Floriculture for the Republic of Rwanda

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REVIEW STUDY

Requested by the Government of Rwanda

Commissioned by

the Embassy of the Kingdom of the Netherlands

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ACRONYMS AND ABBREVIATIONS

ABAKIR	Trilateral Lake Kivu and Rusizi River Basin Authority
ATI	African Trade Insurance Agency
BUZA	Ministry of Foreign Affairs of the Netherlands
CKIV	Lake Kivu water catchment
COMESA	Common Market for East and Southern Africa
CRUS	Rusizi water catchment
EIA	Environmental Impact Assessment
EKN	Embassy of the Kingdom of the Netherlands
EWSA	Energy, Water and Sanitation Authority
GoR	Government of Rwanda
IBO	Investment Protection Agreement
ICSID	Centre for the Settlement of Investment Disputes
INES	The Institute of Applied Science, Musanze
ISEA	Higher Institute for Agriculture and Animal Husbandry, Musanze
IWRM	Integrated Water Resources Management
KIAC	Kigali International Arbitration Centre
LVEMP	Lake Victoria Environmental Management Project
MIGA	Multilateral Investment Guarantee Agency
MINAGRI	Ministry of Agriculture and Animal Resources
MINIRENA	Ministry of Natural Resources
NAEB	National Agricultural Export Development Board
NAKL	Lower Akagera water catchment
NAKN	Akanyaru water catchment
NAKU	Upper Akagera water catchment
NELSAP	Nile Equatorial Lakes Subsidiary Action Program (Pertaining to NBI: Nile Basin Initiative)
NMUV	Muvumba water catchment
NMUK	Mukungwa water catchment
NNYU	Upper Nyaborongo water catchment
NNYL	Akagera water catchment
NWRMP	National Water Resources Master Plan
PIA	Potential Irrigation Area
RDB	Rwanda Development Board
REMA	Rwanda Environmental Management Authority
RNRA	Rwanda Natural resources Authority
SME	Small and Medium Enterprises
TK	Turkish Airways
UNCITRAL	United Nations Commission on International Trade Law
UPOV	The International Union for the Protection of New Varieties of Plants
WHO	World Health Organization

INTRODUCTION AND ACKNOWLEDGEMENTS

This review was conducted at the request of the Government of Rwanda in close cooperation with the Embassy of the Kingdom of the Netherlands. Although Rwanda is known to have a favourable business investment climate, it has found it difficult to attract any substantial foreign investment in agribusiness. In order to enable focus of its resources and efforts on initiating foreign investment in Rwandan floriculture the Ministry of Agriculture and animal resources requested this review addressing the following questions..

1/ Is floriculture development in Rwanda a realistic option?
2/ Key interventions to successfully attract foreign investment for sustainable flower production.

In close and full cooperation with local officials, a multidisciplinary team of independent experts was commissioned. It was agreed that this study would have a dual-purpose character. To find missing links in floricultural development and suggest key interventions or stepping stones that could indeed initiate foreign investment, and at the same time provide a document for presenting (foreign) investors insight into opportunities for engaging in floriculture. After initial interviews with key players and potential stakeholders in the Netherlands, a fact finding mission was conducted in Rwanda with participation of a wide variety of departments and officials of the Government of Rwanda.

Following the mission in Rwanda a key Rwandese delegation was invited to the Netherlands in a tailor made programme to familiarize themselves with horticultural developments and meeting with Dutch agribusiness. Although this visit by officials was not part of this mission both activities are strongly linked and the mission team continued their strong commitment by offering their expertise and agribusiness network to the ministerial visit of GoR.. Potential key initial investors were identified and confirmed in a agri-business meeting hosted by the Rabo bank.
Reflecting the determination, of the Rwandese and self-reflection, and open attitude of Rwanda, to learn and tackle challenges, it was suggested that this document would also serve as an orientation document for potential investors evaluating their investment options. Showing critical issues in some areas and demonstrating progress in other, it will trigger entrepreneurs to explore the challenges and opportunities of floriculture in Rwanda.

The outcome of this study would not have been possible without the dialogue and support of those who were willing to share their expertise and input way beyond the regular closing hours. A word of gratitude is addressed to Epimaque Nsanzabaganwa and Marie Nizeyimana, whose constant support and organisational skills were enjoyed by the team members and whose talents made much possible and to Ms. Teddie Muffels for her suggestions, dedication and soft-side-wind-like-directions, which directed us at critical moments. A final word of appreciation is dedicated to Mrs Dr Agnes Kalibata who requested this independent review. A level of transparency and a show of character in office that is so seldom experienced.

The mission team formulated by Tierra BV consisted of:

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EXECUTIVE SUMMARY

This review was conducted at the request of the Government of Rwanda in close cooperation with the Embassy of the Kingdom of the Netherlands. In order to enable focus Rwandan resources and efforts to initiate foreign investment in Rwandan floriculture this review is addressing the following questions..

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1/ Is floriculture development in Rwanda a realistic option?
2/ Key interventions to successfully attract foreign investment in sustainable flower production.

Growing conditions

Growing conditions in Rwanda for flowers, in particular for roses and summer flowers were found to be favourable and promising. The climate in Rwanda is similar, but not the same, to those in the other at in East African flower producing countries. Average day temperatures, at the different altitudes, as well as the minimum and maximum temperatures are generally favourable for growing a variety of flowers, considering the various altitudes available in Rwanda. Most critical will probably be high mid-day temperatures at lower altitudes and early-morning humidity at higher altitudes where nights are relatively cool. However flower production at higher altitudes close to the equator will result in improved flower quality as a result of the light intensity, altitude and low night temperatures.

The water use implications for floriculture development have been examined for eight potential sites situated on either wetland or hillside locations. From a perspective of availability of water resources , the development of floriculture projects in the larger area of the Congo - Nile watershed seems most appropriate. In particular the Mukungwa, Upper Nyabarongo, Rusizi, Kivu catchment all at higher altitudes remain with sufficient resources. The other catchments experience water stress in the dry season. Water availability at the catchment level needs to be corroborated at the local level. Current water management procedures in Rwanda are poor with inadequate knowledge on the renewable resource and largely insufficient coordination of water use between sectors. A system of water permits (authorization or concession will apply for floriculture projects) is under development for implementation in the near future.

For the development of flower park sites, it is recommended to follow four recommendations for water use and management of the Flower Park locations.

- Mandatory recirculation of irrigation water to control environmental hazards; this implies either layered excavation, installation of geo-plastics and drainage and layered backfill , or the use of substratum.
- Rainwater harvesting to reduce water use and energy costs and manage water quality
- Construction of greenhouses for floriculture at a minimum 5 m above valley level
- Supply of additional water to be secured from a suitable, secure, cost effective, sustainable and environmentally friendly source

Designated areas

The GoR has 7 areas designated for flower c.q. rose production, i.e.:

- **Muhanga / Gabgayi**. Altitude 1,775 meter suitable for intermediate roses.
- **Mukara / Muko** Altitude 1,675 meter. For production of intermediates.
- **Mutobo 1&2** Altitude 2,160 - 2,090 meter for the production of Intermediates/T-hybrids
- **Kahanze** Altitude 2,200 meter for the production of Intermediate/T hybrids
- **Cooperative Nyanzi** Altitude 1,620 meter. Production of intermediates.
- **Orphrlinat** Altitude 2,330 meter for the production of Intermediates/T hybrids
- **Ghisari** Altitude 1,500 meter, production of intermediates.

In general intermediates production in Rwanda will be in severe competition with established producers such as Kenya and Ethiopia. However it is estimated that quality is expected to be better than Zimbabwe/ Zambia/Tanzania/Uganda.

At Ghisari NAEB has engaged in a pilot scheme to demonstrate potential flower production and to attract foreign investors in a PPP flower production for export and/or supply of national market. There is some doubt whether potential investors will be guided by this demonstration project and rather go by their own expertise. Seeking a PPP constructions may not fit in their business philosophy.

For Gishari Flower Park site phase I the following specific recommendations in relation to water should be observed:

- Water supply from Muhazi Lake is sufficient for about 2,000 ha of irrigation; pH requires correction
- Due to pollution of the lake water, drinking water supply should be diluted with rainwater to reduce heavy metal contamination.
- The planned irrigation infrastructure does not provide for recirculation of irrigation water which will at some time in the future result in pollution of Muhazi Lake.
- The use of substratum and recirculation of irrigation water should be introduced in the coming years

Some concerns exist with regard to the realization of Gishari Flower park
Present historic rate of construction is 0.5 Ha /month. Total construction time is expected to be 40 months rather than 24 month time span to realise the total area. The impact for the financial calculations and budget results is 50% production in the first year (calculated per greenhouse) rather than the calculated 70% production in the 1st yr. Budgets and planning need to be reviewed.

Quality and construction concern of 2 Ha already erected. The construction at Gishari Flower Park is medium-tech, which reduces construction costs but increases future risks due to quality problems. Transparent tender procedures, strict definition of the specifications and intensive inspection during the construction as well as evaluation of the final construction can contribute to the longevity of the greenhouse. Terms of guarantee for construction and actual realisation will require double-checking. The realised greenhouses seem to demonstrate some construction shortcomings. A validating company could identify and confirm final construction in relation to envisaged and planned construction. Terms of guarantee are usually subject to weather conditions etc. without any registration of weather conditions on site this may lead to a unresolved claims in the case of weather inflicted damages to structures
Plant health Starting with a clean plant health situation is essential for future production. Tender procedures should be articulate about plant health issues. Plant health and quality requirements should be incorporated in tender procedures to avoid infected imports. Virus free stock is a sensitive issue which many suppliers will not be able to meet.
Environment Also an environmental impact assessment should be part of the regular procedures for preventing issues such as preventing the risk leaching and contamination of sub-soils and finally contamination of the neighbouring waters.
Management Some experience with regards to rose cultivation exists in Rwanda, however, not at the scale of the flower park. Well-qualified staff and senior is needed, from the daily worker to the general manager pioneering flower production in Rwanda. In a demo situation as envisaged by the GoR the stakes are high. Failure is not an option and shortcuts will effect policies.

Pioneering floriculture as envisaged by all stakeholders will require management with proven pioneering skills. Initial failure may damage the chances of attracting foreign investors for the future. The profile of the (international) manager of the demo site should reflect this commitment. This will come at a price. A competitive salary, at around 100,000Euro/annum for the required senior manager in this pioneering situation. Consider senior management in relation to targeted PPP policy.

Financial investment issues.
Costs of growing flowers are comparable to those in neighbouring countries with relatively small differences within the categories of labour and energy. Freight rates are still higher lacking the volumes to get competitive rates, however this will normalize to competitive rates over the years to come if volumes will increase.

There are questions over sustainability the way plants and royalties have been accounted for in relation to Inland Revenue, aga Withholding Tax on royalties paid. For this piloting situation, the present practise of not differentiating plants and royalties will work. However beyond this pilot investment, this practise will deprive Rwanda of withholding tax revenues due.

Withholding tax on royalties in Rwanda is 15%. Although this is clearly stated in the law and probably well known to breeders (owners of floricultural varieties) it has proven to be an unknown area for many years in neighbouring countries resulting in surprisingly retro-actively tax assessments and fines. From a tax perspective it is only fair but business wise it causes hick-ups in profitability and business continuation as well as tensed relationships with investors. Absolute clarity and transparency on this subject and its applicability is key for the doing business.. In order to avoid surprises in future with regard to applicable withholding taxes, we recommend the GoR to be very transparent on this subject and even incentives for early (breeder) investors might be considered. Tax authorities in surrounding countries investigated ins and outs on licenses and withholding tax retrospectively, causing a retro-active repair exercise which damaged business relations and investors trust.

The Government of Rwanda recognizes the private sector is an essential engine of development and welcomes foreign investment in policy and in practice. Rwanda is ranked 3rd (2013) in the World Bank "Ease of Doing Business" indicators of the economies of 44 Sub-Saharan African nations. Investment incentives can be both fiscal and non-fiscal, i.e.:

- Fiscal incentives include a flat fee of 10% of the CIF, instead of import duty, VAT and other taxes.
- Non fiscal incentives include free initial one-year work permits for foreign workers and the acquisition of permanent residence

With regard to the repatriation of funds, the GoR encourages foreign investment through outreach and tax incentives. The freedom of repatriation of profits in combination with the liberal banking system and opportunity to maintain bank accounts in foreign currency with foreign banks is certainly a huge advantage over many other surrounding countries and will provide a considerable amount of comfort to foreign investors. It should be considered to Initiate tax treaties with the most interesting countries (The Netherlands, Germany, France, UK and the US) in terms of supply of floricultural base material as well as marketing of the produce.
In case of dispute, Rwanda's framework for dispute resolution consists of commercial courts, and arbitration and mediation and is member of the International Centre for the Settlement of Investment Disputes (ICSID) and the African Trade Insurance Agency (ATI),. For foreign investors, small and medium enterprises (SME's), a Bilateral Investment Treaty including a neutral arbitration clause is an important pre-condition.
The Arbitration and Conciliation Law, 2009 covers informal dispute resolution. Arbitral rewards are treated as final and binding unless in certain specified exceptional circumstances. The law applies to both domestic and international commercial arbitration and conciliation with respective rules and procedures recognized as long as both parties agree to them.

Perishables and Logistics

- Maintaining the quality of the flowers requires coverage of the full cool chain. By managing the flowers after cutting properly and keep transport time to the pre-cooling as short as possible, regulate temperature and processing time in the post-harvest to a minimum, use cooled trucks to transport to the airport and utilize the cool facilities at the airport to the max, one can establish the full chain in a cooled manner.
- The real success of competitive floricultural export business out of Rwanda depends on the logistics and packing of the floricultural produce. A fully covered cold chain, from harvest to market, is inevitable to compete internationally. Although the cooling facilities at Kigali airport are state of the art to facilitate the cool chain, it also comes down to proper management on handling the flowers, pallet building but even prompt security handling (X ray scanning), and border controls. Fully operating the cold room to international standards will require lots of training still and becoming part of a global network away from the present isolated airport based warehouse. .

- International airfreight carriers are responsible for the cargo they carry. and are hesitant to carry perishables if they are not satisfied with the supply chain/cold chain from field to airport. Despite these facilities seem unused and management seems to have an image problem with international carriers. The operation is isolated in the international spider web of fresh forwarding and ignored by reputed carriers.
- Consider a tender for management /and or PPP with an international fresh forwarding company that can demonstrate the capacity to hook up Kigali to a relevant global network for Rwandan perishables.

Relevant Regulations

Agro Inputs: Agro chemicals and Fertilisers

Especially since greenhouse production is new to Rwanda, the unpredictable will happen. In a greenhouse environment pests and plagues require a swift and adequate reaction. Reaction time is limited to hours rather than days and official procedures for the importation should be prepared

Agro-chemicals play a vital role in pest control in a closed environment. Pioneering new production methods in Rwanda within a closed environment, as is the industry standard in floriculture, will no doubt eventually bring the unexpected. Closed environments enables explosive development of pests, an immediate reaction time is required to limit damages as much as possible. Required agro-chemicals may not be available locally and will then have to be imported. In a pioneering situation this will require an overnight reaction time from officials to allow the importation of an (unknown or unregistered) agrochemical. Present regulations are adequate for crops already grown and known in Rwanda, but will need to be adapted to new production methods.

Agro-chemicals presently available and admitted for use are based on traditional use within traditional Rwandan general agriculture. The establishment flower production and new horticultural production will require direct access and or availability for investors to a wide variety of agrochemicals, which have not been yet used in Rwanda. A non-conclusive list of most used agrochemicals in floriculture has been included and handed over to REMA for evaluation. In a first evaluation none of the listed agro-chemicals was on the list of banned chemicals.

Biological control: The advantage of new flower parks is the absence of high pest levels (since there is no rose crop yet). This offers the opportunity to introduce right at the start biological pest management; this also forms an important pillar for product certification.

Chemical fertilizers are not available in a range that matches agronomic requirements. Application of nutrients should be done on the basis of the need of the crop. A more diverse availability of chemical fertilizers is recommended. Procedures need to facilitate in advance the local availability of a wide spectrum of (tailor-made) fertiliser compositions matching local crops and cultures. The establishment of a reliable fertilizer company is condition for further development of the agricultural and in particular floriculture production

New Varieties admittance procedures & UPOV

The admittance of new varieties for production within the territory of Rwanda, as in most countries is subject to local procedures. New production systems require procedures adapted to new markets that require new varieties.

The importance of new varieties is underlined when considering that the commercial life span of a flower variety is just 5-7 years, while in a crop like potatoes the commercial life span is 30-50 years. Flower production is subject to fashion rather than agronomic characteristics. Only early adaptors/procedures of new varieties make money. Local availability of new varieties from internationally located breeders demand swift local procedures and local protection of plant breeder's rights.

Plant variety protection. Private Breeders of new (flower) varieties invest large sums in creating new flower varieties. New varieties in flowers are prone to consumer taste and fashion as well as agronomic selection. Breeders want a return on their investment. Breeders will want to see their investments in Breeding protected from illegal reproduction.

For a successful export oriented flower production, it is important to have access to (new) varieties, which are in demand at the international market. UPOV membership is a guarantee for plant breeders for safe international trade of their varieties. Plant breeders will be hesitant to supply non-UPOV members with their new varieties of plants. To convince foreign investors and facilitate a successful export oriented flower production, the Rwandan

membership of UPOV will be a prerequisite. Protecting plant varieties is a precondition for getting the newest varieties to Rwanda. Plant Variety protection is internationally regulated within UPOV framework. Also for Rwanda it prevents monopolising and trafficking of indigenous Rwandese varieties as protected varieties can be opposed and limited under UPOV regulations.

Reverse protection at the introduction of UPOV is optional an at the discretion of the local authorities. A grace period may make it possible to grant local plant breeders rights to older varieties coming into the territory. Granting plant breeders rights to older varieties can give local producers to established varieties in demand with established demand such as processors and international buyers.

Plant Variety Protection UPOV. The International Union for the Protection of New Varieties of Plants (UPOV) is an intergovernmental organization, based at Geneva, Switzerland. UPOV's mission is to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society.

. The Convention defines both how the organization must be governed and run, and the basic concepts of plant variety protection that must be included in the domestic laws of Union members, which include:

- The criteria for new varieties to be protected: novelty, distinctness, uniformity, and stability.
- The process for application for a grant
- Intellectual property rights conferred to an approved breeder
- Exceptions to the rights conferred to the breeder
- Required duration of breeder's right
- Events in which a breeder's rights must be declared null and void

Road Map

Designated area's

- Confirmation of construction strengths and realised construction by an independent validating company.
- Check construction, terms of guarantee, maintenance records vs weather inflicted damages. If the construction collapses who and what will be eligible for compensation or blame.
- Pioneering management with proven track record will be required for Gishari park. Senior management will come from a senior expat manager in present setup or alternatively as part of PPP.
- A focus on capacity building with institutes of education and within a possible terms of engagement for PPP.
- Reconsider financial calculations and budgeting with realised construction time.
- Include plant health issues in tender procedures.
- Early bird investor will want to make own selection of varieties and locations.
- Further investment in demonstration greenhouses demonstrates the variety of options at other locations rather than more of the same in Gishari.

Resources

Floriculture requires integrated management of soil and water resources, consider:

- Use substrate as alternative to soil, protect of subsoil from leeching contamination of agro chemicals & residues with a protective layer.
- Recirculation of irrigation water
- Rain water harvesting
- Construction located to facilitate recirculation and rainwater harvesting.
- Identification of additional water requirements

Logistics

- Logistics involving road air and perishables require an integrated approach for Rwanda to tap into global networks. Consider tendering present airport facilities to attract operational management skills.

Regulations: Agrochemicals

Introducing new production methods will see new and unexpected pests and disease. In a closed environment the reaction time to deal with unexpected pests and diseases might be limited to hours rather than days.

- Admittance of and subsequent application procedures to deal with emergencies need to be in place.
- Agrochemical supply companies need to attracted to facilitate local demand for specialised extension and availability of agrochemicals.

Regulations: Fertilisers

Locally available fertilisers do not match agronomic nutrient requirements. This mismatch greatly reduces productivity and yields. The establishment of a fertiliser supply company will directly impact local yields and productivity.

- Agrochemical supplies companies need to be attracted to facilitate local demand for specialised know how, extension and availability of agrochemicals.

Regulations: Introduction of new varieties.

New varieties (flowers potatoes etc.) are not coming into Rwanda because breeders are without any tools to protect their investments to breed new varieties.

- Introduction of system of Plant Variety Protection, UPOV.
- Procedures concerning admittance of new varieties in floriculture need to be adapted to allow for early introduction and production of new varieties, especially in a closed environment.
- Reverse granting of older varieties will at the introduction of UPOV will add to investor attractiveness
- Access to new varieties will help Rwanda to achieve GoR development strategy goals, by attracting foreign investors and give producers the access to varieties required for local and international buyers and agro processors.

Withholding tax/Royalties

Plants and royalties should not be imported as a package depriving Inland revenue of due withholding tax.

- By introducing a transparent and reasonable withholding tax (10 - 20%) on royalties investors will signal appreciate the learning curve from which Rwanda has benefitted. While avoiding future restrictive repair regulations.

Repatriation of funds

It is common practise that flowers are exported from African countries through marketing companies located in tax friendly countries.

- By refusing mediation by marketing companies and calculating with final market prices Rwanda can reasonably request a local reinvestment of a certain percentage of profits in return for free repatriation for profits.

Dispute resolution

Dispute resolution between local government and small to medium sized enterprises that dominate the floricultural sector are a sensitive issue. Most treaties are accessible for large companies only.

- Bilateral Investment Treaty including neutral arbitration clause is an important pre-condition.

1. INTRODUCTION

Although Rwanda is known to have a favourable business investment climate, it has found it difficult to attract any substantial foreign investment in agribusiness. In order to enable focus of its resources and efforts on initiating foreign investment in Rwandan floriculture the Ministry of Agriculture and animal resources requested this review addressing the following questions..

This document follows a self-explaining line of argument in response to the two basic questions considering if floriculture has a place in Rwanda and what can be done differently to indeed attract foreign investors to Rwanda. Local officials are offered an insight in particular points of interest while potential investors are made aware of the potential situation they may encounter. This document is in a sense a time capsule of the situation on the ground on a particular moment.

Natural resources make or brake the potential for floricultural production. Water resources, and climate are initially considered. NAEB designated Flower Park areas are considered and discussed while suggesting some points of improvement. Installations and cultivations systems are then mentioned. Economic indicators and the critical issues concerning perishable global logistics are then discussed. Relevant regulations related to agrochemicals and fertilisers and the need for protection of plant varieties in Rwanda is then explained. Investment considerations such as Dispute management, withholding Tax and Exchanging and remitting of funds are also dealt with.

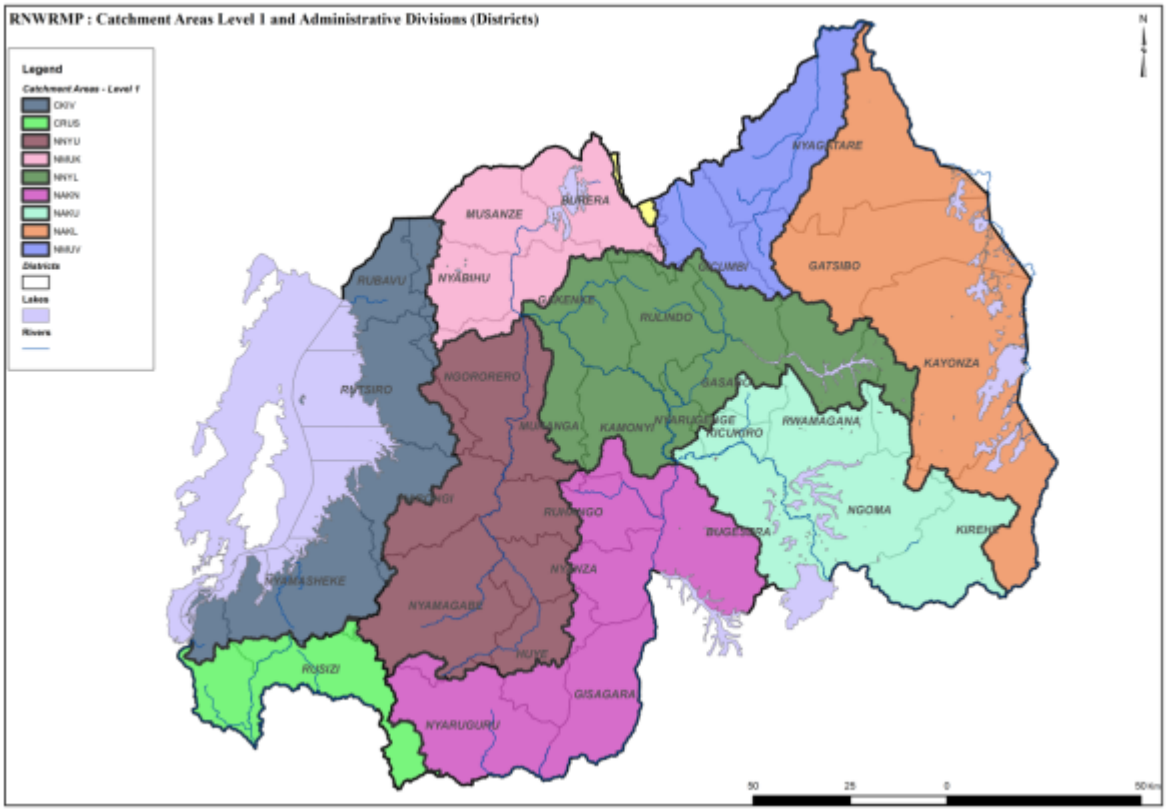
The highlights of this study are reflected in the included Executive summary while Road Map indicates practical action points that will contribute to establishing Rwanda as a new land of opportunity for floricultural investment.

2. RESOURCES

2.A. Water resources.

Production of flowers and in particular roses is dependent on clean and sufficient water supply. This section will deal with the availability of water in the different catchment areas and selected sites visited by the team. Also considerations for future water use in relation to flower production are included. Map 1 below shows the 9 hydrographic basins of Rwanda intersected with the 30 administrative districts.

Map 1: Level 1 catchment areas (9) and administrative division of Rwanda



Within the framework of the study of the National Water Resources Master plan, the annual rainfall, renewable ground and surface water resources as well as current and future demand projections (up to 2040; unadjusted for resources availability) have been assessed on the basis of the assessment for each catchment; what demand is considered; what are the water balance conclusions at the catchment level, and what are the implications of these conclusions within the catchment (at catchment tributary level)

The detailed tables for this assessment are presented in annexes 1 - 9.

2.A.1. Resources assessment for each catchment

The table below summarizes resources availability at each catchment:

Table 1: Essential information on water resources for the 9 catchments of Rwanda

Catchment Number	1	2	3	4	5	6	7
Name:	Lake Kivu	Rusizi	Upper Nyaborongo	Mukungwa	Lower Nyabarongo	Akanyaru	Upper Akagera
Code NWRMP	CKIV	CRUS	NNYU	NMUK	NNYL	NAKN	NAKU
Surface area [km²] in Rwanda	2 425 km²	1 005 km²	3 348 km²	1 887 km²	3 305 km²	3 402 km²	3 053 km²
Upstream national dependencies	none	Lake Kivu	none	none	Upper Nyaborongo & Mukungwa	none	Upper & Lower Nyabarongo & Akanyaru
Upstream international dependencies	none	Lake Kivu DRC	none	Insignificant (Uganda)	none	none	none
Shared catchment	2 203 km² DRC	368 km² DRC	none	62 km² Uganda	none	1 926 km² Burundi	13 714 km² Burundi
Av. Annual rainfall [mm/yr.]	1 240	1 295	1 365	1 315	1 191	1 225	925
Water Balance evaporation [mm/yr.]	870	865	980	851	919	990	760
Approx. base flow [m³/s]	1,75 m³/s (6,7 l/skm²)	3,75 m³/s (11,4 l/skm	34,2 m³/s (9,5 l/skm²)	53,5 m³/s (10,2 l/skm²)	66,8 m³/s (5,3 l/skm²)	16,4 m³/s (7,2 l/skm²)	9,2 m³/s (5,0 l/skm²)
Approx. Peak flow [m³/s]	14,5 m³/s (67,8 l/skm²)	35 m³/s (>100 l/skm²)**	207 m³/s (33,4 l/skm²)	318 m³/s (163 l/skm²)**	417,5 m³/s (126,2 l/skm²)	225 m³/s (66,1 l/skm²)	653 m³/s (168 l/skm²)
# level 2 groundwater strata	Schist, Granite, Green Rock	Basalt Granite Green rock	Schist, Granite, Quartzite	Basalt, Volcanic rocks, Granite, Quartzite	Quartzite, Schist, Granite	Granite	Granite, Quartzite
Approx. gr. water storage [hm³], Mean Residence Time [y]	24 10^6 (MRT= 5 y)	50 10^6 (MRT= 15 y)	250 10^6 (MRT= 20 y)	49 10^6 (MRT= 7,5 y)	87 10^6 (MRT= 15 y)	51 10^6 (MRT= 7,5 y)	46 10^6 (MRT= 15 y)
Approx. gr. water safe yield [hm³/yr.]	6,1 10^6 hm³/y	3,5 10^6 hm³/y	11,7 10^6 hm³/y	6,3 10^6 hm³/y	5,4 10^6 hm³/y	7,7 10^6 hm³/y	3,5 10^6 hm³/y
Key issues: (resources, use, flooding, drought, pollution, …)	Floods, erosion, evaporation	Floods, hydropower, irrigation	Water tower, erosion, hydropower	Water tower, groundwater hydropower	Floods, water quality degradation, groundwater	Floods, irrigation, sediment transport	Evaporation, irrigation

Source: *Consultancy Services for development of Rwanda National Water Resources Master Plan - Exploratory Phase report - Main Report - May 2013 by SHER Ingénieurs-Conseils s.a.*

2.A.2. What demand is considered?

Consumptive water demand is essentially defined by the following water use activities:

- Domestic water supply based on a presumed per capita daily consumption gradually increasing from 40 to 100 l/cap/day over the period from 2012 to 2040. The population increases from a current 11 million population to a maximum of 22.6 million in 2040. Medium and low estimates stand at 20 and about 17 million respectively. This is and will remain a substantial water demand category over the period up to 2040.
- Industrial and commercial water demand. Lacking any records on current industrial water use, and considering the low level of industrialization in Rwanda, projections are based on population data gradually increasing from 1 to a maximum of 10 l/cap/day.
- Livestock watering. Based on cattle inventory data converted to cow equivalent (c.e.) with 20 l/c.e./day. This demand is marginal.
- Irrigation. The Rwanda Irrigation Master Plan (Minagri - August 2010) identifies about 600,000 ha of Potential Irrigation Area according to a number of irrigation methods: based on Rain Water Harvesting ponds, development of marshlands with and without surface storage reservoir, and hill side irrigation from surface waters (rivers and lakes) with and without artificial reservoirs and from ground water resources. The current demand is at a modest level but the demand from the combined identified potential irrigation areas will exceed available resources in a number of catchments (see below).

