

Riverine Management Models Report

Business Case for Durban's Transformative Riverine Management Programme

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CONTENTS

About the C40 Cities Finance Facility.....	1
Acknowledgements	1
1. Introduction	3
2. Methodology	3
2.1 Overview	3
2.2 Conceptual Framing.....	4
2.3 Stakeholder Inputs	5
3. Defining Basic vs Transformative Riverine Management.....	5
4. Riverine Management Models	7
4.1 Summary of all Scenarios	7
4.2 “Do Nothing” Scenarios.....	8
4.3 Riverine Management Models: Municipal Land	9
4.3.1 Upscaling Sihlanzimvelo Stream Cleaning Programme	9
4.3.2 Transformative Management	9
4.4 Riverine Management Models: Private Land	10
4.4.1 Basic Management.....	10
4.4.2 Transformative Management	10
4.5 Riverine Management Models: Traditional Authority Land.....	11
4.5.1 Basic Management.....	11
4.5.2 Transformative Management	11
5. Implementation Costs	12
5.1 Basic Riverine Management Costs	12
5.2 Transformative Riverine Management Costs	12
5.3 Scaling the Costs per length of River.....	12
Annexure A – Riverine Management Models.....	14
Annexure B – Riverine Management Cost Assumptions.....	20
Annexure C – Transformative Riverine Governance Assumptions	24

1. INTRODUCTION

FutureWorks has been appointed to prepare a Business Case for Durban's Transformative Riverine Management Programme (TRMP). The process includes undertaking a Benefit Cost Analysis (BCA) for management of municipal, private and traditional authority land in riverine areas.

Nine future riverine management scenarios will be modelled in the BCA. These include:

- (i) A "do nothing" scenario for municipal, private and Traditional Authority¹ land in riverine areas with climate change as a driver of river impacts;
- (ii) Upscaling of Sihlanzimvelo Stream Cleaning Programme on municipal land in upper catchments with climate change;
- (iii) A "basic management" scenario for private and Traditional Authority land in riverine areas with climate change; and
- (iv) A "transformative management" scenario for each of the three land ownership types with climate change impacts.

The purpose of this report is to describe the assumed "riverine management models" applicable in each of the scenarios. In the BCA, the costs and benefits of implementation of these different riverine management models has been estimated at a city-wide scale.

2. METHODOLOGY

2.1 Overview

The first step in the Business Case preparation process was a Baseline Assessment involving a Vulnerability Assessment for Durban's rivers and an appraisal of five riverine management project examples in the eThekweni Municipal Area. Each case example project was distinct in terms of its ownership, focus and objectives, spatial context, governance, funding, and partnerships. The appraisal of these projects identified lessons on how the ecological, social and economic impact from riverine management investments can be optimised. Project interventions that demonstrated achievements or potential for achieving transformative, sustainable, inclusive and resilience-building outcomes were identified.

The next step involved modelling the flows of ecosystem services in the Ohlanga River Catchment² as a prototype example to understand: (i) the current state of riverine ecosystem services delivery and associated user dependencies; (ii) the potential

¹ Traditional Authority refers to land administered by the iNgonyama Trust. The iNgonyama Trust is a corporate entity established to administer the land traditionally owned by the Zulu people, represented by their king, for the benefit, material welfare and social well-being of the Zulu nation, who continue to occupy the land as they historically have done. The Trust is governed by a Board of Directors (the iNgonyama Trust Board), and the sole Trustee is King Zwelithini Goodwill kaBhekuzulu.

² The Ohlanga River Catchment was selected for owing to: (i) it being located wholly within the eThekweni Municipality boundary, such that management effects on the whole catchment system could be modelled, (ii) land uses, land ownership patterns and topography within the catchment are broadly similar to many other river catchments in the eThekweni Municipal Area, and the catchment was therefore considered representative of typical conditions, (iii) the catchment discharges via an estuary into a coastal area containing important coastal investment and recreational use, allowing modelling of the effects of catchment management on coastal users.

effect of climate change on riverine ecosystem services and riverine communities; and (iii) the impact of management in mitigating climate change driven ecosystem services reductions and associated social and economic impacts. The results of this modelling provided a set of assumptions for the BCA. The modelling process suggested that riverine management could play a major role in ameliorating climate change impacts on rivers (and associated users) and that by also reducing urban impacts on rivers, rivers in the eThekweni Municipal Area could deliver significantly increased benefits than today. The results of the modelling were used to inform the preparation of a Transformative Riverine Management Proto-Masterplan for the Ohlanga River Catchment, which was used to develop estimates for the cost of implementing riverine corridor management as envisaged for the eThekweni Municipality’s TRMP, and for estimating the associated benefits thereof.

The findings of the Baseline Assessment and Ohlanga Catchment Proto-Masterplan modelling have therefore been used to develop assumptions for how rivers in the eThekweni Municipal Area could be managed to achieve, (i) a basic set of benefits, or (ii) transformative outcomes. These assumptions are written up in this report as the “Riverine Management Models” which inform the BCA.

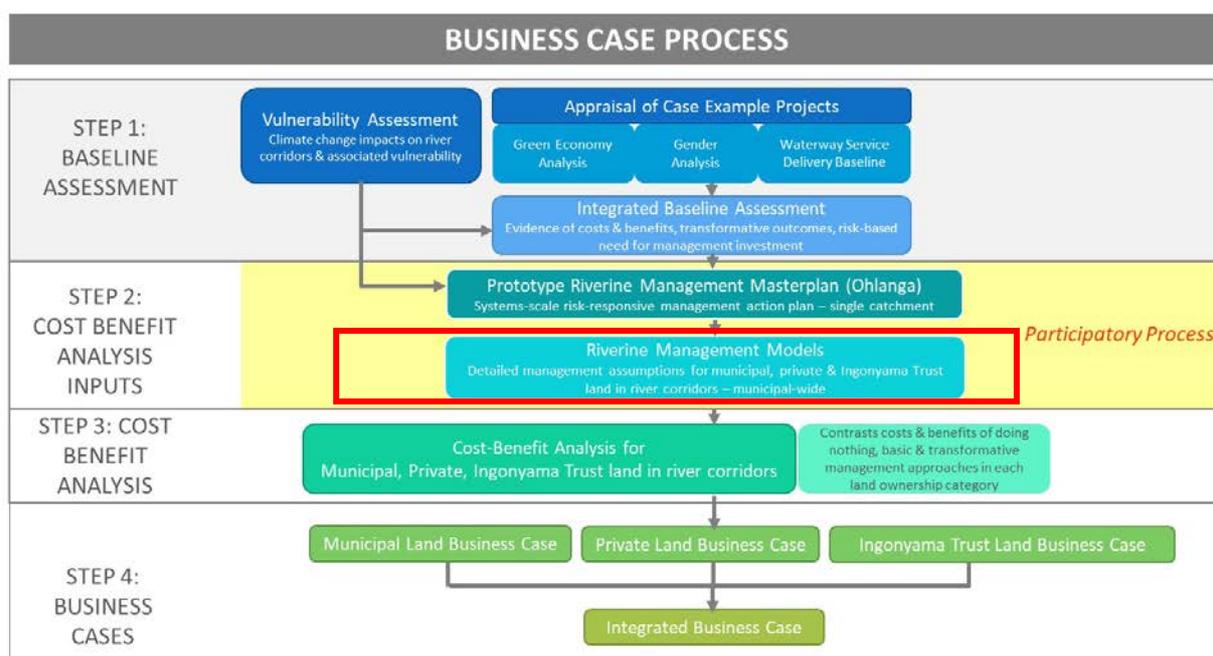


Figure 1: Schematic of the Business Case Preparation process, showing the “Riverine Management Models” report as an informant to the Cost Benefit Analysis

