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Shared risk and opportunity in water resources:

SEEKING A SUSTAINABLE FUTURE FOR LAKE NAIVASHA

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EXECUTIVE SUMMARY

Lake Naivasha is a freshwater lake in the Kenyan Rift Valley. It is unique in that it is home to both an internationally renowned environmental treasure as well as a blossoming agriculture industry that exports high value fresh vegetables and cut-flowers to European and English markets. The Lake is currently under intensive scrutiny over concerns about how its environmental integrity can be maintained whilst still supporting a valuable and growing economy and society.

Agricultural activity in the basin has expanded dramatically in terms of both the rural smallholder farmers in the upper catchment and the high value exported commercial horticulture around the Lake and this sector anchors a local economy that supports almost 650 000 people.

The two most valuable crops in the Naivasha basin are cut flowers and vegetables. The vegetables grown in Lake Naivasha contribute approximately KSh6.65 billion ($95 million) to the Kenyan economy. Whilst predominantly focused on producing for the local market, small-holders are increasingly able to access high value export markets through their association as "outgrowers" with the commercial vegetable farms. Kenya is also one of the world's largest exporters of cut-flowers and Lake Naivasha is at the heart of the nation's floriculture industry, accounting for more 70% (KSh 28 billion) of the country's cut flower exports.

The Naivasha basin involves a broad group of stakeholders including large horticulture companies and their employees, the outgrowers and small holders, local government and basin inhabitants, and those dependent on the broader Kenyan economy and trade.

For an agriculture based economy that is completely dependent on its water resources for economic production, the social, economic, financial (investment), regulatory and reputational risks associated with a deteriorating bio-physical environment are significant. Given its linkages to the national economy and the international export markets, these risks are not localized within the basin but extend through to the rest of Kenya.

The central aim of this paper is to articulate the risks for each of these groups and to highlight the commonalities between them, or in other works the shared risks between corporate, government and civil society stakeholders. In so doing, these stakeholders can recognize the incentive for a common consensus in mapping out a path to achieving improved water resource management in the basin and the future economic and environmental sustainability of Lake Naivasha.

It is important to recognize that the shared risk framework is not linear and does not fall within a conventional quantifiable cost-benefit metric. A reduction in abstraction for commercial farmers has knock effects in terms of employment, export earnings, livelihoods and social tensions. The manifestation of these risks is highly uncertain, but the implications are potentially significant.

Despite the experience of the recent drought, it is unlikely that the current water resources situation would cause such severe and sustained physical deterioration that major irrevocable economic impacts will be experienced in the local economy or that individual companies will fail financially, in the short term. However, it is highly likely that some level of local economic and corporate financial impacts will occur during crisis periods of drought, water quality deterioration and/or wetland degradation.

In the future, increasing urban - agricultural abstraction and increasing temperature - climate variability, is highly likely to impact on the recurrence and severity of crisis periods. Similarly, the already significant developmental pressures on this area will increase over time, due to population pressure and economic growth in the country as a whole. Lake Naivasha provides an important opportunity to support social and

economic development in Kenya in an ecologically sustainable manner, but these opportunities may be squandered without adequate engagement of the risks outlined in this paper.

Three areas of focus may be identified in responding to these risks and opportunities and should be expanded during the WWF convened session on 27th September 2010:

Risk mitigation requires improved institutional arrangements, to support a clear definition and management of the availability of water and the rules for its use in the different parts of the catchment.

Innovative partnerships between government, private sector and/or civil society organisations should be fostered to address problems in and around the lake.

Progressive horticulture companies should develop Naivasha specific water stewardship standards and gain both competitive distinction and reputational "immunisation" by gaining accreditation by a recognised body.

1 INTRODUCTION

Lake Naivasha is an internationally renowned Ramsar[1] site located in the Rift Valley in Kenya. But unlike most other Ramsar sites in Kenya, the water in Lake Naivasha also anchors a flourishing horticultural industry. Many stakeholders, from government to the private sector are concerned about the future sustainability of the Lake. A simple Google news search on "*Kenya's Lake Naivasha*" finds a collection of headlines that mostly place the blame for the Lake's perennial "imminent ecological collapse" on the shoulders of the seemingly all-powerful cut-flower industry surrounding the Lake.

Yet this is a far more layered story than the headlines imply. It extends well beyond that of a single focus on the impact that the export horticulture industry has on the Lake's ecology. Lake Naivasha is at the confluence of a range of political and economic pressures that influence and are influenced by decision making that takes place outside of the boundaries of the Lake itself. It is only through extending the focus on the Lake to its linkages with the local, national and international political economy that common ground can be found in identifying and agreeing on what can be done to ensure the Lake's long-term social, economic and ecological sustainability.

Its economic impact stretches from the job markets of migrant labour seeking work on the shores of the Lake and the household incomes of small holder farmers in the upper catchment, through the economic base of the local economy and the tax & foreign exchange revenues generated for the Kenyan government, to the purchasing decisions of the major English (and European) supermarkets and the dividends sent to internationally-owned commercial agri-business.

In turn, there is a feedback loop from the international economy back into the economy of the Lake. The supermarkets respond to the purchasing decisions of their customers, which are informed by their perceptions of a range of issues from the environmental sustainability of the Lake, to labour rights and food miles. The profile of Lake Naivasha as a premier tourism destination strengthens these perceptions of European travellers.

1 Second Ramsar site in Kenya; Ramsar Site No 724 designated in 10th April1995

The Lake also cannot be viewed in isolation from the political economic context of the basin in which it resides. The water that flows into Lake Naivasha passes a growing population and emergent smallholding farmer group that have an influential local and national political voice. The proximity of the lake to Naivasha means that it is also the location of the second homes and absentee farms for some of Kenya's political and economic elites.

Figure 1: Lake Naivasha in the news

Water is a shared resource and many stakeholders may lay claim to it. The water used by small-holders to flood their crops in the catchment north of the lake may be perceived as a direct opportunity cost to the commercial farmers on its shores that demand that water for their roses, and vice versa. The discharge of municipal waste water and irrigation return flow poses threats to the water quality in the lake. The direct use of lake riparian wetland areas for the cultivation of horticulture, cattle ranching and game during drought periods may be perceived as having detrimental consequences for the lake's ecological functioning as an important RAMSAR wetland. The lake environment and water resources can therefore not be separated from the local and national political economy, nor should the importance of water governance and institutional arrangements be ignored.

There are significant medium-term economic and social risks to Kenya, the flower industry and local residents. These arise from the primary risk of deterioration of the lake's water quality, quantity and ecosystems, leading to secondary risks such as reputational loss, withdrawal of existing investments and loss of future investment potential. This has potential consequences that include loss of jobs, loss of foreign exchange earnings and (maybe as important) withdrawal of those investors in the basin that are considered forerunners with state-of-the-art environmental and social practices. It is therefore of utmost importance that the government, business and civil society stakeholders have an appropriate and constructive response to the threats at hand, based on a vision that provides for long-term attractive economic, social and environmental perspectives.

This shared risk lens brings into simultaneous focus many of the tensions between politics, economics, institutional capacity, local governance, development priorities and investment decisions. In particular it highlights the way in which they all come together to inform the decisions that determine water use and protection, which will ultimately determine the long run sustainability of the Lake.

The purpose of this study is to bridge the understanding of environmental concerns with the economic, social and political ramifications of the Lake's current and future water use. This report does not seek to revisit discussions regarding the causes of fluctuating water levels or the hydrology of the lake or the scientific underpinnings of the Lake's ecosystem's health. Rather, it introduces the economic contribution that the Lake and its surrounding basin makes to the local and national GDP as well as identifies its linkages to important and lucrative export markets abroad. It also adapts the water footprint framework to show how water use in the basin can be viewed in terms of economic value and job creation. The information presented here was collected via a desktop study of academic and other research materials, as well as through interviews with multiple stakeholders during a site visit to Nairobi and Naivasha in August of 2010.

2 PHYSICAL DESCRIPTION

Lake Naivasha is the only fresh water lake situated in the Kenyan Rift Valley, approximately 80km to the northwest of Nairobi, Kenya's capital city. The water remains fresh predominantly because of the seepage out of the lake to other lakes in the Rift Valley.

The Lake Naivasha catchment area is approximately 3 400 km² and stretches from the Aberdares mountain ranges in the north and north east to the Olkaria, Longonot, mountains in the south and south east. It is bounded by the Mau escarpment in the west, Eburru to the North and the Kinangop plateau in the East.

The mean annual temperature in the basin varies with altitude, ranging from 25˚C on the shores of the Lake (1890m asl) to 16˚C in the Aberdares mountains, with daily temperatures ranging from 5˚C to 25˚C.

The Aberdares mountain range casts a rain shadow over the rest of the basin, collecting moisture from the trade / monsoon winds. The average rainfall in the basin ranges from 1350mm in the Aberdares mountains to 600mm on the shores of the lake. Rainfall is bimodal and is distributed between two rainy seasons in April – May (long rains) and October- November (short rains). Most of the upper parts of the catchment are considered semi-humid and are suitable for rain-fed agriculture, whereas the area around the lake is classified as semi-arid.

The lake itself is located in the south east of the basin and consists of three lakes; the main lake, Olodien and Sonachi. Sonachi is in the south west is separate from the main lake. Olodien is in the south of the lake and depending on lake levels can either form part of the main lake or be separate.

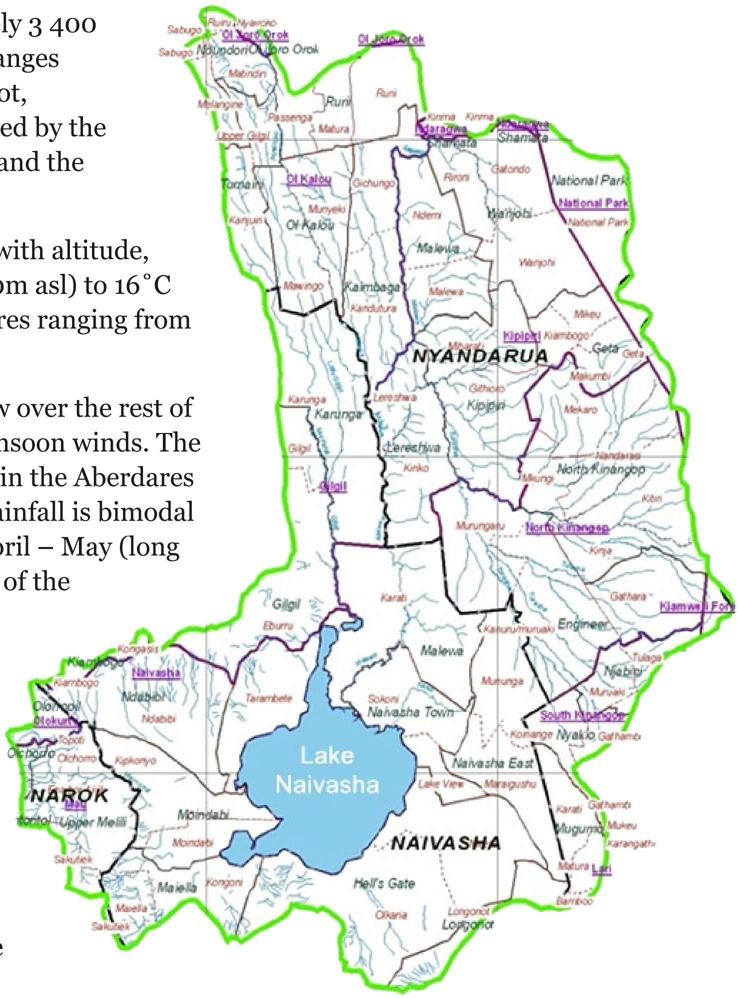


Figure 2: The Naivasha basin

3 ECONOMIC ACTIVITY AND LAND USE IN THE NAIVASHA BASIN

There is a wide range of agricultural land user in the Naivasha basin, ranging from traditional pastoralists to subsistence and small holder farmers, through dairy and beef farmers to high-tech international commercial vegetable and cut flower farming.

The Lake itself is internationally renowned because of its biodiversity and natural beauty, which attracts thousands of local and international tourists. In the south of the Lake, close to Hell's Gate National Park, geothermal steam is harnessed to drive electrical turbines, which then contribute electricity to the national grid.

