declined which is attributed to
48 rapid increase in the demand for lake and river water and clearance of catchment area for
49 human settlement. Similarly, area covered by the papyrus, which has been an important part
50 of the lake's ecosystem, has declined in acreage from 1200 ha to 200 ha over the last four
51 decades [5].

52 Within sustainable tourism debate, the hotel sector has come under close scrutiny, not only
53 as pivotal to tourism growth but also as a sector with significant implications for both
54 development and environmental conservation. In fact, there is increasing acceptance that
55 hotels, large or small, must adopt an environmental management or "Greening" approach to
56 their operations so that they positively contribute to the sustainability of tourism (Holden,
57 2000). In spite a wide range of literature on environmental issues in the hospitality industry
58 as well as the factors affecting the hotels' responses to environmental issues; little research
59 has been done to establish the effectiveness of water resource management strategies on
60 water sustainability in the hospitality industry. It is in this connection that the current study
61 endeavored to assess the effectiveness of water management strategies on water
62 sustainability in the selected hotels around Lake Naivasha.

63 **2. METHODOLOGY**

64

65 **2.1 Research design**

66 A case study research design was used in this study since it is suitable for gathering and
67 analysis of both qualitative and quantitative data, and involves a careful and complete
68 observation of a social unit be it a person, a family, an institution, a cultural group or even an
69 entire community [6]. The case study as a research strategy and an empirical inquiry
70 enabled the researcher to investigate the water resource management strategies within the
71 real-life context.

72 **2.2 Target Population**

73 Hotels in Lake Naivasha region represents tourism stakeholders operating under situations
74 of water scarcity hence provides a focal point for assessing the effectiveness of water
75 resource management strategies on water sustainability in hotels. In this study, the target
76 population comprised of the 30 class A registered hotels with 120 management staff and 24
77 managers of 8 water management bodies, namely the Lake Naivasha WRMA regional office,
78 World Water Foundation (WWF), National Water Conservation and Pipeline Corporation,
79 Catchment Area Advisory Committee (CAAC), Lake Naivasha Water Users Association
80 (LANA WRUA) and Naivasha Water and Sanitation Services Company (NAWASSCO).

81 **2.3 Sampling techniques and sample size**

82 In this research, as shown in Table 1 the following sampling techniques were used:

83 **Table 1: Target population and sampling techniques**

Target population	Sampling technique	Target population	Sample size	Percentage
Hotel management staff	Purposive sampling	120	40	30%
Managers of water management bodies	Convenience sampling	24	8	30%

84 Source: Author (Pilot survey, 2009)

85 **2.4 Instrumentation and data collection methods**

86 The researcher used both primary and secondary data sources to generate primary and
87 secondary data respectively.

88 In this study, primary data was obtained through the use of questionnaires and scheduled
89 interviews which constituted of open ended questions and close ended questions, that
90 solicited for respondents' views on use of water by hotels, water resource management
91 strategies put in place in the sampled hotels, the perceived effectiveness of these strategies,
92 the constraints faced and other issues. With the use of observation sheets the researcher
93 recorded data on the various structural measures put in place for water conservation.

94 Secondary data was obtained from Lake Naivasha Water and Sanitation Services Company
95 (NAWASSCO) records and reports on the hotels' water consumption records and
96 expenditure. Additional information was obtained from WRMA sub-regional office in
97 Naivasha, World Water Foundation (WWF), National Water Conservation and Pipeline
98 Corporation, Catchment Area Advisory Committee (CAAC), Lake Naivasha Water Users
99 Association (LANA WRUA). These sources provided information on the role and level of
100 participation of the hotel sector in the stakeholders' meetings and initiatives for water
101 resource management.

102

103 Document analysis provided information on documented water consumption, expenditure
104 and the subsequent implementation of structural and non- structural water resource
105 management strategies as a tool towards sustainable use of water resources in the selected
106 hotels in the environs of Lake Naivasha..

107 **2.5 Reliability and validity tests**

108 Before embarking on data collection, the questionnaires and the interview schedules were
109 first piloted by using a sample of 4 hotels in Lake Naivasha region. After piloting, the
110 questionnaire was restructured and refined to suit the study. The Coefficient of Stability was
111 used to determine reliability of the questionnaires through test and retest method where two
112 administrations of the same questionnaire were done, separated by a one week delay and
113 the scores between the two tests were then correlated. Methodological triangulation was
114 adopted to verify the validity of the data given in the questionnaires on water resource
115 management strategies in the selected hotels, by cross checking the information through
116 direct observation and from analysis of secondary sources such as hotel bookings, receipts,
117 water bills and others.

