Revised Water Balance

Maintenance of the Crocodile West River System Reconciliation Strategy Study

SSC Meeting 3

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Presentation Layout

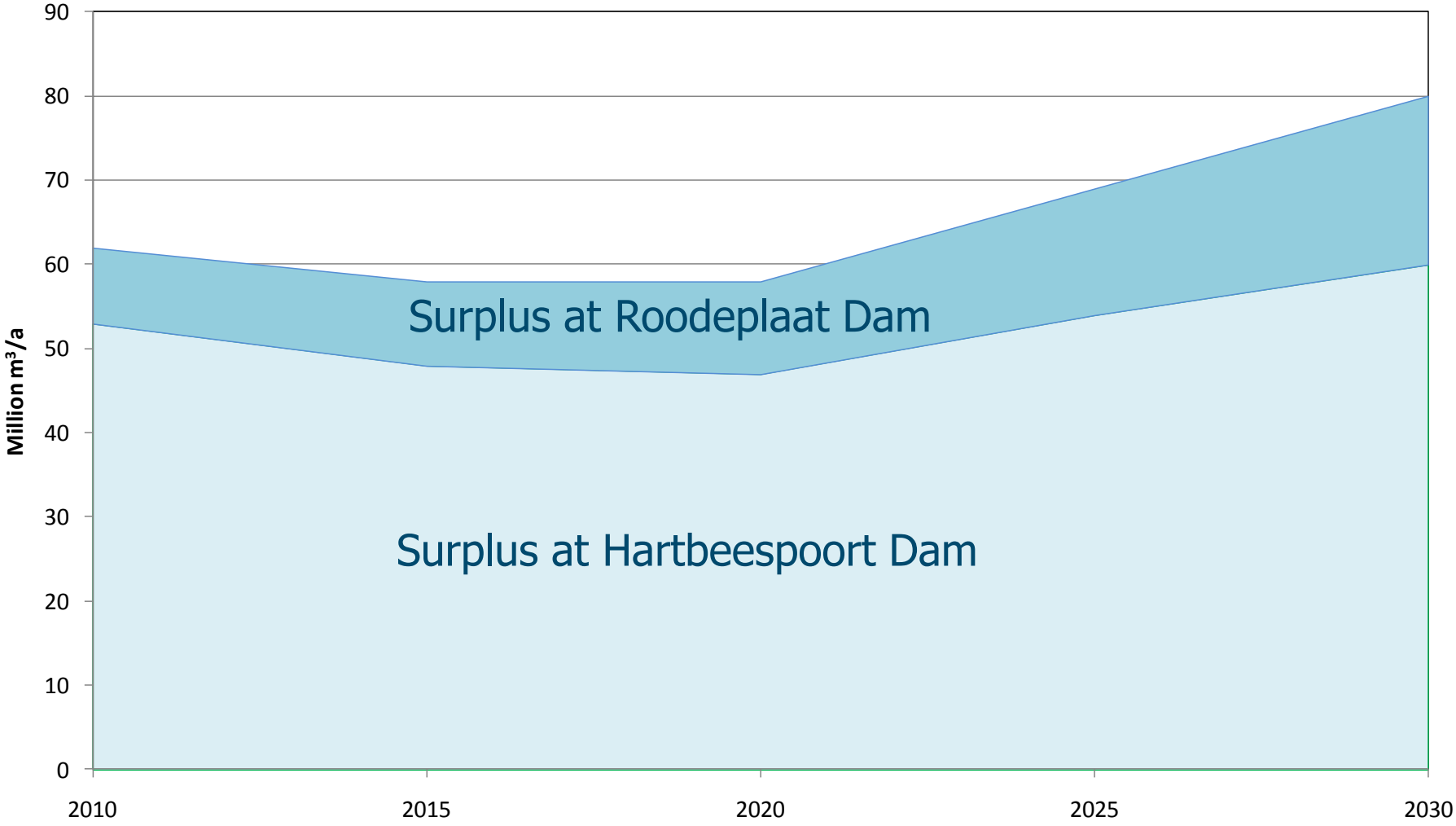
- Previous results
- Water requirements
- Scenarios
- Water balances
- WQT at Hartbeespoort

Previous Results (SSC2)

- Water Balance
  - Calculated taking the most up to date water requirements available at that time.
  - Surpluses determined at Hartbeespoort and Roodeplaat dams.
  - Water Quantity only.

Surplus in Crocodile Catchment at Key points

Crocodile high growth with WC/WDM



Urban Water Requirements (1)

- Water requirement scenarios
  - High population growth rate used for planning purposes
  - Medium WC/WDM efficiency assumed (15% saving achieved within 5 years)
  - Updated water requirement projections for the Rand Water supply area of the catchment obtained from the Vaal Reconciliation Strategy Study
  - Water requirement projections for other areas based on existing information – updated with recent water supply figures (2008 to 2010) e.g. Tshwane

Additional Information

- Water demand projections
  - Magalies Water
  - Madibeng
  - Tshwane
- Water re-use plan received from Tshwane:

Scenarios (1)

- Based on new information 3 main scenarios:

1. Base scenario – preferred planning scenario, and takes into account the new water license at Temba WPW (Leeuwkraal Dam).
2. Tshwane Re-use Scenario – which uses the base scenario water requirements but includes the various re-use projects planned.
3. Magalies Scenario – includes demands for some areas foreseen by Magalies Water and assumes supply increases in order to meet these requirements.

Scenarios (2)

- Additional considerations/scenarios:

1. WC/WDM outside of large Metro's within the Crocodile catchment.
2. Possible transfer of water to Lephalale.
3. Possible transfer of water to the Olifants River Catchment.
4. Possible re-use of water by Johannesburg MM.

WRPM Test

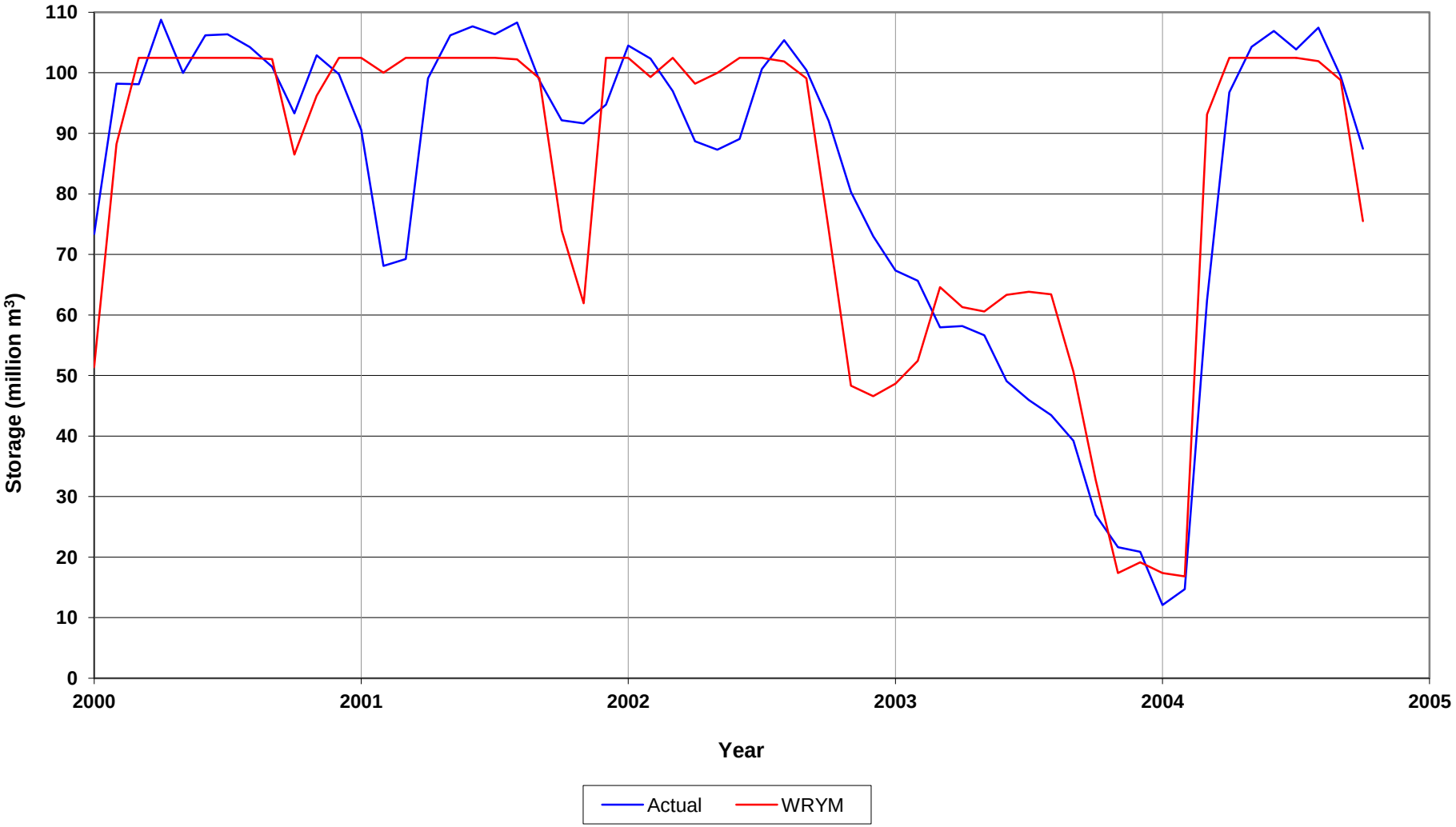
- Before we dive into updated water balances and scenario analyses …..
- There was a question posed at the previous meeting about water restrictions in the Lower Crocodile and how there could be a surplus?