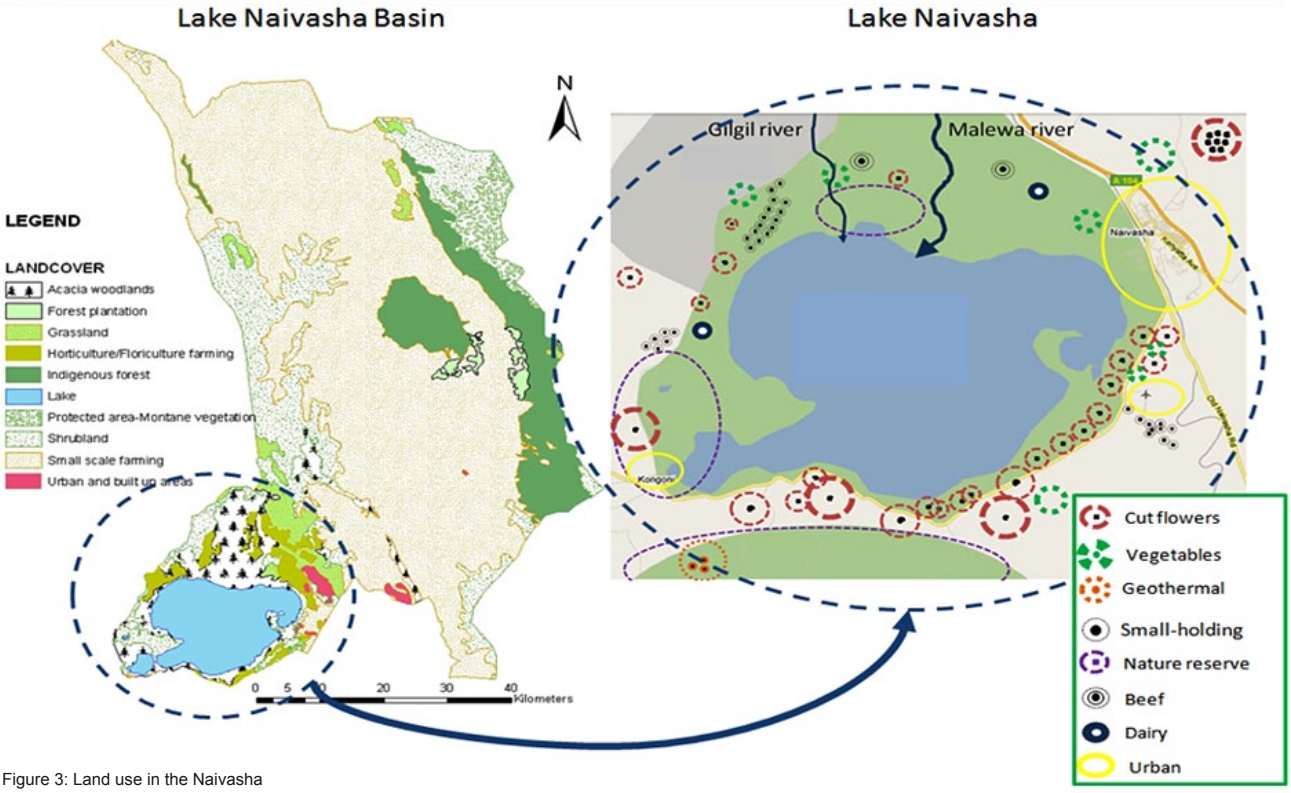


Figure 3: Land use in the Naivasha

When attempting to understand the water stresses of Lake Naivasha, it is tempting to only focus on the lake itself and its immediate surrounds (as has the media). However, in order to get a full picture of the ecological, social and economic stresses of the lake, it necessary to look at the water and land use of the entire basin (including the upper catchment) and how it links to the Kenyan and international economy.

The first significant agricultural settlement of Lake Naivasha occurred in 1905 when a colonial agreement shifted the Masai from around the Lake to accommodate European settlements. For the next 80 years Lake Naivasha was an area of cattle and crop farming.

In the early 1980s a local vegetable farm decided to switch its production to cultivate cut-flowers and this decision changed the economic and environmental trajectory of the area forever.

As incomes in developed countries have increased, and transport and refrigeration technology has improved,

supermarkets in Europe have tapped into the agriculture sectors of developing countries such as Kenya to provide their customers with a year-round supply of fresh produce[2].

A combination of factors makes Lake Naivasha one of the best sites in the world to produce cut flowers and fresh vegetables. Its altitude and climate, its access to a reliable supply of high quality fresh water, low rainfall, fertile soils and its proximity to an international airport than can easily reach European markets has supported the development of Naivasha into what is now considered the heartland of Kenya's horticulture sector.

The upper catchment of the basin which has historically consisted of indigenous forest and open woodland has also experienced significant changes in land use over the past 50 years as the forest has been converted into rain-fed small holdings. This has had a direct impact on the water resources of the Lake.

The sub-division of the northern and eastern catchment has placed considerable pressure on its natural resource base. Given the small size of the plots, farmers are not ordinarily afforded the option of crop rotation and diversification and this has led to decreasing land productivity[3]. This is exacerbated by growing population pressures which lead to further sub-division and deforestation.[4]

This deforestation has had a marked effect on the hydrology of the basin as flows have become more extreme with intense flooding in the wet season and low volumes in the dry season[5]. This rapid runoff has led to higher rates of siltation, while water quality concerns have been further compounded by poor farming methods in the upper catchment. The use of fertilizers to improve crop production and the farming and overgrazing of riparian areas has increased siltation and nutrient loads. It is estimated that the Malewa and Gilgil rivers currently discharge approximately 7 million tons of sediment into the Lake each year. This reduces the depth of the lake and ecosystem functioning.[6]

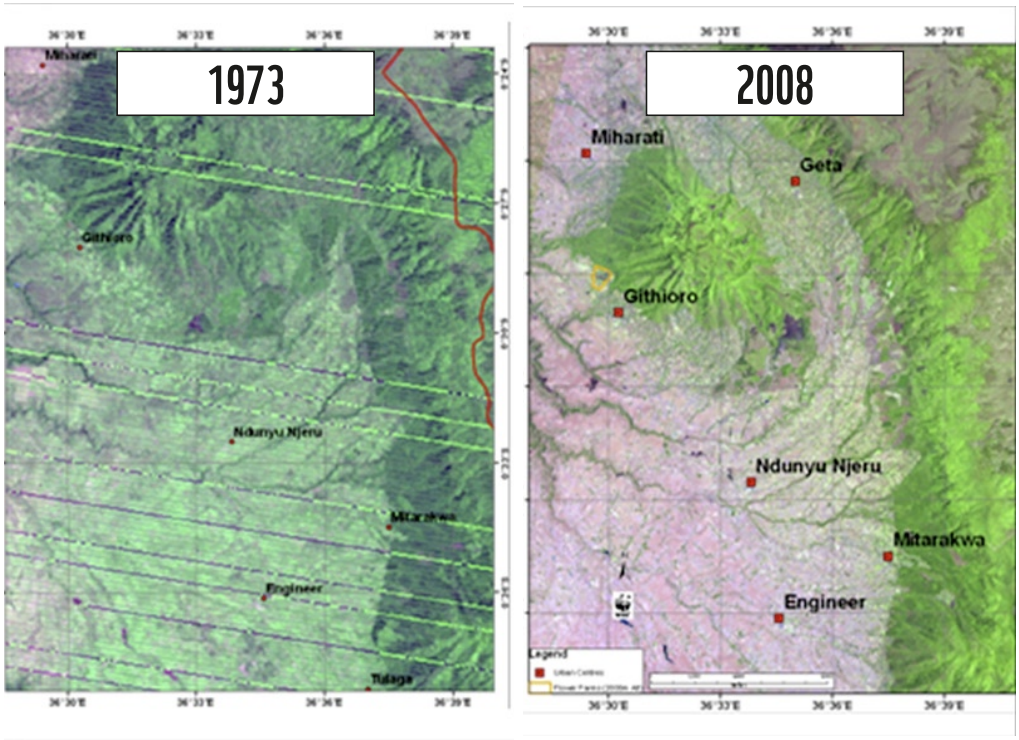


Figure 4: Indication of deforestation in the upper catchment

2 Tyler (2005?) 'Critical success factors in the African high value export industry" pp 2
3 Githaiga (2008) "Malewa basin land use planning guidelines"
4 Kut and Agevi (2007) "MFS linking futures, economic growth, poverty reduction and environmental sustainability" WWF EARPO project pp 20
5 Ibid pp 22
6 Otiang a Owiti and Oswe (2006) "Human impact on lake ecosystems: the case of Lake Naivasha,Kenya" in African Journal of Aquatic Science pp 83

3.1 POPULATION DISTRIBUTION

According to the recent 2009 census, the total population of the basin was estimated to be 650 000 people of which approximately 160 000 lived around the Lake itself. The basin has experienced significant population growth over the past 30 years growing from a base of approximately 237 902 in 1979[7]. In the decade between 1989 and 1999 (during the boom years of the horticulture industry), the population of the basin grew by 64%. In the past decade this population growth has slowed to approximately 13%.

The economy of the basin is anchored in the agricultural sector. The income earned from wages or from small-holdings is spent in the local towns. In each small town there are a range of small businesses that support the farmers and farm workers, be they agricultural lenders, mechanics, bars and restaurants or food stalls.

Figure 6 tells a revealing story about the population pressures on the Naivasha basin have been spread across the catchment. There are 28 urban settlements in the Basin with population ranging between 5 000 and 50 000. The five largest divisions in the basin are Hells Gate (64 000) Gilgil (45 000), Engineer (45 000), Naivasha Town (45 000), Kinangop North (40 000) and Ntundori (35 000).

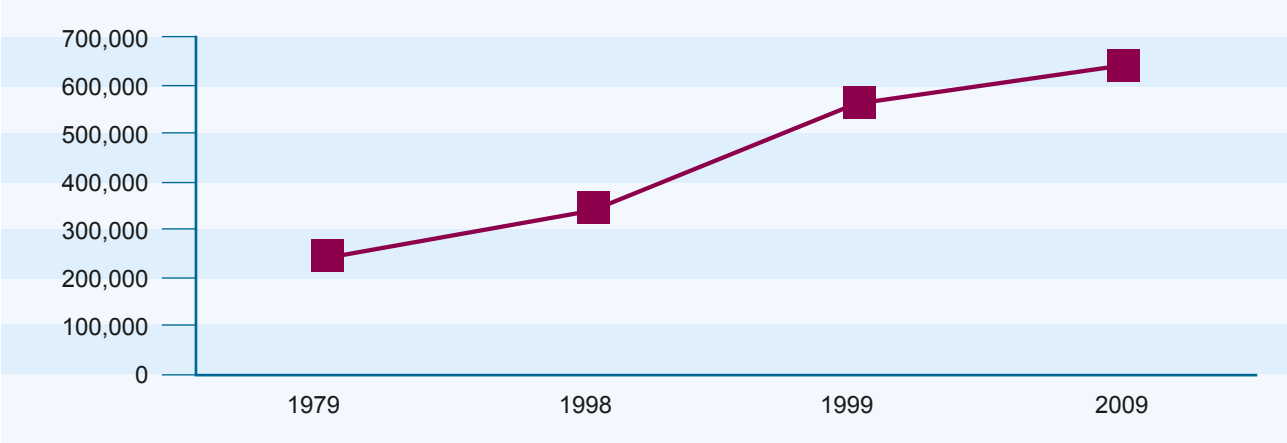


Figure 5: Population growth in the Naivasha basin (1979 - 2009)

The opportunity of earning a wage almost double that of the average per capita income, is a magnet for job seekers who migrate from the western parts of the country into the basin looking for work. Most of the commercial farms actually pay more than the minimum wage and provide auxiliary services and facilities such as clinics, houses, schools and sports facilities, making this even more attractive for migrants who have a high dependency ratio on their remittances.

A simple calculation that multiplies the minimum wage by the number of employed residents indicates that horticulture contributes at least KSh 3 billion in wages to the local economy, most of which is spent locally or a decreasing portion remitted back to workers' families in the impoverished western parts of Kenya.