118 **2.6 Data analysis and interpretation**

119 Data analysis was done using both descriptive and inferential statistics facilitated by the use
120 of SPSS (Statistical Package for Social Science) Computer package. Descriptive analysis
121 involved computing frequencies and percentages (proportions) based on respondents'
122 responses to diverse questions on the use of structural and non- structural water resource
123 management strategies

124

125 **3. RESULTS AND DISCUSSION**

126

127 **3.1 Background information of hotels**

128 The purpose of this study was to evaluate the implementation of structural and non-
129 structural water resource management strategies in hotels within the environs of Lake
130 Naivasha, establish the perceived effectiveness of the structural and non- structural
131 strategies and compare the two options in terms of their effectiveness on water sustainability
132 in the hospitality industry.

133 Hotels constitute one of the main pillars in the tourism sector which is highly unique on
134 issues related to use of water resources and water resource management. However the
135 water use intensity and management practices are dependent on the hotel characteristics. In
136 this study, the 3 star hotels constituted the highest percentage of the respondent hotels
137 (37.0%). At this level, hotels provide a significantly greater quality and range of facilities than
138 at the lower star classifications. All bedrooms will have fully en suite bath and shower rooms
139 and offer a high standard of comfort and equipment. Further, 18.5% constituted both 1 star
140 and 2 star hotels. In the 1 star classification hotels, there may be a limited range of facilities
141 and meals may be fairly simple and some bedrooms may not have en- suite bath/shower
142 rooms. In the two star hotels are typically small to medium sized and offer more extensive
143 facilities than at the one star level. Some business hotels come into the two star
144 classification and guests can expect comfortable, well equipped, overnight accommodation,
145 usually with an en-suite bath/shower room. Reception and other staff will aim for a more
146 professional presentation than at the one star level, and offer a wider range of
147 straightforward services, including food and drink.

148

149

150 **3.2 Structural and non-structural Water Resource Management strategies adopted**

151 Water resource management requires adoption of a variety of strategies both structural and
152 non-structural so as to maximize the benefits. Singh and Cloude [8] reported that by
153 adopting such modern water resource management methods, hotels in Barbados and St.
154 Lucia could reduce water consumption by an amount sufficient to accommodate anticipated
155 rates of growth in the industry over the next 20 years, without a net increase in water
156 consumption.

157

158 From the interview sessions with the staff of water management bodies revealed that hotels
159 within the environs of Lake Naivasha complied in the effort to sustainably manage water.
160 Key informant 3 indicated that practicing rainwater harvesting is a widely recommended
161 structural WRM strategy to hotels to promote water sustainability. From the study results, it
162 was evident that the main structural water resource management strategies adopted by the
163 hotels within the study area was the development of alternative water resources like
164 harvesting of rainwater and drilling of boreholes (66.7%) and installation water saving
165 gadgets (59.9%).
166

167 According to Rainwater Connection [9] rainwater harvesting is an effective method of
168 building freshwater. This involves collecting rainwater from roof and gutter system,
169 transporting it via downspouts and piping to cistern tanks, filtering and then storage.
170 Rainwater tanks collect rain water directly or surface run off so that no water is lost. A report
171 for International Centre for Responsible Tourism ICRT by Goodwin [10] indicates that Hilton
172 hotel, Madagascar and Marriott Hotel, India have rain water storage tanks for monsoon
173 rainwater collection which has been successfully used directly for irrigation, flushing toilets,
174 within air con systems or treated for drinking.
175

176 In tourism, water is an important commodity that ensures the successful operations within
177 the hotels and other hospitality facilities especially in the catering and accommodation
178 sectors. Any accommodation facility that aims at any success has to develop alternative
179 water resource and manage them. Literature reviews, coupled with field observation,
180 revealed that the two main alternative water sources that could be developed and used
181 include harvested rain water and water from sunken boreholes. Having an alternative source
182 of water for a hotel or restaurant would ensure that if the main source of water such as taps
183 are interrupted, water would still be available in the hotel and common embarrassment due
184 to lack of water avoided. Rainwater tanks which collect rain directly and as surface run off
185 ensures that no water is lost.
186

