UPPER BERG RIVER CATCHMENT (G10A) MANAGEMENT UNIT CONTROL PLAN

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Upper Berg River Catchment (G10A) Management Unit Control Plan

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Executive Summary

This document sets out a plan for clearing the alien plant invasions in the Upper Berg catchment, quaternary catchment G10A. Quaternary catchment G10A covers 17,718 ha and contains the source of the Berg River, which is the Western Cape's second largest river, and the Franschhoek River, a tributary of the Berg River. The major stakeholders in the catchment include the Cape Winelands District Municipality, Stellenbosch Municipality, CapeNature, Working for Water, Working on Fire, Department of Water Affairs, Department of Agriculture Fisheries and Forestry, Western Cape Department of Agriculture and the Upper Berg River Irrigation Board.

This document describes the rationale and necessity for a plan and the process that was followed in developing it. It provides information on the:

- Current state of the catchment including key aspects of the environment, land-use and land ownership
- A summary of the current state of alien plant invasions
- The goal of IAP control in the catchment developed with stakeholders
- The criteria used to the prioritise control operations
- The budgets and resources, and the partnerships that will be needed to achieve those goals over a 20 year period
- The last section of the document provides information on a range of useful topics for public entities or private land owners embarking on clearing programmes.

The components of an effective invasive alien plant management as well as links to information on capacity (training) and resources, communications and advocacy, legal requirements and additional sources of information. A list of useful literature is also provided. Links to a number of websites (resources) including WfW training matrix.

The catchment has been delineated into 267 compartments of which 185 have been invaded to some degree and are scheduled for treatment. All the pertinent information for each compartment such as the water flows (runoff), accessibility, slope and the age of the veld is stored within a geo-database. The information on historical and current invasions, previous control treatments and their costs is stored for each of the treatment units (NBALs) is stored in the same geodatabase. There is also a cross-link identifying which NBALs fall within each compartment so this information can be summarised at the compartment level. The geodatabase allows for all this information to be easily retrieved and presented at a compartment level and this information to be loaded into the Automated Management Unit Control Plan Generation Tool (MUCP Tool).

A multi-criteria decision making process, the Analytic Hierarchy Process, was followed to develop a goal for invasive alien plant control operations in the catchment, to develop the criteria needed to achieve the goal, and to assess the relative importance of these criteria by allocating weights (ranking) to them by means of pair-wise comparisons. The last step in the process was to identify the

datasets that enabled objective comparisons to be made between compartments with regard to particular criteria. During this process the stakeholders identified the following goal for the plan:

By 2030 we will have controlled the IAPs in the catchment to a maintenance level by applying integrated weed management

We have developed a set of budget scenarios for this plan using a computerised planning system called the Management Unit Control Plan (MUCP) tool. It schedules treatments of invasions in the catchment over the next 20 years based on the priorities that have been identified by the stakeholders in the plan. The CSIR has worked closely with the developers and NRM to modify the MUCP tool to meet the current needs of NRM. We have used the Upper Berg River catchment as to case study for understanding the modifications needed to operationalise the MUCP tool and produce a workable plan.

The schedule generated by the MUCP tool takes into account the current state of the invasions, benefits of the clearing, treatments that are required and the resources provided in its budget. The tool allows the stakeholders to vary the resource budgets to evaluate whether the goal is feasible or not and to set a more realistic goal where necessary. The tool does not generate a detailed annual schedule of annual operation however there is an Annual Plan of Operations tool which serves that purpose.

The MUCP tool generates treatments schedules for an optimal budget, as if funds were limited, and four budget scenarios which are set by the user. We selected two realistic budget scenarios with ceilings of R 2.5 million and R 5.0 million and extracted and summarised the compartment treatments and annual budgets per compartment for the next 15 years. . Since it is impossible to eradicate every invading plan, the aim is to achieve a maintenance level of <1% canopy cover. In the case of the R 2.5 million this would take 14 years and for the R 5.0 million scenario 7 years.

We believe that it is seen as essential to have a lead agent per catchment who drives the implementation of the plan. In cases where Working for Water is the funding agency this should be achievable with either themselves or an implementing agent taking the lead. However if there are multiple funding sources, the position of the lead agent would need to be negotiated. Lastly this plan needs to be regularly reviewed and revised depending on progress made each year and whether or not an event such as a wildfire that changes the treatment option occurs.

Acknowledgements

Derek Malan, the previous technical manager for Working for Water (WfW) in the Western Cape (now retired) who was the prime mover within WfW to focus on a systematic, area and priority based, catchment-level approach to clearing invasive alien plants rather than the current, largely unsystematic approach.

The authors wish to acknowledge the following persons for their valuable contributions:

Manfred Paulsen, for being an invaluable source of information on the operations of the Working for Water projects has managed as the responsible person in the Cape Winelands District Municipality. He also provided assistance in checking the accuracy of the information and in checking the budgets and other of the outputs of the MUCP tool.

Andrew Wannenburgh of the Department of Environment Affairs' Chief Directorate: Natural Resources Management (NRM) for providing information on updated costs and the mapping for the invasive alien plants clearing programme

CapeNature for supplying us with the latest information on the latest status of alien plant invasions and fire history of the land that they manage in the Upper Berg River catchment.

The participants in a workshop held to formulate the goal for the management plan and identify the criteria that would be used to prioritise the clearing operations.

MTO Cape Group, previously CapePine, for providing us with the compartment data for the La Motte plantation prior to its de-commissioning.

Our colleague Janis Smith for compiling the initial spatial geo-database that provided the foundation for the plan.

Photographs included in this report were taken by Greg Forsyth.

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Glossary

APO	Annual Plan of Operations – a plan setting out the work that needs to be done by an organisation over a calendar or financial year
CapeNature	Western Cape Nature Conservation Board
CARA	Conservation of Agricultural Resources Act
CMS	Catchment Management System
DEA	Department of Environmental Affairs
DWAF	Department of Water Affairs and Forestry
Ecological Reserve	The amount of water that is required to maintain the health and integrity of a river's ecosystems so that is can supply people with good quality water
GIS	Geographical Information System
IAP	Invasive Alien Plants – plants that have been introduced from outside an area, generally overseas, and have now spread from where they were planted
LandCare	LandCare programme of the Western Cape Department of Agriculture
LUI	Land user incentive scheme
MTO	Mountain to Ocean Forestry – the private company that managed the state plantation areas and is in the last stages of withdrawing. It merged with another company to become CapePine in about 2010.
MUCP	Management Unit Control Plan
NBAL	Natural Biological Alien – the code for the management treatment unit (polygon)
NEM:BA	Natural Environmental Management: Biodiversity Act
NQF	National Qualifications Framework
NRM	Natural Resources Management Programme – a set of programmes within DEA which manage natural resources
PPRI	Plant Protection Research Institute
Safcol	South African Forestry Company Ltd – the state forestry corporation responsible for managing state forest land and managing private company leases
SANBI-ISP	South Africa National Biodiversity Institute which runs an invasive species programme (ISP) specifically aimed at finding and eradicating newly invading species
SAPIA	South African Plant Invaders Atlas
TCTA	Trans Caledon Tunnel Authority
TMS	Table Mountain Sandstone – the dominant rock type forming the mountains around Franschhoek; gives rise to nutrient-poor, sandy soils
WCWSS	Western Cape Water Supply System
WESSA	Wildlife and Environment Society of South Africa
WfW	Working for Water Programme – a programme specifically aimed at managing invasive alien plants to reduce their environmental and social impacts, especially on water resources
WIMS	Working for Water Information Management System which stores information on the location and characteristics (e.g. area, slope, IAPs) of each of the treatment units (NBALs) and the treatments applied to it.

1 INTRODUCTION

This document sets out a plan for dealing with alien plant invasions in the upper Berg catchment, the area extending from about the railway bridge over the Berg River to the top of the mountains. This catchment is known as quaternary (4th order) catchment G10A in the Department of Water and Sanitation's terminology. The plan has been developed with the support of the Working for Water programme of the Department of Environment Affairs because they use a water catchment as a logical unit for planning control measures for invasive alien plants (IAPs).

This document describes the rationale and necessity for a plan and the process that was followed in developing it. It provides information on the:

- Current state of the catchment including key aspects of the environment, land-use and land ownership
- A summary of the current state of alien plant invasions
- The goal of IAP control in the catchment developed with stakeholders
- The criteria used to the prioritise control operations
- The budgets and resources, and the partnerships that will be needed to achieve those goals

The plan is based on spatial management units we have termed compartments. The boundaries of these units are clearly locatable on the ground and include water courses, roads and tracks, ridgelines, and boundary fences and other permanent features. This means also that each compartment, or potions of it, can be clearly linked to individual land owners or management bodies. Each of the compartments will be given a priority for treatment and will be used to monitor and evaluate progress against the plan. This document does go into the details of the schedule of the operations because that is done by a computerised planning system called the Management Unit Control Plan (MUCP) tool which uses budgets to calculates schedules for treatments of invasions in the catchment over the next 20 years.

The CSIR has worked closely with the developers and NRM to modify the MUCP tool to meet the needs of NRM and area-based planning. We have used the Upper Berg River catchment as to case study for understanding the modifications needed to operationalise the MUCP tool and produce a workable plan.

The schedule generated by the tool takes into account the current state of the invasions, benefits of the clearing, treatments that are required and the resources provided in its budget. The tool allows the stakeholders to vary the resource budgets to evaluate whether the goal is feasible or not and to set a more realistic goal where necessary. This is important because the goal needs to be challenging but achievable to ensure that people are motivated to rise to the challenge. In addition to the control operations, the plan also needs to provide for: (a) the prevention of new invasions by ensuring, as far as possible, that no new invaders are introduced to the area; (b) surveys to identify new invaders; and (c) rapid action to eradicate those invaders wherever possible.

The overall goal for this plan was developed in 2014 in collaboration with a group of people who represented stakeholders in Franschhoek, based on the information on the state of the catchment presented in this report. The overall goal that was set is:

By 2030 we will have controlled invasive alien plants in the catchment to a maintenance level by applying integrated weed management.

The participants in this workshop also developed a set of criteria that would be used to prioritise control measures in the catchment.

1.1 Why manage invasions?

Invasions of alien plant species in South Africa are recognised as a major threat to biodiversity, water resources and land productivity (De Lange and Wilgen, 2010; van Wilgen *et al*., 2008). Recent estimates are that some 8 750 taxa have been introduced, 660 of these have become naturalised and about 559 have been listed as invasive (NRM, 2014; Wilson *et al*., 2013). The total amount of water that is lost because of invading alien plants is estimated to be at least 2.9% of the volume of water that flowed in our rivers prior to European colonisation (Le Maitre *et al*., 2013). In volume terms, this is 1 444 million m^3/year - a quantity that is hard to grasp. A typical household of 4 people uses around 1000 litres per day or about 365 m^3/year (1 000 litres = 1 m^3). This means that invading alien plants use enough water to supply about 10 million households for a year. In the Western Cape the Berg and Breede Rivers are the most heavily invaded and the water losses are estimated to be around 6%. If left unchecked the extent and density of the invasions, and thus the impact on water resources, could increase significantly. This would result in the loss of much of the available water in certain catchment areas, including the Berg River.

1.2 A brief history of IAP management in the catchment

It is important to understand the history of alien plant clearing in the upper reaches of the Berg River catchment because, while this plan needs to continue and complete the clearing that has been done, it will involve a wider group of implementers and direct efforts towards clearing the areas that are considered most important for the whole catchment. Although the records are not readily available, the Department of Forestry began clearing in this area in the late 1960s and continued into the 1980s. Most of their efforts were focused in the neighbouring Wemmershoek catchment but they included the mountains forming the watershed between the Wemmershoek and Berg River catchments and parts of this catchment. From the mid-1980s onwards, these operations were taken over by CapeNature but shortages of funds meant that the treatment operations had to be scaled down and some treated areas were abandoned. Between 2001 and 2004 the private forestry company, Mountain to Ocean (MTO), which took the Franschhoek plantation over from the government, used funding provided for in the dam construction budget to clear invasions and also removed many of the pine plantation compartments, rehabilitating them to fynbos (Geland *et al*., 2008). There are reasonable records for the operations of the WfW programme, which has been active in the upper reaches of the Berg River Catchment since 2001 and these records include some areas treated by MTO. The main emphasis was on clearing the portion of quaternary catchment

G10A around and upstream of the Berg River dam, including the floodplain below it. There have been limited clearing operations in the catchment of the Franschhoek River, particularly in the mountains and in the Keerweerdernek area, also funded by Working for Water.

Most of the low lying areas around the Berg River Dam and the former plantation areas have been cleared. In many instances there have been nine or more follow-up operations to ensure that the IAP species have not re-established themselves or that new IAP species have not colonised the area from seed dispersed into the area or from seeds in the soil or by any other means. Most of the high lying areas managed by CapeNature have only received an initial treatment and some high altitude areas have not been treated at all. In some areas the clearing or follow operations have not been effective because the different agencies involved have not co-ordinated their operations properly. One of the aims of this plan is to try to coordinate all the efforts so that they can be as effective as possible.

1.3 Working for Water

The Department of Water Affairs and Forestry's Working for Water (WfW) programme was initiated in 1995 with two main aims: (i) to control and monitor invasive alien plants (IAPs) to reduce their impacts on water and other natural resources; and (ii) to provide unemployed or previously disadvantaged people with work for a period and to develop their skills to improve their employment prospects (van Wilgen *et al*., 1998). During 2013 the Working for Water programme was relocated in the Department of Environment Affairs Natural Resource Management programmes (NRM, 2014). The environmental and social imperatives of the programme include: (i) augmenting water security; (ii) improving ecological integrity; (iii) restoring the productive potential of land; (iv) promoting the sustainable use of natural resources; and (v) investing in the marginalised communities of South Africa.

The programme has grown during the past 20 years and is now one of the largest environmental programmes in the world. Until recently its actions were confined to supporting actions that helped to control and eradicate invasive alien species. The recently published regulations (DEA, 2014) under the National Environmental Management: Biodiversity Act (NEM:BA) (DEA, 2004) now enable it to exercise its legal powers to deal with invasive alien species and their management. However, the primary focus of the programme is on educating people about the negative impacts of invasions and enabling them to take action themselves, rather than prosecuting them. One of the requirements of the new legislation is that organs of state must compile plans to deal with all the invasive alien species in a particular area (section 76 of NEM:BA). This plan is aimed at meeting those requirements and providing the inhabitants one such area, the Upper Berg River catchment, with a systematic approach to controlling invasive species.

The threats posed by IAPs are addressed in section 76 of the NEM:BA Act which requires all organs of state to prepare invasive species monitoring, control and eradication plans for land areas under their control. The wording and the context make it clear that these plans are for specific areas of land, namely area-based, site-based or site-led plans (Downey and Sheppard, 2006; NRM, 2014). The focus of these plans is on characterising, prioritising and effectively managing the invasions. A good

example of regional[1] level prioritisation is the one developed for the Western Cape by Working for Water (Forsyth *et al*., 2012). This plan focuses on one of the high priority catchments identified in that study.

The programme has also developed a number of ways of supporting control measures against invasive alien plants. They provide funds and resources in a number of ways:

- Direct involvement in the management of the clearing teams where they provide all the resources and oversee the operations;
- Indirect involvement through the funding of:
    - Control operations managed by implementing agents; in the case of this catchment this includes:
    - The Cape Winelands District Municipality who have been clearing the Berg River Dam area and elsewhere in the catchment, focusing on the middle and lower slopes, valley bottoms and river floodplain.
    - CapeNature for the higher lying areas.
    - Working on Fire for the steep areas which require specialised safety precautions and skills, such as rope-work.
    - Land-user incentives (LUIs) where groups of land-owners apply for funding to carry out control operations on their land (not yet active in this catchment). These initiatives can also include way of using the material (biomass) from the clearing to produce products and rehabilitation of degraded land and river systems.
- Other inputs such as providing herbicides and advice to land-owners.
- Support for the introduction and maintenance of biological control agents for invasive alien plants in the catchment, as well as research into agents for invasive aliens plants which do not yet have effective agents.

A key aim of this plan is to find ways to use all of these options to optimise the efficacy and efficiency of the management of the invasions in this catchment. This plan is aligned with the national strategy (NRM 2014) and the regional priorities of the Working for Water programme. These include ensuring that the benefits of the clearing are maximised, in this case by protecting a critical catchment for supplying water to the City of Cape Town and to the towns and irrigation schemes downstream.

1.4 Managing invasive alien plant species

Management of invasive species is a complex task, whether it involves managing all the species found in a particular area, as done by Working for Water and other agencies, or managing invasions by single species (DEA, 2014, 2004). It is complex because it involves motivating and co-ordinating a range of land owners and land management agencies (each with their own agendas) and dealing with invasions by mixtures of species, each with different treatment requirements, in a range of environments from river banks to mountain tops. The plan also needs to allow for unpredictable events such as wildfires and floods which create opportunities for the spread and regeneration of

[1] The WfW programme has 9 regions corresponding more or less with the different provinces.

invading alien plants. The plan also must include monitoring procedures to measure and record progress and to evaluate progress against the objectives and treatment schedule so that the plan can be adapted when progress is not satisfactory.

The Act and regulations require that all state organs, from national departments to local municipalities, must control declared invader species on their land. Everyone who is a land owner must have at least a list of the invaders on their land and a plan to deal with them. The only way to do this effectively is for all the land owners to combine their efforts and resources and become actively involved in controlling invasive alien plants. Treatment operations are labour intensive and many species require herbicides for effective control which makes these operations very resource intensive and expensive, so cost sharing is essential to ensure that the available resources are used to maximum effect. We deliberately followed a participatory approach to developing this MUCP by consulting with stakeholders to ensure that they: (a) develop a common understanding of the rationale for controlling invading alien plant species, (b) actively participate in its implementation, and (c) coordinate activities to achieve goals.

2 SITUATIONAL ASSESSMENT

The section provides a description of the upper Berg River as a background to the plan and to provide the context for it. Quaternary catchment G10A covers 17,718 ha and contains the source of the Berg River, which is the Western Cape's 2nd largest river. The Franschhoek River, a tributary of the Berg River also rises within the catchment.

2.1 Location and elevation

The upper parts of the catchment area are bounded on the eastern, southern and western sides by rugged sandstone mountains while the flatter include arable granite-derived and alluvial soils. The mountains include some of the highest peaks in the Western Cape, reaching more than 1500 metres above sea level. The rugged mountain landscape contrasts markedly with the broad valley bottoms with their gentle slopes which are ideal for agriculture and other developments (Figure 1).

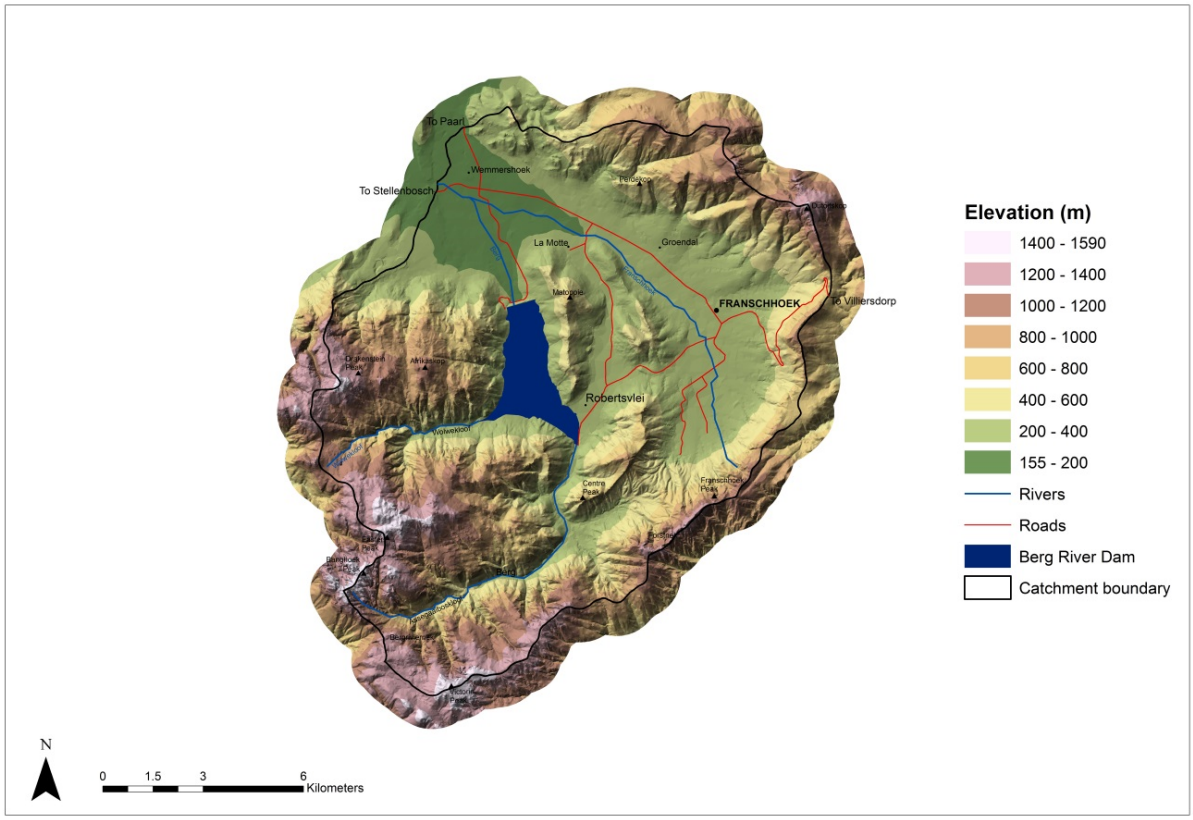


Figure 1: *Locality map for quaternary catchment G10A showing main topographical features.*

2.2 Mean annual run-off

This catchment (G10A) is estimated to have a mean annual river flow of 136.5 million m^3/year prior to modern developments (Middleton and Bailey, 2008). This is equivalent to about 20% of the flow in the entire Berg River system although it only comprises 1.9% of the total catchment area – so it is clearly a major water source area. The Berg River Dam, which is one of the City of Cape Town's main water storage dams, is located on the upper Berg River. It was commissioned in 2009 and is designed to supply Cape Town with up to 80 million m^3/year of water as well supplying irrigators downstream and meeting the requirements of the ecological reserve (Foord *et al.*, 2008; Matthews, 2013). Much of the rain falls on the upper slopes and peaks of the mountains where the mean annual rainfall is estimated to exceed 3 000 mm/year. Over the whole catchment the rainfall is estimated to be about 1 600 mm/year (Middleton and Bailey, 2008). An estimate of the distribution of the mean annual runoff, based on the rainfall (Nel *et al.*, 2013), emphasises that most of the water is sourced from the mountain areas and relatively little from the valley bottoms (Figure 2). This is important because it means that invasions in the mountain areas can, potentially, have a much greater impact on water resources than those in the valley bottoms.

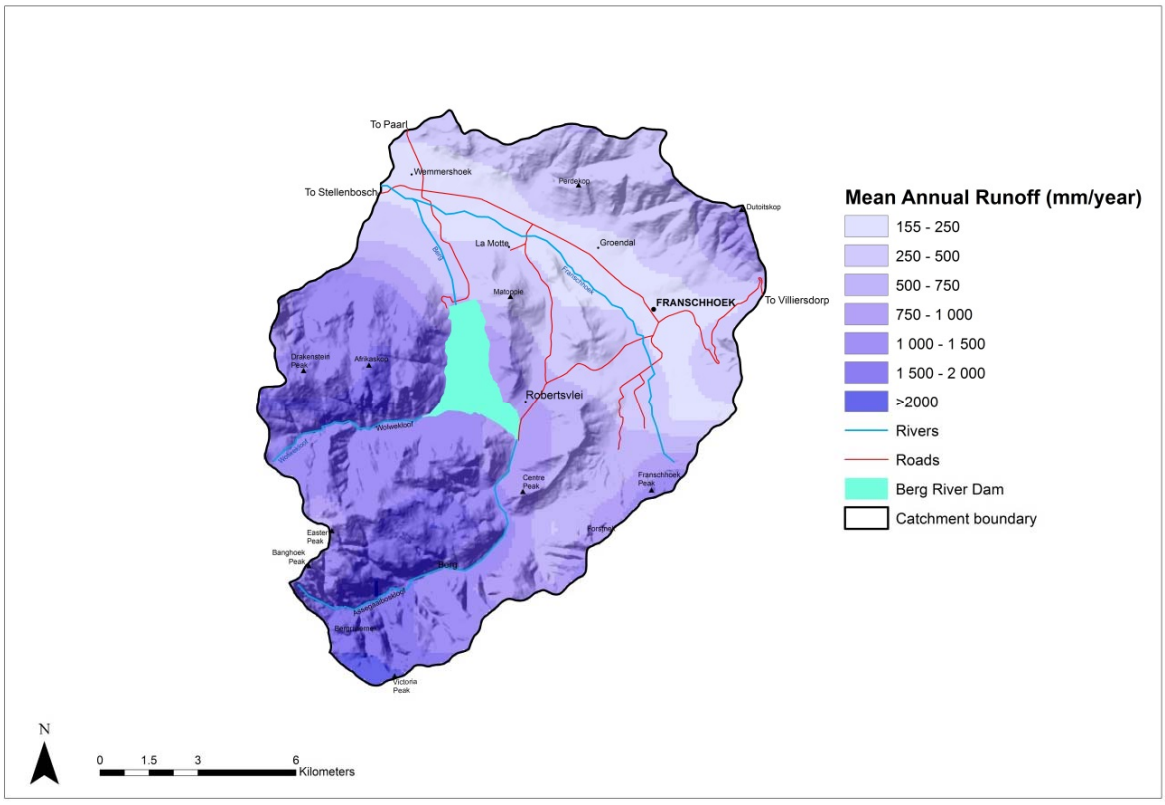


Figure 2: *Mean annual run-off in quaternary catchment G10A ranging from 155 to > 2000mm per year.*

2.3 Terrain and slope

Given the rugged nature of the mountains, it is not surprising that that a large part of the area is characterised by steep to very steep slopes (Figure 3, Table 1). This is important because steep areas like this are difficult to work in, especially when carrying the equipment needed to deal with large trees such as pines. The WFW programme has identified that slopes ≥ 35° need to be worked by the high altitude team of Working on Fire because they need rope skills to ensure their safety. The steep slopes also have significant implications for the cost of clearing because these skilled workers rightly cost more per hour and the time required to reach and move around in these areas adds significantly to the cost.

