Reconciliation Strategy Study

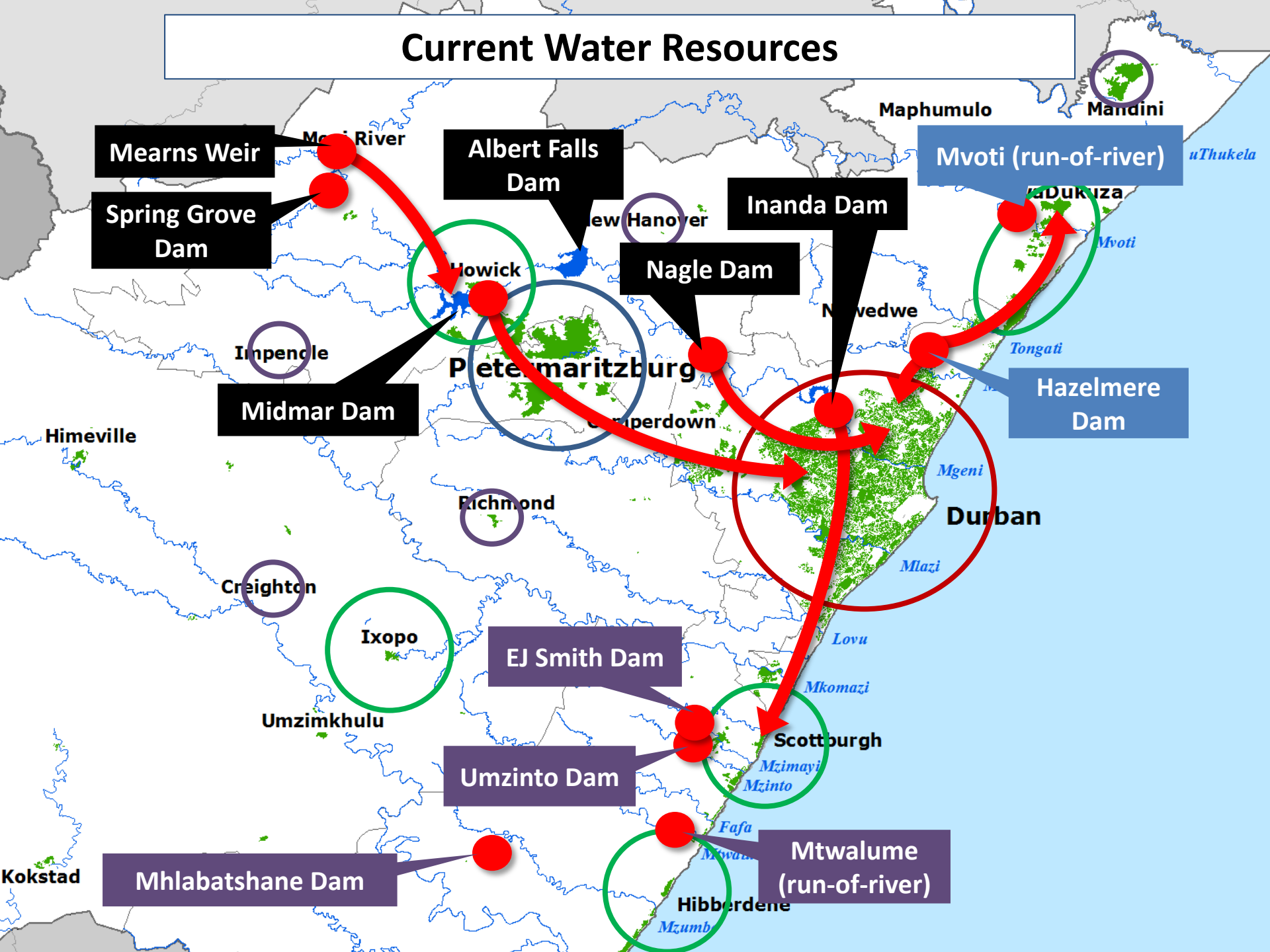
Report by Umgeni Water

03 March 2016

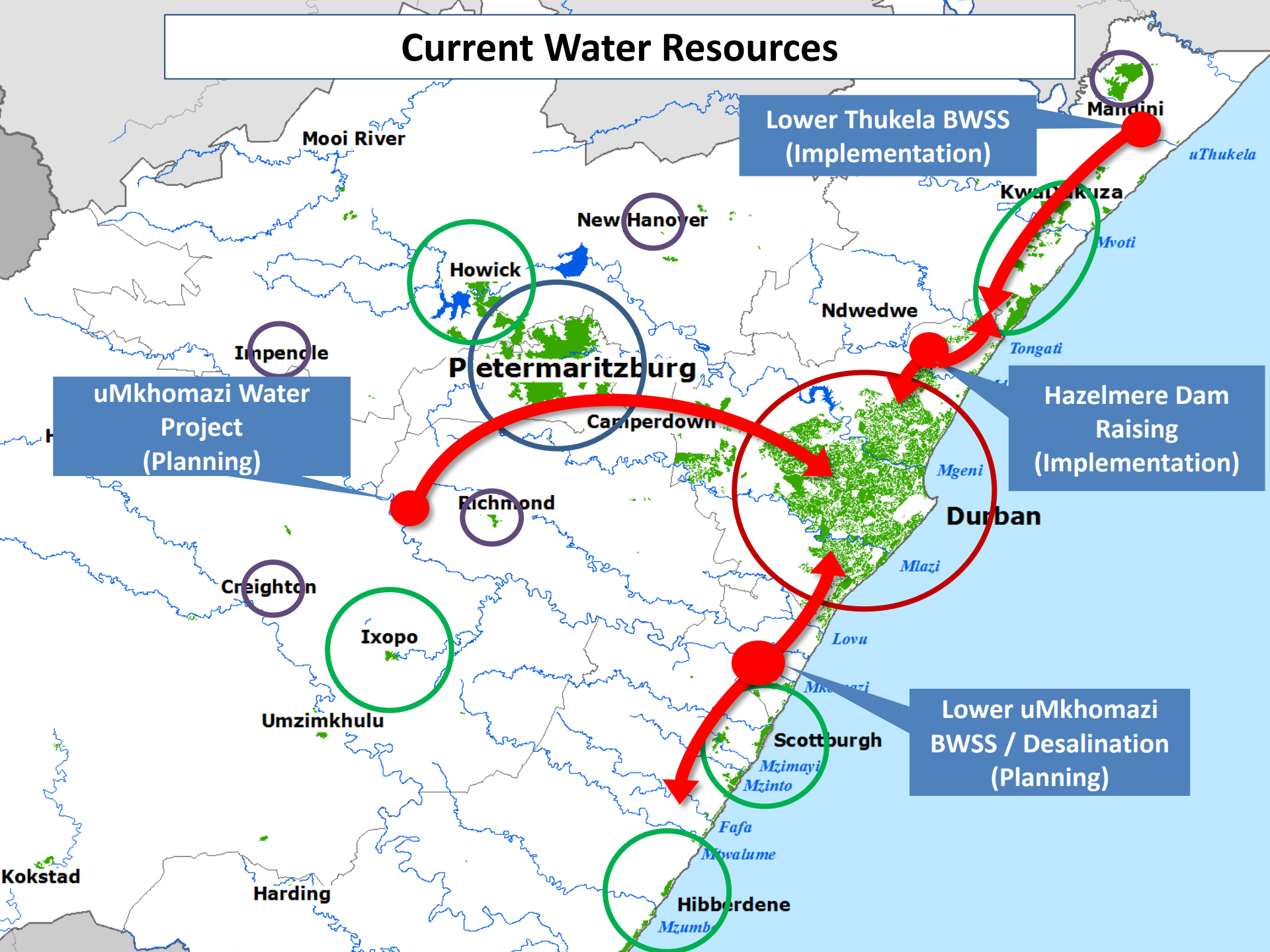
Parts of KwaZulu-Natal are in a drought situation
Please play your part by **saving water now**

2015 - 2016: Year of the Freedom Charter
Umgeni Water subscribes to the values, principles and spirit of the Freedom Charter.