187 To complement the use of rainwater, installation of low flow facilities can be valuable cost
188 effective methods of substantially reducing water consumption. Study findings also revealed
189 that having water saving gadgets is preferred much as a structural water resource
190 management strategy where 59.2% of the respondents indicated to have implemented in
191 their respective hotels. A study by Environment Canada [11] indicted that the top three
192 facilities that consume the largest volume of water in a hotel are showers (35%), toilets
193 (30%), cleaning and laundry (25%). These gadgets include depressible sink taps, low water
194 volume flush toilet and low pressure showers that use less water and among others. All
195 these gadgets are designed to at least reduce the normal water consumption by a great
196 percentage if implemented and well maintained. Installing efficient toilets and shower heads
197 can reduce water consumption by 35% [12]. A report on hotels in Barbados and St. Lucia
198 indicted that guest rooms are fitted with water conservation devices and as such
199 showerheads have flow aerators, and there are low flush toilets in. These devices were fitted
200 two and one-half years earlier and there were dramatic reductions in the water consumption
201 when the devices were installed. Changes totaled about 10,000 gallons in one month [8].
202

203 Treatment of waste water and later recycling were the other structural water management
204 strategies where 18.5% and 11.1% respectively of the sampled hotels had adopted to lower
205 costs in implementation. Many hotels use less than 5% for cleaning food and drinking. Water
206 that has been treated and recycled is viable for the majority of other uses. Reuse of water for
207 other areas such as irrigation makes water useful twice. Findings by Goodwin [10] revealed
208 that Le Sport Hotel in St Lucia wastewater recycle system saved 1 million gallons per year.
209 This therefore guarantees clean and consumable water in the taps of the residents in these
210 countries and tourist destinations. However, the current study established that a majority of

211 hotels in Kenya are yet to embrace the technology of converting waste water from sewers
212 back to the taps to be drunk by humans. The main water resource that the country depends
213 on is rivers and when they dry up, a water crisis of often looms. Other sources are
214 boreholes, lakes and others that can be threatened especially in these times of severe
215 climate change.

216

217 Reusing of waste water for irrigation and cleaning was mentioned as a structural strategy of
218 water resource management by 14.5% of the respondents. Recycled water is a valuable
219 resource. Instead of being thrown away, appropriately treated water can be recycled and
220 used a second time to reduce the demand on high quality freshwater sources and improve
221 environmental water quality. Water recycling increases the available supply of water and
222 enables greater human benefit to be achieved with less freshwater. Therefore, water
223 recycling can make a substantial contribution to meeting the world's water needs and to
224 lessening mankind's impact on the world's water environment [13]

225 This strategy in the study area and in Kenya as a whole is still at its introductory stage
226 although reusing of waste water has made a contribution in drastically reducing operating
227 costs and improved the environment by ensuring the vegetation is well watered and facilities
228 are clean. Within the study area, results indicated that 81.5% of the sampled hotels
229 registered a reduction of the water bill while 66.6% indicated an overall increase in water
230 supply.

231

232 **3.3 Perceived effectiveness of the structural water resource management strategies**

233

234 From the study results 40.7% of the respondents perceived the structural water resource
235 management strategies as being very effective while a further 29.6% rated the strategies as
236 being fairly effective as indicated by the reduced water bill. Indeed, 81.5% of the sampled
237 hotels reported to have reduced their water bill by between 25-50%. Any business or
238 enterprise has an inbuilt mandate of reducing its general operating cost. In the wake of
239 global economic crisis, every business enterprise always seems to reduce operating costs.
240 Goodwin [9] reveals the applicability of such measures where for example Hyatt Regency
241 Sanctuary Cove installed low flow showerheads in guestrooms, reducing consumption from
242 27 litres to nine litres per minute and the Renaissance Reading Hotel in the UK adopted the
243 waterless urinals which saved hotel 81,440 litres per urinal per annum. This is very suitable
244 to the hotels in Naivasha because it would reduce pressure on the diminishing water
245 reserves thus ensure sustainability of water in the region would be ensured.

246

247 Studies performed globally on factors that influence the quest to sustainably manage water
248 resources more sustainably is cost rationalization due to increasing cost of utilities [14] This
249 fact is further confirmed by key informants interviewed who indicated that cost reduction is
250 the main reason that drives hotels to participate in water resource management. The larger
251 the operating cost, the lesser the profit and vice versa. This assertion is supported by the
252 sentiments of one key respondent who remarked that *In this era of global economic*
253 *hardship, every business venture and enterprise makes every effort to reduce cost and*
254 *increase profit.* The structural water management strategies according to the key informants
255 may have a longer payback period but are most effective in reducing operating cost, thereby
256 increasing the profitability of the hotels.