Further non-consumptive demand is earmarked for ecological purposes in reserved areas, generalized for environmental flow of any surface water (proposed at 30% of mean monthly flow), run-off-river hydropower, fisheries (in lakes), navigation, recreation, etc. These needs may have implications on water use and used water disposal within each of these catchments.

2.A.3. What are the water balance conclusions at the catchment level (2012 - 2040)?

The details of the comparison of available resources and consumptive demand are presented in annexes 1-9. The observations on the availability of water resources over time are as follows:

- (Current): the water balance of the catchment of Muvumba (NMUV) indicates that there is some stress during the dry season which compromises environmental flow during dryer years. All other catchments generate sufficient resources for the overall catchment demand.
- (2020): the water balances of Muvumba (NMUV) and upper Akagera (NAKU) indicate insufficient resources during the dry season during relatively dry years.

  The environmental flow for the Akanyaru catchment (NAKN) is compromised during the dryer years.

  All other catchments generate sufficient resources for the overall catchment demand.

- (2030): the situation for Muvumba (NMUV) and upper Akagera (NAKU) catchments becomes critical in the sense that lasting deficits during the dry season are common and may also occur in about January between the wet seasons for most years;

  There are insufficient resources for lower Nyabarongo (NNYL) and the Akanyaru (NAKN) catchments during the dry season of the relatively dry years.

  The environmental flow for the lower Akagera catchment (NAKL) is compromised during the dryer years.

  The remaining catchments (CKIV, CRUS, NNYU, and NMUK) generate sufficient resources for the overall catchment demand including environmental flow requirements.

- (2040): the ranks of catchments with critical balances includes the Muvumba (NMUV), upper Akagera (NAKU), Akanyaru (NAKN), and lower Nyabarongo (NNYL) catchments characterized by lasting

deficits during the dry season that may also occur in about January between the wet seasons for most years;

There are insufficient resources for lower Akagera catchment (NAKL) during the dry season of the relatively dry years.

The environmental flow for the Kivu, (CKIV), Rusizi (CRUS) and upper Nyabarongo (NNYU) catchments is compromised during the dryer years.

Only the Mukungwa catchment (NMUK) remains with ample resources for its demand up to the 2040 horizon.

In this perspective, the most critical catchments are first of all Muvumba (NMUV) and secondly the Akanyaru (NAKN) catchment. The other catchments either show no meaningful deficit or available resources can be augmented by means of a transfer of resources from upstream to downstream[1].

Both the Muvumba and Akanyaru catchments are upstream (a transfer of resources implies very substantial investment and operational costs), and trans boundary (resources are shared with a neighbouring country which complicates management substantially).

2.A.4. Implications at local level

The assessment of the catchment water balances in the previous paragraphs indicates that except for the Mukungwa catchment, all catchments will gradually be subjected to stress over the period from current up to 2040. This assessment should however be seen in the proper context. Demand for each catchment is essentially defined by domestic water supply and irrigation. Considering the highest demand scenario for 2040 the total national demand stands at about 50 % of the national renewable resources of which about 2/3 (of the mentioned 50%) is needed for the irrigation sector. Where the development of resources for domestic water supply is to a large extent imperative, the development of resources for irrigation purposes will be adjusted to local conditions and technical, social, environmental and economic feasibility of the singular projects (including the flower sector).

For the development of the floriculture sector the following interpretation is put forward:

- From a perspective of water resources availability, the development of floriculture projects in the larger area of the Congo - Nile watershed seems most appropriate
- Notwithstanding an alleged long terms availability of resources at the catchment level, there is need to corroborate such availability at the local level.
- Even when water demand projections may indicate current or future stress in a catchment, it may well be possible to develop floriculture projects. For these cases it should however be taken into account that the (commercial) demand from floriculture may have lower priority than primary use (domestic water supply, livestock, ecological and environmental demand) and a reduction of supply may be enforced in the future under conditions of stress.

2.A.5. Current practice and of water resources management

The current practice of resources development and water use is essentially unregulated.

For the larger resources development actions (domestic water supply networks by EWSA, irrigation and water management projects under Minagri, hydropower projects under Mininfra, etc.) the implementing entity studies the location to assess the available resources based on the best possible information (which may be insufficient) typically ignoring eventual other claims for the development of the same resource (even within the same ministry).

[1] Nevertheless for these cases it may still be difficult (costly) to make resources available at tributaries within the catchment.

At the micro scale ('individual' water supply, temporary and minor irrigation activities, ...) there will be contact with the local administration to obtain permission, but this is not based on any investigation on availability of the resource and or nuisance to other water users.
A notable exception to this poorly organized practice is when trans-boundary resources are involved; for those cases there is generally ample investigation and negotiation between Rwanda and its neighbours typically within the framework of international agencies and projects (NELSAP, LVEMP, ABAKIR, ...).

2.A.6. Anticipated water sector reform in line with state of the art IWRM practices

Rwanda is undertaking major efforts to improve on this ineffective water management practice. The RNRA - IWRM division has been recently created to achieve effective water management based on the premises of IWRM. One of the most important tools to this effect is the introduction of 'Water Permits'. Draft regulations and guidelines are being produced at this moment. 'Law No 62/2008 of 10/09/2008 putting in place the use, conservation, protection and management of water resources regulations' provides for three regimes of water use:

- declaration regime; this regime is foreseen for those activities that intervene in the natural hydrological cycle but which are expected to have none or negligible impact on health and security, the water resource including the aquatic environment and other water users (e.g. groundwater abstraction with manual pumping, protection of natural spring for purposes of water use, fishing in lake, ..)
- authorization regime: this regime is foreseen for activities that are expected to have some impact on matters of health and security, the state of the natural resource and/or other users. Although not explicitly mentioned in the law, it is likely that an authorization be granted to several aspiring users sharing the resource.
- concession regime: this regime is foreseen for activities that are expected to have substantial impact on matters of health and security, the state of the natural resource and/or other users. Although not explicitly mentioned in the law, it is likely that a concession be granted to a single aspiring user in a specific domain.

Within the framework of the Master Plan study which integrates a Water Management Information System, it is proposed by the consultant in charge of the NWRMP to structure these permit regimes according to five types of intervention:

a) flow permit: abstraction of surface water from the natural hydrological cycle by means of pumping or deviation for imminent application in a water use process
b) storage permit: retention of surface water in an in-stream or off-stream reservoir of sizeable volume for ultimate application in a water use process
c) groundwater permit: abstraction of groundwater from an aquifer (either a 'land' aquifer or a floodplain)
d) used water disposal permit: for the disposal of used water in natural surface or ground waters (infiltration).
e) miscellaneous intervention permits: for the management of interventions which are likely to have some impact on flow regimes without actual abstraction or disposal of water (flood-protection works, bridges, drainage works, etc.)

The technical analysis of the water permit will be handled by RNRA-IWRM, likely with decentralized consultation (at catchment and/or district level) and the final (formal) decision taken by the Minister in charge of Water.

The need to integrate the process for acquiring a water permit within the EIA study and clearance process (compulsory for any intervention that requires an authorization or a concession) is fully recognized. The EIA study is handled by RDB and monitored by REMA.

For the regulation of existing interventions in the natural hydrological cycle, a time frame of 1 year is foreseen.

A further essential tool towards IWRM in Rwanda is the development of a hydrographic master plan for each hydrographic basin or coherent hydro geological unit.

Considering the generally capital intensive production methods with indispensable use of irrigation water and a wide range of agro-chemicals for optimum production and protection of investments, the key issues for any project to be undertaken within the framework of the horticultural sector are:

- An EIA study shall be conducted by an REMA accredited consultant or bureau (Annex 14). The cost of this study is borne by the developer / investor of the floriculture venture.
- The EIA shall be complemented with (or conditioned by) an authorization or concession for water use based on flow, storage, and / or groundwater abstraction and possibly for used water disposal.

2.A.7. Water use for Flower Park Gishari - and other sites visited

The following sites have been visited by the mission; Except for Gishari flower park (already under implementation) note that these sites are not necessarily 'Flower Park' sites, nor should it be surmised that other sites may not be part of the 'Flower Park'.

1. Flower Park Gishari (altitude: 1,535 m, District Rwamagana, Nile lower Nyabarongo)
2. Muhanga / Gabgayi (altitude: 1,795 m, District Muhango, Nile Akanyaru)
3. Cooperative Nyanzi (altitude: 1,620 m, District Nyarugenge, Nile lower Nyabarongo)
4. Mukara / Muko (altitude: 1,655 m, District Musanze, Nile lower Mukungwa)
5. Mutobo 1 (altitude: 2,160 m, District Musanze, Nile lower Mukungwa)
6. Mutobo 2 (altitude: 2,090 m, District Musanze, Nile lower Mukungwa)
7. Kanzenze (altitude: 2,230 m, District Rubavu, Congo Kivu)
8. Orphelinat (altitude: 2,330 m, District Rubavu, Congo Kivu)

Further details with coordinates and altitude of these sites are presented in annex 10.

Reflections on water availability and the impact of the sites on the natural resource and other water uses are presented below for each of these sites.

2.A.7.a. Flower Park Gishari (at 1,535 m, District Rwamagana, Nile lower Nyabarongo)

The Flower Park at Kavumu cell, Gishari sector, is located at a distance of about 400 to 900 m from the shore of Lake Muhazi at an altitude varying between 1,520 to 1,540 m. Water supply is provided by means of rain water harvesting from the greenhouses with additional supply pumped from Lake Muhazi at an altitude of about 1447 m. For the final stage of the project an effective greenhouse area of 60 ha is foreseen. A first stage of 20 ha of greenhouses, with complementary infrastructure is under construction.

Water use and availability.

Annual evaporation rate at this site is of the order of 1,600 mm (120 to 150 mm/month; 135 mm/month on average) or on average 4 to 5 mm/day. It is assumed that this value can be maintained within the greenhouses (likely somewhat higher temperatures, RH, less wind). Assuming an irrigation supply rate at 125% of evaporation rate the annual water supply stands at about 2,000 mm or 5.5 mm/day (the water supply infrastructure of the park is designed for a capacity of 7.5 mm/day which is both adequate and appropriate)

According to the draft EIA report of March 2012, annual precipitation varies between 910 and 1,120 mm. Considering the location of the Gishari flower park site, these values appear rather high and an average value of the order of 900 mm/year seems more appropriate. Considering an efficiency of rainwater harvesting infrastructure of 80 to 90 %, the water supplied through rainwater harvesting is of the order of 750 mm/year.
The annual water abstraction from Muhazi Lake will be of the order of 1,250 mm/yr or about 250,000 m^3/year (or average 8 l/s over the year) for a 20 ha production area and ultimately 750,000 m^3/year for a 60 ha production area (24 l/s or 0.024 m^3/s).

The base flow at the outflow of the Nyabugogo river stands at about 2.5 m³/s generated over a 1,550 km² catchment area. More than half of this catchment area (~800 km²) is drained through Muhazi lake which implies a base flow in the range of 1 to 1.25 m³/s. Pending further development of the irrigation sector along Lake Muhazi, the available resource largely exceeds demand from the Gishari site.

However, the Irrigation Master Plan presents some 14,000 ha of PIA (potential irrigation area) along the shores of Lake Muhazi (5308 ha in the district of Gatsibo, roughly 1,000 ha in the district of Kayonza and about 8,000 ha in the district of Rwamagana). Considering the same level of sophistication of irrigation technology as for Gishari, this irrigation area would require a continuous supply of the order of 5.5 m³/s. It is overly evident that such irrigation command area cannot be realistically supplied from the renewable resources inflow into Lake Muhazi. Considering a dry season base flow of the order of 1m³/s, considering environmental flow requirements of the order of 30% of such base flow and assuming that water supply to Kigali can be provided from the Nyabugogo river, there is about 0.7 m³/s available which would limit the irrigation command area dependent on Lake Muhazi waters to about 1,800 to 2,000 ha assuming reasonably efficient irrigation methods (at least during the dry season).

Water quality issues of Lake Muhazi waters
(information and interpretation provided by C. Kuells - University of Freiburg – Hydrologist for NWRMP study by SHER Ingénieurs-Conseils s.a.).

As regards the water quality in Muhazi Lake, a recent publication on the distribution of Heavy metals in Lake Muhazi[2] gives a disturbing picture on the current water quality with relatively high levels of Lead and Cadmium which exceed WHO guidelines for drinking water. Further Manganese was found to exceed WHO guideline levels at one site out of four.

Iron and manganese levels are high but not toxic. These elevated concentrations result from variations in redox (reducing-oxidizing conditions).

The levels of lead and cadmium are serious (although not necessarily for floriculture). It is surmised to be related to zinc mining in the upper part of the basin. Zinc deposits have Cd and Pb-bearing minerals as co-minerals. It goes down the rivers with washing of ore from zinc mines. While concentrations or Cd and Pb in the ore are not sufficient for mining, they are high enough to create a significant environmental problem. Quite mobile in river water due to lower pH and in general their mobility increases with decreasing pH.

Due to higher CO2 levels in the lake (plant and algae with declining fish population) the lake has a substantially higher pH than river waters and ‘traps’ the metals (pH-trap), mainly in the lake bottom sediments. With variable pH it is released / precipitated according to the seasonal flow pattern with seasonal change of pH level in the lake.

The implications for the Gishari Flower Park are essentially related to the use of Lake water for purposes of drinking water. Raw water must be checked for heavy metals. Elevated metal concentrations can be reduced by iron removal (the iron precipitate also binds metals) and/or dilution. It is recommended that drinking water supply is predominantly (or even exclusively) provided through rain water harvesting. The implications of heavy metals in the irrigation water are not known to be detrimental to flower production.

This issue on the Lake Muhazi water quality degradation and its treatment needs to be addressed by Minirena.

The impact of the Gishari Flower Park on Lake Muhazi water quality.

[2] Article by: Innocent Nhapi, Umara Garba Wali, Denise Usanzineza, Japhet J. Kashaigili, Noble Banadda and Richard Kimwaga - "*Distribution of Heavy Metals in Lake Muhazi, Rwanda*" - Open Environmental Engineering Journal, 2012, 5, 96-102

The Gishari Flower Park site is hydro geologically characterized by a deeply weathered soil (typically 50 m or more) overlaying a low yield fractured basement aquifer (see NWRMP - Exploratory Phase report). Deep infiltration of surface water from rainfall will typically result in a groundwater cone under the Gishare Flower Park (and surrounding hills) that slowly recharges the Muhazi Lake waters.

The year round irrigation of the first phase 20 ha pilot plot (at least slightly in excess of the water requirements of the crops) will typically result in a continuous leaching of irrigation water with unsaturated flow of water including agro-chemicals.

The list of agrochemicals as commonly applied in floriculture with a brief comment on the hazard created by the use of the product is provided in annexes 11 and 12. Whilst none of these chemicals are included in the list of prohibited chemicals and pollutants, nor in the list of substances requiring authorization or temporary permit (see annex 13) as defined in Ministerial Order no 27/03 of 23/10/2008, it is clear that some of these substances are very toxic with sometimes long term effects in aquatic environments. Considering the hydro geological conditions for the Gishari Flower Park, it is virtually guaranteed that the use of some of these persistent and hazardous chemical substances will ultimately find their way into the lake. The actual pollution levels are very difficult to predict and will depend on the production area, amount of substances used, the leaching rate applied, the filtering effect of the subsoil and the resident time of the water in the lake (estimated at about 2-3 years as a first indication) (lake volume of the order of 130 Mm^3, annual total inflow in the lake of the order of 50 Mm^3; annual leaching volume from Gishare site at current 20 ha test site is of the order of 0.15 Mm^3 - leaching of about 2 mm/day).

Implications and recommendations for the Gishari Flower Park site:
The EIA of the Gishari Flower Park site recommends the interception and treatment of waste water from domestic use but does not specify any action on irrigation leaching water. There is a mention of irrigation water reuse but no such facility is provided.

Considering the actions on the ground (20 ha of greenhouses under construction) and the fact that interception of drainage water would require subsoil sealing for effective drainage of leaching water, the following is suggested:

- Domestic waste water treatment recommendations as stipulated in the EIA are fully endorsed;
- The leaching of drainage water from the existing site can be temporarily condoned; the ultimate conversion to the use of substratum with drainage interception, reuse and treatment as required, should be considered and, depending on the outcome of water quality monitoring of Lake Muhazi, at some point in the future possibly enforced. It is mandatory to monitor the water quality of the lake in the proximity of the Gishari Flower Park site for toxic substances; the cost of this monitoring effort should be borne by the operators of the flower park;
- Further development of floriculture sites (including Gishare phases II and III) should require interception of drainage waters through subsoil sealing and drainage or the use of substratum). This allows for the reuse of drainage water and treatment of possibly toxic waste water. In addition to the control on environmental hazards, this practice will reduce water demand per hectare which will allow for a larger PIA (Potential Irrigation Area) to be ultimately developed.
- State of the art rainwater harvesting as foreseen for Gishare I should be the rule for water supply for further floriculture production reducing pollution hazard and per hectare water demand.
- Drinking water supply for Gishari should be predominantly or even exclusively based on rainwater harvesting until the issues of lead and cadmium content are controlled.

2.A.8. Water use other sites visited

2.A.8.a. Muhanga / Gabgayi (at 1795 m, District Muhango, Nile Akanyaru)

The site at Muhanga on the Hugeramigazi river is a wetland which has initially been developed for rice cultivation by means of a reservoir and open channel irrigation infrastructure. Due to the altitude of the site, there

have been persistent problems with the yield of the rice fields. The development of part of this site for flower cultivation appears to be a very promising alternative.

Water use and availability.
Water demand at this site does not substantially differ from that at the Gishari site hence an annual supply rate of the order of 2,000 mm/yr inside the greenhouse or 0.64 l/s/ha as continuous flow
The upstream reservoir has a capacity of the order of 500,000 m³. The inflow area of the reservoir is only 13.3 km²; with a base flow of the order of 7.2 l/skm² [3] (see he table below summarizes resources availability at each catchment:

Table **1**), the dry season minimum inflow in the reservoir would be about 90 l/s. This equates to about 140 ha supplied from the inflow at the reservoir site , assuming that there is no upstream abstraction (irrigation, drinking water supply or other) and considering the sophisticated irrigation methods applied in floriculture (drip irrigation)). The area is hydro geologically characterized as a fractured basement aquifer with low yields.

Assuming an effective reservoir volume of 500,000 m³ and 90 days 'base flow only' inflow (which has been considered above), the supplemental area to be irrigated from the reservoir during this 90 days period, would be about 11 ha.

The use of rainwater harvesting techniques does not have an impact on the development potential but is highly recommended for.

Finally, the valley bottom of almost any wetland in Rwanda may be subject to flooding. The same as previously mentioned indicates a peak flow of 66 l/skm² for the Akanyaru catchment including a 60 km long and floodplain. On the scale of the reservoir catchment the peak flow would be about 0.9 m³/sec. Considering the high urbanization level in the catchment (Muhanga / Gitarama town), actual peak flows will likely be substantially higher but may be buffered by the reservoir area. Greenhouse construction just off the lowest reaches of the floodplain is recommended.

Water quality issues of irrigation waters . Considering the high urbanization level in the catchment, surface waters and even groundwater are likely to show higher BOD and COD values. No other issues are suspected.

The impact of flower production on resources and other water users. The production of roses and other high value added greenhouse productions will set off the use of agro chemicals as listed under annexes 11 and 12. Unless adequate isolation of the water cycle in the greenhouses is provided for either by soil sealing (which may not be very evident in valley bottoms which are prone to fluctuating water tables and intermittent flooding), or by the use of substratum, the use of such agro-chemicals in greenhouses located within the wetland area itself, will result in a direct contamination of the surface and groundwater downstream of the wetland.

The production of field flowers as currently practiced near Kigali by the Nyanzi Cooperative (Yari river in Nyarugenge district - see item 3 in the next section) is far less susceptible to pests and diseases and does not generally involve the use of agro-chemicals

Implications and recommendations for the development of the Muhanga / Gabgayi site as a Flower Park site:

The following is recommended:

A. For the production of roses and other high value productions in greenhouses:
   - A first indicative estimate of water availability hints at a potential of some 100 ha (considering environment flow requirements of 30% of base flow).

[3] This is the value obtained for the entire catchment; actual baseflow may possibly differ substantially; this subcatchment is located in a geohydrological zone of fractured basement aquifer with low yields

- The location of greenhouses should be identified off the lowest parts of the valley bottom to protect them from flooding. Considering the next point, it may be more appropriate to construct the greenhouses directly outside of the floodplain
- It is considered mandatory that the irrigation-drainage cycle in the greenhouses is isolated to control major environmental risks from leaching of toxic substances used for pest control in flower production; this implies either sealing of the subsoil and a drainage network, or the mandatory use of substratum.
- Rainwater harvesting should be used for complementary water supply of the plants.

B. For the (complementary) production of field flower production by out growers
   - Water availability within the wetland area is currently provided through an irrigation network conceived for rice irrigation. This network will be just as suitable for open field flower productions. The groundwater table will remain close to the surface even during the dry season.
   - Flower production should be initiated on fields that are free from regular flooding.
   - Considering the natural resistance of local flower varieties against pests and diseases and the modest levels of overall investment, there is little incentive to apply hazardous agro-chemicals.
   - Training in the appropriate use of fertilizers and crop protection products is recommended.

2.A.8.b. Cooperative Nyanzi (at 1,620 m, District Nyarugenge, Nile lower Nyabarongo)

These farmers at this site are organized in a cooperative that produces a variety of local flowers in the floodplain for the local market mostly in Kigali at about 15 km from the site.

Water use and availability.
Water demand for greenhouse productions will be of the order of the previous sites, or about 2,000 mm/year.
The catchment area is about 50 km² and is hydro geologically classified as containing a complex fractured aquifer with local groundwater. During the field visit ample evidence of groundwater recharge from the surrounding hills into the valley bottom was observed as this water was actually used for irrigation (by means of buckets and watering cans) of the flower plants. Further irrigation water was collected from the water course (Yari river).

Water quality issues of irrigation waters
No information was found on this issue.
The impact of flower production on resources and other water users. The production of local flower varieties in the floodplain as currently practiced is unlikely to pose a major threat to water availability or to pose water quality issues.
The introduction of professional greenhouses poses the same environmental risk as specified for other floodplain areas and should be countered by isolation of the irrigation - drainage cycle.

Implications and recommendations for the development of the Yari river site as a Flower Park site:
Although no detailed investigation was done, the water availability for this site is likely substantially better than for the Muhanga / Gabgayi site. The recommendations for high value added flower production in greenhouses and complementary production by out growers are similar to those formulated for the previously discussed sites.

2.A.8.c. Mukara / Muko (at 1,655 m, District Musanze, Nile lower Mukungwa)

This site is proposed on a tributary of the Mukungwa river; it consists of a wide floodplain with relatively light soil. Current cultivation is predominantly stock beans and a variety of other crops including potatoes and tomatoes.

Water use and availability.
Water demand for greenhouse productions will be of the order of the previous sites, or about 2,000 mm/year.
This area is hydro geologically classified as complex fractured/layered aquifer with pseudo karst. Considering this classification an assessment of catchment area is of little significance. The discharge in the watercourse at end of May was estimated at a few hundred l/s and this flow was reported to be quite consistent throughout the

year. The Google earth image (dated 6/8/2010) shows a predominantly brown and barren floodplain which corroborates the observation of lighter soils in the floodplain in combination with difficult accessibility of groundwater.
This picture is very different from the Mukungwa River floodplain immediately downstream which shows a lush vegetation over the entire width of its floodplain for the early August satellite image.
Water quality issues of irrigation waters: No information was found on this issue.
The impact of flower production on resources and other water users. The production of local flower varieties in the floodplain is unlikely to pose a major threat to water availability or to pose water quality issues. It may proof difficult to guarantee water supply to perennial crops in the floodplain during the dry season even when it is relatively short in this area.
The introduction of professional greenhouses poses the same environmental risk as specified for other floodplain areas and should be countered by complete isolation of the irrigation - drainage cycle by means of geoplastics or substratum.

Implications and recommendations for the development of the Suza River as a Flower Park site:
Surface water from the Suza river may be sufficient throughout the dry season for a relatively small area under greenhouse. Prior to actual investment in such venture further investigations are required to ascertain water availability or to identify back up supply.

The year round water availability for field crops does not seem guaranteed. If viable, the recommendations for high value added flower production in greenhouses and complementary production by out growers are similar to those formulated for the previous sites.

2.A.8.d. Mutobo 1 (altitude: 2,160 m, District Musanze, Nile lower Mukungwa)
This site is a softly sloping plain located directly along the Ruhengeri - Gisenyi road with rich soils from volcanic origin that are currently exploited by smallholding farmers for the production of corn and other crops.

Water use and availability. Water demand for greenhouse productions will be of the order of the previous sites, or about 2,000 mm/year.

Like all sites in the volcanic region, this area is hydro geologically classified as complex fractured/layered aquifer with pseudo karst. Considering this classification an assessment of catchment area is of little significance. There is no perennial surface flow in the vicinity of this site and supply of irrigation water is proposed to be captured at the Mutobo spring (altitude at 2,115 m) at a distance of about 2 km. With the altitude of Mutobo 1 site at about 2,160 m this implies an additional lift of about 75 m for water conveyance (about 15 m/km for conveyance with a pipe system).

The 'captured' Mutobo spring has an impressive discharge of several tens of l/s, but all along the water course natural springs contribute and the discharge swells to several hundred l/s before it reaches the EWSA water treatment station (Mutobo II site, see next item). There is little doubt that this discharge remains constant throughout the year.

With a continuous water demand of about 0.64 l/s/ha year round (probably less at these higher altitudes, and disregarding supply for other uses (DWS Ruhengeri) there is sufficient water resource for the watering of several hundreds of hectares of greenhouses.

It is worthwhile to mention that the Mutobo spring has at one stage been considered for water supply up to Kigali.

The abundant rainfall and undoubtedly excellent water holding capacity of the deep volcanic soils reduce or even annul the need for irrigation of local variety field flowers

Water quality issues of irrigation waters; no information was found on this issue.

The impact of flower production on resources and other water users.
The production of local flower varieties in the floodplain is unlikely to pose a major threat to water availability or to pose water quality issues.

The introduction of professional greenhouses poses the same environmental risk as specified for other areas (hill side or floodplain) and should be countered by complete isolation of the irrigation - drainage cycle within the greenhouse by means of geo-plastics or substratum.

Implications and recommendations for the development of the Mutobo 1 site as a Flower Park site:
Surface water from the Mutobo spring will allow for substantial development of greenhouse area for high value added flower production. This may be complemented with out grower production of local flower varieties which can be essentially rain-fed.
The recommendations for high value added flower production in greenhouses and complementary production by out growers are similar to those formulated for the previous sites.

2.A.8.e. Mutobo 2 (altitude: 2,090 m, District Musanze, Nile lower Mukungwa)
This site is essentially similar to the above discussed Mutobo 1 site; a softly sloping plain located at about 1.5 km from the Ruhengeri - Gisenyi road with rich soils from volcanic origin that are currently exploited by smallholding farmers for the production of corn and other crops.
All water related aspects of this site are identical to the observations for the Mutobo 1 site and it uses the same water source; due to the lower altitude of this site, gravity supply is possible. Recommendations for the development of this site as a flower park site are identical to previous sites.

2.A.8.f. Kanzenze (altitude: 2,230 m, District Rubavu, Congo Kivu)
This site is in the same area and is very similar to the Mutobo 1 and 2 sites. It is located at about 1.5 km from the Ruhengeri - Gisenyi road with excellent soil from volcanic origin that are currently exploited by smallholding farmers for the production of a variety of crops.
All water related aspects of this site are identical to the observations for the Mutobo 1 and 2 sites. A water source is reportedly available at a distance of 4 km yet it is not known if the supply can be provided by gravity. Further recommendations for the development of this site as a flower park site are identical to previous sites:

- for greenhouse productions (minimum dry season water supply needed as continuous flow of about 0.64 l/s/ha, free from flooding, isolation of the greenhouse irrigation - drainage cycle, rainwater harvesting fully endorsed for a variety of reasons)
- for open field productions (water supply from rainfall, water holding capacity of soils and access to groundwater, free from flooding, training of farmers in flower production)

2.A.8.g. Orphanage (altitude: 2,330 m, District Rubavu, Congo Kivu)
This site (60 ha privately held or leased) is located at a distance of about 6 km from the Gisenyi - Ruhengeri road. It shares the same features of the previous sites except for the significant absence of surface water and groundwater; also during the time when this site was exploited as orphanage (the orphanage has been discontinued recently) it proved near impossible to access groundwater.
In the absence of a secure water supply during the dry season, this site is less suitable for high value high investment greenhouse production. Notwithstanding the abundant rainfall in this area (1,200 mm/year) it is possible to encounter 90 days or more without significant rainfall during the dry season (requiring an effective storage capacity of 5,000 m^3/ha)

2.A.9 Suggested general approach for water resources use in floriculture ventures
From the above analysis it is clear that there are essentially 2 types of locations; the hill side (including more or less plain areas like Mutobo 1 and 2) and the wetland or marshland locations (sites 2, 3, 4 of the preceding chapter). The hill side locations require additional lift from water source to hill side location which may become a substantial cost (e.g. energy costs of the order of 300 to 500 Frw/m^3 for about 100 m lift). Further pressure is required for filtering and drip irrigation but this is not excessive; 1 to 2 bar at most.

As regards drainage water from greenhouse flower productions, it should be considered that it will be polluted if not immediately than at least at some point in the future. Whether on hill side or in a wetland, natural drainage of irrigation water will ultimately contaminate the environment.

Considering these circumstances the following is suggested:

- The use of substratum and complete recycling and control of the irrigation and drainage cycle is recommended for environmental reasons; this practice increases costs (reportedly about ~35%) and demands better management but appears to gain in attractiveness worldwide because of higher yields and improved quality of produce when properly operated.
- Alternatively the greenhouse soil and drainage water should be isolated by means of geo-plastics and a subsoil drainage system for the same recirculation of irrigation and drainage waters and dissolved agro-chemicals; the additional costs (layered soil excavation (20 - 30 cm topsoil and the rest), geo-plastics layer with protection, filtering and drains, backfill of excavated soil, collection reservoir, water quality monitoring and treatment (EC, pH, alkalinity, sanitation, ...), filtering of water, recirculation, ...)
- Apply rainwater harvesting from the greenhouses; it saves water, energy and is generally a clean water resource that is easily fed into the irrigation water recirculation system. It should however be kept separated from the greenhouse irrigation drainage cycle and contain controlled overflow into a surface water course or infiltration pond.
- Considering the previous points greenhouses for flower production should not be considered on the valley bottom of a wetland; there is difficulty of storing rainwater and drainage effluent and there is a substantial risk of flooding of greenhouses and storage reservoirs. Depending on the flooding levels that may occur, a minimum 5 m above the valley bottom seems indicated.
- Identify the most suitable, least cost and secure additional water source without compromising other water users (in terms of remaining water quantity and return flow water quality): surface water resource, groundwater extraction, surface water storage facility, or a combination of these methods.
- Apply for a water permit at the RNRA - IWRM department (application process being developed)
- Apply for an EIA through RDB with the list of accredited consultants (see annex 14)
- Consult with REMA for the monitoring of the EIA.