2015 the Year of the Freedom Charter


Current Water Resources
Mearns Weir
Spring Grove Dam
Albert Falls Dam
Inanda Dam
Nagle Dam
Midmar Dam
Mvoti (run-of-river)
Hazelmere Dam
EJ Smith Dam
Umzinto Dam
Mtwalume (run-of-river)
Mhlabatshane Dam
Maphumulo
Mandini
uThukela
Mvoti
Tongati
Howick
Impendle
Himeville
Richmond
Durban
Mgeni
Mlazi
Lovu
Mkomazi
Creighton
Ixopo
Umzimkhulu
Scottburgh
Mzimayi
Mzinto
Fafa
Kokstad
Hibberdene
Mzumb

Current Water Resources



Lower Thukela Bulk Water Supply Scheme

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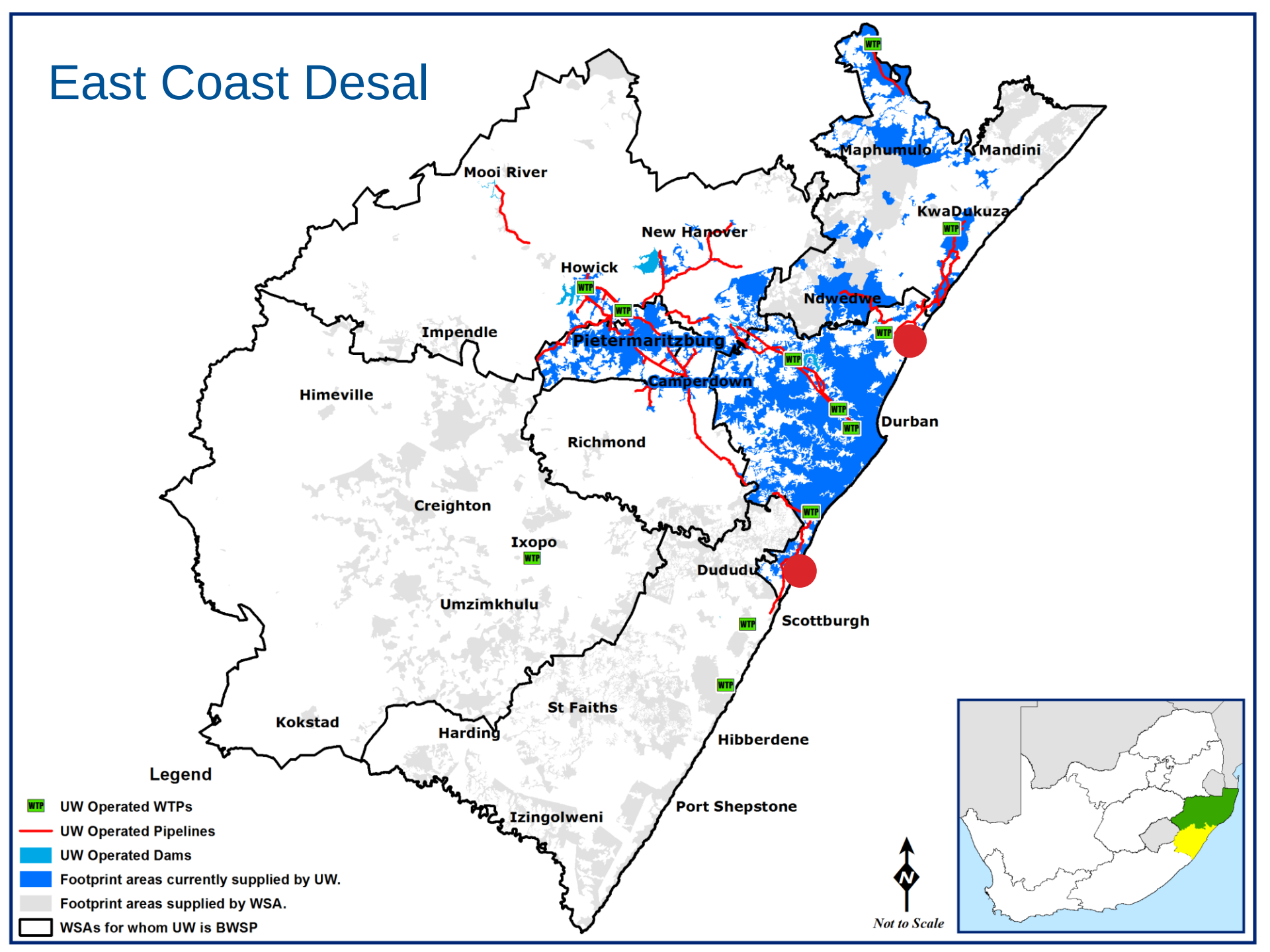
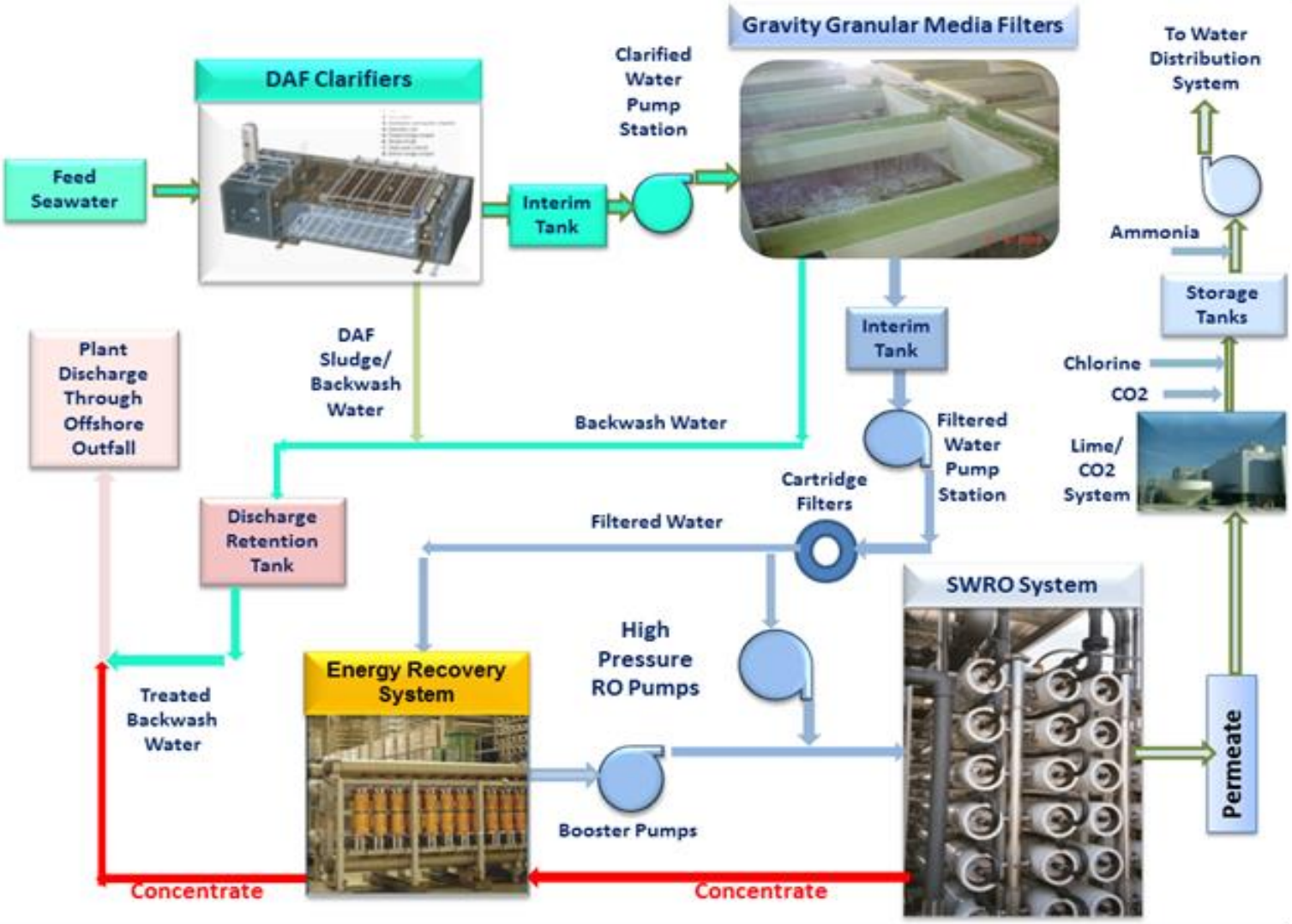
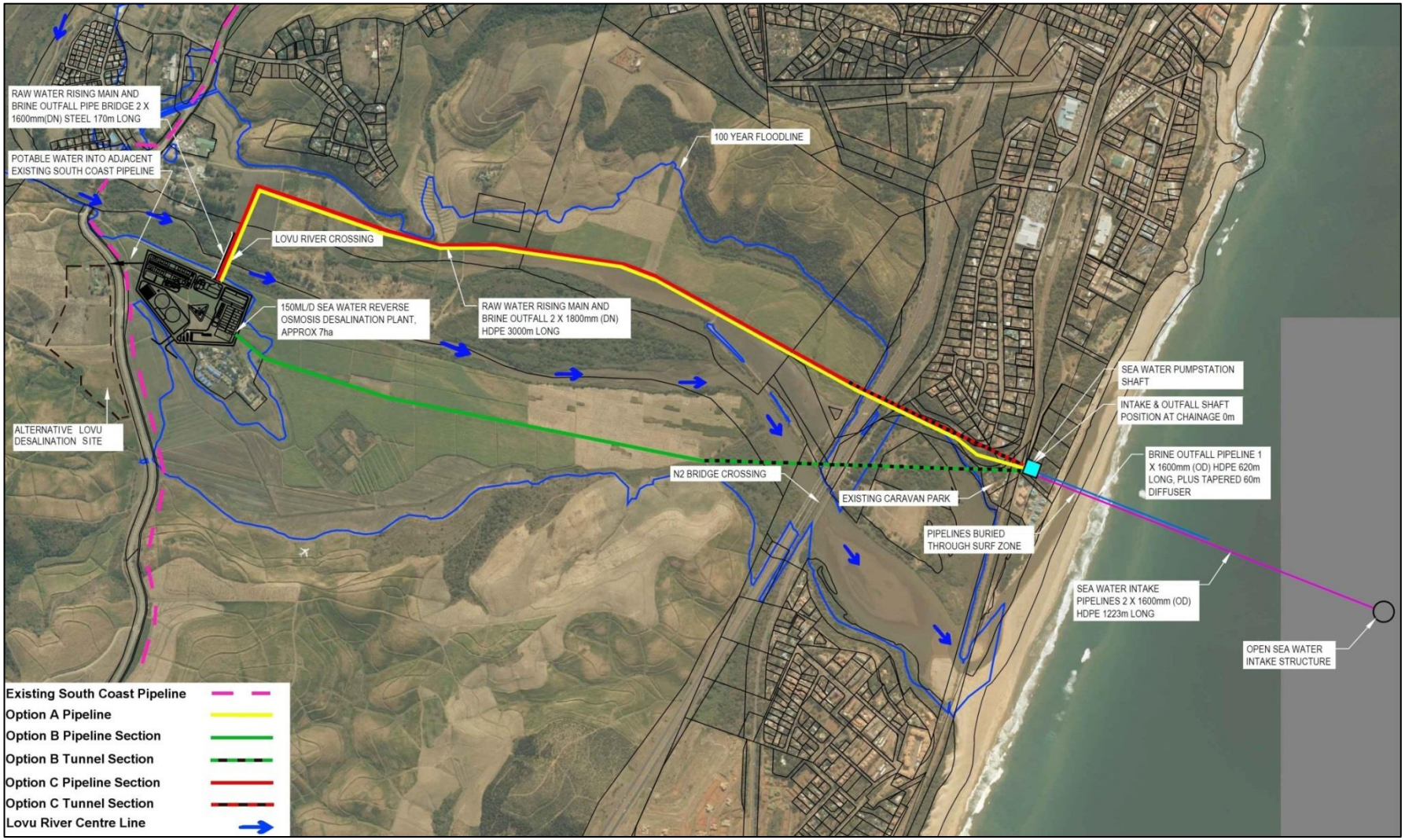
East Coast Desal



