

Investing in Infrastructure and Institutional Development for water security, growth and development

Reflecting on South Africa's experience

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***Institutions: capacity,
organisations, policies,
processes, rules and
agreements***

SA has a strong infrastructure platform for growth and development

- One new example: De Hoop Dam
 - Water to drive new mining activities
 - Water to 800 000 people
 - Hydro-electric scheme
 - Pumped storage



But South Africa cannot continue to rely solely on building new dams to ensure water security

- Relatively few prime dam sites left
- Cost of development is rising = more expensive water
- We have to make more effective use of the water we have
- Rising water utilisation and consumption means rising return flows
- **Our water security depends, in part, on how well we manage our return flows** - especially wastewater
 - To safeguard our river systems
 - To ensure our water remains fit for use

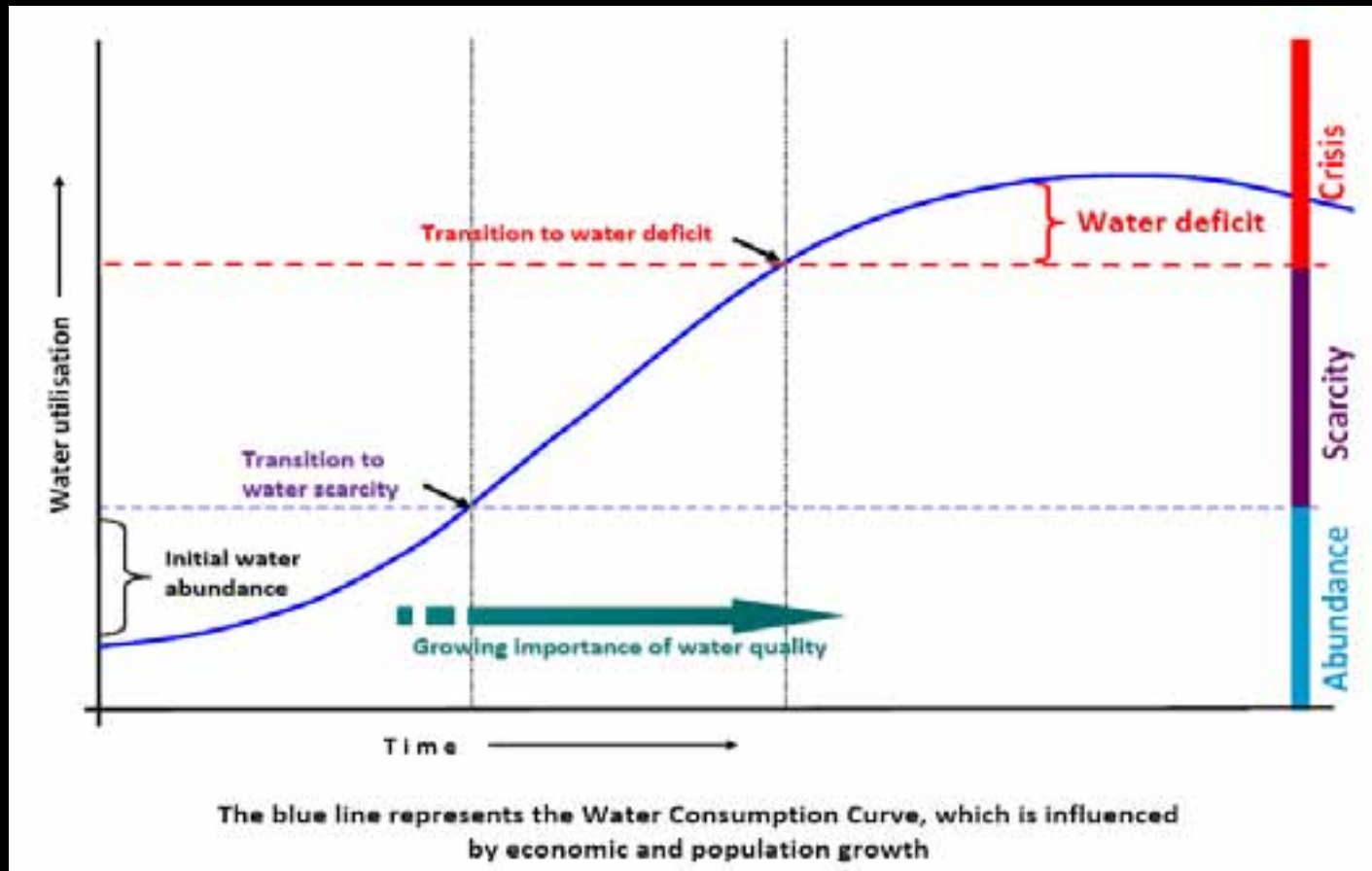
SA's water security depends on the strength of its institutional arrangements

- If South Africa cannot make the necessary institutional shifts in its water management systems, it will go into water deficit
 - Because of both Quantity and Quality constraints
- Our area of greatest vulnerability is municipal wastewater management