2.2 Conceptual Framing

The Business Case will be framed from the perspective of eThekweni Municipality as the proponent of the TRMP. Acknowledging that eThekweni Municipality is not in a position legally, financially or institutionally to manage or restore all rivers within its boundary, creating a supportive policy environment and appropriate incentives, and building partnerships and social capital around river protection and management will be key instruments for catalysing action by others. The municipality will therefore need to implement a system of “transformative riverine governance” which unlocks this wider, scaled-up interest and investment in rivers.

In this vein, the BCA assumes that the costs of implementation include (i) eThekweni Municipality's costs of "transformative riverine governance", where this is additional to its current activities and capacity, and (ii) the costs of implementing basic / transformative management of its own landholdings in riverine areas. The costs of managing rivers on private and Traditional Authority land will not be attributed to the municipality, as these are assumed to be borne by the landowners in response to the "transformative riverine governance" approach adopted by eThekweni Municipality. Therefore, through supportive policy, partnerships and incentives, eThekweni Municipality is assumed to be able to leverage significant positive action around rivers by individuals and businesses. It is this "leverage value" that will be considered in the BCA.

Given the above, the riverine management models for private and Traditional Authority owned land are presented as interventions that can be catalysed, enabled or supported through an eThekweni Municipality governance / programme co-ordination umbrella.

2.3 Stakeholder Inputs

Basic and transformative management interventions for each land ownership type (municipal, private and Traditional Authority) were initially identified by the FutureWorks consultant team with inputs from Groundtruth (sub-consulting to FutureWorks).

The draft riverine management interventions for all land ownership types were then presented to a core group of eThekweni Municipality officials comprising the "Project Management Team" of the Business Case project for inputs and refinement.

The draft riverine management interventions for private land was presented to a broad grouping of "riverine stakeholders" that had been identified by eThekweni Municipality for consultation during the Business Case preparation process. The discussion at this meeting focused on how the municipality could best support / leverage riverine management by private landowners (individuals and businesses).

Inputs from these two groups were used to refine the riverine management models.

The costs and benefits of implementing the identified riverine management models were developed by FutureWorks and Groundtruth, with substantive inputs and collaboration from various eThekweni Municipality staff.

3. DEFINING BASIC VS TRANSFORMATIVE RIVERINE MANAGEMENT

Given the focus in the BCA on contrasting the costs and benefits of a basic versus transformative riverine management approach, it has been necessary to define the difference as part of defining the riverine management models.

A "basic" riverine management approach assumes a focus on biophysical riverine management interventions that maintain a "stable state" in the riverine ecosystem in response to urban impacts and climate change. These management interventions do not include ecosystem restoration but do include activities such as removal of solid

waste and invasive alien plants from riverine areas and fixing stream bed and bank erosion in key locations. eThekweni Municipality is assumed to play a limited “riverine programme coordination role”, in which it facilitates legislative enforcement where required to defend rivers from inappropriate activities, unattenuated urban stormwater discharge, pollution and alien plant invasions. It is assumed that when the municipality is the implementer of “basic management” interventions, the costs include project management and administration, and facilitating inter-departmental co-operation and external partnerships at a project-level.

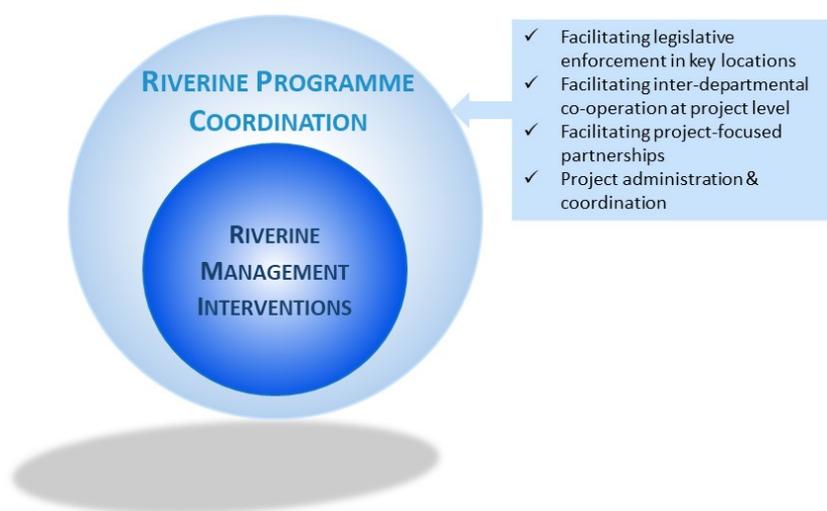


Figure 2: Basic Riverine Management

A “transformative” riverine management approach is assumed to include an overarching “transformative riverine governance” umbrella implemented by eThekweni Municipality. This provides the necessary framework for facilitating cross-sectoral and multi-stakeholder collaboration (including with other spheres of government) and creating enabling conditions for riverine management action across all riverine landowners in the city.

Implementation of transformative riverine management assumes a focus on positive social-ecological systems change in relation to rivers. Biophysical riverine management interventions include both ecological restoration and management at a systems scale, aiming to improve the functionality and resilience of rivers to urban impacts and climate change. The condition and/or management of the built / agricultural landscape surrounding rivers would also be improved, such that accelerated stormwater, sediment loads and pollution entering rivers is minimised.

Social interventions aim to build human, social and institutional capital in a way that promotes positive behaviour change and active river stewardship in response to a recognition of the value of rivers to people and the economy. Socio-economic and environmental benefits of riverine management are accelerated through circular economy initiatives that make productive use of solid waste and alien plant biomass – either arising from riverine management activities or as a means of reducing waste entering rivers. The social / economic use of riverine areas as places of recreation and tourist activities or harvesting of natural resources is assumed to be optimised within sustainable limits. Agriculture / food gardening on river floodplains is supported, where

appropriate, to enhance resilience to increased river flooding and sedimentation, and to limit negative impacts on river ecosystems.