257

258 Key informants further indicated that improving water quality was a major reason for hotels
259 to be involved in WRM. It was also clear that the declining water quality was a challenge
260 experienced by hotels in the study area. Therefore, an effort to improve the water quality is
261 what motivates most hotels in the study area to engage in WRM. Another reason was
262 compliance with the laid down laws which relate to water and its management. NEMA was

263 the body charged with the responsibility of ensuring that the environment is properly
264 managed has the mandate of overseeing the implementation of some of these laws.
265

266 Reuse and recycling of waste water for irrigation and cleaning was however adopted by less
267 than 15% of the sampled hotels despite other studies showing cases of success. For
268 example in the water recycling and re-use scheme that was installed at Homebush Bay in
269 Sydney, Australia where the Sydney Olympic Games were staged up to 7,000 m³ per day of
270 recycled water from storm water and treated wastewater sources, was re-used for toilet
271 flushing in sporting venues, irrigation of open space areas, and was also supplied to 2,000
272 residential houses for gardens and toilet flushing. Through the adoption of microfiltration and
273 reverse osmosis treatment processes which was used to achieve the required water quality,
274 the scheme reduced demands on Sydney's freshwater supplies by about 850,000 m³ per
275 year [15].
276

277 **Perceived effectiveness of the non-structural water resource management strategies**

278 Information in the hospitality industry is a key factor in ensuring sustainable management of
279 water resources. This can be done through launching a responsible business programme to
280 staff and solicit feedback. maintain staff awareness of the programme through regular
281 meetings, posters and information on notice-boards encourage motivation through
282 competitions, suggestion boxes and reward staff for successes each month [16].
283

284 In this study, the results indicate that provision of water saving manuals to guests and
285 employees was adopted by 85.2% of the sampled hotels. This strategy involves educating
286 guests and employees about saving water through provision of printed literature and
287 awareness meetings to explain what the hotel is doing to reduce water use and how they
288 can participate in the effort to save water resources. A study at Yokohama Grand
289 Intercontinental Hotel Japan between 1992–1996 reduced water uses by 28% despite a 26%
290 higher occupancy through setting up green teams among the workers which would meet
291 and discuss issues and progress and ensure implementation of water resource management
292 strategies as part of the green measures within the hotel [10]

293 The effectiveness of this strategy is confirmed by 85.2% of the respondents who reported a
294 reduction of the water bill by a range below 25%. The key informants within the water
295 management bodies interviewed support this view that hotel guests should always be
296 reminded of water conservation through awareness creation since this approach is cost
297 effective and customer friendly.
298

299 Raising the awareness on proper waste disposal was also cited in the research as the
300 second most preferred non-structural strategy of water resource management by 48.1% of
301 the respondents. Proper waste disposal ensures that the environment which is important in
302 the tourism industry is not destroyed. Improper waste disposal will lead to environmental and
303 ecological degradation. In order for environmental sustainability to be ensured, proper waste
304 disposal methods have to be utilized in the tourism industry. Other non-structural strategies
305 considered in water resource management included conducting preventive water loss
306 maintenance (26.0%), setting water use targets (18.5%) and water use monitoring and audit
307 (14.8%) which the study established were not widely implemented.
308

309 The non-structural WRM strategies are generally cheaper and easier to implement when
310 compared to the structural strategies but can be instrumental in ensuring that the
311 sustainability of water is ensured in the tourism and hospitality industry. The importance of
312 water in the tourism industry cannot be over-emphasized and every effort to conserve it is
313 highly appreciated. When a water resource is properly managed, the operation costs of the
314 tourism and hospitality establishment will be reduced. A proportion of 59.3 % of the
315 respondents in the study area contended that the non-structural strategies reduced water

316 bills while 40.7% of the respondents had not experienced any change. Therefore it is evident
317 from that non- structural strategies are not very effective since 85.2% of the respondents
318 registered a change in the water bill below 25%. The key informant 1 interviewed argued
319 that this could be due to the fact that such strategies are based on a conscious human effort
320 which may not be very attractive to guests who have booked the hotels to enjoy the comfort
321 that their money can buy and the workers who lack awareness may not to be committed to
322 water related issues. Schahn and Holzer [16] agree that a number of personal attributes
323 which would appear to be linked to environmental actions and behavior which includes
324 gender, age and educational level which may limit the adoption of such strategies.
325