Conventional Plant



Lovu Layout


RAW WATER RISING MAIN AND BRINE OUTFALL PIPE BRIDGE 2 X 1600mm(DN) STEEL 170m LONG
POTABLE WATER INTO ADJACENT EXISTING SOUTH COAST PIPELINE
100 YEAR FLOODLINE
LOVU RIVER CROSSING
150ML/D SEA WATER REVERSE OSMOSIS DESALINATION PLANT, APPROX 7ha
RAW WATER RISING MAIN AND BRINE OUTFALL 2 X 1800mm (DN) HDPE 3000m LONG
ALTERNATIVE LOVU DESALINATION SITE
SEA WATER PUMPSTATION SHAFT
INTAKE & OUTFALL SHAFT POSITION AT CHAINAGE 0m
BRINE OUTFALL PIPELINE 1 X 1600mm (OD) HDPE 620m LONG, PLUS TAPERED 60m DIFFUSER
N2 BRIDGE CROSSING
EXISTING CARAVAN PARK
PIPELINES BURIED THROUGH SURF ZONE
SEA WATER INTAKE PIPELINES 2 X 1600mm (OD) HDPE 1223m LONG
OPEN SEA WATER INTAKE STRUCTURE
Existing South Coast Pipeline
Option A Pipeline
Option B Pipeline Section
Option B Tunnel Section
Option C Pipeline Section
Option C Tunnel Section
Lovu River Centre Line

Capital Cost - Lovu

Desalination Plant Construction	Cost (Rands)
a. Marine Intake Works	191,000,000
b. Marine Discharge Works	51,000,000
c. Temporary Works (Jetties, sheet piling, dewatering)	185,000,000
d. Discharge Pipe from Plant to Outfall	134,900,000
e. Intake Pump Station	87,600,000
f. Intake Pipeline from Pump Station to Desalination Plant	134,900,000
g. First Stage Gravity Filters	162,408,000
h. Second Stage Gravity Media Filters	162,408,000
i. Desalination System (Including Energy Recovery)	1,167,354,000
j. Product Water Re-mineralization System	43,673,000
k. Product Water Disinfection System	13,648,000
l. Waste Disposal System	9,963,000
m. Site Preparation	6,414,000
n. Product Water Storage Tank	61,415,000
p. High-voltage Plant Power Substation & Conduits	55,500,000
q. Electrical and Instrumentation System	300,250,000
r. Other Construction/Procurement/Installation Costs	38,214,000
s. Treated Water Pumps and SCS Pipeline Upgrade	222,620,000
Sub total	3,028,267,000
t. Construction Cost Contingency (assumed 25% of all above costs)	757,067,000
CONSTRUCTION COST TOTAL	3,785,334,000
Other Related Costs	
a. Engineering (assume 8%)	302,827,000
b. Environmental and Social	5,000,000
c. Land Acquisition	1,000,000
d. Project Management and Administration (assumed 3%)	113,560,000
e. Geotechnical and Surveying Services	3,000,000
Sub total	425,387,000
GRAND TOTAL	4,210,721,000

