

uMhlathuze Catchment Monitoring and Management

Bloemfontein September 2019



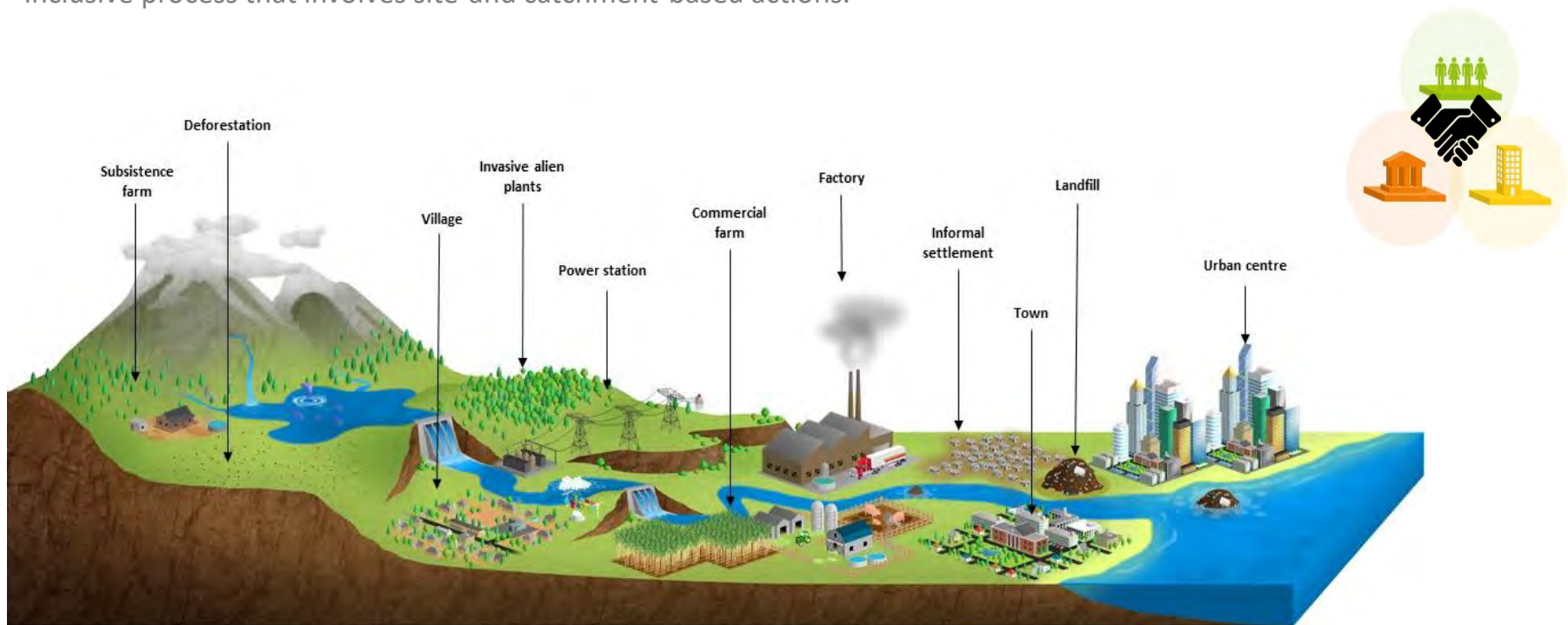
UWASP

uMhlathuze Water Stewardship Partnership



Stewardship Principles

Water Stewardship is : the use of water that is socially and culturally equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that involves site-and catchment-based actions.



NatuReS South Africa



Water security is one of the biggest economic risks in South Africa today

Sustainable economic growth depends on natural resource stewardship



- The Natural Stewardship Resource Programme (NatuRes) is an **international initiative** which combines **global best practices** with **local know-how**
- The programme **facilitates partnerships** between the public sector, the private sector and civil society, promoting collective action to protect and manage **natural resources and the services** they provide to economic centres; securing livelihoods and fostering sustainable development
- NatuReS operates in **five African countries**, including South Africa and is **funded by the BMZ** (the German Federal Ministry for Economic Cooperation and Development) and implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH ("GIZ")



21.7% of South Africa's population is **unemployed**

• Youth unemployment is currently at 54%

South Africa is the **35th largest economy** and has one of **20 biggest stock exchanges** in the world



PARTNERSHIPS, APPROACH AND MISSION

Our strategic approach



Resilient cities



Special Economic Zones



Catchment approach



Circular & green
economy



Our Mission



Support partnerships in natural
resources stewardship



Create and secure jobs



Safeguard investments in
Special Economic Zones



Embed lessons and experiences
into key institutions



Drive policy practice

NatuReS Strategy



Cities are the economic powerhouses of the country but are most heavily impacted by natural resource limitations



Special Economic Zones provide favourable investment environments and create jobs but require natural resource security to operate



Circular Economy returns waste to the value chain



Partnerships are what drive the NatuReS approach



A partnership was catalysed by a major drought in 2016, and the need for a collective response