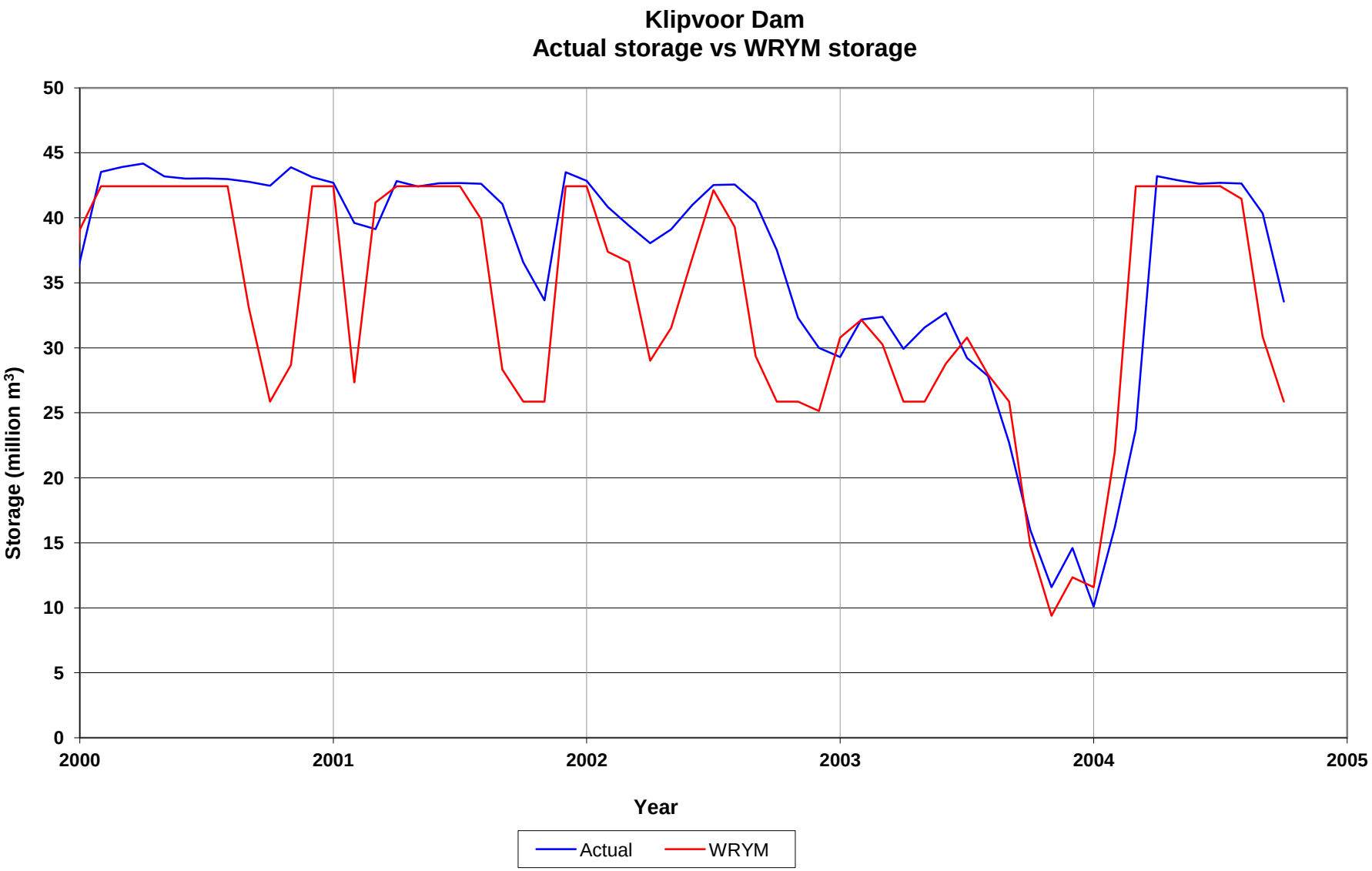
➢ The study team aimed at replicating what happened historically with the model as a verification test for the model.

Water Supply in Lower Crocodile

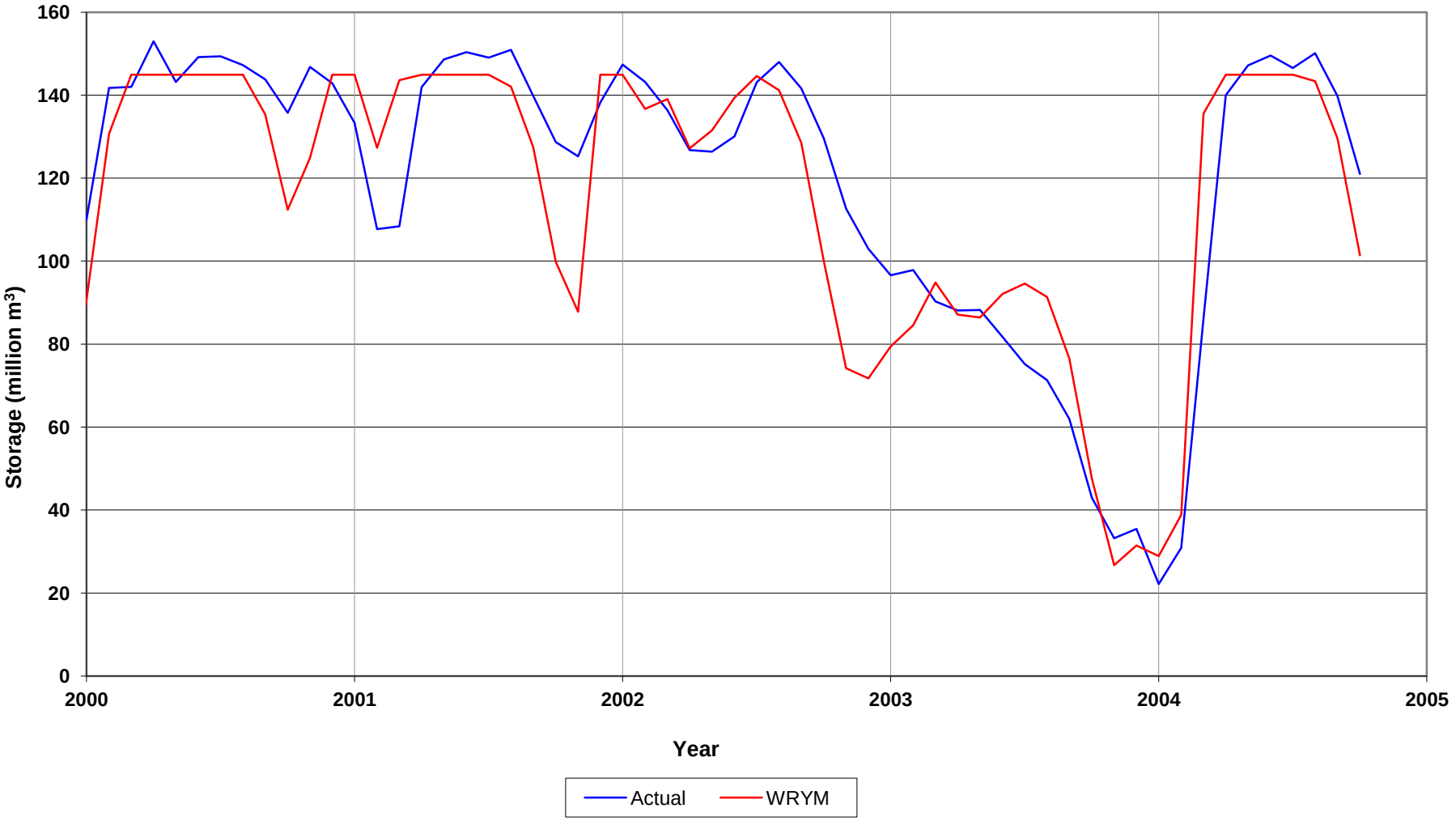
- Irrigators (CWIB) receive allocations from Roodekopjes and Klipvoor dams (which are used in approximately an equal draw-down manner).
- Historical irrigation water requirements simulated using crop information and areas.
- Losses in the Lower Crocodile model explicitly with sand aquifers calibrated against actual water levels in the aquifers.