2.B. CLIMATE

2.B.1. General climate description

Rwanda has a temperate tropical climate with an average temperature of 19 °C and an annual rainfall between 900 and 1600 mm, depending on the location. Annual rainfall is generally heavier in the western and north-western mountains than in the eastern savannas. The relatively low temperatures are due to the high altitudes. The country has two rainy seasons, viz. a short rainy season from September to November and a long rainy seasons from February to May. The country knows three major climate zones:

a) The west high-altitude region, characterized by a relatively cool and humid climate.
b) The south-eastern region, characterized by a relatively warm and humid climate.
c) The north-eastern region, characterized by a relatively warm and dry climate.

Climate data for Kigali, Rwanda

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high (°C)	26.9	27.4	26.9	26.2	25.9	26.4	27.1	28.0	28.2	27.2	26.1	26.4	26.89
Average low °C	15.6	15.8	15.7	16.1	16.2	15.3	15.0	16.0	16.0	15.9	15.5	15.6	15.73
Precipitation (mm)	76.9	91.0	114.2	154.2	88.1	18.6	11.4	31.1	69.6	105.7	112.7	77.4	950.9
Avg. precipitation days (≥ 0.1 mm)	11	11	15	18	13	2	1	4	10	17	17	14	133

Source: World Meteorological Organization

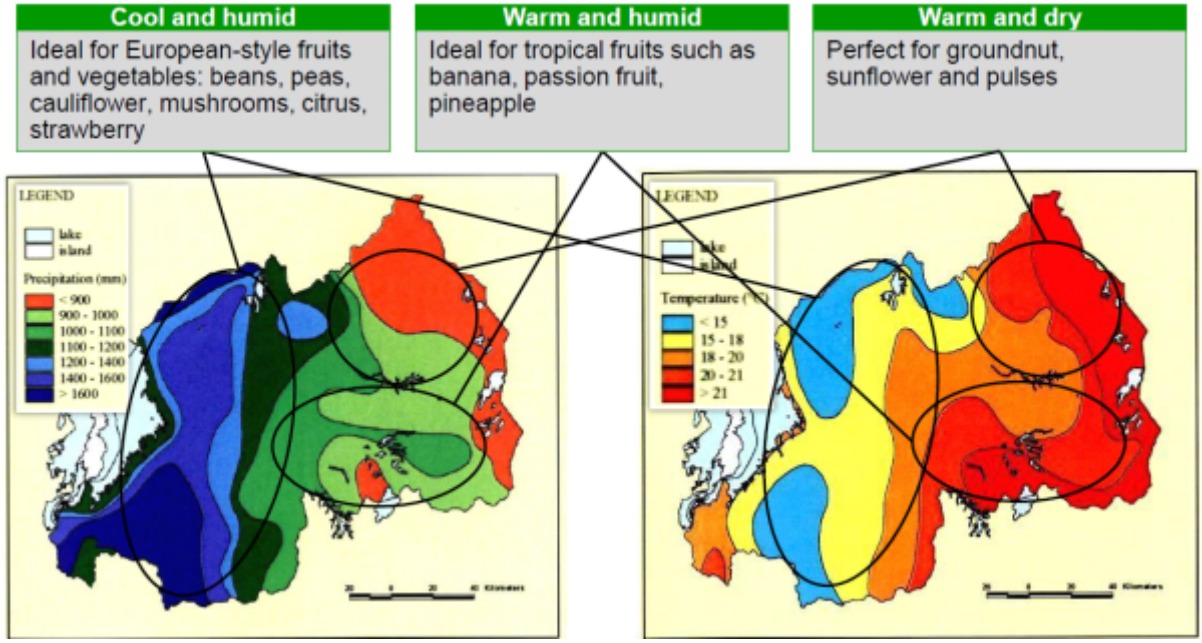


Figure 1: The major climate zones of Rwanda

2.B.2. Temperature and humidity.

Air temperature depends, among others, on the altitude. Towards the east, where altitudes are relatively low, maximum temperatures vary between 25 and 30 °C, with lower or higher values during short periods (Figures 1 and 2; altitudes approximately 1,500 m). At higher altitudes (Figure 3, 1,878 m), the average maximum temperature varies between 20 and 25 °C. The daily average temperatures in the east vary between 15 and 20 °C for Gishari (Figure 1) and around 20 °C Mugesera (Figure 2). At Mugera, it is slightly warmer due to the higher night-time temperatures.

Figure 1 is of particular interest, as it provides climate information for the future flower park at Gishari.

Relative air humidity can be very high at all locations, regularly approaching 100%. This can induce the spread of fungi and bacteria. Maximum early-morning air ventilation in greenhouses is an important prevention measure.

In a greenhouse, temperatures may reach even higher values due to the heat load of the solar radiation. A greenhouse construction with maximum ventilation capacity is needed under such circumstances. Experiences in African countries such as Kenya and Ethiopia, and also Asian countries such as Indonesia and Malaysia, show that such greenhouse constructions are possible.

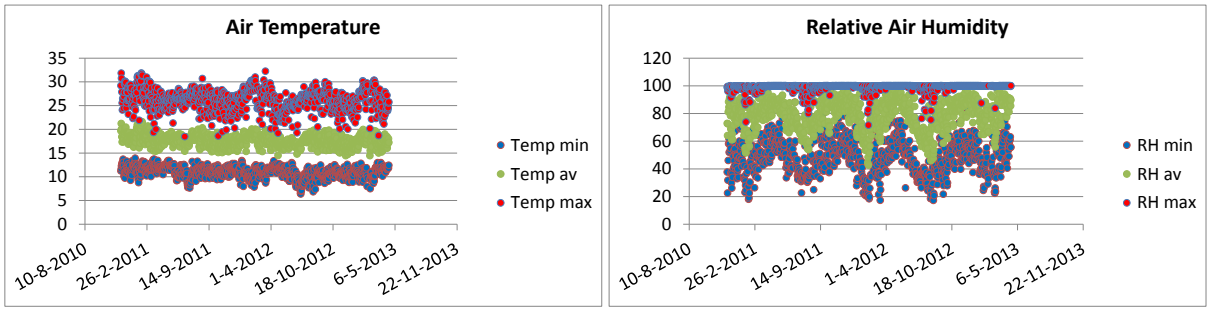


Figure 1: Profiles of temperature and relative air humidity at Kayonza (Eastern province; 01° 49'27" S, 030° 26'52" E; altitude 1,473 m; near Gishari flower park location; see appendix 14d for exact location).

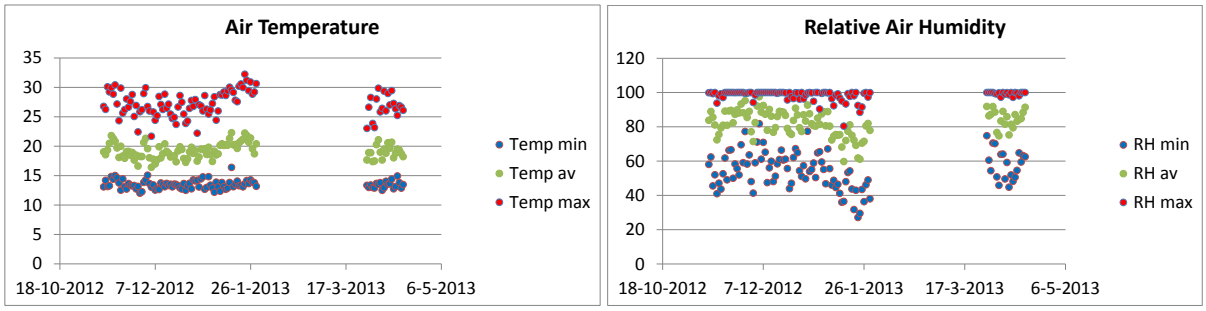


Figure 2: Profiles of temperature and relative air humidity at Mugesera, Ngoma (Eastern province; 02° 07'48" S, 030° 24'36" E; altitude 1,515 m; see appendix 14d for exact location).

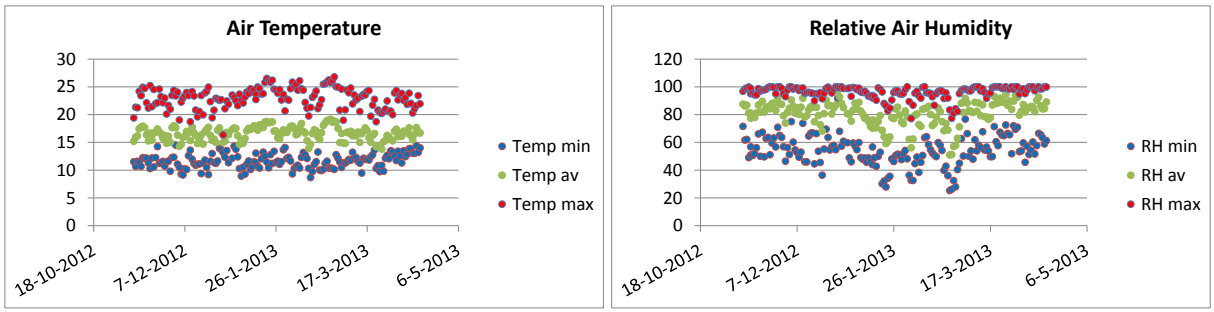


Figure 3: Profiles of temperature and relative air humidity at Musanze (Northern province; 01° 29'58" S, 029° 37'56" E; altitude 1,878 m; see appendix 14d for exact location).

2.B.3. Effect of altitude

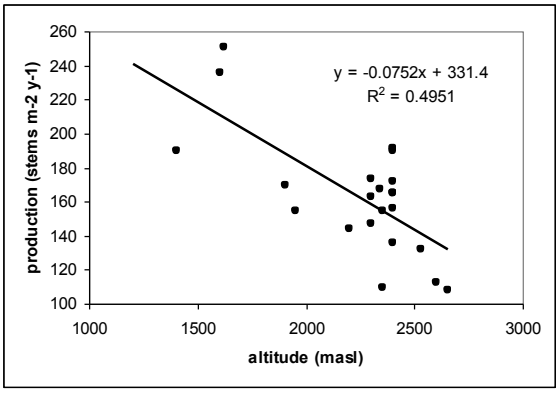
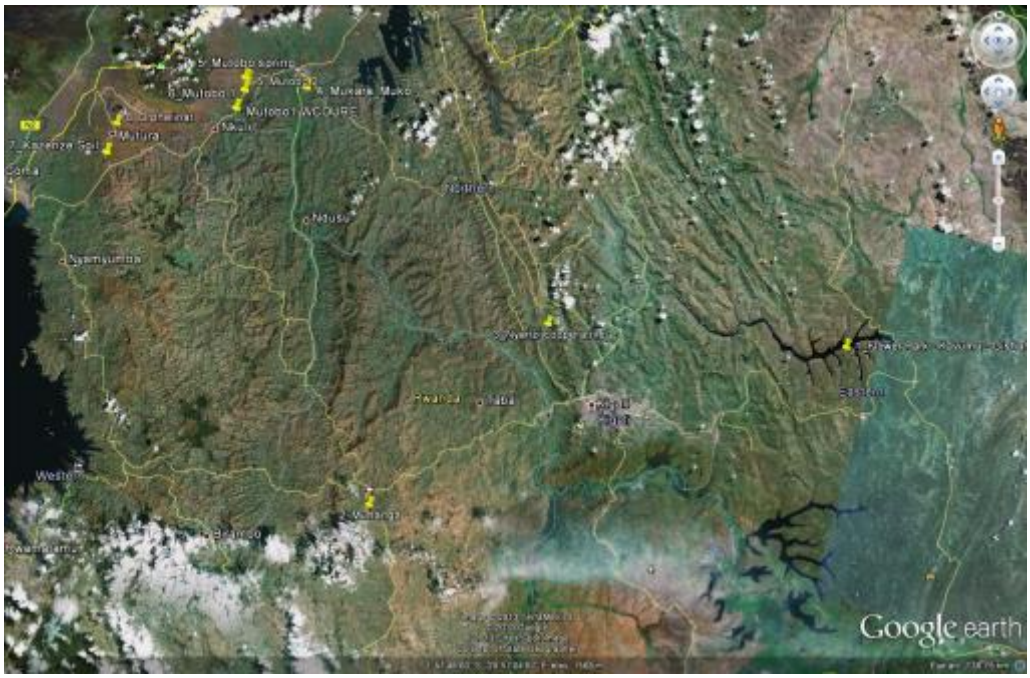


Figure 4. The empirical relation between altitude of rose farms in Ethiopia and their annual production of rose stems (den Belder & Elings, 2007).

There is a linear relation between the altitude and the number of produced rose stems per year per m^2, as is shown in Figure 4 for Ethiopia.
A higher altitude is associated with lower temperatures. The lower temperatures cause a lower development rate, resulting in a longer time period between bud break and flowering, and a lower number of rose stems per year per m^2. The lower temperatures have only a relatively small effect on photosynthesis and growth rates. The combined effect is that the weight per stem increases. The relation for Rwanda is probably different from the one for Ethiopia, however, it is expected that the general trend is similar.

Choices with regards to the market region have implications for the rose type and variety to be produced, and therefore for the location. For example, a T-hybrid will remain a T-hybrid, however, the size of the flower will be larger if a location at higher altitude has been selected.

2.B.4. Climatic conditions for the designated flower parks



In addition to Ghisari (approximately altitude 1,500 m), 7 other areas are designated for flower production, i.e.:

a) in Kigali region

- **Cooperative Nyanzi** Altitude 1,620 meter . production of intermediates roses.

b) SW of Kigali

- **Muhanga / Gabgayi**. Altitude 1,775 meter will give intermediates.

c) In NW region

- **Mukara / Muko** Altitude 1,675 meter. production of intermediates.
- **Mutobo 1&2** Altitude 2,160 - 2,090 meter for the production of Intermediates/T-hybrids
- **Kahanze** Altitude 2,200 meter for the production of Intermediates and T hybrids
- **Orphelinat** Altitude 2,330 meter for the production of Intermediates and T hybrids

The climate at all locations appears suitable for rose production. Besides variation in the size of the rose flowers that is associated with the altitude, variation within the year will occur. It is difficult, however, to predict in advance the length and weights of roses at different altitudes in Rwanda throughout the year. It can be considered to construct at a selection of the designated areas (for instance, at Nyanzi, Muhanga, and in the NW), relatively small and inexpensive evaluation greenhouses and test a selection of varieties. This will result in accurate knowledge on production levels and product quality. In addition, valuable experience with cultivating flowers under conditions specific for Rwanda can be gained.

Soil characteristics are different, in the NW being more volcanic. No special problems are foreseen.

3. PRODUCTION SYSTEM

3.A. Greenhouse type

The basic functions of a greenhouse are:

1) Keep out insects;
2) Protect the crop against harsh weather conditions;
3) Create favourable growing conditions inside.

In order to keep out insects, the greenhouse construction must be impermeable for insects, which can be achieved by a proper netting structure[4]. Other measures, such as a sluice construction must also be implemented. Sanitation measures during the growing season (see below) must complement this. Protection against harsh weather conditions is offered by plastic cover in the top that stops hard rains, and the overall construction that limits wind speed. A problem in Rwanda are the localized hail storms that can seriously damage the plastic greenhouse cover. As there is very little that can be done against large hail stones, a certain risk does exist. Glass greenhouse cover is for financial reasons not an option, and glass is also vulnerable to hail. A favourable growing climate primarily means that the temperature must be kept sufficiently low. The construction requires a top opening (with insect nets) to enable hot air leaving the greenhouse. The temperature is further managed by the cooling effect of crop transpiration and sufficient lateral air movement through the side nets, which can be stimulated with fans.

3.A.1. Greenhouses used in East Africa

Given the fact that the climate in Rwanda is not very different from the climates in Kenya and Ethiopia (the major rose producing countries in Africa), a similar greenhouse construction can be used. This are multi-span greenhouses with one-sided top vents. These greenhouses have a plastic greenhouse cover, with retractable side plastic to enable ventilation. The openings are covered with insect nets. UV-blocking and diffuse foil can be used to reduce the heat load and improve the light quality inside the greenhouse.

3.A.2. Observations on the Gishari construction site

The construction site of the Gishari flower park was visited. A number of remarks can be made:

- Water should be sufficiently available.
- Pressure-regulated drippers
- Netting in the top openings is also required: insects can easily enter at this place.
- Also, the mesh size of the insect netting is max. 2 mm. This is not sufficient for smaller insects such as aphids, leaf-miners, thrips and white fly, for which 0.35 mm mesh size is required. It is sufficient for moths (caterpillars) such as *Tuta absoluta* and harmful *Heteroptera*.
- Netting in the top is also required.
- Gutters etc. are not very straight, which might influence the robustness of the construction.
- Better quality control during the construction will improve the longevity of the greenhouse.

3.A.3. Importance of maintenance

With regard to maintenance of the construction the following observations are important:

- Good maintenance of the Gishari flower park is essential for its lasting operation, and should not be saved upon in financial terms. Therefore:
    - Implement a ‘zero-tolerance’ policy towards degradation of the facilities.
    - Ensure that repairs to the facilities can be done at the shortest possible notice, which may require for instance that small stocks of frequently used goods are available in the country, and that less frequently used goods can be imported swiftly.

[4] This report focuses on flowers. If, for some reason, for example tomatoes will be produced, than it must be ensured that pollination can take place. And as bees can neither enter the greenhouse due to the insect nets, bees must be brought in.

- Various quality levels exist in greenhouse constructions and installations. As a rule of the thumb, high-quality is relatively expensive and last relatively long while limiting operational risks (due to e.g. break-down), while low-quality is relatively cheap and shorter lasting with a higher risk-profile. A strategic balance is chosen between investments and risks. As in case of most other rose farms in East Africa, a medium quality level has been selected for the Gishari flower park. This introduces the need of
    - Strict definition of the specifications;
    - intensive inspection during the construction;
    - optimum maintenance later on.
- a 4-year maintenance contract with the constructor has been negotiated: OK
- maintenance costs should be well-budgeted, e.g. 0.5 – 5% for most hardware and 8% for computers.

3.A.4. Technology levels and transitions

Greenhouses in East Africa are of the low to medium-tech level. To prepare for future developments, it is useful to describe possible transitions. Table 1 gives a possible outline of future developments. The exact sequence of technology steps will vary on the basis of the decisions by the grower and/or investor. Many combinations of and sequences in technology are possible. Developments in fertigation, climate management and greenhouse cover must be combined in different transition paths:

A. Water and nutrient application (fertigation): in the soil – drip irrigation – on substrate – recirculation.
B. Climate: flexible window opening – misting – screens – liquid CO_2.
C. Greenhouse cover: Plastic – glass – diffuse.

Table 1. Summary of possible technology levels.

Technology level	Description
1	plastic foil greenhouse cover, fixed openings, no automated fertigation, soil cultivation
2	1 + drip irrigation / fertigation
3	2 + flexible side/window opening
4	3+ substrate cultivation
5	4+ recirculation (with reverse osmosis water)
6	5 + misting installation
7	6 + retractable screen installation
8	7 + glass greenhouse cover
9	High tech greenhouse, closed, diffuse cover, liquid CO_2, energy screen, etc. Diffuse screen is not required.

Technology level 1 is not recommended for export-oriented flower production. The lack of any form of climate control and not-automated fertigation do not match with the desired production system.

Technology level 2 has a drip irrigation system included. In a low tech situation, this can be done with a simple Venturi or EC controlled pump, while more advances computer systems are available for higher technology levels (as in Rwanda).

Technology level 3 knows flexible side and/or window openings. Especially flexible side openings are useful to manage the greenhouse climate. Flexible top openings are relatively expensive and in practice rarely used.

Technology level 4 makes the step towards cultivation on substrate. This is an important step: it enables higher production, but also requires continuous good crop management (for example, in terms of water application).

Technology level 5 adds a recirculation system to the system of substrate cultivation. A recirculation system is especially important in terms of water and nutrient saving.

Technology level 6 knows a misting installation which improves the climate during dry periods. Air with a higher humidity has a cooling effect and prevents leaf stomata from closing.

Technology level 7 introduces a screen. At Gishari, a diffuse screen is most appropriate, as this reduces the heat load of the incoming radiation when levels are too high. At high altitudes, an energy screen may even be considered, to preserve heat in the greenhouse during cool nights.

Technology level 8 has been added for completeness, and represents a greenhouse with glass cover. We do not recommend this for African conditions.
Technology level 9 represents a high-tech greenhouse as known in The Netherlands. It is not recommended for Rwanda.

At higher altitudes, boiler heating or heating with geothermal energy might be an option. Geothermal heating is being used in Kenya. However the pioneering stage in Rwanda makes it doubtful if the initial investments can be made economically beneficial. However as soon as larger areas may be envisaged re-evaluation might be considered.
In case of boiler heating, the co-produced CO_2 can be used for air enrichment. A medium technology level has been chosen for the Gishari flower park, with flexible side openings, fixed window openings, soil cultivation, and computerized drip irrigation.
Climate management should focus on the prevention of very high temperatures around noon and low air humidity levels around noon, through optimum ventilation and water application. A misting installation could be considered.
High humidity levels will occur in the rainy season, to be solved through good ventilation and considering the installation of mechanical ventilators.

3.B. Cultivation

3.B.1. Pests and disease management

Reported pests include thrips, white fly and aphids, and reported diseases include bacterial wilt, late blight, and powdery and downy mildew. It is difficult to forecast the intensity of the pest and disease problems. Even if prevention measures are sufficient, insects, bacteria and viruses will at some moment enter the greenhouse. There they find a monoculture crop where they can potentially flourish.
The advantage of the Gishari flower park is currently the absence of high pest levels (since there is no rose crop yet). This offers the opportunity to introduce right at the start biological pest management, which is preferable over its introduction after a history of chemical pest management. Biological control if possible, minimal chemical control if needed, form an important pillar for product certification, which is an important factor to consider in view of the export ambitions.

Inevitably, nematodes will start occurring in the soil, which will affect the growth of the rose plants. There exist a number of soil enhancing measures, however, the only true solution to nematodes is substrate cultivation.

Good pest and disease management starts with prevention. Double-door sluices and nets in the side walls are present at the Gishari flower park. Also for pest and disease management we recommend a critical look at some other design and management elements

- Netting in the top openings is also required: insects can easily enter at this place.
- Also, the mesh size of the insect netting is max. 2 mm. This is not sufficient for smaller insects such as aphids, leaf-miners, thrips and white fly, for which 0.35 mm mesh size is required. It is sufficient for moths (caterpillars) such as *Tuta absoluta* and harmful *Heteroptera*.

It is felt that pest management in Rwanda can be improved. Not knowing in advance the approach at rose farms, calendar spraying and application of high dosages should be avoided; instead, scouting and (spot) spraying only when critical pest levels have been reached are much better approaches.

3.B.2. Water, soil and nutrient management

Water is applied to the crop to maintain transpiration and a sufficiently low leaf temperature. Without sufficient water, transpiration will drop, stomata will close, photosynthesis rates will fall, and the crop will wilt. There is no other solution to this than the supply of sufficient water. Depending on the soil type, this may have to be done at very high frequency. Best is to apply water on the basis of information coming from sensors that are placed in the soil (or substrate), which are linked to the fertigation computer. An alternative is to apply water on the basis of incoming radiation, however, this is a replacement of the status of soil water availability.
For nutrient application, a regular A-B-C tank system will be placed at the Gishari flower park, which should be sufficient. It is planned to manage fertigation per individual greenhouse, which is also adequate. Pressure-

regulated drippers are planned, which ensures good water availability to all plants. A slope of 0.5^{o} seems appropriate; however, it must be ensured that the slope has the same direction as the tubes.
We could not evaluate the computer system. It is recommended to invest in a good automated system that fertigates on the basis of the right sensor information.

3.B.3. Soil and substrate management

The greatest advantage of soil cultivation is the water holding capacity of the soil, which makes possible malfunctioning of the fertigation system or sub-optimal supply of water and nutrients less critical. However, soil quality must be maintained in terms of nematodes (difficult to avoid), fertility, structure, etc. For a start, soil cultivation appears an appropriate choice.

A move to substrate requires investments, but is also likely to reduce costs of fertilizers (which are recycled) and increase production and benefits. Water use efficiency and nutrient use efficiency are likely to increase.

3.C. Workforce

Employ the best available staff at the Gishari flower park. Some experience with regards to rose cultivation exists in Rwanda, however, not at the scale of the flower park. Well-qualified personnel is needed, from the daily worker to the general manager.
Ensure a good reputation of the entrepreneurs at Gishari flower park, in order to preserve good staff (please note that we do not have any negative indication with regards to this). This can be done through for example ensuring decent salaries, strict policies on sexual harassment, sick leave rights, etc., and through secondary benefits such as a local hospital, support to small village projects, etc. This are considered distinct features of some flower producing farms in other East African countries, which also may play a role if certification for alternative CSR certificates is applied for.
The sector as a whole, and the individual farms will benefit from a country-wide knowledge infrastructure. It is recommended to invest in this, e.g., by

- Continued development of horticultural education at ISAE (the Higher Institute for Agriculture and Animal Husbandry) at Musanze. ISAE is currently one of the current seven public universities who will be merged in 2014 in one national university. ISAE will then be assigned the primary responsibility for agricultural/horticultural education at the academic level. ISAE offers agriculture and animal husbandry at Advanced Diploma (A1) and a four-year Bachelor Degree (A0). MSc and PhD programmes are not offered, while MSc and PhD qualified persons are required for a sustainable development of the sector and its enabling environment.
- Further strengthening the collaboration with private universities, such as The Institute for Applied Science (INES) in Musanze. Their strength lies in applied, market-oriented research.
- International collaboration.
- Enriching the knowledge and (electronic) dissemination systems at the Agricultural Service Centres with knowledge on protected cultivation.
- The establishment of a ‘farmer group’ in which knowledge and experiences with regards to rose cultivation at various locations in Rwanda are exchanged.

4. ECONOMIC INDICATORS

4.A. Labour and Labour Costs.

4.A.1. Available Labour

Most allocated locations are in a direct neighbourhood of villages or even bigger cities, except for Gishari. Available labour for Gishari is mainly to be sourced from Rwamagana 15 km away. General labour is available in all nearby villages and cities. Since most of the allocated locations are in current occupied wetlands and marshlands, it is expected that labour will also come available in cases where land that is currently cultivated by farmers will be used for flower growing.

4.A.2. Labour Cost Structure, minimum wages and social securities

There is not a minimum wage set for workers or category of workers. Regular salaries for basic workers ranges from 500 to 1,000 Rwandan francs ($0.83 to $1.66) per day in the tea industry and 1,500 to 5,000 francs ($2.50 to $8.30) per day in the construction industry. The most common salary in the allocated locations is around 1,50 USD per day. This includes all social securities.

4.A.3. Foreign Management and expat attractiveness

Pioneering floriculture as envisaged by all stakeholders will require a heavy weight with proven pioneering skills. An initial failure may damage the chances of attracting foreign investors for the future. The profile of such a manager will have to make clear that Rwanda is serious and that failure is not an option. This obviously comes at a price. The position of the general manager will have to be recruited internationally against competitive salaries. The market indicates at around 100,000 Euro/annum package for the required senior manager in this pioneering situation. Consider senior management in relation to targeted PPP policy.

In some cases where Expats come to work in countries that seek for new developments, governments facilitate by imposing tax incentives for them. In Rwanda this is not the case, every employee is considered equal and is treated as such. The lack of Expat Attractiveness from tax incentives is believed not to jeopardize the development too much and will be accepted in the end anyway.

4.A.4. Competitiveness Rwandan Labour Internationally

Like any other East-African country commencing floricultural activities on larger scale, Rwanda also faces a lack of well trained staff. Experience in surrounding countries teaches us that basic skills are easy to adept for regular labour forces.

The Rwandan Labour Law is renewed in May 2009, including important international standards like Child Labour Prohibition. In the table below an overview is presented of Rwanda employing workers data.

Rwanda Employing workers data (RWANDA: FOSTERING PROSPERITY BY PROMOTING ENTREPRENEURSHIP; DOING BUSINESS 2013 Small and Medium-Size Enterprises										
Fixed-term contracts prohibited for permanent tasks?	Maximum length of fixed-term contracts (months)a	Minimum wage for a T9-yearold worker or an apprentice (US$/month)b	Ratio of minimum wage to value added per worker	50-HOUR WORKWEEK ALLOWED?C	Maximum working days per week	Premium for night work (% of hourly pay)d	Premium for work on weekly rest day (% of hourly pay)d	Major restrictions on night worked	Major restrictions on weekly holiday worked	Paid annual leave (working days)e
No	No Limit	0.0	0.00	Yes	6	0	0	No	No	19.3
Dismissal due to redundancy allowed by law?	Third-party notification if 1 worker is dismissed? 1 worker is dismissed?	Third-party approval if	Third-party notification if 9 workers are dismissed?	Third-party approval if 9 workers are dismissed?	Retraining or reassignment	Priority rules for redundancies?	Priority rules for reemployment?	Notice period for redundancy dismissal (weeks of salary)e	Severance pay for redundancy dismissal (weeks of salary)e	
Yes	Yes	No	Yes	No	No	Yes	No	4.3	8.7	

4.B. Financial Management

Like in any other surrounding country starting to develop floriculture there is no such thing as specific financial management with experience in the floriculture business. Rwanda will have to develop this and that means that the experience will come in time and in the beginning this will not be ideal. The level of financial management related to the floriculture is experienced on the basis of the Gishari project calculations and budgets. It is clear that the project lacks experienced financial management to oversee the consequences of erecting 10Ha in a timeframe with an average of 0,5Ha per month. However also revenue generation and investment in plants over time in the first year is not accounted for. The level of financial management not related to floriculture is comparable to the level in surrounding countries. The world largest accounting firms are all represented in Rwanda.

4.B.1. Investment and Capital Requirements.