Operational Costs - Lovu

O&M Cost	2021 (75 Ml/d) Rands	2021 %	2027 (150 Ml/d) Rands	2027 %
Operation and Maintenance Costs	31,822,522	15%	37,820,021	10%
Energy Costs	138,460,185	67%	293,908,212	74%
Plant Staff	9,583,373	5%	9,583,373	2%
Chemical Costs	19,499,392	9%	38,998,784	10%
Membrane Replacement	7,996,800	4%	15,993,600	4%
Total	207,362,272		396,303,990	
Contingency (10%)	20,736,227		39,630,399	
Total	228,098,500		435,934,389	

Cost of Water Produced - Lovu

Scenario	Electricity Increase	Combined Tariff (includes capital and O&M Costs) R/kl	Capital Charge (to redeem capital costs only) R/kl	Operating and Maintenance Cost (R/kl) (150 Ml/d)
A	Electricity increase with inflation	12.33	6.54	5.79
	Electricity increases - Eskom Requirement	13.78	6.54	7.24
B	Electricity increase with inflation	6.35	0.56	5.79
	Electricity increases - Eskom Requirement	7.8	0.56	7.24
C	Electricity increase with inflation	8.65	2.86	5.79
	Electricity increases - Eskom Requirement	10.1	2.86	7.24

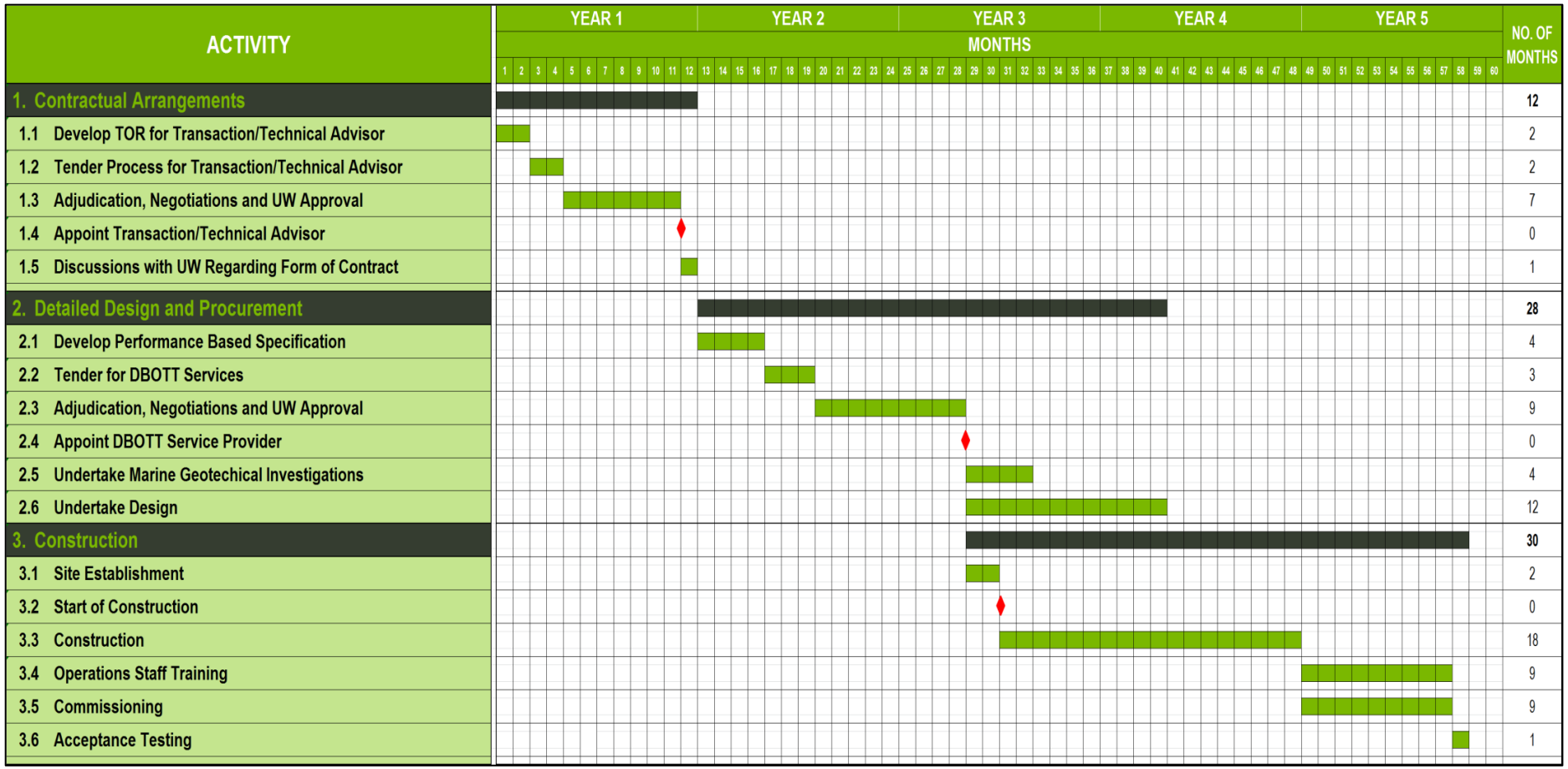
Risk

Risk No.	Risk Category	Risk Description	Impact	Potential Fatal Flaw	Consequences	Probability	Control Strength	Residual Risk	Residual Risk	Recommended Mitigation Actions / Control Measures	Responsibility
22	Techinical	(Tongaat) Offshore geotechnical drilling reveals tunnelling is not feasible.	Project not possible at Tongaat site within expected budget.	Yes	Catastrophic	Unlikely	Unsatisfactory	9	Medium	Undertake offshore. Geotechnical drilling to determine likelihood of project feasibility.	Umgeni Water
72	Financial / Procurement	High Tender Prices	Total tendered price is higher than that allowed for by Umgeni Water	No	Moderate	Moderate	Unsatisfactory	8.1	Medium	Ensure cost estimates in feasibility study are based on most recent prices.	Umgeni Water
5	Techinical	(Lovu) Geology in surf zone requires excessive volume of hard rock excavation	Difficulty to blast and remove rock; not built according to design; escalated costs and project duration.	No	Major	Moderate	Satisfactory	6	Medium	Supplementary geotechnical investigation. If bedrock level too high, consider alternative design and construction options - Tunnelling	Designer and Umgeni Water
52	Operational	Labour Unrest	Delays in Contract completion date	No	Moderate	Likely	Satisfactory	6	Medium	Liasion with local communities/tribal authorities on employment issues	Umgeni Water
57	Social / Environmental	Increased pressure on the electricity grid.	Could face particular public criticism for depending entirely on an already stressed power supply grid and for not investing sufficient effort on supplementary "green" options.	No	Moderate	Likely	Satisfactory	6	Medium	Further investigate alternative power supply options.	Eskom
66	Financial / Procurement	Rand : Dollar exchange rate.	Capital raised on international markets will be much more expensive to repay if the Rand continues to weaken.	No	Moderate	Likely	Satisfactory	6	Medium	Raise as much of the finance as possible domestically.	Umgeni Water
69	Financial / Procurement	Interdependency of Contract programmes where separate contracts for separate components of the works are used.	Installation and subsequent commissioning delays	No	Moderate	Likely	Satisfactory	6	Medium	Strict Site supervision and Contract Admin to be in place. Regular meetings to co-ordinate smooth interdependencies.	Umgeni Water
2	Techinical	(Lovu) Incorrect installation of marine pipelines due to difficulty to cross the surf zone with deep pipe trench - major high points	Pipes not installed to grade, forms major high point and affects operation.	Yes	Major	Unlikely	Weak	5.6	Low	Utilise experienced contractor; clear contractual communication regarding risk.	Umgeni Water
3	Techinical	(Lovu) Storm damage to temporary works, ie jetty and sheet piling, during construction	Escalated costs and project duration, project overruns	No	Moderate	Moderate	Satisfactory	4.5	Low	Utilise experienced contractor; limit time required for temporary works; good control on site; good knowledge of geotechnical conditions to reduce construction time.	Umgeni Water
65	Financial / Procurement	Tariffs exceed affordability / willingness to pay.	Water becomes unaffordable.	No	Moderate	Moderate	Satisfactory	4.5	Low	Introduce an early phasing of tarrif increases well ahead of desalination implementation. Consider alternative financing structures to mitigate the impact on tariffs. Ensure most apprpriate procurement model is selected.	Umgeni Water