Roodekopjes Dam
Actual storage vs WRYM storage

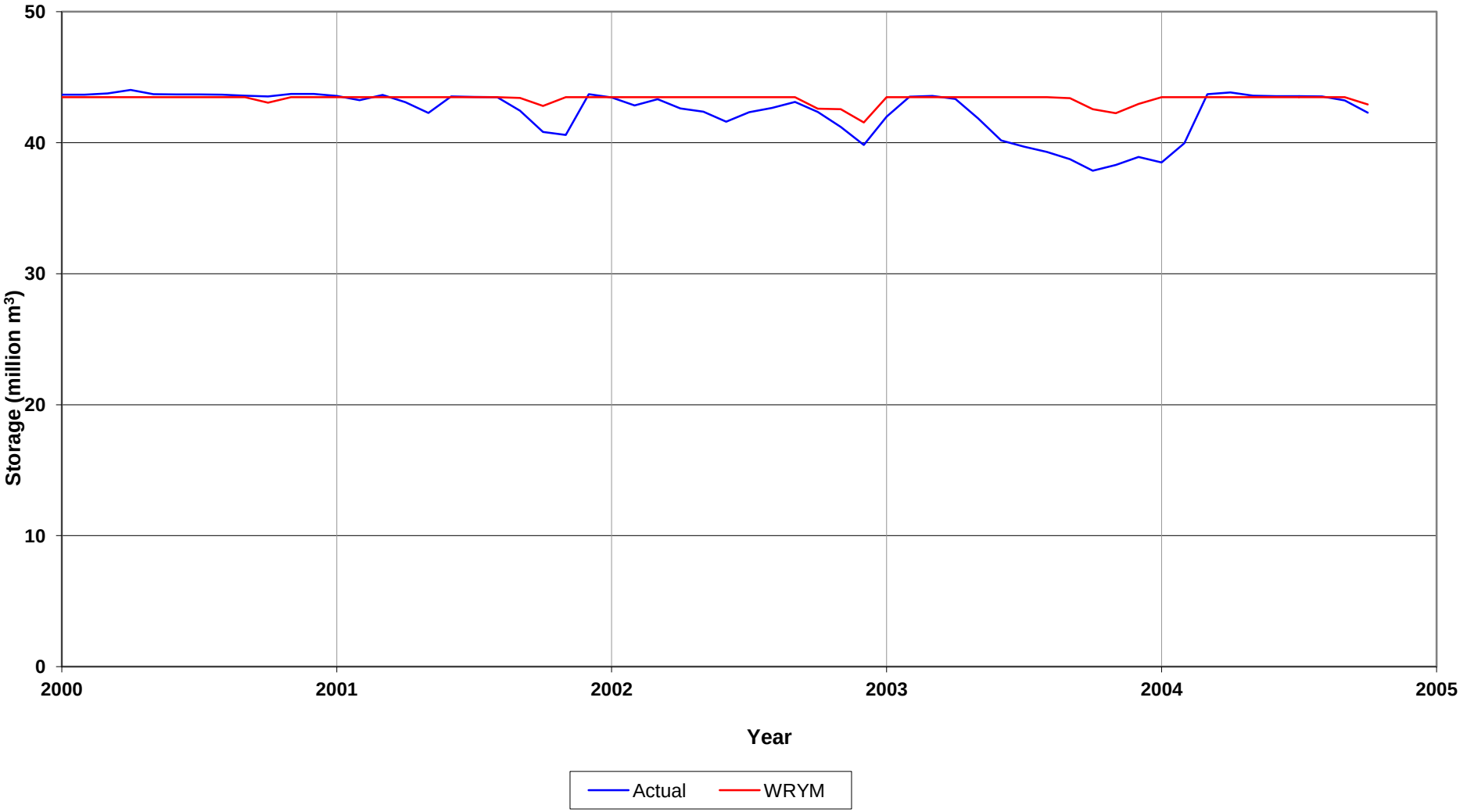


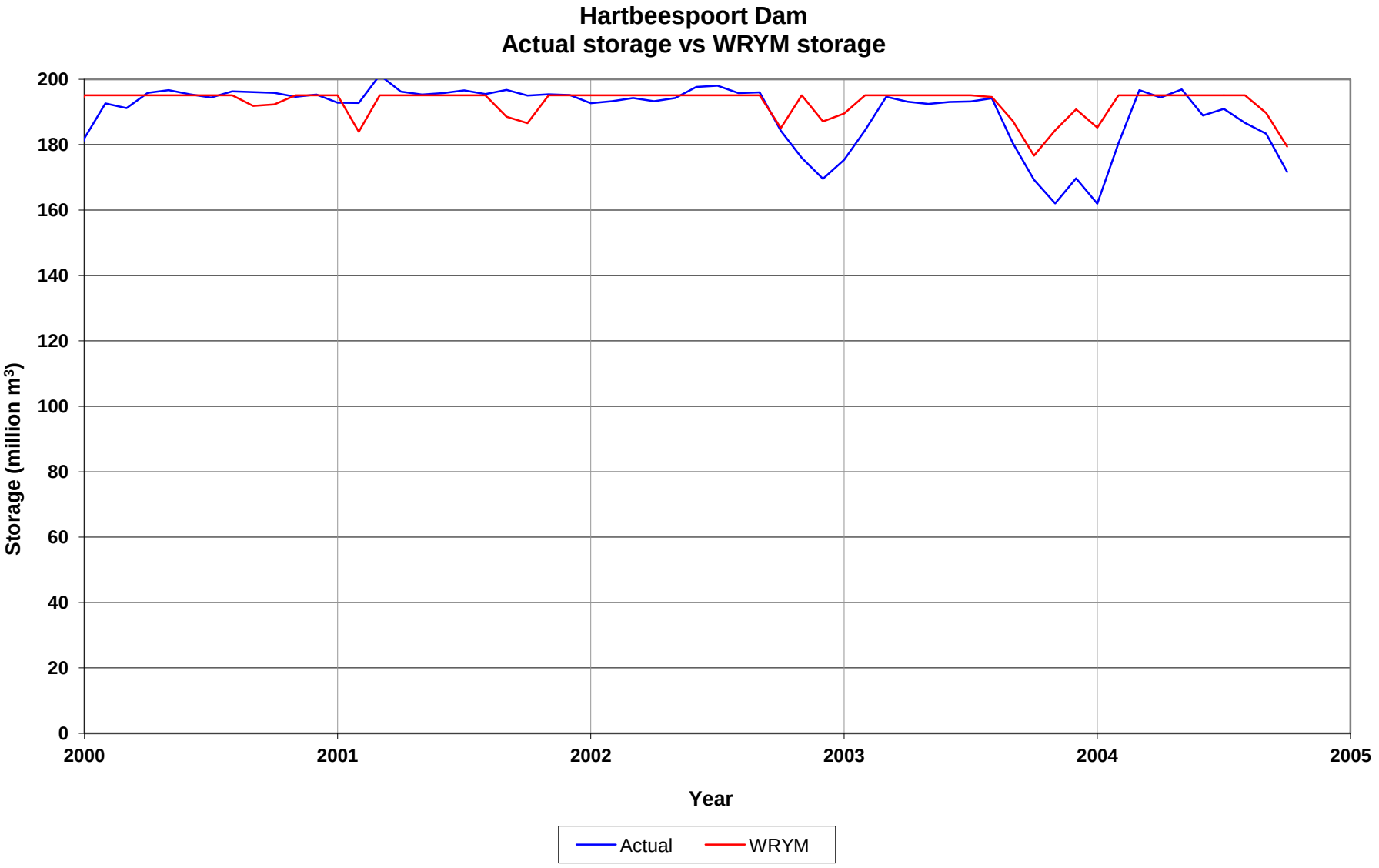

Klipvoor Dam
Actual storage vs WRYM storage
Storage (million m³)
50
45
40
35
30
25
20
15
10
5
0
2000
2001
2002
2003
2004
2005
Year
Actual
WRYM

Combined storage volumes
Roodekopjes + Klipvoor dams



Roodeplaat Dam
Actual storage vs WRYM storage




Hartbeespoort Dam
Actual storage vs WRYM storage
Storage (million m³)
200
180
160
140
120
100
80
60
40
20
0
2000
2001
2002
2003
2004
2005
Year
Actual
WRYM

WRPM Test - Summary

- During the 2002/2003 period, Roodekopjes and Klipvoor dams were drawn low due to particularly hot dry years.
- Although little drawn down due to the significant return flows in the upper Crocodile, Hartbeespoort and Roodeplaat dams did not spill much during this period?

➢ The surplus water sits up in Hartbeespoort and Roodeplaat dams which do not make releases to the lower Crocodile as there is no allocation.

Base Scenario - Updates

- Updated Water balance calculations include the following fine tuning:
- Recent water license upgrade from 60 Mℓ/d to 130 Mℓ/d and subsequent plan to upgrade Temba WPWs to 120 Mℓ/d.
- Modeling of irrigation requirements of HBP GWS using irrigation blocks (irrigation previously included as allocations with no annual variance).