The required level of investment in floriculture depend on a couple of main factors:
- is the crop grown outside or inside greenhouses
- does the crop require irrigation and fertilizers
- is starting material to be imported or not
- are royalties involved

The most common crop that is expected to be grown on a larger scale is cut roses. The capital requirement for investing in cut roses exists of investment and pre-operational costs. Average investment per m2 in Euro:

Land:	3.00
Buildings:	11.50
Greenhouses:	16.00
Installations:	6.00
Plants and royalties:	7.50
Total average:	*45.00*

Pre-operational costs per m2:

Labour cost:	3.00
Fertilizers and chemicals:	2.50
Other cost:	2.00
Total average:	*7.50*

4.B.2. General Cost Structure of Floriculture

In general the cost structure for greenhouse production like cut roses is as follows :

SALES		**29,00**	**100%**
COS			
Fertilizers/Chemicals	3,00		10%
Packaging	1,00		3%
Freight	7,50		26%
Commissions	2,50		9%
COST OF SALES		**14,00**	**48%**
GROSS MARGIN		**15,00**	**52%**
COSTS			
Labour and management	5,50		19%
Depreciation	3,00		10%
Other personnel expenses	0,35		1%
Housing and energy	1,10		4%
Vehicle costs	0,10		0%
General costs, telephone and office	0,30		1%
Sales costs and representation	0,65		2%
Interest and bankcosts	1,00		3%
COSTS		**12,00**	**41%**
RESULT		**3,00**	**10%**

The above investment and cost structure is in fact based on averages and depending on among others the location, altitude, rose types and management.

It is known for roses that the choice of varieties is a key for success but also the right type of variety given the climatological circumstances.

INTERNATIONAL COMPARISON					
	Labour cost	**Average labour**	**Average stems**	**Main type of**	**Airfreight in USD**
	Per day	Per Ha	Per sqm	Roses	Per kg
RWANDA	€ 1.20	26	200	Intermediates	$1.50
KENYA	€ 1.40	21	205	Intermediates	$1.30
ETHIOPIA	€ 1.20	22	190	Intermediates	$1.20
UGANDA	€ 1.30	22	280	Sweethearts	$1.30
ECUADOR	€ 6.00	17	150	T-Hybrids	$2.20

Calculating the turnover, freight, commissions and other costs for the three types of roses, one will notice that per square meter the differences are in fact very small. Although a T-Hybrid variety generates a better price per stem, the harvest per square meter is also lower resulting in the same average turnover per square meter as with intermediates. The same counts for commissions, packaging and freight per stem compared to square meter for T-hybrids and intermediates. There is some difference though in labour if one compare sweethearts with T-hybrids as sweethearts is more intensive because of the larger number of stems per square meter.

Growing T-hybrids in higher altitudes is more difficult than intermediates because on higher altitudes the weather conditions may vary more during a day than in lower areas as well as the humidity which is higher above 2.000 meter, especially in the mornings. Nevertheless, with T-hybrids one can make a larger difference in comparison to other growers on higher altitudes if one can grow a better quality of roses. Price differences are larger in the T-hybrid segments than the smaller ones. Better prices can be generated by striving for the best quality roses and varieties but also by having more intense colours and continued focus on quality and strict procedures in cutting, handling, post harvesting and packing. This may all result in a better presentation of one's roses in the market, which is better paid.

4.B.3. Profit, Forex, Exportation of Profits, Cross Border Payments

Rwandan banking and forex policy is quite liberal compared to many other surrounding countries. This will strengthen the international position of Rwanda and attractiveness for investors.
Maintaining forex bank accounts abroad is allowed in Rwanda which increases the flexibility for foreign investors. There are no major restrictions on cross border payments as well as exportation of funds, interest and profits. Expatriation of capital (loans, interest and profits) is unlike in some surrounding countries part of the government policy on attracting foreign investors. It is important for investors that these instruments are incorporated for the long term, either in general law or else in specific incentive agreements with investors.

5. LOGISTICS

Rwanda is considered a land locked country by some and a regional hub for others. Rwanda has accessible roads that are generally in a very well state of maintenance. All the mentioned possible locations in this study have access to the national road system which is beyond doubt. Final connection of pre designated areas has not been completed but is expected in due time.

The real success of competitive floricultural export business out of Ruanda depends on the logistics and packing of the floricultural produce. Solid packing of flowers is rather an art than logical thinking or just experience. Well packed boxes travel better.

A fully covered cold chain, from harvest to market, is inevitable to compete internationally. Although the cooling facilities at Kigali airport are quite state of the art to facilitate the cool chain, it also comes down to proper management on handling the flowers, pallet building but even prompt security handling (scanning). Fully operating the cold room to international standards will require lots of training still.

5.A. Fresh Forwarding

Perishable transport connects primary production with consumer outlet,
Fresh Forwarding is the missing link to connecting Rwanda with international fresh forwarding companies and networks.

- Maintaining quality of perishables/flowers requires coverage of the full cool chain. By managing the flowers after cutting properly and keep transport time to the pre-cooling as short as possible, regulate temperature and processing time in the post-harvest to a minimum, use cooled trucks to transport to the airport and utilize the cool facilities at the airport to the max, one can establish the full chain in a cooled manner.
- The real success of competitive floricultural export business out of Rwanda depends on the logistics and packing of the floricultural produce. A fully covered cold chain, from harvest to market, is inevitable to compete internationally. Although the cooling facilities at Kigali airport are state of the art to facilitate the cool chain, it also comes down to proper management on handling the flowers, pallet building but even prompt security handling (X ray scanning), and border controls. Fully operating the cold room to international standards will require lots of training still and becoming part of a global network away from the present isolated airport based ware house. Despite state of the art facilities already in place.
- International airfreight carriers are responsible for the cargo they carry. As was the case in early times in Ethiopia airline companies are hesitant to carry perishables if they are not satisfied with the supply chain/cold chain from field to airport. Despite these facilities seem unused and management seems to have an image problem with international carriers. The operation is isolated in the international spider web of fresh forwarding and ignored by reputed carriers.
- Although Kigali airport has a state of the art airport ware house for fresh forwarding is not or hardly operational. Airway side access and air cargo management, including X-ray scanning should be a single management line with security as service delivered to facilitate trade. A single ware house in itself is no guarantee that any origin is connected to an international network or becomes a hub for fresh produce forwarding. Hardware is as important as software and management in place at any airport warehouse. It could be considered that present airport warehousing is tendered (PPP ?) so as to connect Rwandan fresh produce to a recognised international network.
- Airfreight companies are responsible for any freight they carry to destination, being in dedicated aeroplanes, being belly cargo in passenger aeroplanes. If ground operations and manipulations are not up to standard airfreight operators will decline or be hesitant to take any produce.
- Consider a tender for management /and or PPP with an international fresh forwarding company that can demonstrate the capacity to hook up Kigali to a relevant global network for Rwandan perishables. A well-managed and connected transport facility would add to the attractiveness of Rwanda as a country for investment in Floriculture.

The outlines of such a deal might include PP in which the GoR takes a (temporarily) share in exchange for use of airport facilities by the PPP. As well as:

- Description of services to be provided.
- A time frame balancing initial losses, exclusivity and future benefits, including an exit clause and a continued involvement clause beyond contract period.
- Access to airway side, pallet building and brake down
- Description of Scanning and Security services available as provided by GoR
- A exit deal for either

5.B. Cost Comparison air freight

Current airfreight rates to Netherlands:
KLM 2.50 USD p/kg, daily flights, in fact a way to discourage exporters to ship produce that could not be part of a well-organized cool chain. Almost all freight is sold to Entebbe exporters at contracted rates of around 1.30 USD per kg.

THY 1.60 USD p/kg, Turkish operates a full freighter (64 Tons) from Kigali to Istanbul and continues to Maastricht. Contracted volumes may lower the rates in future. Passenger flights (5 times a week and soon7 times) to Istanbul do not accommodate freight capacity.

Present airplane schedules indicate that Kigali freight is still subject to Entebbe2destination freight availability. Some airlines prefer to carry load from Entebbe and are seemingly uninterested in odd cargo from Kigali until the situation on the ground changes. There is a chicken and egg deadlock situation. Without sufficient supply of cargo no reliable farm gate-to-aeroplane is required, without the required uninterrupted cool chain the required investments in fresh produce/floriculture are facing a vital bottleneck.

The newly operational weekly Turkish airfreight flight, connecting Kigali with Maastricht, may prove to be a game changer. However all onward logistics depends on the local situation on the ground. How well is the system on the ground that feeds perishables and or flowers into the airfreight. If the delivery system to the airport and airway side is not up to standard then local producers will not be connected to global logistical networks as non perishable airfreight (minerals) are preferred.

6. RELEVANT REGULATIONS OVERVIEW

6.A. Environment

Local procedures are dedicated to preserving natural habitat en environment while facilitating already present agricultural production. An Environment Impact assessment (REMA) is required when setting up flower production

6.B. Agro Inputs: availability and admission procedures

- Chemical fertilizers are not available in a range that matches agronomic requirements. Application of nutrients should be done the basis of the agronomy aga nutrients required for optimal crop growth.
- Fertilizer use in Rwanda is at low level, compared to countries in the region. No specialised suppliers are found. Local crops do not receive the required and specialised compositions that would increase productivity dramatically. Therefore it is recommended that a more diverse availability of chemical fertilizers is critical to being able to address agronomic needs.
- Procedures need to facilitate in advance the local availability of a wide spectrum of (tailor-made) fertiliser compositions matching local crops and cultures.
- The establishment of a reliable fertilizer company is condition for further development of the agricultural production.
- A list of most commonly used fertilisers in floriculture in the Netherlands is found in the appendices Annex 12
- RAB is the coordinating and approving body for the use and importation of chemical fertilisers.
- A quick scan by RAB, although non-conclusive, indicated that there was no objection.

6.C. Agro inputs chemicals

- Agro-chemicals presently available and admitted for use are based on traditional use within traditional Rwandan general agriculture. The establishment of flower production and new horticultural production will require direct access and or availability for investors to a wide variety of agrochemicals which have not been yet used in Rwanda.
- Especially since greenhouse production is new to Rwanda, the unpredictable will happen. In a greenhouse environment pests and diseases require a swift and adequate reaction. Reaction time is limited to hours rather than days and official procedures for the importation should be prepared.
- Biological control: The advantage of new flower parks is the absence of high pest levels (since there is no rose crop yet). This offers the opportunity to introduce right at the start biological pest management, which is preferable over its introduction after a history of chemical pest management. This also forms an important pillar for product certification.

Local procedures have come from experience and requirements of agricultural production already in the country. Since Rwanda knows no floriculture local officials and administrative procedures have not yet been exposed to the demands of this newcomer.

A list of most commonly used agro-chemicals has been attached to this report. This list does not conflict with the local list of banned agro chemicals.

Importing non registered agro chemicals that are not on the banned substances list, are subject to approval by REMA. Local protocols are in place to cater for unregistered agrochemicals. Local protocol allows a 5 day reaction time, this may be adequate for general agriculture already inside present in Rwanda but is way too long to cater for emergencies in a closed greenhouse environment where pests and diseases can spread like wildfire.

It is advised that local procedures are adapted to the requirements of the floriculture so that contingency plans are in place ahead of any occurring emergencies.

6.D. Location and Construction: permits required and procedures

Rwanda Development Board (RDB) is handling most affairs connected to foreign investment coming into Rwanda as a one stop shop for foreign investors. This applies a.o. to licenses land, tax regulations, construction permits, RDB is known to work in a tailor made fashion to make investments possible. Without any past exposure to a particular industry or activity a dialogue is proposed.

7. INVESTMENT

The Government of Rwanda recognizes the private sector is an essential engine for development and welcomes foreign investment in policy and in practice. Rwanda is ranked 52 in the World Bank "Ease of Doing Business" indicators from 185 economies in the world and 3rd among the 44 Sub-Saharan African nations. Next table shows how Rwanda compares to neighbouring countries, competing in floriculture. (See Appendix 13.c for detailed rankings per item.)

Rankings Ease of Doing Business (index; 1=most business-friendly regulations) 2012 (source: Int. Finance Corporation / World Bank)

	Rwanda	Uganda	Kenya	Ethiopia	Tanzania
Ease of Doing Business	**3** / 52	**9** /1 20	**10** / 121	**13** / 127	**15** / 134
- Starting a Business	**1** / 8	**28** / 144	**23** / 126	**35** / 163	**15** / 113
- Dealing with Construction Permits	**15** / 98	**22** / 118	**3** / 45	**4** / 53	**44** / 174
- Getting electricity	**2** / 49	**22** / 127	**36** / 162	**12** / 94	**13** / 96
- Registering Property	**5** / 63	**21** / 124	**37** / 161	**18** / 112	**27** / 137
- Getting Credit	**4** / 23	**7** / 40	**2** / 12	**13** / 104	**22** / 129
- Protecting Investors	**3** / 32	**24** / 139	**16** / 100	**20** / 128	**16** / 100
- Paying Taxes	**3** / 25	**12** / 93	**33** / 164	**16** / 103	**21** / 133
- Trading Across Borders	**32** / 158	**33** / 159	**25** / 148	**34** / 161	**12** / 122
- Enforcing Contracts	**3** / 39	**19** / 117	**30** / 149	**6** / 50	**1** / 36
- Resolving Insolvency	**37** / 167	**5** / 69	**14** / 100	**19** / 117	**21** / 129
*(Ranking: **Sub-Saharan Africa** 44 countries / World 185 countries)*					

(source: eRegulations RWANDA, RDB and 2012 Investment Climate Statement - Rwanda, US dept. of State)

The GoR encourages foreign investment through outreach and tax incentives. The only difference in treatment between foreign and domestic companies is the initial capital requirement for official registration. Foreign investors can start a new business irrespective of the initial capital requirement.

7.A. Investment procedures

To apply for incentives, an investor must first be registered as an investor by obtaining an investment certificate issued by Rwanda Development Board (RDB).To obtain the investment certificate, applicants must prove that they will invest more than USD 250,000 for foreigners and more than USD 100,000 for local investors or COMESA investor. They must be registered as either domestic or foreign companies in Rwanda in order to apply for the investment certificate.

7.B. Investment incentives can be both fiscal and non-fiscal

Fiscal incentives include paying only a flat fee of 10% of the CIF (cost, insurance and freight) value of building and finishing materials instead of import duty, VAT and other taxes. There are several other tax exemptions on imported goods including: machinery and raw materials; privileges on movable property and equipment such as personal car, personal and household properties; equipment in the education field; specialized vehicles; tourist chartered airplanes; medical equipment, medical products, agricultural equipment and livestock; equipment meant for tourism and hotel industry.
In cases where the government is eager to develop certain sectors, income tax exemptions are negotiable for individual cases.

Non fiscal incentives include free initial one-year work permits for foreign workers and the acquisition of permanent residency (granted to an investor if he deposits an amount of at least USD 500,000 on an account in a Rwandan commercial bank for a period no less than six months).

The full list of incentives are listed in the law relating to investment and export promotion and facilitation (N° 26/2005 of 17/12/2005), annexes I and II.(source: *eRegulations RWANDA, RDB)*

Tax Comparison

Taxes (IFC WBank 2013)

	Payments (number per year)	Time (hours per year)	Profit tax (%)	Labour tax and contributions (%)	Other taxes (%)	Total tax rate (% profit)
Ethiopia	31	306	27.0	2.0	4.3	33.3
Kenya	41	340	28.1	6.8	9.5	44.4
Rwanda	17	134	21.2	5.6	4.4	31.3
Tanzania	48	172	20.2	18.0	7.1	45.3
Uganda	31	213	25.0	11.3	0.8	37.1

With respect to the tax comparison as shown above we learn that Rwanda has a tax friendly climate. The administrative burden is with 17 payments and 134 hours spent per year the lowest in the area. The tax rates are cumulatively the lowest as well. This makes Rwanda also attractive for foreign investors from a tax perspective.

7.C. Investment Protection

The Government of Rwanda has put in place a number of legal and treaty measures to provide investors with protection of their investments.
(source: *eRegulations RWANDA, RDB)*

7.C.1. Protection from Expropriation

The Constitution guarantees protection of property. At the same time Article 30 of the Investment Law 2006 stipulates that the Government is responsible for the protection of foreign investment. Expropriation of property may be carried out by the Government in the public interest defined as development, social welfare, territorial integration and security. However, there should be prior and just compensation that is calculated as being equal to the value of the land and the activities performed thereon by the expropriated person, calculated in consideration of market prices. Offences against property are punishable in accordance with the provisions of the penal code.

7.C.2. Revocation of Investment Certificate

The Investment Law provides that in instances of fraudulent representation or the provision of false or incorrect material, the investment certificate may be revoked by RDB by giving a written notice to the investor requiring him or her to show cause within 10 days from the date of the notice why the certificate should not be revoked. If within that period a satisfactory explanation is not provided, the Board may withdraw the certificate. The entity affected may, however, continue to operate as a business in Rwanda while the legal process takes its due course or even after the certificate is revoked but then without the associated incentives.
In practice RDB has never revoked certificates. It normally relies on counselling to achieve the desired corrective action.

7.C.3. Exchanging and Remitting Funds

The National Bank of Rwanda governs matters relating to the management of foreign exchange. Financial transfers to service debt payments, dividends, royalties and profits are unrestricted. However, they are subject to a 15 per cent withholding tax. There are some restrictions on the transfer of earnings by expatriate employees, subject to meeting fiscal obligations. There are also reporting and repatriation requirements for exporters with transactions exceeding US$ 10,000. Both residents and non-residents may open foreign currency accounts with domestic banks. Only authorized dealers are allowed to engage in the foreign exchange business, except where the National Bank of Rwanda permits a specific person or class of persons to do so, subject to the conditions it may impose.

7.C.4 Dispute Settlement

Rwanda's framework for dispute resolution consists of commercial courts, and arbitration and mediation. Rwanda is also a member of the International Centre for the Settlement of Investment Disputes (ICSID) since 1979, the World Bank's Multilateral Investment Guarantee Agency (MIGA), which offers insurance against non-commercial risk, and the African Trade Insurance Agency (ATI), which are supported by the World Bank and Lloyds of London. ATI covers risk against restrictions on import and export activity, inconvertibility, expropriation, war, and civil disturbances.

The commercial justice system covers commercial, financial, fiscal and other matters closely related to them, and consists of three commercial courts and a commercial high court. The three lower courts cover commercial disputes with a value less than US$ 37,000 while the high court covers disputes above this value as well as appeals against decisions from the lower courts.

The Arbitration and Conciliation Law, 2009 covers informal dispute resolution. Arbitral rewards are treated as final and binding unless in certain specified exceptional circumstances. The law applies to both domestic and international commercial arbitration and conciliation with respective rules and procedures recognized as long as both parties agree to them. Moreover if during arbitral proceedings the parties settle the dispute, the arbitral tribunal shall terminate the proceedings thus encouraging peaceful agreement. The law also clarifies the case of bankruptcy, where a provision relating to arbitration specified in the contract relating to the bankrupt person, shall be enforceable by the trustee in bankruptcy.

Kigali International Arbitration Centre (KIAC) was established by the Law no 51/2010 of 10/01/2010 as a supportive organization for administered arbitration in Rwanda. The KIAC does not itself resolve disputes. It administers the resolution of disputes by arbitral tribunals in accordance with the rules of arbitration. The arbitral tribunal includes 1 or 3 arbitrators. One designated by KIAC and on request by respectively the claimant and respondent.

7.C.5. International Investment Treaties

Rwanda is still developing its legal infrastructure. Specialized commercial courts began operations in 2008 and have largely cleared a substantial backlog of cases. Despite this, still concerns exist regarding a lack of independence and capacity in the judicial system as well as corruption in legal processes. Investors have commented that the sanctity of contracts is not always upheld and court judgments are not always enforced in a timely fashion. For foreign investors, a Bilateral Investment Treaty including a neutral arbitration clause may assuage these concerns. Rwanda has Bilateral Investment Treaties with the following 7 countries: Belgium and Luxembourg, Germany, Mauritius, South Africa, Switzerland and the United States.

7.D. Intellectual Property

Intellectual property in Rwanda is governed by the Protection of Intellectual Property Law, 2009. The law regulates industrial property, and copyright and related rights.

Industrial property may be registered and obtained at the RDB. Protection for inventions is provided through patents that are issued for 20 years with no possibility for renewal. Trademarks may be issued for periods of 10 years and can be indefinitely renewed at the end of each term. Both patents and trademarks may be transferred or assigned. Copyrights and related rights are also available under the law; for natural persons such rights are guaranteed for life and up to 50 years after. Effective technical protective measures are protected against circumvention. Furthermore utility model certificates as well as protection rights for designs for layouts and industrial designs are provided, though on a more short term basis.

7.D.1. Plant Breeders Rights UPOV

The Protection of Intellectual Property Law does not cover Plant Variety Protection or Plant Breeders rights. The importance of new varieties is underlined when considering that the commercial life span of a flower variety is just 5-7 years, while in a crop like potatoes the commercial life span of variety is 30-50 years.

Flower production is subject to fashion rather than agronomic characteristics. Only early bird producers of new varieties make premium money as exclusive producers. Local availability of new varieties from internationally located breeders demand swift local procedures and local protection of plant breeder's rights.

Private Breeders of new (flower) varieties invest large sums in creating new flower varieties. New varieties in flowers are prone to consumer taste and fashion as well as agronomic selection. Breeders want a return on their investment. will want to see their investments in breeding protected from illegal reproduction. Protecting plant varieties is a condition to getting the newest varieties to Rwanda. Plant Variety protection is internationally regulated within UPOV framework.

Monopolising and Trafficking of indigenous Rwandese varieties as plant variety protected varieties can be opposed and limited under UPOV regulations. The following observations with regard to UPOV can be made.

The International Union for the Protection of New Varieties of Plants (UPOV) is an intergovernmental organization, based at Geneva, Switzerland. UPOV was established by the International Convention for the Protection of New Varieties of Plants. UPOV's mission is to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society.

For a successful export oriented flower production, it is important having access to (new) varieties which are in demand in the international market. UPOV membership is a guarantee for plant breeders for safe international trade of their varieties. Plant breeders will be hesitant to supply non-UPOV members with their new varieties of plants.
To convince foreign investors and facilitate a successful export oriented flower production, the Rwandan membership of UPOV will be a pre requisite.

7.D.1.a. System of Plant Variety Protection (UPOV)
The International Union for the Protection of New Varieties of Plants (UPOV) is an intergovernmental organization, based at Geneva, Switzerland. UPOV's mission is to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society. The Convention defines both how the organization must be governed and run, and the basic concepts of plant variety protection that must be included in the domestic laws of the members of the Union. These concepts include:

- The criteria for new varieties to be protected: novelty, distinctness, uniformity, and stability.
- The process for application for a grant
- Intellectual property rights conferred to an approved breeder
- Exceptions to the rights conferred to the breeder
- Required duration of breeder's right
- Events in which a breeder's rights must be declared null and void

In order to be granted breeder's rights, the variety in question must be shown to be new. This means that the plant variety cannot have previously been available for more than one year in the applicant’s country, or for more than four years in any other country or territory. The variety must also be distinct, that is, easily distinguishable through certain characteristics from any other known variety (protected or otherwise). The other two criteria, uniformity and stability, mean that individual plants of the new variety must show no more variation in the relevant characteristics than one would naturally expect to see, and that future generations of the variety through various propagation means must continue to show the relevant distinguishing characteristics.

A breeder can apply for rights for a new variety in any union member country, and can file in as many countries as desired without waiting for a result from previous applications. Protection only applies in the country in which it was granted, so there are no reciprocal protections unless otherwise agreed by the countries in question. There is a right of priority, and the application date of the first application filed in any country is the date used in determining priority.

The rights conferred to the breeder are similar to those of copyright in the United States, in that they protect both the breeder's financial interests in the variety and his recognition for achievement and labour in the breeding process. The breeder must authorize any actions taken in propagating the new variety, including selling and marketing, importing and exporting, keeping stock of, and reproducing. This means that the breeder can, for example, require a licensing fee for any company interested in reproducing his variety for sale. The breeder also has the right to name the new variety, based on certain guidelines that prevent the name from being deliberately misleading or too similar to another variety's name.

There are explicit exceptions to the rights of the breeder, known as the "breeder's exemption clause", that make it unnecessary to receive authorization for the use of a protected variety where those rights interfere in the use of the variety for a private individual's non-monetary benefit, or the use of the variety for further research. For example, the breeder's rights do not cover the use of the variety for subsistence farming, though they do cover the use of the variety for cash crop farming. Additionally, the breeder's authorization is not required to use a protected variety for experimental purposes, or for breeding other varieties, as long as the new varieties are not "essentially derivative" of the protected variety.

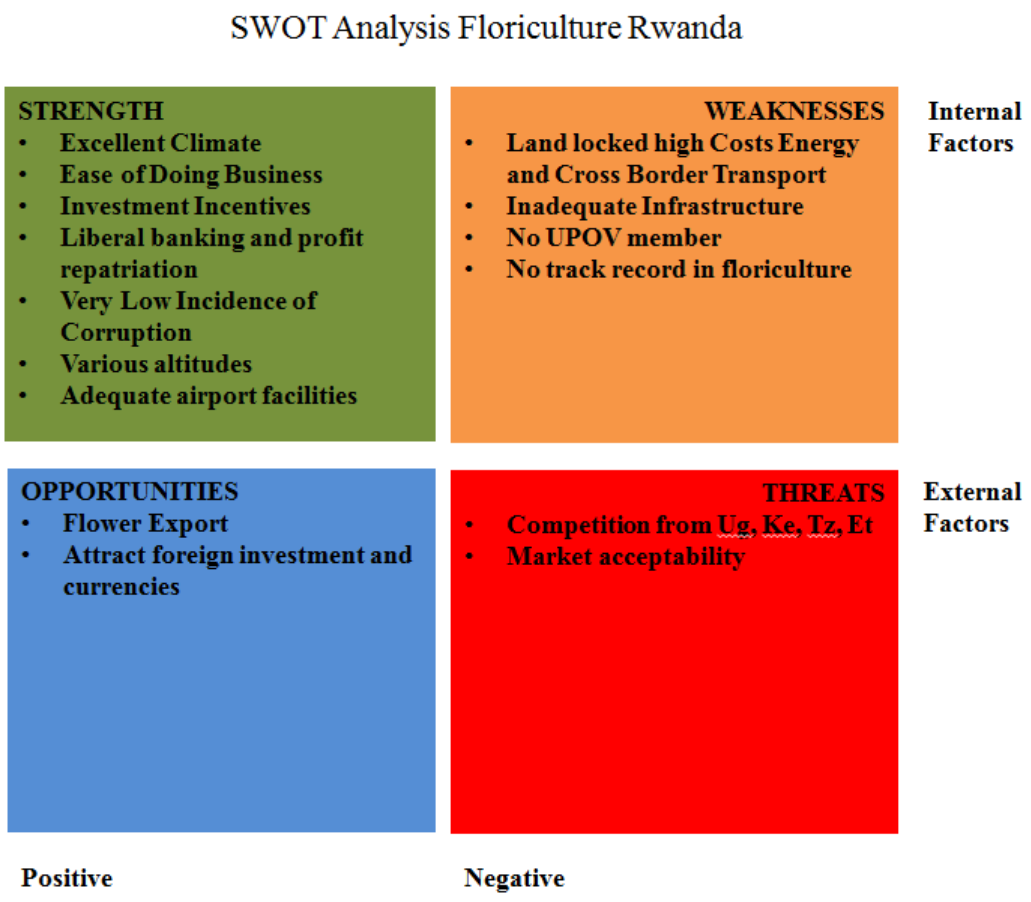
The Convention specifies that the breeder's right must be granted for at least 20 years from grant date, except in the case of varieties of trees or vines, in which case the duration must be at least 25 years.

Finally, there are provisions for how to negate granted breeders' rights if the rights are determined to be unfounded. That is, if it is discovered after the application has been granted that the variety is not actually novel or distinct, or if it is discovered to not be uniform or stable, the breeder's rights are nullified. In addition, if it is discovered that the person who applied for protection of the variety is not the actual breeder, the rights are nullified unless they can be transferred to the proper person. If it is discovered after a period of protection that the variety is no longer uniform and stable, the breeder's rights are cancelled.

7.D.1.d. Investor attractiveness; grace period for new varieties when introducing UPOV

To add to the attractiveness of Rwanda as a country of opportunity it is suggested to make use of the option UPOV has incorporated. In compliance with UPOV regulations a grace period at the introduction can be granted during which older varieties are granted Plant Breeders Rights. Granting older varieties Plant Breeders Rights would then also make it possible to grant locally developed varieties plant breeders rights. Granting local varieties Plant Breeders Rights creates the fundamentals makes it possible to generate revenues from past research on local and or foreign markets.

7.E. SWOT analyse



7.F. Expert Institutions & identified initial investors

Flora Holland B.A. (FH)
FH is convinced of the growing conditions in Rwanda for different flowers if all other conditions are met. The political and economic turmoil in Zimbabwe has created an opportunity for smaller rose types. For the large rose types growing conditions are presumed to be available in Rwanda.

More is needed then growing conditions only are required to trigger positive investment decisions. Rwanda will need pioneering management, daring investment and some well reputed early bird investors in production, services and logistics. The failure of earlier pioneers in floriculture has haunted Rwanda as an opportunity for investment in floriculture.

Rabobank through Banque Populaire du Rwanda
The Rwandan economy is dominated by subsistence farming, which provides a living for an estimated 90 percent of the working population. Tea and coffee are the main exports. Since 1975, Banque Populaire du Rwanda (BPR) has provided basic credit and savings services to the rural population of this central African country. Based upon Rabobank's in-depth knowledge of cooperative models and agri finance Rabo Development and BPR make a natural match.

In 2008, BPR transformed itself from a loosely knit group of cooperative banks into a tightly woven commercial bank. Its 590,000 client members became shareholders, taking a combined 65 percent stake. The remaining 35 percent was acquired by Rabo Development.

Today, BPR is by far Rwanda's largest retail bank with the most customers and branches.
Rabobank's own cooperative roots and expertise in agri finance make it a natural match for BPR. Rabo Development has brought BPR valuable management experience and extensive technical know-how, essential for the metamorphosis into a strong and modern retail bank.
Since 2008, with Rabo Development's help, BPR has taken huge strides in developing IT systems and improving internal organization. This has enabled the bank to automate its network, introduce innovative new products such as mobile banking and expand the ATM network beyond the main cities – all vital ingredients in improving access to financial services in both urban and rural areas.

Currently, BPR is developing products for specific customer segments, notably private persons, SMEs, rural enterprises and agriculture. Agri finance is a primary growth area, which is why BPR recently received a grant from the World Bank to support its ambitions in this sector. BPR is also forging stronger client relationships with agricultural cooperatives that in turn finance their members. In this way, BPR is strengthening its own loan portfolio and reducing risk, while simultaneously facilitating finance for small-scale farmers.
BPR aims to become Rwanda's leading rural bank by improving banking practices, and contributing towards the country's overall prosperity.

Banque Populaire du Rwanda

Employees	1,477
Customers	1.4 million
Outlets	190
Total assets	EU R 200 million
Rabobank's stake	35%

Rabobank states that tomorrow's world will not be fed without Africa and has put its money where its mouth is in taking an important stake in BPR. The presence of the Rabobank makes an important argument for investor attractiveness.