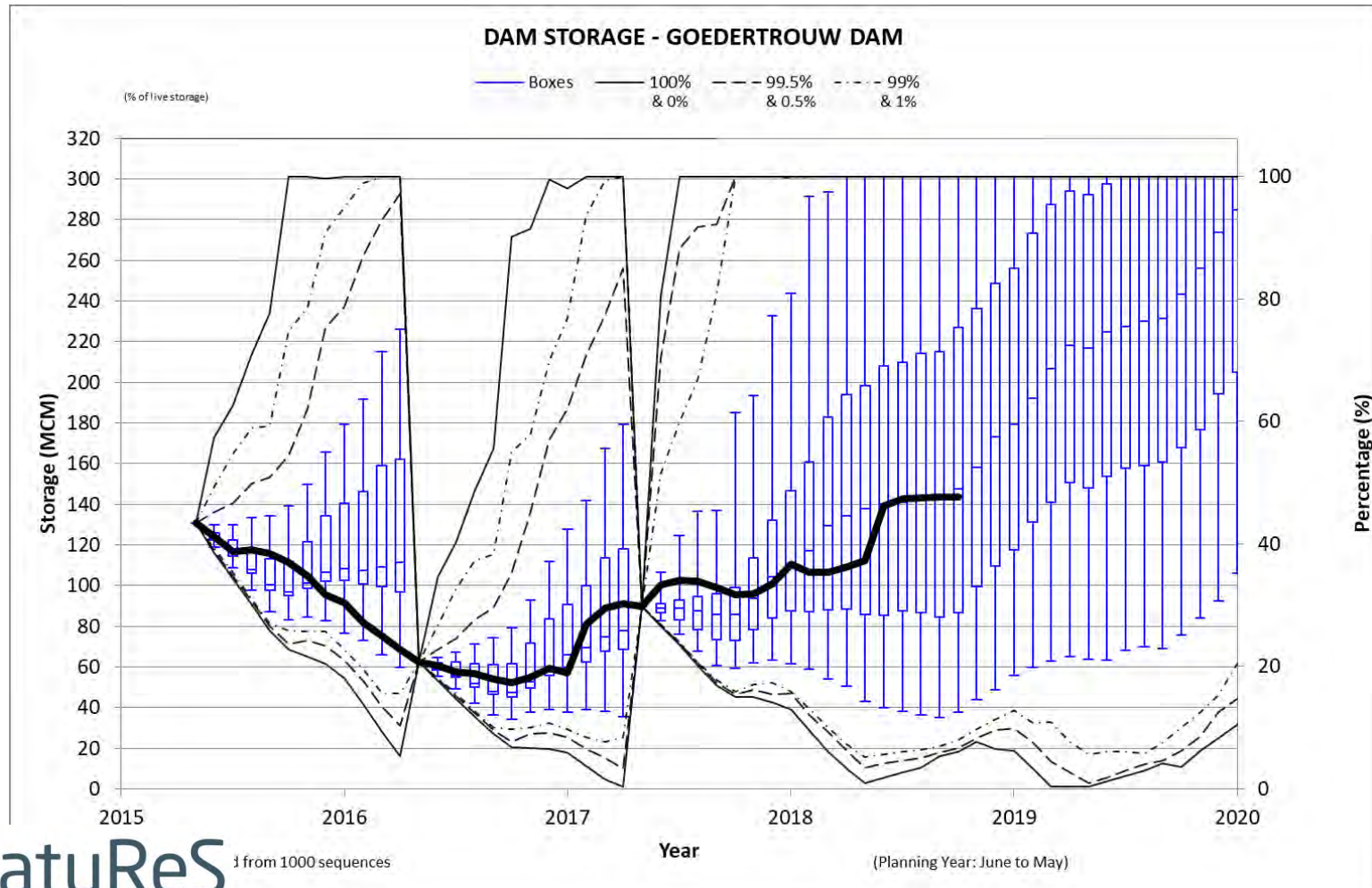
The major dam serving the uMhlathuze region, at 18% capacity in August 2016:



Field trip – August 2016



The risk of drought is increasing.
Collective action is needed. Water stewardship is a
meaningful part of this journey.



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uMhlathuze Water Stewardship Partnership