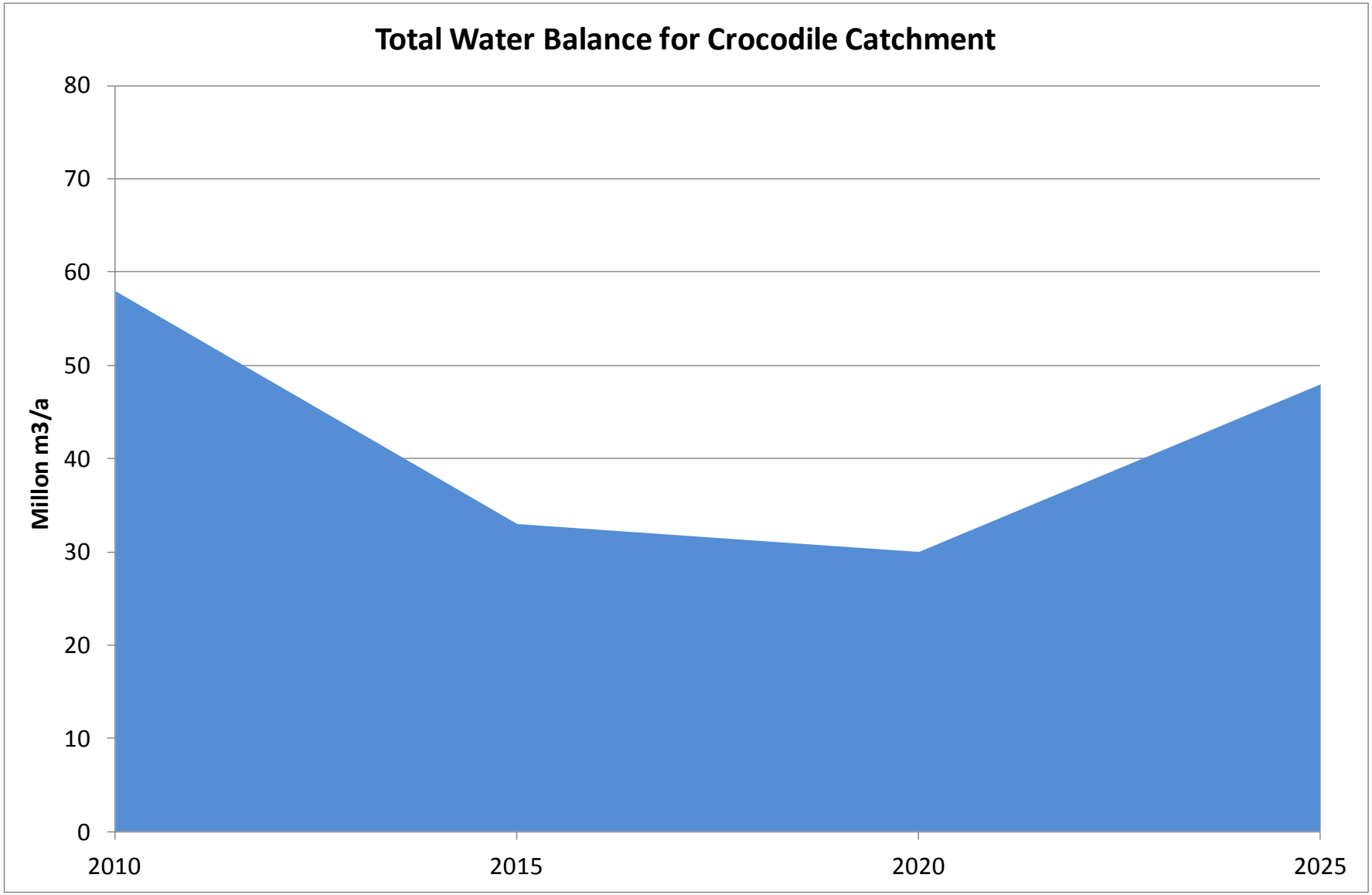
Base Scenario - Results

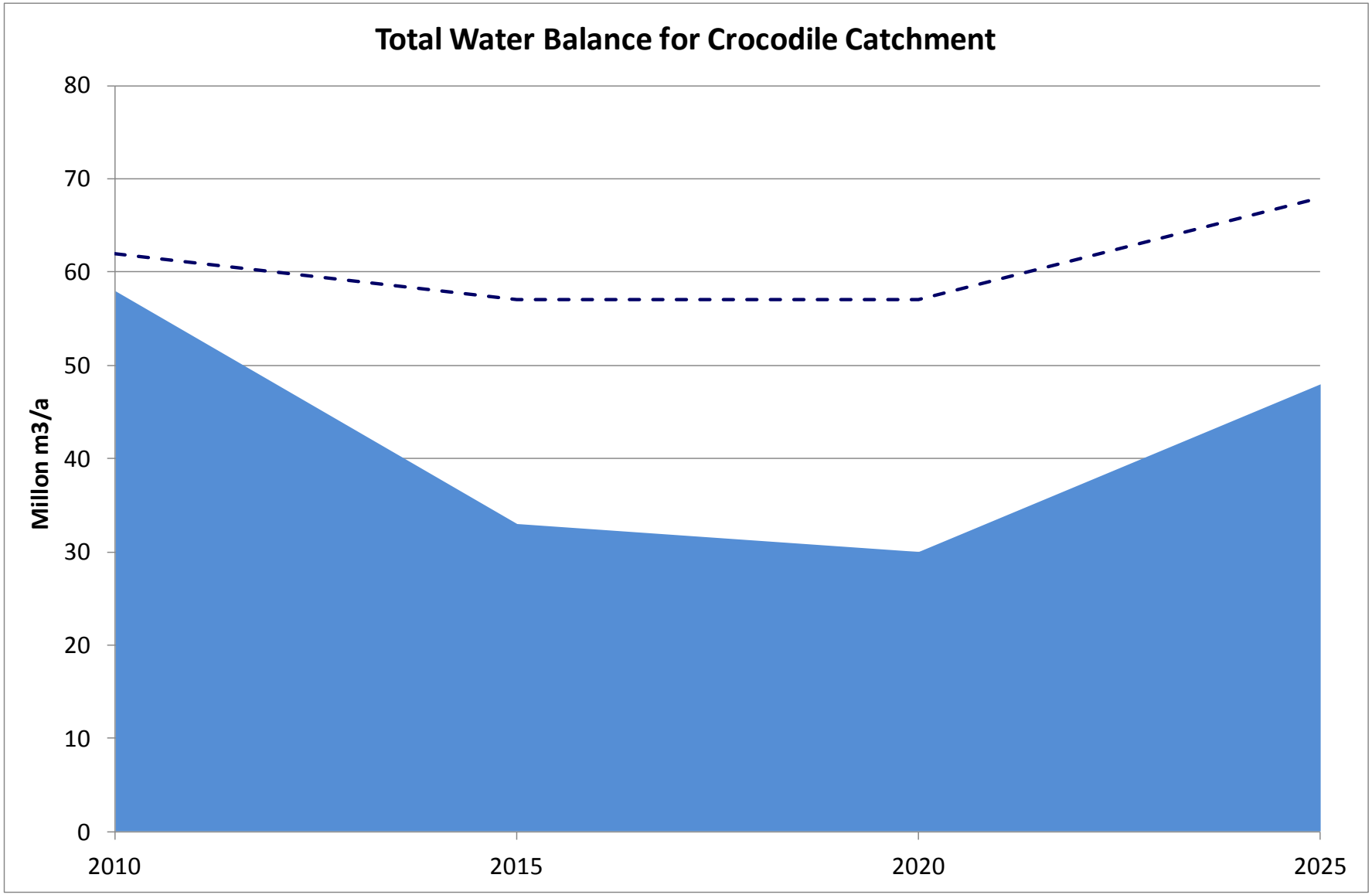
- Water balance calculated for 5 year time slices: 2010, 2015, 2020, 2025 up to 2030.
- Surplus available at 3 key points in the catchment:

➢ Hartbeespoort Dam

➢ Roodeplaat Dam

➢ Rietvlei Dam


Total Water Balance for Crocodile Catchment
Millon m3/a
80
70
60
50
40
30
20
10
0
2010
2015
2020
2025


Total Water Balance for Crocodile Catchment
Millon m3/a
80
70
60
50
40
30
20
10
0
2010
2015
2020
2025

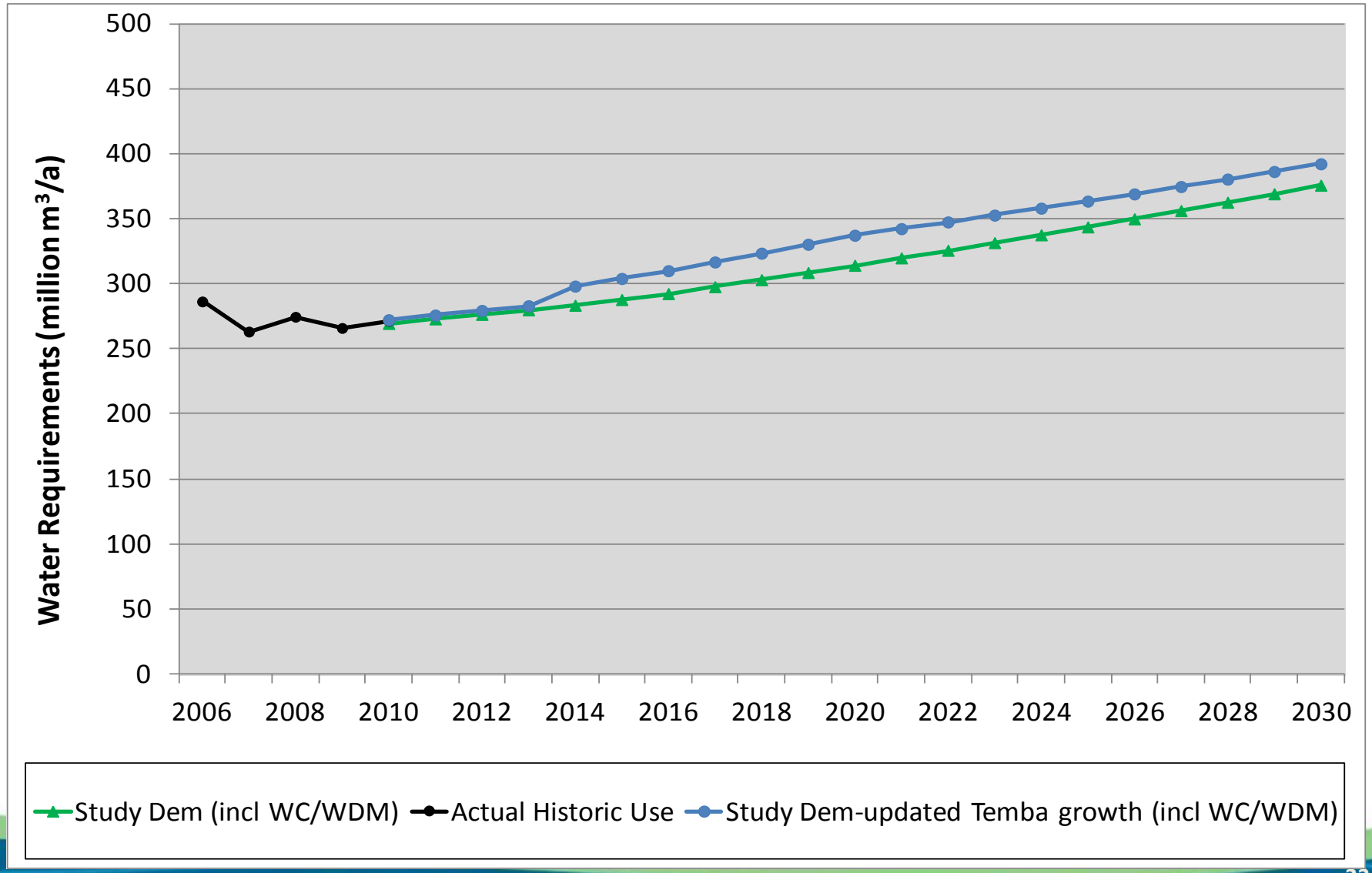
Tshwane Re-use Scenario

- Tshwane Metro's representative at the 2nd SSC meeting requested that Tshwane's Potable Water Augmentation Program be incorporated as a scenario for evaluation
- Program includes increases in some current abstractions as well as additional abstractions to make more use of projected return flows.
- Predominantly in-direct re-use envisaged.