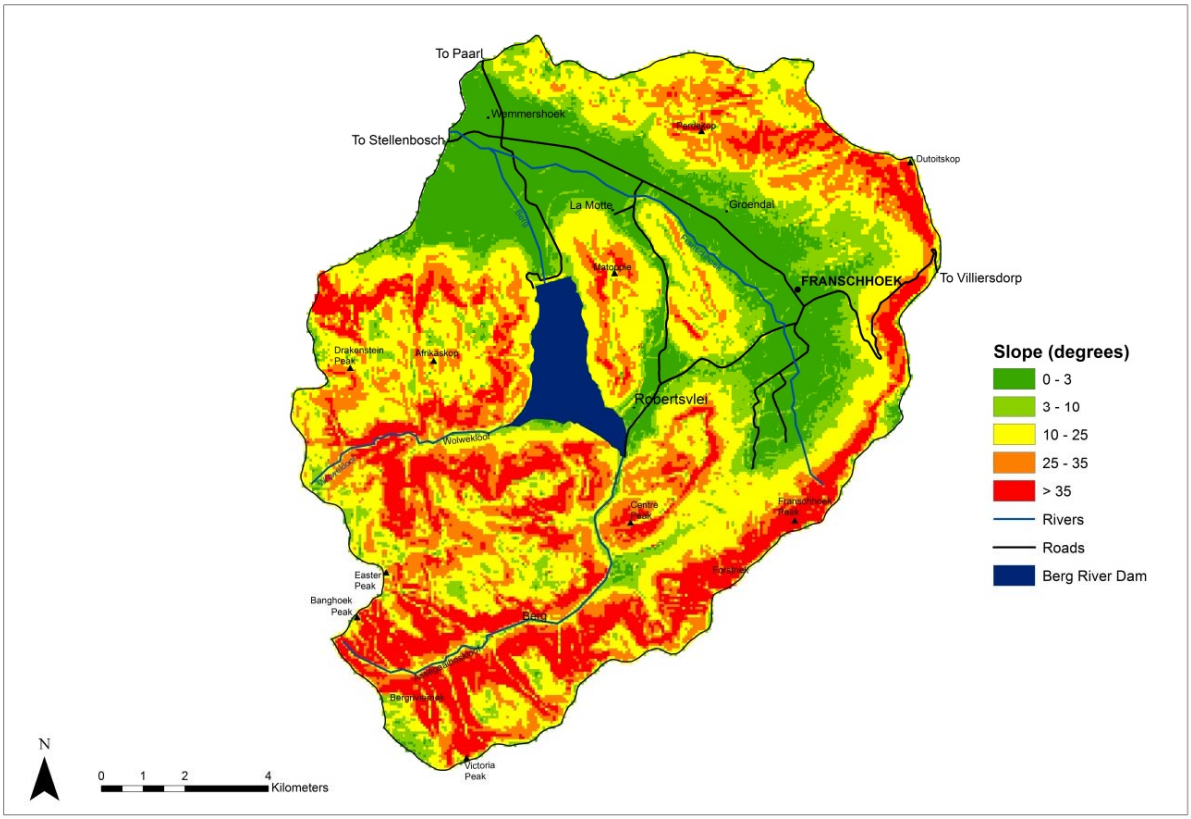


Figure 3: *Distribution of Working for Water slope classes in quaternary catchment G10A.*

Table 1: *The relative importance of different Working for Water slope classes in Quaternary Catchment G10A.*

Slope class (degrees)	Hectares	% of total area
0 – 3	3192.8	18.0
3 – 10	2774.2	15.7
10 – 25	5836.8	32.9
25 – 35	3342.8	18.9
≥ 35° (high attitude – rope work)	2571.1	14.5
	17717.7	

2.4 Land use and transformation

The mountain areas have retained most of their natural vegetation because the combination of the rugged terrain and infertile soils has protected most of the Kogelberg and Hawequas Sandstone Fynbos and the Western Coastal Shale Band Vegetation from agricultural or urban development (Figure 4, Table 2). The Boland Granite Fynbos and Cape Winelands Shale Fynbos occur on the lower slopes and the relatively fertile soils have resulted in extensive conversion for agriculture, leaving only limited natural remnants. Very little of the Swartland Alluvium Fynbos, which occurred on the deep sands of the valley bottoms now remains, and it is classed as a Critically Rare ecosystem in terms of the NEM:BA Act (Anon, 2011).

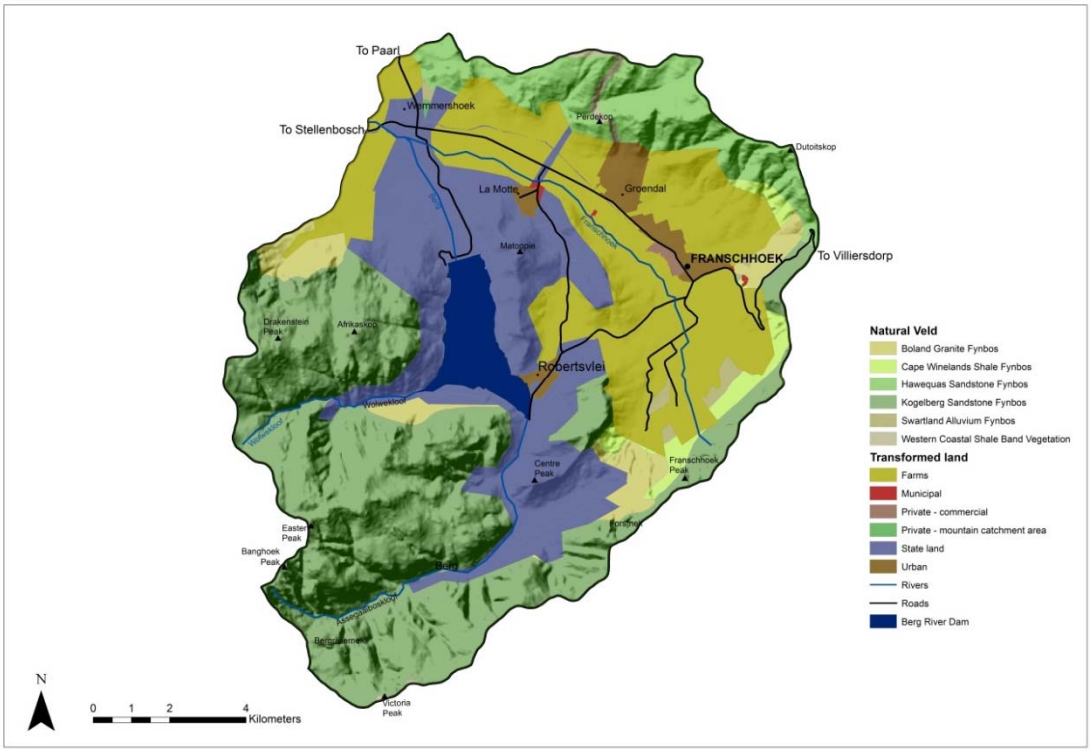


Figure 4: *The extent of natural and transformed land in quaternary catchment G10A. Vegetation type distributions and names were taken from the National Vegetation Map (Mucina and Rutherford 2006).*

About 50.1 % of the area has now been transformed either by conversion into plantation areas, or for cultivation. The main land-use is viticulture although some farms produce fruit and other

products such as lavender. The urban areas include the town of Franschhoek itself, Groendal, Robertsvlei village (buildings now largely demolished), La Motte (former forestry village, now redeveloped) and the Wemmershoek houses and sawmill. This plan includes invasions of the natural areas and farmlands but excludes those occurring in the urban areas of the catchment.

***Table 2:** Land cover by category in Quaternary Catchment G10A*

Category	Description	Area (ha)	Area (%)
Agriculture	Agriculture other	250.13	1.394
	Annual Crop Cultivation / Planted Pastures Rotation	47.4	0.263
	Horticulture / Viticulture	1566.9	8.733
	Old Fields	4.67	0.026
Other	Bare none vegetated	130.1	0.725
Natural	Boland Granite Fynbos	2128.68	11.989
	Cape Winelands Shale Fynbos	712.2	3.969
	Hawequas Sandstone Fynbos	1678.38	9.496
	Kogelberg Sandstone Fynbos	8082.88	46.038
	Swartland Alluvium Fynbos	1428.06	7.959
	Western Coastal Shale Band Vegetation	75.8	0.422
Forestry	Plantation / Woodlots clearfelled	0.2	0.001
	Plantation / Woodlots young	23.8	0.133
	Plantations / Woodlots mature	329.4	1.836
Water	Water permanent	552	3.076
	Water seasonal	34.6	0.193
	Mines water permanent	0.2	0.001
	Wetlands	408.7	2.278
Urban	Urban built-up	0.6	0.003
	Urban commercial	5.2	0.029
	Urban industrial	6	0.033
	Urban informal	13.9	0.077
	Urban school and sports ground	34	0.189
	Urban township	78.5	0.438
	Urban residential	112.4	0.626
	Urban sports and golf	8.7	0.048
	Urban smallholding	4.3	0.024
Grand Total		**17717.7**	**100**

2.5 History of clearing and current state of invasion

As noted in the section 1.2, active control of invasive alien plants was begun by the national forestry department in the late-1960s but records of the clearing prior to 2001 are not readily available. The Working for Water Programme has used a number of implementing agents to carry out control operations in the catchment since 2001: Cape Nature, the Cape Winelands District Municipality (CWDM) and MTO Forestry (till 2005). The clearing of the former La Motte plantation area (state land in Figure 4) was financed from funds allocated under the dam construction budget which was managed by TCTA, the state corporation that built the dam, until 2010. Since 2010, all the clearing operations have been funded by WfW and most of the operations have been managed by the CWDM.

Some areas of the catchment have had as many as 15 treatments (an initial treatment and 14 follow-ups), others only one and many areas, particularly in the Franschhoek River catchment, have never been treated (Figure 5). The areas that have received the most treatments are all located in the former plantation areas and while the major species are still present, for example pine, there are now invasions by a variety of other species which generally occur at quite low densities.

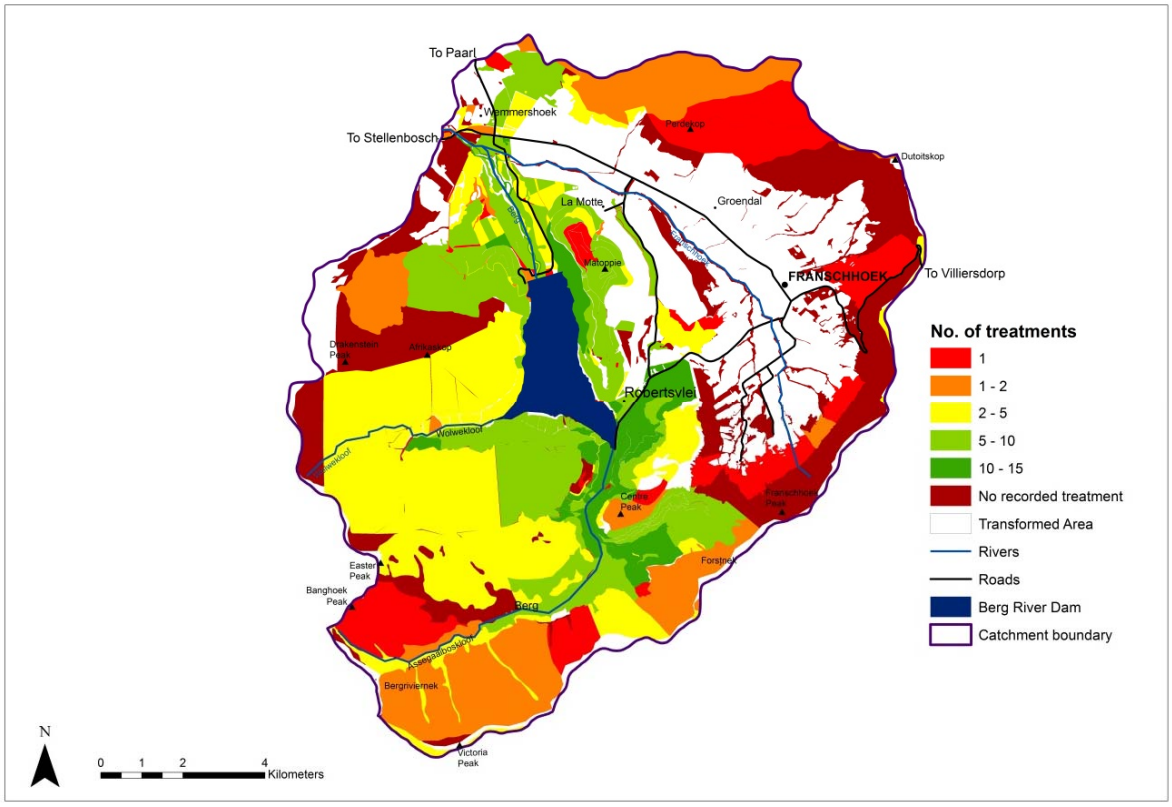


***Figure 5**: The invasive alien plant treatment status for natural and previously afforested areas in quaternary catchment G10A since 2004.*

Even if only the dominant species are considered, the catchment has been invaded by at least 20 different species (Figure 6, Table 3). In the high lying areas of the catchment the invasions are dominated by pine species, particularly *Pinus pinaster* and *P. radiata*, which comprise more than half of the invaded area (Table 3). *Hakea* species are only dominant in the upper section of Assegaaiboschkloof in the south and parts of Hawequas Nature Reserve in the north. The Australian *Acacia* species are probably most problematic species as they form extensive (Table 3) and dense stands and require many follow-ups to deal with their ongoing recruitment from long-lived seed banks (Campbell, 1993; Stirton, 1978). *Acacia longifolia* (Long-leaf wattle) is the most important species and is found on the middle and lower slopes throughout the catchment, particularly from Keerweerdernek to Franschhoek Pass and the slopes west of and above the Berg River dam. *Acacia mearnsii* (Black wattle) is mainly found in the lower areas along the rivers and had dense stands in the Berg River floodplain within and below the dam before these areas were cleared.

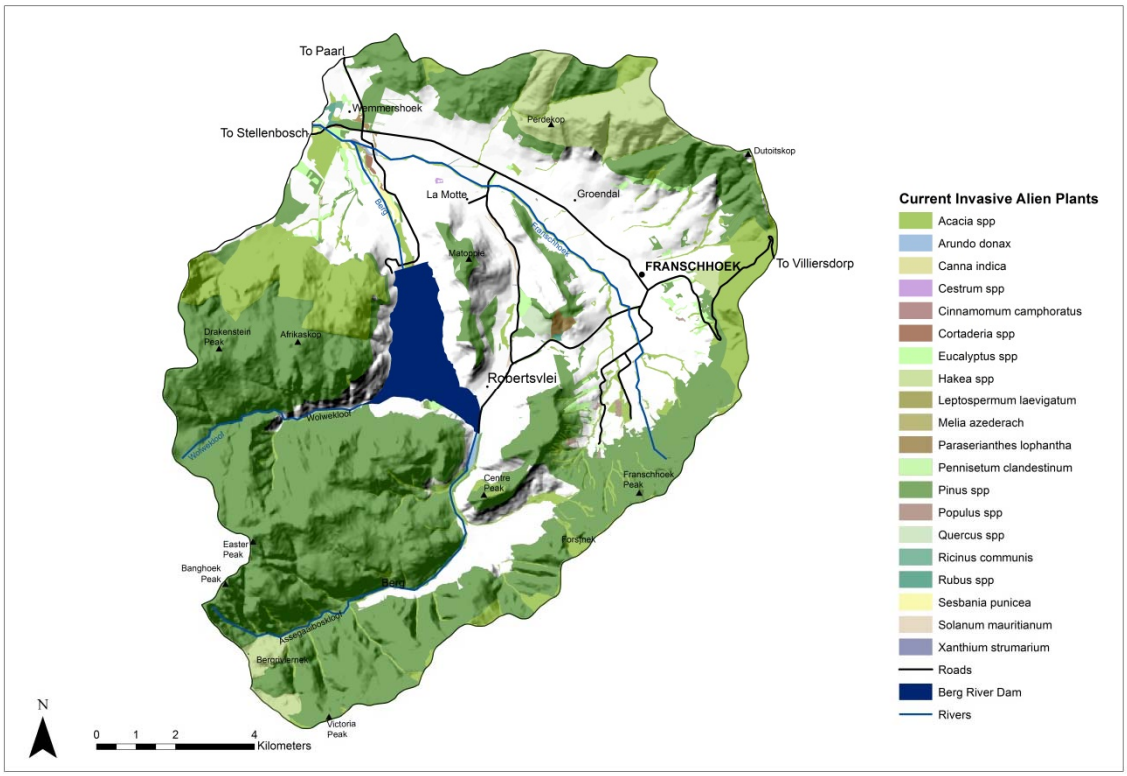


Figure 6: *The current extent of invasive alien plants in quaternary catchment G10A*

Closed stands occupy only about 2% of the total invaded area of 13 698 ha (Table 3) and dense stands about 9%, while medium density (25-50% cover) stands occupy about 22% (3 043 ha) and scattered stands (5-25%) about 58% (8 010 ha) (Figure 7). The relatively low proportion of the low density classes (9%) is a result of the long history of invasions in the catchment which have allowed the invasions to develop over many decades. The relatively high densities of pine trees on the upper slopes of the mountains is a concern because, although they are relatively easy to control, access will be difficult. Simply ring-barking or poisoning the trees will allow the seeds to be released and,

potentially disperse long distances. Many of the areas indicated as pine dominated to the south of the Franschhoek Pass are actually a mixture of *Acacia longifolia* and pines which makes them much more expensive to control. *Acacia longifolia* does have effective biological control agents which limit its seed production (Table 4) but it is still important to deal with these invasions before they can replenish their long-lived seed banks which were depleted by the fires in 2005 and 2006 (see next section).

Most of the invasions are found on state land managed either by CapeNature or by the Cape Winelands District Municipality (CWDM) as the implementing agent, with more than half of the total invaded area being on CapeNature's land (Table 3). Most of the former State Forest Land (all categories beginning with State) was managed by MTO under contract to the state forestry corporation, SAFCOL. MTO has now exited these areas, except for a few plantation compartments where the pines must still reach maturity. These areas, which include nearly 30% of the total invasions, are currently managed by the CWDM on behalf of the Department of Agriculture, Fisheries and Forestry until a suitable organisation can be found to take over this responsibility. There are extensive invasion on the private farmlands, particularly from Keerweerdernek to the Franschhoek pass. Many of these areas were poorly managed pine plantations which had been invaded by *Acacia longifolia*. Some of these areas were cleared by the CWDM with funding from WfW, but dense regeneration following fires means that they will have to be cleared again. This process is already underway and some of these areas have been cleared in the past year (after the 2014 data were compiled).

***Table 3**: Invasions by ownership based on the state of invasions in 2014.*

	Public (condensed area)									Private (condensed area)							
Species	**Cape Nature**	**Municipal mountain catchment**	**Municipal Nature Reserve**	**Municipal open land**	**Municipal WWTW**	**State land safcol**	**State land sawmill**	**State land Transnet**	**State land x**	**Comm**	**Farm fields**	**Farm hortic**	**Mountain catchm area**	**Urban formal**	**Urban informal**	**Other**	**Grand Total**
Other	0.000		0.000			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			0.00
Acacia dealbata									0.800					0.175			0.98
Acacia longifolia	178.498		27.041			336.216	0.186	0.184			147.637	3.838	2.878	8.153		1.1139	705.74
Acacia mearnsii	16.518		0.006			89.889	2.777	0.031	0.206	0.059	26.513	11.953	0.441	4.868		0.0045	153.26
Acacia melanoxylon	3.303		12.297			6.218					2.177	0.048	1.893			0.0046	25.94
Acacia saligna	0.170					22.642	5.904	0.065			0.941	0.310	5.395				35.43
Acacia spp						0.912								0.030			0.94
Acacia terminalis								0.004			1.216	0.216					1.44
Arundo donax						2.302			0.036					0.093			2.43
Canna indica								0.011			0.816	0.698		0.340			1.86
Cestrum spp						0.029											0.03
Cinnamomum camphoratus						3.185	0.012	0.003									3.20
Eucalyptus camaldulensis						6.956											6.96
Eucalyptus cladocalyx	0.244		0.025			5.808					54.372	4.213		0.394	0.002		65.06
Eucalyptus spp	0.482					14.324	2.533		0.034		27.860	1.490		0.140		0.0001	46.86
Hakea sericea	77.954		0.026								0.016	0.000				0.0062	78.00
Hakea spp	15.798		15.545								9.878	0.201		0.396			41.82
Leptospermum laevigatum	10.862					4.384	0.664				2.837	0.350	7.683			0.0007	26.78
Paraserianthes lophantha						9.636	2.254				1.290			0.181			13.36
Pinus canariensis	75.215					0.761											75.98
Pinus pinaster	1261.618		4.990			158.186					98.654	3.419	3.652	0.295		0.0150	1530.83
Pinus radiata	0.296				0.004	0.375		0.002			35.181	1.517	24.155	0.469	0.000	0.0054	62.00
Pinus spp	21.461	0.004	0.441			235.371	0.129		0.004		89.598	0.864	4.939	0.786		0.0006	353.60
Populus canescens											4.937	0.873		0.011			5.82
Populus spp						2.337					3.423	0.073					5.83
Quercus robur						0.064					9.375	1.618					11.06
Quercus spp						16.855											16.86
Quercus suber						0.957								0.003			0.96
Robus spp	0.002					1.669											1.67
Rubus spp											0.012	0.009					0.02
Sesbania punicea						0.096					2.228	0.632				0.0003	2.96
Solanum mauritianum						3.260					0.429					0.0004	3.69
Xanthium strumarium	0.078					7.652		0.000			0.039			0.115			7.88
Grand Total	**1662.498**	**0.004**	**60.372**	**0.000**	**0.004**	**930.085**	**14.459**	**0.298**	**1.079**	**0.059**	**519.430**	**32.323**	**51.036**	**16.448**	**0.002**	**1.151472**	**3289.25**

Table 4: *Scientific and common names and characteristics, areas invaded and treatments recommended for the species recorded as invaders in Quaternary Catchment G10A. The effectiveness of the biological control agent has been included as species with effective control can have a lower priority for management than those without.*

Species	Common name	CARA Category	NEMBA Category	Area invaded (ha)	% of total invaded area	Growth form	Distribution and habitat invaded	Reproductive mode	Age (years) first seed produced	Herbicide required	Bio-control agent***
*Acacia longifolia**	Long-leaved wattle	1	1b	2149	15.7	Tree	Mountain slopes	Reseeder	3	Yes	Yes, effective *Trichilogaster acacialongifoliae*
*Acacia mearnsii**	Black wattle	2	2	583	4.3	Tree	Riparian and landscape	Sprouter	3	Yes	Yes, effective *Ceratocystis albofundus, Cylindrobasidium leave, Dasineura rubiformis, Melanterius maculatus*
*Acacia melanoxylon**	Australian blackwood	2	2	144	1.1	Tree	Riparian and landscape	Sprouter	3	Yes	Yes, effective *Melanterius acaciae*
*Acacia saligna**	Port Jackson willow	2	1b	97	0.7	Tree	landscape	Sprouter	3	Yes	Yes, effective *Melanterius compactus, Uromycladium tepperianum*
*Arundo donax**	Spanish Reed	1	1b	13	2.0	Reed	Riparian and moist landscape	Sprouter	-	Yes	No
*Canna indica c. x generalis**	Garden canna	1	1b	3	0.5	Herb	riparian	Sprouter	?	Not registered	No
Phytolacca octandra (Cestrum)[#, **]	Ink berry	3	1b	<1	<0.0	Herb	Cleared plantations	Sprouter	2	Not essential 1% glyphosate**	No
Cinnamomum camphora	Camphor tree	Not listed for WC	3 (WC)	9	0.1	Tree	landscapes	Reseeder	?	Not listed	No

Species	Common name	CARA Category	NEMBA Category	Area invaded (ha)	% of total invaded area	Growth form	Distribution and habitat invaded	Reproductive mode	Age (years) first seed produced	Herbicide required	Bio-control agent***
Cortaderia spp (selloana)	Pampas grass	1	1b	<1	<0.0	Herb	Riparian and Landscape	Sprouter	?	Yes	No
Eucalyptus spp	Red river gum	2	1b	248	1.7	Tree	River courses		5	Yes	No
Hakea spp (sericea)	Silky hakea	1	1b	425	3.0	Shrub	Mountain slopes	Reseeder	2	Yes (minor use)	Yes, partly effective *Aphanasium austral, Carposina autologa, Colletotrichum acutatum, Cydmaea binotata, Dicomada rufa, Erytenna consputa*
*Leptospermum laevigatum***	Australian myrtle	1	1b	157	1.2	Tree	Coastal areas	Sprouter	4**	Yes	Yes, not effective *Aristaea thalassias, Dasineura strobili*
Melia azedarach	Syringa	3	1b, 3 in urban areas	<1	<0.0	Tree	Riparian and Landscape	Sprouter	-	Yes	No
Paraserianthes lophantha	Stink bean	1	1b	29	0.21	Tree	Riparian and coastal areas	Reseeder	3	Yes	Yes, effective *Melanterius servulus*
Pennisetum clandestinum	Kikuyu grass	1	1b	<1	<0.0	Grass		Sprouter		Not listed	No
Pinus pinaster	Cluster pine	2	2 in plantations, 1b elsewhere	7370	53.8	Tree	Mountain slopes	Reseeder	5	Yes	No
Pinus radiata	Radiata pine	2	2 in plantations, 1b elsewhere	220	33.1	Tree	Mountain slopes	Reseeder	7	Not listed	No
Pinus species	Pines	2		1758	12.8	Tree			5-7		No

Species	Common name	CARA Category	NEMBA Category	Area invaded (ha)	% of total invaded area	Growth form	Distribution and habitat invaded	Reproductive mode	Age (years) first seed produced	Herbicide required	Bio-control agent***
Populus spp	Grey poplar	2	2	30	0.2	Tree	Riparian, moist areas	Resprouter		Yes	No
Quercus spp	Oaks	-	-	101	0.7	Tree		Reseeder	?	Not listed	No
Ricinus communis	Castor-oil plant	2	2	<1	<0.0	Shrub	Riparian and landscape	Reseeder	?	Yes	No
Rubus spp (fruticosus)	Bramble	2	2	12	0.1	Herb			2	Yes	No
Sesbania punicea	Red Sesbania	1	1b	4	<0.0	Tree	Riparian and landscape	Reseeder	3	Yes	Yes, effective *Neodiplogrammus quadrivittatus, Rhyssomatus marginatus, Trichapion lativentre*
Solanum mauritianum	Bugweed	1	1b	6	1.0	Shrub	Riparian and landscape	Resprouter	2	Yes	Yes, not effective *Anthonomus santacruzi, Gargaphia decoris*
Xanthium strumarium	Large cocklebur	1	1b	35	0.3	Herb	Riparian and landscape	Reseeder	2	Yes	No

Notes:

 # Phytolacca octandra (Ink berry) was incorrectly named as *Cestrum laevigatum* in the databases acquired from the Working for Water Information Management System (WIMS)
Casuarina cunninghamiana (Beefwood) were observed in the initial stage of spreading in farm drainage ditches during a site visit to the catchment in 2014.
**information from http://www.issg.org*
***information from https://florabase.dpaw.wa.gov.au/*
Herbicide information taken from https://sites.google.com/site/wfwplanning/
Biocontrol data obtained from (Klein, 2011).