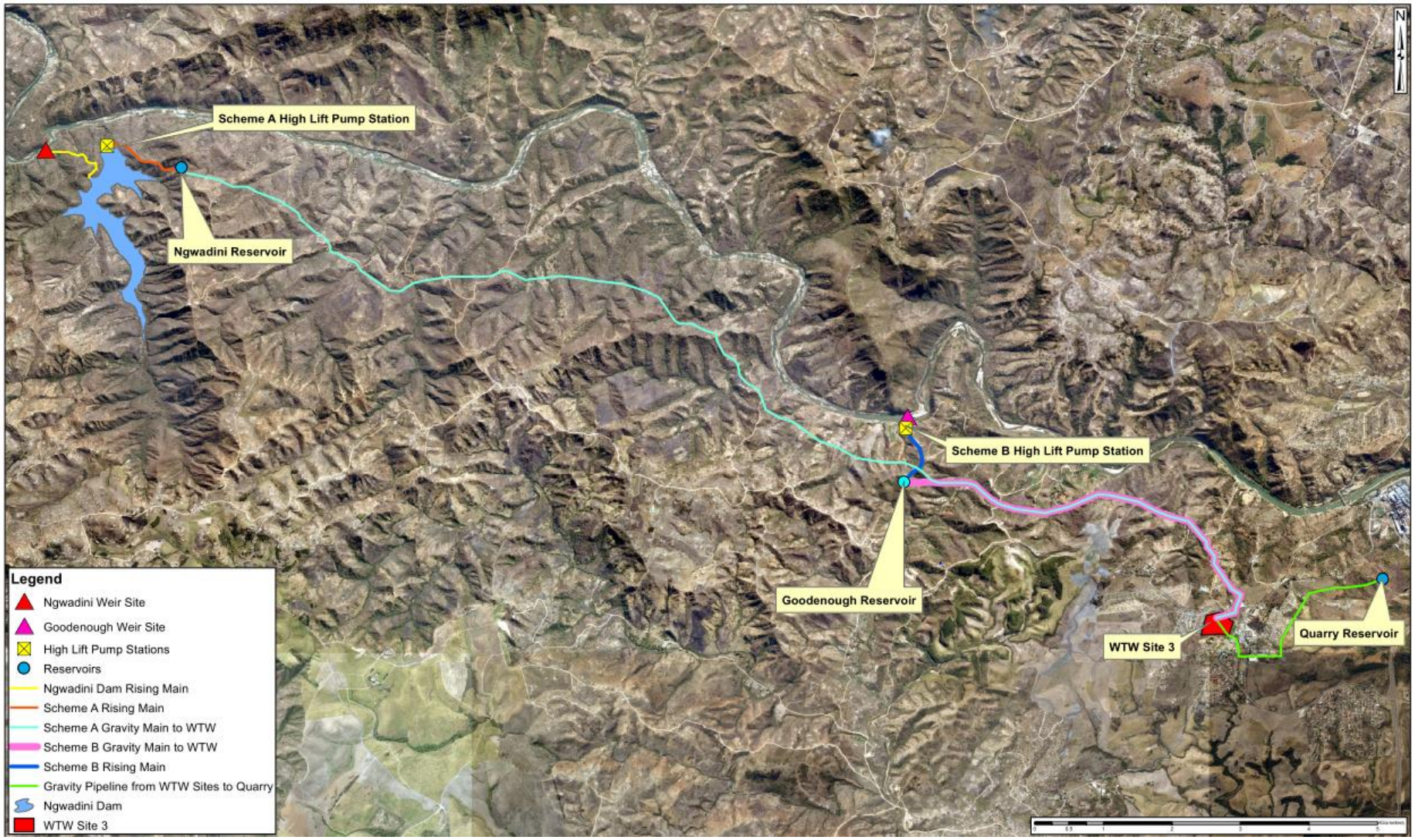
Institutional Arrangements

OPTIONS	Prelim design	Design	Construction	Com-missioning	Operations	Financing	Permitting	Asset ownership
DBB	Umgeni	Umgeni	Umgeni	Umgeni	Umgeni	Umgeni	Umgeni	Umgeni
DBB+O	Umgeni	Umgeni	Umgeni	Umgeni	Private	Umgeni	Umgeni	Umgeni
DB	Umgeni	Private	Private	Private	Umgeni	Umgeni	Umgeni	Umgeni
DB+O	Umgeni	Private	Private	Private	Private	Umgeni	Umgeni	Umgeni
DBO	Umgeni	Private	Private	Private	Private	Umgeni	Umgeni	Umgeni
DBO alliance	Umgeni	Shared	Shared	Shared	Shared	Shared	Umgeni	Umgeni
BOT	n/a	Private	Private	Private	Private	Private	Private	Umgeni

Implementation Programme



Lower uMkhomazi Bulk Water Supply



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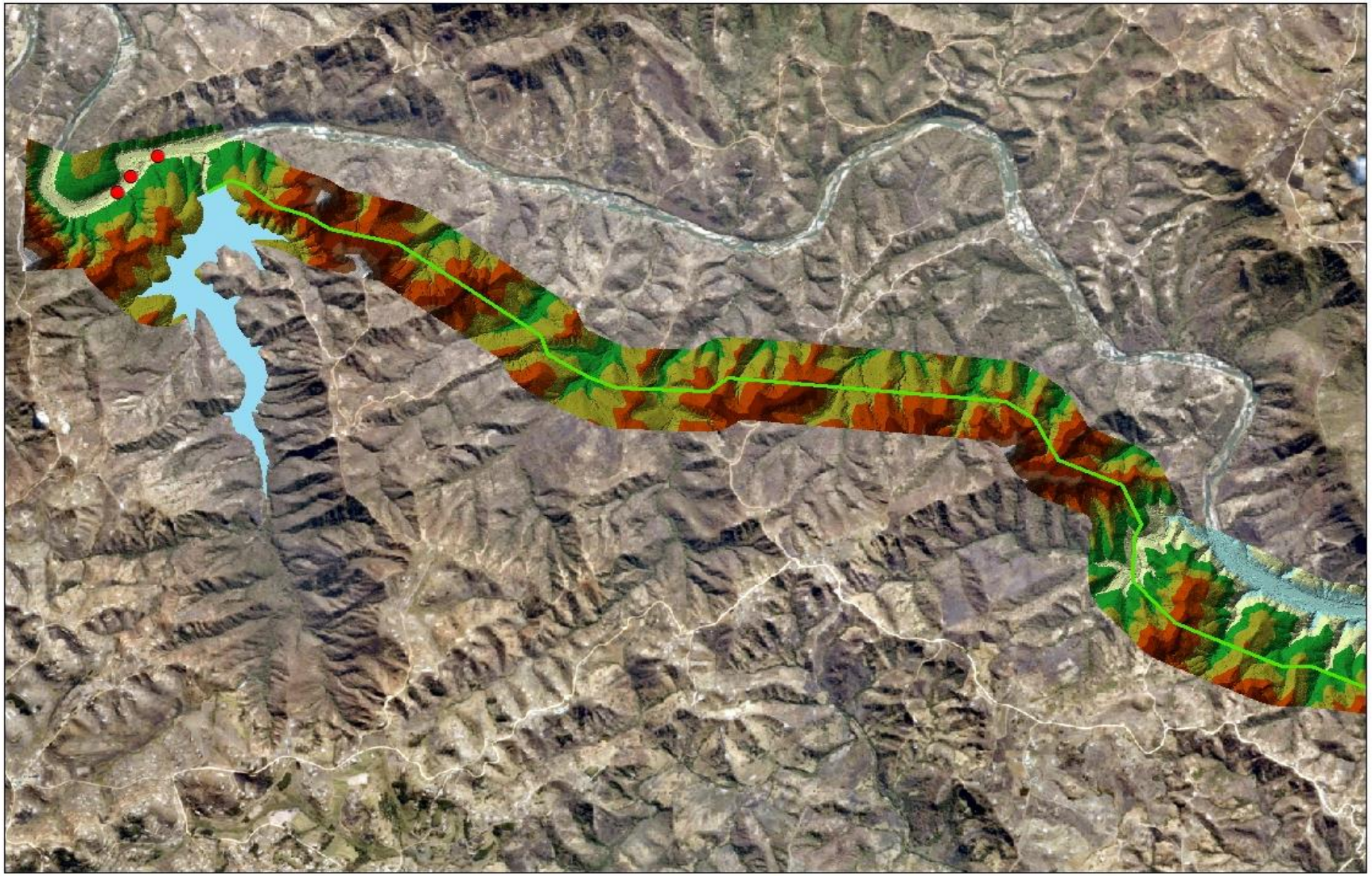