A partnership
between:



water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

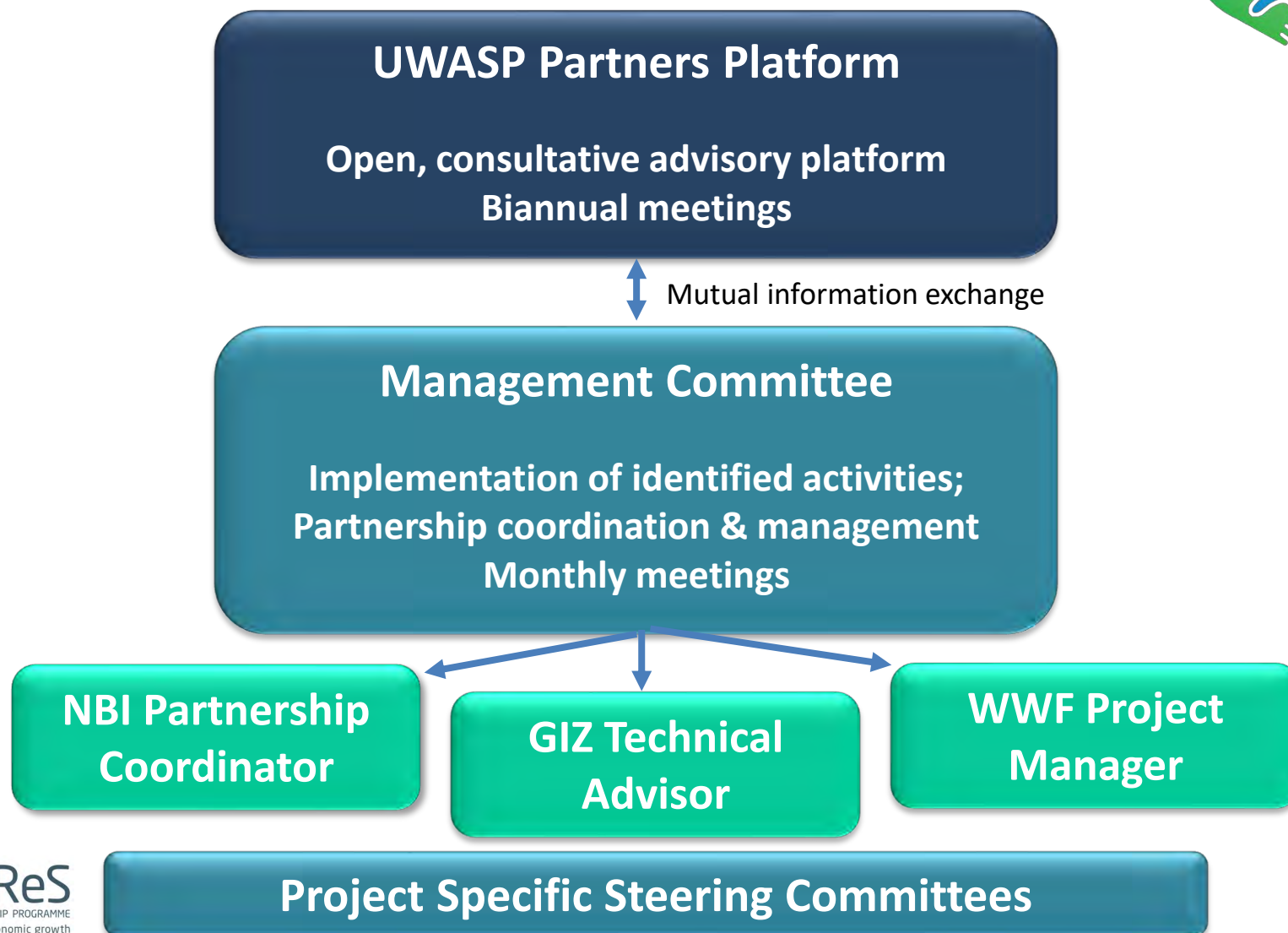


Pongola-Umzimkulu Proto-CMA



2018/9:
City of uMhlathuze
South32
Mhlathuze Water

UWASP has an established governance structure that supports your participation



UWASP has five work areas, as agreed by the partners:



1

Enhanced coastal lakes management & dam mentorship programme

Lead: NBI
Support: IWaSP

2

Downstream water-use efficiency & water losses

Lead: IWaSP
Support: SWPN

3

Agricultural water stewardship & efficiency

Lead: WWF-Mondi
Support: SASA & Tongaat Hulett

4

Ecological infrastructure: invasive clearing and wetlands

Lead: WWF-Mondi
Support: uMhlathuze Irrigators Forum

5

Cross-cutting: develop local community environmental champions

Partnership objectives



1. Serve as a **coordination** hub for collective action on water security across the uMhlathuze region
2. **Collaborate** with all key stakeholders and water users in the region
3. Implement **short and medium-term measures** to improve water security for industry, agriculture and communities
4. Use water as a focal point **for transformation and economic development** to strengthen resilience and adaptive capacity
5. Work with public sector institutions to support improved **service delivery** and natural resource **management**



Current Management of water releases

Current Management of releases



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uMhlathuze Water Stewardship Partnership



Contents



1. Problems with water releases
2. What are the solutions
3. What did we use in Mhlathuze?
4. The Water Stewardship Partnership.
5. DWS role in the relationship.

Genral problems with water releases



1. Operators at the dams have a variety of tasks to concentrate on, including the safety and maintenance of the structure
2. They also have staff to supervise, which keeps them away from the office. They see office work as a tedious exercise.
3. Downstream users quickly complain if releases are too small, even if there is water but pumps are too high to draw it.