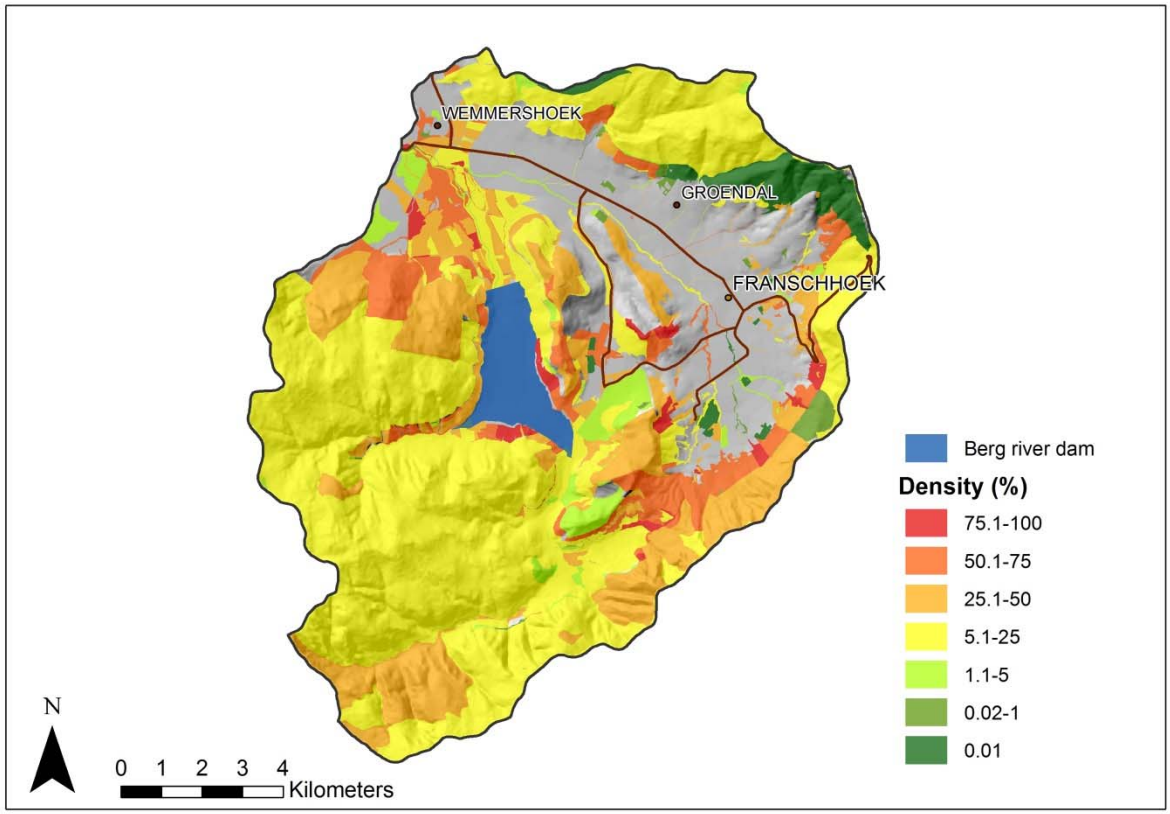


Figure 7: *Current **i**nvasive alien plant **density** classes per management compartment in quaternary catchment G10A.*

Dominant invasive alien plant species in the area are *Acacia mearnsii, Acacia longfolia, Pinus pinaster, Pinus radiate and Rubus fruiticosus* (Figure 8).

See http://www.invasives.org.za/plants/plants-a-z for more information on these species and other invaders in the catchment.

Figure 8: *The main invasive alien plant species in the catchment (A) Black Wattle (Acacia mearnsii) (B) Stinkbean (Paraserianthus lophantha); (C) Red River Gum (Eucalyptus camaldulensis); (D) Silky Hakea (Hakea sericea; (E) Cluster Pine (Pinus pinaster). (F) Blackwood (Acacia melanoxylon) (Photos: G. Forsyth).*

2.6 Fire history

There have been many fires over the decades but the most important ones for this plan are the two major fires which have occurred since 2004. The one was on 29 December 2005 and the other on 31 March 2006 (Geland *et al*., 2008) and between them they burnt 80% of the catchment of the Berg River Dam and across to the lower part of the Franschhoek Pass. This has resulted in the vegetation age of much of the catchment (40%) being 11 years old, with only two sections in the southern part being approximately nine years old (Table 5 and Figure 9). Much of the burnt area, especially the former plantations, was being treated or was due for treatment shortly because the old plantations had been felled and needed rehabilitation. In areas which had not been treated, notably the high altitude areas, the fires stimulated the recruitment of large numbers of pine and long-leaf *Acacia* seedlings. The same fires may have stimulated the seeds of many fynbos species as well. Therefore it is important to clear the alien species as soon as possible to prevent suppression of the fynbos species, particularly in areas which were under fynbos prior to the fire.

The risk of further fires has been reduced by the young vegetation, but even young fynbos can burn under extreme wildfire conditions (Van Wilgen *et al*., 2010). It is, therefore, important that wild fires are kept out of the area. Special care needs to be taken to prevent fires burning in areas of the cleared plantations where there is a lot of slash (i.e. cut branches), and even many logs or whole trees, lying on the surface. Due to the high availability of fuel (i.e. wood), fires in these areas can reach extremely high temperatures and can sterilise the soil (Holmes and Newton, 2004; Holmes *et al*., 1987; Le Maitre *et al*., 2014). These areas then require reseeding which is expensive. Fire can still be used as part of the control treatments (e.g. in dense long-leaf acacia stands), but care must be taken to prevent these fires from escaping.

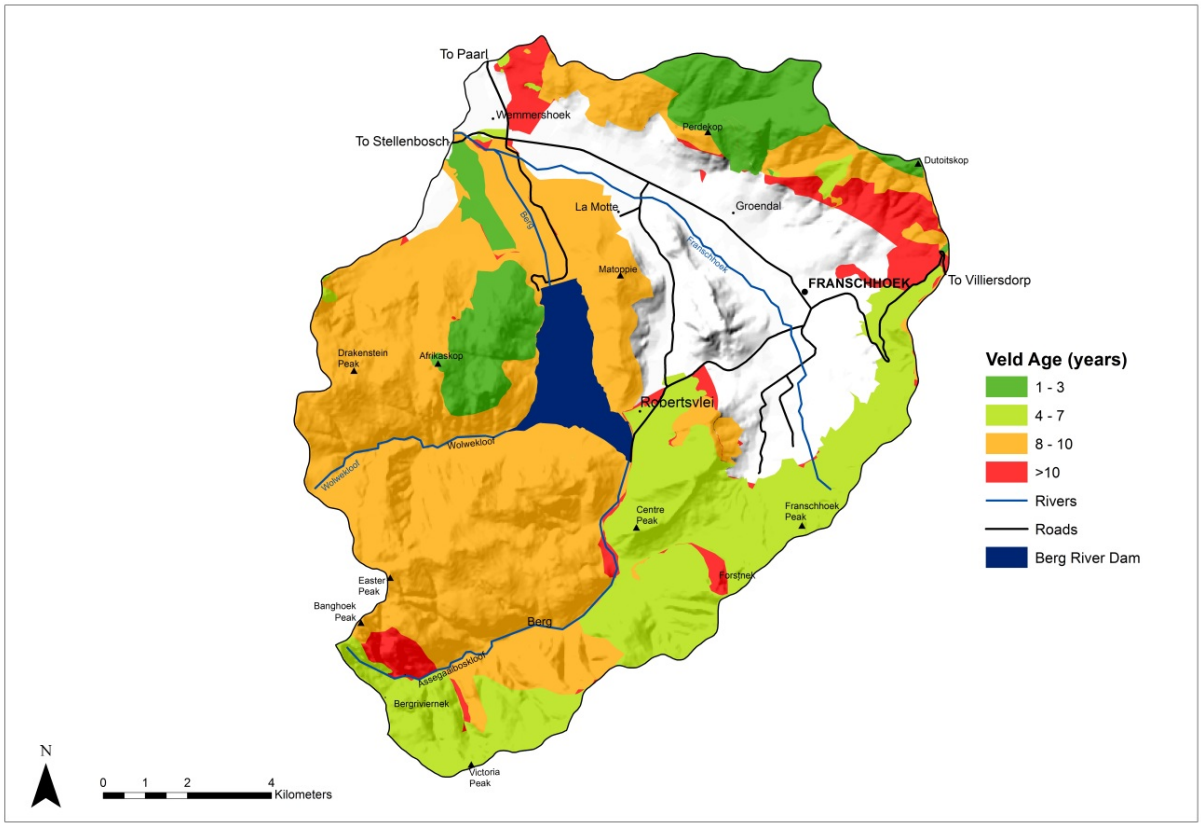


Figure 9: *Current veld age of quaternary catchment G10A as determined at the end of April 2014.*

Wildfires occur in the catchment regularly with periods when extensive fires or numerous small fires occur. For example 2000 and 2006 (Figure 10). The majority of the area burns in the ecologically acceptable time during summer and early autumn (Figure 11).

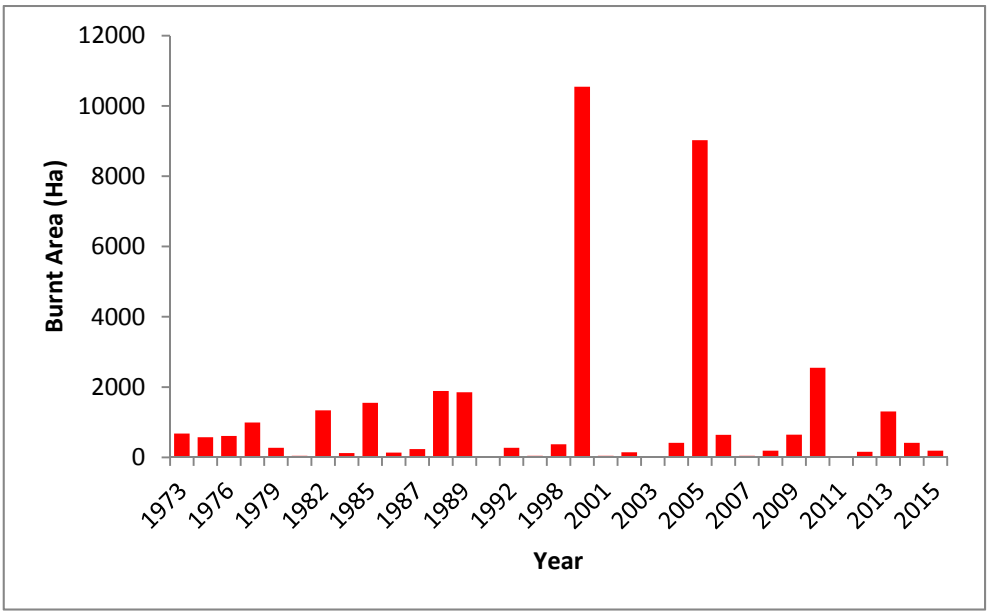


Figure 10: *Area burnt per annum for fires on record in quaternary catchment G10A as of April 2015.*

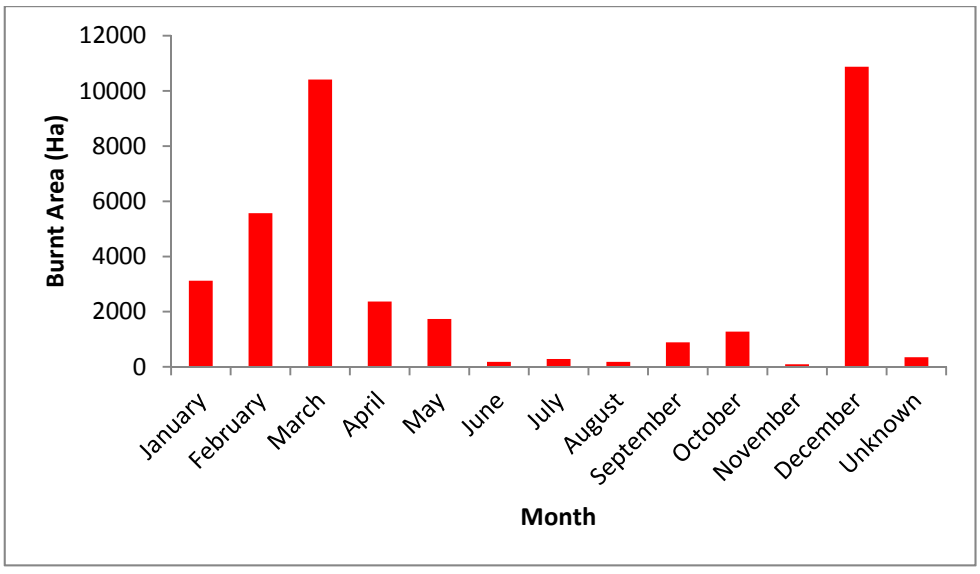


Figure 11: *Area burnt per month for fires on record in quaternary catchment G10A as of April 2015.*

Table 5: *Veld age in April 2014 for the portion of Quaternary Catchment G10A covered by natural veld (invaded and uninvaded)*

Post-fire veld age (years)	Ha	% of total area
0 - 3	1909.5	10.8
4 - 6	2707.3	15.3
7 - 10	883.8	5.0
11 – 15	7031.8	39.7
16 – 20	591.6	3.3
21 – 25	0	0
26 - 30	117.4	0.7
≥ 31	25.8	0.1
	13267.3	**74.9**
Unknown / Not applicable (Mainly farming and urban land)	4450.4	25.1
	17717.7	**100**

2.7 Land ownership

Public land accounts for a little over 71% of the total area of the catchment G10A (Table 6 and Figure 12). This is made up of land managed primarily by the CapeNature, Stellenbosch Municipality, CapeNature and Transnet. The status of the State Forest land which fell under MTO Forestry, and was leased from the state forestry corporation, Safcol, is not clear at this stage. Indications are that it is now the responsibility of the Department of Public Works which does not have the capacity to manage these areas. CapeNature have indicated that there are portions which they would like to add to their reserves to consolidate them but the ownership rest of the land must still be determined.

A large proportion of the private land is not under horticulture (e.g. vineyards, orchards, cultivation of annual crops) and much of this is fallow land, often with a mixture of grasses and various agricultural weeds. Some of these areas have become densely invaded by a variety of plant species, particularly pines and long-leaf wattle and should be prioritised for treatment.

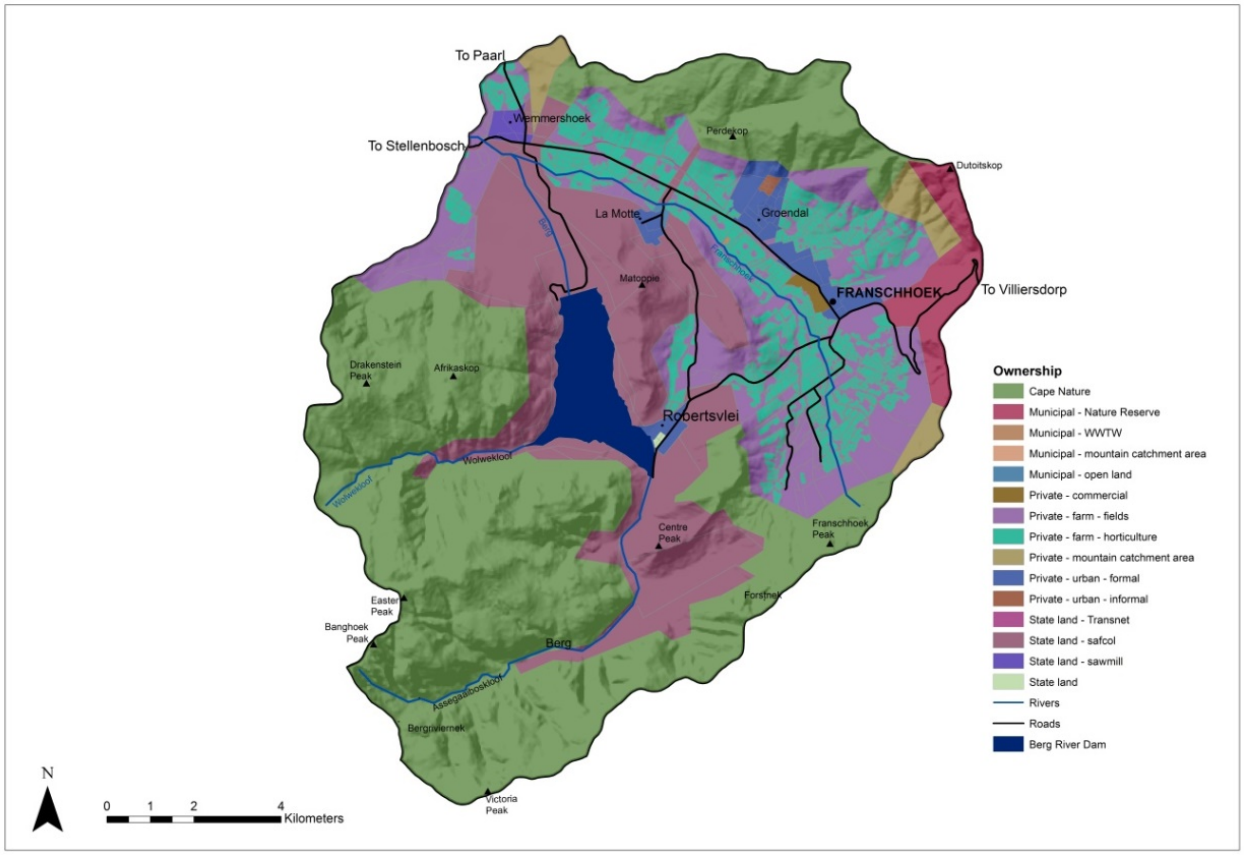


Figure 12: *Land ownership in quaternary catchment G10A.*

Table 6: *Land ownership by category in Quaternary Catchment G10A*

Category	Sub-category	Hectares	% of total area
PUBLIC	Berg River Dam surface (City of Cape Town?)	530.44	2.99%
	Berg River Dam surrounds (Servitude)		
	CapeNature	8003.33	45.17%
	Municipal - mountain catchment area	0.03	0.00%
	Municipal - Nature Reserve (Mont Roche)	453.23	2.56%
	Municipal - Open Land	0.27	0.00%
	Municipal – WWTW (Waste Water Treatment Works)	2.04	0.01%
	State land - Safcol	3579.07	20.20%
	State land - Wemmershoek Sawmill	62.21	0.35%
	State land - Transnet	15.62	0.09%
	State land - other	5.99	0.03%
PRIVATE			
	Farms (Commercial)	34.23	0.19%
	Farms - fields	2406.08	13.58%
	Farms - horticulture (vineyards?)	1861.28	10.51%
	Mountain Catchment Area	335.72	1.89%
	Urban - formal	414.82	2.34%
	Urban – informal (often on public land)	13.39	0.08%
		17717.75	**100.00%**

2.8 Water Users

The main user of water from the Upper Berg catchment (G10A) is the City of City of Cape Town which receives a total of about 300 million m^3/year from the Western Cape Water Supply System (WCWSS). This includes transfers from areas outside the Berg River dam such as the Steenbras and Theewaterskloof dams (DWA, 2008). The Berg River dam scheme is designed to supply Cape Town with up to 80 million m^3/year, primarily from the Berg and Dwars River systems. The Stellenbosch Municipality also receives water from the WCWSS via the Riviersonderend-Berg-Eerste River water transfer scheme. The town of Franschhoek gets its water supplies, about 1.5 million m^3/year, from local rivers and springs and from Wemmershoek dam via a pipeline (DWA, 2011). Downstream water users include the towns of Paarl of Wellington and irrigation boards. The main users of water from the Franschhoek River catchment are the farmers who irrigate using water stored in farm dams and supplied via irrigation systems to water their vineyards, orchards and pastures, and a limited amount of annual crops.

The Upper Berg Major Irrigation Board was established in 1986 and covers the Berg River upstream of Wellington. It includes some 530 farms with an irrigated area of about 14 800 ha. The annual

water requirement is about 66 million m^3/year, 34 million m^3/year extracted from the rivers and 32 million m^3/year from farm dams (DWA, 2008). The aim is to convert the board to a Water User Association under the Berg-Olifants Catchment Management Agency.

2.9 Stakeholders

The main institutions and organisations actively supporting and participating in invasive alien plant control operations within the catchment are listed in Table 7. Private land owners have not been listed individually but are represented by local government and organised agricultural bodies.

Table 7: *Stakeholder representatives for Quaternary Catchment G10A*

Organisation	Contact	Designation	Telephone	Cell	e-mail
Western Cape – DEADP Development Planning	Jason Mingo	Berg River improvement plan	021 483-0798	084 661-8264	Jason.Mingo@westerncape.gov.za
Western Cape Department of Agriculture: Sustainable Resources Management	Rudolph Röscher	LandCare Manager : Cape Winelands DM & Berg River improvement plan	023-3471003	083 675 1315	rudolphr@elsenburg.com
Agriculture Depart. of Agriculture: Sustainable Resources Management	Francis Steyn	Sustainable Resources Management	021 808-5090	082 907-2813	Franciss@elsenburg.com
Living Lands	Marijn Zwinkels	Partners in RMMP		073 734-5100	marijn@livinglands.co.za
Agriculture (Private)	Weskaap Argi in Paarl	Farmers Association			
Berg River Irrigation Board	WD (Billy) Bourbon-Leftley	Chairman	021 8633475	082 880-1470	billyb@vodamail.co.za
CapeNature	Peter Viljoen	Catchment Management: Boland		082 7407736	pviljoen@capenature.co.za
	Ben van Staden	Natural Resources Manager	021 483-0171	079 503-6424	bvanstaden@capenature.co.za

Organisation	Contact	Designation	Telephone	Cell	e-mail
	Deon Rossouw	Limietberg Reserve Manager	021-871-1535	082-494-9707	dross@capenature.co.za
	Dian Dreyer	Central Region Protected Areas Manager	021-851-1996	082-823-7415	ddreyer@capenature.co.za
	Patrick Shone	Jonkershoek Reserve Manager (also FPA)	021 866-1560	082-467-0405	pshone@capenature.co.za
	Corlie Hugo	Ecological co-ordinator Boland		082 380-9071	chugo@capenature.co.za
	Tony Marshall	Integrated Catchment Management		082 740-7787	tmarshall@capenature.co.za
Cape Pine (MTO Forestry)	Dirk Nortjie	MTO Area Manager	021 867 0184	0828875529	Dirk@mto.co.za
Cape Winelands Biosphere Reserve	Jimmy Naggs?				
Cape Winelands District Municipality	Manfred Paulsen	IA Manager	021 876-3041	084 208-6423	manfred@capewinelands.gov.za
Stellenbosch Municipality	Andre van Niekerk or EJ Wentzel	Water Section			
Water Affairs Department of Water and Sanitation	Aisha Petersen	Director: Institutional Establishment	021 941-6000 021 941-6182	082 320-8228	pietersena@dwa.gov.za
	Derril Daniels	Western Cape Water Supply System (Berg River Manager)	021 941-6000 021 941-6189	082 908-3236	DanielsD@dwa.gov.za
	Melissa Lintnaar-Strauss	Western Cape Water Supply System (Water Quality)	021 941-6000		
	Bertrand van Zyl	Chief Engineer: Operations		082 807-3541	vanzylb@dwa.gov.za
Working on Fire Programme (NRM – Environment	Jason de Smidt	Project Manager SW region High altitude teams	021 761-1992	084 548-7140	desmidtjason@gmail.com

Organisation	Contact	Designation	Telephone	Cell	e-mail
Affairs					
Working for Water Programme (NRM – Environment Affairs	Aadelia Moerat	Regional Programme Leader: W Cape Environmental Programmes	021 941-6008	076 184-0298	AMoerat@environment.gov.za
	Wessel Wentzel	Implementation Manager: WC Working for Water	021 941-6016	082 888-7766	WWentzel@environment.gov.za
	Colin Sharp	Area manager		074 100-9206	Csharp@environment.gov
	Nicolette (Nikki) Oliver	WIMS	021 941-6023	074 454-4556	NOliver@environment.gov.za
WWF-SA	Mirelle Lewarne	Operational Manager: Champion Farms			mlewarne@wwf.org.za

3 DELINEATING MANAGEMENT COMPARTMENTS

When the Working for Water programme was launched in 1995, the programme management realised that there was a need for a standardised way of mapping invasions so that records could be kept of the spatial boundaries of invaded areas and so that the costs of treatments could be estimated and monitored. The mapping standards that were developed were based on those developed by the CSIR for the Catchment Management System (CMS) for fynbos (Le Maitre *et al*., 1993) and subsequently revised and modified (Working for Water, 2003). The CMS included a series of spatial data layers aimed at providing the managers with the information they needed on the spatial distributions of key species, fires, invasions and land ownership among others. One of the key ones was a management unit known as a "compartment" which was based on the approach developed by the Department of Forestry for the mountain catchment areas they managed (similar units were used in forest plantations). Essentially these were spatial units with clearly defined and identifiable boundaries that were also useful as boundaries for fire management and other operations. They also provided a complete coverage of the area of interest, in this case a catchment. In contrast, the mapping of invasions was based on mapping units with similar invasions (similar species mix and density and location in the landscape), generally with no consideration of compartment boundaries, although rivers and streams often formed natural units. This is because rivers, streams and their floodplains (i.e. riparian areas) often have invasions which differ in species composition, structure and density from adjacent dryland invasions, typically making them separate invaded units.