City of Tshwane Water Requirements

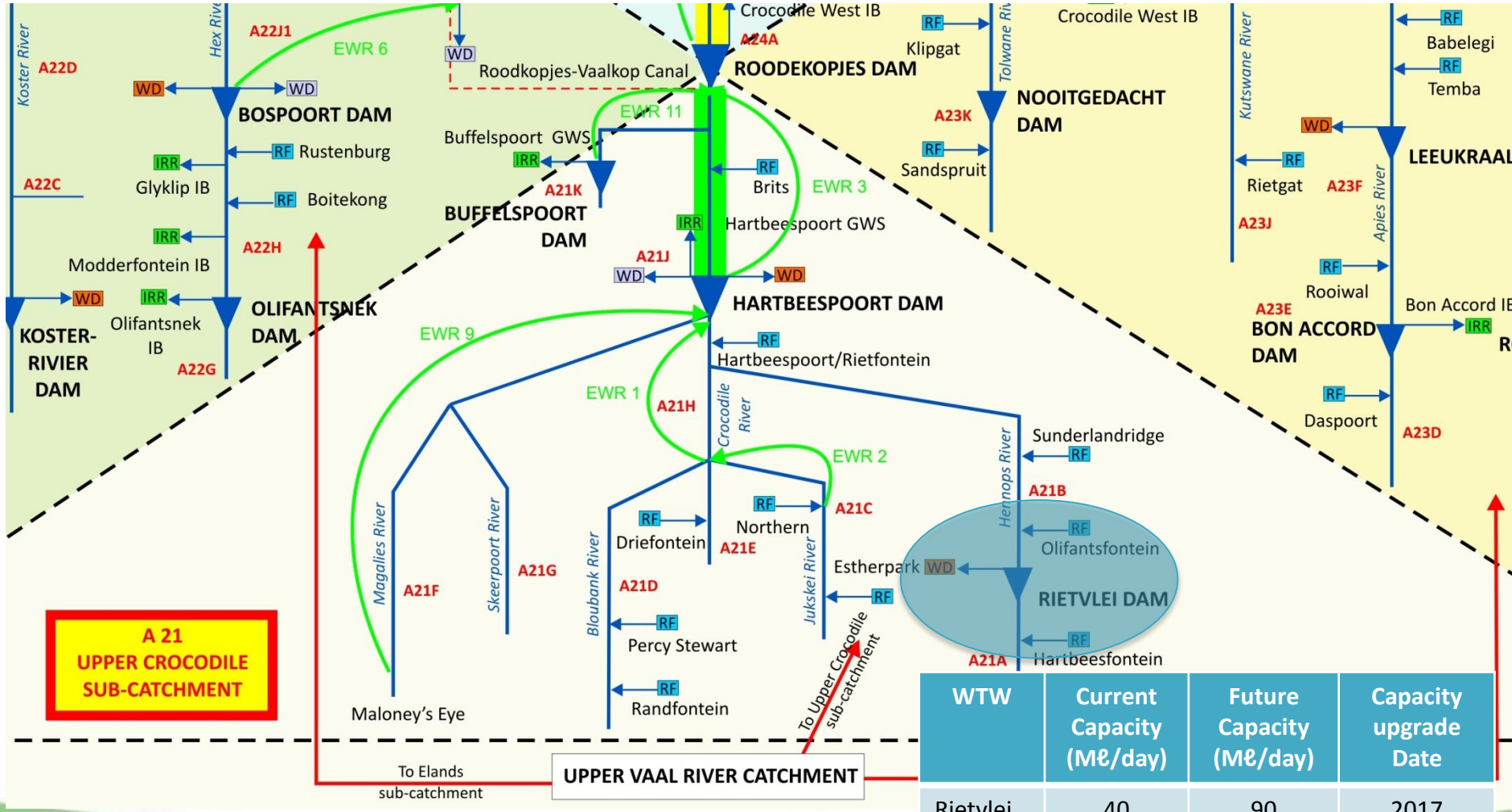
- Key points from discussions with City of Tshwane
  - Substantial growth in the Hammanskraal / Tswaing Area planned (+- 60 000 households upgraded to full sanitation)
  - Upgraded Temba WTW to supply the growth (60 Mℓ/day to 120 Mℓ/day in 2014)
  - Water requirement projections of Base Scenario approved by Tshwane, provided that the Hammanskraal / Tswaing growth is accounted for.
  - Assumed 50% of the upgraded Temba WTW is utilised in 2014, 100% utilised by 2020

City of Tshwane Water Requirements



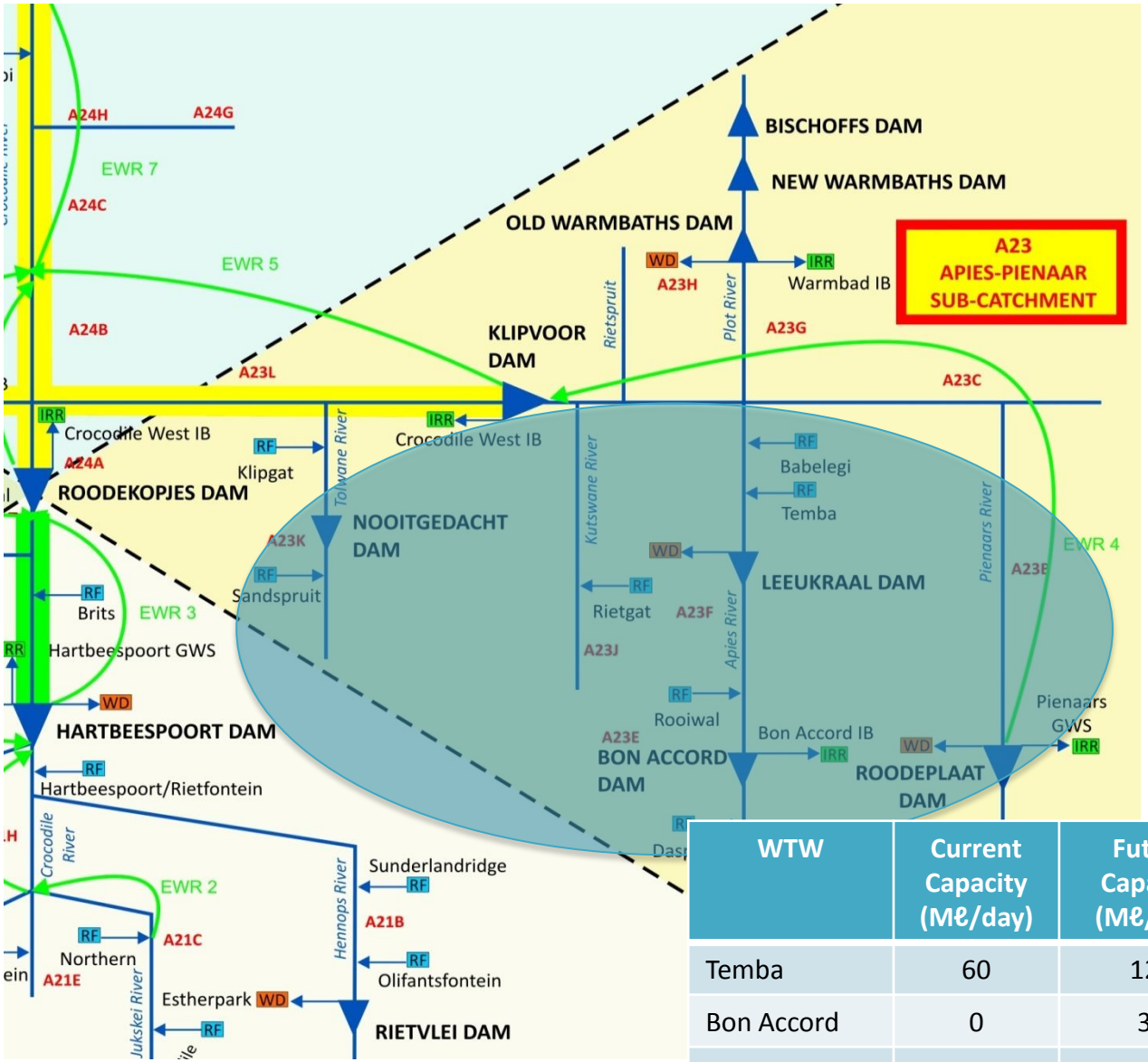
City of Tshwane Proposed Potable Water Augmentation Program

Upper Crocodile Sub-catchment

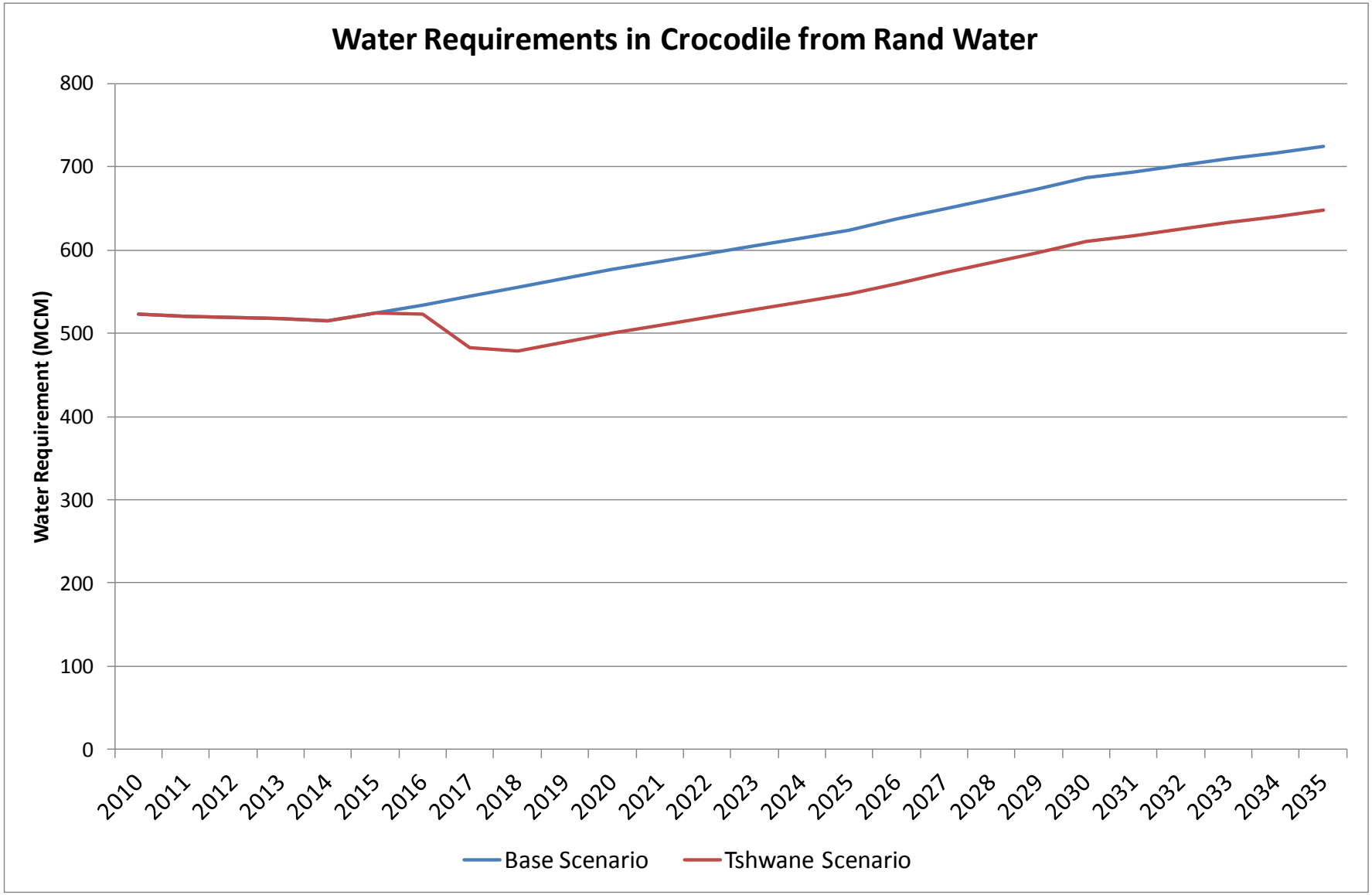


WTW	Current Capacity (Mℓ/day)	Future Capacity (Mℓ/day)	Capacity upgrade Date
Rietvlei	40	90	2017
Hennops	0	60	2017