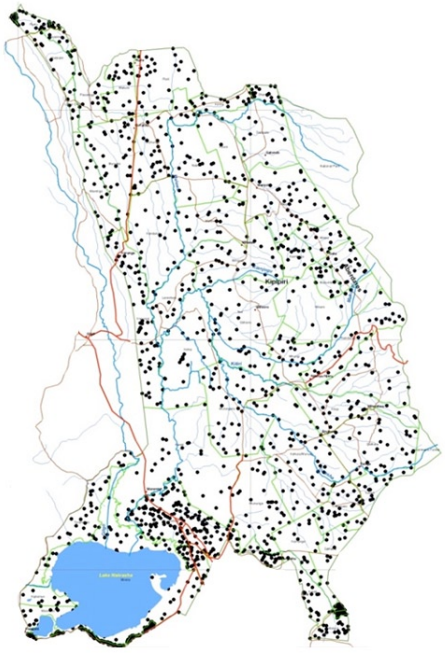


Figure 6: Population distribution of the Naivasha basin

7 Internal WWF / Market Econ report "Survey of Lake Naivasha basin – final report" pp 6

3.2 EXPORT VEGETABLE FARMING

Annual vegetable exports from Kenya have increased from approximately KSh2.5 billion in 1996 to approximately KSh 16 billion ($230 million) in 2008. Fifty five percent of this value is exported to the UK, 19% to Holland and 15% to France. It is generally accepted - and this is supported by local Horticulture Crop Development Authority (HCDA) - that the Naivasha basin accounts for 20% (KSh 3.2 billion or 16 500 tons) of Kenya's vegetable exports.

The overseas markets that the commercial farmers supply are highly dynamic and respond quickly to changing consumer patterns. Supermarkets overseas will supply farmers with their orders via email or phone each morning and most expect the product to be delivered within the next 24 -48 hours. Large retailers compete in a highly concentrated market (the six largest retailers in the UK account for 76% of fruit and vegetable sales) and they compete on the basis of quality, year-round availability, product range, presentation, packaging and innovation.[8]

Figure 7: Vegetable sorting at Lake Naivasha

Vegetable farming in Naivasha is highly labour intensive. Vegetables have to be picked, sorted and then sent to Nairobi for packaging. There is a growing demand for pre-packed "ready-made" vegetables in the overseas supermarkets and this category accounts for 29% of the value of Kenyan vegetable exports. The exporters have responded by establishing packhouses next to the Nairobi airport. It is estimated that average productivity of Kenyan workers in the export vegetable industry is between 1.4 -2.1 tonnes a year.[9] This would imply that vegetable production from Naivasha contributes about 5000 jobs in the Nairobi packing industry. This is supported by a study by Dolan (2004)[10] indicated 50% of employment related to vegetable production is found on the farm whilst 50% is found in the packhouses.

In Kenya vegetables grown for export are produced by both smallholders and commercial farmers. Although commercial farms and the major exporters have had an increasing share of Kenya's total vegetable export market, they have started establishing "outgrower" schemes over the past decade which have enable smallholder farmers to gain access to more profitable, export-orientated supply chains. During 2008, a small-

8 Humphrey et al (2004) "The impact of European market changes on employment in the Kenyan horticulture sector" in Journal of International Development vol 16 pp 64
9 Ibid Humphrey et al ,pp 73
10 Dolan (2004)"On farm and packhouse: employment at the bottom of the global food chain" in Rural sociology, pp 114

holder participating in the Kenya Horticulture Development Programme was expected to earn an average of KSh 80 000 growing fruits and vegetables for the export market.

It is estimated that there are approximately 5000 smallholder farms associated with the commercial farming / export vegetable industry in the Naivasha basin. They have an average cultivated size of five acres and the vast majority are located in the upper catchment, which implies a total area of about 10 000 ha under cultivation.

Figure 8 provides a breakdown of prices of vegetables for the domestic and export markets[11]. It is clear that vegetables grown for the export markets earn significantly more money per a kilo of produce than those grown for domestic consumption, although the domestic vegetables typically have a greater yield per hectare. Anecdotal evidence in August 2010 indicated that the French beans were earning KSh 65 per kilo at farm; a significantly higher return than that of cabbages grown for the domestic market, but only a fraction (<20%) of the export market value.

Domestic Market	KSh/ kg	Export Market	KSh/ kg
Potatoes	17.4	Fine beans	448
Tomatoes	62.1	Mange tout	484
Cabbage	12.2	Sugar Snap peas	386
Onions	53.7	Green chillies	453
Kale	16.6		

Figure 8: Prices for domestic and export vegetables

Nevertheless, this offers small scale farmers the opportunity to earn significantly higher incomes by leveraging the land and labour of their household.

There are a range of estimates about how much of Kenya's export horticulture and vegetables are grown by smallholder farmers. Dolan and Sutherland (2002) suggest that the smallholder's share of export vegetable production is as low as 20% whilst the HCDA (supported by anecdotal evidence from farmers interviewed in the Naivasha basin) indicates that is about 40%. Based on 'at farm-gate" prices this would imply that the smallholders in the catchment would earn approximately KSh 480 million ($ 7 million) for their export vegetables.

An HCDA/ US Aid study shown in Figure 9 indicated that there has been considerable growth in the production of Kenyan outgrowers between 2001 and 2007. French bean production which are the most popular single exported vegetable crop from Kenya grew from 16 000 tons in 2001 to more than 46 000 tons in 2007.

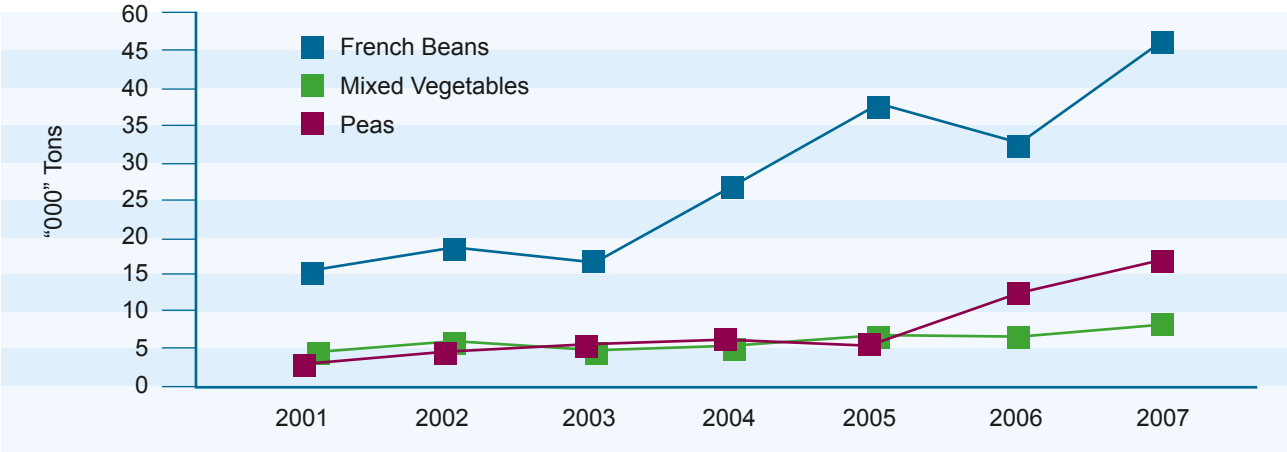


Figure 9: Change in outgrower production (2001 - 2007) Source: http://www.agrifoodstandards.net/en/filemanager/active?fid=135

In these schemes, outgrower groups are established with between 10 and 15 independent small-holders that are provided with seeds and technical assistance to grow a range of export quality vegetables such as beans, sugar snaps and mangetout. Each outgrower group is responsible for the management of its own cooling shed in which the vegetables are stored and graded before being collected and transported through to Nairobi by the commercial farming partner, where it is packed and then sent overseas.

In this way the commercial farmers are able to ensure that the produce of the small-holders is acceptable to the quality and food-safety requirements of its international clients, whilst managing the production cycles of their outgrowers by advising on crop rotations and other technical support. By adjusting the production cycles of the outgrowers, the commercial farmers are able to respond as quickly as possible to changing consumer demands overseas. The commercial farmers have the benefit of lower input costs as they don't have to invest as much into land and labour as they do in running their own farms.

By joining these co-operatives and getting technical support from the commercial farming operations (and NGOs in some instances), the small-holders are able to shift from a subsistence livelihood to one with more stability and higher earnings. Historically, in the absence of this assistance, the small-holders have not been able to co-ordinate to produce at a sufficient scale, at a suitable quality or in an adequately responsive manner to be attractive to the more lucrative international markets.

3.3 VEGETABLE FARMING FOR DOMESTIC CONSUMPTION

Despite the advantages of the export market, the vast majority of domestic fresh produce production (as much as 90%) is grown for local consumption in a national market worth approximately KShh 50 billion ($700 million) a year[12]. In 2003 Kenya grew 4.35 million tons of horticultural products of which 6% to 7% was processed and only 4% was exported.

Muendo and Tschirley (2004) explored the value chain of Kenya's vegetable production between 1997 and 2001 and found that vegetables sold on the domestic market accounted for 52% of farm production, followed by on-farm consumption (36%) and vegetables sold on the export market (12%)[13]. They also calculated the mark-ups of these different market categories based on the farm-gate prices. On-farm consumption obviously had no markup, vegetables grown for the domestic market typically had an average mark-up of 150% and export vegetables had a markup of 300%. Farm gate prices can be used to calculate the contribution that vegetable production makes to the local Naivasha GDP, whereas the market prices can be used to calculate the contribution to the Kenya GDP.

These approximations can then be used to estimate the value of vegetable production of the Naivasha basin at both farm-gate prices and market prices, as presented in Table 1. The base figure used in this analysis is the market value of 40% of the export market attributable to small holder farmers under the outgrower programme (or KSh 1.28 billion), with all other figures being calculated from that.

Vegetable farming in the Naivasha basin is estimated to contribute about KSh 2.75 billion ($50 million) to the local GDP. Of this value, on-farm consumption accounts for about 35% and vegetables grown for the domestic market account for 37%.

12 Ayiejo, Tschirley and Mathenge (2008) "Fresh fruit and vegetable consumption patterns and supply chain systems in urban Kenya: implications for policy and investment priorities" pp 5

13 Muendo and Tschirley (2004) " Improving Kenya's domestic horticulture production and marketing system: current competitiveness, forces of change and challenges for the future. Volume 1: Horticultural production" pp 15

In terms of final market prices, vegetable production in the Naivasha basin contributes just over KSh 6.65 billion to the Kenyan GDP. Vegetables grown for domestic Kenyan consumption account for just under 40% of this value, while vegetables for export account for just under 50% of the total value of Naivasha vegetables.

Total Kenya vegetable exports at market price	KSh 16,129 million
Estimated Lake Naivasha vegetable exports at market price	KSh 3,200 million

Value add Naivasha	Volume share	Total mark-up	On farm Prices KSh million	Market Value KSh million
Small holders				
- On farm consumption	36%	0%	950	950
- Sold domestically	52%	150%	1,000	2,500
- Sold on export markets	12%	300%	320	1,280
Total small holder production	100%		2,270	4,730
Commercial vegetables for export	100%	300%	480	1,920
Total vegetable production			2,750	6,650

Table 1: Estimated vegetable production for the Naivasha basin

3.4 CUT-FLOWER FARMING

The flower farms surrounding the Lake growing 1 900 hectares of cut-flower of which 1 200 are grown in greenhouses. Roses make up about 75% of Kenya's annual agricultural production, followed by mixed flowers (8%), hypericums (3%) and carnations (2%).

During the 1990s cutflower was highly profitable for the Kenyan flower farms but increasing global and local supply has expanded at a faster rate than demand, putting more pressure on profit margins and investment decisions. Current cut flower production in Naivasha is estimated to be 60.8 tons. National production of cut flowers has trebled in the past 15 years.

The Naivasha basin accounts for 70% of Kenya's cut flower exports and generates approximately 9% or KSh27.8 billion (approximately US$ 400 million) of Kenya's total foreign exchange revenue. Mitiambo estimated that 45% of the revenue generated by a typical cut flower farm is spent on production costs at the farm. This would imply that the contribution of the floriculture industry to Lake Naivasha's local economy is approximately KSh 12.6 billion ($180 million). It is estimated that the flower industry employs approximately 20 000 people in Naivasha directly.