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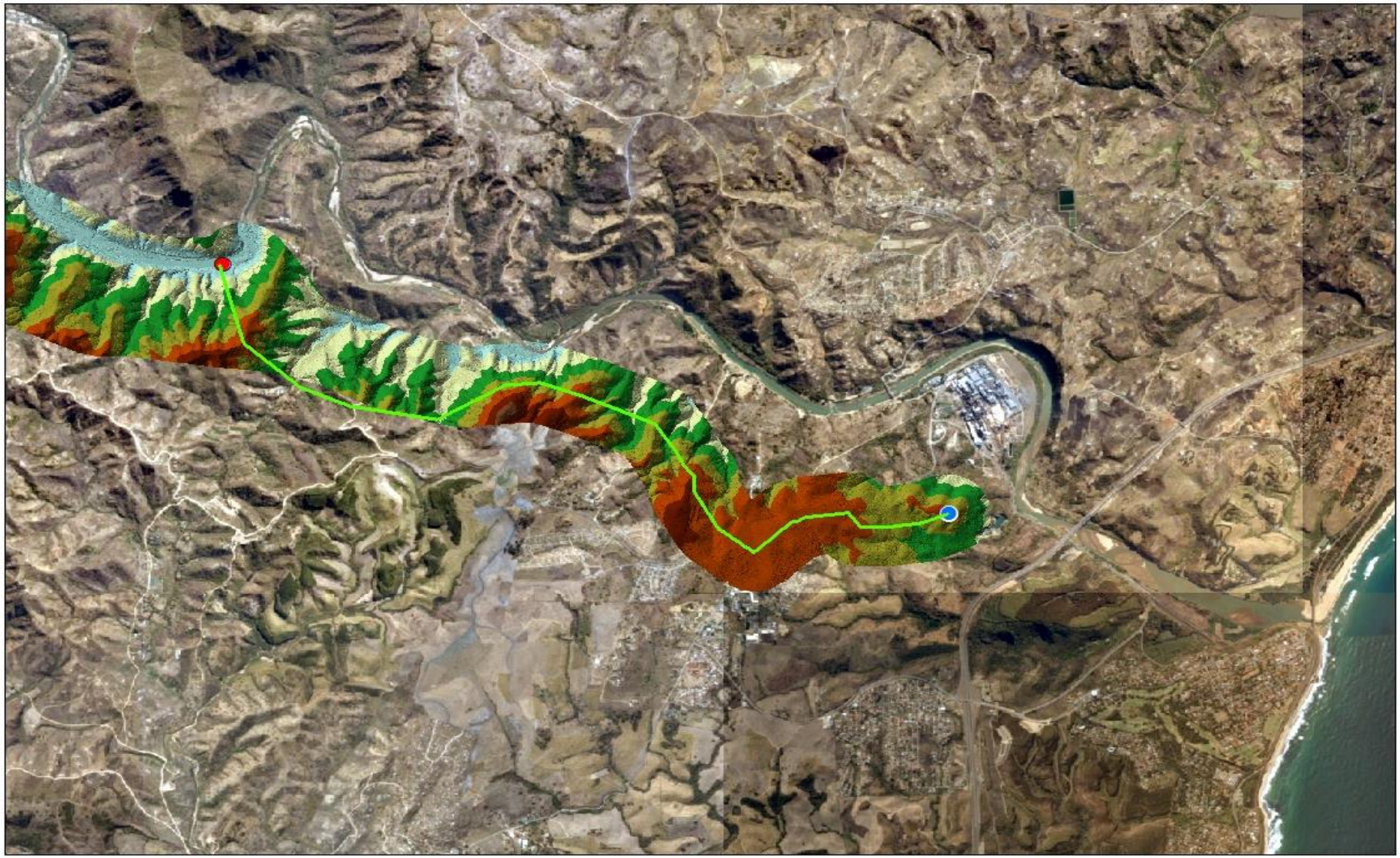
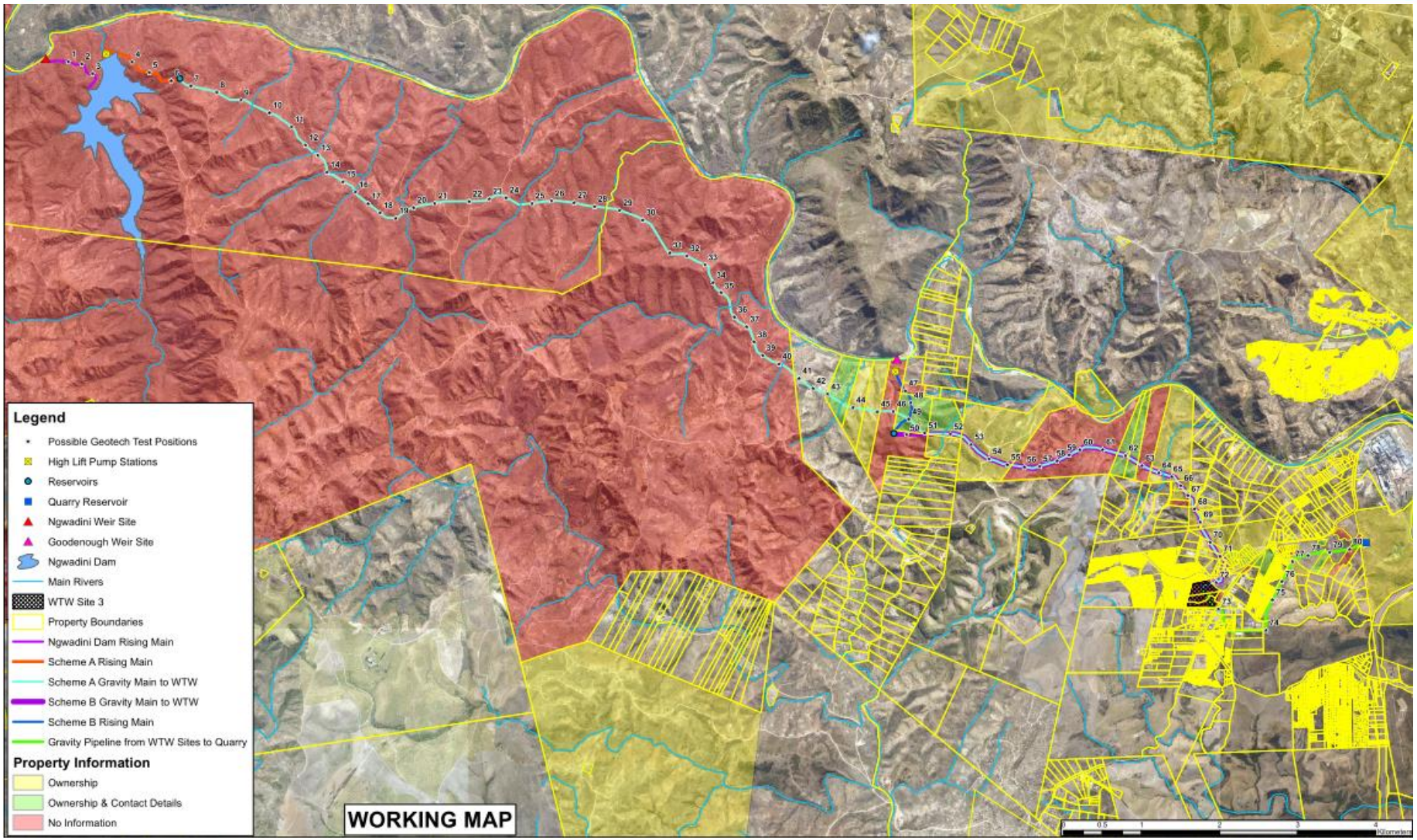