Invaded areas were then overlaid with compartments to provide information on the characteristics of the invaded areas in each compartment. The key point is that there was only one fixed management unit – the compartment. This choice was deliberate and was intended to ensure that as the different invaded units within each compartment were treated the changes would be documents and form a permanent record of the treatments and the resulting changes in the state of the invasions. In this way the boundaries of the treatment unit could change over time depending on what was best suited to the contract requirements regarding workloads and time-frames. In discussions with NRM planners and implementing agents in was agreed that for the Upper Berg River catchment, compartment boundaries should follow clearly identifiable features in the landscape such as rivers, ridges or roads.

We began delineating compartments for the Upper Berg River Catchment by using the existing compartment information provided by Cape Nature and MTO Forestry in the case of state land and the urban and farm cadastre for private land. These data were overlaid on recent digitally corrected aerial photographs using GIS to assist in determining logical compartment boundaries. CapeNature had already completed a similar exercise for their "NBAL" units, which in their case these are the same as their compartments. Their boundaries correspond with features that are easily located in the field. For the state land previously managed by MTO Forestry (now managed by Public Works), we combined previous plantation compartments into larger units. Similarly, on private farm land we used the cadastral boundaries to group properties into logical units bounded by roads, railways or

rivers. Each of these coverages was then combined to create a "wall-to-wall" coverage of 267 compartments for the catchment (Figure 13). Although this appears to be a straightforward process, much effort was needed to ensure that the resultant coverage had spatial integrity.

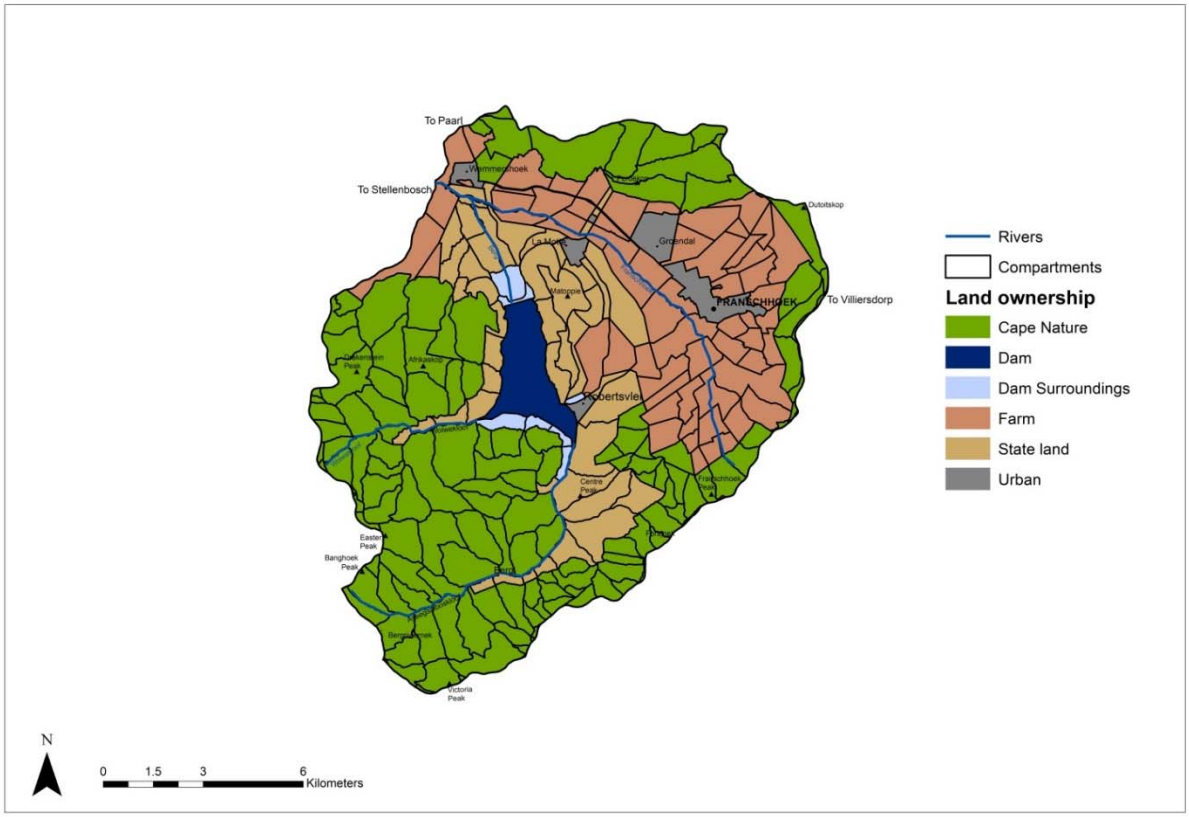


Figure 13: *Delineation of 267 compartments per ownership category in the quaternary catchment G10A*

All the pertinent information for each compartment such as the water flows (runoff), accessibility, slope and the age of the veld is stored within a geo-database (Appendix 1). The information on historical and current invasions, previous control treatments and their costs is stored for each of the treatment units (NBALs) is stored in the same geodatabase (Appendix 1). There is also a cross-link dataset which tells us which NBALs fall within each compartment so this information can be summarised at the compartment level as well. The geodatabase allows for all this information to be easily retrieved and presented at a compartment level and for such information to be loaded into the automated Management Unit Control Plan (MUCP) generation tool (Appendix 2) (see Section 5). An example of the compartment-level information is the average slope for each which clearly shows the prevalence of steep slopes in the south-western and eastern parts of the catchment (Figure 14).

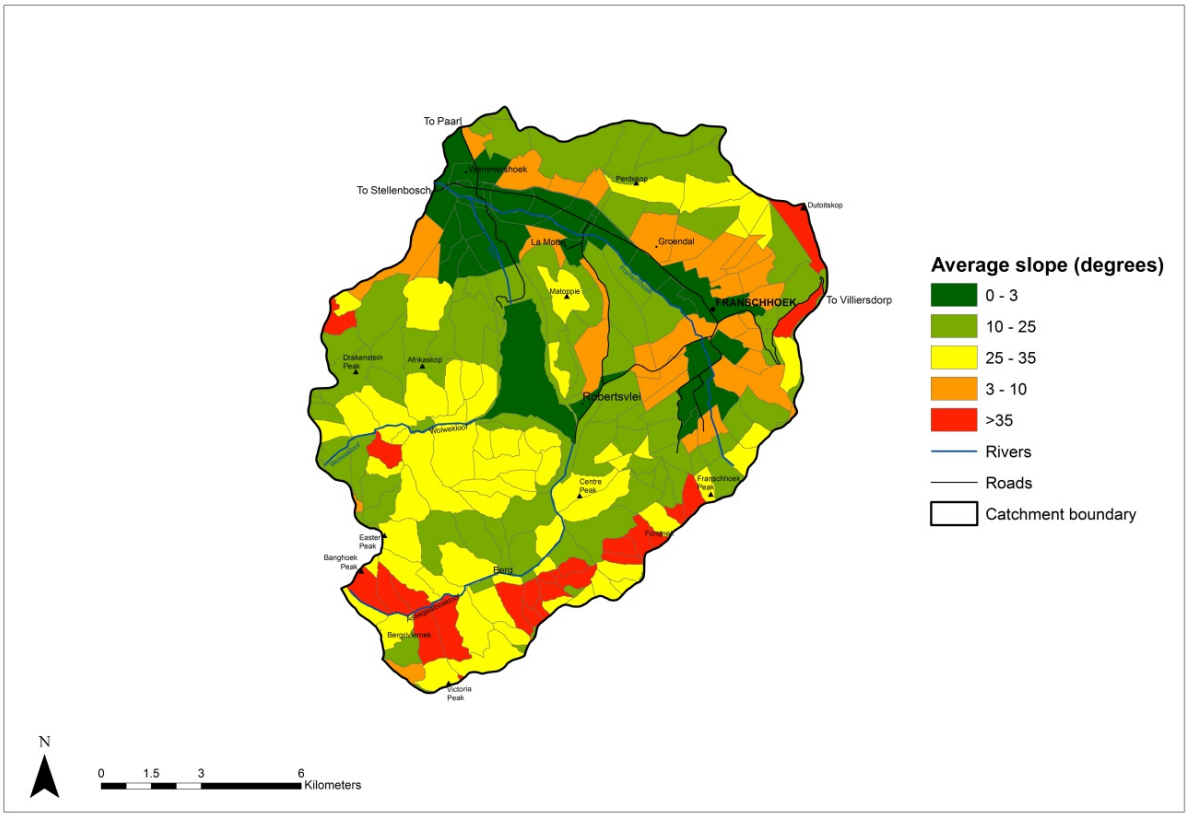


Figure 14: *The average slopes of the management compartments in quaternary catchment G10A*

4 PRIORITISATION (Vision and goals)

Invasive alien plant control requires that managers match the available resources and budget with the work that needs to be accomplished so as to maximise benefits. This means that "trade-offs" often must be made in setting up schedules of which invasions plants will be treated and where over time. As described in Section 3 above, the entire catchment has been demarcated into management units known as "compartments", spatial units with clearly identifiable boundaries. The problem is to decide which of these compartments to treat first. This decision is influenced by two primary factors: (a) the benefits generated by the clearing (e.g. increased water flows); and (b) the nature and extent of the invasions in each compartment at a given time, its treatment history, and the funds available to deal with the problem in a given budgetary cycle. Prioritisation is, therefore, critical for ensuring that both the individual treatments and the overall programme are as effective as possible.

The general approach to prioritisation is to firstly establish a clear goal that states a desired outcome of what needs to be achieved where and by when. Any such goal should be S.M.A.R.T (Specific, Measurable, Assignable, Realistic and Time-bound). Once the goal has been defined the next step is to develop the criteria (objectives) and sub-criteria (sub-objectives) that have to be realized if the goal is to be achieved.

A multi-criteria decision making process, the Analytic Hierarchy Process (AHP, Saaty 1990), was followed to develop a goal for invasive alien plant control operations in the catchment, to develop the criteria needed to achieve the goal, and to assess the relative importance of these criteria by allocating weights (ranking) to them by means of pair-wise comparisons. This was facilitated by using Expert Choice software (Anon 2009) to construct an AHP model for the catchment. The AHP process is useful for setting priorities when both qualitative and quantitative aspects of a decision need to be considered, and for achieving group consensus. The last step in the process was to identify the datasets that enabled objective comparisons to be made between compartments with regard to particular criteria.

Literature on the application of multi-criteria decision techniques suggests that the difficulties of comparing criteria increase as the number of criteria increases, with the optimal being around seven criteria (Saaty and Ozdemir 2003). The hierarchical structure followed by the AHP method reduces that difficulty somewhat as it groups criteria into clusters that facilitate comparisons. Even so, as the number of criteria increase, it takes more and more time to do the comparisons and participants become fatigued or lose interest and focus. In our experience, many of the criteria are ultimately given low weights in the final models so they have little influence on the outcomes. The aim is therefore to limit the prioritisation model to as few criteria as possible at each level in the hierarchy, while maintaining the diversity of views among stakeholders.

A number of stakeholders participated in a workshop held during December 2014 to construct a prioritisation model for quaternary catchment G10A. The major stakeholders in the catchment include the Cape Winelands District Municipality, CapeNature, Working for Water, Working on Fire, Department of Water Affairs and Western Cape Department of Agriculture (Appendix 2). We invited a representative from the Upper Berg River Irrigation Board but they did not attend the workshop.

We deliberately followed a strategy of allowing the stakeholders at the workshop to establish a goal and set their own criteria as this facilitated participation and debate and got participants to agree to the final priorities that were identified. The process that was followed was participatory and transparent so that all the contributors could check the outcomes of their discussions and decisions and alter these dynamically until a consensus was reached.

The workshop participants agreed on a common goal and timeframe for the control of IAPs in quaternary catchment G10A, and the criteria needed to support this goal (Figure 15). They then assessed the relative importance of these criteria by allocating weights to them by means of pairwise comparisons (Figure 16).

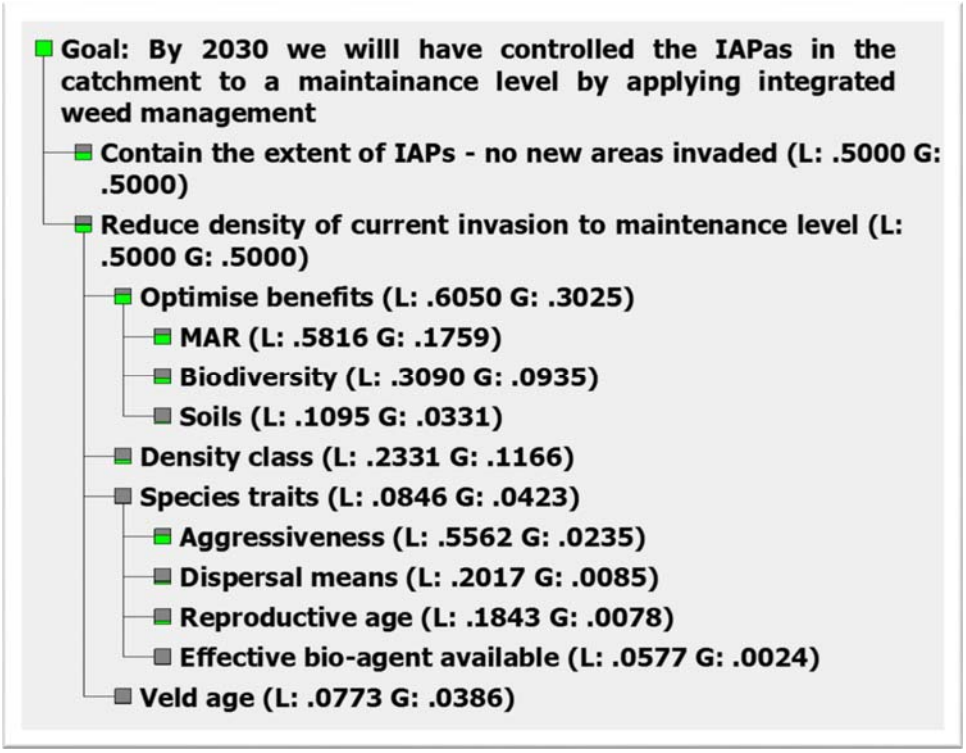


Figure 15: *Prioritisation model for quaternary catchment G10A (Upper Berg River) showing the goal and hierarchy of weighted criteria. G values refer to the overall weights in relation to the goal while L values refer to weights for each criterion or sub-criterion.*

Containing the extent of invasions through preventing new areas from becoming invaded was seen by participants as being as important as reducing the density of current invasions (Figure 13). This means that some funds need to be set aside for regular surveys of currently uninvaded areas to ensure that any merging invasions are treated. Reducing the density contains four sub-criteria: optimise benefits, target low density invasions and aggressive species, and take advantage of the opportunity for IAP control afforded by recently burnt areas. The relative important of each individual criterion, and sub-criterion, clearly shows that preventing the further spread of IAPs in the catchment is considered the most important activity. Together with the control of IAPs in

compartments having a high mean annual run-off or those that contribute to the maintenance of bio-diversity, these three criteria account for 75% of the weight assigned in the model (Figure 15).

Experience and research have shown that it is best to begin with sparsely invaded areas as more area can be cleared per unit cost and this prevents the invaders from increasing in density. Controlling dense invasions is a slow process which can demotivate the clearing team which can reduce their productivity.

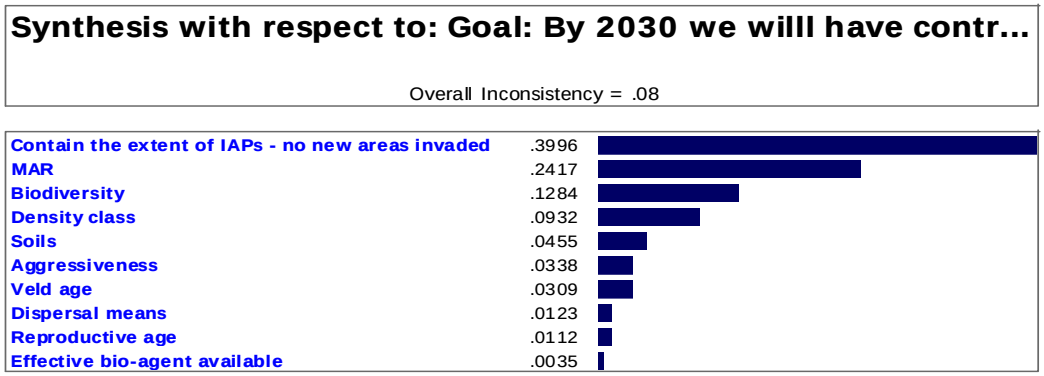


Figure 16: *Ranks assigned to individual criteria in the prioritisation model for quaternary catchment G10A (Upper Berg River)*

Species traits were also considered. These include aggressiveness, dispersal means or agents (e.g. wind or water), reproductive age and whether an effective bio-agent is available. The time to initial seed production (reproductive age) varies between IAPs. In most cases initial treatments are of stands of mature plants although in some cases, for example after an unplanned fire, the seedlings or young plants need to be treated. Failing to treat a species before it produces more seeds means that the expenditure on the previous treatments was largely fruitless. This also means, in general, that first priority should be given to follow-up treatments and second priority to initial clearing.

Initially the focus in developing the MUCP tool has been on getting the datasets formatted for the tool, implementing WfW's method of using their norms and standards to estimate the treatment cost per Nbal and assessing, together with the implementing agent, whether the estimated costs calculated by the MUCP tool are realistic based on their experience.

We were unable to find suitable datasets of some of the criteria in the prioritisation model (Figure 15) so the soil criterion was omitted. The proto-type of the MUCP tool was not designed to use species characteristics in weighting compartments. This has meant that we have not been able to take species data into account in the tool's prioritisation. However, we do not believe that this has biased the priorities substantially as the combination of high mean annual run-off and invasion densities has an overriding influence on the priorities assigned to compartments. In any case, the costs will remain the same and only the scheduling of compartments may have had more criteria been included.

5 ESTIMATING LONG TERM CLEARING COSTS (MUCP Tool outputs)

An Automated Management Unit Control Plan (MUCP) generation tool for planning and budgeting for invasive alien plant control is being developed on behalf of NRM by a firm of software developers, Handmade Connections. The system is known as the MUCP planning tool and it can automate the planning of control operations for different budgets over a 20 year timeframe.

By linking the MUCP planning tool to important sources of information such as the status and impacts of invasions, conservation priorities, progress with control operations, the occurrence of events such as fires, and the availability of resources, Working for Water managers are able to set annual targets that are aligned with the overall goal and time frames set out in any MUCPs.

The approach used by the MUCP tool is to divide the entire catchment into compartments with are defined by fixed boundaries and can be located on the ground (Figure 17). The high mean density of all the invading plant species in each compartment are found mainly on the state forest land and in parts the private farmland, while the upper catchment, CapeNature's land, has relatively low densities.

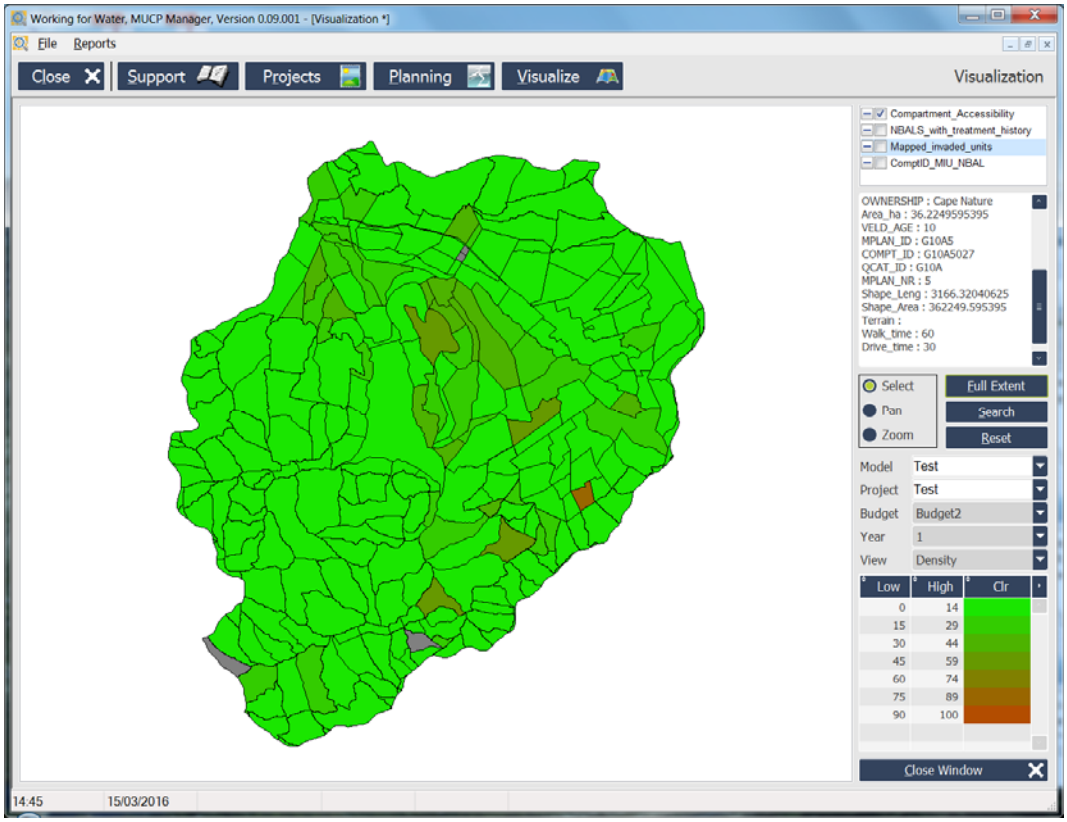


Figure 17: *Location of compartments in Catchment G10A showing IAP densities*

All the invasions in the catchment have been grouped into mapped invaded units (MIUs) based on the characteristics of their invasions (e.g. species and densities). When invaded areas are identified for treatments, the portions of the MIUs in that designated area are included in the treatment unit (Nbal). Thus MIUs include invasions which have yet to be treated while Nbals include invasions which have been treated and have a record of the history of their treatments. New Nbals (treatment units) are created during the process of generating clearing contracts.

Every Nbal falls within an MIU and they in turn should be nested within compartments. In the case of the Upper Berg River catchment some areas have been worked on since 2000 so there are many Nbals which have long clearing histories. The MUCP tool is used to schedule future work and, therefore uses both MUIs and Nbals when scheduling initial and follow-up treatments for MUIs and follow-up treatments for Nbals. The complex arrangement of the MIUs and the Nbals is indicative of their long history and that many of them were defined using the compartments of the previous forestry plantation (Figure 18). Although the distribution of invasion densities follows the same general pattern as the compartments (Figure 17), they do show the complexity of the mixture of invasions densities in the catchment in 2014 (Figure 18).