The Kenya Flower Council indicates that the floriculture industry represents 500 000 indirect jobs to Kenya through a variety of formal and informal industries such as transport, packaging, business suppliers, fertilizers, irrigation engineers, chemicals, consultants and auditors (or 350 000 indirect jobs associated with the Lake Naivasha flower industry). However, this may be an overestimate and based on a 50:50 split between local and national value add, the national contribution would be an additional 20 000 working in supporting industries outside of Naivasha.

The industry is highly capital and technology intensive and requires scarce managerial and technical skills. The establishment costs of setting up a flower farm in Naivasha are estimated to be as much as $500 000 a hectare. A typical commercial farm will have greenhouses, shade cloth, drip irrigation and hydroponics, cold storage facilities, packing sheds and refrigerated trucks. These capital costs create significant barriers to entry for the industry. The largest forty cut flower farms account for 75% of Kenya's cut flower exports.

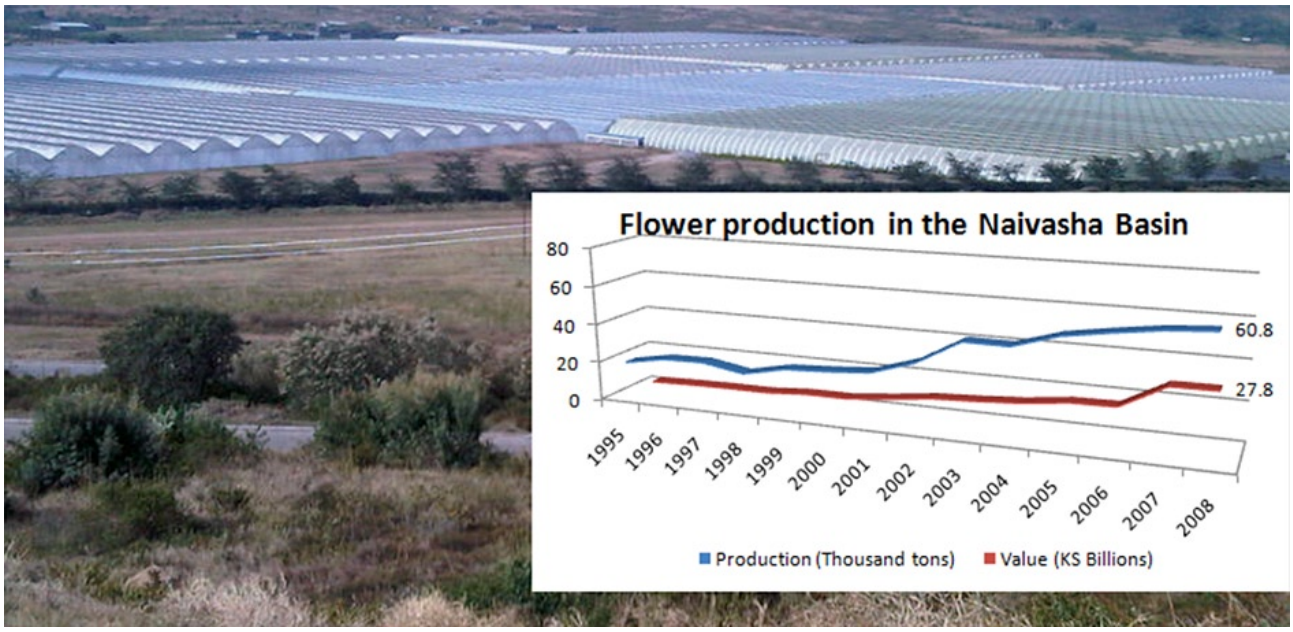
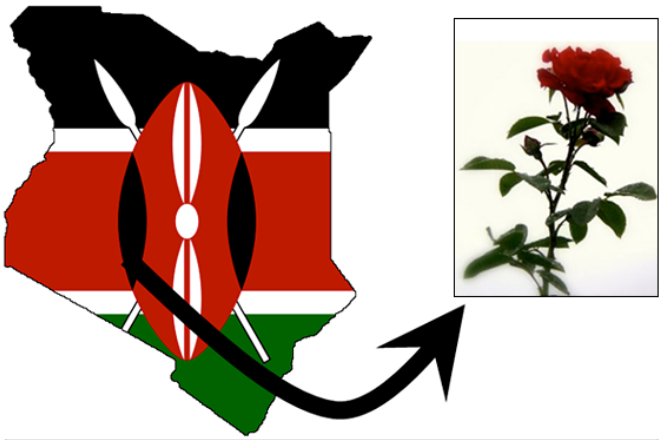


Figure 10: Cut flower production in the Naivasha basin (1995-2008)

An additional 4000 to 5000 small-holders, supply between 5% and 10% of the export flower market. However, if international buyers continue to become stricter about the health & safety standards, labour practices and environmental (& water) impact of their suppliers, the industry will likely become more concentrated as the smaller farmers will be unable to compete with these additional requirements.

The production of cut-flowers is highly labour intensive as each stem has to be picked by hand. Once harvested the flowers are cooled, packed and sent to a central freight forwarding point in Nairobi where they are flown to the European markets. Air freight is provided by four specialized airfreight services companies, 3 of which have links or are owned by the major flower farms.

Whilst the Dutch flower auctions remain the dominant purchaser of Kenyan flowers, some of the larger producers are able to negotiate higher margins by selling directly to the major supermarkets such as Tesco and Sainsbury. An average rose stem sold in the Aalsmeer auctions in Holland was worth KSh 21 in 2008 versus a rose sold in a UK supermarket which was worth approximately KSh 300. In 2008, Holland accounted for 51% of Kenya's cut-flower exports followed by the UK (25%) and Germany (9%).



Price per rose stem (KS)*		
Kenya export earnings	Aalsmeer Auction	UK supermarkets
8 KS	21 KS	300 KS

Figure 11: the price of a Kenyan rose
* Assuming that an average stem weighs 25 grams

3.5 GEOTHERMAL ELECTRICITY GENERATION

The first geothermal plant in Lake Naivasha became operational in 1982. The generation wells are located in the "Hells Gate" National Park about 7km south of the Lake shore, but obtain their water supply of about 1 million m^3 per year from the lake. There are currently 3 geothermal projects which have 128 MW of capacity and generated approximately 1039 GWh in 2008. This electricity accounts for 18.9% of the country's national power supply and was worth about KSh 2.8 billion ($40 million) in 2008.[14]

Given that so much of Kenya's electricity is generated from hydropower which loses capacity in time of low rainfall, geothermal's share of national electricity generation can be as high as 30%. If current rainfall trends continue, it is likely that geothermal energy will continue to take up a greater share of national electricity generation.

3.6 CONSTRUCTION AND MANUFACTURING ACTIVITY

Growth in the national economy and its proximity to Nairobi has led to an increasing amount of property development in Naivasha. High value residential property around the Lake ranges from approximately US$4000 to US$60 000 an acre. There are also three gated golf communities on the outskirts of the Lake. Based on similar local agriculturally based economies, this typically translates to construction and residential economic activity of about 5% of GDP.

3.7 TOURISM AND RESIDENTIAL ESTATES

Whilst Lake Naivasha accounts for a very small proportion of the total tourism industry in Kenya, it has a very high profile due its proximity to Nairobi and Nakuru. It has hosted two high profile international events, namely the Sudanese Peace Agreement (2005) and the constitutional negotiations that led to the recent Kenyan referendum (2010). The basin is bounded by the famous Aberdare National Park in the north and the Hell's Gate National Park in the south. There are several private nature sanctuaries bordering the lake, like Marula, Mundiu, Kongoni Game Valley and Oserian.

There are approximately 4 000 accommodation beds in Lake Naivasha that cater across a range of markets from international political and business delegations to truck drivers carrying freight to Uganda. Anecdotal estimates are that about 5% of all international tourists visiting Kenya (1.8 million in 2007) pass through Naivasha and that more than 2500 of the available beds were marketed towards domestic conference tourism. The total value of the tourism sector in Naivasha was estimated to be approximately KSh 600 million a year in 2010, which is relatively small (less than 5%) compared with the horticulture industry.

14 Kenyan Bureau of Statistics "Economic Survey 2009" pp 183

3.8 TRADE, SERVICES AND GOVERNMENT

Lake Naivasha is primarily an agricultural area with some tourism. Trade and services in this type of economy are typically located around towns and settlements, consisting of both formal economic activities and informal markets. National economic data was used to estimate private trade and services (over 30%), but this was estimated to account for about 25% of GDP in the Naivasha basin, due to the predominantly high value agriculture economy in this area. Sectors that fall under this category include wholesale and retail trade, transport and communication, financial intermediation, and real estate, renting and business services.

Government services contributed 13.7% of national GDP. This category includes public administration and defense, education and health and social work. Against this national average, government contribution to local GDP is typically in the order of 10%.

3.9 ECONOMIC ACTIVITY IN RELATION TO KENYA'S ECONOMY

Table 2 below provides a summary of some of the key economic indicators of the Naivasha basin. The Kenyan government collates its economic data centrally so there is no available economic activity at a district level. The data for Naivasha was collected from various industry and government sources like the HCDA and the Kenyan Bureau of Statistics.

Table 2 provides some important perspective about Naivasha's local economy in terms of its relationship with the Kenyan economy. It estimates the local GDP of the Naivasha basin and its contribution through value add to the national economy. It accounts for 70% and 20% of Kenya total cut-flower and vegetables exports and at least 10.7% of Kenya total export earnings.

Naivasha's local GDP may be estimates to be in the order of KSh 40 billion ($570 million) and its contribution to the Kenyan economy can be estimated to be at least KSh 59 billion ($ 830 million). GDP per capita was estimated to be KSh 62 500 a year compared to the national average of KSh 54 895.

	Naivasha			Kenya	
KSh Millions	Local GDP*	Contribution to Kenya GDP*	Contribution to export earnings	GDP**	Export
Flowers	12,600	27,800	27,800	39,766	39,766
Vegetables	2,750	6,650	3,200	62,000	16,128
Tourism & accommodation	600	600	< 200	23,755	
Construction & manufacturing	2,000	2,000		303,488	
Energy	2,800	2,800		30,805	
Trade & services	10,000	10,000		421,012	
Government	4,000	4,000		288,817	
Other	5,250	5250		612,364	266,706
TOTAL	40,000	59,100	31,000	1,852,263	322,600
Per capita income	62,500			54,895	

Table 2: Sectoral contribution to GDP in Naivasha and Nationally. * Own calculations ** Economic Survey 2009

The contribution of the agriculture sector directly accounts for about 40% of Naivasha's local economy. The majority of trades and services in the basin will be directly or indirectly linked to the agriculture sector; be it in terms of providing goods and services to the farms themselves or to supporting those that work on the land. Following this, the contribution of the agriculture sector to Naivasha's local economy is likely to be about 75%.

The Naivasha basin accounts for 1.6% of Kenya's total population and contributes at least 2.1% of its GDP. Naivasha is also clearly attractive from a jobs perspective. The formal employment to population ratio is about 8.3% as compared to the national average of 5.1%, and this does not include the self-employed on small holdings.

From Table 3, it is estimated that flower and vegetable production in the Naivasha basin provides a total of at least 75 000 jobs in Kenya (although this is a conservative estimate). This is split between employment opportunities on the farms themselves, to jobs further up the value chain (such as truck drivers and vegetable packers). The agricultural sector completely anchors Naivasha's economy and it is estimated that it provides further 25 000 indirect jobs in the basin.

	Direct jobs in Naivasha	Indirect jobs in Naivasha	Related jobs in Kenya	Total
Vegetables	5,000	5,000	5,000	15,000
Flowers	20,000	20,000	20,000	60,000
Total	25,000	25,000	25,000	75,000

Table 3: Estimated employment from vegetable and flower production in Naivasha

4 HYDROLOGY, WATER USE AND ECOSYSTEM FUNCTIONING

The following issues are various explanations by various stakeholders for the falling lake levels and decreases in the water quality:

- Abstraction from the lake by commercial flower growers and vegetable farms
- Increases in unregulated water abstraction in the upper catchment
- Increasing use of agro-chemical in the upper catchment as soil productivity declines
- Return flow of contaminants to the lake from horticulture
- Water transfer out of the basin via the Nakuru pipeline
- Deforestation in the upper catchment leading to erosion and siltation
- Excessive abstraction (both surface and groundwater) by commercial flower farms
- Natural fluctuations in water levels
- Climate change and reductions in rainfall
- Destruction of papyrus
- Invasion of the riparian zone by pastoralists, small-holders and commercial farmers
- Human waste discharge from growing human settlements

These are perceptions and opinions, rather than established facts, but all have some basis in reality. It is important to understand how people perceive the water problems in the basin if a consensus is to be reached on how to solve these problems. The debate surrounding what is a sustainable equilibrium level for the Lake is as much a socio-political question as a hydrological one. There needs to be agreement on the answer to this question before adequate water management planning and processes can be established. Any rate of abstraction will lead to a long-term steady state of lake levels, where the sum of the inflows into the Lake, outflows and evaporation is zero.