General problems with water releases (2)



4. Most years dam operators are in a system with sufficient water, so it is easier to supply more than the minimum.
5. They also have limited understanding of weather and rain forecasting, and don't see the relevance to their work.
6. If there is heavy rain, they can shut down when the river is in flood and still save some water.
7. They don't always know what is happening on the river because of limited relationship with the users.

What are the solutions



1. Operators and users need to be reminded that it is better to have a temporary shortage one day in 60 than to be without water for 60 days
2. Users worldwide are slowly becoming aware that their greatest business risk is water supply. They need to get involved in management of this resource.
3. Operators and users need to build relationships and trust.
4. There is no excuse for not communicating. We have the tools

Issues in the Umhlathuze Catchment



- Knowledge gap due to Norman retirement
- This issue is most likely

What did we use in Mhlathuze?



1. Engineer at Regional Office established a Watsapp group with users
2. Users communicate weir levels, weather conditions such as heat waves or rainfall and expected changes in use on this group.
3. The operator did not have a smartphone, so was out of the loop except the engineer communicated by phone and releases were confirmed by SMS or by email.
4. There were also problems with overtime payment for weekend adjustments which were solved by email to the supervisor.

The Water Stewardship Partnership



1. The engineer making the call for releases retired. An engineer in training took over this role.
2. The Water Stewardship Partnership, noting the level of the dam which had still not recovered, decided to prioritise a number of initiatives in the catchment to ensure sustainability.
3. One of these initiatives was to employ the retired engineer to pass on his experience to a group of stakeholders in the catchment.

The current situation



1. The engineer in training has been seconded to a company for experience, but is still involved with making the adjustments to the release in conjunction with the operator.
2. The retired engineer has been mentoring him as well as trying to encourage stakeholders in the catchment to develop some institutional knowledge on their system.
3. The water stewardship has organised a number of workshops for the stakeholders and the retired engineer so that they can be trained

The current situation (2)



4. A separate whatsapp group was established for training purposes and daily discussion on the releases.
5. The idea was to form a decision-making group as had happened 20 years ago in a previous drought.
6. Only a few actively participated in discussion.
7. Possibly this was aggravated by the application during winter, when rainfall events were scarce and little adjustment of levels was needed.

The current situation (2)



8. A spreadsheet was used to help with the timing of the releases. Users found this difficult to understand.
9. Awareness of the weather, the river level and future demands requires concentration. External stakeholders as well as the dam operator have many other things occupying their minds.

DWS Role in the relationship



1. DWS needs to recognise that there is common ground between themselves and stakeholders in protecting the resource from failure.
2. They also need to recognise the benefits of having external users involved. These users have expertise as well as passion to see the system operated effectively.
3. Perhaps there needs to be a statement or MOU drawn up in catchments where this is feasible.
4. In the long term DWS needs to build up expertise on water releases for all systems within a region, and have a dedicated person to manage them.

Contents



1. Purpose of workshop
2. Why train a varied group of people
3. Why the flows and releases need constant monitoring and adjustment
4. The weather and sources of information
5. The effect of rainfall and duration of river flow
6. Timing the shutoff and new releases
7. How long does it take for the change to be felt.
8. Recap of workshop and feedback for future training

Purpose of workshop

why train a group?



1. To train a group of affected stakeholders to assist in managing a resource which supplies their water needs.
2. Training a group is important for continuity
3. It is also important that stakeholders have an understanding of the dynamics of their catchment so that they can give meaningful input especially during drought periods but also so that they can assist in advising on future improvements and developments.

Why flows and releases need constant monitoring



1. Demands from the system are varying, especially Irrigation needs.
2. Heat waves and wind not only affect demand, but also evaporation from the river surface.
3. Natural river flow drops steadily after a flood peak
4. Unexpected rainfall from some point within the catchment can cause levels to rise.

How to monitor the flows and rainfall effectively



1. A group of people at different points in the catchment can monitor flows more effectively and economically.
2. The key is to establish relationships and keep everyone involved and informed.
3. The Mhlathuze Whatsapp group has been an effective tool, but there may be room for improvement.
4. There is a daily report of the level and pumped volume at Mhlathuze weir as well as the level at P230 weir and pumping rate.
5. We need a tool to monitor the lake levels on a weekly basis and standard measure such as live volume & percent

The weather and sources of information



1. Weather can be sourced from many websites, from the TV and from people on the ground
2. People on the ground can also give rainfall figures afterward to confirm if the forecast came to pass
3. It is good to look up to 10 days ahead, so that release changes can be anticipated and modelled, but rain, especially if it is forecast to be localised can disapper before the time or arrive a day or two late
4. https://www.yr.no/place/South_Africa/KwaZulu-Natal/Heatonville/ or <https://www.wunderground.com/weather/za/empangeni/-28.75%2C31.88999939> are two I use. Windguru is favoured by some
5. Yr underestimates rain and wunderground overestimates, but when they confirm each other with high rainfall, it is fairly reliable.

