Caring for Zandvlei

Managing nutrients, silt and flows in Zandvlei and Westlake Wetlands

Prepared for ZPAAC, 18 January 2017

Bernelle Verster & co

Structure

- Personal background
- Project background
- Dredging
- Nutrient inflow mapping
- Wetlands rehabilitation
- Way forward
- Images from Zandvlei parkrun, https://www.facebook.com/zandvleiparkrun/

Bernelle Verster – indiebio – Water Maverick

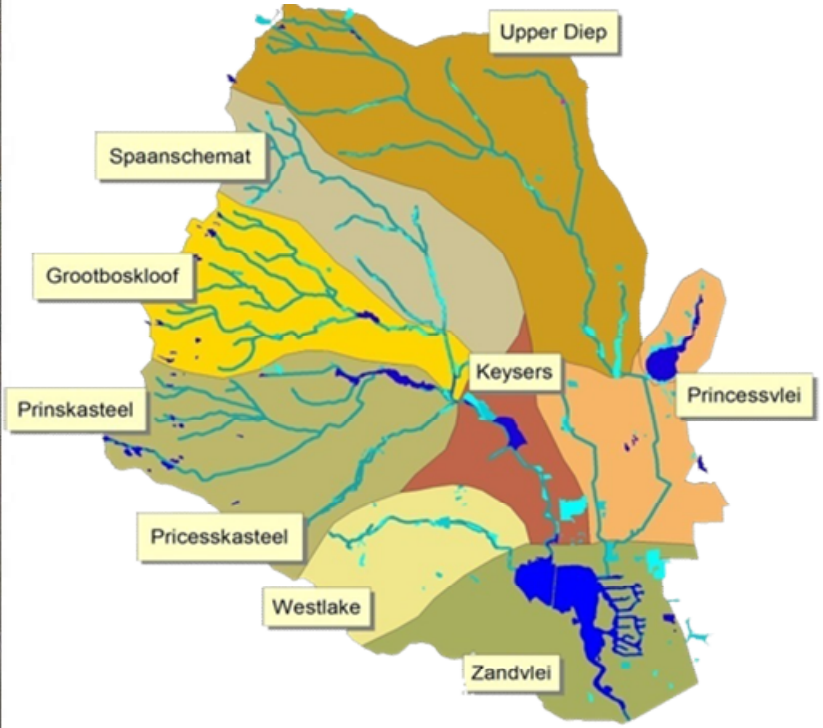
- PhD: Bioprocess Engineering (UCT) post-environmentalist, at heart a biotechnologist
- Resident of Lakeside
- Passionate about water, sport-STEM (science, technology, engineering, mathematics (& design) interface, the connectedness of things: Orienteering, Zandvlei parkrun… community.

Project background

- “water environments have one of the greatest potential values among urban open spaces (Turpie et al., 2001).” – WRC report, van Zyl et al
- “I sail at Zandvlei - and dodging sandbanks (coral?) is proving to be quite challenging.” – Neil Armitage, 2016
- “the Vlei is getting shallower in the southern part (referred to as the “Narrows”), destroying what used to be one of the better fishing venues and an enjoyable paddle down to the sea.” – Andy Killick, 2014, 2016

‘Areas’

Road reserve mentioned in the meeting



http://sourcetosea.org.za/about-3/

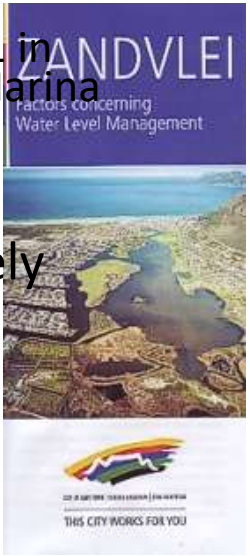
The centre of the reserve lies at the following grid coordinates:

34 05 28.43 S

18 28 08.28 E

Martin Thompson (CoCT): Zandvlei – Factors concerning Water Level Mangement

- 2004: sophisticated hydraulic modelling exercise for Zandvlei, using revised inflow figures for the various river catchments.
- rubble weir level: need 0,6 m MSL (mean still water level) for 1 in 100-year flood to pass through the outlet accompanied by a vlei level of 1,78 m MSL.
- Presently (2008?) at a level of 0,7 m MSL, requests for 0,8 m MSL or even 0,9 m MSL.
  - With the rubble weir at 0,9 m MSL (200 mmm above its present height) the predicted 1 in 100 year flood level will result in extensive damage to a great many properties in the Marina and surrounding areas.
- Marina houses revetments are stable between 0.7 and 1.0m MSL
- Each mechanical opening and closing cycle of the sandbar costs approximately R20 000 (2007 figures)
- http://www.zandvleitrust.org.za/art-zandvlei%20water%20level%20management%20oct%202008.html



Bottom line on the water level: 0.6 - 0.8m MSL

- Limited scope for the retention of high water levels in the vlei.
- During the winter months the avoidance of large-scale flooding is of paramount importance with the rubble weir at a low level (0,6 m – 0,7 m MSL) and the sandbar open when the river inflow is high and/or when a cold front is impending.
- During dry spells in winter it will be possible to raise the water level above 0,7 m MSL by manipulating the sandbar, although with good river inflow and the sandbar open the vlei water level is likely to hover around 0,8 m MSL.
- During the summer months the sandbar is closed to keep the operating water level high and is only opened when the water level becomes too high or when there is an adequate **spring high tide** (five to six times per summer period).Ideally the water level should not be allowed to exceed **1,0 m MSL** for long periods of time and this should not be allowed to occur too frequently. Recreational users will need to take cognisance of these operating procedures.
- The yachting fraternity have undertaken to ensure that all their main events are programmed for non-spring high tide periods. However, the situation is not as easy for the canoeing fraternity, since a large component of their season occurs during the winter months, although it is expected that the closing of the sandbar during dry winter periods will go some way to alleviating their concerns regarding the level of the water.

Reality checks: Zandvlei & Westlake

- City money not much
- Lagoon and wetlands are no longer natural, restoring to natural state is not possible with the current urban scenario
- Maintenance plan needs to be self-funded
- Need an ideal state to take as standard and compare against

Dredging

- Why? Sand, nutrient in sediment
- Where does the sand come from?
  - 1. From the sea, a mouth clearance issue, BUT, this is local, does not affect entire vlei
  - 2. Windblown sand, BUT with the development of the area, this source is greatly reduced
  - **3. Streams coming in: Sandriver, Diepriver and Westlake river**
  - 4. Does coral worm contribute?
- A slow, passive “conveyer belt” could work, but it takes the sand both ways, not expected to be successful.
- Most common dredging is venture-type system.
- Biggest challenge: dealing with the sediment once dredged – where does it go?

How much material needs to be moved?

Estimate:

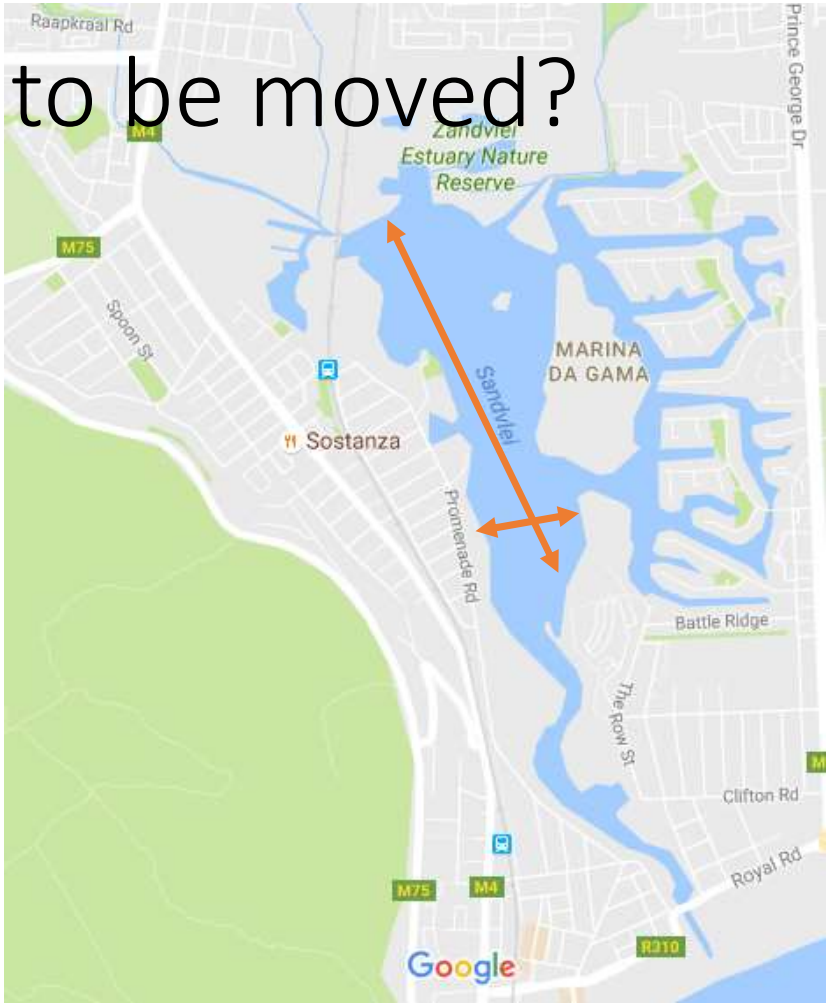
Length of vlei: 1300m

Width of vlei: 300m

Depth of removal: 0.5m
gives 1350 x 300 x 0.5 = **195 000 m3**

Killick report estimates required area ‘the narrows’ needing dredging at ~35740m2

At 0.5m depth removal gives ~
17 870 m3



Company: Dredging Services (22 Nov 2016)

We submit the below, but with the full rights to tender / quote on this project.

Basic breakdown of rates as per your request:

- Mob and de-mop of equipment**: R. 76 000.00**
- Site establishment: **R. 45 000.00**
- Cubic meter rate: between **R. 32.00 and R. 36.00**
- Site de-establishment: **40 000.00**

Not included:

- Mobile crane for loading / off-loading of equipment
- Security services.

We need to establish from current depth to final depth work need to be done.
This will determine the dredger...

Can you sent more details of the sediment areas?

- **Surveys**
- **Photographs**
- **Google place map with marked areas?**

Fred De Pauw / Managing Director
info@dredging-servicesco.za / +27 82 226 9420

195 000 m3: R161k + R7.02m **= R7.2m**

17 870 m3: R161k + R643k **= R804k**

Potential beneficiation options of dredgings:

- If it was coarse sand, could work for building sand
  - Need mining permit
- Quarry fill / backfill areas?
- Truck transport cost (to e.g. capping on waste site) is probably prohibitive, best is to pump it.

- … no real options in my opinion
- At meeting: road reserve filling, Two Rivers Urban Park substrate, sand bags, caravan park, landscaping (wind breaks for picnics)

Three options for disposal:

3. Out to sea (where it would have gone in nature)

    Unlikely to be permitted

2. ‘Steenberg vlei’ (areas 23, 24, 25)