326 **3.4 Comparison of the effectiveness of structural and non-structural Water Resource** 327 **Management strategies** 328

329 Structural strategies are optional technologies that enable recycling, reuse, conservation,
330 and treatment of water which is aimed at reducing water loss and wastage among water
331 users. Structural measures follow a particular structure stipulated by the organization and in
332 comparison are more expensive to implement when compared to non-structural measures.
333 Water conservation is crucial and important to a tourism establishment for example a hotel
334 because water is an essential commodity. The availability of water to a hotel or a restaurant
335 is important because it ensures the operations in catering, hygiene, entertainment and
336 others are successful. Treating of waste water reduces the need of requiring new fresh water
337 thereby reducing the operating cost in the long run.
338

339 Non-structural measures on the other hand refers to policies, awareness, knowledge
340 development, public commitment, and methods and operating practices, including
341 participatory mechanisms and the provision of information, which can reduce water use.
342 The non-structural strategies adopted according to the findings of the study shows that the
343 most widely implemented strategies included provision of water saving manuals to guests
344 and employees, awareness on proper waste disposal, conducting preventive water loss
345 maintenance, setting water use targets and water use monitoring and audits.

346 In this study, the researcher sought to establish how the respondents compared the two
347 options on their effectiveness in addressing the challenges related to water resources. The
348 results obtained from the comparative views shows that 70.4% of the respondents viewed
349 the structural strategies as being more effective compared to a 29.6% who indicated rating
350 the non- structural strategies as being more effective. This is further supported by the
351 outcome of the two options on the percentage reduction in the water bill where 81.5% of the
352 sampled hotels achieved a reduction of between 25-50% contrary to the 85.5% of the
353 sampled hotels which attained below 25% reduction in the water bill through use of non-
354 structural strategies.
355

356 The non-structural measures or strategies do not possess a particular structure and are
357 much easier and less expensive to implement when compared to structural measures.
358 Making the public to commit themselves to water resource management is an uphill task as
359 some people are generally wasteful of water. This is made possible by constant
360 enlightenment of the general public on issues of water and the dangers of the crisis related
361 to the same. Having proper policies that are water-related is an important non-structural
362 measure of WRM. Increasing awareness of the importance of WRM is probably cheaper
363 compared to recycling waste water. According to the study, the structural strategies of WRM
364 were having water saving gadgets, recycling waste water after treatment, reusing waste
365 water for irrigation and cleaning, developing alternative water resources and treatment of
366 waste water.
367

368 **4. CONCLUSION**

369

370 The study revealed that the major structural water resource management strategy preferred
371 in the area was the development of alternative water resources. This is appropriate because
372 overdependence on a single water resource may be jeopardized if it becomes
373 unsustainable. Other structural measures either adopted or recommended included having
374 water saving gadgets, recycling waste water after treatment, reusing waste water for
375 irrigation and cleaning and treatment of waste water.

376

377 The study also revealed that structural measures of water resource management are more
378 expensive to implement compared to the non-structural ones. The results revealed that the
379 main perceived effectiveness of the structural water resource management strategies
380 adopted have been that they reduce operating costs thereby increasing profitability. Other
381 reasons cited included reduction of negative environmental impacts, resolution of conflicts
382 with other water users and guest satisfaction. These strategies are important to the success
383 of the hotel and hospitality industry in relation to water resource management.

384 The non-structural measures included provision of water saving manuals to guests and
385 employees, awareness on proper waste disposal, conducting preventive water loss
386 maintenance, setting water use targets and water use monitoring and audits. Results on the
387 effectiveness of non- structural water resource management strategies indicate a minimal
388 impact on the water bill compared to the structural strategies. However they are cost
389 effective since they are cheaper to adopt but are more dependent on the guest, customer or
390 tourist for their effective implementation.

391

392 In conclusion, study results indicate that lack of finances and manpower are the main
393 setbacks to the implementation of structural and non- structural water resource management
394 strategies. This however can be addressed if cheaper water saving technology is made
395 available and finances can be sourced from donors. Other strategies would include water
396 imports from areas with surplus and legal redress where illegal water abstractors are
397 penalized. Formulation of better water resource management policies and increased
398 involvement of other stakeholder was also realized to an amicable solution to the setbacks

399

400

401

402 **COMPETING INTERESTS**

403

404 "Author declares that no competing interests exist."

405

406

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