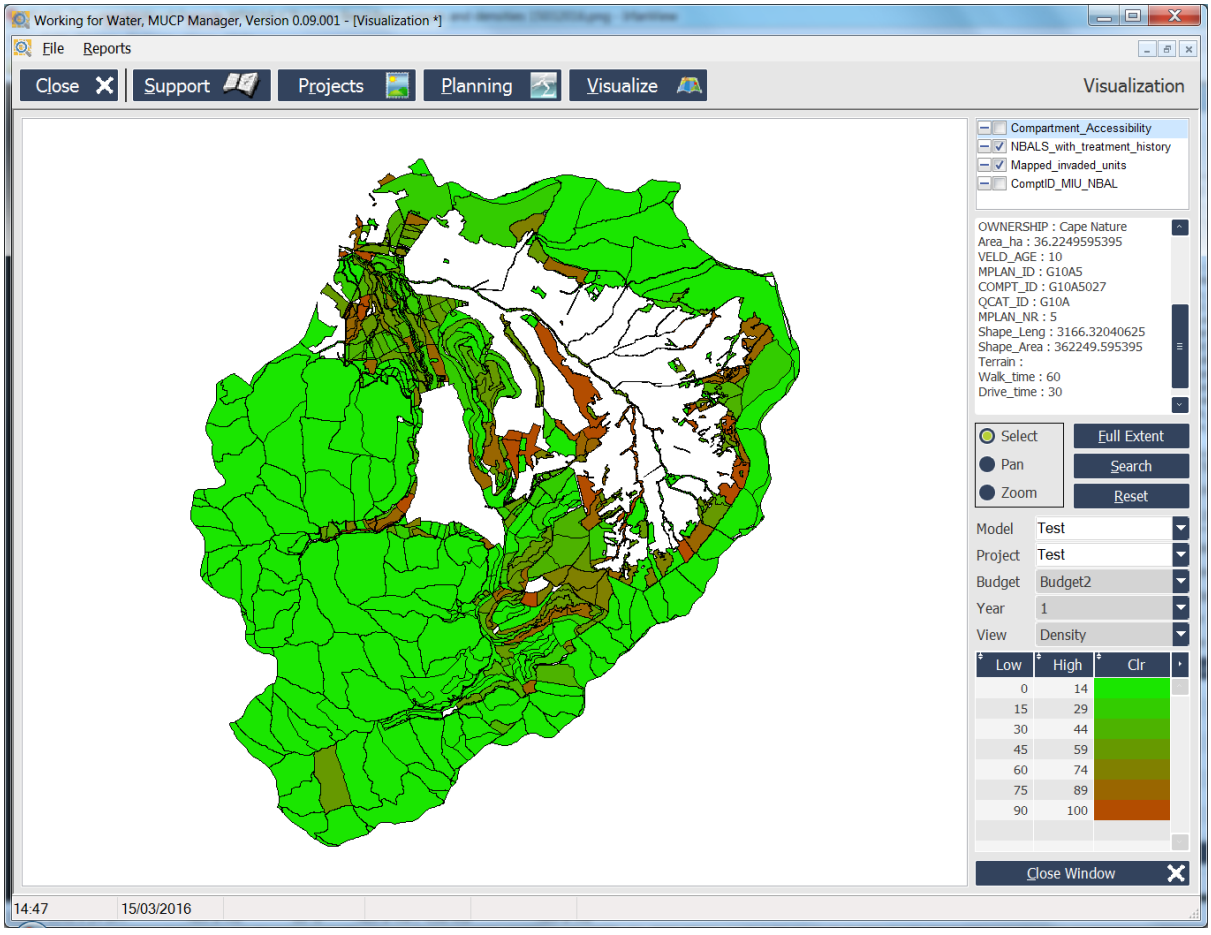


Figure 18: *Location of MIUs and Nbals in catchment G10A and IAP densities*

The tool applies different annual budgets over a period of the next 20 years based on the prioritisation of the compartments for clearing. In this case the annual budgets ranged from a ceiling of R 1.25 million to an unlimited amount (Figure 19).

The duration and total annual cost for each treatment unit, either an Nbal or a MIU, for each species and treatment is displayed in the top panel. The bar chart in the middle panel gives total cost per year with different colours for different annual budget ceilings. The line graph in the bottom panel shows how average species densities change in the catchment over time for each of these budgets. Once the levels of invasion have been reduced to < 1% of canopy cover, then the compartment is under maintenance. Although it appears as if the budgets drop to zero after a number of years, there is ongoing maintenance for the remaining years but the maintenance amounts are too small to be apparent at this scale.

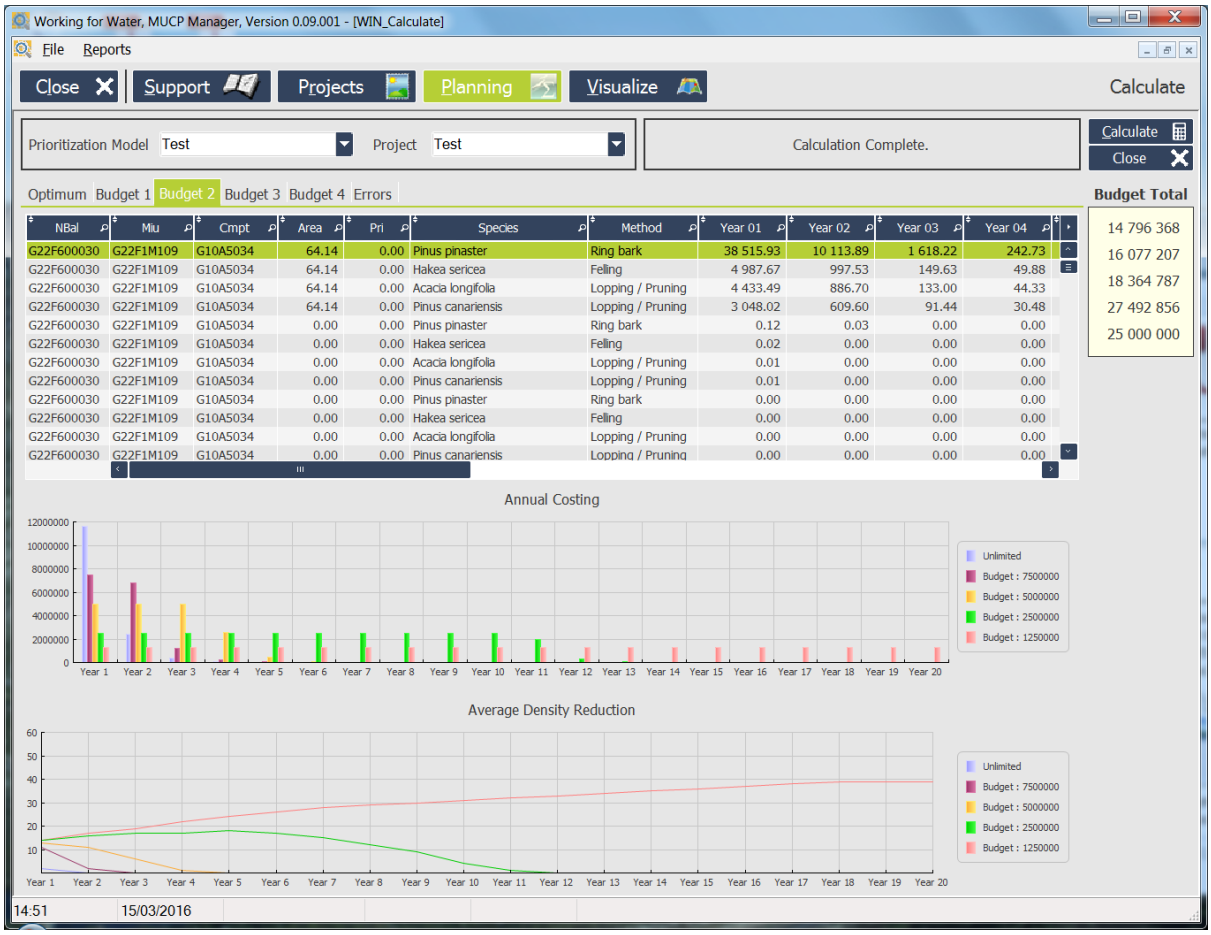


Figure 19: *Summary of the annual budget per compartment for the next 20 years based on the prioritisation of the compartments for clearing and different annual budget ceilings.*

In the case of a R 5.0 million budget the maintenance level is reached after 7 years. With budget of R 1.25 million you will only be able to contain the invasions after about 20 years, whereas a budget of R 2.5 million will achieve maintenance from year 13 onwards. The greatest total expenditure over

the next 20 years is R 27.5 million for the R 2.5 million budget ceiling whereas a budget ceiling of R 5.0 will result in an overall saving of R9.1 million. The R1.25 million per annum budget only allows for invasions to be contained at a mean density of about 40%, this is clearly not an effective option. Compartment schedules showing the annual costs per compartment for two different annual budgets, R 2.5 million and R 5.0 million, for the next 15 years, and sorted by priority, are given in Annexures 4 and 5.

The visualization of the location of the compartments identified for treatment in the first year (year one) of control if the annual budget is set at R 2.5 million shows the high levels of expenditure projected for certain compartments (Figure 20). Most of the compartments prioritised for expenditure in year one are in in areas having a high mean annual runoff.

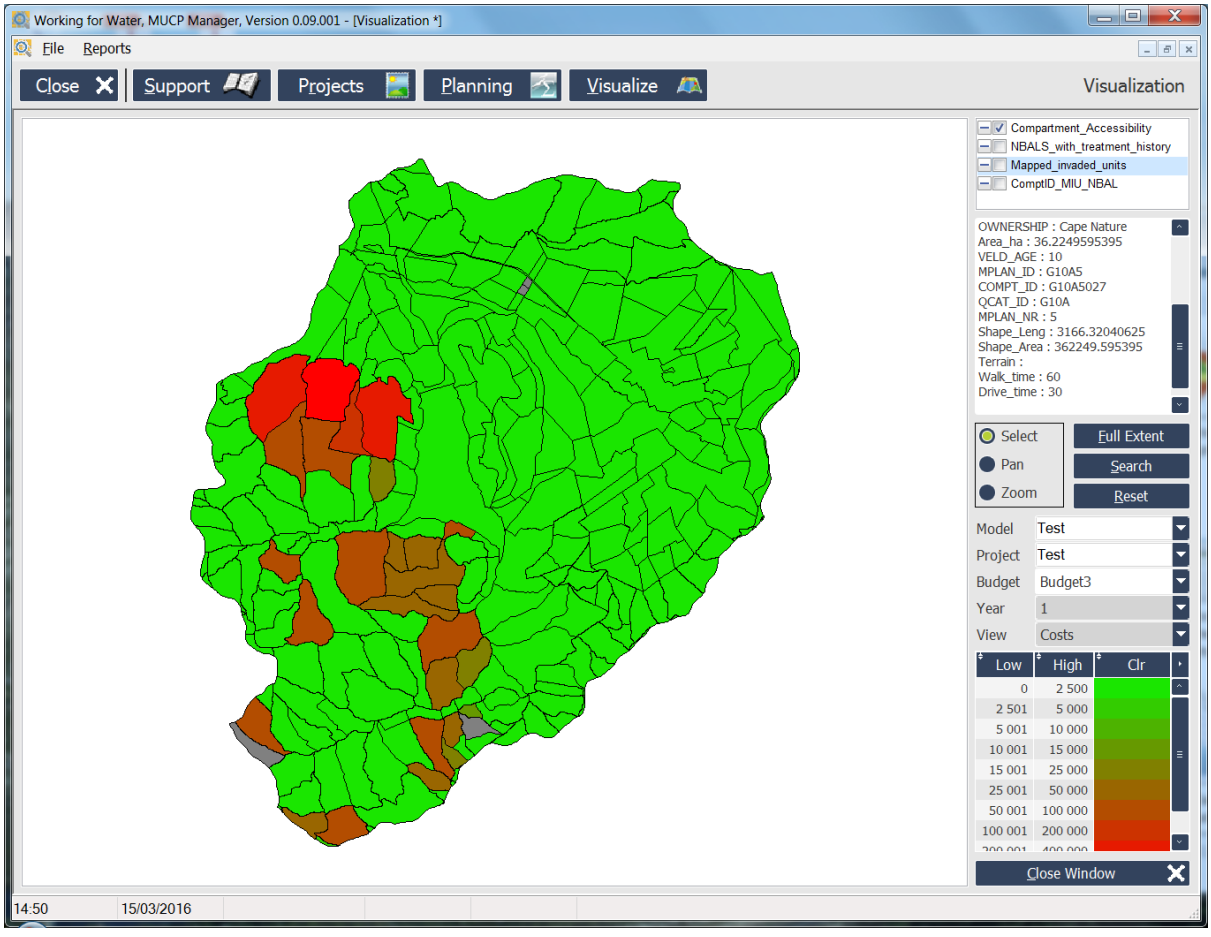


Figure 20: *Location of compartments that will receive treatments during the first year if the annual clearing budget is set to R 2.5 million (Budget 3). The shading from green to red indicates the increasing costs of the treatments.*

Similarly the visualisation of the location of the compartments identified for treatment first year (year one) of control if the annual budget is set at R 5.0 million (Figure 21). Many more

compartments can be treated compared to the smaller budget of R 2.5 million (Figure 20). Once again compartments in areas having a high mean annual runoff are in the majority.

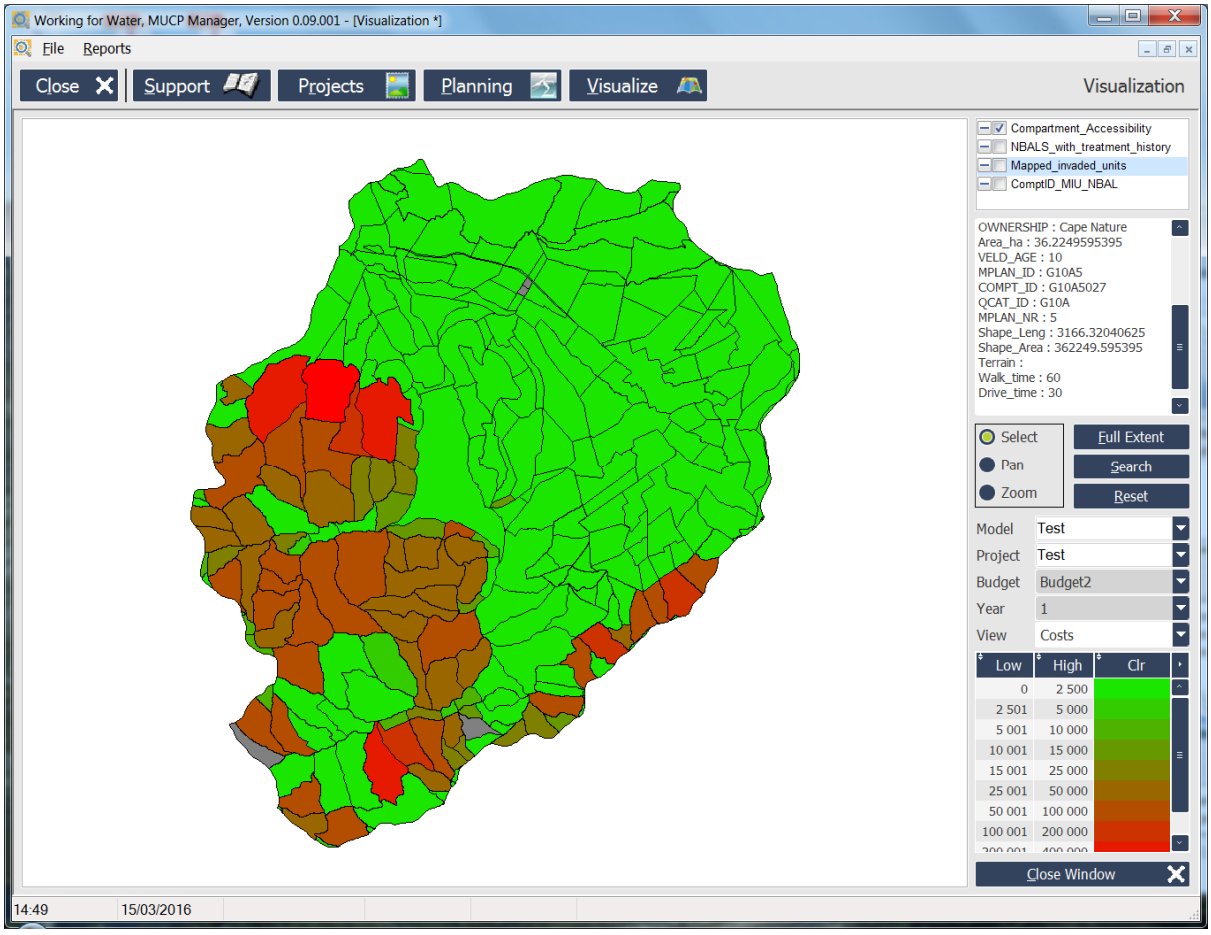
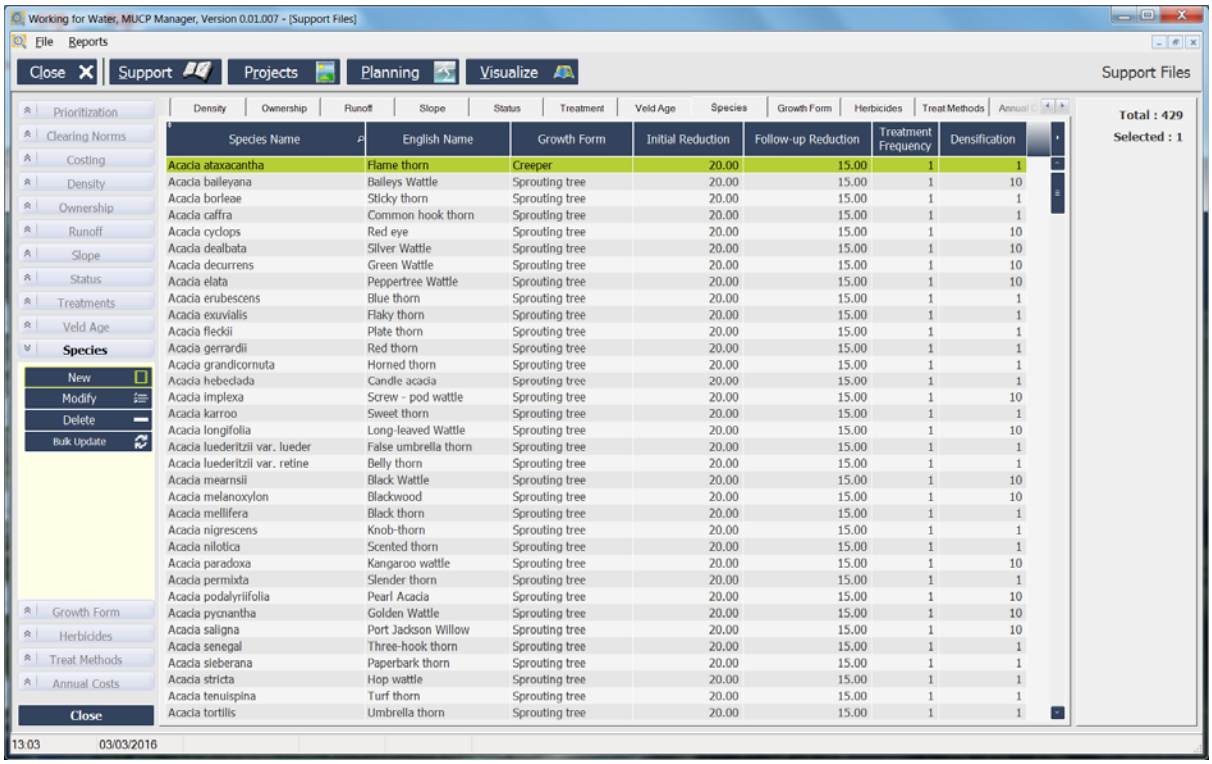


Figure 21: *Location of compartments that will receive treatments during the first year of clearing if the annual clearing budget is set to R 5.0 million (Budget 2). The shading from green to red indicates the increasing costs of the treatments per compartment.*

Another feature of the MUCP tool is that it is preloaded with WfW norms data and formulas for calculating person days, including team sizes, daily rates, and daily workloads for different species-linked treatments (e.g. herbicide on cut stumps, lopping) and densities and adjustments for slope and other factors. The MUCP tool also includes information on the typical reduction in densities after initial and follow-up treatments which can be adjusted by the user either for individual species of for selected groups of species (Figure 22). The user can also adjust the treatment frequency and how rapidly invasions by different species become denser if left untreated.



Species Name	English Name	Growth Form	Initial Reduction	Follow-up Reduction	Treatment Frequency	Densification
Acacia ataxacantha	Flame thorn	Creeper	20.00	15.00	1	1
Acacia baileyana	Baileys Wattle	Sprouting tree	20.00	15.00	1	10
Acacia borleae	Sticky thorn	Sprouting tree	20.00	15.00	1	1
Acacia caffra	Common hook thorn	Sprouting tree	20.00	15.00	1	1
Acacia cyclops	Red eye	Sprouting tree	20.00	15.00	1	10
Acacia dealbata	Silver Wattle	Sprouting tree	20.00	15.00	1	10
Acacia decurrens	Green Wattle	Sprouting tree	20.00	15.00	1	10
Acacia elata	Peppertree Wattle	Sprouting tree	20.00	15.00	1	10
Acacia erubescens	Blue thorn	Sprouting tree	20.00	15.00	1	1
Acacia exuvialis	Flaky thorn	Sprouting tree	20.00	15.00	1	1
Acacia fleckii	Plate thorn	Sprouting tree	20.00	15.00	1	1
Acacia gerrardii	Red thorn	Sprouting tree	20.00	15.00	1	1
Acacia grandicornuta	Horned thorn	Sprouting tree	20.00	15.00	1	1
Acacia hebeclada	Candle acacia	Sprouting tree	20.00	15.00	1	1
Acacia implexa	Screw - pod wattle	Sprouting tree	20.00	15.00	1	10
Acacia karroo	Sweet thorn	Sprouting tree	20.00	15.00	1	1
Acacia longifolia	Long-leaved Wattle	Sprouting tree	20.00	15.00	1	10
Acacia luederitzii var. lueder	False umbrella thorn	Sprouting tree	20.00	15.00	1	1
Acacia luederitzii var. retine	Belly thorn	Sprouting tree	20.00	15.00	1	1
Acacia mearnsii	Black Wattle	Sprouting tree	20.00	15.00	1	10
Acacia melanoxylon	Blackwood	Sprouting tree	20.00	15.00	1	10
Acacia mellifera	Black thorn	Sprouting tree	20.00	15.00	1	1
Acacia nigrescens	Knob-thorn	Sprouting tree	20.00	15.00	1	1
Acacia nilotica	Scented thorn	Sprouting tree	20.00	15.00	1	1
Acacia paradoxa	Kangaroo wattle	Sprouting tree	20.00	15.00	1	10
Acacia permixta	Slender thorn	Sprouting tree	20.00	15.00	1	1
Acacia podalyriifolia	Pearl Acacia	Sprouting tree	20.00	15.00	1	10
Acacia pycnantha	Golden Wattle	Sprouting tree	20.00	15.00	1	10
Acacia saligna	Port Jackson Willow	Sprouting tree	20.00	15.00	1	10
Acacia senegal	Three-hook thorn	Sprouting tree	20.00	15.00	1	1
Acacia sieberana	Paperbark thorn	Sprouting tree	20.00	15.00	1	1
Acacia stricta	Hop wattle	Sprouting tree	20.00	15.00	1	1
Acacia tenuispina	Turf thorn	Sprouting tree	20.00	15.00	1	1
Acacia tortilis	Umbrella thorn	Sprouting tree	20.00	15.00	1	1

Figure 22: *Species information contained in the MUCP tool as listed in WfW norms for calculating contract work loads.*

The historical data on the treatments and state of the Nbals in the MUCP is extracted from the data stored in WIMS, so it is important that data are captured correctly in the field and entered correctly into WIMS and conform to the standards (Le Maitre et al. 2016; NRM in preparation). The project managers now have smart phone based apps which they can use for mapping Nbals and recording the state of invasions which eliminates the potential for errors in recording the information on paper and entering the data into Working for Water Information Management System.

6 IMPLEMENTING THE PLAN

When the Working for Water programme was launched in 1995, the general perception was that the programme would be able to control invasive alien plants (IAPs) effectively and reduce invasions to maintenance level. It would do this by accepting responsibility for controlling all invasions on state land and do the initial clearing and two follow-ups on private land. Experience has shown that the programme was not able to achieve effective control and that the only hope for achieving such control was to actively involve everyone who owned or managed land in the clearing effort. This has brought about a shift in the programmes policies and operations of the Chief Directorate of Natural Resource Management programmes (NRM) and it is now changing its main funding model to support both government non-government IAP management initiatives through what are called Land-User Incentives. In parallel, they have promulgated regulations (DEA 2014) that will enable them to use the provisions of the NEM: Biodiversity Act (DEA 2004) to compel all land owners and organs of state to develop and implement invasive alien species management plans. They have also developed a National Strategy for Biological Invasions which sets out what needs to be done to being invasions by alien species under control (NRM 2014).

This means that NRM now have three key things in place to bring invasive alien species under control: (a) an approach that seeks to motivate land owners to take responsibility for clearing, (b) legislation to compel those that do not, and (c) a strategy which sets out what is needed to achieve control. What they are now seeking is for the land owners in the Upper Berg River catchment to jointly take on the responsibility of controlling the invasive species under control. They could take the lead role themselves, or through their implementing agent, but they really want all land owners to take ownership. This plan shows that IAPs in this catchment can be brought under control providing there is sufficient funding and the problem is tackled systematically and the treatments are executed efficiently and effectively and it provides a schedule of those treatments that will result in the greatest benefits (e.g. water flows released and biodiversity protected).

This means that the next key step is for the stakeholders, who include the multiplicity of land owners¸ to decide who will represent them and take the lead in ensuring that this plan will be implemented. The regional office of the Working for Water programme will remain involved, as will its implementing agents because there are extensive state lands in the catchment. They will also need the active participation of other land owners in the execution of that plan but they have a key incentive – those land owners need to have a management plan for their land but by actively participating in this plan they can meet their legal obligations without having to invest in their own plans. And so can all the organs of state involved in this plan.