The effect of rainfall and duration of flow



1. Light rain, especially after a dry spell is not important. Irrigation normally continues and river levels do not rise, as it soaks into the ground
2. Follow-up rain when the catchment is wet, on the other hand, can have a significant effect on river levels and Irrigation demand. Judging this requires experience. Hopefully a group decision will provide a more accurate assessment, but we all get it wrong sometimes, just like the weatherman.
3. It is also important that stakeholders have an understanding of the dynamics of their catchment and contacts within the catchment.

Timing the shutoff and new releases



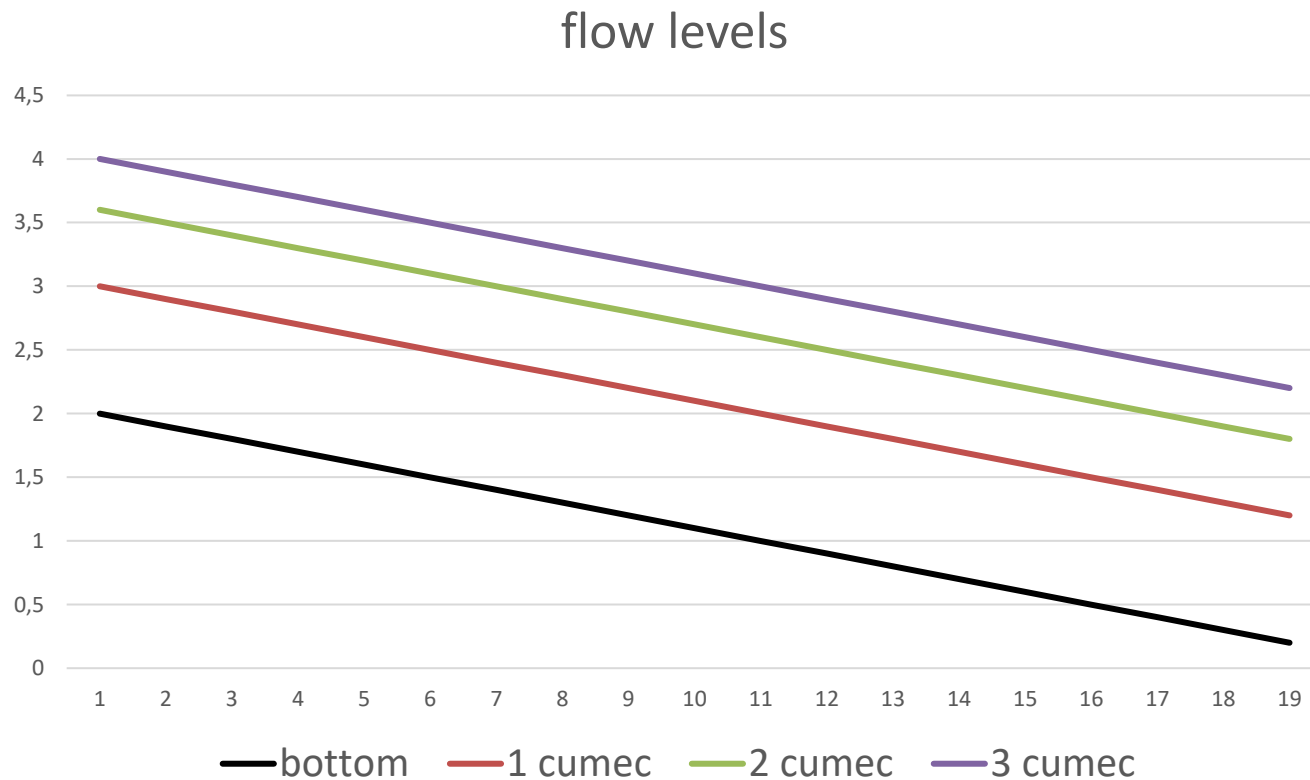
1. To save water, flows should be reduced before rainfall so as to drop the river level on the day that the rain arrives at the Mhlathuze weir, but not too soon.
2. Flows should not be cut too much unless a large storm is expected. Judging this requires experience.
3. Afterward flow should be gradually increased before the river flow drops completely, as a dry river bed will delay the flow and cause shortage of supply.
4. Gradual stepped increases are also easier to model and thus more accurate.