The current observed data indicates that the long term Lake level is 1886.9 m a.s.l. which implies a Lake size of approximately 140 km^2. If abstraction rates increase, this lake level will decrease. It is conceivable that even if the Lake levels drop to zero temporarily, the commercial flower farms will still be able to operate by pumping groundwater – however this steady state would not be acceptable to the environmentalist and riparian land-owners. Similarly, a steady state can be reached in which there is no abstraction in the Lake. This would cause lake levels to rise by approximately 3-4 m (with possibly improved ecosystem functioning), but would be unacceptable to the commercial farmers, Kenyan government and wage earners who are reliant on the water for their incomes.

4.1 LAKE AND CATCHMENT HYDROLOGY

Lake Naivasha is approximately 140 km^2 to 160 km2 and is fed by two perennial rivers, the Malewa and the Gilgil which contribute 80 % and 20% of the total inflow of the lake respectively. The Malewa comes from the north east and has a catchment area of approximately 1 700 km2 and has a daily flow of 20m^3/s. The Malewa's main tributary is the Turasha River which drains the Abedares range, Kipipiri Mountain and the Kinangop Plateau.

There are a range of other ephemeral rivers carrying stormwater runoff to the lake. The largest of which is the Karati, which flows for 2 months of the year and drains the area east of the lake. It only reaches the Lake in the high rains. The drainage from the west infiltrates before reaching the lake and there is not much runoff reaching the lake from the south.

Lake Naivasha is the only fresh lake amongst its neighboring lakes in the Rift Valley (Magadi, Elementia, Nakuru, Bogaria) despite it not having a surface outflow. This implies that the lake has significant subsurface outflow as there needs to be a constant flow to stop the buildup of mineral salts in the water. It estimated that the Lake holds approximately 680 Mm^3 of water but this level has fluctuated considerably over time.[15]

4.2 WATER LOSSES

Analysis of the groundwater flows indicate that the groundwater flows away from the lake to the north and south through a shallow, but thick and wide aquifer. This water loss accounts for 12% of the total natural water loss (between 18 -50 Mm^3) This shallow aquifer then drains into a deeper aquifer system which, over thousands of years, takes the water towards Lake Magadi, Lake Elementeita and Lake Baringo.

The vast majority of the natural water loss comes from evaporation. Naivasha is a shallow lake and its large surface area leads to a high rate of evaporation. In the past, there has been a relatively constant flow of water into the Lake, which has resulted in a relatively constant rate of evaporation. But land use changes and deforestation have caused the inflow into the river to peak and trough. During peak flood seasons, the Lake loses a disproportionately higher amount of water to evaporation, which means that there is less flow coming into the Lake during the dry season.

Table 4 presents a water budget for Lake Naivasha in dry, wet and average conditions. Water quantities and lake levels for Lake Naivasha increase during the wet seasons. There is significant variability in the inflows into the river depending on the rain conditions. Direct rainfall can range between 45 and 140 Mm3. This variability is also reflected in the water flowing in from the incoming rivers which can range from 60 to 460 Mm^3 - a significant difference. During the heavy rainfalls of 1997-1998, the water level of the Lake was reported to have increased by 3m.

The recorded levels of the lake have fluctuated considerably from a high of 1891 m a.s.l. to a minimum of 1882 m a.s.l. It is estimated that over the past 1000 years there have been four periods where the lake has almost dried up. There was a long term pattern of declining lake levels throughout the 20th Century, except for the period between 1955-1965 when this was reversed[16].

Evaporation from the lake surface accounts for about 60% of the average total water balance output from the Lake. The estimated abstraction rates accounted for between 10% and 20% of the total outputs. In July 2010, the Water Resources Management Authority completed its abstraction survey. The survey covered both the

15 Ibid Otiang-a Owiti and Oswe pp 82
16 Becht and Harper (2002) Towards an understanding of human impact on the Hydrology of Lake Naivasha, Kenya in Hydrobiologia (488)" pp3

Lake and the upper catchment. The preliminary findings indicate that 67 Mm^3 of water is abstracted from the Lake, whilst 37 Mm^3 is abstracted from the upper catchment. This would imply that previous approximations of water abstraction in the Lake have been significantly underestimated.

A water balance model has been developed to simulate different scenarios of water abstraction. It indicates that the maximum estimated abstraction in 2001 (5 Mm^3/month) is probably an unacceptable rate of abstraction as it sometimes breaches a lake level in which the surrounding ecology experiences an unacceptable level of stress. Clearly, there is a need to formally determine what the sustainable level of abstraction is, but these would require a broad consensus across a range of stakeholder groups.

Inputs	Wet conditions	Average conditions	Dry conditions
Direct rainfall over the Lake	140.8	72.9	45
Inflowing rivers (Gilgil, Karati and Malewa)	458.5	179.1	56.5
Ungauged watershed area	117.8	77.9	34.2
Seepage in	54	54	32
Total inputs	771.1	383.9	167.7
Outputs			
Evapotranspiration	38.5	26.7	21.9
Evaporation	229	183.5	177.8
Seepage out	54	54	32
Estimated abstraction	33.8	44.6	53.2
Total outputs	355.3	308.8	284.9
Balance	**415.8**	**75.1**	**-117.2**

Table 4: Annual water budget for Lake Naivasha (Mm^3) [17]

17 Ibid Otiang-a Owiti and Oswe pp 82

4.3 WATER QUALITY CONDITIONS AND ECOSYSTEM FUNCTIONING

The Lake faces a range of water quality issues stemming from increasing in nutrient loads such as nitrogen and phosphorous, increasing siltation and a growth in a level of pathogens and viruses from the inadequate treatment of sewage (either from the municipal sewage facility, surface runoff or through seepage from pit latrines). There is also increasing evidence of heavy metal (iron, cadmium and lead) and pesticide contamination[18].

The destruction of papyrus surrounding the lake due to the expansion of agricultural and human settlements has removed an important natural filter from the Lake which can also reduce siltation levels. This is compounded by falling lake levels, which open the riparian zones up for grazing by cattle and wildlife.

The decline in papyrus leads to increasing through flows from the catchment to the lake which brings in a higher proportion of sediments, nutrients and other organic material.[19]

It is estimated that the Malewa and Gilgil rivers discharge approximately 7 million tons of sediment into the Lake, of which 20% is estimated as being organic matter. Sedimentation reduces lake depth, destroys aquatic habitats such as fish breeding grounds and diminishes the flood control capacity of the Lake.

Overall, the water quality of the Lake does not seem to be deteriorating too drastically. There are however, two areas of concern, the Malewa mouth and Crescent Lake/ Oloiden lagoon. The Malewa mouth is experiencing an increase in nutrient load that has been attributed to the agricultural and human settlement activities in the catchment area. Oloidien water quality issues have been blamed on the direct agricultural and livestock activities taking place on the Lake shore. [20]

18 Ibid Otianga-Owiti and Oswe pp 82
19 Ibid 85
20 Lake Naivasha Water Resource Management Programme (2001)" Water status report (Main report)" pp15

5 WATER FOOTPRINT AND THE ECONOMIC USE OF WATER

The water footprint of a product estimates the volume of water that is indirectly or directly used to produce it, along its supply chain. The water footprint approach can also be used to estimate the indirect and direct water consumption of a catchment area, by summing up the individual water footprints of the products and the services that they consume.

This concept can then be applied to identify how water flows through the economy of a basin and a country. Its objective is not to just estimate the volume of water emebedded in the products of a particular area but to compare how different water uses contribute to economic activity and job creation.

For the purposes of this analysis, water footprint captures both the blue and green components of water consumption. A blue water footprint refers to the volume of surface and groundwater that is used for irrigation in the supply chain of a product (net abstraction less return flow), whilst the green footprint refers to the consumption of rainwater that is evapotranspired from soil moisture.

Mekonnen and Hoekstra (2010) have developed a water footprint for the Naivasha basin. It differentiates between crops grown around the lake and crops grown in the upper catchment. There has been some criticism about the accuracy of their water footprint for the upper catchment as it is dominated by tea and coffee which are crops that are not found in the area. They estimated that there were 43 241 hectares of crops in the upper catchment, which equates to about a 20% cultivated land for the approximately 200km^2 nominally under small holdings.

Kimenju and Tschirley (2008)[21] estimate the different shares of different crop categories in different zones of Kenya. These estimates were used to adjust Mekonnen and Hoekstra's data to make it more reflective of the actual crops in the upper catchment. It was estimated that the upper catchment held approximately 30 000 hectares of maize, 6500 of vegetables and about 4 300 of fodder.

These estimates of crop hectares were cross checked with the same process used to calculate the total value of Naivasha's vegetable production. It was estimated that Naivasha accounts for approximately 20% (16, 475 tons) of Kenya's 82 376 tons of exported vegetables. This accounts for a 12% share of total vegetable production which would mean that the Naivasha basin produces about 137 000 tons of vegetables a year. This implies that the average yield of the estimated 6500 hectares of vegetables grown would be approximately 21 tons a hectare. This compares favourably with Muendo and Tschirley's (2004) estimate of cabbage and tomato yields in Kenya which were found to be between 15 & 17 tons a hectare, given that this is a high rainfall productive area.

The resultant water footprint is presented in Table 5 below, which is largely derived from existing footprint analysis, but has been significantly adapted using other sources of information from the water use survey and personal communications. It also includes the blue water footprint of the water transfers to Nakuru, the annual abstraction for geothermal electricity generation and an estimate for residential water use.

21 Mekonnen & Hoekstra (2010) "Mitigating the water footprint of export cut flowers from the Lake Naivasha basin, Kenya" in UNESCO Value of water, research report series

Commercial Farms around the lake	Area (h)	Green WF (1,000 m^3)	Blue WF (1,000 m^3)	Total WF (1,000 m^3)
Flowers	1,911	3,640	31,388	35,028
Export Vegetables	1,824	7,887	16,644	24,531
Fodder	665	3,716	3,194	6,910
Total of commercial farms	4,400	15,243	51,226	66,469

Upper catchment	Area (h)	Green WF (1,000 m^3)	Blue WF (1,000 m^3)	Total WF (1,000 m^3)
Vegetables	6,500	20,181	7,118	27,299
Domestic market	5,720	16,808	-	16,808
Export market	780	3,373	7,118	10,491
Maize	30,000	87,824	-	87,824
Fodder	4,300	24,028	-	24,028
Total	40,800	132,033	7,118	139,151

Industrial and residential use	Area (h)	Green WF (1,000 m^3)	Blue WF (1,000 m^3)	Total WF (1,000 m^3)
Nakuru transfer			6,570	6,570
Domestic supply			10,745	10,745
KenGen geothermal abstraction			1,000	1,000
Total			18,315	18,315
Grand Total	**45 200**	**147,276**	**76,659**	**223,935**

Table 5: High level water footprint for the Naivasha basin

The total water footprint for the Naivasha basin is estimated to be 224 Mm^3. The green water footprint accounts for 65% of the total water footprint. Unsurprisingly, the largest share of green water (70%) was found in the rainfed agriculture of the upper catchment.

The total blue water footprint is estimated at about 77 million m^3, which, once losses are taken into account, corresponds well the estimates of water abstraction in the water use survey (about 280 Ml/day or over 100 million m^3 per year).

The blue water footprint for agriculture in the basin was approximately 58 Mm^3 of which 87% could be found in the commercial farming around the Lake. The blue water footprint for farming in the upper catchment was 8 Mm^3, but the assumption that only export vegetables are irrigated is does not reflect the information captured in the water use survey. In contrast, 77% of the Lake's water footprint is derived from blue water, related to irrigation.

6 INSTITUTIONAL ARRANGEMENTS

Through a combination of consumer and buyer pressures, the private sector has made some significant strides in self regulating water use in commercial farming operations. The Lake Naivasha Growers Group (LNGG) is a commercial farming body that has its own code of practice relating to water use and environmental impacts that its members have to follow.