Apies-Pienaar Sub-catchment

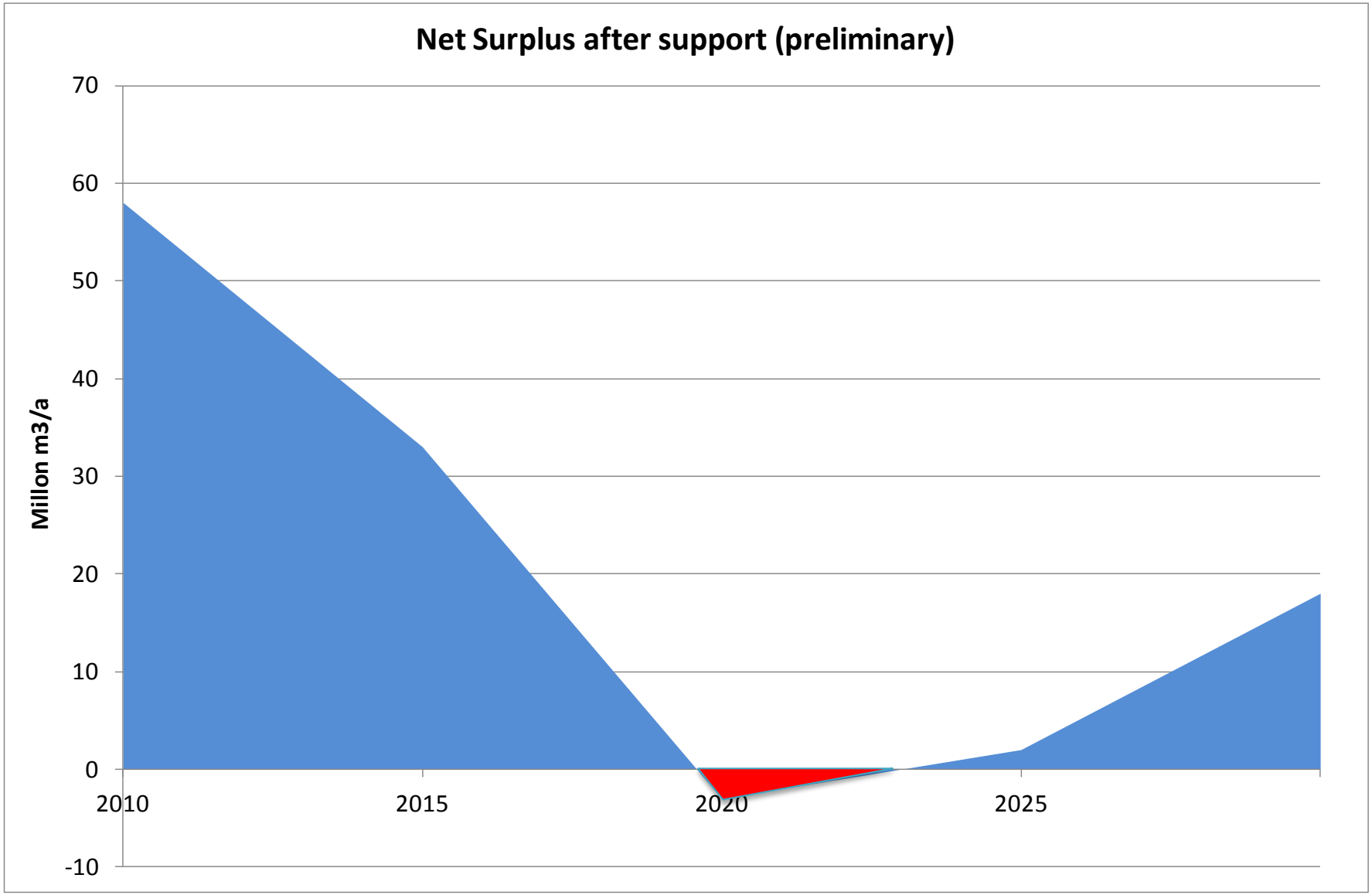


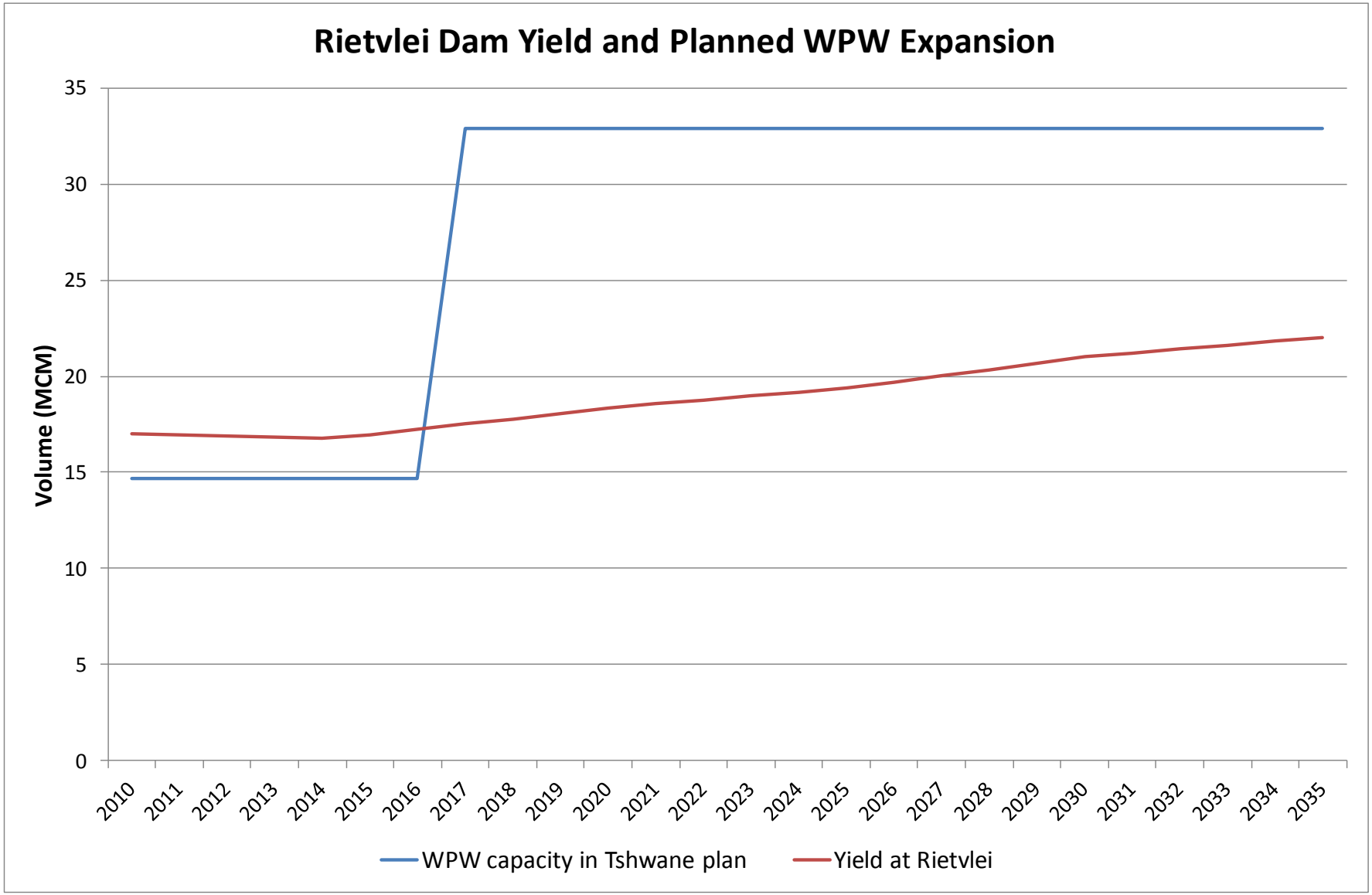
WTW	Current Capacity (Mℓ/day)	Future Capacity (Mℓ/day)	Capacity upgrade Date
Temba	60	120	2014
Bon Accord	0	30	2017
Roodeplaat	60	90	2016
Nooitgedacht	0	40	2018


Water Requirements in Crocodile from Rand Water
Water Requirement (MCM)
800
700
600
500
400
300
200
100
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
Base Scenario
Tshwane Scenario