Travel times in a river system and how they vary

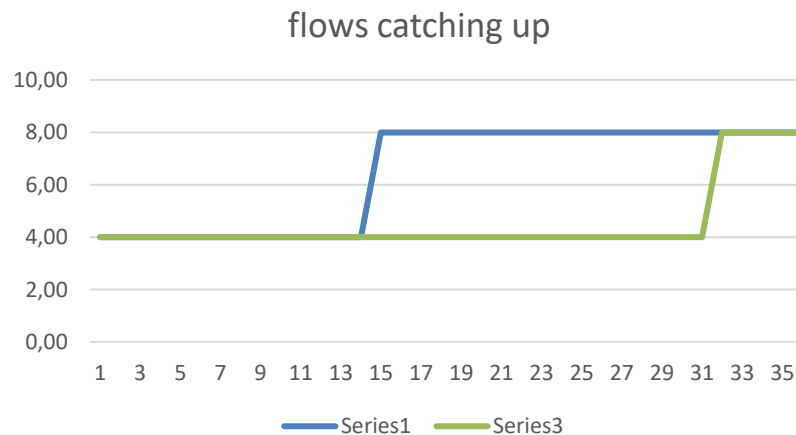
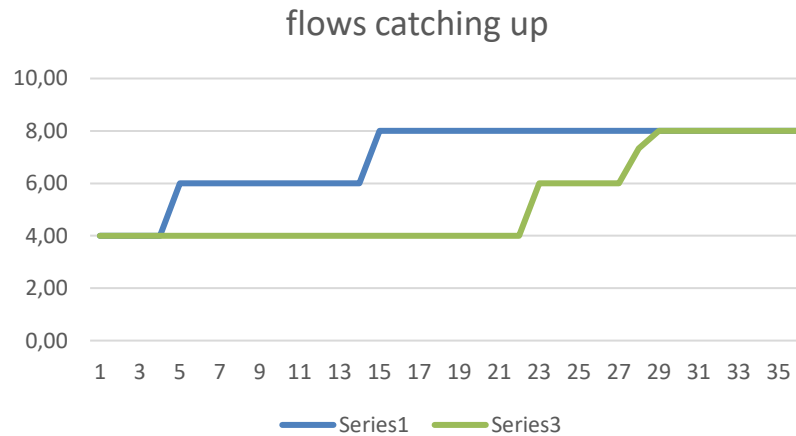


1. Water takes very long to fill a dry river bed.
2. Small flows flow slowly and bigger flows are faster.
3. An increase in top of a small flow travels even faster than a big flow in a dry river.
4. You can catch up for a late release with a bigger release over 24 hours, but it will not save more than a quarter of the time.

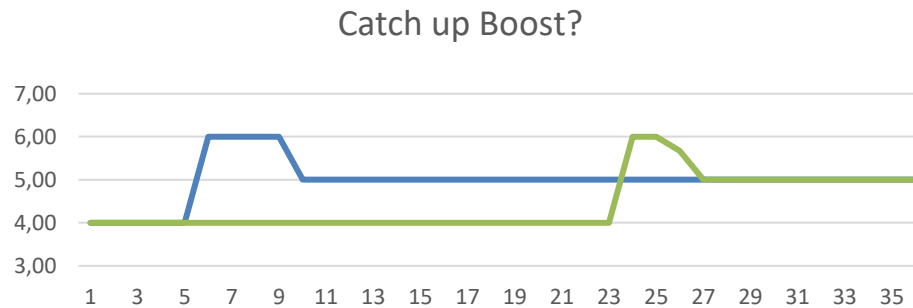
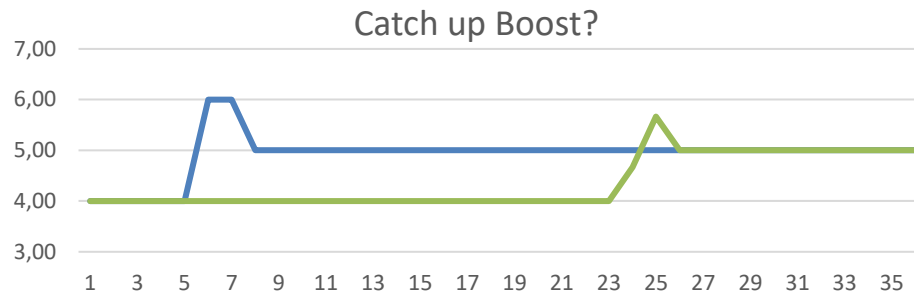
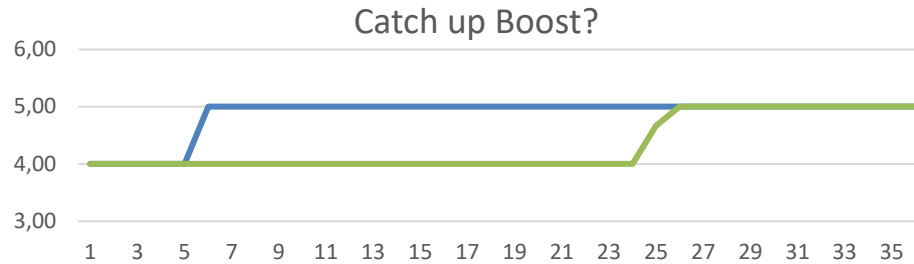
Travel times in a river system and how they vary



Travel times example from Tugela



Travel times example from Tugela





Recap and final questions
Feedback
Future follow-up

Thank you!