Given the greater consumer awareness in the international markets, many of the supermarkets and buyers make it compulsory for the commercial farmers to follow the requirements of different certifications such as the EuroGAP, Fairtrade, GAP and the Tesco certification of compliance. These certifications put down certain standards in terms of water use, environmental standards, operational health and safety and labour relations. The certifications have been successful in reducing water use and improving water management behaviour such as requiring member farms to reduce water consumption by a set target every year.

There is a degree of replication as each certification has its own processes and standards and the commercial flower farms have to be audited for each one. The Kenya Flower Council manages a single auditing process that allows farmers to be certified for more than one standard.

These certifications are predominantly focused on what happens "within the farm gates" and, whilst successful at a micro level, are just not appropriate tools to enforce or encourage behaviour at a catchment level. Furthermore, it is clear that upstream small holder farming has an impact on the hydrology of the basin, which is largely not addressed by these certification processes.

To look at water resource management at a catchment level it is necessary to understand Kenya's legislative and institutional water management environment.

6.1 LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK IN KENYA

Kenya's water resource legislative framework is progressive. The Water Act (2002) places policy development under the Ministry of Water and Irrigation, which establishes and mandates the Water Resource Management Authority (WRMA) amongst other bodies to implement that policy in regard to water resource management. Prior to 2002 both policy and implementation fell under the ministry.

The Water Act separates water resource management and water services and supply into two different institutions, as indicated in Figure 14. The Water Act similarly delinked water services and supply to 117 water services providers that are managed by 8 water services boards. These are managed by the Water Services Regulatory Board.

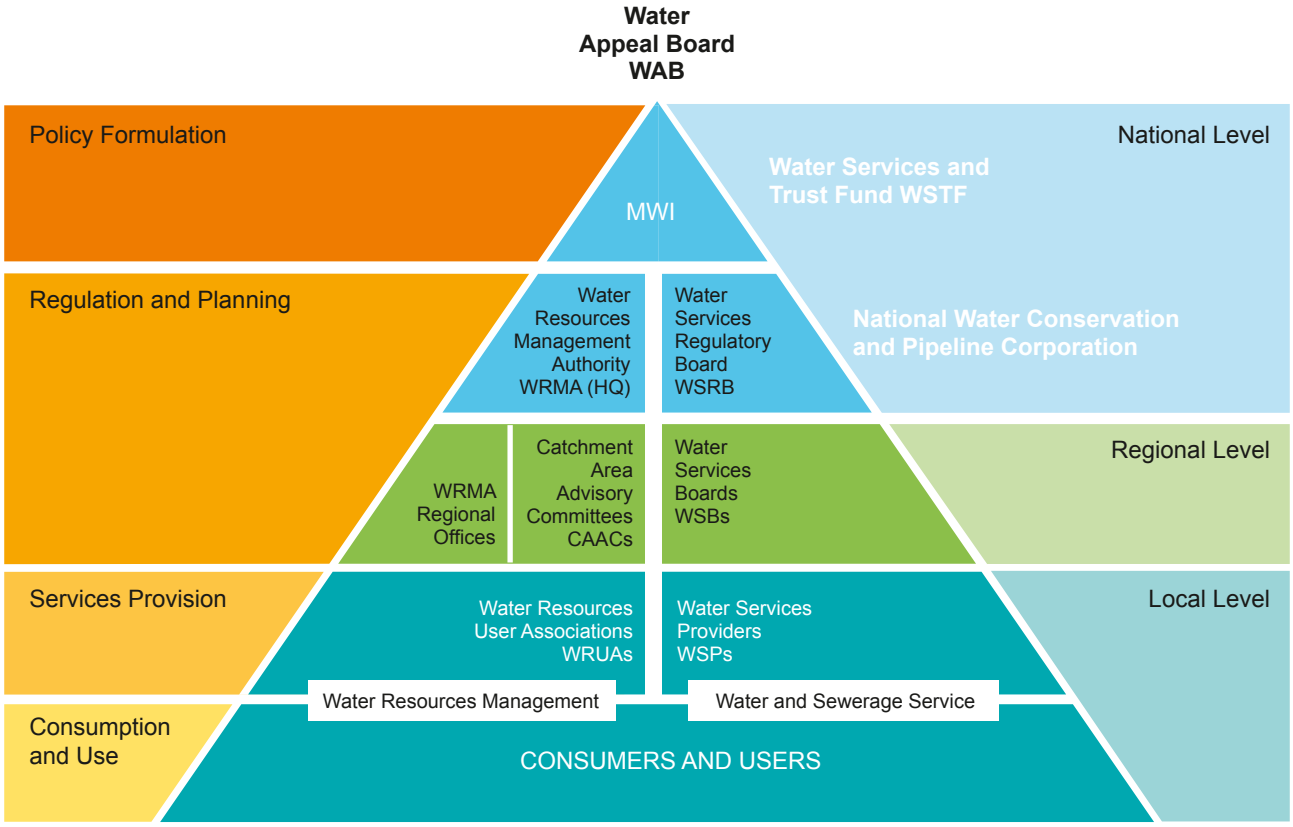


Figure 12: Institutional map of water resource management in Kenya
Source: DEVELOPMENT OF A WATER ALLOCATION PLAN (WAP) FOR THE NAIVASHA BASIN: STAKEHOLDER PARTICIPATION

WRMA is tasked with the following responsibilities[22]:

- Water apportionment and allocation,
- Catchment protection and conservation,
- Water resource assessments and conservation,
- Delineation of catchment areas,
- Gazetting water protected areas,
- Protection of wetlands,
- Gazetting water schemes to be state and community owned,
- Establishing Catchment Management Strategies (CMS)
- Collecting water use and effluent discharge charges

WRMA is mandated to charge for water usage. Domestic and non-domestic water users are charged KSh 0.5 and KSh 0.75 per a cubic meter of water[23]. This charge serves the dual purpose of funding WRMA and of incentivizing water users to become more efficient.

22 http://www.wrma.or.ke (Accessed 23 August 2010)
23 Ibid Mekkonen and Hoekstra (2010) pp 20

WRMA has formulated a catchment strategy for each of Kenya's six catchment management areas. These areas have been delineated according to their natural drainage boundaries. Each catchment area has a WRMA regional office which manages the relevant sub-regional offices. The Naivasha basin falls within the Rift Valley catchment area.

The sub-regional WRMA office for the Naivasha basin is situated in Naivasha and is one of five sub-regional offices in the Rift Valley catchment area. The regional office is in Nakuru and it reports to the head office in Nairobi. The WRMA regional offices are supported by catchment area advisory committees which are made up of a range of stakeholders within each catchment. These committees meet regularly to discuss water management issues in the catchment and to advise on water allocations and water permit applications.

In addition to WRMA, the legislation expects water resource user associations (WRUA) to be established and play a role in the local management of water resources in Kenya and in support of WRMA.

The Water Act recognizes that water management needs to be locally driven. Accordingly, each sub-catchment area is supposed to have a range of water resources user associations (WRUAs) that collaborate with WRMA in managing water resources in a harmonized and co-operative manner. The membership of the WRUAs is meant to be representative of all water users in an area and can include commercial and small scale farmers, pastoralists, fishermen, industrial users, land owners and domestic users. A typical WRUA in Kenya manages the water resources of an area of 200km^2 (or about a 10-20km stretch of river). There is a formal registration processes that needs to be completed before WRUA can work with WRMA. This registration process often takes some time to be completed because of legal complexities and requirements.

The National Water Resources Management Strategy intends for the WRUAs to be involved in the identification and registration of water users, assisting WRMA in monitoring water use and gathering information and assisting in conflict resolution, and the co-operative management of water resources at a sub-catchment level. This is done through a sub-catchment management plan. There are currently 12 WRUAs in the Naivasha catchment with varying degrees of capacity.

6.2 INSTITUTIONAL ARRANGEMENTS AND PARTNERSHIPS IN LAKE NAIVASHA

The Lake Naivasha Water Resources User Association (LANAWRUA) is probably one of the most developed WRUAs in Kenya. Local water resources management in Naivasha finds its roots in the Lake Naivasha Riparian Association (LNRA) which was originally established in 1929 to protect local landowner's rights. With the advent of the floriculture industry in the early 1980's the LNRA became more strident in trying to balance the impact of the expanding commercial interests surrounding the Lake with protecting its environmental integrity. The Lake Naivasha Growers Group was established in the late 1990s by a group of progressive commercial farmers who recognized that their commercial interests were tied up in the sustainable water use of the Lake.

Although they have different incentives, both of these groups have established capacity and are well versed in the environmental issues of the Lake. They have access to funding and have good communication networks. The LANAWRUA has been able to access this capacity in establishing itself. The other WRUAs in the Lake do not have as long a history or have established stakeholder groups. As a result, many of them are still trying to establish the capacity to effectively manage the water resources in their area. WRMA has stated its intention to delegate some of its functions to the WRUAs but the institutional restructuring needed to do this is still taking place.

The legislation recognizes that resources are needed to establish and capacitate WRUAs if they are going to be effective. A proportion of the water charge is allocated to the water service trust fund (WSTF), which

WRUAs can apply to in order to access funding for capacitation. The commercial farmers and the WRUAs argue that in reality it is almost impossible to get the trust fund to release money for capacity building despite multiple applications. The counter argument to this is that the WRUAs need to follow the correct legal processes in establishing themselves before WRMA can recognize them and allocate money from the WSTF. WRMA argues that the WRUAs should access other funding avenues from the private sector, NGOs and other government (non WRMA) funds. The problem is that the WRUAs do not have capacity, financial resources or institutional memories to pursue these alternative funding sources.

This deadlock is rooted in the funding arrangements of WRMA. The institution is intended to be self sustaining and its funding from central government decreases each year. As a newly established institution, WRMA faces the coinciding pressures of having to generate funding for its operational survival but not necessarily having the financial and operating resources and institutional memory and capacity to effectively do so. As a result, WRMA has a direct interest in protecting its control over its principal revenue source – the registered water user.

One successful example of a project that has been implemented without the support of government funding sources is the pilot project for Equitable Payment for Watershed Services which was jointly facilitated by CARE and WWF and linked the commercial water users around the lake with 565 smallholder farmers via the WRUAs. The LANAWRUA members paid the Wanjohi and Upper Turusha WRUAs to rehabilitate and maintain the riparian zones, plant trees and reduce fertilizer use. The upper catchment WRUAs identified 565 farmers to undertake these activities who were then rewarded with KSh 1200 ($17) vouchers that could be cashed in to purchase agricultural inputs and basic household goods. Although still a pilot, the project is an effective of example of the co-ordination of different water users to manage the water resources from the top of the catchment to the end user.

Figure 13 illustrates the level of regulation and water charge compliance in the Naivasha basin. This data is based on an abstraction survey undertaken by the WRMA sub-regional office that was completed in July 2010. A major complaint about WRMA in Naivasha is that the institution focuses only on regulating (and charging) the major commercial water users but does not have the capacity or institutional will to regulate water use in the upper catchment.

The commercial farms see themselves as being the low hanging fruit and argue that they are complying with the water resource regulations and paying for their water use and that part of this money should by regulation be used for improving the water resource management in the upper catchment. They also argue that WRMA would be able to generate more funding if they could register and hence charge the currently unregistered water users in the upper catchment.