Identified Potential Early Bird Investors

The latent interest of investors in Rwanda is demonstrated by the investors interest in meeting with Rwandese official ministerial mission to the Netherlands headed by Ms Dr. Agnes Kalibata and organised by the Netherlands Embassy in Kigali. A short list of confirmed and selected potential investors include a variety of potential pioneers and early bird investors.

Floriculture production	Rose intermediates/ T hybrids
Floriculture production	Summer flowers
Floriculture services	Transport and perishables forwarding
Floriculture services	Agricultural supplies/fertilisers
Agricultural commodities	Green Coffee
Animal husbandry	Poultry

8. RECOMMENDATIONS & Road map

Designated area's

The designated area's have been well selected and represents potential production covering a wide range of altitudes and production of alternative flower qualities and types. The designated areas resemble the altitudes as known in alternative and established producers in Central America and the East African region. Potential investors contacted during the time of this study expressed their opinion that the production potential is not in doubt. The NAEB designated area's have attracted some interest by potential early bird investors. This mission has some observations as mentioned below.

- Confirmation of construction strengths and realised construction by an independent validating company.
- Check construction, terms of guarantee, maintenance records vs weather inflicted damages. If the construction collapses who and what will be eligible for compensation or blame.
- Pioneering management with proven track record will be required for Gishari park. Senior management will come from a senior expat manager in present setup or alternatively as part of PPP.
- A focus on capacity building with education institutes within a possible terms of engagement for PPP.
- Reconsider financial calculations and budgeting with realised construction time.
- Include plant health issues in tender procedures.
- Early bird investor will want to make own selection of varieties and locations.
- Further investment in demonstration greenhouses demonstrate the variety of options at other locations rather than more of the same in Gishari.

Capacity building

- Since the initial managers will train the trainers, it is of highly importance that above average managers and expats are recruited as initial management on pioneering (demo) projects.
- Usually foreign investors will bring in their own expertise next to the expats that execute investors' policies.
- Benefits and incentives to early bird investors may be connected to achieving realistic capacity building targets

Resources

Water and environment are sensitive issues with regard to establishing floriculture. Contaminations and multiple claims for different use of the same water sources need to be managed to avoid present and future depletion of sources and potential endangering food security through deterioration of irrigation and or drinking water.
Floriculture requires integrated management of soil and water resources, consider :

- Use substrate as alternative to soil, protect of subsoil from leeching contamination of agro chemicals & residues with a protective layer.
- Recirculation of irrigation water
- Rain water harvesting
- Construction located to facilitate recirculation and rainwater harvesting.
- Identification of additional water requirements

Logistics

Rwanda is considered a land locked country by some and central hub for Eastern Africa by others. Rwanda is well positioned to serve as a hub for the region, connecting Rwanda and neighbouring areas to the rest of the world. This well connected position has generated increased interest from airway companies. Airway traffic to Kigali has seen a strong increase of regular international connections, destinations and different operators. Potential investors seem hardly aware of the increased airway traffic. Perishables and flower production in particular depends on good international connections to potential markets. If Rwanda is to benefit then the situation on the ground concerning cooled chains from producer to plain requires a make over.

- Logistics involving road air and perishables require an integrated approach for Rwanda to tap into global networks. Consider tendering present airport facilities to attract operational management skills.

Regulations

Agrochemicals; Introducing new production methods will see new and unexpected pests and disease. In a closed environment the reaction time to deal with unexpected pests and diseases might be limited to hours rather than days.

- Admittance of and subsequent application procedures to deal with emergencies need to be in place.
- Agrochemical supply companies need to attracted to facilitate local demand for specialised extension and availability of agrochemicals.

Fertilisers; Agronomic nutrient requirements are not matched by locally available fertilisers. This mismatch greatly reduces productivity and yields. The establishment of a fertiliser supply company will directly impact local yields and productivity.

- Agrochemical supply companies need to be attracted to facilitate local demand for specialised know how, extension and availability of agrochemicals. Tailor made fertiliser production may greatly stimulate local production.

Regulations: Plant Breeders rights, UPOV and Introduction of new varieties.

New varieties (flowers potatoes etc.) are not coming into Rwanda because breeders are without any tools to protect their investments to breed new varieties. Flowers are subject to consumer taste and therefore subject to fashion. Early producers of a new flower or variety will benefit from early premiums, to facilitate early production of new varieties through the admission of testing while in production in a closed environment.

- Introduction of system of Plant Variety Protection, UPOV.
- Procedures concerning admittance of new varieties in floriculture need to be adapted to allow for early introduction and production of new varieties, especially in a closed environment.
- Reverse granting of older varieties will at the introduction of UPOV will add to investor attractiveness
- Access to new varieties will help Rwanda to achieve GoR development strategy goals, by attracting foreign investors and give producers the access to varieties required for local and international buyers and agro processors.

Most investors use a structure of companies in their efforts of doing business in the floricultural sector. Obvious growing is done locally in East African countries by companies incorporated in East Africa, however marketing, logistics, financing and management is merely done outside East Africa. Driven by tax reasons they keep this international structure. There is an incentive for Rwanda to make this transparent as it is important for Rwanda to have transparency in financing structures as well as real market information. Making use of an international network within a group of companies diffuses this.

Tax incentives may be linked to a transparent market chain, avoiding tax heavens as these are then no longer interesting from a tax perspective. It is needless to say that an international network of companies for tax reasons will not lead to taxable income levels in the East African country as expected by many governments, and this has shown to be the case in the past. In some countries this caused uncomfortable situations for East African companies as tax authorities imposed fines and interest on undeclared income taxes. Mandatory transfer pricing arrangements and benchmark investigations have become important tools for tax authorities to control the taxable income of floricultural and horticultural companies. Other East African countries have imposed other measurements due to the disappointing income declared for tax. There are cases known that repatriation of funds and foreign currencies is so overregulated that it has become very hard to export money.

Withholding tax/Royalties on protected varieties

Most floricultural varieties are either protected by plant breeders rights or trademark rights. Breeders of those varieties charge royalties, either included in the plant price or separately. Royalties are subject to withholding taxes in Rwanda and all other East African countries. This was neglected for in the beginning of the floricultural episodes in those countries and that is what Rwanda should be careful of. Having a clear policy and make the business transparent from the start is key for success. Plants and royalties should not be imported as a package depriving Inland revenue of due withholding tax.

- By introducing a transparent and reasonable withholding tax (10 - 20%) on royalties investors will signal appreciate the learning curve from which Rwanda has benefitted. While avoiding future restrictive repair regulations.

Repatriation of funds

It is common practise that flowers are exported from African countries through marketing companies located in tax friendly countries.

- By refusing mediation by marketing companies and calculating with final market prices Rwanda can reasonably request a local reinvestment of a certain percentage of profits in return for free repatriation for profits.

Dispute resolution

Dispute resolution between local government and small to medium sized enterprises that dominate the floricultural sector are a sensitive issue. Most treaties are accessible for large companies only.

- Bilateral Investment Treaty including neutral arbitration clause is an important pre-condition.
- SME foreign investors will require a dispute resolution clause in their relation to the GoR which accessible and mutually acceptable.

9. SOURCES CONSULTED

- An investment guide to Rwanda, iGuide Rwanda; (http://www.theiguides.org/public-ocs/guides/rwanda/)
- eRegulations Rwanda, Rwanda Development Board (RDB) (http://rwanda.eregulations.org/)
- Investment Climate Report 2010; Embassy of the United States Kigali, Rwanda.
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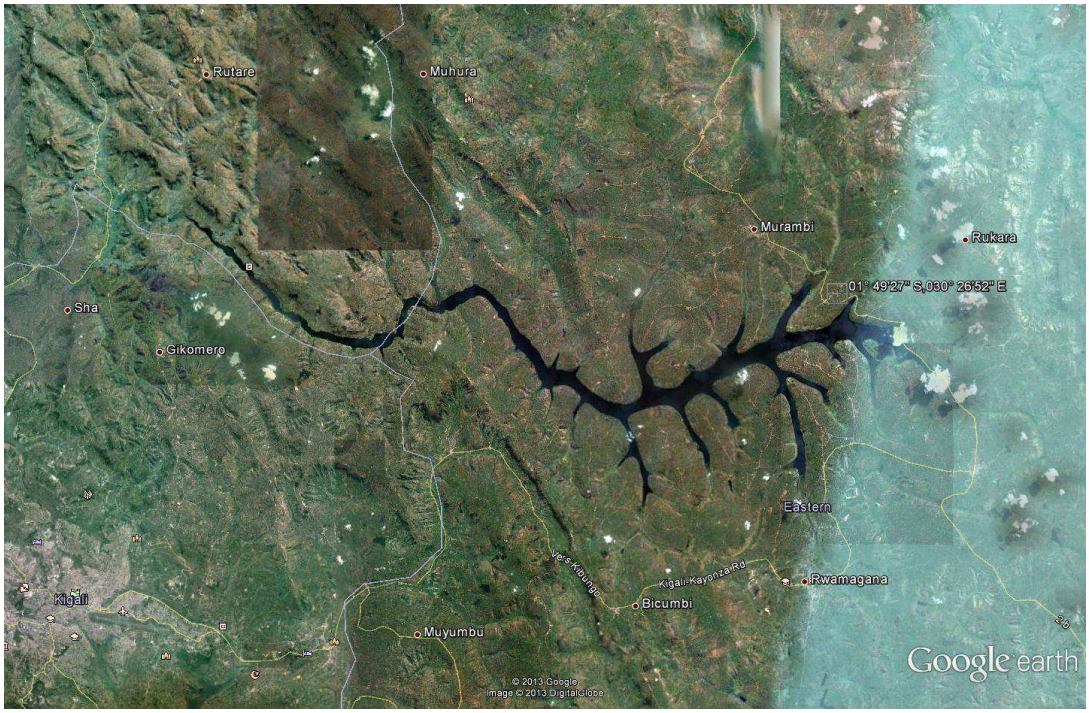
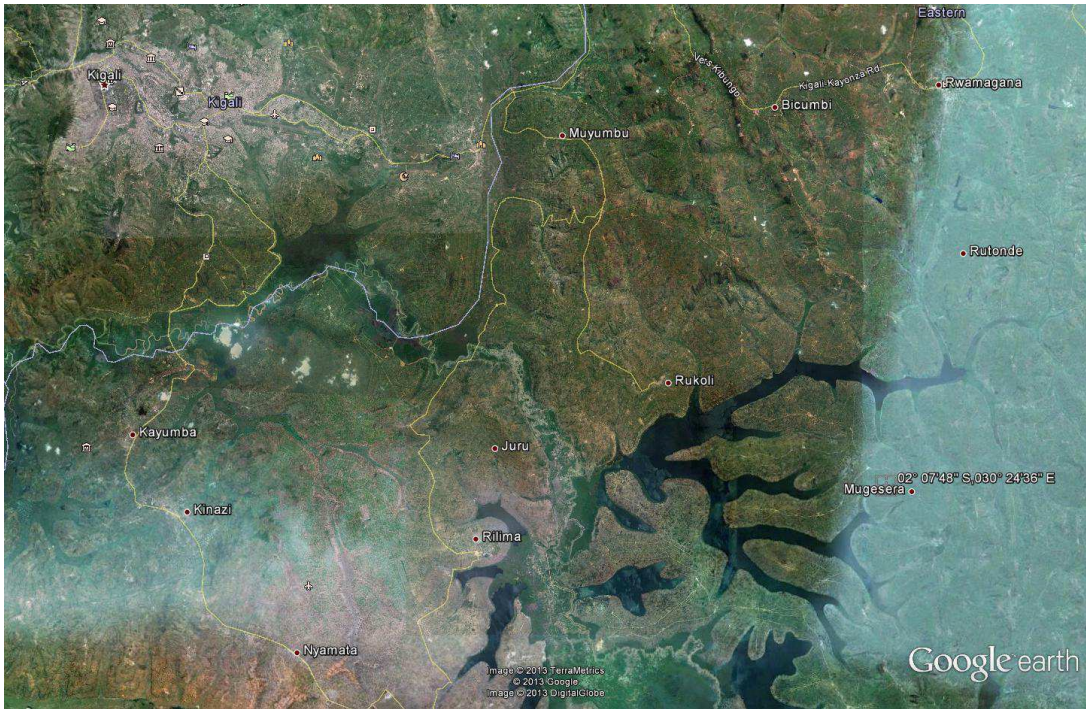
- RWANDA: FOSTERING PROSPERITY BY PROMOTING ENTREPRENEURSHIP; DOING BUSINESS 2013 Small and Medium-Size Enterprises
- ROSES PRODUCTION DEVELOPMENT PROPOSAL March 2013
- World Bank. 2013. *Doing Business 2013: Smarter Regulations for Small and Medium-Size Enterprises.*
- KIGALI INTERNATIONAL ARBITRATION CENTER (KIAC) ARBITRATION RULES 2012
- 2012 Investment Climate Statement - Rwanda; U.S. Department of State
- MINICOM ANNUAL REPORT (July 2010-June 2011)
- Guidelines for obtaining a water right over water resources in Rwanda - RNRA - Department of Integrated Water Resources Management - June 2013 (unissued working version)
- Rwanda Irrigation Master Plan - Ministry of Agriculture & Animal Resources, Republic of Rwanda - August 2010
- Consultancy services for Development of Rwanda National Water Resources Master Plan - Exploratory Phase Report - draft version - May 2013 - SHER Ingénieurs Conseils for MINIRENA - RNRA - IWRM department
- Floriculture development project proposal - Developing Rose production in Rwanda - March 2013 - NAEB
- Environmental Impact Assessment (EIA) of Flower Park Project in Kavumu Cell, Gishari Sector, Rwamagana District, Eastern Province - Draft Report - March 2012 - Fabien Twagiramungu, PhD, Consultant
- Distribution of Heavy Metals in Lake Muhazi, Rwanda" - Open Environmental Engineering Journal, 2012, 5, 96-102 - Innocent Nhapi, Umara Garba Wali, Denise Usanzineza, Japhet J. Kashaigili, Noble Banadda and Richard Kimwaga.

10. APENDICIS

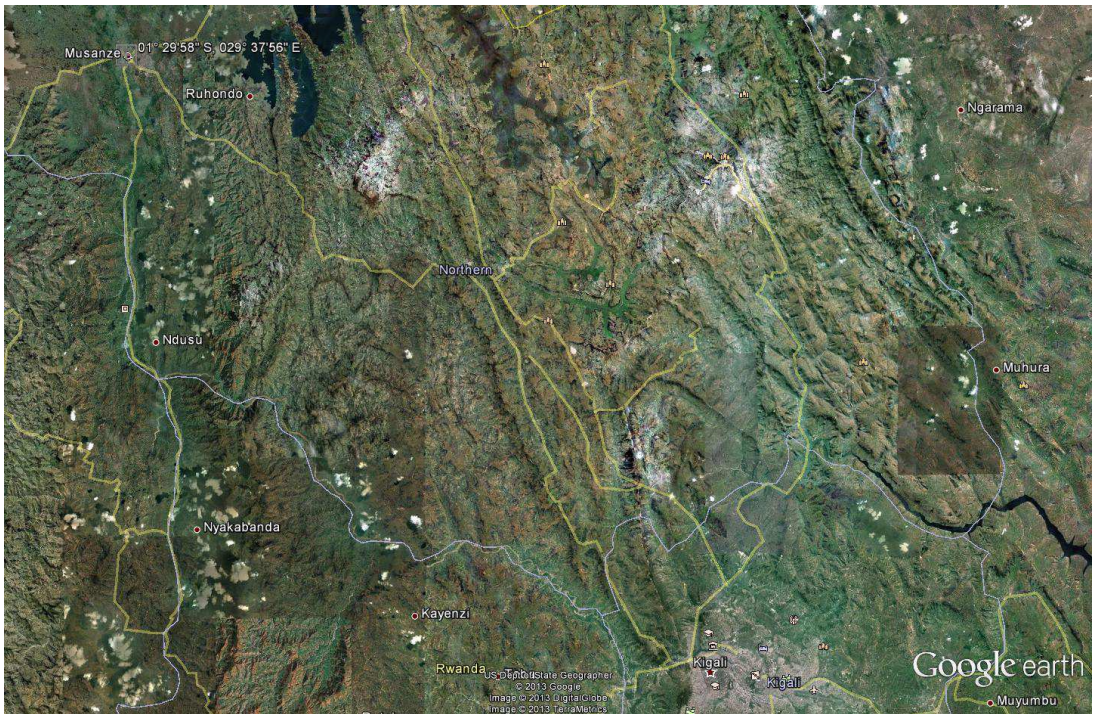
Sites with climate information



Kayonza (Eastern province; 01° 49'27" S, 030° 26'52" E; altitude 1473 m; near Gishara flower park location).



Mugesera, Ngoma (Eastern province; 02° 07'48" S, 030° 24'36" E; altitude 1515 m)



Musanze (Northern province; 01° 29'58" S, 029° 37'56" E; altitude 1878 m)

Annex 1. Table 2: Water balance CKIV 2012 - 2020 - 2030 - 2040.

volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	1.417.336	83.101	81.156	84.013	82.855	128.614	117.495	156.967	130.919	117.975	156.485	164.763	112.992
$Rs_{35\%}$	895.407	72.544	71.553	71.675	62.498	78.047	78.185	96.092	92.687	74.746	67.442	66.545	63.393
$Rs_{50\%}$	810.129	64.543	67.339	62.048	58.089	70.341	72.761	85.407	83.324	65.669	59.102	61.504	60.003
$Rs_{65\%}$	762.033	59.982	61.875	59.614	56.590	64.768	69.613	75.506	78.760	63.128	56.980	56.640	58.577
$Rs_{95\%}$	633.986	51.828	57.346	50.777	50.931	52.479	50.229	64.280	60.631	51.807	48.458	47.734	47.486
$gr.w._{50\%}$	606.250	51.679	52.360	50.777	50.931	51.612	50.229	51.612	53.108	51.612	48.458	47.498	46.376
Dem 2012	28.189	2.308	2.308	2.308	2.317	2.308	2.314	2.314	2.313	2.427	2.427	2.427	2.418
Surpl @ 95%	605.797	49.520	55.038	48.469	48.614	50.171	47.915	61.966	58.318	49.380	46.031	45.307	45.068
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	87.008	5.810	5.810	7.102	9.708	7.102	4.522	4.522	4.525	10.157	10.100	10.100	7.550
Surpl @ 95%	546.979	46.018	51.536	43.675	41.222	45.377	45.707	59.759	56.106	41.650	38.359	37.634	39.936
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-med	90.131	6.070	6.070	7.362	9.969	7.362	4.782	4.782	4.786	10.417	10.360	10.360	7.811
Surpl @ 95%	543.855	45.758	51.276	43.415	40.962	45.116	45.447	59.498	55.846	41.390	38.098	37.374	39.675
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-	92.327	6.253	6.253	7.545	10.152	7.545	4.965	4.965	4.969	10.600	10.543	10.543	7.994
Surpl @ 95%	541.659	45.575	51.093	43.232	40.779	44.933	45.264	59.315	55.663	41.207	37.915	37.191	39.492
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-low	155.716	9.710	9.710	12.647	18.562	12.647	6.767	6.767	6.781	19.581	19.438	19.438	13.666
Surpl @ 95%	478.270	42.118	47.636	38.130	32.368	39.832	43.462	57.513	53.850	32.226	29.020	28.296	33.820
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-med	165.964	10.564	10.564	13.501	19.416	13.501	7.621	7.621	7.635	20.435	20.292	20.292	14.520
Surpl @ 95%	468.023	41.264	46.782	37.276	31.514	38.978	42.608	56.659	52.996	31.372	28.166	27.442	32.966
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-	174.169	11.248	11.248	14.185	20.100	14.185	8.305	8.305	8.319	21.119	20.976	20.976	15.203
Surpl @ 95%	459.817	40.580	46.098	36.592	30.831	38.294	41.924	55.975	52.312	30.688	27.482	26.758	32.283
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-low	259.910	15.121	15.121	20.994	32.824	20.994	9.221	9.221	9.255	34.862	34.633	34.633	23.032
Surpl @ 95%	374.076	36.707	42.225	29.783	18.107	31.485	41.008	55.060	51.376	16.945	13.825	13.101	24.454
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-med	287.783	17.444	17.444	23.317	35.147	23.317	11.544	11.544	11.578	37.185	36.956	36.956	25.355
Surpl @ 95%	346.204	34.384	39.902	27.460	15.784	29.162	38.686	52.737	49.054	14.623	11.502	10.778	22.132
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-	312.475	19.501	19.501	25.375	37.205	25.375	13.601	13.601	13.635	39.242	39.013	39.013	27.412
Surpl @ 95%	321.511	32.327	37.845	25.402	13.726	27.104	36.628	50.679	46.996	12.565	9.445	8.720	20.074
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%

With:

- $Rs_{5\%}$: Renewable surface water resources available in the catchment in one out of twenty years
- $Rs_{35\%}$: Renewable surface water resources available in the catchment in one out of three years
- $Rs_{50\%}$: Renewable surface water resources available in the catchment in one out of two years
- $Rs_{65\%}$: Renewable surface water resources available in the catchment in two out of three years
- $Rs_{95\%}$: Renewable surface water resources available in the catchment in nineteen out of twenty years
- $gr.w_{50\%}$: Renewable ground water resources available in the catchment in one out of two years
- Dem 2012/2020/2030/2040-low/med/high: Demand for different time horizons according to demand growth projections
- $surpl@_{95\%}$: Surplus of renewable surface water resources in 19 out of 20 years over annual demand

- Reliab.%: The reliability of the renewable surface water resources that is superior to the demand (exclusive of environmental demand)

A yellow highlight marks the insufficiency of the resource to satisfy environmental demand estimated at 30% of $Rs_{50\%}$.

Annex 2 Table 3: Water balance CRUS 2012 - 2020 - 2030 - 2040

volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	785.627	59.189	80.191	95.900	53.534	51.018	62.242	110.416	103.210	48.591	29.330	48.891	43.115
$Rs_{35\%}$	459.635	29.794	39.700	45.539	44.455	36.725	53.036	61.698	53.676	32.766	22.267	17.641	22.338
$Rs_{50\%}$	379.596	25.524	34.947	39.539	30.975	32.244	38.875	45.122	47.330	28.500	20.045	16.279	20.217
$Rs_{65\%}$	335.702	22.201	29.933	37.421	23.399	27.965	32.954	41.388	41.352	26.120	18.102	15.828	19.038
$Rs_{95\%}$	205.632	17.448	15.743	20.720	17.698	20.678	17.588	16.719	29.014	17.607	10.808	11.050	10.558
$gr.w._{50\%}$	269.036	21.609	22.330	23.410	23.050	23.770	23.410	25.211	29.173	25.211	18.008	15.847	18.008
Dem 2012	7.134	518	518	518	522	518	521	521	521	745	745	745	741
Surpl @ $_{95\%}$	198.498	16.930	15.225	20.201	17.176	20.160	17.067	16.198	28.493	16.862	10.063	10.305	9.817
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	13.472	958	958	970	1.013	970	941	941	949	1.461	1.448	1.448	1.417
Surpl @ $_{95\%}$	192.160	16.490	14.785	19.750	16.685	19.709	16.647	15.778	28.065	16.147	9.360	9.603	9.141
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-med	14.173	1.017	1.017	1.028	1.071	1.028	999	999	1.008	1.519	1.506	1.506	1.476
Surpl @ $_{95\%}$	191.460	16.432	14.727	19.692	16.627	19.650	16.589	15.720	28.006	16.088	9.302	9.544	9.082
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-	14.667	1.058	1.058	1.069	1.112	1.069	1.040	1.040	1.049	1.560	1.547	1.547	1.517
Surpl @ $_{95\%}$	190.966	16.390	14.685	19.651	16.586	19.609	16.548	15.679	27.965	16.047	9.261	9.503	9.041
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-low	22.473	1.503	1.503	1.528	1.620	1.528	1.461	1.461	1.479	2.637	2.605	2.605	2.545
Surpl @ $_{95\%}$	183.159	15.946	14.241	19.192	16.078	19.150	16.127	15.258	27.535	14.970	8.203	8.446	8.013
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-med	24.784	1.695	1.695	1.721	1.812	1.721	1.653	1.653	1.672	2.830	2.797	2.797	2.738
Surpl @ $_{95\%}$	180.849	15.753	14.048	18.999	15.886	18.958	15.935	15.066	27.342	14.778	8.011	8.253	7.820
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-	26.634	1.849	1.849	1.875	1.966	1.875	1.807	1.807	1.826	2.984	2.951	2.951	2.892
Surpl @ $_{95\%}$	178.999	15.599	13.894	18.845	15.732	18.804	15.781	14.912	27.188	14.623	7.857	8.099	7.666
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-low	34.310	2.117	2.117	2.168	2.352	2.168	2.030	2.030	2.069	4.387	4.334	4.334	4.203
Surpl @ $_{95\%}$	171.323	15.331	13.626	18.551	15.346	18.510	15.559	14.689	26.945	13.221	6.474	6.716	6.355
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-med	40.594	2.641	2.641	2.692	2.875	2.692	2.553	2.553	2.592	4.910	4.858	4.858	4.727
Surpl @ $_{95\%}$	165.039	14.807	13.102	18.028	14.823	17.986	15.035	14.166	26.422	12.697	5.950	6.192	5.831
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-	46.161	3.105	3.105	3.156	3.339	3.156	3.017	3.017	3.056	5.374	5.322	5.322	5.191
Surpl @ $_{95\%}$	159.472	14.343	12.638	17.564	14.359	17.523	14.571	13.702	25.958	12.233	5.486	5.728	5.367
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%

Annex 3 Table 4: Water balance NNYU 2012 - 2020 - 2030 - 2040

volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	1.858.415	138.436	136.591	143.245	163.932	178.526	183.368	185.509	206.542	142.537	123.629	122.377	133.725
$Rs_{35\%}$	1.397.023	98.741	124.979	119.083	112.942	116.062	125.847	143.764	141.071	118.539	101.229	99.054	95.711
$Rs_{50\%}$	1.202.282	93.734	100.109	99.927	96.617	97.539	107.570	126.569	129.294	101.163	87.014	78.548	84.198
$Rs_{65\%}$	1.060.332	84.857	88.299	89.847	82.106	82.537	86.997	117.140	119.050	81.118	74.991	74.612	78.779
$Rs_{95\%}$	884.495	66.953	72.108	72.734	72.187	74.505	72.843	90.663	93.948	76.374	64.894	64.219	63.066
$gr.w._{50\%}$	977.616	74.002	79.700	80.392	79.787	82.349	80.512	100.208	103.840	84.415	71.726	70.980	69.706
Dem 2012	31.285	2.530	2.530	2.551	2.610	2.551	2.502	2.502	2.509	2.767	2.763	2.763	2.709
Surpl @ $_{95\%}$	853.211	64.424	69.579	70.183	69.577	71.954	70.341	88.161	91.440	73.607	62.132	61.456	60.357
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	93.403	5.623	5.623	6.922	9.638	6.922	4.268	4.268	4.325	12.160	12.104	12.104	9.445
Surpl @ $_{95\%}$	791.092	61.330	66.485	65.812	62.549	67.583	68.575	86.394	89.623	64.214	52.791	52.115	53.621
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-med	96.639	5.893	5.893	7.192	9.907	7.192	4.538	4.538	4.595	12.430	12.373	12.373	9.715
Surpl @ $_{95\%}$	787.856	61.060	66.216	65.542	62.279	67.313	68.305	86.125	89.353	63.944	52.521	51.846	53.351
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-	98.907	6.082	6.082	7.381	10.096	7.381	4.727	4.727	4.784	12.619	12.562	12.562	9.904
Surpl @ $_{95\%}$	785.588	60.871	66.027	65.353	62.090	67.124	68.116	85.936	89.164	63.755	52.332	51.657	53.162
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-low	174.907	9.677	9.677	12.629	18.767	12.629	6.611	6.611	6.725	24.501	24.359	24.359	18.363
Surpl @ $_{95\%}$	709.588	57.276	62.432	60.105	53.420	61.876	66.232	84.052	87.223	51.874	40.536	39.860	44.703
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-med	185.468	10.557	10.557	13.509	19.647	13.509	7.491	7.491	7.605	25.381	25.239	25.239	19.243
Surpl @ $_{95\%}$	699.027	56.396	61.552	59.225	52.540	60.995	65.352	83.172	86.343	50.994	39.656	38.980	43.823
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-	193.924	11.261	11.261	14.214	20.352	14.214	8.196	8.196	8.310	26.085	25.943	25.943	19.948
Surpl @ $_{95\%}$	690.571	55.692	60.847	58.520	51.835	60.291	64.647	82.467	85.638	50.289	38.951	38.276	43.118
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-low	302.142	15.373	15.373	21.278	33.550	21.278	9.240	9.240	9.469	45.017	44.790	44.790	32.745
Surpl @ $_{95\%}$	582.354	51.581	56.736	51.456	38.637	53.227	63.603	81.423	84.480	31.357	20.104	19.429	30.321
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-med	330.866	17.766	17.766	23.672	35.944	23.672	11.633	11.633	11.862	47.411	47.184	47.184	35.139
Surpl @ $_{95\%}$	553.629	49.187	54.342	49.063	36.243	50.833	61.210	79.029	82.086	28.963	17.711	17.035	27.927
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-	356.313	19.887	19.887	25.792	38.064	25.792	13.754	13.754	13.983	49.532	49.304	49.304	37.260
Surpl @ $_{95\%}$	528.182	47.066	52.222	46.942	34.122	48.713	59.089	76.909	79.966	26.843	15.590	14.915	25.806
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%