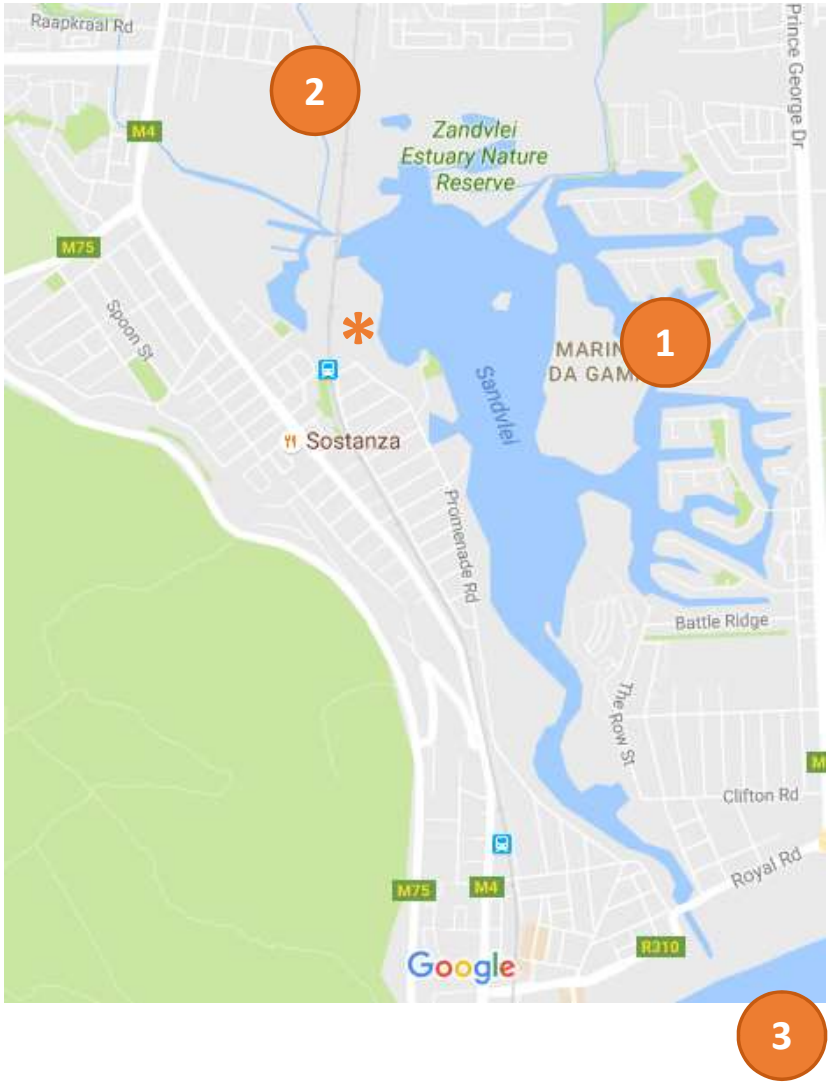
    IF possible to gain access, then rehabilitate to meander, slow water down, become a silt trap, also purify water.
    * Also the piece next to the railway line

1. Island near Marina da Gama

    Size approx 480m x 250m: Raise by about 2m.

    Treat it like a slimes dam: build a berm, pump, let it drain

    May slightly affect wind patterns



Nutrient mapping

- Why? Best positions of interventions, most effective solutions
- Continuous monitoring with probes

1. pH
2. Dissolved Oxygen, a measure of the health of the water
3. Electrical Conductivity,
   a measure of the dissolved contaminants in the water
   the things we can't see
4. Total Disssolved Solids, a measure of the turbidity of the water,
   the contaminants that we can see, that makes the water murky
5. Salinity
6. Voltage: check solar powered battery.

- Kevin Winter (UCT) lends these out.
  Really need continuous monitoring in these streams
  - the only way to map properly.
- Possibly put probes on floating wetlands:
  http://merahmas.co.za/blog/smart-wetlands1
- Once-off / periodic analysis (wet chem)

Nutrient removal options

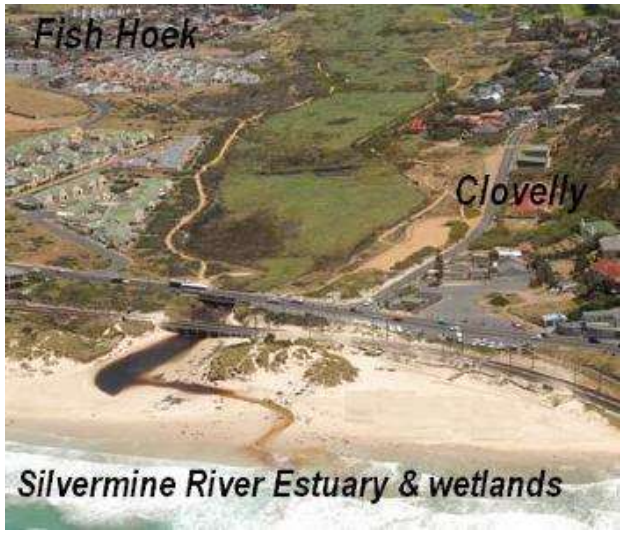
Conventional option	Benefit	Drawback	Recommendation
Forebay structure, earth embankment, vegetation	Traps silt, catches litter	Needs regular maintenance: dredging, at awkward angles?	? At entrances to the vlei, areas 24, 29, 3 ???
Meander flows through vegetation	Nutrient removal into plant biomass, sediment	Permanent biomass, hard to get to. Tricky when natural wetland doubles as treatment wetland?	Restructure Steenberg vlei, design for access and periodic removal
Unconventional option	**Benefit**	**Drawback**	**Recommendation**
Floating wetlands	Nutrient removal into plant biomass, movable platform, distinct from natural wetland	Might blow around if not adequately tethered. New/unknown	Install pilot at demarcated areas (?). Make into a feature