UMGENI WATER · AMANZI



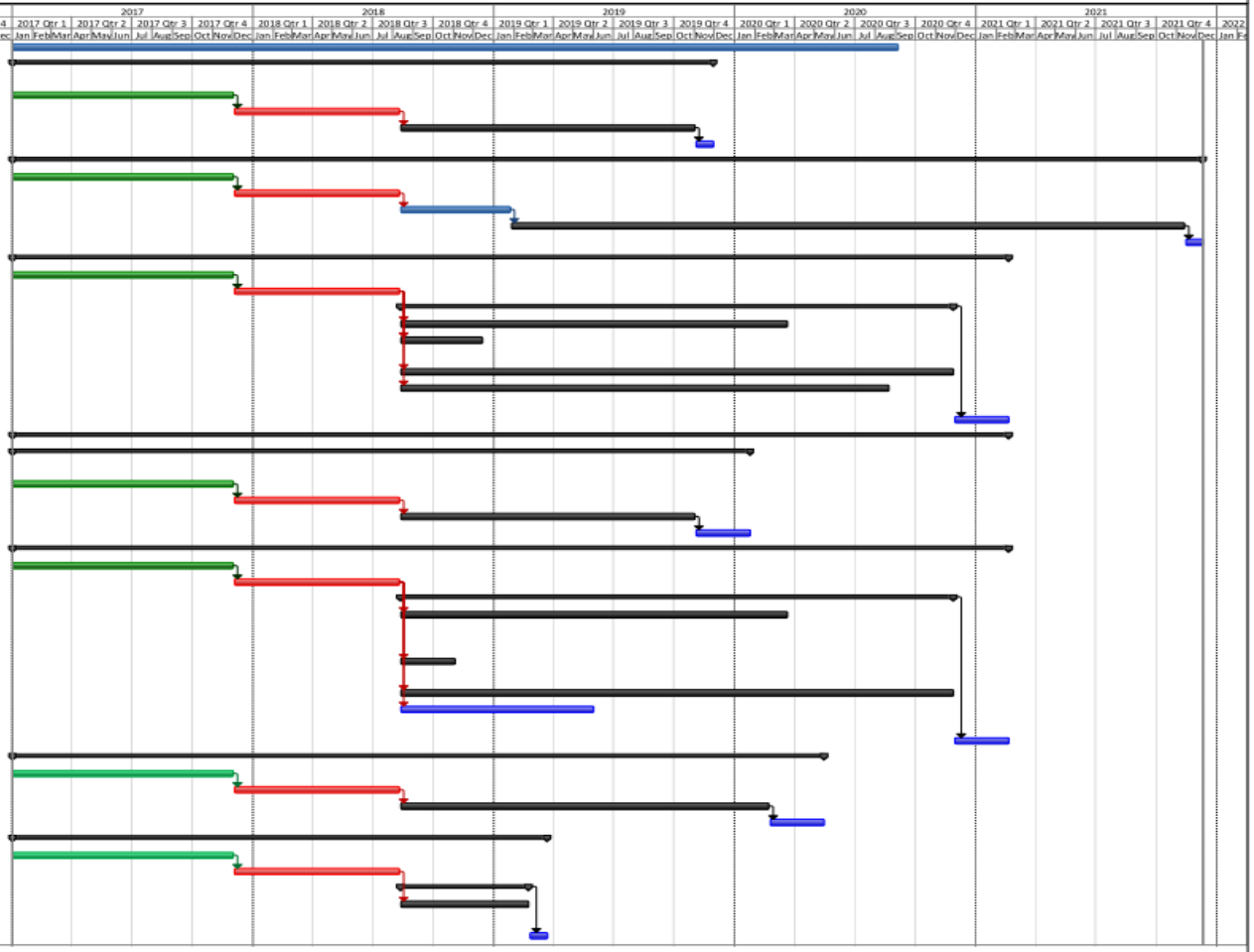
UMGENI WATER · AMANZI

Element	Scheme A		Scheme B		Difference
Description	Flows (m^3/s) Design	Costs (Rands) Civil and M&E	Flows (m^3/s) Design	Costs (Rands) Civil and M&E	Scheme B minus Scheme A
Ngwadini Weir	2.5 m high	R 25.3	2.5 m high	R 25.3	R 0.0
Abstraction works	2.62	R 101.0	1.00	R 65.7	R 35.3
low lift pump station	2.62		1.00		
Rising main to Dam	2.62	R 35.1	1.00	R 19.7	R 15.4
Ngwadini OCS Dam	10.5 million m^3/a	R 530.0	10.5 million m^3/a	R 530.0	R 0.0
High lift pump station	1.62	R 126.2	1.62	R 126.2	R 0.0
Rising main to Reservoir	1.62	R 39.6	1.62	R 24.4	R 15.2
Raw water reservoir	6 hours	R 68.1	6 hours	R 98.3	-R 30.1
Gravity main to WTP	1.62	R 418.8	1.62	R 147.2	R 271.7
WTP - treatment component	130 ML/d	R 652.6	130 ML/d	R 674.6	-R 22.0
WTP - sludge handling	125 NTU	R 38.1	805 NTU	R 105.0	-R 66.9
Goodenough Weir	N/A		1.72	R 111.2	-R 111.2
Goodenough abstraction works	N/A		1.72		R 0.0
Low lift pump station	N/A		1.72	R 12.1	-R 12.1
rising main to hydrocyclones	N/A		1.72	R 5.1	-R 5.1
Hydrocyclones	N/A		1.72	R 4.1	-R 4.1
Wet well for high lift pumps	N/A		20 minutes	R 7.5	-R 7.5
Gravity main to Quarry Res.	1.54	R 70.0	1.54	R 70.0	R 0.0
Electrical conveyance infra.	pumping points	R 9.8	pumping points	R 8.5	R 1.3
Total		R 2 114		R 2 035	R 79.7