Annex 4 Table 5: Water balance NMUK 2012 - 2020 - 2030 - 2040

volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	1.518.572	131.749	164.627	178.394	98.713	100.871	110.822	157.046	146.911	127.432	104.583	92.474	104.951
$Rs_{35\%}$	886.599	68.467	87.657	69.652	57.517	62.176	63.545	95.396	105.610	88.052	63.913	59.728	64.887
$Rs_{50\%}$	766.459	62.255	70.863	62.308	55.621	58.885	59.070	77.944	95.686	66.335	49.251	51.673	56.569
$Rs_{65\%}$	678.644	55.832	58.885	55.174	48.804	54.016	55.621	67.546	81.603	55.042	47.408	47.777	50.936
$Rs_{95\%}$	511.148	34.826	48.303	47.172	42.223	41.775	34.431	52.252	57.174	43.065	39.301	36.116	34.510
$gr.w._{50\%}$	627.665	45.453	56.196	53.717	50.412	49.585	45.453	64.461	66.113	53.717	49.585	47.519	45.453
Dem 2012	31.285	2.530	2.530	2.551	2.610	2.551	2.502	2.502	2.509	2.767	2.763	2.763	2.709
Surpl @ $_{95\%}$	479.864	32.296	45.774	44.620	39.613	39.224	31.929	49.750	54.666	40.298	36.538	33.353	31.801
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	48.094	3.810	3.810	3.827	3.889	3.827	3.779	3.779	3.793	4.432	4.388	4.388	4.370
Surpl @ $_{95\%}$	463.054	31.016	44.494	43.345	38.334	37.948	30.652	48.473	53.381	38.633	34.912	31.727	30.140
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-med	50.873	4.042	4.042	4.059	4.121	4.059	4.011	4.011	4.025	4.664	4.620	4.620	4.602
Surpl @ $_{95\%}$	460.275	30.784	44.262	43.113	38.102	37.717	30.420	48.241	53.150	38.401	34.681	31.496	29.908
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-	52.807	4.203	4.203	4.220	4.282	4.220	4.172	4.172	4.186	4.825	4.781	4.781	4.763
Surpl @ $_{95\%}$	458.341	30.623	44.101	42.952	37.941	37.555	30.259	48.080	52.989	38.240	34.520	31.335	29.747
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-low	74.027	5.724	5.724	5.763	5.892	5.763	5.659	5.659	5.685	7.127	7.017	7.017	6.997
Surpl @ $_{95\%}$	437.122	29.102	42.580	41.409	36.330	36.013	28.772	46.593	51.489	35.939	32.284	29.099	27.513
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-med	82.975	6.469	6.469	6.508	6.638	6.508	6.405	6.405	6.431	7.872	7.763	7.763	7.743
Surpl @ $_{95\%}$	428.173	28.356	41.834	40.663	35.585	35.267	28.026	45.847	50.744	35.193	31.538	28.353	26.767
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-	90.140	7.067	7.067	7.105	7.235	7.105	7.002	7.002	7.028	8.469	8.360	8.360	8.340
Surpl @ $_{95\%}$	421.008	27.759	41.237	40.066	34.988	34.670	27.429	45.250	50.147	34.596	30.941	27.756	26.170
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-low	105.943	7.932	7.932	8.009	8.267	8.009	7.803	7.803	7.854	10.735	10.560	10.560	10.478
Surpl @ $_{95\%}$	405.206	26.894	40.372	39.162	33.956	33.766	26.628	44.449	49.320	32.330	28.741	25.556	24.032
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-med	130.282	9.960	9.960	10.038	10.295	10.038	9.832	9.832	9.882	12.764	12.588	12.588	12.506
Surpl @ $_{95\%}$	380.866	24.866	38.344	37.134	31.928	31.738	24.599	42.420	47.292	30.302	26.712	23.527	22.004
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-	151.844	11.757	11.757	11.835	12.092	11.835	11.628	11.628	11.679	14.560	14.385	14.385	14.303
Surpl @ $_{95\%}$	359.304	23.069	36.547	35.337	30.131	29.941	22.803	40.624	45.495	28.505	24.916	21.730	20.207
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%

Annex 5 Table 6: Water balance NNYL 2012 - 2020 - 2030 - 2040

volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	1.326.684	94.382	116.797	129.692	112.083	119.469	116.557	163.914	156.350	99.833	78.173	64.834	74.599
$Rs_{35\%}$	929.046	62.576	84.225	73.718	68.738	73.252	87.327	117.368	117.145	73.290	59.153	54.749	57.504
$Rs_{50\%}$	848.870	58.585	75.168	72.133	62.985	69.387	72.348	101.115	107.112	69.155	53.382	52.050	55.450
$Rs_{65\%}$	786.114	57.373	71.344	66.814	57.528	63.222	64.380	95.325	96.483	64.215	51.009	46.721	51.700
$Rs_{95\%}$	633.802	45.188	54.583	52.307	49.586	51.934	53.577	75.826	75.628	48.402	42.429	40.508	43.833
$gr.w._{50\%}$	544.628	41.858	50.561	48.452	45.932	48.107	48.593	49.287	48.593	45.816	39.303	37.523	40.603
Dem 2012	55.845	4.412	4.412	4.412	4.864	4.412	3.978	3.978	4.414	5.357	5.350	5.350	4.905
Surpl @ $_{95\%}$	577.957	40.776	50.171	47.895	44.722	47.522	49.598	71.848	71.214	43.045	37.080	35.158	38.928
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	158.060	11.240	11.240	11.240	16.187	11.240	6.377	6.377	11.244	19.494	19.437	19.437	14.547
Surpl @ $_{95\%}$	475.741	33.948	43.343	41.067	33.400	40.694	47.200	69.449	64.384	28.908	22.992	21.071	29.286
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-med	162.932	11.646	11.646	11.646	16.593	11.646	6.783	6.783	11.650	19.900	19.843	19.843	14.953
Surpl @ $_{95\%}$	470.870	33.542	42.937	40.661	32.994	40.288	46.794	69.043	63.978	28.502	22.586	20.665	28.880
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-	166.279	11.925	11.925	11.925	16.872	11.925	7.062	7.062	11.929	20.179	20.122	20.122	15.232
Surpl @ $_{95\%}$	467.523	33.263	42.658	40.382	32.715	40.009	46.515	68.764	63.699	28.223	22.307	20.386	28.601
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-low	298.561	20.505	20.505	20.505	31.706	20.505	9.462	9.462	20.509	39.222	39.080	39.080	28.021
Surpl @ $_{95\%}$	335.240	24.683	34.079	31.802	17.880	31.429	44.115	66.364	55.120	9.180	3.349	1.428	15.812
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-med	313.887	21.782	21.782	21.782	32.984	21.782	10.739	10.739	21.786	40.500	40.358	40.358	29.298
Surpl @ $_{95\%}$	319.914	23.406	32.801	30.525	16.603	30.152	42.837	65.087	53.842	7.902	2.072	150	14.535
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-	326.160	22.805	22.805	22.805	34.006	22.805	11.762	11.762	22.809	41.522	41.380	41.380	30.321
Surpl @ $_{95\%}$	307.642	22.383	31.779	29.502	15.580	29.129	41.815	64.064	52.820	6.880	1.049	0	13.513
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=95%
Dem 2040-low	528.851	35.312	35.312	35.312	57.715	35.312	13.219	13.219	35.316	72.747	72.520	72.520	50.345
Surpl @ $_{95\%}$	104.950	9.875	19.271	16.994	0	16.621	40.357	62.607	40.312	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=50%	>=95%	>=95%	>=95%	>=95%	>=35%	>=5%	<5%	>=65%
Dem 2040-med	570.539	38.786	38.786	38.786	61.189	38.786	16.693	16.693	38.790	76.221	75.994	75.994	53.818
Surpl @ $_{95\%}$	63.263	6.402	15.797	13.521	0	13.147	36.883	59.133	36.838	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=50%	>=95%	>=95%	>=95%	>=95%	>=5%	>=5%	<5%	>=50%
Dem 2040-	607.469	41.864	41.864	41.864	64.266	41.864	19.771	19.771	41.868	79.299	79.071	79.071	56.896
Surpl @ $_{95\%}$	26.332	3.324	12.719	10.443	0	10.070	33.806	56.055	33.760	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=35%	>=95%	>=95%	>=95%	>=95%	>=5%	<5%	<5%	>=35%

Annex 6 Table 7: Water balance NAKN 2012 - 2020 - 2030 - 2040

volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	1.248.658	74.172	109.085	128.465	89.581	118.511	113.420	167.240	170.708	79.532	61.315	68.819	67.810
$Rs_{35\%}$	866.158	59.890	77.863	73.058	73.575	68.228	80.707	111.251	112.898	64.086	50.843	42.392	51.367
$Rs_{50\%}$	774.661	54.490	68.652	69.979	67.758	62.281	70.365	96.823	100.495	54.783	43.937	39.988	45.110
$Rs_{65\%}$	706.238	51.682	62.774	65.558	59.873	58.473	64.345	86.703	89.091	49.217	38.868	39.093	40.562
$Rs_{95\%}$	430.507	32.783	33.200	34.551	39.433	32.230	50.611	63.623	46.054	32.720	22.384	21.414	21.503
$gr.w._{50\%}$	531.701	36.569	38.563	39.893	51.861	49.866	56.515	63.623	47.872	45.212	36.569	33.244	31.914
Dem 2012	50.884	3.787	3.787	3.787	5.108	3.787	2.478	2.478	3.788	5.809	5.793	5.793	4.488
Surpl @ $_{95\%}$	379.623	28.996	29.413	30.764	34.325	28.442	48.134	61.145	42.266	26.911	16.591	15.621	17.014
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	136.635	8.496	8.496	8.496	12.721	8.496	4.424	4.424	8.498	19.225	19.178	19.178	15.001
Surpl @ $_{95\%}$	293.872	24.287	24.704	26.055	26.712	23.733	46.187	59.199	37.556	13.495	3.206	2.236	6.502
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-med	139.708	8.752	8.752	8.752	12.977	8.752	4.680	4.680	8.754	19.482	19.434	19.434	15.257
Surpl @ $_{95\%}$	290.799	24.031	24.448	25.799	26.456	23.477	45.931	58.943	37.300	13.239	2.950	1.980	6.246
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-	141.850	8.931	8.931	8.931	13.155	8.931	4.859	4.859	8.933	19.660	19.613	19.613	15.435
Surpl @ $_{95\%}$	288.657	23.853	24.269	25.621	26.277	23.299	45.753	58.764	37.121	13.060	2.772	1.802	6.067
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-low	269.153	15.884	15.884	15.884	25.405	15.884	6.665	6.665	15.886	40.188	40.070	40.070	30.668
Surpl @ $_{95\%}$	161.353	16.899	17.316	18.667	14.028	16.345	43.947	56.958	30.168	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=50%	>=35%	>=65%
Dem 2030-med	279.080	16.712	16.712	16.712	26.232	16.712	7.492	7.492	16.713	41.015	40.897	40.897	31.495
Surpl @ $_{95\%}$	151.427	16.072	16.488	17.840	13.201	15.518	43.119	56.131	29.341	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=50%	>=35%	>=65%
Dem 2030-	287.028	17.374	17.374	17.374	26.894	17.374	8.154	8.154	17.376	41.677	41.559	41.559	32.157
Surpl @ $_{95\%}$	143.479	15.409	15.826	17.177	12.538	14.856	42.457	55.469	28.678	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=50%	>=35%	>=65%
Dem 2040-low	490.241	27.757	27.757	27.757	46.795	27.757	9.316	9.316	27.759	76.361	76.172	76.172	57.323
Surpl @ $_{95\%}$	0	5.026	5.443	6.794	0	4.473	41.296	54.307	18.295	0	0	0	0
Reliab.%	>=65%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	>=5%	<5%	<5%	>=5%
Dem 2040-med	517.240	30.007	30.007	30.007	49.045	30.007	11.566	11.566	30.009	78.611	78.422	78.422	59.573
Surpl @ $_{95\%}$	0	2.776	3.193	4.544	0	2.223	39.046	52.057	16.045	0	0	0	0
Reliab.%	>=65%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	>=5%	<5%	<5%	>=5%
Dem 2040-	541.158	32.000	32.000	32.000	51.038	32.000	13.559	13.559	32.002	80.604	80.415	80.415	61.566
Surpl @ $_{95\%}$	0	783	1.200	2.551	0	229	37.053	50.064	14.052	0	0	0	0
Reliab.%	>=65%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	<5%	<5%	<5%	>=5%

Annex 7 Table 8: Water balance NAKU 2012 - 2020 - 2030 - 2040

volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	673.170	48.331	57.528	60.128	56.777	57.305	61.020	63.323	67.324	61.353	53.412	41.207	45.463
$Rs_{35\%}$	531.383	39.194	45.497	49.594	46.844	45.537	47.169	52.143	54.762	51.294	35.623	30.154	33.573
$Rs_{50\%}$	502.501	35.147	43.340	46.852	44.265	44.003	44.342	51.118	53.228	48.053	33.576	27.096	31.481
$Rs_{65\%}$	478.721	32.941	40.081	44.896	42.082	42.116	42.754	50.314	52.144	45.871	30.856	25.153	29.512
$Rs_{95\%}$	350.708	26.089	31.449	28.983	32.004	35.245	33.536	36.804	41.338	27.453	21.543	16.322	19.941
$gr.w._{50\%}$	351.095	26.118	31.484	29.015	32.039	35.284	33.573	36.845	41.384	27.484	21.567	16.340	19.963
Dem 2012	39.633	2.919	2.919	2.919	3.869	2.919	2.915	1.979	2.921	4.082	4.061	4.061	4.068
Surpl @ $_{95\%}$	311.075	23.170	28.530	26.064	28.135	32.326	30.620	34.825	38.417	23.372	17.483	12.261	15.874
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	156.710	9.621	9.621	9.621	16.055	9.621	9.535	3.281	9.623	19.996	19.961	19.961	19.816
Surpl @ $_{95\%}$	193.998	16.468	21.828	19.362	15.949	25.624	24.001	33.523	31.715	7.458	1.582	0	126
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=95%
Dem 2020-med	159.183	9.827	9.827	9.827	16.261	9.827	9.741	3.487	9.829	20.202	20.167	20.167	20.022
Surpl @ $_{95\%}$	191.525	16.262	21.622	19.156	15.743	25.418	23.795	33.317	31.509	7.252	1.376	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=65%
Dem 2020-	160.895	9.970	9.970	9.970	16.403	9.970	9.883	3.630	9.971	20.344	20.310	20.310	20.164
Surpl @ $_{95\%}$	189.813	16.120	21.479	19.013	15.600	25.276	23.652	33.174	31.367	7.109	1.234	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=65%
Dem 2030-low	326.007	19.368	19.368	19.368	33.940	19.368	19.192	4.979	19.370	42.897	42.810	42.810	42.538
Surpl @ $_{95\%}$	24.701	6.721	12.081	9.615	0	15.877	14.344	31.825	21.968	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	>=65%	>=5%	<5%	>=5%
Dem 2030-med	333.895	20.025	20.025	20.025	34.597	20.025	19.849	5.637	20.027	43.554	43.467	43.467	43.195
Surpl @ $_{95\%}$	16.813	6.064	11.424	8.958	0	15.220	13.686	31.167	21.311	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	>=65%	>=5%	<5%	>=5%
Dem 2030-	340.212	20.552	20.552	20.552	35.124	20.552	20.376	6.163	20.553	44.080	43.994	43.994	43.721
Surpl @ $_{95\%}$	10.496	5.538	10.897	8.431	0	14.694	13.160	30.641	20.785	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	>=65%	>=5%	<5%	>=5%
Dem 2040-low	616.893	35.804	35.804	35.804	64.948	35.804	35.449	7.023	35.806	82.861	82.723	82.723	82.143
Surpl @ $_{95\%}$	0	0	0	0	0	0	0	29.781	5.532	0	0	0	0
Reliab.%	>=5%	>=35%	>=65%	>=65%	<5%	>=65%	>=65%	>=95%	>=95%	<5%	<5%	<5%	<5%
Dem 2040-med	638.349	37.592	37.592	37.592	66.736	37.592	37.237	8.811	37.594	84.649	84.511	84.511	83.931
Surpl @ $_{95\%}$	0	0	0	0	0	0	0	27.993	3.744	0	0	0	0
Reliab.%	>=5%	>=35%	>=65%	>=65%	<5%	>=65%	>=65%	>=95%	>=95%	<5%	<5%	<5%	<5%
Dem 2040-	657.356	39.176	39.176	39.176	68.320	39.176	38.821	10.395	39.178	86.233	86.095	86.095	85.515
Surpl @ $_{95\%}$	0	0	0	0	0	0	0	26.409	2.160	0	0	0	0
Reliab.%	>=5%	>=35%	>=65%	>=65%	<5%	>=65%	>=65%	>=95%	>=95%	<5%	<5%	<5%	<5%

Annex 8 Table 9: Water balance NAKL 2012 - 2020 - 2030 - 2040

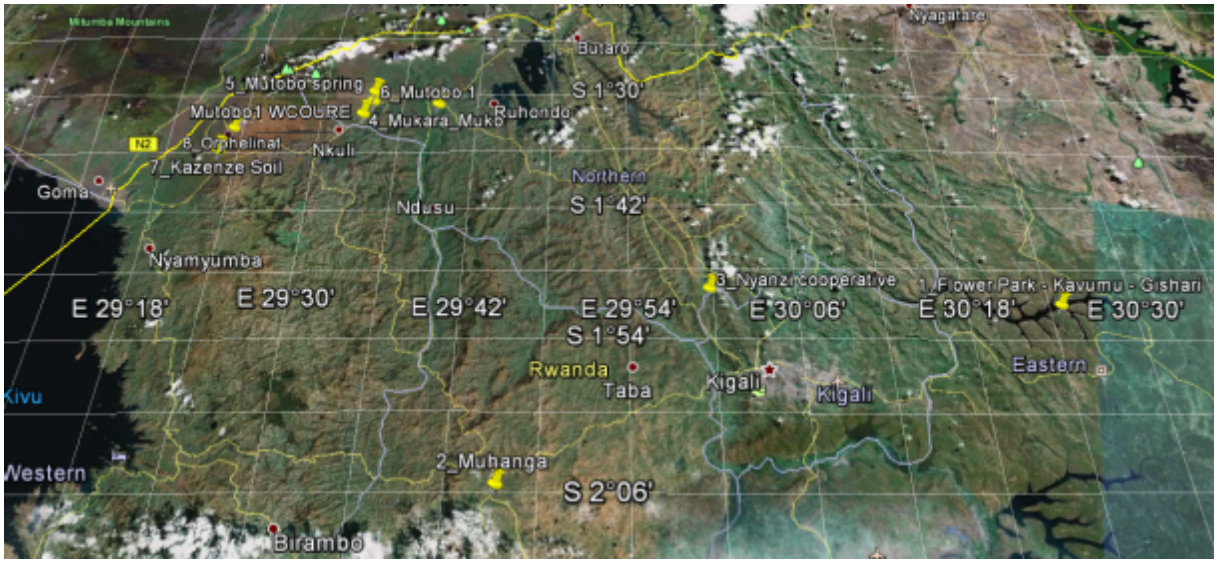
volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	1.285.266	73.080	82.640	97.397	98.981	105.763	115.277	136.037	142.848	134.544	114.129	106.544	78.026
$Rs_{35\%}$	964.603	59.628	65.017	72.784	78.192	78.205	90.840	102.955	107.707	96.775	82.500	68.334	61.665
$Rs_{50\%}$	874.040	56.391	60.588	69.081	71.164	71.196	76.402	91.208	97.439	86.018	75.166	62.834	56.553
$Rs_{65\%}$	814.376	52.479	57.393	61.835	64.558	69.924	71.661	84.199	92.047	79.178	70.200	60.077	50.823
$Rs_{95\%}$	593.775	35.191	40.411	42.008	50.423	56.371	56.287	59.817	68.756	58.442	48.887	40.876	36.306
$gr.w._{50\%}$	536.000	31.767	36.479	37.921	45.517	50.886	50.810	53.997	62.066	52.756	44.130	36.899	32.773
Dem 2012	19.625	1.391	1.391	1.391	1.836	1.391	1.388	951	1.391	2.136	2.115	2.115	2.129
Surpl @ $_{95\%}$	574.150	33.800	39.019	40.617	48.587	54.980	54.898	58.866	67.364	56.307	46.772	38.761	34.177
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	110.915	6.430	6.430	6.430	11.317	6.430	6.348	1.624	6.430	14.920	14.900	14.900	14.756
Surpl @ $_{95\%}$	482.860	28.762	33.981	35.579	39.106	49.942	49.938	58.193	62.326	43.522	33.987	25.976	21.549
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-med	112.036	6.523	6.523	6.523	11.411	6.523	6.442	1.718	6.523	15.014	14.993	14.993	14.850
Surpl @ $_{95\%}$	481.739	28.668	33.888	35.485	39.012	49.848	49.845	58.099	62.232	43.428	33.894	25.883	21.456
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-	112.825	6.589	6.589	6.589	11.477	6.589	6.507	1.784	6.589	15.080	15.059	15.059	14.916
Surpl @ $_{95\%}$	480.950	28.603	33.822	35.420	38.946	49.782	49.779	58.034	62.167	43.363	33.828	25.817	21.390
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-low	237.670	13.424	13.424	13.424	24.488	13.424	13.261	2.525	13.424	32.677	32.625	32.625	32.349
Surpl @ $_{95\%}$	356.105	21.767	26.987	28.584	25.935	42.947	43.026	57.292	55.331	25.766	16.262	8.251	3.957
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-med	241.348	13.731	13.731	13.731	24.795	13.731	13.567	2.831	13.731	32.983	32.932	32.932	32.655
Surpl @ $_{95\%}$	352.427	21.461	26.680	28.278	25.628	42.641	42.719	56.986	55.025	25.459	15.955	7.944	3.651
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2030-	244.294	13.976	13.976	13.976	25.040	13.976	13.813	3.077	13.976	33.229	33.177	33.177	32.901
Surpl @ $_{95\%}$	349.481	21.215	26.435	28.032	25.383	42.395	42.474	56.740	54.779	25.214	15.710	7.699	3.405
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2040-low	457.737	25.378	25.378	25.378	47.506	25.378	25.051	3.579	25.378	63.883	63.801	63.801	63.227
Surpl @ $_{95\%}$	136.038	9.814	15.033	16.631	2.917	30.993	31.236	56.238	43.377	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=65%	>=35%	>=5%
Dem 2040-med	467.741	26.212	26.212	26.212	48.339	26.212	25.884	4.412	26.212	64.717	64.635	64.635	64.061
Surpl @ $_{95\%}$	126.034	8.980	14.199	15.797	2.084	30.160	30.402	55.405	42.544	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=65%	>=35%	>=5%
Dem 2040-	476.604	26.950	26.950	26.950	49.078	26.950	26.623	5.151	26.950	65.455	65.373	65.373	64.799
Surpl @ $_{95\%}$	117.171	8.241	13.461	15.058	1.345	29.421	29.664	54.666	41.805	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=65%	>=35%	>=5%

Annex 9 Table 10: Water balance NMUV 2012 - 2020 - 2030 - 2040

volume data in '000 m³	annual total	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep
$Rs_{5\%}$	290.071	22.974	34.164	26.179	18.623	20.148	20.605	36.243	36.165	20.772	18.006	17.761	18.433
$Rs_{35\%}$	198.480	16.342	17.065	16.883	15.839	15.739	16.398	18.235	18.018	16.420	15.951	15.683	15.907
$Rs_{50\%}$	185.593	15.314	16.080	15.957	14.706	14.901	15.337	17.124	16.990	15.169	14.694	14.666	14.655
$Rs_{65\%}$	172.744	14.287	15.169	14.923	14.007	13.656	14.169	16.063	15.962	14.141	13.403	13.400	13.564
$Rs_{95\%}$	108.685	8.662	11.025	10.689	8.358	6.390	7.572	13.716	13.684	8.423	5.602	6.246	8.320
$gr.w._{50\%}$	110.376	8.797	11.196	10.855	8.488	6.490	7.690	13.929	13.896	8.554	5.689	6.343	8.449
Dem 2012	21.802	1.370	1.370	1.370	1.732	1.370	1.367	1.012	1.370	2.717	2.705	2.705	2.710
Surpl @ $_{95\%}$	86.883	7.292	9.655	9.318	6.625	5.020	6.205	12.704	12.313	5.706	2.896	3.540	5.609
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%
Dem 2020-low	53.822	3.081	3.081	3.081	4.479	3.081	3.014	1.749	3.081	7.339	7.317	7.317	7.205
Surpl @ $_{95\%}$	54.864	5.581	7.944	7.608	3.879	3.310	4.558	11.967	10.603	1.085	0	0	1.115
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=65%	>=95%
Dem 2020-med	55.116	3.188	3.188	3.188	4.587	3.188	3.122	1.857	3.188	7.447	7.424	7.424	7.313
Surpl @ $_{95\%}$	53.570	5.474	7.837	7.500	3.771	3.202	4.450	11.859	10.495	977	0	0	1.007
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=65%	>=95%
Dem 2020-	56.022	3.264	3.264	3.264	4.662	3.264	3.197	1.933	3.264	7.522	7.500	7.500	7.388
Surpl @ $_{95\%}$	52.664	5.398	7.761	7.425	3.696	3.126	4.375	11.783	10.419	901	0	0	932
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=95%	>=65%	>=65%	>=95%
Dem 2030-low	106.970	5.733	5.733	5.733	8.871	5.733	5.601	2.728	5.733	15.370	15.314	15.314	15.106
Surpl @ $_{95\%}$	1.715	2.929	5.292	4.956	0	657	1.971	10.988	7.950	0	0	0	0
Reliab.%	>=95%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	>=35%	>=35%	>=35%	>=35%
Dem 2030-med	111.186	6.084	6.084	6.084	9.222	6.084	5.953	3.079	6.085	15.721	15.666	15.666	15.457
Surpl @ $_{95\%}$	0	2.577	4.940	4.604	0	306	1.619	10.637	7.599	0	0	0	0
Reliab.%	>=65%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	>=35%	>=35%	>=35%	>=35%
Dem 2030-	114.563	6.366	6.366	6.366	9.503	6.366	6.234	3.360	6.366	16.003	15.947	15.947	15.739
Surpl @ $_{95\%}$	0	2.296	4.659	4.323	0	24	1.338	10.356	7.318	0	0	0	0
Reliab.%	>=65%	>=95%	>=95%	>=95%	>=65%	>=95%	>=95%	>=95%	>=95%	>=35%	>=35%	>=5%	>=35%
Dem 2040-low	194.868	9.874	9.874	9.874	16.145	9.874	9.612	3.865	9.874	29.144	29.055	29.055	28.620
Surpl @ $_{95\%}$	0	0	1.151	815	0	0	0	9.851	3.809	0	0	0	0
Reliab.%	>=35%	>=65%	>=95%	>=95%	>=5%	>=65%	>=65%	>=95%	>=95%	<5%	<5%	<5%	<5%
Dem 2040-med	206.337	10.830	10.830	10.830	17.101	10.830	10.568	4.821	10.830	30.100	30.011	30.011	29.576
Surpl @ $_{95\%}$	0	0	195	0	0	0	0	8.895	2.854	0	0	0	0
Reliab.%	>=5%	>=65%	>=95%	>=65%	>=5%	>=65%	>=65%	>=95%	>=95%	<5%	<5%	<5%	<5%
Dem 2040-	216.497	11.677	11.677	11.677	17.948	11.677	11.415	5.668	11.677	30.947	30.858	30.858	30.423
Surpl @ $_{95\%}$	0	0	0	0	0	0	0	8.048	2.007	0	0	0	0
Reliab.%	>=5%	>=65%	>=65%	>=65%	>=5%	>=65%	>=65%	>=95%	>=95%	<5%	<5%	<5%	<5%

Annex 10 Coordinates and Altitude of prospective Sites

site	name	lat	long	altitude	date and time	district	sector	cell	catchment	waterway	
1	**Flower park Gishari**	-1.865824°	30.407199°	1535		Rwamagana	Gishari	Kavumu	Nile - Lower Nyabarongo	Muhazi lake	
2	**Muhanga**	-2.108380°	29.752606°	1796		Muhanga	Nyamabuye /Shyogwe	xx	Nile - Akanyaru	Hugeramigazi	
3	Nyanzi cooperative	-1.848826°	29.991303°	1619		Nyarugenge	xx	xx	Nile - Lower Nyabarongo	Yari river	
4	**Mukara / Muko**	-1.53475723	29.6435647	1655	30/05/2013 09:07	Musanze	xx	xx	Nile - Mukungwa	Mukara river	
5	**Mutobo1 field**	-1.54264578	29.5594033	2162	30/05/2013 10:59	Musanze	xx	xx	Nile - Mukungwa	Mutobo spring / river	
5	**Mutobo Spring**	-1.52530999	29.5598097	2115	30/05/2013 10:14	Musanze	xx	xx	Nile - Mukungwa	Mutobo spring / river	
6	**Mutobo2**	-1.52553798	29.5650039	2090	30/05/2013 09:43	Musanze	xx	xx	Nile - Mukungwa	Mutobo spring / river	
7	**Kanzenze_SOIL**	-1.63572329	29.3719214	2231	30/05/2013 14:02	Rubavu	xx	xx	Congo - Kivu	river	
7	**Kanzenze**	-1.63837072	29.3700642	2279	30/05/2013 11:51	Rubavu	xx	xx	Congo - Kivu	river	
8	Orphelinat	-1.59438031	29.384905	2333	30/05/2013 12:15	Rubavu	xx	xx	Congo - Kivu	rain water	
	Mutobo1 water cour	-1.56787254	29.548454	2185	30/05/2013 11:17						



Annex 11 Chemicals

	Aphids			
2	Actara	Kg	Thiamethoxam	*Toxic to aquatic organisms *Dangerous to bees * Use only on potatoes
5	Neemraj Super	Lt	Azadiranchtin	* Biodegradable
6	Oxymatrine	Lt	Oxymetrine	* Natural organic *Bio
7	Teppeki	Kg	Flenicamid	*Low toxicity
	Botrytis			
8	Bavistan (1Kg Damaged)	Kg	Carbendazim	*Low toxicity *Toxic to fish: Not contaminate streams or waterway with it
9	Roveral Flo	Lt	Iprodion	*Toxic to aquatic organisms
10	Segard/Roveral Flo		Iprodion	*Toxic to aquatic organisms
12	Scala Sc 40	Lt	Pyrimethanil 400 gr ltr	*Toxic to aquatic organisms *Never use with any irrigation methods * Not apply to sloping grounds
14	Teldor Wg	Kg	Fenhaxamid	*Do not contaminate streams, rivers or waterways with the chemical or used containers. DO NOT spray across open bodies of water.
	Caterpillar			
16	Match 050 Ec	Lt	Lufenuron	*Low water solubility>No leaching in soil
17	Nomolt 150 SC	Lt	Teflubenzuron+ Ethyleneglycol	*Very toxic to aquatic organisms on long term *Irritant
18	Prove 1.9 EC	Lt	Emamectin Benzoate 1.9 % E.c	
	Dawney			
22	Antracol 70 WP (5Kg Damage)	Kg	Propineb	*Do not contaminate streams, rivers or waterways with the chemical or used containers
23	Bellis	Kg	Boscalid+Pyraclostrobin	*Do not contaminate surface waters or ditches with chemical or used container *Avoid contamination via drains from farmyards and roads #agricentre.basf.co.uk
24	Daconil	Lt	Chlortolonic	*highly toxic to fish and aquatic invertebrates, but not toxic to birds *Long-term exposure resulted in kidney damage and tumours in animal tests #Wikipedia
25	Delan	Lt	Dithianon/Nitrile	*Moderately toxic to birds, highly toxic to aquatic organisms, low risk to earthworms, honey bees and predatory mites. *May cause kidney damage from repeated oral exposure at high doses #basf.netfinity.co.nz #triachem.com
26	Equation Pro		Famoxate+Cymoxanil	*Rapid degradation in the soil and aqueous environment *low toxicity on human, mammals, and does not adversely affect beneficial populations under normal use #farmchemafrica.com/
28	Folpan	Kg	Folpet	*May be fatal if inhaled *Eye irritant and skin sensitizer *low mammalian toxicity, is not toxic to honeybees or beneficial insects #www.uap.ca #ma-industries.com