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uMhlathuze Water Stewardship Partnership



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The uMhlathuze Spreadsheet (1)



- The purpose of learning this spreadsheet is that each person should fill it in as if they are the sole person deciding on the dam releases.
- Having a single copy on the net was considered, but filling all the info in by hand will give one a better feel for the quantities and avoid mistakes. If a figure looks wrong, the query it on the whatsapp so we can all take note.
- The most important thing is to try different releases and see what the effect is at the bottom weir.
- We will then agree on a release and everybody will assume that release from then on, but can continue to fill in different figures for later that week

The uMhlathuze Spreadsheet (2)



1. Column A contains the date. If there is significant rain recorded that morning you can right click and add a note on the rainfall. This will help you get an idea how this affects the flow later that week, so it is a useful place to store info without creating another column.
2. Column B is the dam level from the Midmar sheet sent out daily. You need to give Cobus your email address to get on this list. It is useful if you want to plot a graph to see the trend in level.
3. Column C gives the past releases and the formula sets each day forward at the same flow as yesterday. If you set a new flow today it will change the flow at the Mhlathuze weir in column I at some future date. This is the most important column, as you need to see what a change in release today or tomorrow or the next day will make.

The uMhlathuze Spreadsheet (3)



4. Column D is the flow at the P230 derived from a formula, and column E is the level at P230. Only change column E when the p230 reading comes through. Do not type in column D. You should right click in E to record the pumping rate from the whatsapp group.
5. If you add back the pump rate you can see how much water is arriving at Heatonville. Changes at the dam normally take half as long to Heatonville as to the bottom of the catchment.
6. P230 is past the Heatonville pump station, so when the pumps are on, the flow reduces a little later. This reduced flow is what is heading for the Mhlathuze weir, so when the pumping increases you should consider releasing more.
7. The irrigators should warn the group when it is getting drier or wetter so we can anticipate the change in pumping.

The uMhlathuze Spreadsheet (4)



8. Column F is the level at the Mhlathuze Weir up until today. There are two ways to estimate the future level of the Mhlathuze Weir. One is to assume values manually and see if the use column (J) matches the expected use (K) on future dates. This is very time consuming, unfortunately. We will cover another method in future training.
9. Column G is the spillage from the weir calculated from the shape before construction. Unfortunately this will have to be recalculated when DWS produces a DT table for the new weir.
10. It would appear that floods are being released from the scour each time it rains, so it makes it very hard to know how much water is coming down after a rain event and when it is likely to stop flowing. For now one will have to use the P230 flow as an indicator.

The uMhlathuze Spreadsheet (5)



11. Column H is the deficit in flow over 24 hours when the weir level has dropped. It means the actual use has been more than the release reaching the weir. If the deficit continues the weir will fall too low for abstraction.
12. When there is a surplus this column will have a minus sign. Don't worry about this.
13. Column I is the release that should be arriving at the weir over the last 24 hours based on the release some time ago. There is a complicated formula used to calculate the travel time to determine this. This has been derived from 3 years experience, but is still only an approximation. The flows can take more or less time depending if the catchment is wet or dry.
14. Column J is derived from column I and is the total use in the catchment less spills but allowing for the deficit or surplus in the weir.
15. Do not change the formulas in columns G to J, just copy them down up to two weeks in advance.

The uMhlathuze Spreadsheet (6)

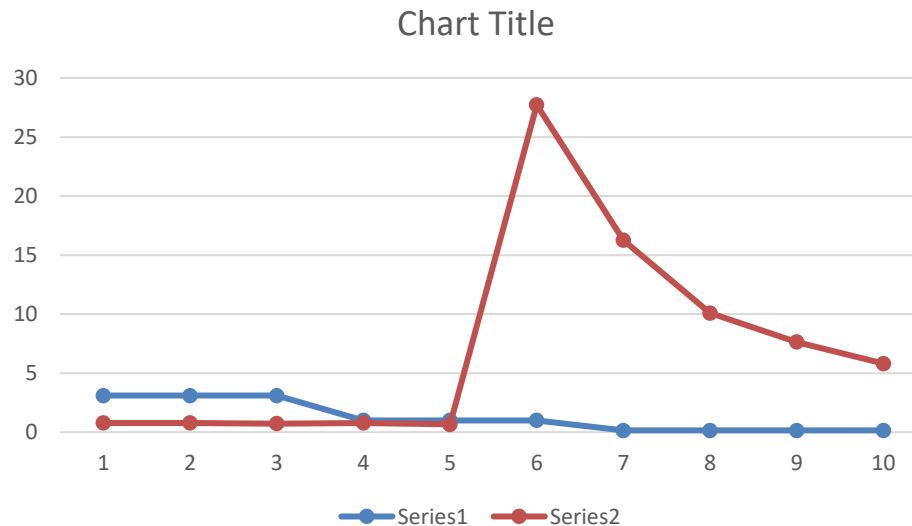


16. Column K is the estimated use in the catchment based on the weather patterns and the past few days use. This one you should try to fill in for the next few days. You can plot a short term graph of actual use to see if it is going up or down, but the weather is still the biggest factor. Reduce the estimated use on the days when rain is expected and shortly after.
17. Column L is the difference between the estimated use (K) and the water arriving at the weir (J). You should alter the flow for today and the days that follow so that (J) and (K) are similar and that (L) will be close to zero.
18. So this is where skill and experience is needed firstly to estimate future use and secondly to try and match this use with the correct releases.
19. Column M should be filled in with the abstraction figure from the weir for both the MW and Tronox. Tronox can be filled in in column N and added with a formula. Then you can see the trend in use from the water board.
20. However remember that (J) is the more important one, as it reflects ALL use.