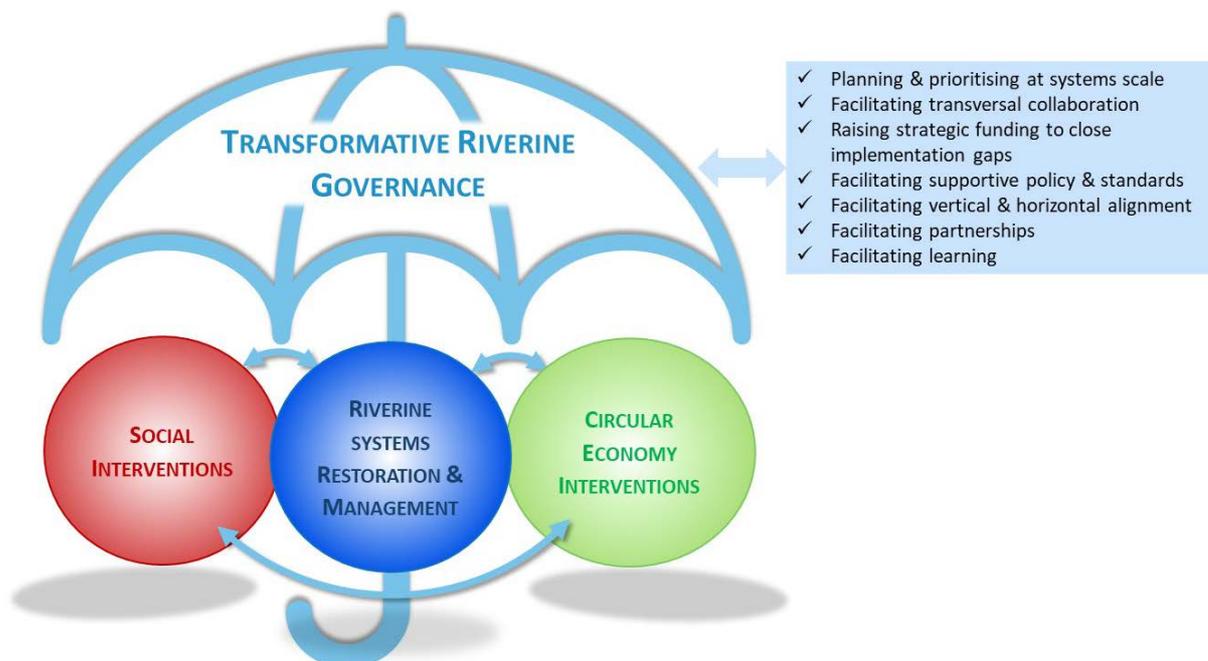


Figure 3: Transformative Riverine Management

4. RIVERINE MANAGEMENT MODELS

4.1 Summary of all Scenarios

Nine scenarios have been modelled in the BCA (see Figure 4).

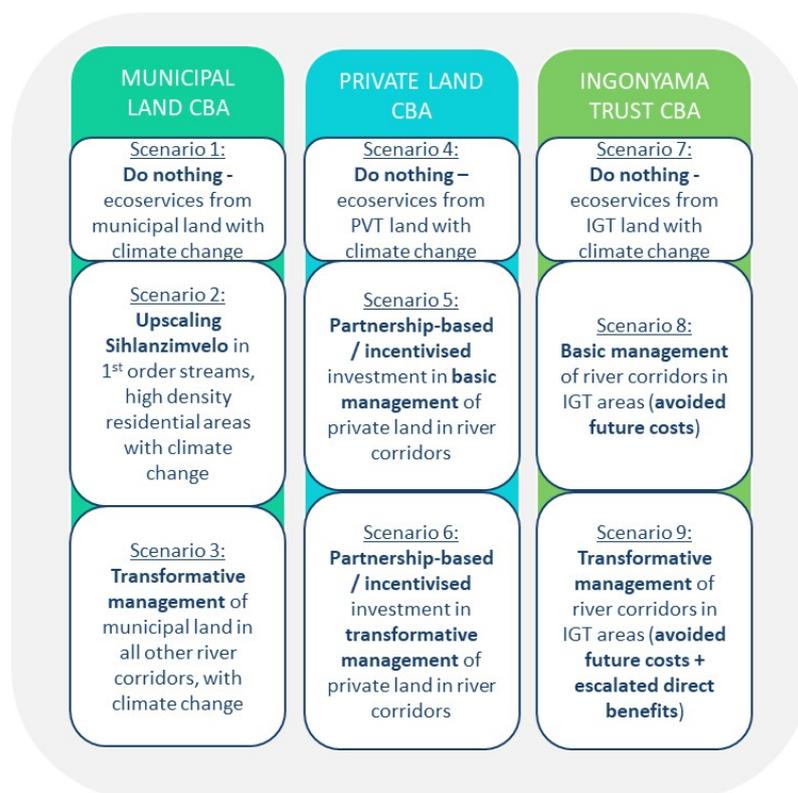


Figure 4: Summary of the Nine BCA Scenarios

4.2 “Do Nothing” Scenarios

In the BCA, a “Do Nothing” scenario has been modelled for municipal, private and Traditional Authority land in the eThekweni Municipal Area. These scenarios assume that:

- (i) Current levels of riverine ecosystem services delivery will decline as a result of climate change impacts. By association, river-related human and economic impacts and risks will increase.
- (ii) No riverine management is implemented.

These scenarios are intended to present a “worst case” in terms of the potential ecological, social and economic disbenefits that may arise in relation to rivers under conditions of climate change, if no management takes place.

The Ohlanga Catchment Proto-Masterplan modelling³ has provided some of the key assumptions needed for these scenarios, including that climate change will have a significant impact on riverine ecosystem services delivery, decreasing most ecosystem services by an average of 11% below baseline. The exception is bioenergy, which could increase by up to 28%. The BCA has analysed how such changes in ecosystem services translate into financial, social and economic disbenefits or impacts.

³ Mander, M., Mander, N., de Winnaar, G. and Graham, M. 2020. *Ohlanga Proto-Masterplan for Transformative Riverine Management: Business Case for Durban’s Transformative Riverine Management Programme*. C40 Cities Finance Facility Report.

4.3 Riverine Management Models: Municipal Land

4.3.1 Upscaling Sihlanzimvelo Stream Cleaning Programme

The Sihlanzimvelo Stream Cleaning Programme upscaling scenario (Scenario 2 per Figure 4) involves expanding the current project model to all streams in the eThekweni Municipal Area that meet the existing project site selection criteria⁴.

The project model (see Figure 5) involves community co-operatives being hired directly by eThekweni Municipality, trained in a variety of skills, and implementing a range of riverine management activities in a 3m wide strip along each side of specified sections of stream. Projects are managed by dedicated eThekweni Municipal staff, with the management of co-operatives outsourced to a third party.