Wetlands rehabilitation

- Why? Wetlands provide ecosystem services (NB for flood attenuation!), they are our insurance against nature's temper tantrums.
- Case study already in 2004 – Kirstenhof. Main costs associated with flood prevention, but main benefits were aesthetic and recreational (and increased property values) "Such low benefits indicate how the overall benefit cost ratio of the project could be negative if a narrow 'engineering only' approach is followed.

Case study: Lower Silvermine Area (Fish Hoek)

- Annual maintenance costs of approximately **R65 000** (2004 prices) are spent mainly on cutting, clearing, landscaping and waste removal. Clearing takes place three times per year in order to ensure that that area remains effective in attenuating floods (Martin Thompson & Chris Bonthuys, City of Cape Town, 2004)



http://scenicsouth.co.za/a-history-of-the-silvermine-river-by-lewis-walter/

- Reference: WRC report: The costs and benefits of urban river and wetland rehabilitation projects with specific reference to their implications for municipal finance: Case studies in Cape Town (2004). Authors: Hugo van Zyl (Independent Economic Researchers cc), Anthony Leman (University of Cape Town School of Economics), Ada Jansen (University of Stellenbosch) http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV-159-04.pdf

Case study: Westlake river in Kirstenhof

- Maintenance costs of just under **R200 000** per annum are spent mainly on silt removal, cutting and clearing the area three time per year inorder to ensure it remains effective in attenuating floods (Jan Botes, City of Cape Town, 2004)

- Reference: WRC report: The costs and benefits of urban river and wetland rehabilitation projects with specific reference to their implications for municipal finance: Case studies in Cape Town (2004). Authors: Hugo van Zyl (Independent Economic Researchers cc), Anthony Leman (University of Cape Town School of Economics), Ada Jansen (University of Stellenbosch) http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV-159-04.pdf

http://www.zandvleitrust.org.za/art-Sand%20River%20Catchment%20Forum%20westlake%20river%20inspection%20may%202010.html

Next steps

1. Get a plan: proposal

   Get current dredging rates

2. Meet with people who can advise on permits, EIA, public participation processes

   Find out what is nature reserve, what can be worked with

3. Meet with Catchment Management (CoCT)

   Argue for the benefits towards Water Sensitive Urban Design “This checks all the boxes except water supply”, including:

   1. Flood prevention (after a drought comes a flood!)
   2. Water quality
   3. Biodiversity
   4. Property rates
   5. Blue flag beach
   6. The maintenance of a well utilised, truly multi-racial public space

The plan for 2017: WHAT IS THE DREAM?

- (from email with FoL, Liesbeek River Life Plan – Kevin Winter and Andrew Bennett)
- The value of images and architectural designs to sell the dream is a must-have.

1. Make a very basic brochure with mock-ups.
2. Examine the concept with a wider network of people, including
   - Finding people who can help with creating good conceptual drawings
   - Iteratively fleshing out where we want to go: WHAT IS THE DREAM?
   - Develop a fundraising strategy, for a start the funding to create the framework plan.
3. Have a great brochure explaining the dream.