31	Ortiva	Lt	Azoxystrobin	*Toxic to aquatic organisms, not contaminate soil, stagnant or running water by disposal of waste *WHO Class IV:Unlikely to present acute hazard in normal use #docstoc.com
32	Previcure Energy SL	Lt	Propamocarb Hydrochloride+Fosetyl -Al	*Do not contaminate surface waters or ditches with chemical or used container. *Irritant, may cause skin sinsitization #bayercropscience.co.uk
34	Stargem	Kg	Mancozeb 80 %	*WHO Class III,Slightly hazardous *Environmentally safe #nri.org #swal.in
35	Victory 72WP(Gold) 3Kg Damaged	Kg	Metalaxyl mancozeb drip	*WHO Class III
	Fussarium & Rizoctonia			
38	Rhizolex	Kg	Tolclofod methyl	*Dangerous to aquatic organisms. DO NOT contaminate streams, rivers or waterways with this product, used containers or bags which have held treated seed #sumitomo-chem.com.au
	Herbicide			
43	Dizmazone 20%	Lt	Paraquat Dichloxide	*WHO Class II
44	Gramaxon	Lt	Paraquat	*does not have a negative effect on ground water or soil organisms *high mammalian toxicity. #syngenta.com #weedecology.css.cornell.edu
	Mite			
44	Baroque	Lt	Etoxazole	*In high-dose animal studies, causes liver injury and reproductive effects *Product unlikely to present acute hazard in normal use #http://hazmap.nlm.nih.gov #http://www.capl.sci.eg/
46	Daniseraba		Cyflumetofen 20%	*WHO Class II #http://sitem.herts.ac.uk
47	Fastmite 75 EC	Lt	Tatradifen 75.2g	*Little or no hazard to birds, fish and beneficial insects. * Relatively nonhazardous to honey bees. Biological magnification unlikely.Generally safe on plants #http://pmep.cce.cornell.edu/profiles/insect-mite/propetamphos-zetacyperm/tetradifon/insect-prof-tetradifon.html
48	Floramite	Lt	Bifenazate	*When used as labeled, Floramite is unlikely to be harmful to fish or wildlife. #http://pmep.cce.cornell.edu/profiles/insect-mite/abamectin-bufencarb/bifenazate/Bifenazate_600.html
49	Magister	Lt	Fenaxaquin 20 %	*WHO Class II #http://sitem.herts.ac.uk
50	Mecure/Pegasus 500 SC	Lt	Diafenthiuron	*Toxicity class WHO (a.i.) III *No acute hazard under field conditions to birds and fish, not toxic to algae and earthworms, toxic to honey bees #http://www.chinese-pesticide.com/insecticides/diafenthiuron.htm
51	Peropal	Kg	Azocyclotin	*Not authorised in France *Irritant for skin and eyes, dangerous to fish #http://e-phy.agriculture.gouv.fr/spe/7800395-5750.htm

52	Pride	Lt	Fenaxaquin 20 %	*WHO Class II *fenazaquin highly toxic to fish, low toxicity on birds #http://books.google.rw/pesticides affecting oxidative phosphorylation
53	Silwet Gold		Heptamethyltrisiloxaan .	*Toxic to aquatic organisms *Not readily biodegradable
54	Ro 208/Silwet gold		Polyalkylemaoxide	
55	Talstar	Lt	Bifenthrin	*TOXIC TO FISH: Avoid contamination of any water supply with chemical or empty container. TOXIC TO BEES: Do not apply to flowering plants #http://www.astra-agri.com.sa/products/pdf/TDB/TDB%20Talstar%20100EC1.pdf
	Nematicide			
57	Malathione 50%EC	Lt	Malathion	*toxic to fish, aquatic invertebrates, and aquatic life stages of amphibians. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark #http://winnipeg.ca/publicworks/bugline/mosquitoes/pdfs/Malathion%20EC50.pdf
58	Sesamine/Phyto Protect		seasamoil 25 %	*Sesame Extract is safe. And there is no report s of over dosage of sesamin. #http://nutra-max.en.alibaba.com/product/466801247-202217007/10_95_Sesamine_gmp_supplier.html
59	Rugby	Lt	Cadusafos (nematodes)	*little potential for bioaccumulation in the environment *toxic to aquatic arthropods and fish. Care should be taken to avoid contamination of the aquatic environment. Cadusafos is also considered highly toxic to upland game birds #http://www.philagrosa.co.za/products/getfile/17
61	Vydate		Oxamyl (nematodes)	*Toxic to aquatic organisms, extremely toxic to birds and mammalians (they may die) *not apply to water #http://www.cdms.net/LDat/ld264021.pdf
	Powdery			
63	Baycore 300 Ec	Lt	Bitertanol	*Not authorised in France #http://e-phy.agriculture.gouv.fr/spe/8200249-7681.htm
64	Bayleton	Kg	Triadimefon	*Harmful to fish. DO NOT contaminate streams, rivers or waterways with this product or used containers #http://www.herbiguide.com.au/Labels/TRIAD125_57058-0403.PDF
65	Collis	Lt	Boscalid+Kresoxim Methyl	

66	Impact 125 SC	Lt	Flutriafol 125 g/l	*DO NOT contaminate streams, rivers or waterways with the chemical or used containers *Risk low for the other organisms (i.e. bees, arthropods, earthworms, soil macro-organisms, plants and biological methods of sewage treatment) #http://www.genfarm.com.au/label/flutriafol-label.pdf #http://www.efsa.europa.eu/en/efsajournal/doc/1868.pdf
67	Impulse	Lt	Spiroxamine	*Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment *Harmful by inhalation or in contact with skin #http://www.guidechem.com/dictionary/118134-30-8.html
68	Kobe 1.2 SL			*low toxicity product to humans and livestock and it is friendly to the environment. #http://www.kobe12sl.com/
69	Flint	Kg	Trifloxystrobin	*Low hazard to bees *Dangerous to fish and other aquatic organisms #http://www.bayercropscience.com.au/resources/uploads/label/file7261.pdf
70	Kumulus	Kg	Sulphur	*Not apply directly to water to areas where surface water is present or to intertidal areas below the mean high water mark *Hazardous to humans and domestic animals when swallowed, breathing or in contact with skin, eyes or clothes #http://strawberry.ifas.ufl.edu/plantpathfiles/Fung%20label/fung%202009/sulfur/kumulus%20DF.pdf
71	Meltatox	Lt	Dodemorph Acetate	*irritating to skin and nose, may cause permanent eye damage #http://www.mgshort.com/images/Meltatox(roses)_03Jun2003.pdf
72	M-Protect Gold 10Lts/can		Plant Conditioner	*It is completely natural, which means it is safe for the crop, the environment, and for the people who work with M-Protect GOLD #http://mprotectgold.com/
73	Milpan	Kg	Polyoxin	*relatively non-toxic to mammals, birds and bees *toxic to fish and other aquatic life. Do not contaminate ponds and waterways by direct application, cleaning of equipment, disposal of wastes or empty container #http://www.triachem.com/Products/Fungicides/Milpan%2010WP.pdf

74	Nimrod	Lt	Bupirimate 25 %	*Not toxic for bees, low mammalian toxicity *Toxic to aquatic organisms, DO NOT CONTAMINATE SURFACE WATERS OR DITCHES with chemical or used container #http://www.mauk.co.uk/pdfs/labels/Nimrod%20web%20label.pdf #http://www.chemkind.com/chemicals-p_199744_fungicide-bupirimate-nimrod.htm
75	Nustar	Lt	Fluzilazol	*Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment *slight toxicity to mammals and birds, moderate to bees and high to fish #http://www2.dupont.com/Crop_Protection/en_DZ/assets/downloads/pdfs/msds/PUNCH40EC.pdf #http://www.agf.gov.bc.ca/pesticides/infosheets/flusilazole.pdf
76	Pencol		penconazool	*Toxicity class WHO (a.i.) III *Not toxic to bees #http://www.chinese-pesticide.com/fungicides/penconazole.htm
81	Rubigan	Lt	Fenarimol	*Toxic to fish. Not apply directly to surface water #www.domyownpestcontrol.com/msds/RUBIGAN_AS.pdf
82	Thiovit Jet 80 WG	Kg	Sulphur	*DO NOT contaminate streams, rivers or waterways with the chemical or used containers #www.herbiguide.com.au/Labels/SULP800_53904-0406.PDF
	Rust			
83	Plantvax		Oxycarboxin	*contact with eyes and skin may cause irritation. Chronic inhalation may cause lung damage. *DO NOT contaminate streams, rivers or waterways with the chemical or used containers, *Some hazard to fish and wildlife. Relatively nonhazardous to honey bees. Nonphytotoxic #http://pmep.cce.cornell.edu/profiles/fung-nemat/febuconazole-sulfur/oxycarboxin/fung-prof-oxycarboxin.html #http://greenhouse.ucdavis.edu/pest/pmsds/Plantvax.PDF
84	Folicur	Lt	Tebuconazole	*toxic to mammals, fish and aquatic invertebrates. Do not apply directly to water *may leach to groundwater for low permeability soil or shallow water table, may runoff in surface water for months #http://www.pesticides.montana.edu/News/Pesticide%20Label%20pdf's/Folicur%20Label_08%2013%2008.pdf
	Sticker			
88	Finish Additve 10Lt/cane		Vegetable oil	*Safe
	Trips			

91	Akrimactin		Abamectin	*WHO Class II
92	Applaud	Lt	Buprofenzin	*no adverse effects on human health when used in accordance with the label directions unlikely that the proposed use is a hazard to birds or mammals. *Direct overspray would present a hazard to fish and daphnids and possibly other aquatic species #www.apvma.gov.au/registration/assessment/docs/prs_buprofezin.pdf
94	Decis 2.5 Ec	Lt	Deltametrin	*Flammable. Harmful by inhalation and if swallowed. Irritating to respiratory system and skin. Risk of serious damage to eyes. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Harmful: may cause lung damage if swallowed. #http://www.bayercropscience.ie/sds/Decis_EC.pdf
95	Starchlor/Divipan	Lt	Dichlovos	*corrosive to skin and eyes #http://www.fivestarchemicals.com/wp-content/uploads/StarChlorTech1.pdf
96	Evisect		Thiocyclam Oxalate	*Rapid degradation in the environment WHO class III #http://www.bioamerica.cl/archivos/Evisect-50-SP_1214955447_EVISECT-50sp.pdf
98	Mesurol 500SC	Lt	Methiocarb	*Dangerous to bees. DO NOT spray any plants in flower while bees are foraging. DO NOT treat areas on which poultry graze. *Dangerous to fish. DO NOT contaminate dams, rivers, ponds, waterways or drains with the chemical or used containers #http://www.entomology.umn.edu/cues/mnla/mesurol.pdf #http://www.herbiguide.com.au/Labels/METH750_33276-1209.PDF
99	Prempt	Lt	Pyriproxyfen 50 gr / Fenproathrin 150 ml	*Unlikely to be Hazardous #http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC35792#Toxicity
101	Prove		Imidachloprid	* toxic to birds and wildlife and mildly toxic to fish, highly toxic to honey bees #http://www.sierraclub.ca/national/programs/health-environment/pesticides/imidacloprid-fact-sheet.shtml
102	Lannet		Methomyl	*very low impact on the environment when applied according to label directions *rapidly degrade in studies on plants, soil, forest and soil ecosystems, water, aquatic plants and animals, *moderately to highly toxic to fish and highly toxic to aquatic invertebrates, highly toxic to birds #http://extoxnet.orst.edu/pips/methomyl.htm #http://www.amaroc.ma/produits/Details-produits/Presentations-produit/Lannate%2025%20wp/lannate.pdf

WHO Classibication of Pesticides

[#ppdnepal.gov.np/.../Registered_Pesticides_List_2068_in_Nepal.pdf]

- IA= Extremely Hazardous
- IB= Hazardous
- II= Moderately Hazardous
- III= Slightly Hazardous
- NH= Non Hazardous

Annex 12 Fertilizers

Ammonium nitrate		Kg		*not an extremely hazardous chemical #wikipedia
Ammonium sulphate		Kg		*it isn't considered highly hazardous to humans (except when eaten or drunk ..) #http://www.aluminumsulfate.net/Ammonium-Sulfate.htm
Borax		Kg	trace element	*not acutely toxic *sufficient exposure to borax dust may lead to irritation, may damage fertility #wikipedia
Calcium nitrate		Kg	Main element, supplied in 24 MT containers	
Copper sulphate		Kg	trace element	Copper sulphate is an irritant Skin contact may result in itching or eczema Upon oral exposure, copper sulphate is only moderately toxic. #Wikipedia
Fe-DTPA 6%		Kg		
Fe-EDDHA		Kg		*Not considered a hazardous product. *Irritating to skin and eye and respiratory tract #http://www.agrowchem.com/lang_english/metal_chelates/pdf/eddha_fe_6_msd.pdf
Fe-EDTA 13%		Kg		*EDTA fully biodegradable #wikipedia
Magnesium nitrate		Kg		*may be toxic ingested, inhaled, irritant to skin and eyes #http://www.ihcworld.com/royellis/ABCSafe/chemicals/magnesium-nitrate.htm
Magnesium sulphate		Kg	Main element, supplied in 24 MT containers	*neutral, doesn't change soil pH
Manganese sulphate		Kg	trace element	*Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment #http://datasheets.scbt.com/sc-203130.pdf
MomoAluminium Sulphate		Kg		*not toxic but may only cause trouble if ingested or irritation #http://www.bakerbro.com/pdf_library/Fertilizer/Innophos_Monoammonium_Phosphate_MSDS.pdf
MonoPotassium Sulphate		Kg		*Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator) #http://www.sciencelab.com/msds.php?msdsId=9927235
Nitric Acid		Kg		*strong acid, powerful oxidising agent, may cause chemical burns #wikipedia
Phosphoric acid		Kg		*corrosive #http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/phosphoric.html
Potassium nitrate		Kg	Main element, supplied in 24 MT containers	*oxidizer, and may cause irritation #wikipedia
potassium sulphate		Kg		*not flammable #wikipedia
sodium molybedate		Kg	trace element	*can cause copper deficiencies in animals, particularly cattle #wikipedia
zinc sulphate		Kg	trace element	*eye irritant #wikipedia

Umwaka wa 47 n° 21bis Year 47 n° 21bis
01 Ugushyingo 2008 ***1st November 2008***

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Ibirimo/Summary/Sommaire **Page**

ITEKA RYA MINISITIRI W'INTEBE N° 26/03 RYO KUWA 23/10/2008 RISHYIRAHO URUTONDE RW'IMITI Y'UBUTABIRE N'IBINDI BINTU BIHUMANYA BITEMEWE	PRIME MINISTER'S ORDER N° 26/03 OF 23/10/2008 DETERMINING THE LIST OF CHEMICALS AND OTHER PROHIBITED POLLUTANTS .	ARRETE DU PREMIER MINISTRE N° 26/03 DU 23/10/2008 DETERMINANT LA LISTE DES SUBSTANCES CHIMIQUES DANGEREUSES ET D'AUTRES POLLUANTS INTERDITS
Minisitiri w'Intebe;	**The Prime Minister;**	**Le Premier Ministre ;**
Ashingiye ku Itegeko Nshinga rya Repubulika y'u Rwanda ryo ku wa 4 Kamena 2003 nk'uko ryavuguruwe kugeza ubu cyane cyane mu ngingo zaryo iya 49, iya 118, iya 119, iya 120, iya 121 n'iya 201;	Pursuant to the Constitution of the Republic of Rwanda of 04 June, 2003 as amended to date especially in Articles 49, 118, 119, 120, 121, and 201;	Vu la Constitution de la République du Rwanda du 04 juin 2003, telle que révisée à ce jour, spécialement en ses articles 49,118, 119, 120, 121 et 201 ;
Ashingiye ku Itegeko Ngenga n° 04/2005 ryo ku wa 08/04/2005 rigena uburyo bwo kurengera, kubungabunga no guteza imbere ibidukikije mu Rwanda cyane cyane mu ngingo yaryo ya 91;	Pursuant to Organic Law nº 04/ 2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of the environment in Rwanda especially in Article 91;	Vu la Loi Organique nº 04/2005 du 08/04/2005 portant modalités de protéger, sauvegarder et promouvoir l'environnement au Rwanda, spécialement en son article 91 ;
Bisabwe na Minisitiri w'Umutungo Kamere ;	On proposal by the Minister of Natural Resources;	Sur proposition du Ministre des Ressources Naturelles ;
Inama y'Abaminisitiri yateranye ku wa 14/11/2007 imaze kubisuzuma no kubyemeza;	After consideration and approval by the Cabinet in its session of 14/11/2007;	Après examen et adoption par le Conseil des Ministres, en sa séance du 14/11/2007
ATEGETSE:	**ORDERS:**	**ARRETE:**
UMUTWE WA MBERE : INGINGO RUSANGE	**CHAPTER ONE : GENERAL PROVISIONS**	**CHAPITRE PREMIER : DISPOSITIONS GENERALES**
Ingingo ya mbere: Ikigamijwe n'iri teka		

no kurunda imiti y'ubutabire n'ibindi bintu bihumanya cyangwa byateza impanuka.	chemicals and other pollutants.	au transit, au dépot et au stockage des substances ou combinaisons de substances chimiques dangereuses.
Ingingo ya 2: Imiti y'ubutabire n'ibindi bintu bihumanya bitemewe	**Article 2: Chemicals and other prohibited pollutants**	**Article 2: Les Substances chimiques dangereuses et autres polluants interdits**
Urutonde rw'imiti y'ubutabire n'ibindi bintu bihumanya bitemewe biri ku mugereka w'iri teka.	The list of Chemicals and other prohibited pollutants is annexed to this Order.	Les substances chimiques dangereuses et les autres polluants interdits se trouvent en annexe du présent arrêté.
Ingingo ya 3: Kuvugurura urutonde	**Article 3: Revision of the list**	**Article 3: Révision de la liste**
Urutonde rw'imiti y'ubutabire n'ibindi bintu bihumanya bitemewe ruri ku mugereka ruvugururwa igihe cyose bibaye ngombwa**.**	The list of chemicals and other prohibited pollutants annexed to this order may be revised at any time when it is deemed necessary.	La liste des substances chimiques dangereuses et d'autres polluants interdits se trouvant en annexe est susceptible de révision chaque fois que cela s'avère nécessaire.
UMUTWE WA II: INGINGO ZISOZA	**CHAPTER II: FINAL PROVISIONS**	**CHAPITRE II: DISPOSITIONS FINALES**
Ingingo ya 4: Ibindi bidateganyijwe n'iri teka	**Article 4: Provisions not provided for by this Order.**	**Article 4: Dispositions qui ne sont pas prévues dans le présent arrêté**
Ibidateganyijwe muri iri teka rya Minisitiri w'Intebe bikurikiza amategeko asanzwe agenga imicungire y'imiti y'ubutabire.	Save for what is provided for by this Prime Ministerial Order, other aspects not provided for hereunder shall be governed by laws and regulations in force regulating chemical products.	Tout ce qui n'est pas prévu dans le présent arrêté est régi par la législation en vigueur relative à la gestion des produits chimiques.
Ingingo 5 : Abashinzwe kubahiriza iri teka	**Article 5 : Authorities responsible for the implementation of this Order**	**Article 5 : Autorités chargées de l'execution du présent arrêté**
Minisitiri w'Umutungo Kamere na Minisitiri w'Ubuzima basabwe gushyira mu bikorwa iri teka.	The Minister of Natural Resources and the Minister of Health are entrusted with the implementation of this Order.	Le Ministre des Ressources Naturelles et le Ministre de la Santé sont chargés de l'exécution du présent arrêté.
Ingingo ya 6 : Ivanwaho ry'ingingo zinyuranyije n'iri teka	**Article 6: Repealing of inconsistent provisions**	**Article 6 : Disposition abrogatoire**
Ingingo zose z'amateka abanziriza iri kandi zinyuranyije naryo zivanyweho.	All prior provisions contrary to this Order are hereby repealed.	Toutes les dispositions antérieures contraires au présent arrêté sont abrogées.

Iri teka ritangira gukurikizwa umunsi ritangarijweho mu Igazeti ya Leta ya Repubulika y'u Rwanda.	This Order shall come into force on the date of its publication in the official Gazette of the Republic of Rwanda.	Le présent arrêté entre en vigueur le jour de sa publication au Journal Officiel de la République du Rwanda.
Kigali, kuwa 23/10/2008	**Kigali, on 23/10/2008**	**Kigali, le 23/10/2008**
Minisitiri w'Intebe **MAKUZA Bernard** (sé)	The Prime Minister **MAKUZA Bernard** (sé)	Le Premier Ministre **MAKUZA Bernard** (sé)
Minisitiri w'Umutungo Kamere **KAMANZI Stanislas** (sé)	The Minister of Natural Resources **KAMANZI Stanislas** (sé)	Le Ministre des Ressources Naturelles **KAMANZI Stanislas** (sé)
Minisitiri w'Ubucuruzi n' Inganda **NSANZABAGANWA Monique** (sé)	The Minister of Trade and Industry **NSANZABAGANWA Monique** (sé)	Le Ministre du Commerce et de l'Industrie **NSANZABAGANWA Monique** (sé)
Minisitiri w'Ubuhinzi n'Ubworozi **BAZIVAMO Christophe** (sé)	The Minister of Agriculture and Animal Resources **BAZIVAMO Christophe** (sé)	Le Ministre de l'Agriculture et des Ressources Animales **BAZIVAMO Christophe** (sé)
Minisitiri w'Ubuzima **Dr NTAWUKURIRYAYO J.Damascene** (sé)	The Minister of Health **DR NTAWUKURIRYAYO J. Damascene** (sé)	Le Ministre de la Santé **Dr. NTAWUKURIRYAYO J. Damascène** (sé)

Umunyamabanga wa Leta ushinzwe Ibidukikije, Amazi na Mine muri Minisiteri y'Umutungo Kamere **Prof. BIKORO MUNYANGANIZI** (sé) Bibonywe kandi bishyizweho Ikirango cya Repubulika Minisitiri w'Ubutabera / Intumwa Nkuru ya Leta **KARUGARAMA Tharcisse** (sé)	The Minister of State in charge of Environment, Water and Mines in the Ministry of Natural Resources **Prof. BIKORO MUNYANGANIZI** (sé) Seen and sealed with the Seal of the Republic: The Minister of Justice / Attorney General **KARUGARAMA Tharcisse** (sé)	Le Secrétaire d'Etat chargé de l'Environnement, de l'Eau et des Mines au Ministère des Ressources Naturelles **Prof. BIKORO MUNYANGANIZI** (sé) Vu et scellé du Sceau de la République: Le Ministre de la Justice / Garde des Sceaux **KARUGARAMA Tharcisse** (sé)

UMUGERERKA W'ITEKA RYA MINISITIRI W'INTEBE N° 26/03 RYO KUWA 23/10/2008 RISHYIRAHO URUTONDE RW'IMITI Y'UBUTABIRE N'IBINDI BINTU BIHUMANYA BITEMEWE

ANNEX OF THE PRIME MINISTER'S ORDER N° 26/03 OF 23/10/2008 DETERMINING THE LIST OF CHEMICALS AND OTHER PROHIBITED POLLUTANTS

ANNEXE DE L'ARRETE DU PREMIER MINISTRE N° 26/03 DU 23/10/2008 DETERMINANT LA LISTE DES SUBSTANCES CHIMIQUES DANGEREUSES ET D'AUTRES POLLUANTS INTERDITS

ANNEX OF THE PRIME MINISTER'S ORDER N° 26/03 OF 23/10/2008 DETERMINING THE LIST OF CHEMICALS AND OTHER PROHIBITED POLLUTANTS

Chemical substance	CAS number	Category
Aldrine	309-00-2	Pesticide
Chlordane	57-74-9	Pesticide
Dieldrine	60-57-1	Pesticide
Endrine	72-20-8	Pesticide
Heptachlor	76-44-8	Pesticide
Hexachlorobenzene	118-74-1	Pesticide
Mirex	2385-85-5	Pesticide
Toxaphene	8001-35-2	Pesticide
Polychlorinated Biephenyls « 1 »		Industrial
DDT (1-1-1-Trichloro-2,2-bis-(4-chlorophenyl) ethane)	50-29-3	Pesticide
Polychlorinated dibenzo-p-dioxins « 1 » and dibenzofurans (PCDD/PCDF) **« 1 »		

* : Category of POPs: Intended Production of POPs

** : Category 2 des POPs: Un-intended Production of POPs

CAS : Chemical Abstract System (International code of chemicals)

« 1 » : No Codification number provided since they are constituted of different isomers

ANNEXE DE L'ARRETE DU PREMIER MINISTRE N° 26/03 DU23/10/2008 DETERMINANT LA LISTE DES SUBSTANCES CHIMIQUES DANGEREUSES ET D'AUTRES POLLUANTS INTERDITS

Substance chimique	Numéro CAS *	Catégorie
Aldrine	309-00-2	Pesticide
Chlordane	57-74-9	Pesticide
Diéldrine	60-57-1	Pesticide
Endrine	72-20-8	Pesticide
Heptachlore	76-44-8	Pesticide
Hexachlorobenzène	118-74-1	Pesticide
Mirex	2385-85-5	Pesticide
Toxaphène	8001-35-2	Pesticide
Polychlorobiphényles (PCB) « 1 »		Industriel
DDT (1-1-1-Trichloro-2,2-bis-(4-chlorophényl) éthane)	50-29-3	Pesticide
Polychlorodibenzo-p-dioxines « 1 » et dibenzofuranes (PCDD/PCDF) **« 1 »		
Déchés toxiques (uranifères)		Radioactive
Substances chimiques nouvelles qui proviennent d'activités de recherche et de développement ou d'enseignement et dont les effets sur l'homme et/ou sur l'environnement ne sont pas connus (exemple : déches de laboratoire…….		Non identifiées

	* : Catégorie 1 des POPs : Production intentionnelle/volontaire des POPs **: Catégorie 2 des POPs : Production non intentionnelle/non volontaire des POPs **CAS** : Chemical Abstract System (Codification internationale des produits chimiques) « 1 » : Sans numéro de CAS car ils sont constitués des plusieurs isomères.

BIBONYWE KUGIRA NGO BISHYIRWE KU MUGEREKA W' ITEKA RYA MINISITIRI W'INTEBE N° 26/03 RYO KUWA 23/10/2008 RISHYIRAHO URUTONDE RW'IMITI Y'UBUTABIRE N'IBINDI BINTU BIHUMANYA BITEMEWE Kigali, ku wa **23/10/2008**	**SEEN TO BE ANNEXED TO THE PRIME MINISTER'S ORDER N° 26/03 OF 23/10/2008 DETERMINING THE LIST OF CHEMICALS AND OTHER PROHIBITED POLLUTANTS** Kigali, on **23/10/2008**	**VU POUR ETRE ANNEXE A l'ARRETE DU PREMIER MINISTRE N° 26/03 DU 23/10/2008 DETERMINANT LA LISTE DES SUBSTANCES CHIMIQUES DANGEREUSES ET D'AUTRES POLLUANTS INTERDITS** Kigali, le **23/10/2008**

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Minisitiri w'Ubuzima **Dr NTAWUKURIRYAYO J.Damascene** (sé)	The Minister of Health **DR NTAWUKURIRYAYO J. Damascène** (sé)	Le Ministre de la Santé **Dr. NTAWUKURIRYAYO J. Damascène** (sé)
Umunyamabanga wa Leta ushinzwe Ibidukikije, Amazi na Mine muri Minisiteri y'Umutungo Kamere **Prof. BIKORO MUNYANGANIZI**	The Minister of State in charge of Environment, Water and Mines in the Ministry of Natural Resources **Prof. BIKORO MUNYANGANIZI**	Le Secrétaire d'Etat chargé de l'Environnement, de l'Eau et des Mines au Ministère des Ressources Naturelles **Prof. BIKORO MUNYANGANIZI**

(sé) **Bibonywe kandi bishyizweho Ikirango cya Repubulika:** Minisitiri w'Ubutabera / Intumwa Nkuru ya Leta **KARUGARAMA Tharcisse** (sé)	(sé) **Seen and sealed with the Seal of the Republic:** The Minister of Justice / Attorney General **KARUGARAMA Tharcisse** (sé)	(sé) **Vu et scellé du Sceau de la République:** Le Ministre de la Justice / Garde des Sceaux **KARUGARAMA Tharcisse** (sé)

ITEKA RYA MINISITIRI W'INTEBE N°27/03 RYO KUWA 23/10/2008 RISHYIRAHO URUTONDE RW'IMITI ITEMEWE KERETSE HABONETSE UBURENGANZIRA CYANGWA URUHUSHYA RW'AGATEGANYO	PRIME MINISTER ORDER N°27/03 OF 23/10/2008 DETERMINING A LIST OF PROHIBITED DRUGS UNLESS AUTHORIZED OR TEMPORARY PERMITTED	ARRETE DU PREMIER MINISTRE N°27/03 DU 23/10/2008 DETERMINANT LA LISTE DES PRODUITS CHIMIQUES INTERDITS SOUS RESERVE D'HOMOLOGATION OU D'AUTORISATION PROVISOIRE
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ITEKA RYA MINISITIRI W'INTEBE N°27/03 RYO KUWA 23/10/2008 RISHYIRAHO URUTONDE RW'IMITI ITEMEWE KERETSE HABONETSE UBURENGANZIRA CYANGWA URUHUSHYA RW'AGATEGANYO	PRIME MINISTER ORDER N°27/03 OF 23/10/2008 DETERMINING A LIST OF PROHIBITED DRUGS UNLESS AUTHORIZED OR TEMPORARY PERMITTED	ARRETE DU PREMIER MINISTRE N°27/03 DU 23/10/2008 DETERMINANT LA LISTE DES PRODUITS CHIMIQUES INTERDITS SOUS RESERVE D'HOMOLOGATION OU D'AUTORISATION PROVISOIRE
Minisitiri w'Intebe;	**The Prime Minister;**	**Le Premier Ministre ;**
Ashingiye ku Itegeko Nshinga rya Repubulika y'u Rwanda ryo ku wa 4 Kamena 2003 nk'uko ryavuguruwe kugeza ubu cyane cyane mu ngingo zaryo iya 49, iya 118, iya 120, iya 121 n'iya 201;	Given the Constitution of the Republic of Rwanda of June 4, 2003 as amended to date especially in its articles 49, 118, 120, 121, and 201	Vu la Constitution de la République du Rwanda du 04 juin 2003, telle que révisée à ce jour, spécialement en ses articles 49, 118, 120, 121, et 201 ;
Ashingiye ku Itegeko Ngenga N° 04/2005 ryo kuwa 08 Mata 2005 rigena uburyo bwo kurengera, kubungabunga no guteza imbere ibidukikije mu Rwanda cyane cyane ingingo yaryo ya 92;	Pursuant to the Organic Law Nº 04/ 2005 of 08/04/ 2005 determining modalities of protection, conservation and promotion of environment in Rwanda especially in its article 92	Vu la Loi Organique nº 04/2005 du 08/04/2005 portant modalités de protéger, sauvegarder et promouvoir l'environnement au Rwanda, spécialement en son article 92 ;
Bisabwe na Minisitiri w'Umutungo Kamere;	On proposal by the Minister of Natural Resources;	Sur proposition du Ministre des Ressources Naturelles;
Inama y'Abaminisitiri yateranye ku wa 14/112007 imaze kubisuzuma no kubyemeza;	After consideration and approval by the Cabinet in its session of 14/11/2007	Après examen et adoption par le Conseil des Ministres, en sa séance du 14/11/2007
ATEGETSE:	**HEREBY ORDERS:**	**ARRETE:**
UMUTWE WA MBERE : INGINGO RUSANGE	**CHAPTER ONE : GENERAL PROVISIONS**	**CHAPITRE PREMIER : DISPOSITIONS GENERALES**
Ingingo ya mbere: Ikigamijwe n'iri teka	**Article one: Scope**	**Article premier: Objet du présent arrêté**