While in reality the upscaling of Sihlanzimvelo would be implemented incrementally based on a prioritisation process, for Scenario 2 in the BCA it will be assumed that all streams meeting the defined site selection criteria will be managed under the Sihlanzimvelo model.

4.3.2 Transformative Management

Scenario 3 involves implementation of a transformative riverine management approach on all land belonging to the eThekweni Municipality in river corridors, excluding estuaries.

The riverine management model (see Figure 6) includes transformative riverine governance, biophysical restoration and management interventions, social interventions and circular economy interventions. These interventions are generalised for upper, middle and lower catchment areas for the purposes of being able to model transformative riverine management costs and benefits on all municipal land. In implementation, such interventions would need to be tailored to fit localised riverine management context, requirements and opportunities.

The biophysical interventions are assumed in this model to include restoration of wetlands and replanting of riparian vegetation on floodplains. Riverine management is implemented through community co-operatives which are upskilled in a range of technical and sustainable livelihood subject areas. Additional solid waste and debris trapping interventions are implemented in key locations. In lower catchment areas (stream orders 3 and greater), biophysical interventions include improving the condition / management of built and agricultural landscapes in riverine zones with a view to reducing negative impacts on the river from urban and agricultural run-off.

Social interventions include building awareness and skills amongst community leaders of the value of rivers, how to change behaviour to protect rivers and to encourage positive river stewardship amongst riverine communities. Through an Enviro-Champs approach, social capital is developed amongst riverine communities to value and take care of rivers. Schools programmes and citizen science are used to activate inclusive,

⁴ Projects are implemented on municipal land alongside streams in upper catchment areas (i.e. first order streams draining catchments of less than 1000 hectares in extent) and where surrounding land use is predominantly high density residential.

participatory engagement in river stewardship, while building the skills and capacity necessary for communities to respond to river issues.

eThekwini Municipality enables circular economy initiatives to develop using solid waste and invasive alien plant biomass by issuing offtake agreements and partnering with non-profits, community organisations and businesses.

4.4 Riverine Management Models: Private Land

4.4.1 Basic Management

Scenario 5 involves implementation of a basic riverine management approach on all land belonging to private individuals and businesses in river corridors, excluding estuaries (see Figure 7).

Biophysical riverine management on private land is enabled, incentivised and supported through a municipal transformative riverine governance approach. Laws and policies are enforced in such a way that landowners keep riverine areas clear of invasive alien plants and do not undertake activities which degrade riverine ecosystems. eThekwini Municipality uses its existing mandates and functions to ensure that development nearby rivers does not discharge unattenuated stormwater, pollution or solid waste into rivers. eThekwini Municipality works proactively with other spheres of government to activate support from those whose mandates can support the municipality in enabling improved protection / management of rivers.

4.4.2 Transformative Management

Scenario 6 involves implementation of a transformative riverine management approach on all land belonging to private individuals and businesses in river corridors, excluding estuaries.

The riverine management model (see Figure 8) involves transformative riverine governance that enables and leverages biophysical restoration and management interventions, social interventions and circular economy interventions on private land.

Like in the basic riverine management model for private land, laws and policies are enforced in such a way that landowners keep riverine areas clear of invasive alien plants and do not undertake activities which degrade riverine ecosystems. eThekwini Municipality uses its existing mandates and functions to ensure that development nearby rivers does not discharge unattenuated stormwater, pollution or solid waste into rivers. eThekwini Municipality engages other spheres of government with mandates relating to riverine protection / management to play a supporting role.

eThekwini Municipality develops supportive policy and by-laws and enters into partnership arrangements that leverage enhanced protection and management of riverine areas on private land at no additional cost to the municipality. In lower catchment areas, eThekwini Municipality applies a requirement for “flood negative” development designs which add to flood reduction services delivered by the built landscape in river catchments.

Social interventions include supporting community-based organisations, businesses and agricultural landowners to value rivers and become proactive riverine stewards. Schools programmes and citizen science are used to activate inclusive, participatory

engagement in river stewardship, while building the skills and capacity necessary for communities and businesses to respond to river issues.

eThekwini Municipality supports circular economy initiatives and the sustainable economic use of riverine areas for recreation, tourism and conservation agricultural activities.

4.5 Riverine Management Models: Traditional Authority Land

4.5.1 Basic Management

Scenario 8 involves implementation of a basic riverine management approach on all Traditional Authority land in river corridors, excluding estuaries (see Figure 9).

Biophysical riverine management on Traditional Authority land is enabled, incentivised and supported through a municipal transformative riverine governance approach. Laws and policies are enforced in such a way that riverine areas are kept clear of invasive alien plants and are not the subject of activities which degrade riverine ecosystems. eThekwini Municipality uses its existing mandates and functions to ensure that development nearby rivers does not discharge unattenuated stormwater, pollution or solid waste into rivers. eThekwini Municipality works proactively with other spheres of government to activate support from those whose mandates can support the municipality in enabling improved protection / management of rivers.

4.5.2 Transformative Management

Scenario 9 involves implementation of a transformative riverine management approach on all Traditional Authority land in river corridors, excluding estuaries.

The riverine management model (see Figure 10) involves transformative riverine governance that enables and leverages biophysical restoration and management interventions, social interventions and circular economy interventions.

Like in the basic riverine management model, laws and policies are enforced in such a way that riverine areas are kept clear of invasive alien plants and are not subject to activities which degrade riverine ecosystems. eThekwini Municipality uses its existing mandates and functions to ensure that development nearby rivers does not discharge unattenuated stormwater, pollution or solid waste into rivers. eThekwini Municipality engages other spheres of government with mandates relating to riverine protection / management to play a supporting role.

eThekwini Municipality develops supportive policy and by-laws and enters into partnership arrangements that leverage enhanced protection and management of riverine areas. In lower catchment areas, eThekwini Municipality supports floodplain restoration to improve stormwater attenuation and filtration, as well as litter trapping services.

Social interventions include building awareness and skills amongst community leaders of the value of rivers, how to change behaviour to protect rivers and to encourage positive river stewardship amongst riverine communities. In addition, eThekwini Municipality supports community-based organisations to value rivers and become proactive riverine stewards. Schools programmes, citizen science and education campaigns are used to activate inclusive, participatory engagement in river

stewardship, while building the skills and capacity necessary for communities to respond to river issues.

eThekwini Municipality supports circular economy initiatives associated with alien plant biomass cleared from riverine areas and the sustainable economic use of riverine areas for recreation and tourism activities. It also supports resilient floodplain food gardening and sustainable natural resources usage (e.g. river sand, natural fibre harvesting and processing etc.).

5. IMPLEMENTATION COSTS

To undertake the required Cost Benefit Analysis, the cost of implementing the assumed basic and transformative riverine management models has needed to be estimated. The cost estimates, as described below, are presented in Annexure B.