- 2018: Develop the "framework plan", with the "design interventions at a framework level with associated principles and guidelines"

Future work: Management plan, emulate the FoL concept

- Get a plan (2017), rest 2018…
- Register a NPO (?)
- Incentives, benefits to businesses and residents
- Approach City of Cape Town
  - BUT “Despite their benefits, the potential for increased municipal funding of rehabilitation projects seems limited for the foreseeable future.” Approach is intended to comply with regulations, ‘have the City’s blessing’ rather than a source of funds.
- Approach businesses
  - Westlake green businesses
  - Property managers (estate agents) – capitalise on the increase of property values
  - Insurance companies: costs avoided
  - Hotels & Restaurants?
  - Training providers - FETs
- Approach residents
- Approach NGOs
  - Possibly not able to direct funds, can help with advice
  - WESSA
  - South Peninsula Wetlands Rehabilitation Project
  - http://sourcetosea.org.za/about-3/

References

- Martin Thompson (CoCT, now retired)… Zandvlei report http://www.zandvleitrust.org.za/art-zandvlei%20water%20level%20management%20oct%202008.html
- Andy Killick report, Parts 1 and 2 (part 2 dated Jan 2016): Zandvlei Dropbox
- Communications with Neil Armitage (UCT)
- Communication with Ross Singleton, Zaheer Ortell (Bergstan Consulting Engineers)
- WRC report: The costs and benefits of urban river and wetland rehabilitation projects with specific reference to their implications for municipal finance: Case studies in Cape Town (2004). Authors: Hugo van Zyl (Independent Economic Researchers cc), Anthony Leman (University of Cape Town School of Economics), Ada Jansen (University of Stellenbosch) http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV-159-04.pdf
- Aurecon report: Rehabilitation plan for the working for wetlands rehabilitation programme, Eastern Cape Project: Hogsback S32D (2014) http://www.sahra.org.za/sahris/sites/default/files/additionaldocs/WfW_Hogsback%20Rehab%20Plan.pdf

Please share your dreams, concerns regarding Zandvlei with me:

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083 5454 993

@indiebio

This is my house, good view of the vlei. Come visit, share your dream in person.

Andy Killick feedback after 18jan meeting

- 1. Two additional sources of sediment you mentioned: Culverts (stormwater) that feed into the vlei. Bank erosion. The extent of this erosion can be seen by the retreat of the bank behind revetments and also the extent to which original culvert outlets now protrude out beyond the bank into the vlei.

  2.Depth of dredging: (0.5m). This may be reasonable for the upper reaches but there is a case to be put for dredging a deeper channel through the narrows. Zandvlei is the only viable estuarine nursery in False Bay. Thus consider the (financial) impact it has on our False Bay fishing industry. Researchers (e.g. Whitfield 1998, p40) have concluded that a channel depth of 1.5m is required for predatory fish to be abundant (and they are an important part of the ecosystem) in estuaries. Thus it would seem prudent to plan on creating a 1.5m deep channel through the Narrows.

  3. Different sediment characteristics: The sediment near the mouth originates largely from the sea and is likely to consist largely of quartz granules, together with some shell detritus ($CaCO_3$). There will be an organic component but it will be relatively small. The sediment at the proximal deltas/ entry channels, is derived from weathered material in the catchment area (which includes an important granitic component). Although this sediment will also be dominated by quartz grains, it is likely to contain more finer grained material and have a higher clay and organic component. These two components are likely to contain or adsorb many more of the nutrients/ pollutants, whereas the quartz is relatively inert. Thus these two bodies of dredged sediment are likely to have different characteristics both physically, mineralogically and chemically. A large proportion of the salts and nutrients in the sediment at mouth will be in the pore spaces and readily soluble. Thus draining or washing of this sediment is likely to result in a relatively clean sediment that may be suitable for building or fill. Conversely, the effluent draining from the dredged material is likely to contain much of the pollutants. The same cannot be expected for the sediment from the proximal delta.

  4. Closing a mouth reduces water turbidity and it increases markedly in time of flood/opening. I am not a ichthyologist, but I believe that turbidity has an important impact on the ichtyofauna. Juveniles of many species are attracted to turbid waters; thus some turbidity can positively affect fish recruitment. Excessive turbidity can affect fish egg survival. So the message is that your amelioration programme should not be overly aggressive in eliminating suspensoids.

Study on environmental flow requirements

- Anchor Environmental are busy with a study for the Department of Water Affairs on environmental flow requirements for the Zandvlei estuary along with several other systems in the Western Cape. We have looked at a number of options for restoring ecological health of Zandvlei including considering merits of dredging the vlei and would be happy to discuss this with you further if you are interested.