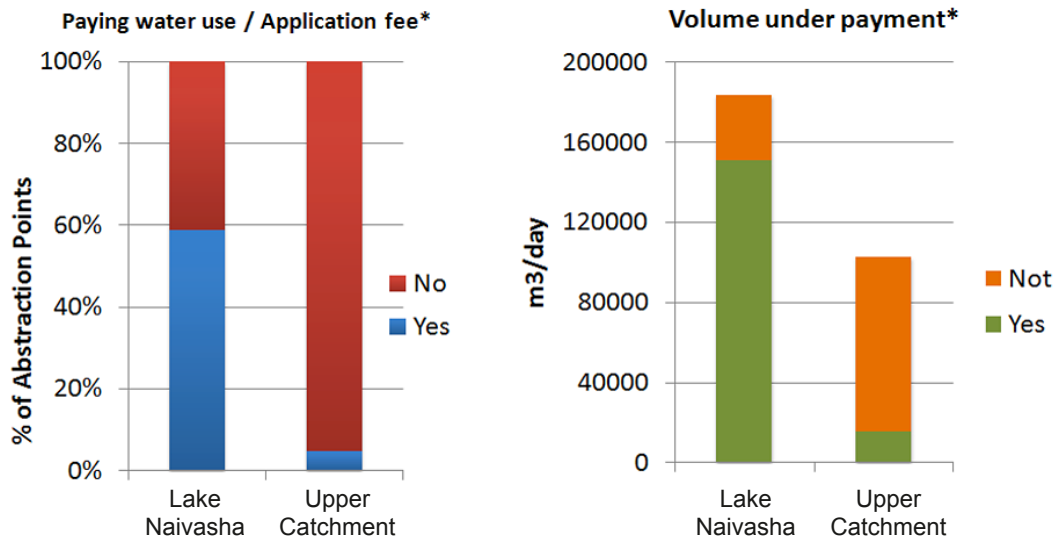


Figure 13: Water use payment in the Naivasha basin

The evidence clearly supports this assertion. Whilst Lake Naivasha water users abstract significantly more water than the upper catchment users, they also have a far higher level of water use payment.

With the support of WWF, WRMA and the Ministry of Water and Irrigation are drafting a new set of rules for the Lake Naivasha catchment that will empower WRUAs in the catchment with more autonomy. The WRUAs are tasked with assisting WRMA "in gathering information about water resources within its area of operation; monitoring the use of water; inspecting compliance to these rules; enforcing compliance with the conditions of water use permits; and collecting water use charges."

In order to do this, the WRUAs are allowed to keep a portion of the water charges that they collect as an agency fee. This money can be used to pay for operational and administration costs. This will hopefully unlock the funding constraints of the WRUAs, which in turn will allow them to develop their institutional capacity so as to better manage and regulate the water use in their particular area.

6.3 INSTITUTIONAL OPPORTUNITIES AND CHALLENGES

It is clear that the challenges facing the Lake take place against a backdrop of a concerned stakeholder group that includes both government and the private sector. This common interest presents an opportunity for consensus-driven water governance solutions that can tailor existing institutional capacity to the unique requirements and issues facing the Lake.

In its sub-catchment management plan, the LANAWRUA identified water regulation enforcement and non-compliance as greater concerns than declining water quantity and quality issues. Each of the most pressing issues facing the lake is symptomatic of an inefficient regulatory and enforcement environment. The high level of illegal or un-permitted abstractions, both in the upper catchment and around the Lake are indicative of this. However, the fact that the abstraction survey has been undertaken at all marks out a clear intention from WRMA to improve the water management of the basin.

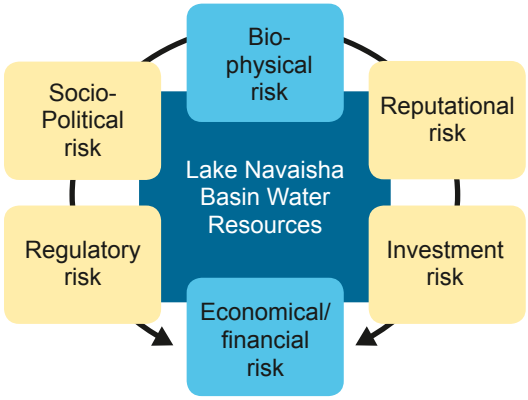
It is also important to recognize that many of the challenges facing the Lake such as the expansion of human settlement in the upper catchment and the increase in human waste discharge from the growing urban centers are not directly under the control of the water resource managers. The Lake is home to a unique conflation of social, economic and political pressures and the formulation of long term sustainable solutions to its problems will require the co-operation and engagement of a broad church of stakeholders. In order to begin this engagement process it is necessary to outline some of the shared risks that these stakeholders face.

7 UNDERSTANDING SHARED RISK FOR THE NAIVASHA BASIN

The hydrological and ecological functioning of Lake Naivasha is naturally variable and this has been compounded by the development of the basin and the use of its water resources. A nationally important agricultural economy has developed around the lake, with a strong political-economic relationship to Nairobi and Nakuru. At the same time, there are social and political tensions within the basin that surface during periods of drought, dropping lake level and water quality deterioration. The export market also faces perceptional and market challenges around water use and environmental concerns. Projections of water use into the future indicate increasing pressure on the lake, which will most likely exacerbate these various pressures and tensions.

There is a general recognition of the issues around the lake and its catchment, but coherent and proactive management of the water resources in the basin has been limited during the period of rapid development over the past two decades. There is also widespread acknowledgement that the water and land management of the basin must improve, which will require adequate institutional arrangements and resourcing. Investment and business decisions work best in a regulatory and economic environment that is stable and predictable and in which the rules are coherently and consistently applied to all participants.

In order to adequately respond to these needs, it is useful for the key role players to understand the nature of the risks related to the basin. These include distinct risks to the large horticulture companies and their employees, the outgrowers and small holders, local government and basin inhabitants, and the broader Kenyan economy and foreign exchange. The issue of risk should not be perceived as only being a corporate issue. Risk response by companies has impacts on investment and profitability, which have social impacts through employment and income levels, and which in turn affects the local economy. This will inform the political and social equilibrium of the basin. On the other hand, impacts on agricultural production will have consequences in the domestic food and international trade arenas.



The central aim of this paper is to articulate these risks for each of these groups and to highlight the commonalities between them, or in other works the shared risks between corporate, government and civil society stakeholders. By doing this, it is hoped that an opportunity for constructive engagement may be found between these groups to improve the management of the basin and thereby reduce the risk to all groups.

The following risk discussion has been developed against six inter-dependent dimensions of this shared risk, namely:

- Bio-physical risk related to the water resources and ecosystem of the basin
- Socio-political risk related to perceptions of inhabitants of the basin
- Regulatory risk associated with governance at a local and basin scale
- Reputational risk around requirements on products from the basin
- Investment risk linked to increasing requirements of financial institutions
- Economic-financial risk due to impact of these other risks

In reading these risk descriptions, it is important to understand that it is unlikely that there will be a complete collapse in any one of these areas with irreversible consequences for Lake Naivasha and Kenyan society, economy or ecology. Rather these are issues that are likely to pose greater challenges and thereby to incur greater costs over time, with the consequent lost opportunity for development through possible growth forgone or in the worst case a reduction in existing activity. This is an important facet of the shared risk paradigm in a developing country context, where maximising development opportunities are necessary to address the significant social and economic challenges of the Kenya.

7.1 BIO-PHYSICAL RISK

The economy of the Lake Naivasha basin is anchored in its capacity to harness water resources primarily for agricultural production. Water resources concerns around fluctuating lake levels and deteriorating water quality pose a direct risk to this political economy. The primary physical water risk is around the lake itself, because the flow generated in the headwaters exceeds the local upper catchment water requirements. An important characteristic of this physical risk is that it is cyclical, linked to hydrological variability, and typically manifests itself in crisis events linked to drought periods. This risk is shared by those that depend upon the lake or surrounding groundwater, namely the:

- horticulture (cut flower and vegetable) industry that abstracts from lake or groundwater;
- tourism industry focused on the lake, its wetlands and wildlife as a source of domestic and international eco-tourist;
- communities and towns around the lake that are dependent upon this industry for employment and secondary economic activity, as well as domestic supply;
- ranchers, farmers and pastoralists that use the riparian zone for grazing and stock watering;
- geothermal plants using lake water for power generation; and
- conservation areas and wetlands dependent upon the lake for ecosystem functioning.

The degree to which there is currently an ecological concern is hotly debated, as are the interactions between lake and groundwater resources. However, this is a Ramsar site, and the combination of water abstraction (leading to declining lake levels), water quality deterioration and riparian zone degradation pose a significant long-term risk to this internationally recognised wetland ecosystem. Furthermore, surface water and shallow groundwater interactions exist in all lake systems, the nature of which the ongoing research into this topic will clarify.

Changing land use (deforestation) and increasing abstraction to meet agriculture and urban demands has reduced the amount of water reaching the lake and recharging its underlying aquifers. The continued deforest-

ation of the upper catchment for fuel and farming represents an ongoing bio-physical risk with indirect physical water resources consequences. The stresses from reductions in water availability have been compounded by concerns about the water quality deterioration caused by increasing siltation, human waste discharge and agricultural runoff. These stresses are mutually reinforcing; as the levels of the lake fluctuate downwards, the riparian zone increases and this leads to further encroachment as agriculturalists, cattle ranchers, pastoralists and wildlife move into newly accessible areas to access water and pasture. The loss of the papyrus around the lake removes the natural filtering system contributing to a further deterioration in water quality.

The hydrology and water quality of the lake therefore depends not only on the activities taking place around it but is also irrevocably linked to what happens in the upper catchment. This relationship sets up a critical upstream-downstream tension, with small holder farmers, urban abstraction and deforestation with lower physical risk in the upper catchment being an important contributing factor to the physical risk for those around the lake. As a consequence, the mitigation of this physical risk will depend on a comprehensive and mutually supportive engagement between all water users in the basin, not just those around the lake.

The bio-physical risk underlies all of the other risks, because the conflicts and perceptions that underlie these other risks are primarily driven by insufficient water, of inadequate quality for productive and domestic uses, and/or degradation of the wetland ecosystem. Even if the current situation is not unsustainable (with occasional periods of drought), population and development pressures on the lake and its rivers will continue and these will most likely culminate in more dramatic and regular bio-physical risk (crisis) events if not managed carefully.

Improved understanding of the hydrological situation, its inter-relationships and contributing factors is critical to assessing the probability and hazard associated with physical risk. At present not enough is known or agreed about the hydrology, geo-hydrology and water quality of Lake Naivasha, and this in itself represents one of the most significant elements of the physical risk and its consequences for other risk areas.

The most important dimension of this physical risk is the recurrence (probability) of severe drawdown of lake level over time and the likelihood of severe water quality incidents in the lake, under current and future water use patterns. It should be noted that hydrological variability and therefore the probability of these events is likely to increase with global climate change.

7.2 SOCIO-POLITICAL RISK

The migration of Kenyans towards Lake Naivasha is likely to continue as long as there is a perception of livelihood opportunities in the area, linked to horticulture industry or small holder farming. As more and more people enter the area, competition over available resources, be they land, water or jobs, will become more and more acute.

One need only look at the violence in Naivasha after the disputed 2008 elections, or the historical violent conflicts over water between pastoralists and smallholders in other parts of the country, to see the damage that social unrest can do the economy, social fabric and by implication the horticultural industry.

These pressures have manifested themselves more directly in the political environment surrounding water management in the basin. During the drought of 2009, the political leadership of the municipality is said to have entertained the prospect of severely restricting cut-flower farms withdrawal of water. Similarly, popular and political discourse around the 2010 fish-kill attributed the water quality deterioration to the horticulture industry, despite the significant impacts of the failing Naivasha town waste water treatment works discharging directly to the lake and runoff from upstream settlements and smallholder areas.

The real impact of social risk is reactive and ill-considered political decision-making that can ride on waves of popular discontent, leading to a shift in regulatory regimes (scope or implementation). Whilst politically attrac-

tive in the short-term, these sorts of decisions have potentially disastrous long-term consequences, because the need for predictability and consistency are violated. The loss of employment and wage income generated from the cut-flower industry in Lake Naivasha would have dire impacts on the local economy and investment.

Social tensions also increase the cost of doing business. Companies have to pay for increased security and have to consider lower worker productivity, while workers are inherently affected by conflict and social unrest in their neighbouring communities. The farms are already trying to mitigate this risk by investing in their workers. In paying for their workers education and medical care, workers have a vested interest in ensuring that their companies continue to have the "social-licence-to-operate" even in an environment of significant instability.

Potential loss of productivity in the northern catchment smallholdings has the potential to fuel these social tensions. As plots become smaller and less profitable, landowners or their families may shift off the land and move to the towns to find work. The need to mitigate social risk in the basin must consider the likelihood that Lake Naivasha town will continue to be the destination of choice for smallholders moving off their land in the upper catchment, because it is perceived to have economic and employment opportunity.

Again, it's clear that despite these actions the social pressures in the areas surrounding the Lake will largely depend on the economic opportunities in the rest of the basin and the rest of Kenya. In the same way that commercial farmers have an interest in engaging the upper catchment smallholders to improve their water use efficiencies, they similarly have an interest in ensuring that the upper catchment can provide livelihoods for as many small farmers as possible so as to minimize the flow of people into the Lake area itself.