5.1 Basic Riverine Management Costs

The costs of implementing basic riverine management interventions have been estimated from known costs in the Sihlanzimvelo programme. These include the cost of an initial clean-up and erosion repair, community co-operative based management of a 10m wide strip of river and adjacent banks, co-operative training, consultant oversight / assessment of the co-operatives' performance, and municipal management of the programme.

5.2 Transformative Riverine Management Costs

There are several biophysical restoration and management interventions, as well as social interventions included in the transformative riverine management models. The implementation costs associated with each of these was estimated as follows:

- Biophysical management costs were estimated using known Sihlanzimvelo implementation costs;
- Biophysical restoration and social intervention costs were developed by Groundtruth with input from eThekwini Municipality.

As transformative riverine management includes the cost of “transformative governance”, the costs of a transformative riverine governance programme team were estimated (see Annexure C) and converted into a cost per kilometre of river, assuming all rivers in the eThekwini Municipality (7,004 km per the spatial models used in this study) are managed. The transformative governance costs were then included in each of the municipal, private and iNgonyama Trust land transformative management scenarios in the BCA based on the length of river applicable to each scenario.

5.3 Scaling the Costs per length of River

The uMhlangane River Catchment was used to develop a per kilometre cost for the implementation of basic riverine management using the existing Sihlanzimvelo cost model. Sihlanzimvelo has been implemented extensively in this catchment, therefore the extrapolation of programme implementation costs to a “per kilometre of stream” unit was deemed a plausible approach. In addition, this catchment was subject to an

eco-hydrological modelling assessment using the ACRU model⁵, which predicted the impact of climate change on riverine functions, and allowed for estimation in the BCA of avoided municipal infrastructure damage costs that could be directly attributed to the Sihlanzimvelo programme.

The Ohlanga River Catchment was used to model implementation of systems scale, transformative riverine management in the catchment. The management interventions were split between upper, middle and lower sections of the catchment. This implementation model was used to calculate a per kilometre average implementation cost for transformative riverine management.

⁵ Undertaken by Isikhungusethu Consulting under contract to GIZ. Umhlangane Catchment was selected for study given the highly variable land uses within it, and the prior focus of this catchment for implementation of the Sihlanzimvelo Stream Cleaning Programme.