Tshwane Re-use Scenario - Results

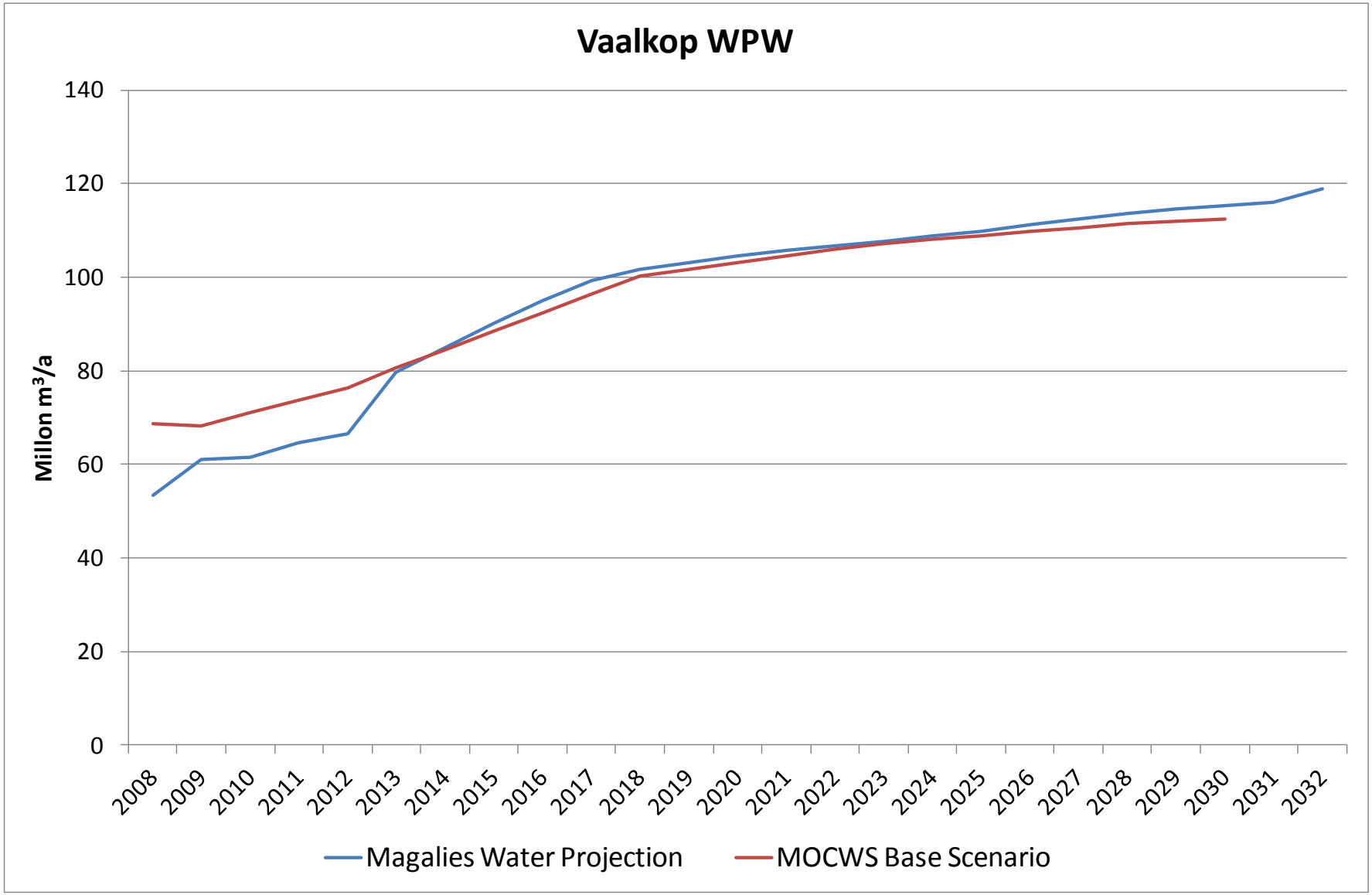
- Water balance calculated as per the Base scenario.
- Full utilisation of new infrastructure assumed i.e. reduction in demand on other sources such as Rand Water.

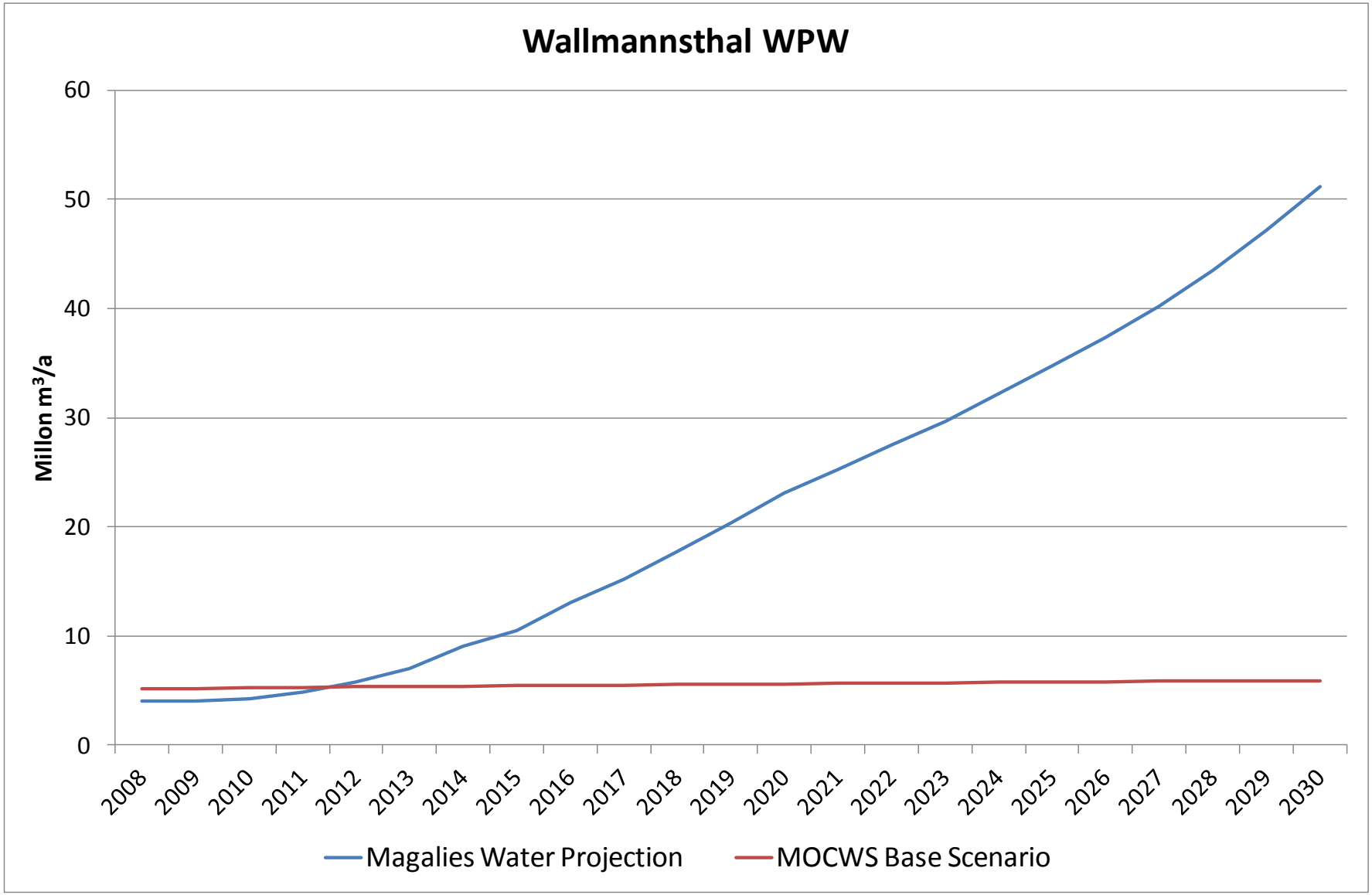

Net Surplus after support (preliminary)
Millon m3/a
70
60
50
40
30
20
10
0
-10
2010
2015
2020
2025

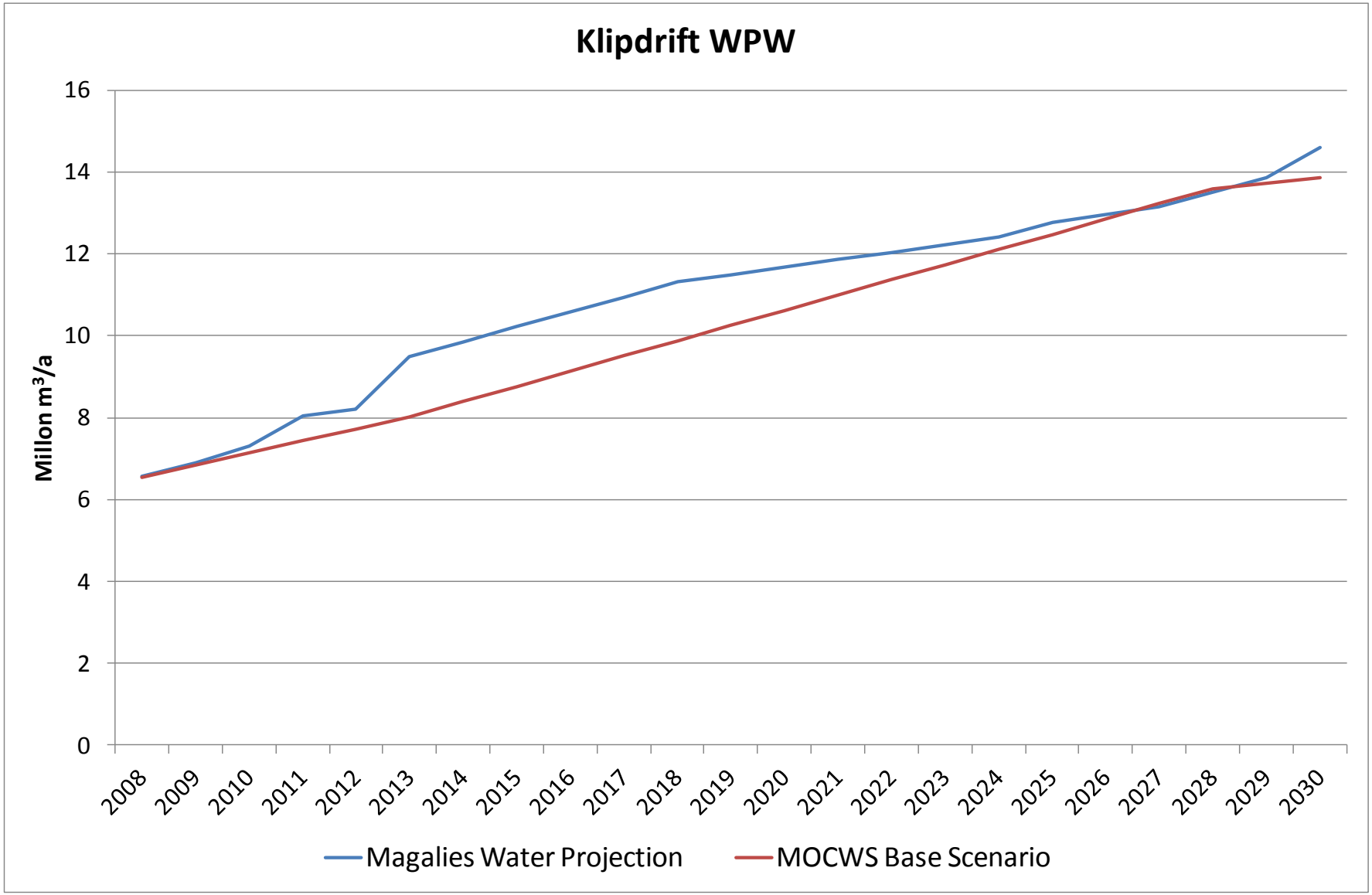

Rietvlei Dam Yield and Planned WPW Expansion
Volume (MCM)
35
30
25
20
15
10
5
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
WPW capacity in Tshwane plan
Yield at Rietvlei