Given this, we suggest that a Steering or Project Implementation Committee (PIC) comprising representatives of the main stakeholders, including the current implementing agents, should be appointed and assigned the responsibility of ensuring that this plan is implemented. The next step would be to ensure that the current plan schedule of operations generated by the MUCP tool is evaluated by the stakeholders and that all those involved agree that it will meet their needs and achieve the goal they set (section ##). The current implementing agents are receiving large budgets for clearing on state and private land but much of CapeNature's funding is being invested in the

other parts of the Jonkershoek Reserve at present. This means that more funding will be needed to secure the R5.0 million that the tool estimates will be required to reduce the IAPs in the catchment to maintenance levels within a reasonable timeframe of 10 years and save R9 million in the long-term. A key factor that will help them to secure the necessary funding from NRM will be the willingness of the parties involved to co-fund the clearing operations (e.g. private farmers using their own labour when they have spare capacity). They will also have to agree on how the NRM funds will be channelled and used and on how they will coordinate their operations. What will not work is if an unfunded mandate is given to any particular organisation. Another challenge will be maintaining stakeholder motivations over what is a long-time period and effective assessment of progress will be a key element in sustaining active participation.

No matter what the available budget, implementation of the clearing programme should always start in compartments with the highest priorities and proceed over time to those having lower priorities (Forsyth et al. 2012). In this way available budgets will be applied to achieve the maximum benefits. The PIC should begin by working through the top priority compartments listed in Appendix 4 or 5. These compartments need to be assessed and inspected to determine who are the land-owners, what has been done in the past, and to verify the current state of invasion. If this matches what the tool suggests, then the PIC need to agree jointly on who will execute the necessary treatments, the source of the funds and whose resources (e.g. labour, equipment) will be deployed. Should that compartment require more or less funding, then the planned budgets can be adjusted by the PIC and fed back into the tool. A key criterion under the goal is the high priority given to ensuring that uninvaded areas are kept clear of new invasions. This means that a portion of the overall budget needs to be set aside for surveys of these areas, with some contingency funding and resources to deal with such invasions appropriately.

This prioritisation will need to be re-examined should a wildfire or any substantial change such as a flood occur in the catchment. This will involve adjusting the underlying data to reflect the post-fire or flood environment, reconsidering the criteria in the prioritisation model and then running the MUCP tool to revise the list of priority catchments their associated clearing costs.

It is critical to report accurately on progress and for the PIC to ensure that the progress is evaluated against the goals and the schedule for the year to ensure that the planning is revised when the progress does not match the planned outcomes or meet expectations. This is the heart of the adaptive management approach which NRM is attempting to implement in all the work that it funds.

7 BACKGROUND INFORMATION (WHAT IS INVOLVED?)

7.1 Natural Resource Management: what it does and how it works

The national Department of Environmental Affairs (DEA) has a number of programmes aimed at achieving environmental goals and creating meaningful employment[2]. The Chief Directorate of Natural Resource falls under the Environmental Programmes (EP) branch is one of six branches within the DEA. Its aim is to: "*address the threats to the productive use of land and water, and the functioning of natural systems by invasive alien species, wild fires and land degradation, as well as the opportunities for value added industries (including fibre and furniture production), whilst ensuring meaningful livelihood opportunities are supported for those employed in doing this work"*. It has a number of programmes aimed at achieving this, including:

- Working for Water (WfW) was established in 1995 and focuses on controlling alien plant invasions either directly or through a range of implementing agents and a variety of incentives aimed at motivating the private sector to participate in invasive alien plant species management.
- Eco-furniture, Working for Biomass and Working for Energy all of which focus on using the material generating by the clearing of alien plant invasions to produce products.
- Working for Forests and Working for Ecosystems focus on rehabilitating degraded indigenous forests and rangelands, respectively, to functional ecosystems so ensure that they deliver ecosystem services including forage, fibre and other natural products. Working for Forests also includes the rehabilitation of neglected state plantations and woodlots to productive systems.
- Working for Wetlands which rehabilitates wetlands using engineered structures (e.g. gabions) and natural methods (e.g. planting wetland species) to ensure that they deliver ecosystem services.
- Working on Fire implements an integrated approach to veld and forest fire management to enhance the protection of life, livelihoods and assets and maintain ecologically sound fire regimes in fire-prone ecosystems. Working on Fire also does clearing of invading alien plants in rugged terrain using funding from the WfW budget.

The EP has established a Chief Directorate which focuses on Biosecurity whose aim is to: "protect the environment from high-risk invasive alien species through the pre-, at- and post- border management of non-indigenous species." This programme focuses on preventing and minimising invasions by high-risk alien species by educating the public about the risks, inspections of goods and baggage entering South Africa, surveys aimed at detecting new invasions, and directing teams to eradicate them wherever possible. They work closely with the Invasive Species Programme of SANBI (SANBI-ISP) to ensure that their efforts are well coordinated.

[2] See https://www.environment.gov.za/projectsprogrammes

The Working for Water programme is the lead agent for the control of invasive species but the other programmes undertake clearing where WfW does not need to be directly involved or where their special skills are needed (e.g. Working on Fire). They support control measures against invasive alien plants by providing funds and resources in a number of ways:

- Direct involvement in the management of the clearing teams where they provide all the resources, employ and train people, and oversee the operations;
- Indirect involvement through the funding of:
    - Control operations managed by implementing agents; in the case of the Upper Berg catchment these agents include:
    - The Cape Winelands District Council who have been clearing the Berg River Dam area and elsewhere in the catchment, focusing on the middle and lower slopes, valley bottoms and river floodplain.
    - CapeNature for the higher lying areas.
    - Working on Fire for the steep areas which require specialised safety precautions and skills, such as rope-work.
    - Land-user incentives (LUIs) where groups of land-owners apply for funding to carry out control operations on their land (not yet active in this catchment). These initiatives can also include way of using the material (biomass) from the clearing to produce products and rehabilitation of degraded land and river systems.
    - Other inputs such as providing herbicides and advice to land-owners.
    - Working with the nursery trade to minimise introduction of invasive species and to stop selling species known to be invaders
    - Support for the introduction and maintenance of biological control agents for invasive alien plants in the catchment, as well as research into agents for invasive aliens plants which do not yet have effective agents.

The WfW programme also works with the LandCare programme of the Department Agriculture, Fisheries and Forests who have been overseeing the clearing of the dense invasions of eucalypt and wattle trees on the banks of the Berg River downstream of the Upper Berg catchment.

The only way to achieve effective control of the alien plant species in this catchment and achieve the goal of reaching a state where only maintenance operations are needed is for every stakeholder to play their part. The failure to develop more effective working relationships, and thus to sustain clearing work already undertaken, is one of the key factors contributing to the overall failure to reduce the extent and impacts of invasions over the past 15 years (van Wilgen *et al*., 2012). This is one of the key reasons why WFW has invested resources in designing and testing various ways of supporting the involvement of other parties in invasive alien plant control as described above. Those responsible for implementing this plan need to ensure that all these options are used to achieve the goal of reaching maintenance levels by 2030.

7.2 Components of Effective Invasive Alien Plant Management

South Africa is one of many countries investing in the management of invasive species and there is a lot that can be learnt from their experiences and ours about what is required for effective management. The recently developed, but still not formally released, National Strategy on Dealing with Biological Invasions (NRM, 2014) builds on that experience. This strategy recognises the following things as requirements for its effective implementation:

- An integrated approach based on co-ordination and collaboration across all sectors and levels of government
- Establishment of an effective legislative and regulatory environment
- Management of invasions which entails prevention, eradication where possible and desirable, and optimising the reduction of adverse impacts by reducing the rate of spread and preventing increases in density (asset protection)
- Effective management of information on invasions and the actions being taken and making such information readily available
- Ensuring that there is adequate monitoring and evaluation so that the effectiveness of the implementation can be continuously improved
- Providing adequate resources to carry out all these measures, including capacity development
- Supporting research to provide to evidence needed to support decision making
- Raising awareness of the problem and the need to act

In particular, this plan must make provision for resources to address all the components of effective management of invading species (Hulme, 2006; McNeely *et al*., 2001; NRM, 2014): prevention, eradication and reducing impacts (i.e. asset protection).

Prevention**:** actions aimed at ensuring that no new invasive species are introduced to the catchment. Since most invaders are introduced to new areas by people, the primary way of doing this would be through educating the inhabitants about the risk involved in growing or planting alien species. Only a small proportion of all the alien species are invasive but prevention is better than cure. Much information is available on the internet (see sections 7.8 and 7.9). The SANBI-ISP has regional representatives who can be contracted should anyone identify a suspicious species and confirm whether or not it is a new invader (see sections 7.8 and 7.9).

Eradication**:** involves taking action to ensure that the population of a newly introduced or established species is completely removed or killed and does not re-establish itself. The SANBI-ISP representative, Working for Water manager or the local Plant Protection Research Institute office should be contacted for advice on what to do (see sections 7.8 and 7.9).

Containment**:** stopping further spread in part or all of the current range of an established invasive species and is another important component of a comprehensive control programme. In the context of this catchment this would involve ensuring that newly established individuals of existing invaders would be removed. The most practical way to do this is through regular surveys of uninvaded areas and removing any invaders that are found to ensure that these areas remain uninvaded.

***Impact reduction/asset protection*:** This involves following a systematic clearing programme in each invaded area: beginning with the initial treatment, then a sequence of follow-up treatments to ensure that all the invading species are reduced to the minimum; and finally ongoing maintenance to deal with any re-establishment. The sequencing of the areas for treatment should be based on the priority assigned to the compartment the invasion occurs in. It is important that these steps are followed but also that they are applied flexibly to ensure that opportunities to make more rapid progress, or avoid going backwards, are taken. One example of this is fires. Fires will facilitate the spread of most alien plant invaders and will result in increases in their densities. However fires can also offer opportunities by opening up dense invasions or replacing adult plants with seedlings which are much less resource intensive to control. If these opportunities are not grasped timeously, then gains made over many years can be lost.

Another essential component of this plan is to make effective use of biological control (biocontrol) which uses natural enemies of invading species to kill them or reduce their growth or seed production. Biocontrol is particularly important because there aren't enough resources to carry out control operations everywhere but biological agents can be introduced everywhere. They will reduce rates of spread and the invader density and impacts significantly in those areas where there are no control operations yet. The agents are carefully selected, bred, tested for specificity and effectiveness and, once they show promise, are then released to attack the species they were selected to target. This is a very cost-effective method of control for many invading species and limits both their ability to spread and to form dense, single-species stands. The WfW programme has regional biological control managers whose job it is to assess whether the agents are being effective, introduce new agents where necessary and maintain reserves for biocontrol agents among others. Contact details are given under Sources of information (see sections 7.8 and 7.9).

7.3 Capacity and Resources

A core component of WfW is human capacity development of staff and beneficiaries (contract workers) and more information can be found on their website: https://www.environment.gov.za/projectsprogrammes/wfw/resources

Working for Water has produced a staff induction manual outlining the operations and procedures within Working for Water. There are clear requirements for employees to undergo a minimum of 48 days of training according to a prescribed training plan. Training is available for both workers and contractors to improve skills and knowledge on biodiversity and environmental practices. For example, accredited training programmes developed by the Wildlife and Environment Society of South Africa (WESSA) provide a range of qualifications. A training matrix outlines the required courses on clearing in Terrestrial and Aquatic environments, Health and Safety, Social Development and Contractor Development. This training matrix provides information on the requirements, standards and appropriate training level (Appendix 3).

Table 8: *Websites and links related to WfW capacity development*

Training topic	Website address
Training matrix	http://workingforwater.org/features/course-information-and-materials
Staff induction manual	https://www.environment.gov.za/sites/default/files/legislations/staffinduction.pdf
WESSA training courses	http://www.wessa.org.za/uploads/documents/projects/Capacity_for_Catchment_%E2%80%93_uMngeni_Ecological_Infrastructure_on_organisations_and_courses.pdf

7.4 Communications and Advocacy

Communication should address:

- Maintaining a contact list and a website
- Regular meetings with stakeholders and their purpose
- Updates on legislation which can be found on the WfW website and www.invasives.co.za
- Further interventions in the catchment

Advocacy focuses on motivating land owners, other bodies and the general public to become actively involved

Communications on invasive alien plants and their management are communicated from different platforms. These are in the form of pamphlets, factsheets newsletters and information can be accessed from different websites. The planning of invasive alien control program can be viewed online and contains information of the annual plan of operations. Some of the useful ones are listed below.

***Table 9:** Websites and links related to communications and advocacy*

Topic	Content	Website address
WfW clearing strategies	It outlines the Working for Water approach, manifesto and research agenda and contains information on clearing strategies, recent research, herbicide registrations and APO plans.	www.wfw.org.za or https://sites.google.com/site/wfwplanning/
WfW training standards	Contains information for trainers and trainees including training and norms and standards needed for workers and contractors, and the levels of qualification that can be obtained.	www.workingforwater.org
WfW overview	Overall view of the working for water programme and how it aligns with governments bodies.	https://www.environment.gov.za/projectsprogrammes/wfw https://www.environment.gov.za/projectsprogrammes/wfw/resources
WfW	This focus is on the planning, operational support and quality assurance terrestrial, invasive alien plant control in South Africa	www.wfw.org.za or https://sites.google.com/site/wfwplanning/
SAPIA and PPRI	Regular newsletters (quarterly?)	http://www.arc.agric.za/arc-ppri/Pages/Newsletters.aspx
National information on invasive species		www.invasives.org.za /

7.5 Legal Background and Requirements

There are two laws, and their respective regulations, that deal with invasive alien species in South Africa. One is the Conservation of Agricultural Resources Act (CARA), 1983 (Act No 43 of 1983) and its regulations and the other is the National Environmental Management: Biodiversity Act (NEM:BA), 2004 (Act No. 10 of 2004) (DEA, 2004) and its regulations.

There are two key sites for this information:

https://www.environment.gov.za/projectsprogrammes/wfw

www.invasives.org.za

The CARA was originally intended for use in regulating agricultural weeds but was also used for plant invaders on land not used for agricultural purposes. However there were problems with the scope and implementation of CARA and the NEM:BA was drafted specifically to address environmental invasion problems and enable the Department of Environment Affairs to manage alien species invasions directly. This section deals with the relevant provisions of the NEM:BA and its current regulations (R. 598 of 1 August 2014) (DEA, 2014) (see Appendix 1 for relevant extracts from the Act and the regulations).

The NEM:BA contains many sections, two of which are important for programmes or plans for the management of invasive alien species (DEA, 2004): (1) Section 75 on the *Control and eradication of listed invasive species*, and; (2) Section 76 on the *Invasive species control plans of organs of state*. Section 75 paragraph (4) requires the relevant minister to *ensure the coordination and implementation of programmes for the prevention, control or eradication of invasive species*. Section 76 requires all organs of state, including protected area management authorities, to develop invasive species monitoring, control and eradication plans for land under their control. The act also stipulates that the Minister must provide guidelines for the development of these plans within one year of the regulations coming into effect the guidelines have been produced and are available here: https://www.environment.gov.za/legislation/actsregulations (see August 2014). These plans are largely aimed at managing extensive, established invasions and, thus, on control through suppression (mitigation) and Asset Protection. There clearly is a role for plans which focus on the key components of prevention, eradication and containment of invasive species, especially given that these components are far more cost-effective than control (NRM, 2014). These plans must be incorporated into the authorities overall plans (e.g. management plans for protected areas, integrated development plans, environmental plans). Section 76 does not specifically state whether these plans are intended for particular species or for particular areas but the wording, taken in conjunction with regulation 8 (of R. 598), makes it clear that it deals with plans for specified areas and for all listed species within those areas. The Act defines control as: *…in relation to an alien or invasive species, means - (a) to combat or eradicate an alien or invasive species; or (b) where such eradication is not possible, to prevent, as far as may be practicable, the recurrence, re-establishment, re-growth, multiplication, propagation, regeneration or spreading of an alien or invasive species*. This makes it clear that the word control is to be interpreted as including all aspects of invasive species management.

Section 75 of NEM:BA deals with the control and eradication of listed species and 75(4) requires the Minister to ensure the coordination and implementation of species management programmes for the prevention, control and eradication of invasive species. In the regulations, Regulations 2-4 deal with the categories of invasive species. Within each of the species categories sub-regulation (3) stipulates that if an "*Invasive Species Management Programme*" has been developed for a listed species in terms of section 75(4) of the NEM:BA, then that species must be controlled in accordance with the programme.

In addition to the CARA and NEM:BA laws and regulations, provincial ordinances can be declared which provide further regulations to control potential invasive alien species. Currently these are available for the Western Cape, Gauteng, Kwazulu-Natal and the Free State provinces.

Table 10: *Websites and links related to legal requirements*

Topic	Content	Website address
Links to the legislation and its implementation		https://www.environment.gov.za/legislation/actsregulations
		www.invasives.org.za
		Incorporate a link the guideline document for an IAS/IAP management plan as required by the Act
Raising awareness of legislation and its implications	WESSA is facilitating NEMBA (National Environmental Management: Biodiversity Act) compliance for all landowners. Workshops on invasive alien plant legislation and individual responsibility	http://www.wessa.org.za/uploads/documents/temporary-docs/WESSA_Facilitates_NEMBA_Compliance.pdf

7.6 Occupational Health and Safety

Employment needs to comply with the Occupational Health and Safety Act (1993). WfW are responsible for making sure that the Act is adhered to on projects that they fund. A number of Health and Safety courses are listed in WfW's training matrix (see Appendix 6).

7.7 Working for Water Policies

Working on private land:

A policy exists for work on private land[1]. On the whole, working on private land is being phased out in favour of land owners managing invasive alien plants themselves. This will be determined through land owner incentives or dis-incentives. There is a process to request assistance for clearing on private land.

Working on State land:

Working for Water has undertaken to reduce the density of established, terrestrial, invasive alien plants, through labour intensive, mechanical and chemical control, by 22% per annum. However, only certain areas are worked at a given time. The current process is to prioritise catchments and locations based on defined criteria. These are discussed in the annual plan of operations which are review each year.

***Aquatics*:**

Until recently aquatic weeds were managed by the Department of Water and Sanitation but that responsibility was recently transferred to the Working for Water Programme. The regional office of WfW should be contacted for help in dealing with these species.

***Biological control*:**

Biological control of invasive alien plants refers to the introduction of natural enemies to reduce the vigour or reproductive potential to levels that are comparable to that of natural vegetation. Working for water works in close contact with the Weeds Research division of the Agricultural Research Councils Plant protection research (ARC-PPRI). The Biological Control Implementation (BCI) programme conducts research on biocontrol agents for invasive alien plants. The current list of biocontrol agents is listed by Klein (2011) and information and links can be found here: http://www.invasives.org.za/resources/biocontrol.

7.8 Sources of additional information

Table 11 list websites that contain information on: invasive species, their biological control; other control methods and training.

Table 11: *Websites and links related to additional information*

Topic	Source	Website address
Invasive species	Arc home page for invasive alien species	http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/Weeds-Research.aspx
	Arc web page for links to other sites containing information on invasive alien plants.	http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/Other-sources-of-information-and-useful-links.aspx
	Information on individual invading plant species that has links via both common and scientific names)	http://www.invasives.org.za/plants/plants-a-z

Topic	Source	Website address
	South African Plant Invaders Atlas (SAPIA) South African National Biodiversity Institute (SANBI) Alien and Invasive Species List, 2014 – Department of Environment Affairs	The current SAPIA website is out of date but there are plans to update it and make it accessible via SANBI's website List SANBI website https://www.environment.gov.za/**sites**/.../nemba10of2004_**alien**and**invasi**.
Biological control	Fact sheets supplied by the ARC	http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/The-Working-for-Water-Programme-and-Biological-Control-Implementation-%28BCI%29.aspx https://www.environment.gov.za/projectsprogrammes/wfw/biocontrol#integration http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/Fact-Sheets-on-Invase-Alien-Plants-and-their-Biological-Control-Agents.aspx http://www.invasives.org.za/resources/biocontrol.
Control methods	Control tables outlining procedure for removing alien plants, including herbicide application Outline of clearing techniques Overview of clearing techniques	www.dwaf.gov.za/wfw/Control/docs/controltables.doc https://www.environment.gov.za/projectsprogrammes/wfw/alienplantcontrol_managementplan http://www.invasives.org.za/resources/control-methods/item/392-how-to-remove-invasive-plants.html https://www.dwa.gov.za/wfw/Control/
Academic training institutes	CIB (Post graduate) NMMU (Under post graduate diplomas and degrees**)** Other training	http://academic.sun.ac.za/cib/ See training matrix in appendix 6 http://www.unep.org/training/programmes/Instructor%20Version/Part_3/readings/WfW_case.pdf

7.9 Clearing support options private land owners

The Working for Water (WfW) programme no longer solely manages the clearing of invasive alien plants on private land. Instead a new policy was adopted whereby working for water would enter in contracts with private land owners and offer incentives to facilitate the clearing of invasive alien plants. This approach aims to get private land owners to both manage and be accountable for invasive alien plants on their own land.

The contract would outline roles, responsibilities and obligations of the land owner, clearing team and working for water. For this approach the clearing team is contracted to the land owner who is responsible for the clearing operation.

The working for water programme provides incentives which include training of clearing teams, support of labour costs (up to 100% for initial clearing, 75% for 1st follow-up, 50% for the 2nd follow up), branded clothing, planning and mapping support, biological control, herbicides and monitoring and evaluations. The private land owner will be responsible for the provision of the following to clearing teams: equipment, protective clothing, food, transport, or facilities for suitable working conditions (e.g. ablutions).

It is important to note that where Emerging species are present on private land then the Working for Water programme may provide the full labour, herbicide and other costs for species listed as "emerging species" in a particular area as part of its prioritization of early detection of and rapid response to emerging invasive alien plant species.

The Working for Water programme reserves the right to issue disincentives which may extend to charges for seed pollution, or a general charge for the control of invasive alien plants, as determined by WfW's parent Departments through its Executive Committee.

Resources:

Full private land policy	https://www.environment.gov.za/sites/default/files/legislations/approachtoworkon_privateland.pdf
WfW incentive application form:	https://www.environment.gov.za/sites/default/files/docs/forms/clearing_assistance_application.pdf

The following applications processes are available to private land owners

Herbicide assistance:

The Working for Water programme provides assistance for herbicides where necessary to control invasive alien plants. This will be provided for the initial and up to three follow-up clearing applications. This assistance does not require that an incentive contract (as mentioned above) be

entered into. Herbicide assistance can be applied for to contain invasive alien species prior to incentive contracts.

Herbicide application form:	https://www.environment.gov.za/sites/default/files/docs/forms/herbicide_assistance.pdf

Biocontrol assistance:

The Working for Water programme may provide biological control agents to the land-owner, who will be responsible to report back to WfW on the impact of these agents against key performance indicators.