ANNEXURE A – RIVERINE MANAGEMENT MODELS

Figure 5: Scenario 2 - Sihlanzimvelo Upscaling Riverine Management Model

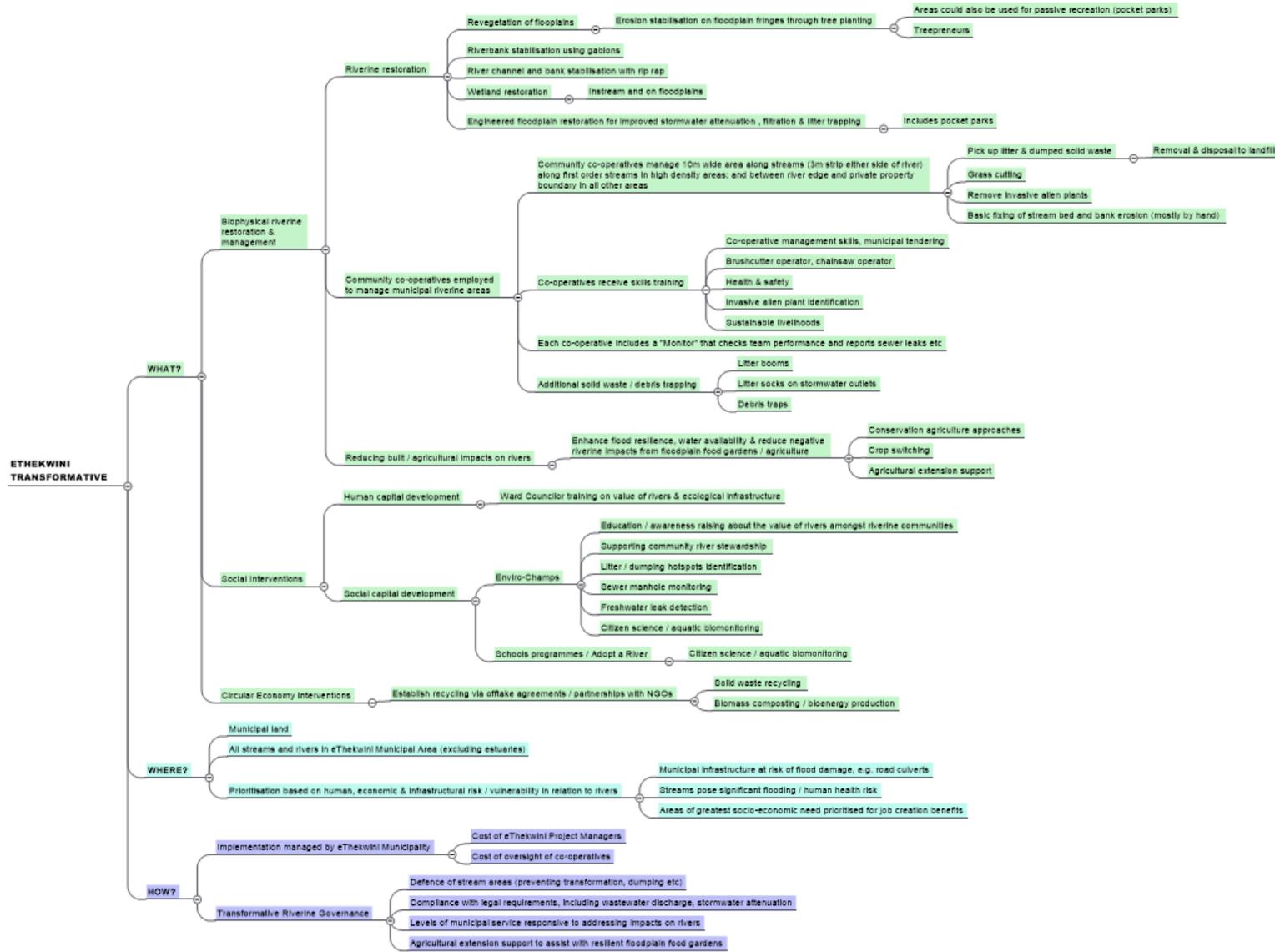


Figure 6: Scenario 3 - Transformative Riverine Management Model: Municipal Land

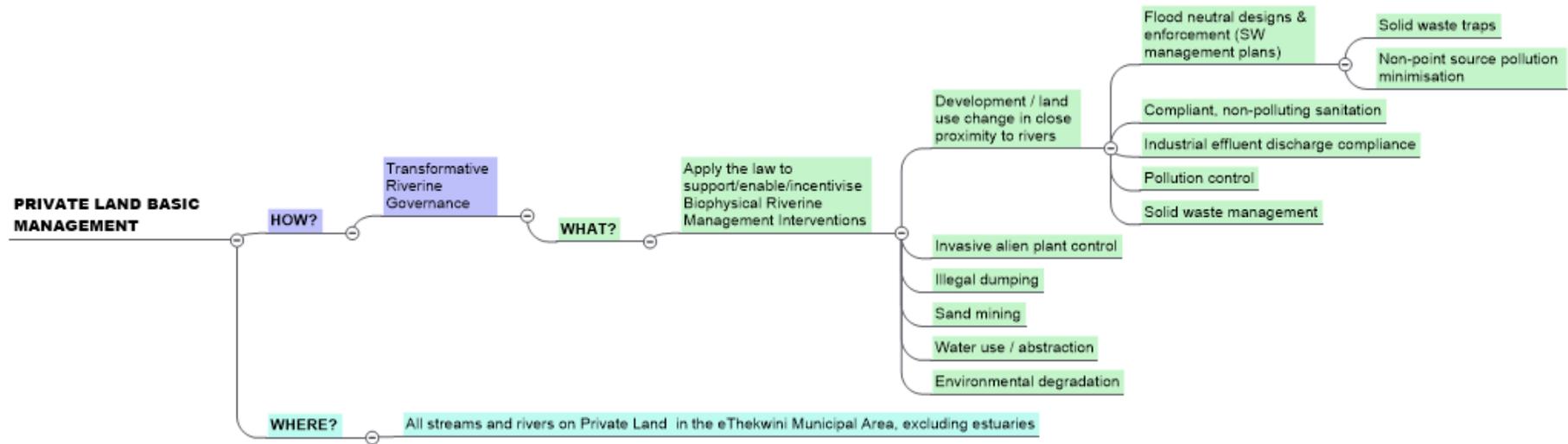


Figure 7: Scenario 5 - Basic Riverine Management Model: Private Land

Figure 8: Scenario 6 - Transformative Riverine Management Model: Private Land

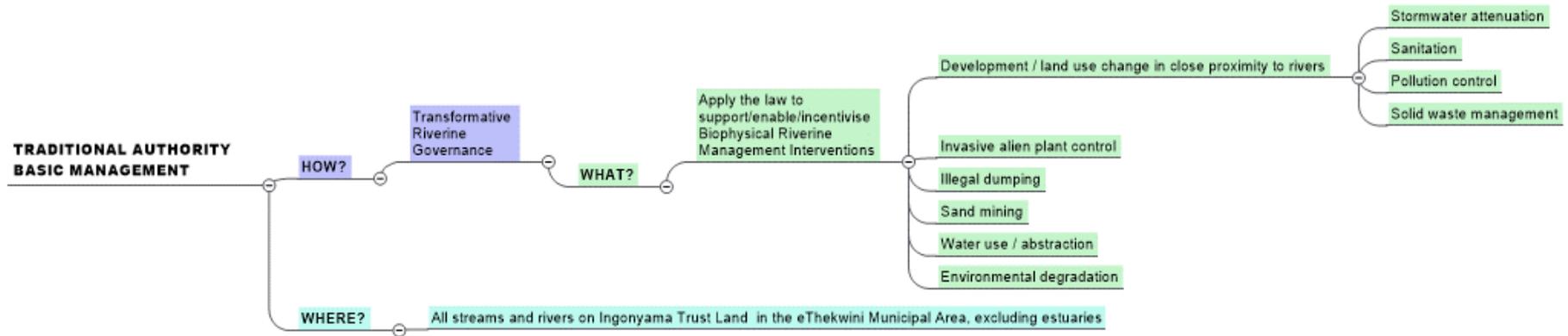


Figure 9: Scenario 8 - Basic Riverine Management Model: Traditional Authority Land

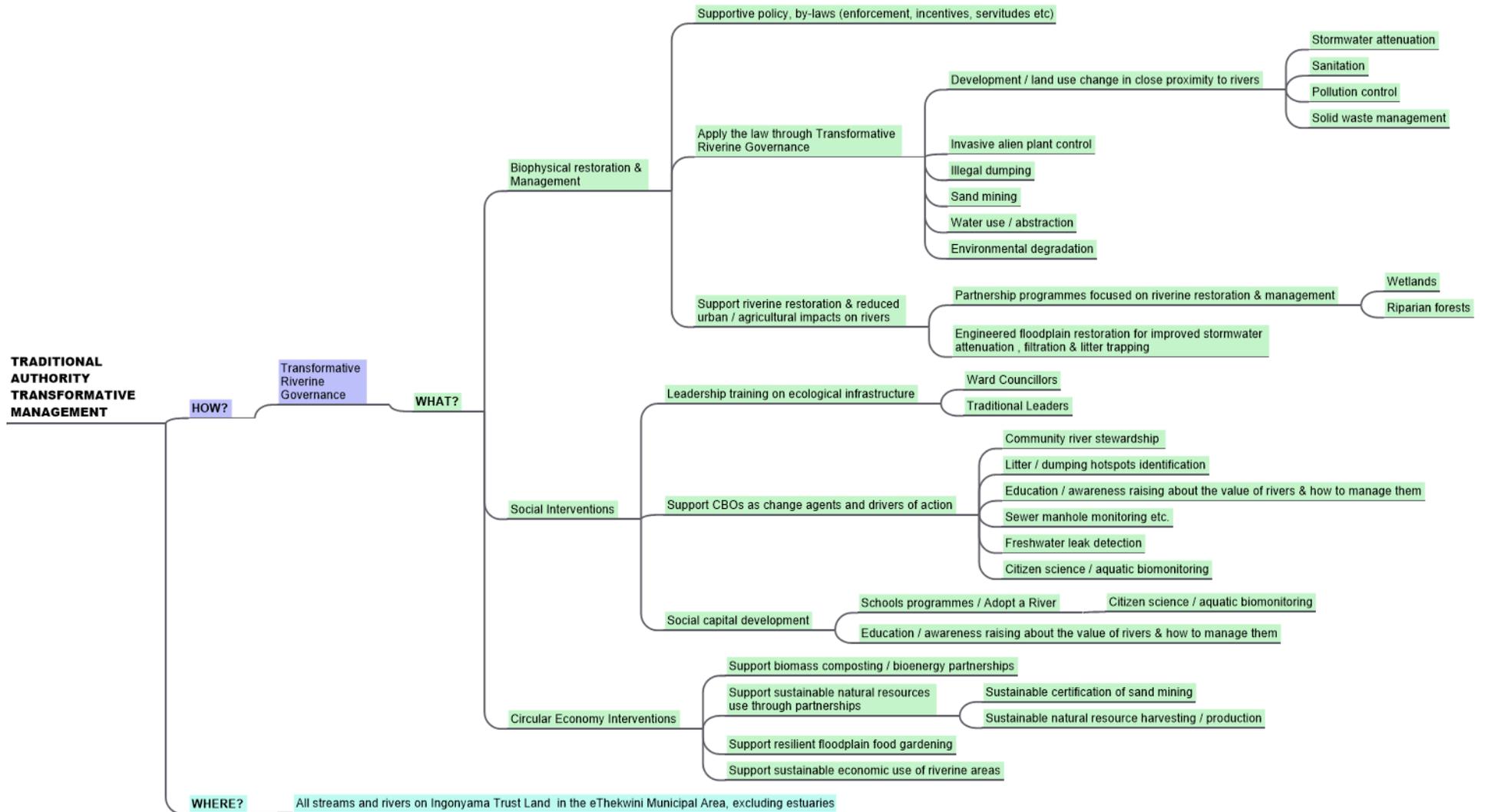


Figure 10: Scenario 9 - Transformative Riverine Management Model: Traditional Authority Land