Iri teka rishyiraho urutonde rw'imiti isanzwe cyangwa y'ubutabire igomba gusabirwa uburenganzira cyangwa uruhushya rw'agateganyo mbere y'uko igurishwa, itumizwa cyangwa yoherezwa mu mahanga, ibikwa iteganywa kuzagurishwa, itangwa kabone naho yaba itangirwa ubuntu.	This Order determines drugs and chemical substances that require authorization or temporary permission before sale, importation or exportation, storage with intention to sell, distribution even if it is free of charge.	Le présent arrêté détermine la liste des médicaments et produits chimiques qui requièrent une homologation ou une autorisation provisoire avant toute vente, importation ou exportation, détention en vue de la vente, distribution même à titre gratuit.
Ingingo ya 2: Imiti isanzwe cyangwa y'ubutabire igomba gusabirwa uburenganzira cyangwa uruhushya rw'agateganyo	**Article 2: Drugs or chemical substances that require authorization or temporary permission**	**Article 2: Médicaments ou produits chimiques requérant une homologation ou une autorisation provisoire**
Imiti isanzwe cyangwa y'ubutabire iri ku mugereka igomba gusabirwa uburenganzira cyangwa uruhushya rw'agateganyo mbere yo kugurishwa, gutumizwa cyangwa koherezwa mu mahanga, kubikwa biteganywa kuzagurisha, gutangwa kabone naho yaba itangirwa ubuntu.	Drugs or chemical substances in the annex to this Order shall require prior authorization or temporary permission before sale, importation, exportation, storage with intention to sell or distribution even if it is free of charge.	Les médicaments ou produits chimiques se trouvant en annexe doivent faire l'objet d'une demande d'homologation ou d'une autorisation provisoire avant leur vente, importation, exportation, détention en vue de la vente et distribution même à titre gratuit.
UMUTWE WA II: GUSABA NO GUTANGA UBURENGANZIRA CYANGWA URUHUSHYA RW'AGATEGANYO	**CHAPTER II: SEEKING AND ISSUING AUTHORIZATION OR TEMPORARY PERMISSION**	**CHAPITRE II: DEMANDE ET OCTROI D'HOMOLOGATION OU D'UNE AUTORISATION PROVISOIRE**
Ingingo ya 3: Gusaba uruhushya	**Article 3: Seeking authorization**	**Article 3: Demande d'autorisation**
Usaba uruhushya rwo kugura, kugurisha, gutumiza no kohereza mu mahanga, gucisha mu gihugu, kubika uteganya kuzagurisha, gutanga kabone naho yaba itangirwa ubuntu imiti isanzwe cyangwa y'ubutabire, igaragara ku mugereka yandikira Minisitiri Ufite Ubucuruzi mu nshingano ze akabimenyesha Minisitiri ufite Ibidukikije mu nshingano ze n'undi Minisitiri wese bireba.	Anyone seeking authorization to buy, sell, import or export, make transit through the country, store with intention to sell or distribute even if it is free of charge any of the drugs or chemical substances in the annex to this Order shall make a written application to the Minister in charge of commerce copied to the Minister in charge of environment and any other concerned Minister.	Toute personne qui requiert l'autorisation d'acheter, de vendre, d'importer ou d'exporter, de faire transiter dans le pays, d'entreposer en vue de vendre, de distribuer même à titre gratuit, les médicaments ou produits chimiques mentionnés en annexe, écrit au Ministre ayant le commerce dans ses attributions avec copie pour information au Ministre ayant l'environnement dans ses attributions et à tout autre

		Ministre concerné.
Ingingo ya 4: Ibikenewe muri dosiye isaba uruhushya	**Article 4: Requirements in the application file for authorization**	**Article 4: Eléments requis dans la demande d'autorisation**
Dosiye isaba uruhushya igomba kugaragaza neza impamvu urwo ruhushya rusabwa n'uburyo buteganyijwe bwo gucunga imiti isanzwe cyangwa y'ubutabire iri ku mugereka.	The applicant shall in his / her application justify the reason for the authorization and indicate the management process of the drugs or chemicals indicated in the annex to this Order.	Le demandeur d'autorisation doit justifier les motifs de la demande d'autorisation et indiquer les modalités de gestion des médicaments ou produits chimiques mentionnés dans l'annexe .
Imiti isanzwe cyangwa y'ubutabire iri ku mugereka yatumijwe mu mahanga igomba kuba iherekejwe n'icyemezo cy'aho ibicuruzwa bikomoka ndetse ifite ikirango cyerekana ibikurikira: 1° izina ry'imiti nk'uko bigaragara ku mugereka; 2° izina ry'uyohereje n'uwayitumije; 3° ibisobanuro byererekeye uko ihumanya n'inama kw'ikoreshwa neza ryayo kugira ngo igabanye ingaruka mbi ku ibidukikije; 4° itariki yakoreweho n'itariki izasaziraho.	Imported drugs or chemical substances listed in the annex to this Order shall bear a certificate of origin, a label indicating the following: 1° name of the chemical as indicated in annex ; 2° name and address of the importer and exporter; 3° information on precautionary measures to reduce the pollution of environment; 4° manufacture and expiry date.	Les médicaments ou produits chimiques importés, mentionnés dans l'annexe, doivent être accompagnés d'une notification comportant les renseignements indiquant: 1° le nom du produit chimique tel que mentionné en annexe; 2° nom et adresse de l'importateur et de l'exportateur ; 3° les informations sur la toxicité et les mesures de précaution pour réduire l'impact sur l'environnement ; 4° la date de fabrication et de péremption du produit.
Iyo ari imiti ivanze, hagomba kugaragazwa imiti igize urwo ruvange n'ibipimo byayo n'icyo iyo miti iteganywa gukoreshwa.	In the case of a mixture, the composition level of concetration and the use of such drugs shall be indicated.	Dans le cas d'un mélange, la composition, la concentration et l'usage de ces médicaments ou produits chimiques doivent être indiqués.
Ingingo ya 5: Uburyo uruhushya rutangwa	**Article 5: Modalities of Issuing authorization**	**Article 5: Modalités d'octroi d'autorisation**
Minisitiri ufite ubucuruzi mu nshingano ze ashobora gutanga uruhushya amaze kugisha inama Ikigo cy'Igihugu cyo Kubungabunga Ibidukikije (REMA) na Minisitri ufite icyo kibazo mu nshingano ze mu gihe	The Minister in charge of commerce may issue the authorization after consultation with Rwanda Environment Management Authority (REMA) and any other concerned Ministry in a period not exceeding thirty	Le Ministre ayant le commerce dans ses attributions peut octroyer l'autorisation après consultation de l'Office Rwandais de Protection de l'Environnement (REMA) et le Ministre concerné dans une période ne

kitarenze iminsi mirongo itatu (30), uhereye igihe ibaruwa isaba uruhushya yamugereyeho.	calendar days (30) from the date of receipt of the application for the authorization.	dépassant pas trente jours calendrier (30) à compter de la date de réception de la demande d'autorisation.
Ingingo ya 6: Guhagarika uruhushya rw'agateganyo no kwamburwa burundu cyangwa by'agateganyo uburenganzira	**Article 6: Suspension of temporary permission and definite or temporary withdrawal of the authorization.**	**Article 6: Suspension de l'autorisation provisoire et retrait ou suspension provisoire de l'homologation.**
Umuntu wese utazubahiriza imwe mu ngingo z'iri teka azahanwa ku buryo bukurikira: 1. guhagarika uruhushya rw'agateganyo; 2. kwamburwa by'agateganyo uburenganzira; 3. kwamburwa burundu uburenganzira.	Any person who fails to abide to one of the provisions of this Order shall be liable to the following sanctions: 1. suspension of temporary permission; 2. temporary suspension of the authorization; 3. withdrawal of authorization.	Quiconque viole les dispositions du présent arrêté est passible des sanctions suivantes: 1. suspension de l'autorisation provisoire; 2. suspension provisoire de l'homologation; 3. retrait de l'homologation.
Urwego rwatanze uburenganzira nirwo rufite ububasha bwo gufata ibyo bihano rubisabwe n'Ikigo cy'Igihugu gishinzwe kubungabunga ibidukikije n'abafite ububasha bwo gushakisha no kugenza ibyaha biteganywa n'iri teka.	The Authority that issued the authorization shall be the one vested with the powers of imposing sanctions mentioned above upon request by Rwanda Environment Management Authority or competent authorities in charge of investigating and prosecuting crimes provided for by this Order.	L'Autorité compétente pour infliger les sanctions ci-haut mentionnées, est celle ayant octroyé l'autorisation et l'homologation sur demande de l'Office Rwandais de Protection de l'Environnement ou des autorités compétences pour rechercher et constater les infractions au présent arrêté.
UMUTWE WA IV: INGINGO ZISOZA	**CHAPTER III: FINAL PROVISIONS**	**CHAPITRE III: DISPOSITIONS FINALES**
Ingingo ya 7: Kuvugurura urutonde	**Article 7: Revision of the list**	**Article 7: Révision de la liste**
Urutonde rw'imiti isanzwe n'iy'ubutabire iri ku mugereka w'iri teka ruvugururwa igihe cyose bibaye ngombwa.	The list of drugs and chemical products in the annex to this Order may be changed when it is deemed necessary.	La liste des médicaments et produits chimiques en annexe du présent arrêté est susceptible de révision chaque fois que cela s'avère nécessaire.
Ingingo ya 8 : Ibidateganyijwe n'Iteka	**Article 8: Provisions not provided for under this Order**	**Article 8 : Les dispositions non prévues dans le présent arrêté**

Ibidateganyijwe muri iri teka bikurikiza amategeko n'amabwiriza asanzwe agenga imicungire y'imiti y'ubutabire.	Save what is provided for in this Order, other aspects not provided for hereunder shall be governed by other laws and regulations in force regulating chemical products.	Tout ce qui n'est pas prévu dans le présent arrêté est régi par la législation en vigueur sur la gestion des produits chimiques.
Ingingo ya 9: Abashinzwe kubahiriza iri teka Minisitiri w'Umutungo Kamere na Minisitiri w'Ubucuruzi n'Inganda basabwe gushyira mu bikorwa iri teka.	**Article 9: Authorities responsible for the implementqtion of this Order** The Minister of Natural Resources and the Minister of Trade and Industry are entrusted with the implementation of this Order.	**Article 9 : Autorités chargées de l'exécution du présent arrêté** Le Ministre des Ressources Naturelles et le Ministre du Commerce et de l'Industrie sont chargés de l'exécution du présent arrêté.
Ingingo ya 10: Ivanwaho ry'ingingo zinyuranyije n'iri teka Ingingo zose z'amateka abanziriza iri kandi zinyuranyije naryo zivanyweho.	**Article 10: Repealing of inconsistent provisions** All prior provisions contrary to this Order are hereby repealed.	**Article 10 : Disposition abrogatoire** Toutes les dispositions antérieures contraires au présent arrêté sont abrogées.
Article 11: Igihe iri teke ritangira gukurikizwa Iri teka ritangira gukurikizwa umunsi ritangarijweho mu Igazeti ya Leta ya Repubulika y'u Rwanda.	**Article 11: Commencement** This Order shall come into force on the date of its publication in the Official Gazette of the Republic of Rwanda.	**Article 11 : Entrée en vigueur** Le présent arrêté entre en vigueur le jour de sa publication au Journal Officiel de la République du Rwanda.
Kigali, ku wa **23/10/2008**	Kigali, on **23/10/2008**	Kigali, le **23/10/2008**
Minisitiri w'Intebe **MAKUZA Bernard** (sé)	The Prime Minister **MAKUZA Bernard** (sé)	Le Premier Ministre **MAKUZA Bernard** (sé)

Minisitiri w' Umutungo Kamere **KAMANZI Stanislas** (sé) Minisitiri w'Ubucuruzi n'Inganda **NSANZABAGANWA Monique** (sé) Minisitiri w'Ubuhinzi n'Ubworozi **BAZIVAMO Christophe** (sé) Minisitiri w'Ubuzima **Dr. NTAWUKURIRYAYO J.Damascène** (sé) Umunyamabanga wa Leta ushinzwe Ibidukikije Amazi na Mine muri Minisiteri y'Umutungo Kamere **Prof. BIKORO Munyanganizi** (sé) **Bibonywe kandi bishyizweho Ikirango cya Repubulika** Minisitiri w'Ubutabera / Intumwa Nkuru ya Leta	The Minister of Natural Resources **KAMANZI Stanislas** (sé) The Minister of Trade and Industry **NSANZABAGANWA Monique** (sé) The Minister of Agriculture and Animal Resources **BAZIVAMO Christophe** (sé) The Minster of Health **Dr. NTAWUKURIRYAYO J. Damascène** (sé) The Minister of State in charge of Environment, Water and Mines in the Ministry of Natural Resources **Prof. BIKORO Munyanganizi** (sé) **Seen and sealed with the Seal of the Republic** The Minister of Justice / Attorney General	Le Ministre des Ressources Naturelles **KAMANZI Stanislas** (sé) Le Ministre du Commerce et de l'Industrie **NSANZABAGANWA Monique** (sé) Le Ministre de l'Agriculture et de Ressources animales **BAZIVAMO Christophe** (sé) Le Ministre de la Santé **Dr. NTAWUKURIRYAYO J. Damascène** (sé) Le Secrétaire d'Etat chargé de l'Environnement, de l'Eau et des Mines au Ministère des Ressources Naturelles **Prof. BIKORO Munyanganizi** (sé) **Vu et Sellé du Sceau de la République:** Le Ministre de la Justice / Garde des Sceaux

KARUGARAMA Tharcisse (sé)	**KARUGARAMA Tharcisse** (sé)	**KARUGARAMA Tharcisse** (sé)

UMUGEREKA W'ITEKA RYA MINISITIRI W'INTEBE N°27/03 RYO KUWA 23/10/2008 RISHYIRAHO URUTONDE RW'IMITI ITEMEWE KERETSE HABONETSE UBURENGANZIRA CYANGWA URUHUSHYA RW'AGATEGANYO

ANNEX TO TRE PRIME MINISTER'S ORDER N°27/03 OF 23/10/2008 DETERMINING A LIST OF PROHIBITED DRUGS UNLESS AUTHORIZED OR TEMPORARY PERMITTED

ANNEXE A L'ARRETE DU PREMIER MINISTRE N°27/03 DU 23/10/2008 DETERMINANT LA LISTE DES PRODUITS CHIMIQUES INTERDITS SOUS RESERVE D'HOMOLOGATION OU D'AUTORISATION PROVISOIRE

ANNEX TO PRIME MINISTER ORDER N°27/03 OF 23/10/2008 DETERMINING A LIST OF PROHIBITED DRUGS OR CHEMICAL SUBSTANCES UNLESS AUTHORIZED OR TEMPORARY PERMITTED.

Chemical Products	**CAS Number**	**Category**
2,4,5-T an dits salts and esters	93-76-5*	Pesticide
Binapacryl	485-31-4	Pesticide
Captafol	2425-06-1	Pesticide
Chlordimeform	6164-98-3	Pesticide
Chlorobenzilate	510-15-6	Pesticide
Dinitro-ortho-cresol (DNOC) and its salts (such as ammonium salt, potassium salt and sodium salt)	534-52-1 2980-64-5 5787-96-2 2312-76-7	Pesticide
Dinoseb, and its salts and esters	88-85-7	Pesticide
1,2-dibromoethane (EDB)	106-93-4	Pesticide
Ethylene dichloride	107-06-2	Pesticide
Ethylene Oxide	75-21-8	Pesticide
Fluoroacetamide	640-19-7	Pesticide
Hexachlorobenzene	608-73-1	Pesticide
Lindane	58-89-9	Pesticide
Mercury compunds, including inorganic mercury compounds, and alkyloxyalkyl and aryl mercury compunds		Pesticide
Monocrotophos	6923-22-4	Pesticide
Parathion	56-38-2	Pesticide
Pentachlorophenol, and its salts and esters	87-86-5	Pesticide
Dustable Powder Formulations containing a combination of : - Benomyl at or above 7% - Carbofurane at or above 10 % - Thiram at or above %	 17804-35-2 1563-66-2 137-26-8	Severely hazardous pesticide formulation
Monocrotophos (Soluble liquid formulations of the substance that exeed 600 g active ingredient/ 1)	6923-22-4	Severely hazardous pesticide formulation
Methamidophos (Soluble liquid formulations of the substance that exeed 600 g active	10265-92-6	Severely hazardous pesticide

ingredient/ 1)		formulation
Phosphamidon (Soluble liquid formulations of the substance that exceed 1000 g active ingredient/ 1)	1317-21-6 (mixture),(E)&(Z) isomers 23783-98-4 (Z) isomer 297-99-4 (E) isomer	Severely hazardous pesticide formulation
Methyl-parathion (emulsifiable concentrates (EC) at or above19.5% active ingredient and dusts at or above 1.5% active ingredients)	298-00-0	Severely hazardous pesticide formulation
(I) Parathion (all formulations – aero-sols, dustable powder (DP) emulsifiable concentrate (EC), granules (GR) and wettable powders (WP) – of this susbtance are included except capsule suspensions (CS)	56-38-2	
Asbestos : - Actinolite - Anthophylite - Amosite - Crocidolite - Tremolite	 77536-66-4 77536-67-5 12172-73-5 12001-28-4 77536-68-6	 Industrial Industrial Industrial Industrial Industrial
Plybrominated biphenyles (PBB)	36355-01-8 (hexa-) 27858-07-7 (octa-) 13654-09-6 (deca-)	Industrial
Polychlorinated terphenyls (PCT)	61788-33-8	Industrial
Chemical Products	**CAS Number**	**Category**
Tetraethyl Lead	78-00-2	Industrial
Tetramethyl Lead	75-74-1	Industrial
Tris (2,3-dibromopropyl)phosphate	126-72-7	Industrial

*** Only the CAS numbers of parent compounds are listed. For a list of other relevant CAS numbers, reference may be made to the relevant decision guidance document**

CAS: Chemical Abstract System

ANNEXE A L' ARRETE DU PREMIER MINISTRE N°27/03 DU 23/10/2008 DETERMINANT LA LISTE DES MEDICAMENTS ET PRODUITS CHIMIQUES INTERDITS SOUS RESERVE D'HOMOLOGATION OU D'AUTORISATION PROVISOIRE

Produit chimique	**Numéro CAS**	**Catégorie**
2,4,5-T et ses sels et esters	93-76-5*	Pesticide
Binapacryle	485-31-4	Pesticide
Captafol	2425-06-1	Pesticide
Chlordiméforme	6164-98-3	Pesticide
Chlorobenzilate	510-15-6	Pesticide
Dinitro-ortho-crésol (DNOC) et ses sels (tels que les sels d'ammonium, de potassium et de sodium)	534-52-1 2980-64-5 5787-96-2 2312-76-7	Pesticide
Dinoseb, ses sels et ses esters	88-85-7	Pesticide
1,2-dibromoéthane (EDB)	106-93-4	Pesticide
Dichloroéthylène	107-06-2	Pesticide
Oxyde d'éthylène	75-21-8	Pesticide
Fluoroacétamide	640-19-7	Pesticide
HCH (mélange d'isomères)	608-73-1	Pesticide
Lindane	58-89-9	Pesticide
Composés du mercure, y compris les composés inorganiques de mercure, les composés alkyles, alkyloxyalkyles et aryles de mercure		Pesticide
Monocrotophos	6923-22-4	Pesticide
Parathion	56-38-2	Pesticide
Pentachlorophénol, ses sels et ses esters	87-86-5	Pesticide
Formulations en poudre contenant une combinaison de: - Benomyl à 7% ou plus - Carbofurane à 10 % ou plus - Thiram à 15 % ou plus	 17804-35-2 1563-66-2 137-26-8	Formulation pesticide très dangereuse
Monocrotophos (formulations liquides solubles de la substance excédent 600 g/l de principe actif)	6923-22-4	Formulation pesticide très dangereuse
Methamidophos (formulations liquides solubles de la substance excédent	10265-92-6	Formulation pesticide très dangereuse

600 g/l de principe actif)		
Phosphamidon (formulations liquides solubles de la substance excédent 600 g/l de principe actif)	1317-21-6 (mélange d'isomères (E)&(Z) 23783-98-4 (isomère Z) 297-99-4 isomère (E)	Formulation pesticide très dangereuse
Méthyl-parathion (concentré émulsifiable (EC) à 19,5/ ou plus de principe actif et la poudre à 1,5% ou plus de principe actif)	298-00-0	Formulation pesticide très dangereuse
(I) Parathion (toutes les formulations – aérosol, poudres (DP), concentrés émulsifiables (EC), granules, (GR) et poudres mouillables (WP) de cette substance sont comprises, exceptéles suspensions en capsules (CS)	56-38-2	Formulation pesticide très dangereuse
Amiante : - Actinolite - Anthophylite - Amosite - Crocidolite - Tremolite	 77536-66-4 77536-67-5 12172-73-5 12001-28-4 77536-68-6	 Industriel Industriel Industriel Industriel Industriel
Polybromobiphényles (PBB)	36355-01-8 (hexa-) 27858-07-7 (octa-) 13654-09-6 (deca-)	Industriel
Produit chimique	**Numéro CAS**	**Catégorie**
Polychloro terphényles (PCT)	61788-33-8	Industriel
Tétraéthyle de plomb	78-00-2	Industriel
Tétrméthyle de plomb	75-74-1	Industriel
Tris (2,3-dibromopropyl) phosphate	126-72-7	Industriel

*** Seuls les numéros du service des résumés analytiques de chimie des composés parents sont indiqués. Pour avoir une liste des autres numéros appropriés du service des résumés analytiques de chimie on se réfère au document d'orientation de décision pertinente**

BIBONYWE KUGIRA NGO BISHYIRWE KU MUGEREKA W'ITEKA RYA MINISITIRI W'INTEBE N°27/03 RYO KUWA 23/10/2008 RISHYIRAHO URUTONDE RW'IMITI ITEMEWE KERETSE HABONETSE UBURENGANZIRA CYANGWA URUHUSHYA RW'AGATEGANYO	**SEEN TO BE ANNEXED TO THE PRIME MINISTER'S ORDER N°27/03 OF 23/10/2008 DETERMINING A LIST OF PROHIBITED DRUGS UNLESS AUTHORIZED OR TEMPORARY PERMITTED**	**VU POUR ETRE ANNEXE A L'ARRETE DU PREMIER MINISTRE N°27/03 DU 23/10/2008 DETERMINANT LA LISTE DES PRODUITS CHIMIQUES INTERDITS SOUS RESERVE D'HOMOLOGATION OU D'AUTORISATION PROVISOIRE**
Kigali, ku wa **23/10/2008**	Kigali, on **23/10/2008**	Kigali, le **23/10/2008**
Minisitiri w'Intebe **MAKUZA Bernard** (sé)	The Prime Minister **MAKUZA Bernard** (sé)	Le Premier Ministre **MAKUZA Bernard** (sé)
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ISUZUMANGARUKA KU BIDUKIKIJE, CYANE MU NGINGO YARYO YA GATANU (5)
IREBANA NO GUHITAMO IMPUGUKE ZO GUKORA INYIGO Z' ISUZUMANGARUKA
KU BIDUKIKIJE,
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URU RUTONDE RUFITE AGACIRO KUVA KU ITARIKI YA 1 NYAKANGA 2012 KUGEZA
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Annex 15 Ease of doing business index

Ease of doing business index (1=most business-friendly regulations) 2012 (sources: Int. Finance Corporation & World Bank)

	Rwanda	Uganda	Kenya	Ethiopia	Tanzania
Ease of Doing Business Rank*	**52**	**120**	**121**	**127**	**134**
Starting a Business Rank**	**1 / 8**	**28 / 144**	**23 / 126**	**35 / 163**	**15 / 113**
- Procedures (number)	2	16	11	5	12
- Time (days)	3	34	33	9	29
- Cost (% of income per capita)	4.7	84.5	37.8	12.8	28.8
- Min. capital (% of income per capita)	0	0	0	333.5	0
Dealing with Construction Permits Rank**	**15 / 98**	**22 / 118**	**3 / 45**	**4 / 53**	**44 / 174**
- Procedures (number)	12	15	8	9	19
- Time (days)	164	125	125	128	303
- Cost (% of income per capita)	312	946.8	160.9	369.1	1,170.1
Getting electricity Rank**	**2 / 49**	**22 / 127**	**36 / 162**	**12 / 94**	**13 / 96**
- Procedures (number)	4	5	4	4	4
- Time (days)	30	91	163	95	109
- Cost (% of income per capita)	4,696.8	5,130.1	1,419.2	3,386.0	1,040.5
Registering Property Rank**	**5 / 63**	**21 / 124**	**37 / 161**	**18 / 112**	**27 / 137**
- Procedures (number)	5	13	8	10	9
- Time (days)	25	48	64	41	73
- Cost (% of property value)	6.3	2.9	4.3	2.1	4.4
Getting Credit Rank**	**4 / 23**	**7 / 40**	**2 / 12**	**13 / 104**	**22 / 129**
- Credit Information Index	6	4	4	2	0
- Private bureau coveage (% of adults)	0	3	4.5	0	0
- Public bureau coverage (% of adults)	1.4	0	0	0.2	0
- Legal Rights Index	8	7	10	4	8
- Sum getting credit	14	11	14	6	8
Protecting Investors Rank**	**3 / 32**	**24 / 139**	**16 / 100**	**20 / 128**	**16 / 100**
- Disclosure Index	7	2	3	4	3
- Director Liability Index	9	5	2	4	4
- Shareholder Suits Index	3	5	10	5	8
- Shareholder Suits Index	6.33	4	5	4.33	5
Paying Taxes Rank**	**3 / 25**	**12 / 93**	**33 / 164**	**16 / 103**	**21 / 133**
- Payments (number)	18	32	41	19	48
- Time (hours)	148	213	393	198	172
- Total tax rate (% profit)	31.3	35.7	49.6	31.1	45.5
Trading Across Borders Rank**	**32 / 158**	**33 / 159**	**25 / 148**	**34 / 161**	**12 / 122**
- Documents for export (number)	8	7	8	7	6
- Time for export (days)	29	37	26	42	18
- Cost to export (US$ per container)	3,275	2,880	2,055	1,760	1,255
- Documents for import (number)	8	9	7	9	6
- Time for import (days)	31	34	24	44	24
- Cost to import (US$ per container)	4,990	3,015	2,190	2,660	1,430
Enforcing Contracts Rank**	**3 / 39**	**19 / 117**	**30 / 149**	**6 / 50**	**1 / 36**
- Procedures (number)	24	38	40	37	38
- Time (days)	230	490	465	620	462
- Cost (% of debt)	78.7	44.9	47.2	15.2	14.3
Resolving Insolvency Rank**	**37 / 167**	**5 / 69**	**14 / 100**	**19 / 117**	**21 / 129**
- Time (years)	3	2.2	4.5	3	3
- Cost (% of estate)	50	30	22	15	22
- Recovery rate (cents on the dollar)	3.2	40.2	30.9	31.4	22
Rank*	**World 185 countries**				
Rank**	**Sub-Saharan Africa / World 185 countries**				

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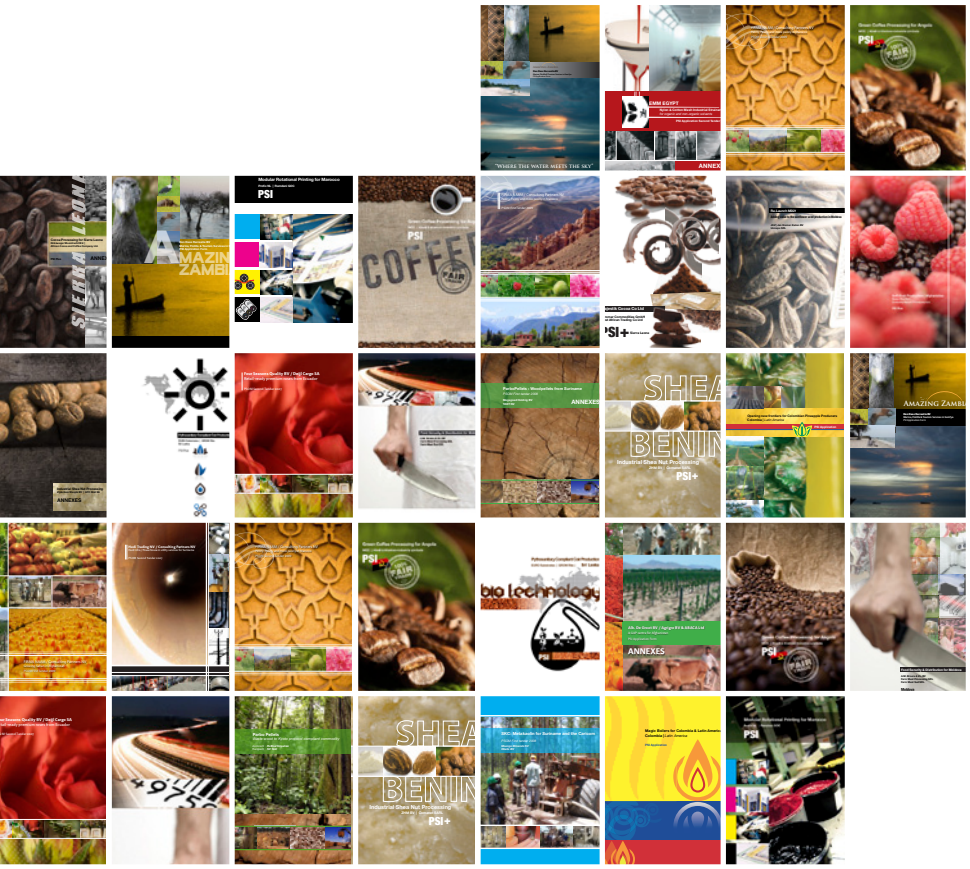
beyond the obvious



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