Biocontrol application form:	https://www.environment.gov.za/sites/default/files/docs/forms/dermacationof_biologicalcontrol_reservesite_forteristerailplants.pdf
Biological control observation forms	https://www.environment.gov.za/projectsprogrammes/wfw/resources

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Appendix 1: *Spatial datasets*

Theme	Data file name	Sources / Scale & Date	Data descriptions, purpose and methods used as a basis of comparison	Type
Invasive alien plants	IAP density.shp	WIMS Nbal data	**Purpose:** Current type of IAP species, density of species, density classes.	Vector
	Treatment history.shp	WIMS Nbal data	**Purpose:** To indicate the number of treatments (for aliens) and cost of treatments in G10A.	Vector
	NbalHistory AsbosTCTA 101214	WIMS Nbal data	**Purpose**: To indicate treatment method and date of treatment for all NBALs.	Excel table
	NIAPs	ARC (National Invasive Alien Plant Survey)	**Purpose:** To show type and extent of invasions in G10A	Raster
Land ownership	Ownership.shp	Cape Nature and CSIR	**Purpose:** Indicate extent of all land ownership in G10A.	Vector
	Ownership by area.xlsx	Cape Nature and CSIR	**Purpose:** Excel table summarizing ownership by area.	Excel table
	Inv by owner.xlsx	CSIR	**Purpose:** To show type and extent of invasions by ownership in G10A. **Method:** Attribute table based on NBAL data. NBAL data was combined with ownership shapefile to show invasions by ownership. Condensed areas of invasions were derived from density field statistics.	Excel table
Natural veld	Veld age.shp	Cape Nature	**Purpose:** To indicate veld age in natural areas with reference to fire attributes. Include attributes on fire history. **Method:**	
	Naturalveld_g10a	SANBI (Mucina and Rutherford 2006)	**Purpose:** Base data - Vegetation types - Mucina and Rutherford 1: 250000	Vector
Landcover	LC_recls	ARC	**Purpose:** Reclassified national landcover, to indicate the extent of different land cover in the catchment.	Raster

Theme	Data file name	Sources / Scale & Date	Data descriptions, purpose and methods used as a basis of comparison	Type
			Method: New national LC 2014 was used as input. All natural veld was assigned according to vegetation map (SANBI). All agricultural areas were assigned to Dept. Agriculture (field boundaries). All other land uses remained as was indicated in the LC 2014.	
	LC_2014	DEA	**Purpose:** Base data - Land cover **Method:** Developed by DEA	Raster
Management compartments	Master table compartments	CSIR	Excel table of compartments and attribute fields	Excel
	Compartments.shp	CapeNature and CSIR	**Purpose:** Management units for input in management decision tool (Base data). **Method:** Contains variables: Slope, Veg Status, Ave MAR, Ownership, Area (ha), IAP density, Veld age, Number of treatments. Each variable was assigned to a compartment based on the unique compartment ID. IAP density shapefile merged with compartments. Table was exported to excel and pivot table created based on unique comp ID. The density class associated with the largest area within a compartment was assigned to the specific compartment. Veld age shapefile merged with compartments. Table was exported to excel and pivot table created based on unique comp ID. The veld age associated with the largest area within a compartment was assigned to the specific compartment. Treatment shapefile merged with compartments. Table was exported to excel and pivot table created based on unique comp ID. The maximum number of treatments within a compartment was assigned to the specific compartment.	Vector
Infrastructure	Berg_River_Dam.shp		**Purpose:** Base data	Vector
	Roads_g10a.shp		**Purpose:** Base data - all major roads	Vector
Topopgraphy	Contours_5m_g10a	CSIR	**Purpose:** To indicate topography	Vector
	dem_g10a	CSIR	**Purpose:** Base data - Elevation **Method:** From 5m contours	Raster

Theme	Data file name	Sources / Scale & Date	Data descriptions, purpose and methods used as a basis of comparison	Type
	Hilsh_g10a	CSIR	**Purpose:** Base data - Shaded relief **Method:** From DEM	Raster
Quaternary Catchment Boundary	G10A_boundary	CSIR	**Purpose:** Base data **Method:** derived from quaternary catchment	Vector
Mean annual runoff	marp2_f3_g10a	*Ask David LeM*	**Purpose:** Base data	Raster
Fire history	Veld age.shp	CapeNature Fire Database	**Purpose:** Base data	Spatial
Plantations	Plantations.shp	MTO Cape	**Purpose:** Base data	Vector
Rivers	Rivers.shp		**Purpose:** Base data	vector

Appendix 2: *Management compartment input data for MUCPs*

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
1	Cape Nature	>35	Transformed	750 - 1000	Cape Nature	125.45	0.01	10	2
2	Cape Nature	10 - 25	Least Threatened	>2000	Cape Nature	4.49	5.1-25	6	5
3	Cape Nature	10 - 25	Least Threatened	500 - 750	Cape Nature	11.18	5.1-25	16	3
4	Cape Nature	10 - 25	Endangered	250 - 500	Cape Nature	116.21	5.1-25	26	3
5	Cape Nature	>35	Least Threatened	250 - 500	Cape Nature	74.29	5.1-25	5	3
6	Cape Nature	10 - 25	Least Threatened	500 - 750	Cape Nature	0.62	5.1-25	16	3
7	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	10.91	5.1-25	8	3
8	Cape Nature	25 -35	Endangered	250 - 500	Cape Nature	83.22	5.1-25	5	3
9	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	16.18	5.1-25	5	3
10	Cape Nature	3 - 10	Least Threatened	185 - 250	Cape Nature	6.36	5.1-25	5	3
11	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	5.34	5.1-25	5	3
12	Cape Nature	3 - 10	Least Threatened	185 - 250	Cape Nature	0.69	5.1-25	5	3
13	Cape Nature	3 - 10	Least Threatened	185 - 250	Cape Nature	0.19	5.1-25	5	3
14	Cape Nature	25 -35	Endangered	750 - 1000	Cape Nature	43.22	25.1-50	5	2
15	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	0.93	5.1-25	5	2
16	Cape Nature	>35	Endangered	750 - 1000	Cape Nature	2.79	5.1-25	5	2
17	Cape Nature	>35	Endangered	750 - 1000	Cape Nature	21.43	5.1-25	5	2
18	Cape Nature	25 -35	Endangered	750 - 1000	Cape Nature	68.08	25.1-50	5	6
19	Cape Nature	>35	Least Threatened	750 - 1000	Cape Nature	0.62	5.1-25	5	2
20	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	2.88	5.1-25	5	4
21	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	20.82	5.1-25	5	4
22	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	29.18	5.1-25	5	3
23	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	4.28	5.1-25	5	2
24	Cape Nature	3 - 10	Least Threatened	1000 - 1500	Cape Nature	1.02	5.1-25	5	2

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
25	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	7.13	5.1-25	5	4
26	Cape Nature	>35	Least Threatened	1500 - 2000	Cape Nature	2.09	5.1-25	5	5
27	Cape Nature	>35	Least Threatened	750 - 1000	Cape Nature	36.23	5.1-25	10	3
28	Cape Nature	>35	Least Threatened	1000 - 1500	Cape Nature	34.41	5.1-25	10	1
29	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	25.15	5.1-25	10	1
30	Cape Nature	10 - 25	Least Threatened	750 - 1000	Cape Nature	11.86	25.1-50	5	3
31	Cape Nature	>35	Least Threatened	1000 - 1500	Cape Nature	15.25	5.1-25	10	1
32	Cape Nature	>35	Least Threatened	1000 - 1500	Cape Nature	24.95	5.1-25	10	2
33	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	47.24	5.1-25	5	3
34	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	41.79	25.1-50	10	5
35	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	47.67	25.1-50	6	4
36	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	220.20	5.1-25	10	11
37	Cape Nature	3 - 10	Least Threatened	1000 - 1500	Cape Nature	9.37	5.1-25	10	3
38	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	63.30	5.1-25	10	3
39	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	89.48	5.1-25	10	8
40	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	130.35	25.1-50	5	8
41	Cape Nature	>35	Least Threatened	1500 - 2000	Cape Nature	127.42	25.1-50	10	4
42	Cape Nature	>35	Least Threatened	1500 - 2000	Cape Nature	107.09	25.1-50	6	4
43	Cape Nature	25 -35	Least Threatened	1500 - 2000	Cape Nature	84.04	25.1-50	6	5
44	Cape Nature	>35	Least Threatened	1500 - 2000	Cape Nature	56.21	5.1-25	16	4
45	Cape Nature	>35	Least Threatened	1000 - 1500	Cape Nature	78.30	5.1-25	16	4
46	Cape Nature	25 -35	Least Threatened	1500 - 2000	Cape Nature	58.84	5.1-25	10	8
47	Cape Nature	25 -35	Least Threatened	1500 - 2000	Cape Nature	107.23	5.1-25	10	4
48	Cape Nature	>35	Least Threatened	750 - 1000	Cape Nature	53.99	5.1-25	5	6
49	Cape Nature	>35	Least Threatened	1000 - 1500	Cape Nature	14.74	5.1-25	5	1
50	Cape Nature	>35	Least Threatened	750 - 1000	Cape Nature	34.29	5.1-25	5	6
51	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	71.68	5.1-25	10	14

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
52	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	95.08	5.1-25	10	8
53	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	219.55	25.1-50	10	6
54	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	135.50	5.1-25	10	6
55	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	149.23	5.1-25	10	6
56	Cape Nature	25 -35	Least Threatened	1500 - 2000	Cape Nature	145.38	5.1-25	10	5
57	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	61.92	5.1-25	2	5
58	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	72.52	5.1-25	2	5
59	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	202.05	25.1-50	2	10
60	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	84.90	25.1-50	2	10
61	Cape Nature	>35	Least Threatened	750 - 1000	Cape Nature	57.72	25.1-50	16	10
62	Cape Nature	>35	Least Threatened	500 - 750	Cape Nature	47.97	25.1-50	6	12
63	Cape Nature	10 - 25	Endangered	500 - 750	Cape Nature	42.99	50.1-75	5	6
64	Cape Nature	>35	Endangered	750 - 1000	Cape Nature	22.94	5.1-25	5	6
65	Cape Nature	10 - 25	Least Threatened	500 - 750	Cape Nature	59.55	25.1-50	5	4
66	Cape Nature	25 -35	Least Threatened	500 - 750	Cape Nature	29.79	25.1-50	5	4
67	Cape Nature	10 - 25	Least Threatened	500 - 750	Cape Nature	48.41	25.1-50	9	4
68	Cape Nature	10 - 25	Least Threatened	750 - 1000	Cape Nature	65.94	5.1-25	10	5
69	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	57.52	25.1-50	5	1
70	Cape Nature	25 -35	Least Threatened	250 - 500	Cape Nature	43.52	25.1-50	5	2
71	Cape Nature	25 - 35	Least Threatened	750 - 1000	Cape Nature	82.41	25.1-50	5	2
72	Cape Nature	>35	Endangered	750 - 1000	Cape Nature	55.69	25.1-50	5	2
73	Cape Nature	25 -35	Least Threatened	500 - 750	Cape Nature	20.21	25.1-50	5	4
74	Cape Nature	25 -35	Least Threatened	500 - 750	Cape Nature	20.33	50.1-75	5	4
75	Cape Nature	10 - 25	Least Threatened	500 - 750	Cape Nature	39.77	50.1-75	5	6
76	Cape Nature	10 - 25	Endangered	500 - 750	Cape Nature	18.50	50.1-75	5	8
77	Cape Nature	10 - 25	Endangered	500 - 750	Cape Nature	28.22	50.1-75	5	7
78	Cape Nature	10 - 25	Endangered	500 - 750	Cape Nature	28.06	25.1-50	5	6

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
79	Cape Nature	>35	Least Threatened	500 - 750	Cape Nature	31.68	25.1-50	5	2
80	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	62.69	25.1-50	5	4
81	Cape Nature	>35	Least Threatened	1000 - 1500	Cape Nature	84.37	5.1-25	10	2
82	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	44.11	5.1-25	5	4
83	Cape Nature	25 -35	Least Threatened	1500 - 2000	Cape Nature	138.33	5.1-25	5	5
84	Cape Nature	25 -35	Least Threatened	>2000	Cape Nature	81.93	5.1-25	5	5
85	Cape Nature	10 - 25	Least Threatened	1500 - 2000	Cape Nature	71.64	5.1-25	6	4
86	Cape Nature	3 - 10	Least Threatened	>2000	Cape Nature	44.58	25.1-50	6	5
87	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	58.92	5.1-25	10	11
88	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	130.23	5.1-25	10	10
89	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	69.40	5.1-25	10	10
90	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	39.53	5.1-25	10	10
91	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	61.43	5.1-25	10	14
92	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	52.40	5.1-25	10	12
93	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	217.23	5.1-25	10	11
94	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	86.74	5.1-25	10	12
95	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	154.06	5.1-25	10	14
96	Cape Nature	10 - 25	Least Threatened	1500 - 2000	Cape Nature	64.63	5.1-25	10	8
97	Cape Nature	10 - 25	Least Threatened	1500 - 2000	Cape Nature	132.06	5.1-25	10	8
98	Cape Nature	25 -35	Least Threatened	1500 - 2000	Cape Nature	78.76	5.1-25	10	7
99	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	111.22	5.1-25	10	5
100	Cape Nature	10 - 25	Least Threatened	1500 - 2000	Cape Nature	158.98	5.1-25	10	5
101	Cape Nature	25 -35	Transformed	1500 - 2000	Cape Nature	152.03	5.1-25	10	8
102	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	123.44	5.1-25	10	5
103	Cape Nature	25 -35	Least Threatened	750 - 1000	Cape Nature	15.62	5.1-25	10	1
104	Cape Nature	>35	Least Threatened	1000 - 1500	Cape Nature	84.09	5.1-25	6	3
105	Cape Nature	10 - 25	Least Threatened	750 - 1000	Cape Nature	13.64	5.1-25	10	3

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
106	Cape Nature	>35	Least Threatened	1000 - 1500	Cape Nature	64.45	5.1-25	10	5
107	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	26.94	5.1-25	10	5
108	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	39.00	5.1-25	10	5
109	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	7.85	5.1-25	10	0
110	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	4.12	1.1-5	10	0
111	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	0.59	1.1-5	10	3
112	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	48.44	5.1-25	10	5
113	Cape Nature	10 - 25	Least Threatened	1500 - 2000	Cape Nature	7.34	5.1-25	10	0
114	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	80.96	5.1-25	10	3
115	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	83.14	5.1-25	10	5
116	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	45.96	5.1-25	10	5
117	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	6.31	5.1-25	10	0
118	Cape Nature	25 -35	Endangered	1000 - 1500	Cape Nature	39.38	5.1-25	10	2
119	Cape Nature	>35	Least Threatened	750 - 1000	Cape Nature	59.60	5.1-25	10	2
120	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	89.25	5.1-25	10	0
121	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	147.84	5.1-25	10	5
122	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	102.52	5.1-25	10	5
123	Cape Nature	10 - 25	Least Threatened	1000 - 1500	Cape Nature	75.15	5.1-25	10	5
124	Cape Nature	25 -35	Least Threatened	1500 - 2000	Cape Nature	112.80	5.1-25	10	5
125	Cape Nature	25 -35	Least Threatened	1000 - 1500	Cape Nature	180.38	50.1-75	10	10
126	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	300.65	5.1-25	10	6
127	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	141.11	5.1-25	2	2
128	Cape Nature	0 - 3	Critically Endangered	185 - 250	Cape Nature	72.06	25.1-50	11	10
129	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	7.68	1.1-5	2	2
130	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	49.29	5.1-25	2	2
131	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	130.19	5.1-25	10	10
132	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	15.73	5.1-25	13	2

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
133	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	20.27	5.1-25	13	6
134	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	117.61	5.1-25	2	2
135	Cape Nature	10 - 25	Least Threatened	250 - 500	Cape Nature	221.59	5.1-25	2	2
136	Cape Nature	25 -35	Least Threatened	250 - 500	Cape Nature	129.78	5.1-25	2	1
137	Cape Nature	25 -35	Least Threatened	250 - 500	Cape Nature	144.71	5.1-25	10	1
138	State Land	25 -35	Transformed	1000 - 1500	State Land	22.69	5.1-25	5	10
139	State Land	10 - 25	Transformed	750 - 1000	State Land	25.12	50.1-75	10	10
140	Farm	3 - 10	Transformed	250 - 500	Farm	87.02	0	0	0
141	Farm	3 - 10	Transformed	500 - 750	Farm	145.05	0	0	11
142	Farm	0 - 3	Transformed	185 - 250	Farm	78.38	0	0	6
143	State Land	25 -35	Transformed	1000 - 1500	State Land	17.85	25.1-50	10	11
144	State Land	10 - 25	Transformed	1000 - 1500	State Land	23.28	50.1-75	10	11
145	State Land	25 -35	Transformed	1000 - 1500	State Land	60.71	25.1-50	10	5
146	State Land	25 -35	Transformed	1000 - 1500	State Land	35.46	50.1-75	10	5
147	State Land	10 - 25	Transformed	500 - 750	State Land	74.60	0	10	10
148	State Land	10 - 25	Transformed	250 - 500	State Land	203.41	0	0	5
149	State Land	0 - 3	Transformed	250 - 500	State Land	60.36	75.1-100	3	9
150	State Land	0 - 3	Transformed	185 - 250	State Land	36.02	5.1-25	10	13
151	State Land	0 - 3	Transformed	185 - 250	State Land	15.64	5.1-25	0	11
152	State Land	10 - 25	Transformed	750 - 1000	State Land	172.20	5.1-25	5	14
153	State Land	10 - 25	Transformed	1000 - 1500	State Land	16.60	5.1-25	10	14
154	State Land	10 - 25	Transformed	1000 - 1500	State Land	10.97	0	10	8
155	State Land	25 -35	Transformed	1000 - 1500	State Land	22.94	5.1-25	10	8
156	State Land	10 - 25	Transformed	1000 - 1500	State Land	19.25	5.1-25	10	8
157	State Land	25 -35	Transformed	750 - 1000	State Land	135.12	5.1-25	5	14
158	State Land	3 - 10	Transformed	250 - 500	State Land	37.30	5.1-25	0	10
159	State Land	10 - 25	Transformed	250 - 500	State Land	126.94	5.1-25	10	11

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
160	State Land	0 - 3	Transformed	250 - 500	State Land	59.12	50.1-75	10	13
161	State Land	0 - 3	Transformed	250 - 500	State Land	74.13	50.1-75	10	15
162	State Land	0 - 3	Transformed	250 - 500	State Land	69.76	5.1-25	10	15
163	State Land	10 - 25	Transformed	250 - 500	State Land	61.45	0	0	8
164	State Land	3 - 10	Transformed	500 - 750	State Land	53.86	25.1-50	3	11
165	State Land	25 -35	Transformed	750 - 1000	State Land	124.86	1.1-5	5	14
166	State Land	10 - 25	Transformed	250 - 500	State Land	11.40	0	0	0
167	State Land	0 - 3	Transformed	185 - 250	State Land	4.29	0	0	0
168	State Land	0 - 3	Transformed	185 - 250	State Land	9.63	0	0	6
169	State Land	10 - 25	Transformed	250 - 500	State Land	40.48	0	0	8
170	State Land	25 -35	Transformed	250 - 500	State Land	132.36	25.1-50	10	10
171	State Land	3 - 10	Transformed	250 - 500	State Land	15.89	5.1-25	10	8
172	State Land	0 - 3	Transformed	185 - 250	State Land	94.01	5.1-25	10	11
173	State Land	0 - 3	Transformed	185 - 250	State Land	15.67	5.1-25	10	13
174	State Land	10 - 25	Transformed	500 - 750	State Land	49.53	5.1-25	10	11
175	State Land	0 - 3	Transformed	500 - 750	State Land	63.55	25.1-50	10	10
176	Urban	0 - 3	Transformed	185 - 250	Urban	206.26	0	0	1
177	Urban	3 - 10	Transformed	185 - 250	Urban	151.34	0	0	1
178	Urban	0 - 3	Transformed	250 - 500	Urban	48.89	0	0	10
179	Urban	0 - 3	Transformed	185 - 250	Urban	51.71	0	0	10
180	Urban	0 - 3	Transformed	750 - 1000	Urban	31.17	25.1-50	7	12
181	Urban	0 - 3	Transformed	185 - 250	Urban	4.92	0	0	0
182	Farm	3 - 10	Transformed	250 - 500	Farm	62.18	25.1-50	0	1
183	Farm	3 - 10	Transformed	250 - 500	Farm	94.10	0	0	0
184	Farm	0 - 3	Transformed	185 - 250	Farm	29.60	0	0	0
185	Farm	3 - 10	Transformed	250 - 500	Farm	193.79	0	0	3
186	Farm	10 - 25	Transformed	250 - 500	Farm	123.07	0.01	16	1

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
187	Farm	0 - 3	Transformed	185 - 250	Farm	15.04	0	0	0
188	Farm	10 - 25	Transformed	185 - 250	Farm	102.57	25.1-50	0	0
189	Farm	0 - 3	Transformed	185 - 250	Farm	79.48	0	0	0
190	Farm	0 - 3	Transformed	185 - 250	Farm	4.96	0	0	5
191	Farm	3 - 10	Transformed	185 - 250	Farm	122.73	0	0	6
192	Farm	0 - 3	Transformed	250 - 500	Farm	106.44	0	0	0
193	Farm	10 - 25	Transformed	250 - 500	Farm	45.07	25.1-50	5	1
194	Farm	0 - 3	Transformed	185 - 250	Farm	1.75	0	0	0
195	Farm	0 - 3	Transformed	185 - 250	Farm	36.12	0	0	0
196	Farm	3 - 10	Transformed	250 - 500	Farm	62.80	0	0	4
197	Farm	0 - 3	Transformed	250 - 500	Farm	59.33	0	0	0
198	Farm	0 - 3	Transformed	185 - 250	Farm	6.85	0	0	0
199	Farm	0 - 3	Transformed	185 - 250	Farm	81.97	0	0	0
200	Farm	0 - 3	Transformed	185 - 250	Farm	44.40	0	0	0
201	Farm	3 - 10	Transformed	185 - 250	Farm	42.01	0	0	4
202	Farm	3 - 10	Transformed	250 - 500	Farm	44.18	0	0	0
203	Farm	3 - 10	Transformed	500 - 750	Farm	176.40	0	0	6
204	Farm	3 - 10	Transformed	750 - 1000	Farm	40.42	0	10	9
205	Farm	25 -35	Transformed	250 - 500	Farm	22.48	0.01	16	0
206	Farm	0 - 3	Transformed	185 - 250	Farm	30.34	0	0	9
207	Farm	10 - 25	Transformed	500 - 750	Farm	27.44	75.1-100	5	2
208	Farm	3 - 10	Transformed	250 - 500	Farm	65.82	0	0	2
209	Farm	10 - 25	Transformed	500 - 750	Farm	33.68	50.1-75	5	1
210	Farm	10 - 25	Transformed	500 - 750	Farm	64.15	0	0	4
211	Farm	10 - 25	Transformed	500 - 750	Farm	26.32	50.1-75	5	1
212	Farm	10 - 25	Transformed	185 - 250	Farm	100.89	0.02-1	5	2
213	Farm	10 - 25	Transformed	250 - 500	Farm	108.28	0	0	1

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
214	Farm	0 - 3	Transformed	185 - 250	Farm	83.18	0	0	4
215	Farm	0 - 3	Transformed	250 - 500	Farm	86.26	0	0	0
216	Farm	3 - 10	Transformed	185 - 250	Farm	43.20	0	0	6
217	Farm	0 - 3	Transformed	250 - 500	Farm	78.46	1.1-5	3	13
218	Farm	3 - 10	Transformed	250 - 500	Farm	61.32	0	0	13
219	Farm	0 - 3	Transformed	185 - 250	Farm	61.91	0	0	0
220	Farm	0 - 3	Transformed	185 - 250	Farm	6.34	25.1-50	5	4
221	Farm	0 - 3	Transformed	250 - 500	Farm	0.65	0	0	12
222	Farm	0 - 3	Transformed	185 - 250	Farm	60.83	0	0	0
223	Farm	10 - 25	Transformed	250 - 500	Farm	32.15	0.01	2	1
224	Farm	25 -35	Transformed	250 - 500	Farm	84.84	0.01	10	2
225	Farm	3 - 10	Transformed	250 - 500	Farm	49.68	0	0	0
226	Farm	10 - 25	Transformed	500 - 750	Farm	76.22	5.1-25	0	1
227	Farm	0 - 3	Transformed	250 - 500	Farm	29.04	25.1-50	0	0
228	Farm	3 - 10	Transformed	185 - 250	Farm	42.43	0	0	0
229	Farm	3 - 10	Transformed	250 - 500	Farm	149.34	0	0	4
230	Farm	3 - 10	Transformed	185 - 250	Farm	18.15	0	0	0
231	Farm	10 - 25	Transformed	250 - 500	Farm	116.63	0	0	1
232	Farm	3 - 10	Transformed	250 - 500	Farm	49.75	0	0	0
233	Farm	25 -35	Transformed	500 - 750	Farm	47.92	0.01	16	0
234	Farm	10 - 25	Transformed	500 - 750	Farm	155.29	50.1-75	16	0
235	Farm	3 - 10	Transformed	250 - 500	Farm	39.01	0	0	0
236	Farm	3 - 10	Transformed	185 - 250	Farm	55.28	0	0	0
237	Farm	3 - 10	Transformed	185 - 250	Farm	38.75	0	0	0
238	Farm	10 - 25	Transformed	185 - 250	Farm	36.84	25.1-50	5	1
239	Farm	0 - 3	Transformed	185 - 250	Farm	66.10	0	0	0
240	Farm	0 - 3	Transformed	185 - 250	Farm	45.88	0	0	0

Compt No	Compt Type	Slope	Veg Status	Ave MAR	Ownership	Area (ha)	IAP density	Veld age	Nr treat
241	Farm	3 - 10	Transformed	500 - 750	Farm	22.10	0	0	1
242	Farm	10 - 25	Transformed	250 - 500	Farm	60.62	50.1-75	5	2
243	Farm	3 - 10	Transformed	250 - 500	Farm	129.69	0	0	0
244	Farm	3 - 10	Transformed	250 - 500	Farm	69.98	0	0	0
245	Farm	10 - 25	Transformed	250 - 500	Farm	99.98	5.1-25	0	11
246	Dam	0 - 3	Transformed	750 - 1000	Dam	532.11	N/A	N/A	N/A
247	State Land	10 - 25	Transformed	1000 - 1500	State Land	53.24	5.1-25	2	10
248	State Land	3 - 10	Transformed	250 - 500	State Land	45.47	0	10	11
249	State Land	10 - 25	Transformed	750 - 1000	State Land	77.09	75.1-100	10	11
250	State Land	10 - 25	Transformed	500 - 750	State Land	72.83	5.1-25	10	11
251	State Land	10 - 25	Transformed	750 - 1000	State Land	59.91	50.1-75	10	11
252	State Land	10 - 25	Transformed	500 - 750	State Land	163.93	1.1-5	7	15
254	State Land	0 - 3	Transformed	500 - 750	State Land	22.84	25.1-50	7	15
255	State Land	10 - 25	Transformed	750 - 1000	State Land	70.14	5.1-25	5	12
256	State Land	10 - 25	Transformed	500 - 750	State Land	181.17	5.1-25	6	14
257	State Land	10 - 25	Transformed	500 - 750	State Land	87.96	50.1-75	5	14
258	Dam Surroundings	3 - 10	Critically Endangered	250 - 500	Dam Surroundings	79.32	25.1-50	10	15
259	Dam Surroundings	3 - 10	Transformed	1000 - 1500	Dam Surroundings	55.77	50.1-75	10	10
260	Dam Surroundings	3 - 10	Endangered	750 - 1000	Dam Surroundings	10.79	50.1-75	10	8
261	Dam Surroundings	10 - 25	Transformed	750 - 1000	Dam Surroundings	25.56	5.1-25	10	14
262	Dam Surroundings	10 - 25	Least Threatened	750 - 1000	Dam Surroundings	16.96	5.1-25	10	14
263	Dam Surroundings	10 - 25	Endangered	1000 - 1500	Dam Surroundings	23.76	75.1-100	10	11
264	State Land	10 - 25	Transformed	1000 - 1500	State Land	41.35	5.1-25	10	9
265	State Land	10 - 25	Transformed	750 - 1000	State Land	35.44	50.1-75	2	10
266	Dam Surroundings	3 - 10	Critically Endangered	500 - 750	Dam Surroundings	22.69	5.1-25	10	13
267	Farm	10 - 25	Transformed	500 - 750	Farm	62.93	50.1-75	0	1

Appendix 3: *Participants in the expert workshop*

Participants in the workshop held at the CSIR in Stellenbosch on 4th December 2014 to determine criteria and rank these to use in prioritising the clearing of invasive alien plants from the Upper Berg River Catchment (Quaternary Catchment G10A)

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Appendix 4: *Summary of annual budget of R 2.5 million*

Summary of the annual budget (Rands) per compartment for the next 15 years based on the prioritisation of the compartments for clearing and a total annual budget ceiling of R2.5 million. Once the levels of invasion have been reached (<1% cover), then the compartment is under maintenance (e.g. year 6 onwards for the 1st compartment below).