ANNEXURE B – RIVERINE MANAGEMENT COST ASSUMPTIONS

Table 1: Sihlanzimvelo implementation costs used to derive a cost per kilometre of river for basic management

SIHLANZIMVELO CURRENT COSTS					
Individual cooperative costs					
Description	Unit	Qty	Rate	Amount	
Stream Cleaning					
Natural Stream Debris	km	5	R 1,000	R	5,000
Natural Stream-Alien Vegetation	km	5	R 1,000	R	5,000
Natural Stream Erosion Protection	km	5	R 1,200	R	6,000
Grass & Vegetation Maintenance	km	5	R 1,800	R	9,000
Litter Control	km	5	R 1,000	R	5,000
Monthly cost - total				R	30,000
Annual cost - total	Months	12	R 30,000	R	360,000
Sihlanzimvelo costs					
Description	Unit	Qty	Rate	Amount	
Annual operational costs					
Total number km rivers managed	km				450
Number of cooperatives engaged	co-ops	90	R 360,000	R	32,400,000
Manager consultant & 7 assessors	Team	1	R 2,400,000	R	2,400,000
Municipal coordinator	Package	0.33	R 1,152,000	R	380,160
Total Annual Operational Costs				R	35,180,160
<i>Annual co-op management costs per 5km of stream</i>				<i>R</i>	<i>30,891</i>
<i>Annual co-op management costs per 1 km of stream</i>				<i>R</i>	<i>6,178</i>
Total Annual Operational Costs per 1km of stream				R	78,178
Start up costs					
Stream management analysis		1	R 500,000	R	500,000
Stream management analysis per km	1 km	90		R	1,111
Initial stream clean up	km	450		R	2,000,000
Initial cleanup costs per km	km	1		R	4,444
Total start up costs				R	2,500,000
Total start up costs per 5km co-op		90		R	27,778
Total start up costs per km				R	5,556
Start up costs annualised					
Assumed project cycle in years					20
Annual start up costs per 5 km co-op				R	1,389
Annual start up costs per km				R	278
Total annual costs per 5km unit				R	392,280
Total annual costs per km				R	78,456
Total annual costs including annualised start up				R	35,305,160
Jobs					
5 to 8 jobs for 86 cooperatives	M. Tomlinson		430 to 688		
686 jobs	J. Houghton				
Average number of jobs					600
Average number of jobs per co-op					6.7
Jobs per km					1.3
Annual cost per job				R	58,842
Income to household per job				R	54,000

Table 3: Implementation costs assumed for the private land transformative riverine management model

Transformative river management costs - Ohlanga Proto-masterplan - PRIVATE LAND RIVERINE MANAGEMENT MODEL											
	Sub catchme	Unit	Cost per unit	No. of ur	Total costs	Ave ur Annual costs	Once off costs	Replacement term in years	Maintenance	Jobs as a % of cost	Jobs
Biophysical Interventions											
IAP control programme											
Upper		Ha	R65,000	60	R3,900,000		R3,900,000			R2,340,000.0	43
Middle		Ha	R65,000	120	R7,800,000		R7,800,000			R4,680,000.0	87
Lower		Ha	R65,000	100	R6,500,000		R6,500,000			R3,900,000.0	72
Revegetation					R0		R0				0
Upper		Ha	R25,000	60	R1,500,000		R1,500,000			R600,000.0	11
Middle		Ha	R25,000	120	R3,000,000		R3,000,000			R1,200,000.0	22
Lower		Ha	R25,000	100	R2,500,000		R2,500,000			R1,000,000.0	19
River bank stabilisation - Gabions					R0		R0				0
Upper		3 m3	R8,000	0	R0		R0		10	R0.0	0
Middle		5 and 6	R8,000	0	R0		R0		10	R0.0	0
River channel and bank stabilisation - riprap					R0		R0				0
Upper		Ha	R7,000,000	0	R0		R0		10	10 years to do	R0.0
Middle		Ha	R7,000,000	0	R0		R0		10		R0.0
Lower		Ha	R7,000,000	0	R0		R0		10		R0.0
Débris walls					R0		R0				0
Upper		3 Ha	R360,000	0	R0		R0			R0.0	0
Middle		5 Ha	R360,000	0	R0		R0			R0.0	0
Lower		8 Ha	R360,000	0	R0		R0			R0.0	0
Wetland rehabilitation					R0		R0				0
Upper (34 wetlands)		Ha	R350,000	74	R25,900,000	2.2	R25,900,000			R7,770,000.0	144
Middle (14 wetlands)		Ha	R225,000	53	R11,925,000	3.8	R11,925,000			R3,577,500.0	66
Lower (61 wetlands)		Ha	R475,000	97	R46,075,000	1.6	R46,075,000			R13,822,500.0	256
Wetland creation (stormwater ponds)					R0		R0				0
Upper		1 to 4	R165,000	15	R2,475,000		R2,475,000			R990,000.0	18
Middle		5 to 8	R165,000	10	R1,650,000		R1,650,000			R660,000.0	12
Litter Booms					R0		R0				0
Upper		3 Number	R35,000	0	R0		R0		3	R0.0	0
Middle		7, 8	R35,000	0	R0		R0			R0.0	0
Lower		12 Number	R70,000	0	R0		R0			R0.0	0
Litter Socks for Drains and Culverts					R0		R0		3		0
Upper		2,3,4	R115,000	0	R0		R0			R0.0	0
Middle		6 Number	R115,000	0	R0		R0			R0.0	0
Groines					R0		R0				0
Middle		7 Number	R585,000	0	R0		R0			R0.0	0
Lower		8 Number	R585,000	0	R0		R0			R0.0	0
Packet Parks					R0		R0				0
Upper		Number	R6,500,000	0	R0		R0			R0.0	0
Middle		Number	R6,500,000	0	R0		R0			R0.0	0
											1143
										Job per km	3.9
Social Interventions											
School Programmes adopting up to 30 km of river											
Primary		Schools	R10,000	23	R230,000		R230,000				
Secondary		Schools	R25,000	10	R250,000		R250,000				
EnviroChamps selected from up to 25 informal settlements											
Training		People	R10,000	30	R300,000		R300,000				
Monitoring of leaks, solid waste, IAPs, river health, etc.		People	R50,000	30	R1,500,000		R1,500,000				
Training and awareness											
Private business		People	R15,000	10	R150,000		R150,000				
Ward Councilor training, CBOs		People	R15,000	10	R150,000		R150,000				
Other											
Tree preneurs		People	R50,000	10	R500,000		R500,000				
					Total costs	Annual costs	Once off costs				
Totals					R116,305,000	R3,080,000	R113,225,000				
Municipal TRMP coordination and management unit		Unit	R21,864,960	0.33	R7,215,437	R7,215,437				This value is not included in the costs to private sector but kept separate	
Ohlanga Transformative River Management costs											
Ohlanga river distances		294			Total costs per km	Annual costs pe	Once off costs per km				
Transformative costs per km					R 395,595	R 10,476	R 385,119				
Sihlanzimvelo costs - per km (ongoing maintenance)						R 78,456					
Total costs - restore and maintain						R 88,932	R 385,119				