Again, it is difficult to assess the scale of this risk, as it largely depends upon the magnitude of the physical risk, but there are indications that some degree of social risk is highly likely.

7.3 REGULATORY RISK

Even in the absence of social pressure, inadequate regulation poses a significant risk in stressed catchments, such as Naivasha. The need for predictable, stable, effective and consistent regulation may not be achieved, due to limited resources, inadequate institutional capacity or political interference by vested interests. Again, this creates an environment that is not supportive of investment and economic growth through effective and efficient use of water resources.

Regulatory failure obviously poses significant risk to the private sector, but also manifests itself in increased bio-physical and economic risks, which are central to government and civil society interests. Thus seen from a broader risk perspective all players have an interest in reducing the regulatory risk in the basin, through improved water resources management and governance.

Under current conditions of limited local institutional capacity and the lack of comprehensive agreement between all role-players on the hydrological information and required management of the entire basin (catchment and lake), this regulatory risk is quite likely. Again, regulatory risk will manifest itself primarily during periods of drought, lake level decline and water quality deterioration, but in turn lack of regulatory action during non-crisis periods will definitely makes the physical risk situation more severe during these crisis periods.

7.4 REPUTATIONAL RISK

Reputational risk relates to the perceptions of consumers who buy goods and services from Lake Naivasha. It is a risk with significant potential to damage the economy of Naivasha, and is the risk that policy makers and stakeholders have the least control over.

Naivasha has a famous local and international profile, not only because of its flowers but also because of the domestic and foreign tourists that visit its natural beauty and biodiversity. Its media profile extends from reports about the horticultural industry's impact on the Lake's water resources, to labour practices and labour unrest, to crime, to the political decisions that have been negotiated at the hotels around the lake.

As a result of this media attention, consumers have a greater awareness about Lake Naivasha than they do about other areas from which they purchase products. It is unlikely that they can differentiate between products that come from Lake Naivasha specifically and products that fall under the "Made in Kenya" brand.

Reports about Naivasha (be they from the media or from returning tourists talking to their families and friends) have the capacity to influence consumer decisions. Lake Naivasha's water stresses are well known if not fully understood. As the publicity (academic, NGO, media, blogs) surrounding the environmental degradation of Lake Naivasha grows, it is likely that the end consumer will demand that the flowers that they buy are produced in an environmentally sustainable manner and as a result choose not to buy flowers or vegetables sold under the "Made in Kenya" label.

In the case of Naivasha it important to recognize that perceptions about water use and environmental impact on the Lake may be different to what is actually happening on the ground. If consumers perceive that the vegetables and cut-flowers producers are contributing to the deterioration of the Lake and as a result change their purchasing decisions, then the producers lose out (regardless of how environmentally sustainable their practices are in reality).

The probability of this eventuality is difficult to assess, but as was seen with the "food-miles" campaign this can escalate rapidly ("go-viral"), even with poor base information. As with the other risks, it would most likely be linked to periods of crisis (physical risk) that gained international prominence. The consequence of this risk would be quite dramatic, as was seen during the prevention of flower exports to Europe associated with the Iceland volcano eruption. Whether this would have long-lasting consequences is also unclear, particularly once the lake condition improved, but reputational damage typically does have some long-term effects.

7.5 INVESTMENT RISK

The increasing public awareness around water has contributed to investors considering water risk in their financing of equity and debt. Carbon Disclosure Project Water Disclosure initiative was launched this year, while other banks and fund managers are beginning to make investment decisions around water considerations.

Perceptions around water risk in Naivasha may have profound consequences for capital access by the companies operating there, and may have spin-off consequences for the risk profile linked to water in Kenya as a whole. The possible implications for foreign direct investment and private sector funding of development should be seriously considered by government and private sector, as markets and investors take water issues more seriously.

The likelihood of this risk is quite high and is not directly linked to periods of crisis (as with the other risks), but is associated with investor perceptions around physical, social and institutional risks. Following the above analysis, Naivasha is likely to be viewed as high risk in an international context and therefore financial institutions may place a premium on debt and equity associated with companies operating in Naivasha. This could be counterbalanced by reduction in these other risks or in individual companies addressing their exposure through joint (or individual) accredited water stewardship interventions.

7.6 ECONOMIC-FINANCIAL RISK

The point has been made above that all of these other risk will eventually have economic consequences at a local economy, national economy or international trade economy level. Horticulture and small holder farming is the mainstay of the local economy, which is by far dominated by the cut flower industry. While Naivasha and the horticulture industry does have a national impact, this is relatively small (<3%). However, it does have a significant (>10%) impact on export earnings and thus the current account. Any negative consequences for these exports related to the above risk areas, will have direct impacts on the country's foreign exchange, as well as possibly indirect investor perception issues. From this perspective, the management of risk in Lake Naivasha must be taken seriously at a national political, economic and planning level.

Similarly, any negative impacts on horticulture companies' operations associated with the abovementioned risks may have impacts on their financial position and profitability. While these companies have made investments in the region, increasing risk may cause them to relocate to other regions with lower risks. This may have significant impacts on the local and national economy.

Assessment of the economic risk is a synthesis of all the other risks, which in turn are largely dependent upon the physical risk. It is unlikely that the current situation would cause such severe and sustained physical deterioration that major irrevocable economic impacts will be experienced in the local economy or that individual companies will fail financially. However, there is highly likely that some level of local economic and corporate financial impacts will occur during crisis periods, largely associated with reduced crop yields associated with reduced water abstraction and/or higher pumping costs from the farms that are directly dependent upon the lake and its surrounding groundwater.

On the other hand, a future facing perspective with increasing urban - agricultural abstraction and increasing temperature - climate variability, is highly likely to impact on the recurrence and severity of crisis periods. Thus the likelihood of the physical and related risks to the basin will definitely increase over time, possibly to a level at which sustained commercial activity is jeopardised.

Finally, the already significant developmental pressures on this area will increase over time, due to population pressure and economic growth in the country as a whole. Lake Naivasha provides an important opportunity to support social and economic development in Kenya in an ecologically sustainable manner, but these opportunities may be squandered without adequate engagement of the risks outlined in this Chapter.

In conclusion, the shared risk of the private and public sectors around the water resources of Lake Naivasha should be reframed as a shared opportunity for future social and economic development of the basin in the interests of all the people in the region. It is through this lens that the responses should be viewed.

8 POSSIBILITIES FOR RESPONDING TO THESE RISKS

This paper has highlighted the nature and magnitude of shared risk and opportunity between various role players around Lake Naivasha. Instead of coalescing around the popular perception that the Lake is at risk of permanent collapse, stakeholders rather have an opportunity to act collectively to optimize the management of their water resources to safeguard against some of the varied risks that water stresses create.

This strategy to increase water efficiency is grounded on three interlocking platforms: improved governance, fostering partnerships and promoting more responsible individual water use behavior. Governance, regulation and enforcement create a broad framework than can incentivize water users to be more efficient. Similarly, partnerships enable the sharing of resources, skills and institutional knowledge which builds capacity and facilitates greater efficiency. Finally however, it is up to the individual water users to take responsibility for their actions and pursue water use efficiency wherever possible.

8.1 GOVERNANCE

There is strong need for the institutional arrangements between WRMA and the WRUAs need to be strengthened and clarified. This may involve the delegation of functions to the most appropriate level. The importance of this area within the Kenyan economy should be an important driver for national government to support this process through political will and resources.

Governance in the catchment is clearly hamstrung by the lack of accurate and available data on the state of the basin's water resources.

The first critical knowledge gap relates to water use in the basin. Although the water abstraction survey has gained some valuable yards in closing this gap, there is still a great deal of uncertainty surrounding the total water use in the basin, the identity of the water users and whether they are licensed, how much water each user abstracts and the purpose for which that water is used. Without this knowledge it becomes very difficult to implement a fair and effective water licensing system which is the integral component of a governance and regulatory framework.

The second unknown relates to the interaction of water flows between the Lake and groundwater reserves. Clearly, it is impossible to implement effective water resource governance measures without knowing how much water is currently being abstracted by stakeholders and similarly knowing how much water is available.

Improving this understanding of the hydrology and water use in the basin is the first step of five in improving regulation and compliance. It allows authorities to begin addressing backlogs, promoting meter usage, processing water charges and developing a database that can used to monitor abstraction and enforce compliance.

The second step is in showing action. Authorities must continue verifying and validating water users but also need to be seen to be responding to complaints, initiating spot checks on users and swiftly penalizing transgressions. This needs to be supported by improved reporting from water users and an analysis of where regulations are being effective and where they are failing.

The third step to improving regulation and enforcement is in the consolidation of available information. Once the verification and validation of licenses has been completed and the supporting hydrological studies

have been finished, the authorities can be in a position to reassess the state of the Basin's water resources. From here they can begin corrective action either through the licensing system (such as the compulsory licensing used in stressed catchments in South Africa) or by changing the water use payment charge.

Once this regulatory framework has been finalized, the authorities can undertake a full compliance audit of the entire catchment area. This can be used to amend the water allocation plan and to inform any future catchment management strategies.

An unresolved issue is identifying where this "authority" rests. It will largely be determined by the degree to which WRMA is able or willing to delegate powers to the WRUAs.

8.2 PARTNERSHIPS

The second platform is developed by fostering partnerships between different stakeholders. This requires a dialogue and the building of consensus between the role players about the situation, challenges and opportunities for managing water resources in the lake and its catchment, linked to a process of strategic environmental assessment and strategic environmental planning around a comprehensive options analysis. Whilst there are many different stakeholder groups within Naivasha, concerns have been raised that their resources, capacity and interests were too disparate to effectively manage and communicate a single strategy.

There is a need for a central mechanism that can collect, synthesise and distribute information as well as building partnerships between water users in the upper catchment and those around the Lake so as to promote better water use efficiency. This mechanism is a necessity if there is to be a common understanding of the main issues facing the Naivasha catchment. Partnerships create transparency and aid the flow of information between water users. With this knowledge, local users can be made aware of best practices and be better empowered to monitor and report non-compliant behavior. This can only assist the governance process.

The Payment for Environmental Services (PES) programme provides a useful precedent of such a partnership. Water users around the Lake were able to influence the land use practices of small holder farmers in the upper catchment by sharing knowledge and promoting more sustainable agriculture practices that have led to tangible welfare increases.

It is important recognize that these partnerships need to apply to all stakeholders, not only the water users in the catchment. Given the economic value of the Naivasha catchment to Kenya's economy, there is strong reason for the Kenyan (and particularly those ministries that are not directly related to agriculture and water management, such as Finance and Trade) to start building up partnerships with stakeholders in the basin. Similarly, those companies that rely on the international supply chain of Naivasha's horticulture produce have an equal interest in ensuring that strong partnerships can be used as a mechanism for improving governance and promoting better water efficiency. Partnerships with institutions of this level of authority and financial clout will put additional important pressure on the regulators to do their job.

8.3 RESPONSIBLE ACTION AND WATER STEWARDSHIP

The final platform to ensuring better water use efficiency in the Naivasha basin is by creating the incentives and disincentives for more responsible individual action. A better, more efficient regulatory net will go a long way in achieving this.

Another mechanism that can be used is through is through the application of a water use (stewardship) standard that promotes self regulation. At the moment, the water use standards certification process is driven by international and national institutions, none of which are focused specifically on the water issues of Lake Naivasha.

There is a growing demand for these various certification processes to be synthesized into one single standard. Importantly, such a standard needs to enforce compliance to the local Lake Naivasha water resource regulations and the needs articulated by local stakeholders. This will shift incentives for compliant behavior to shift from a "within the farm gates" to behavior that considers the needs of the entire catchment. By shifting the focus to become more inclusive, large water users will be able to demonstrate to other stakeholders that they are not the cause of water stress or water pollution problems.

Each of these three platforms reinforces the others. A strong regulatory net incentivizes individual water users to adapt their behavior. Strong and transparent partnerships between different stakeholders can be used to apply pressure on government to ensure that the regulations are fairly and effectively applied. In turn, as individual users become embedded in their role as stewards of water, they too will begin forging partnerships and putting pressure on government to ensure that Naivasha's iconic natural water resources can be conserved for a sustainable future.

WWF's ultimate goal ist to build a future where people live in harmony with nature.

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