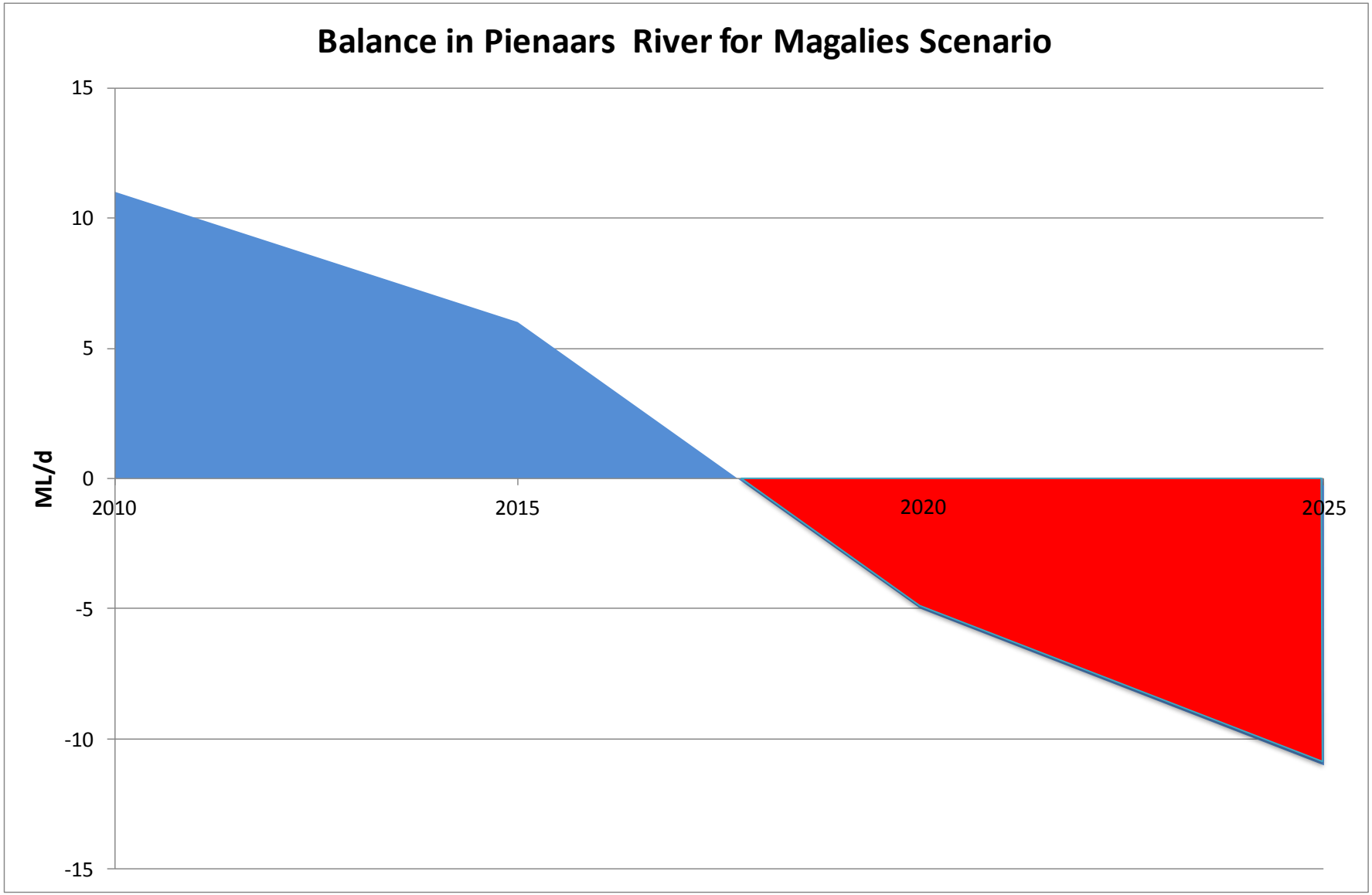
Magalies Water Scenario

- Meetings with Magalies Water indicated that the water requirements and required infrastructure upgrades that Magalies Water foresee in some parts of the catchment are higher than those previously reported in in the 2nd SSC meeting.
- A scenario has been included to assess the impact of water requirements and infrastructure upgrades foreseen by Magalies Water.
- Includes both domestic water requirements and supply to Mining related developments.


Vaalkop WPW
Millon m³/a
140
120
100
80
60
40
20
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
Magalies Water Projection
MOCWS Base Scenario


Wallmannsthal WPW
60
50
40
30
20
10
0
Million m³/a
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Magalies Water Projection
MOCWS Base Scenario


Klipdrift WPW
Million m³/a
16
14
12
10
8
6
4
2
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Magalies Water Projection
MOCWS Base Scenario

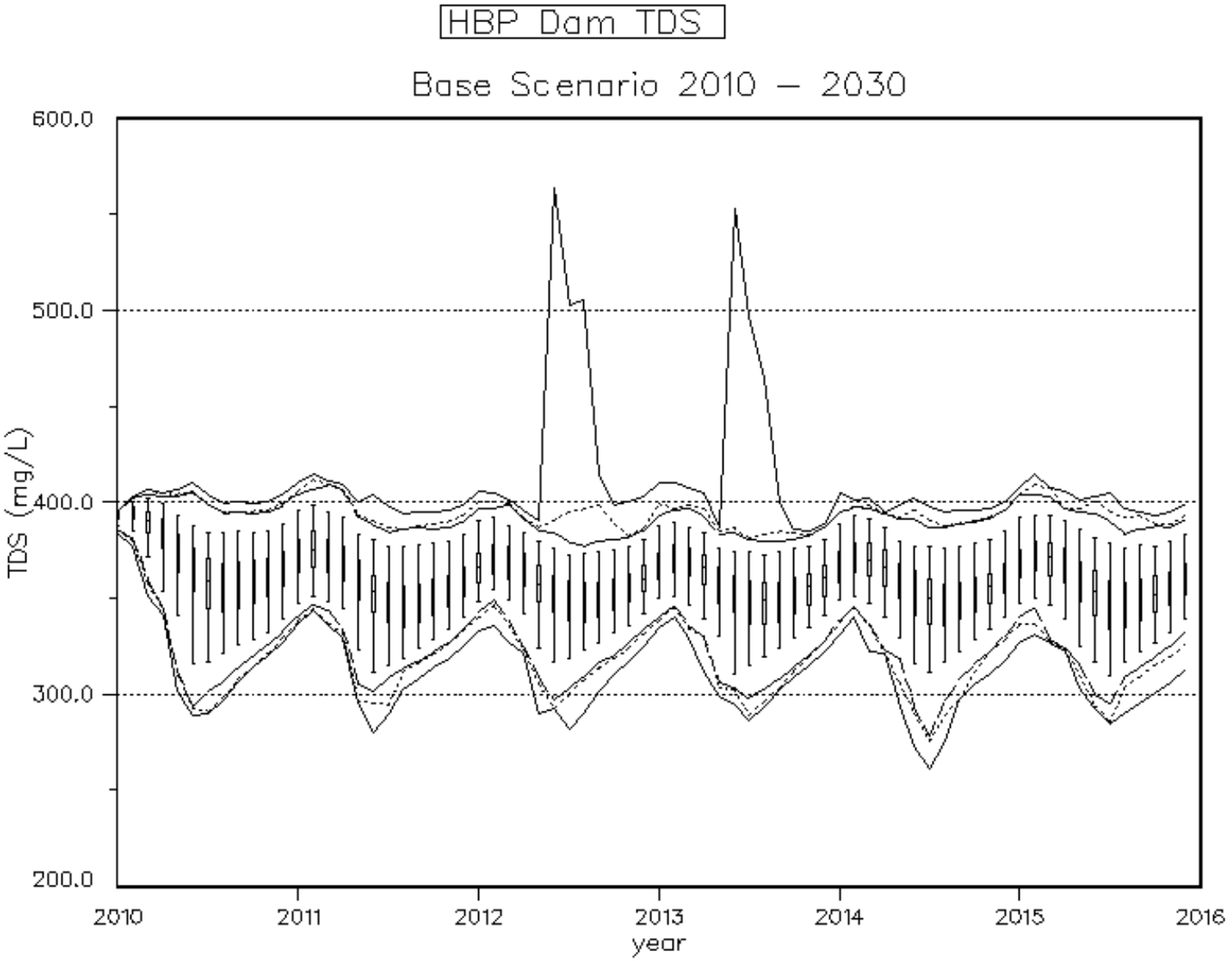

Balance in Pienaars River for Magalies Scenario
15
10
5
0
-5
-10
-15
ML/d
2010
2015
2020
2025

WC/WDM

- Request was made to consider possible WC/WDM savings for local metro's outside of the large Metropolitans
- Two reports – one for the Bojanala DM and one for the Ngaka Modiri Molema DM
- Water savings for the Ngaka Modiri Molema DM are all for systems supplied from aquifers.
- Savings indicated for Bojanala DM are about 4 Mm^3/a more than those included in Base Scenario -> increase the surplus at Hartbeespoort by about 4 Mm^3/a.

Water Quality

- Upper Crocodile, Apies-Pienaars and Elands sub-systems WQT component of the WRPM functional.
- Plots created for Hartbeespoort Dam for Base Scenario


HBP Dam TDS
Base Scenario 2010 – 2030
600.0
500.0
400.0
300.0
200.0
TDS (mg/L)
2010
2011
2012
2013
2014
2015
2016
year

Any Questions for clarification?
Thank You