Table 4: Implementation costs assumed for the iNkonyama Trust land transformative riverine management model

Transformative river management costs - Ohlanga Proto-masterplan - INGONYAMA TRUST RIVERINE MANAGEMENT MODEL												
	Sub catchme	Unit	Cost per unit	No. of ur	Total costs	Ave ur	Annual costs	Once off costs	Replaceme nt term in years	Maintenance	Jobs as a % of cost	Jobs
Biophysical Interventions												
IAP control programme												
Upper		Ha	R65,000	220	R14,300,000			R14,300,000			R8,580,000.0	159
Middle		Ha	R65,000	0	R0			R0			R0.0	0
Lower		Ha	R65,000	0	R0			R0			R0.0	0
Revegetation												
Upper		Ha	R25,000	220	R5,500,000			R5,500,000			R2,200,000.0	41
Middle		Ha	R25,000	0	R0			R0			R0.0	0
Lower		Ha	R25,000	0	R0			R0			R0.0	0
River bank stabilisation - Gabions												
Upper		3 m3	R8,000	0	R0			R0	10		R0.0	0
Middle	5 and 6	m3	R8,000	0	R0			R0	10		R0.0	0
River channel and bank stabilisation - riprap												
Upper		Ha	R7,000,000	0	R0			R0	10	10 years to do	R0.0	0
Middle		Ha	R7,000,000	0	R0			R0	10		R0.0	0
Lower		Ha	R7,000,000	0	R0			R0	10		R0.0	0
Debris walls												
Upper		3 Ha	R360,000	0	R0			R0			R0.0	0
Middle		5 Ha	R360,000	0	R0			R0			R0.0	0
Lower		8 Ha	R360,000	0	R0			R0			R0.0	0
Wetland rehabilitation												
Upper (34 wetlands)		Ha	R350,000	7.4	R2,590,000	2.2		R2,590,000			R777,000.0	14
Middle (14 wetlands)		Ha	R225,000	5.3	R1,192,500	3.8		R1,192,500			R357,750.0	7
Lower (61 wetlands)		Ha	R475,000	9.7	R4,607,500	1.6		R4,607,500			R1,382,250.0	26
Wetland creation (stormwater ponds)												
Upper	1 to 4	Ha	R165,000	0	R0			R0			R0.0	0
Middle	5 to 8	Ha	R165,000	0	R0			R0			R0.0	0
Litter Booms												
Upper		3 Number	R35,000	0	R0			R0	3		R0.0	0
Middle	7, 8	Number	R35,000	0	R0			R0			R0.0	0
Lower		12 Number	R70,000	0	R0			R0			R0.0	0
Litter Socks for Drains and Culverts												
Upper	2,3,4	Number	R115,000	0	R0			R0			R0.0	0
Middle		6 Number	R115,000	0	R0			R0			R0.0	0
Groynes												
Middle		7 Number	R585,000	0	R0			R0			R0.0	0
Lower		8 Number	R585,000	0	R0			R0			R0.0	0
Pocket Parks												
Upper		Number	R6,500,000	0	R0			R0			R0.0	0
Middle		Number	R6,500,000	0	R0			R0			R0.0	0
											638	
											Jobs per km	2.2
Social Interventions												
School Programmes adopting up to 30 km of river												
Primary		Schools	R10,000	10	R100,000		R100,000					
Secondary		Schools	R25,000	5	R125,000		R125,000					
EnviroChamps selected from up to 25 informal settlements												
Training		People	R10,000	15	R150,000		R150,000					
Monitoring of leaks, solid waste, IAPs, river health, etc.		People	R50,000	15	R750,000		R750,000					
Training and awareness												
Private business		People	R15,000	0	R0		R0					
Ward Councilor training, CBOs		People	R15,000	5	R75,000		R75,000					
Other												
Tree preneurs		People	R50,000	5	R250,000		R250,000					
					Total costs		Annual costs	Once off costs				
Totals					R29,640,000		R1,450,000	R28,190,000				
Municipal TRMP coordination and management unit		Unit	R21,864,960	0.33	R7,215,437		R7,215,437	This value is not included in the costs to Nkonyama Trust but kept separate				
Ohlanga Transformative River Management costs					Total costs per km		Annual costs pe	Once off costs per km				
Ohlanga river distances		294										
Transformative costs per km					R 100,816		R 4,932	R 95,884				
Sihlanzimvelo costs - per km (ongoing maintenance)							R 39,228					
Total costs - restore and maintain							R 44,160	R 95,884				

ANNEXURE C – TRANSFORMATIVE RIVERINE GOVERNANCE ASSUMPTIONS

City costs to implement transformative management - all ownership for 7004 km						
	Unit costs	Number	Annual costs	Operating cost f	Operating cost	Total annual costs
Strategic coordinator - policy level	R 1,382,400	1	R 1,382,400	0.3	R 414,720	R 1,797,120
Programme manager - implementation	R 1,382,400	1	R 1,382,400	0.3	R 414,720	R 1,797,120
Programme ecohydrologist / engineer	R 1,382,400	1	R 1,382,400	0.3	R 414,720	R 1,797,120
Catchment project managers	R 1,152,000	10	R 11,520,000	0.3	R 3,456,000	R 14,976,000
Programme M&E specialist	R 1,152,000	1	R 1,152,000	0.3	R 345,600	R 1,497,600
Total costs for 7004 km - all land ownership						R 21,864,960
Total costs per km						R 3,122
Assume 1/3 split between land ownership types per km						R 1,030.19
Total annual costs per year per ownership type						R 7,215,437

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