The uMhlathuze Spreadsheet (7)



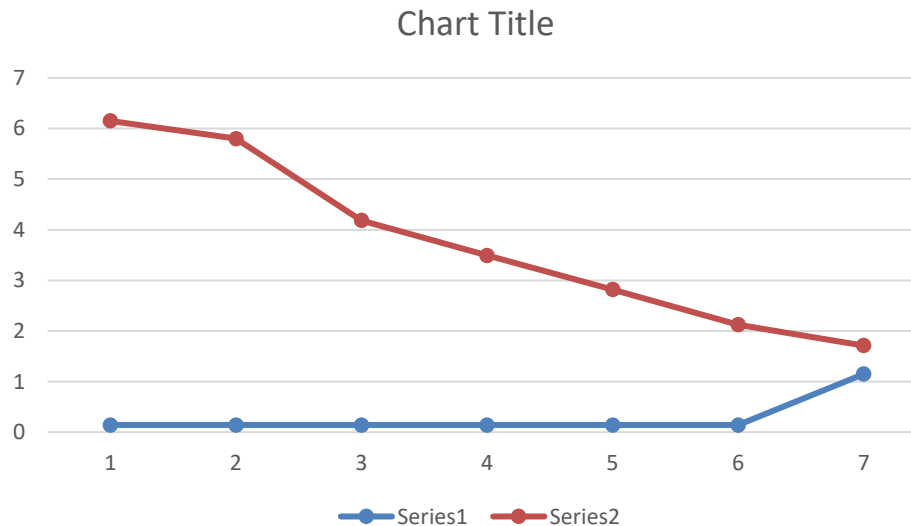
21. You can also draw graphs to help you estimate use and flow. Here is a graph from late February showing the reduction in release in anticipation of rain and the P230 flow spiking after the rain.



The uMhlathuze Spreadsheet (8)



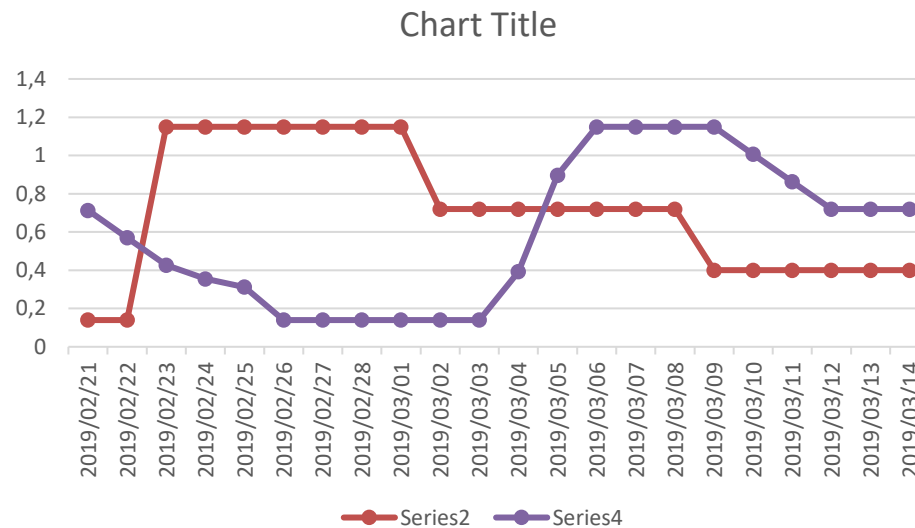
22. This graph shows the decline in the p230 after the rain, and the release timed to reach the lower river before the flow stops. This requires experience and practice with the spreadsheet.



The uMhlathuze Spreadsheet (9)



23. This graph shows the delay between the release and the flow at the Mhlathuze weir.



The uMhlathuze Spreadsheet (10)



24. The flow at the weir was normally very sensitive to rain or release changes. It now appears very stable, which gives little idea how the water balance is actually working.
25. One of the problems I see with the current operation is that there is apparently no flow going to the estuary. It may be that the scour is being operated regularly to release surpluses, but this is not being communicated. This means that the releases could be too high, but we are not aware of it.
26. Alternately the flows may be so low that MW is only drawing what they can get and thus this is not a fair reflection of the demand. If there is sufficient water in the lakes to make up the shortfall, this is OK, but if the lakes get too low again the situation could change without warning.

The uMhlathuze Spreadsheet (11)



27. This graph shows the flows from 15 April till early May. It shows how the flow was reduced in anticipation of rain and how the release was different to the flow arriving at the weir.