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A5054	56.10	0.00	72456	42300	8391	1274	365	296	296	296	296	296	296	296	296	296	296
G10A5123	45.17	0.00	65786	10551	1343	269	186	186	186	186	186	186	186	186	186	186	186
G10A5034	16.04	0.00	50985	12608	1992	367	165	165	165	165	165	165	165	165	165	165	165
G10A3263	2.12	0.00	32748	4561	1113	156	29	12	12	12	12	12	12	12	12	12	12
G10A5099	8.36	0.00	3	95895	22326	3422	505	127	97	97	97	97	97	97	97	97	97
G10A5038	9.52	0.00	2	88594	20276	3039	525	170	170	170	170	170	170	170	170	170	170
G10A5109	8.97	0.00	0	51300	10386	1418	248	123	123	123	123	123	123	123	123	123	123
G10A5037	13.86	0.00	0	48256	10650	1501	272	170	170	170	170	170	170	170	170	170	170
G10A5112	24.22	0.00	0	54797	13163	1900	288	99	99	99	99	99	99	99	99	99	99
G10A5031	15.25	0.00	0	17784	3569	456	84	46	46	46	46	46	46	46	46	46	46
G10A5081	9.73	0.14	84571	14738	1860	355	214	214	214	214	214	214	214	214	214	214	214
G10A5088	17.30	0.14	66647	10956	1460	297	229	229	229	229	229	229	229	229	229	229	229
G10A5084	24.11	0.18	115206	25349	3464	475889	109039	22684	3307	609	408	408	408	408	408	408	408
G10A5035	26.35	0.20	60668	90860	20057	2965	564	256	223	223	223	223	223	223	223	223	223
G10A5094	1.06	0.33	2273	5018	1154	185	25	10	8	8	8	8	8	8	8	8	8
G10A5124	20.82	0.36	1	106917	92995	17118	2721	756	607	601	601	601	601	601	601	601	601
G10A5068	18.92	0.38	61718	113046	81776	17748	2648	640	459	459	459	459	459	459	459	459	459
G10A5092	8.40	0.40	42106	7522	1154	736	146	109	97	95	95	95	95	95	95	95	95
G10A5089	34.70	0.50	41678	7115	955	187	148	148	148	148	148	148	148	148	148	148	148
G10A5057	30.96	0.50	19378	4446	602	105	52	52	52	52	52	52	52	52	52	52	52
G10A5085	19.46	0.50	1	56070	136029	33691	5411	718	246	201	201	201	201	201	201	201	201

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A5113	3.41	0.50	0	4939	6649	1245	167	33	19	19	19	19	19	19	19	19	19
G10A3052	16.91	0.56	106960	31178	5530	4620	1450	611	506	493	493	493	493	493	493	493	493
G10A3145	25.69	0.57	84742	14144	124005	20208	4626	920	441	379	379	379	379	379	379	379	379
G10A3087	14.28	0.65	45483	44400	21416	4089	865	358	300	296	296	296	296	296	296	296	296
G10A5027	4.91	0.67	12309	2030	264	59	42	42	42	42	42	42	42	42	42	42	42
G10A3143	21.84	0.67	2188	117644	26019	41449	4839	1696	668	502	478	478	478	478	478	478	478
G10A5125	27.20	0.68	512700	118214	17583	3065	15412	2223	1022	5857	1055	740	620	601	598	598	598
G10A3262	2.63	0.70	2890	7416	31140	5214	1049	173	31	10	9	9	9	9	9	9	9
G10A5095	16.12	0.71	1420	77963	16518	2229	457	245	233	232	231	231	231	231	231	231	231
G10A5103	14.79	0.72	0	92970	18792	2515	430	209	209	209	209	209	209	209	209	209	209
G10A5022	7.04	0.74	0	21007	63581	39178	7403	1287	374	298	291	291	291	291	291	291	291
G10A3091	6.37	0.75	423	36179	31294	4691	1470	22387	2099	650	182	113	102	102	102	102	102
G10A3155	22.33	0.84	55033	17437	3135	116976	26223	3693	779	466	466	466	466	466	466	466	466
G10A5082	10.53	0.89	2	116947	22953	2853	551	301	301	301	301	301	301	301	301	301	301
G10A5014	10.61	0.92	0	131	125671	30811	4688	642	110	85	43032	5481	1459	314	122	90	90
G10A5053	27.11	0.93	655365	189446	129623	26295	3626	1075	823	808	807	805	805	805	805	805	805
G10A3259	2.03	0.98	17749	21964	33843	7601	1289	187	42	32	32	32	32	32	32	32	32
G10A5080	9.46	1.00	0	18790	26353	5375	766	172	119	119	119	119	119	119	119	119	119
G10A5101	19.61	1.00	0	0	43597	8609	1066	180	74	74	74	74	74	74	74	74	74
G10A3156	2.02	1.00	0	21153	3526	432	74	43	43	43	43	43	43	43	43	43	43
G10A5083	22.82	1.00	0	303180	79591	14817	93225	22117	3481	817	429	429	429	429	429	429	429
G10A5017	18.31	1.00	0	24079	132669	31164	4978	695	163	125	125	125	125	125	125	125	125
G10A5072	1.39	1.00	0	1867	296	46	9	9	9	9	9	9	9	9	9	9	9
G10A5048	17.14	1.00	0	5	31509	7161	993	174	98	98	98	98	98	98	98	98	98
G10A5042	25.52	1.00	0	0	200327	187237	40667	5892	990	257	257	257	257	257	257	257	257
G10A3144	2.85	1.00	0	0	28613	57708	7464	1700	254	47	22	22	22	22	22	22	22
G10A3146	3.13	1.00	0	0	25915	4995	924	118	22	11	11	11	11	11	11	11	11
G10A3264	2.12	1.00	0	0	11536	3346	525	74	14	11	11	11	11	11	11	11	11
G10A5025	7.12	1.00	0	0	0	2721	496	77	22	22	22	22	22	22	22	22	22
G10A3247	10.10	1.11	0	42400	13252	10001	2847	535	187	137	135	135	135	135	135	135	135

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A5069	20.79	1.17	0	3	168872	38175	125571	22749	4711	789	296	248	248	248	248	248	248
G10A3138	7.16	1.17	0	5197	49599	85974	10319	41163	5091	1331	323	181	165	165	165	165	165
G10A5079	6.54	1.32	1501	111815	28978	4660	692	160	134	134	134	134	134	134	134	134	134
G10A5059	1.04	1.33	0	0	0	6143	569	162	6773	574	185	34	10	6	6	6	6
G10A5056	20.39	1.36	0	0	91368	24581	4024	644	199	190	190	190	190	190	190	190	190
G10A5064	6.63	1.45	0	1	165157	40712	6203	829	195	160	160	160	160	160	160	160	160
G10A5102	61.72	1.50	0	61738	15109	2050	366	193	193	193	193	193	193	193	193	193	193
G10A5071	2.08	1.54	606	98	2873	295	91	17	5	3	209762	23084	6305	1039	165	25	25
G10A5058	1.99	1.58	0	0	10600	8049	1945	264	48	26	26	26	26	26	26	26	26
G10A3261	2.13	1.67	0	11144	4855	27321	3363	16627	2658	508	93	37	33	33	33	33	33
G10A2246	0.99	1.67	0	0	1949	414	2118	260	63	9	2	1	1	1	1	1	1
G10A4260	0.29	1.91	2	375	276	68	10	2	1	1	1	4	1	1	1	1	1
G10A6203	14.85	1.92	0	37028	8965	1203	11462	1256	390	263902	34404	7908	1382	359	246	245	245
G10A5063	14.33	2.00	0	1	0	0	171666	19556	4558	731	135	56	56	56	56	56	56
G10A5078	9.35	2.00	0	0	0	0	60755	12076	2411	342	55	34	34	34	34	34	34
G10A5061	14.99	2.00	0	0	111332	35762	99589	18361	3903	717	269	239	239	239	239	239	239
G10A5066	6.13	2.00	0	0	3	20987	56410	10428	2184	298	56	32	32	32	32	32	32
G10A5100	79.49	2.00	0	0	0	82799	17027	2310	413	218	218	218	218	218	218	218	218
G10A5005	74.29	2.00	0	0	0	39321	8882	1249	258	181	181	181	181	181	181	181	181
G10A5009	16.18	2.00	0	0	0	13211	2626	364	64	41	41	41	41	41	41	41	41
G10A5007	3.64	2.00	0	0	0	8631	1921	253	44	23	23	23	23	23	23	23	23
G10A5003	3.73	2.00	0	0	0	6279	1047	135	29	21	21	21	21	21	21	21	21
G10A5011	5.34	2.00	0	0	0	3424	719	105	19	13	13	13	13	13	13	13	13
G10A5006	0.62	2.00	0	0	0	293	48	7	1	1	1	1	1	1	1	1	1
G10A5047	35.74	2.00	0	0	0	0	0	61930	16512	2627	435	134	134	134	134	134	134
G10A5074	20.33	2.00	0	0	0	0	88392	9719	2348	374	62	19	19	19	19	19	19
G10A5127	79.96	2.00	0	0	0	0	0	99481	24265	3684	733	310	310	310	310	310	310
G10A5129	1.45	2.00	0	0	0	0	0	3212	793	108	17	6	6	6	6	6	6
G10A5134	49.25	2.00	0	0	0	0	1	175551	48744	7327	1227	358	358	358	358	358	358
G10A4265	10.10	2.03	266843	60428	8926	2955	421	28289	3580	1120	400	6226	2551	618	325	279	279

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A3165	2.48	2.03	0	0	5316	54387	79484	85830	13351	5539	2624	665	151	72	62	62	62
G10A4258	1.58	2.07	0	0	0	12572	8665	1208	249	474	168	34	12	8	8	8	8
G10A3152	8.33	2.10	0	0	0	32584	103604	57908	11789	2709	381	167	84	57	53	52	52
G10A3255	1.81	2.10	49	3407	545	42594	7010	24238	61248	15396	2519	868	166	58	44	42	42
G10A5001	28.25	2.13	0	0	0	124079	24034	18620	3834	993	506	372	340	336	336	336	336
G10A3096	20.79	2.17	0	368	63	48543	13004	2062	945	344	165	138	134	134	134	134	134
G10A7180	0.45	2.17	0	3	0	7	8138	4140	718	134	21	133	15	6	3	3	3
G10A3157	6.42	2.19	17506	2982	497	41305	311927	261246	122553	169768	35658	7772	9480	2942	694	360	318
G10A5077	8.00	2.21	0	0	0	81	115095	13719	51895	31201	3965	961	179	61	47	47	47
G10A5062	16.79	2.25	0	0	0	0	1406	154376	22138	4555	47049	11299	1969	311	115	100	100
G10A4266	2.41	2.31	0	0	0	57695	20994	32125	27859	9682	1817	9318	1048	335	111	75	71
G10A5065	8.22	2.38	0	0	0	388	181308	33186	7653	1070	218	126	126	126	126	126	126
G10A5076	4.75	2.42	0	0	0	429	66644	6944	4055	564	139	36	26	25	25	25	25
G10A3249	5.86	2.42	0	10915	1826	145899	18480	4886	54118	9970	3186	1097	12327	3993	665	143	75
G10A5008	41.61	2.50	0	0	0	93099	15881	1863	395	240	240	240	240	240	240	240	240
G10A4139	1.13	2.50	0	0	0	3404	1373	25378	5284	4685	894	199	35	12	9	9	9
G10A5073	10.11	2.50	0	0	0	0	54540	10939	2166	312	47	30	30	30	30	30	30
G10A3252	6.47	2.54	0	0	0	2753	16303	24370	44231	23371	90099	15878	2971	505	152	107	105
G10A6185	3.58	2.60	0	103	28	7	4	29420	4216	231176	44076	13171	35412	4144	1257	346	209
G10A6196	2.66	2.64	0	0	0	0	0	2239	51882	5373	2509	343	70	18	14	13	13
G10A5070	9.60	2.67	0	0	108291	26677	4196	3797	590	405	372839	31607	10442	1703	366	158	156
G10A6267	3.03	2.72	0	0	135	18	6	12	41789	12864	180478	27330	6079	1090	188	41	38
G10A4164	3.28	2.75	0	0	0	0	2125	195	1690	241	56	34665	2878	925	148	23	4
G10A5067	6.02	2.75	0	0	0	0	65	7	2	61968	89936	8686	2517	400	61	16	16
G10A4126	24.42	2.78	0	0	0	105493	225933	67292	13489	3484	22970	19839	4897	1275	629	567	563
G10A4251	6.20	2.80	0	0	0	0	132110	29704	119143	10394	3226	18467	4807	920	211	76	60
G10A6186	1.59	2.80	0	0	0	0	0	1212	352	59	63353	7978	1800	256	45	20	20
G10A3250	2.72	2.82	0	0	0	22452	4957	1460	202	18050	3880	8046	2597	422	84	32	32
G10A4175	1.91	2.84	1	227	28	1077	2081	43224	395848	102071	58780	56341	7371	1631	335	136	110
G10A6191	0.36	2.84	0	0	0	0	0	79	91	18	4	2	67	23	5	3	2

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A6141	5.21	2.85	0	0	4495	635	156	11313	1516	21151	45460	403029	53678	12039	1935	331	108
G10A6233	23.32	2.85	0	0	0	0	63	210	9767	13780	3204	888	466	390	380	379	379
G10A5010	1.04	2.86	0	0	0	0	0	240	4233	961	149	29	16	16	16	16	16
G10A4161	1.68	2.90	0	0	0	20524	11983	1966	182192	31914	12026	11169	1690	421	87	41	36
G10A4254	0.89	2.95	0	0	0	0	0	35875	4022	1137	12836	2491	463	95	20	8	8
G10A5135	36.27	2.95	0	0	0	0	0	63738	15372	2306	110993	27465	4632	924	356	356	356
G10A6234	2.25	2.97	0	0	0	0	0	0	291049	53126	9677	1984	298	53	39	38	38
G10A6182	1.52	3.00	0	0	0	0	0	0	0	72550	7540	28049	5030	1025	164	36	16
G10A3257	5.17	3.00	0	0	0	0	0	0	0	26354	2420	50849	4299	1356	218	36	9
G10A4131	0.62	3.00	0	0	0	0	0	0	312	180	34	5	1	1	1	1	1
G10A4149	1.29	3.00	0	0	0	0	0	0	11824	34832	39187	3933	1106	176	29	10	10
G10A4158	1.81	3.00	0	0	0	0	0	25115	69480	55381	26244	3295	780	126	29	19	19
G10A4159	8.51	3.00	0	0	0	0	201	17	5	32926	82353	26618	3828	692	142	75	68
G10A4160	3.22	3.00	0	0	0	0	0	2773	230	239284	96121	12869	3058	476	74	34	34
G10A4169	2.41	3.00	0	0	0	0	0	0	0	13595	1383	415	62	10	2	2	2
G10A4170	5.35	3.00	0	0	0	0	0	92481	7675	2463	1845	3671	340	104	25	13	11
G10A6140	1.66	3.00	0	0	0	0	0	0	0	0	0	26663	3080	716	114	19	5
G10A6148	6.51	3.00	0	0	0	0	0	0	0	279079	127644	122339	19304	4089	699	200	125
G10A6163	4.60	3.00	0	0	0	0	0	0	0	52510	5336	1597	240	40	8	8	8
G10A6183	5.17	3.00	0	0	0	0	0	0	0	12712	57197	8733	1626	243	71	51	51
G10A6192	1.79	3.00	0	0	0	0	0	1	147180	37384	16532	7893	1146	299	146	125	122
G10A6197	4.99	3.00	0	0	0	0	0	0	4997	1295	334	78	45	42	42	42	42
G10A6202	0.11	3.00	0	0	0	0	0	0	373	42	10	2	0	0	0	0	0
G10A6207	1.18	3.00	0	0	0	0	0	0	0	400	57768	4801	1541	248	39	8	8
G10A6208	0.20	3.00	0	0	0	0	0	0	0	279	61	9	2	1	1	1	1
G10A6210	3.02	3.00	0	0	0	0	0	3	23155	49640	25876	3383	792	153	55	44	44
G10A6213	1.79	3.00	0	0	0	0	0	0	0	0	5966	879	169	23	3	1	1
G10A6216	3.06	3.00	0	0	0	0	0	20133	2044	537	86	13	2	2	2	2	2
G10A6217	3.68	3.00	0	0	0	0	0	0	399	81	19	95313	13237	2842	452	92	46
G10A6218	5.81	3.00	0	0	0	0	0	0	32223	60729	20013	152860	16885	4083	675	132	53

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A6223	0.13	3.00	0	0	0	0	0	55	14	2	1	0	0	0	0	0	0
G10A6226	0.06	3.00	0	0	0	0	0	0	10	2	0	0	0	0	0	0	0
G10A6229	2.70	3.00	0	0	0	0	0	0	68480	49967	7276	1448	243	61	41	41	41
G10A6232	2.22	3.00	0	0	0	0	0	169	147150	19107	14256	38239	4919	1109	226	98	79
G10A6235	0.85	3.00	0	0	0	0	0	0	95	21	7087	1045	203	29	7	4	4
G10A6241	1.33	3.00	0	0	0	0	0	0	52237	7879	3512	620	126	41	32	30	30
G10A6242	2.58	3.00	0	0	0	0	0	0	0	0	1492	130	47	13	8	7	7
G10A6243	1.75	3.00	0	0	0	0	0	0	0	1	6	6	6	6	6	6	6
G10A6244	0.94	3.00	0	0	0	0	0	0	0	0	2	3602	414	98	18	5	3
G10A6245	5.80	3.00	0	0	0	0	0	182660	25322	5300	790	527	146	67	53	51	51
G10A7178	0.71	3.10	0	0	0	0	0	2625	3117	378	94	15906	1460	435	72	12	3
G10A4248	4.79	3.12	0	0	0	0	0	3135	1118	44716	70109	15031	6823	811	214	90	74
G10A6193	4.92	3.15	0	0	0	0	0	19967	2274	550	92	127	53873	7982	2044	317	65
G10A4147	5.25	3.20	0	0	0	0	0	0	0	0	26	94090	8769	2821	450	67	11
G10A4128	3.07	3.27	0	0	0	37	5	15	41197	66974	8143	163973	61106	9963	1964	301	90
G10A6215	1.25	3.27	0	0	0	0	0	0	22134	56812	39646	38003	4961	1058	180	50	32
G10A7177	6.01	3.28	0	0	0	0	0	3521	475	155	122177	19954	4232	826	242	157	154
G10A4174	1.72	3.29	0	0	0	0	39454	4507	1748	261	39327	7104	13593	4044	639	103	38
G10A4162	1.31	3.31	0	0	0	0	0	0	522	3465	1863	24693	3506	797	144	23	5
G10A3256	6.85	3.32	0	0	0	0	0	19514	10596	10532	12530	3327	35774	11102	1749	287	101
G10A6214	0.57	3.43	0	0	0	0	0	0	0	0	0	204	4298	416	119	25	9
G10A6221	4.26	3.50	0	0	0	0	0	0	0	0	0	128971	16004	3580	566	92	26
G10A6238	0.65	3.50	0	0	0	0	0	1195	172	37	6	1	17346	1908	504	82	13
G10A6231	4.82	3.60	0	0	0	0	0	334859	45971	27282	4061	56454	655408	81490	18701	3078	547
G10A4173	1.12	3.62	0	0	0	0	0	157	13	15673	18043	11434	106169	9048	2838	455	72
G10A4172	2.36	3.69	0	0	0	163	46	7	41555	4570	1263	210336	73507	10570	2446	385	67
G10A7176	1.21	3.77	0	0	0	0	0	0	0	44487	30707	84478	43297	7217	1588	279	85
G10A6142	0.56	3.78	0	0	0	0	0	19	49	10	1	2197	1995	296	65	11	4
G10A6212	7.24	3.78	0	0	0	0	0	0	0	0	12121	1812	293519	37879	9664	1410	224
G10A6237	1.99	3.79	0	0	0	0	0	109404	12880	15370	1879	53749	103939	12318	2923	498	110

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A4150	1.46	3.80	0	0	0	0	0	53	4	1	0	1149	22411	1881	596	95	14
G10A6188	1.33	3.80	0	0	0	0	0	13	3	0	0	551	145	25	5	2	2
G10A7179	1.36	3.87	0	0	0	0	0	156	26	416	41	62944	46642	6599	1419	233	51
G10A6195	0.42	3.90	0	0	0	0	0	0	1	1	1	14147	2110	433	69	13	5
G10A4151	1.10	4.00	0	0	0	0	0	0	0	0	0	0	17943	1526	482	77	12
G10A6184	2.43	4.00	0	0	0	0	0	0	0	0	0	8	206	44	10	6	6
G10A6190	2.15	4.00	0	0	0	0	0	0	0	0	0	42	22062	1832	588	94	14
G10A6206	0.22	4.00	0	0	0	0	0	0	0	0	0	0	1373	190	44	7	1
G10A6222	0.61	4.00	0	0	0	0	0	0	0	0	0	3864	436	103	17	3	1
G10A6228	1.03	4.00	0	0	0	0	0	0	0	0	0	6727	729	183	32	8	4
G10A6230	1.50	4.00	0	0	0	0	0	0	0	0	0	76321	8814	2084	338	61	21
G10A6236	3.34	4.00	0	0	0	0	0	0	0	0	0	14325	19090	2349	525	86	15
G10A6239	1.27	4.00	0	0	0	0	0	0	0	0	0	9197	39154	8593	1445	258	74
G10A6240	0.17	4.00	0	0	0	0	0	0	0	0	0	282	370	83	14	3	1

Appendix 5: *Summary of annual budget of R 5 million*

Summary of the annual budget per compartment (Rands) for the next 15 years based on the prioritisation of the compartments for clearing and a total annual budget ceiling of R5.0 million. Once the levels of invasion have been reached (<1% cover), then the compartment is under maintenance (e.g. year 6 onwards for the 1st compartment below).

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A5054	56.10	0.00	102157	16450	2110	422	296	296	296	296	296	296	296	296	296	296	296
G10A5038	9.52	0.00	80126	16776	2471	430	170	170	170	170	170	170	170	170	170	170	170
G10A5099	8.36	0.00	78987	18736	2736	404	97	97	97	97	97	97	97	97	97	97	97
G10A5123	45.17	0.00	65786	10551	1343	269	186	186	186	186	186	186	186	186	186	186	186
G10A5034	16.04	0.00	50985	12608	1992	367	165	165	165	165	165	165	165	165	165	165	165
G10A5112	24.22	0.00	47981	9387	1241	194	99	99	99	99	99	99	99	99	99	99	99
G10A5037	13.86	0.00	45952	7591	992	221	170	170	170	170	170	170	170	170	170	170	170
G10A5109	8.97	0.00	45580	7659	1056	177	123	123	123	123	123	123	123	123	123	123	123
G10A3263	2.12	0.00	32748	4561	1113	156	29	12	12	12	12	12	12	12	12	12	12
G10A5031	15.25	0.00	16404	2699	336	72	46	46	46	46	46	46	46	46	46	46	46
G10A5081	9.73	0.14	84571	14738	1860	355	214	214	214	214	214	214	214	214	214	214	214
G10A5088	17.30	0.14	66647	10956	1460	297	229	229	229	229	229	229	229	229	229	229	229
G10A5084	24.11	0.18	115206	358763	90852	14787	2179	508	408	408	408	408	408	408	408	408	408
G10A5035	26.35	0.20	128169	26712	3733	597	223	223	223	223	223	223	223	223	223	223	223
G10A5094	1.06	0.33	5557	1705	262	39	10	8	8	8	8	8	8	8	8	8	8
G10A5124	20.82	0.36	102419	79661	15782	2588	756	607	601	601	601	601	601	601	601	601	601
G10A5068	18.92	0.38	201700	39038	5438	979	459	459	459	459	459	459	459	459	459	459	459
G10A5092	8.40	0.40	42119	8099	1117	216	102	95	95	95	95	95	95	95	95	95	95
G10A5085	19.46	0.50	51031	108890	28467	4335	660	246	201	201	201	201	201	201	201	201	201
G10A5089	34.70	0.50	41678	7115	955	187	148	148	148	148	148	148	148	148	148	148	148
G10A5057	30.96	0.50	19378	4446	602	105	52	52	52	52	52	52	52	52	52	52	52
G10A5113	3.41	0.50	4495	5610	1095	157	28	19	19	19	19	19	19	19	19	19	19
G10A3052	16.91	0.56	116582	25361	3477	730	501	493	493	493	493	493	493	493	493	493	493
G10A3145	25.69	0.57	91884	98459	18211	3526	746	413	379	379	379	379	379	379	379	379	379
G10A3087	14.28	0.65	84338	15738	2177	445	303	296	296	296	296	296	296	296	296	296	296
G10A3143	21.84	0.67	108272	47388	5868	1459	601	495	478	478	478	478	478	478	478	478	478
G10A5027	4.91	0.67	12309	2030	264	59	42	42	42	42	42	42	42	42	42	42	42
G10A5125	27.20	0.68	512700	125132	21152	3408	705	610	599	598	598	598	598	598	598	598	598
G10A3262	2.63	0.70	8984	23595	3637	746	103	17	9	9	9	9	9	9	9	9	9

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
G10A5095	16.12	0.71															