Implementation Programme

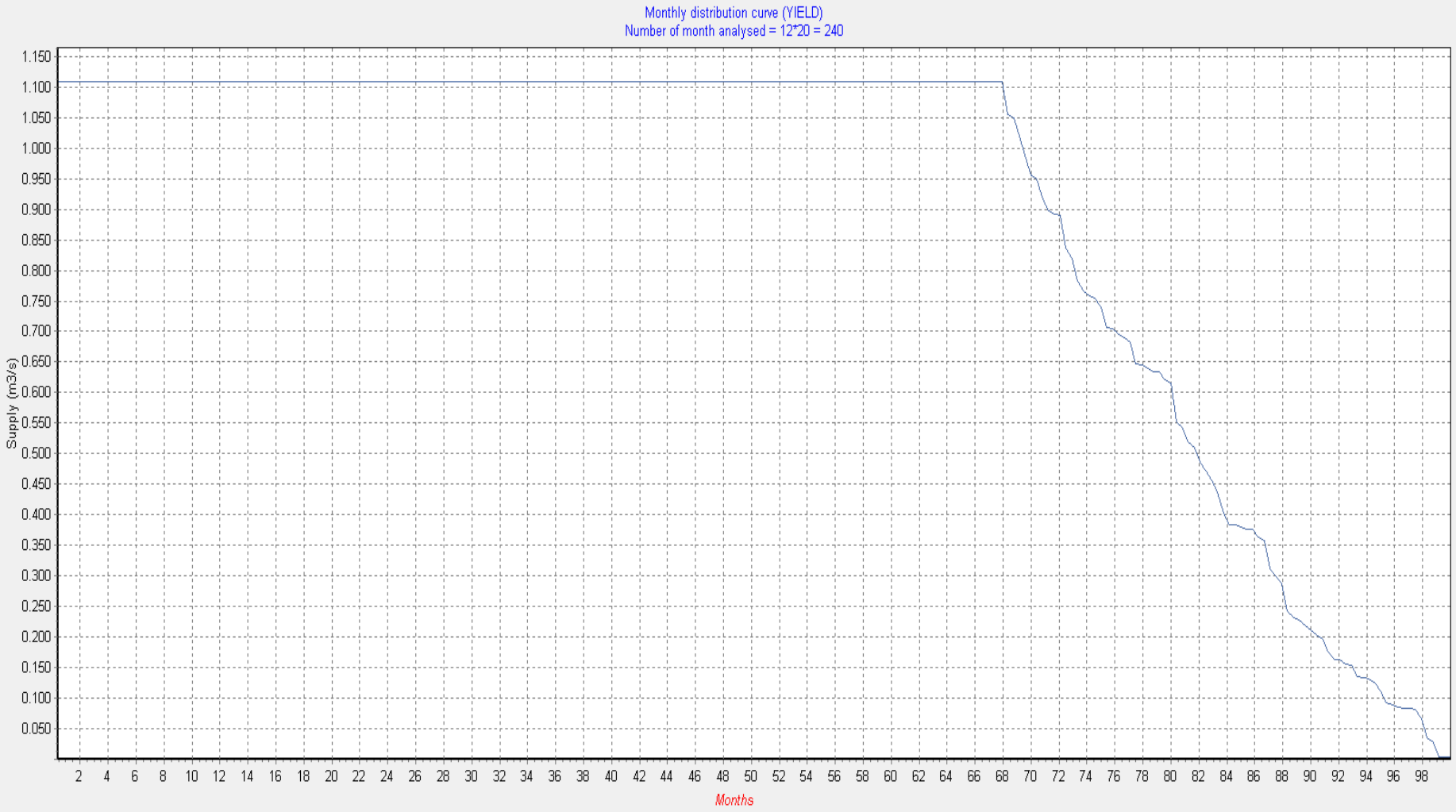
LOWER UMKHUMAZI WATER SUPPLY SCHEMES - PROGRAMME COMPARISON

ID	WBS	Task Name	Duration	Start	Finish
1	1	132kV Substation and transmission lines	48 mons	Mon 17/01/02	Fri 20/09/04
2	2	Ngwadini Abstraction Works (Incl. Low Lift Pumps & Rising Main)	760 days	Mon 17/01/02	Fri 19/11/29
3	2.1	Detailed Design	12 mons	Mon 17/01/02	Fri 17/12/01
4	2.2	Tender and Adjudication	9 mons	Mon 17/12/04	Fri 18/08/10
5	2.3	Construction	320 days	Mon 18/08/13	Fri 19/11/01
6	2.4	Commissioning & Close Out	20 days	Mon 19/11/04	Fri 19/11/29
7	3	Ngwadini Dam	1290 days	Mon 17/01/02	Fri 21/12/10
8	3.1	Detailed Design	12 mons	Mon 17/01/02	Fri 17/12/01
9	3.2	Tender and Adjudication	9 mons	Mon 17/12/04	Fri 18/08/10
10	3.3	Site Establishment	120 days	Mon 18/08/13	Fri 19/01/25
11	3.4	Construction	730 days	Mon 19/01/28	Fri 21/11/12
12	3.5	Commissioning & Close Out	20 days	Mon 21/11/15	Fri 21/12/10
13	4	Scheme A	1080 days	Mon 17/01/02	Fri 21/02/19
14	4.1	Detailed Design	12 mons	Mon 17/01/02	Fri 17/12/01
15	4.2	Tender and Adjudication	9 mons	Mon 17/12/04	Fri 18/08/10
16	4.3	Construction	600 days	Mon 18/08/13	Fri 20/11/27
17	4.3.1	High Lift Pumpstation Scheme A (HL P/S A	420 days	Mon 18/08/13	Fri 20/03/20
18	4.3.2	Rising Main - HL P/S A to Ngwadini Reservoir (1.65km)	90 days	Mon 18/08/13	Fri 18/12/14
19	4.3.3	Ngwadini Reservoir	600 days	Mon 18/08/13	Fri 20/11/27
20	4.3.4	Gravity Main - Ngwadini Reservoir to WTW (17.3km)	530 days	Mon 18/08/13	Fri 20/08/21
21	4.4	Commissioning & Close Out	60 days	Mon 20/11/30	Fri 21/02/19
22	5	Scheme B	1080 days	Mon 17/01/02	Fri 21/02/19
23	5.1	Goodenough Abstraction Works (incl. Low Lift Pumps & Rising Main)	800 days	Mon 17/01/02	Fri 20/01/24
24	5.1.1	Detailed Design	12 mons	Mon 17/01/02	Fri 17/12/01
25	5.1.2	Tender and Adjudication	9 mons	Mon 17/12/04	Fri 18/08/10
26	5.1.3	Construction	320 days	Mon 18/08/13	Fri 19/11/01
27	5.1.4	Commissioning & Close Out	60 days	Mon 19/11/04	Fri 20/01/24
28	5.2	Balance Scheme B Infrastructure	1080 days	Mon 17/01/02	Fri 21/02/19
29	5.2.1	Detailed Design	12 mons	Mon 17/01/02	Fri 17/12/01
30	5.2.2	Tender and Adjudication	9 mons	Mon 17/12/04	Fri 18/08/10
31	5.2.3	Construction	600 days	Mon 18/08/13	Fri 20/11/27
32	5.2.3.1	High Lift Pumpstation Scheme B (HL P/S B)[incl. Wet Well & Hydrocyclones]	420 days	Mon 18/08/13	Fri 20/03/20
33	5.2.3.2	Rising Main - HL P/S B to Goodenough Reservoir (0.95km)	60 days	Mon 18/08/13	Fri 18/11/02
34	5.2.3.3	Goodenough Reservoir	600 days	Mon 18/08/13	Fri 20/11/27
35	5.2.3.4	Gravity Main - Goodenough Reservoir to WTW (6km)	210 days	Mon 18/08/13	Fri 19/05/31
36	5.2.4	Commissioning & Close Out	60 days	Mon 20/11/30	Fri 21/02/19
37	6	Water Treatment Works	880 days	Mon 17/01/02	Fri 20/05/15
38	6.1	Detailed Design	12 mons	Mon 17/01/02	Fri 17/12/01
39	6.2	Tender and Adjudication	9 mons	Mon 17/12/04	Fri 18/08/10
40	6.3	Construction	400 days	Mon 18/08/13	Fri 20/02/21
41	6.4	Commissioning & Close Out	60 days	Mon 20/02/24	Fri 20/05/15
42	7	Potable Supply Main to Quarry Reservoir	580 days	Mon 17/01/02	Fri 19/03/22
43	7.1	Detailed Design	12 mons	Mon 17/01/02	Fri 17/12/01
44	7.2	Tender and Adjudication	9 mons	Mon 17/12/04	Fri 18/08/10
45	7.3	Construction	140 days	Mon 18/08/13	Fri 19/02/22
46	7.3.1	Gravity/Rising Main to Quarry Reservoir (3.2km)	140 days	Mon 18/08/13	Fri 19/02/22
47	7.4	Commissioning & Close Out	20 days	Mon 19/02/25	Fri 19/03/22



Page 1

Risk of Not Constructing Ngwadini



Conclusions

- Lower Thukela first water April 2016

- Decision on Lower uMkhomazi vs Desalination April 2016