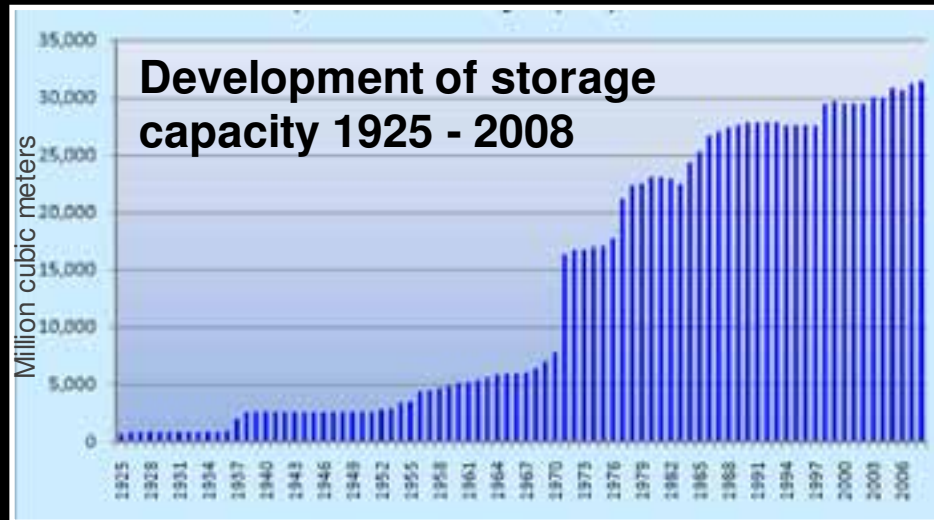
Runaway algal growth in the Vaal, fed by high nutrients in return flow

Growing water scarcity and declining water quality put our water security at risk



Developed from Turton (1999, 2002)

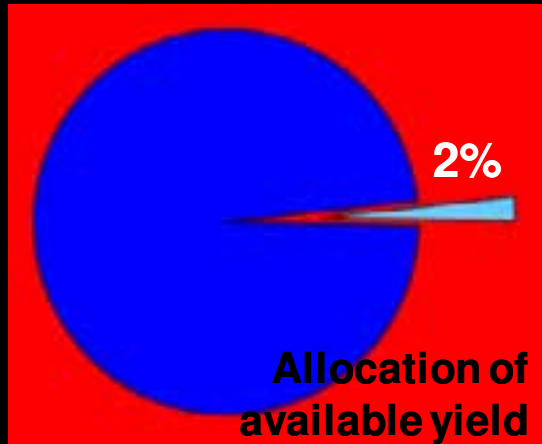
Water security for equitable growth and development



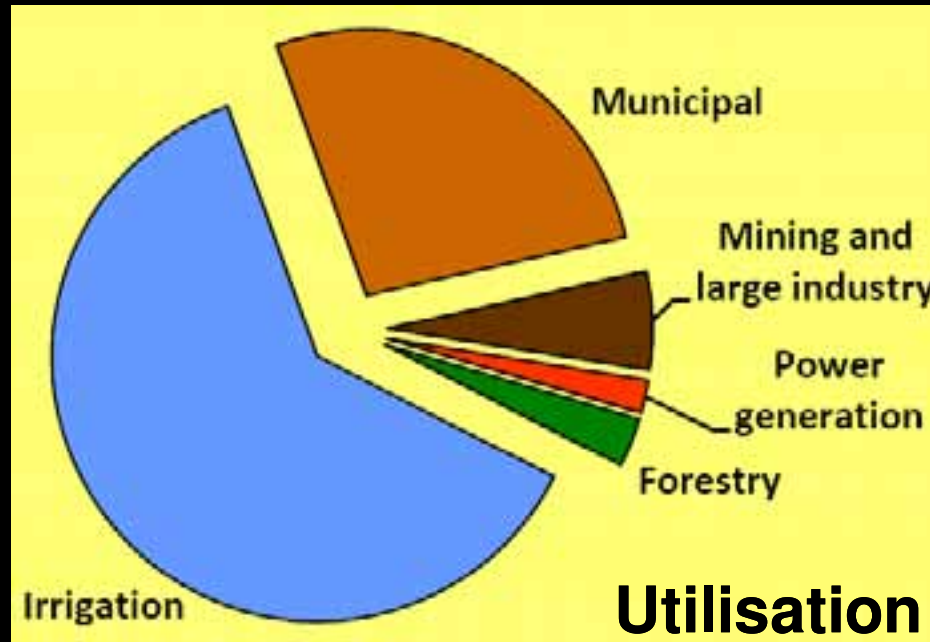
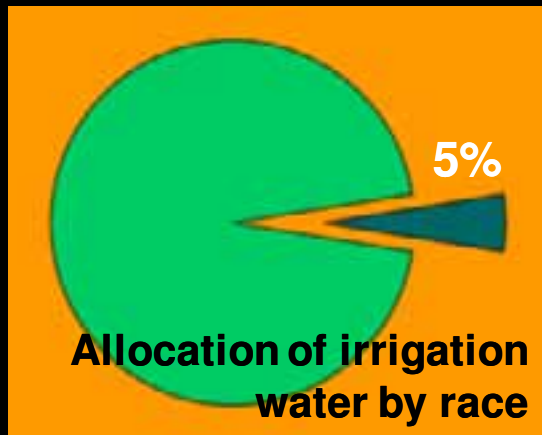
Significant water infrastructure development has enabled diversified economic development

- But pre-1994 infrastructure and institutions served only 10% of the population
- Since 1994, South Africa has pursued far-reaching reforms to serve the whole population
- Key challenge is to ensure water availability for equitable, inclusive and sustainable growth and development

Access and Equity




98% of South Africa's available yield has already been allocated



Commercial agriculture is by far the single biggest water user

95% of irrigation water remains in white hands

Municipal demand is the
sector of water demand

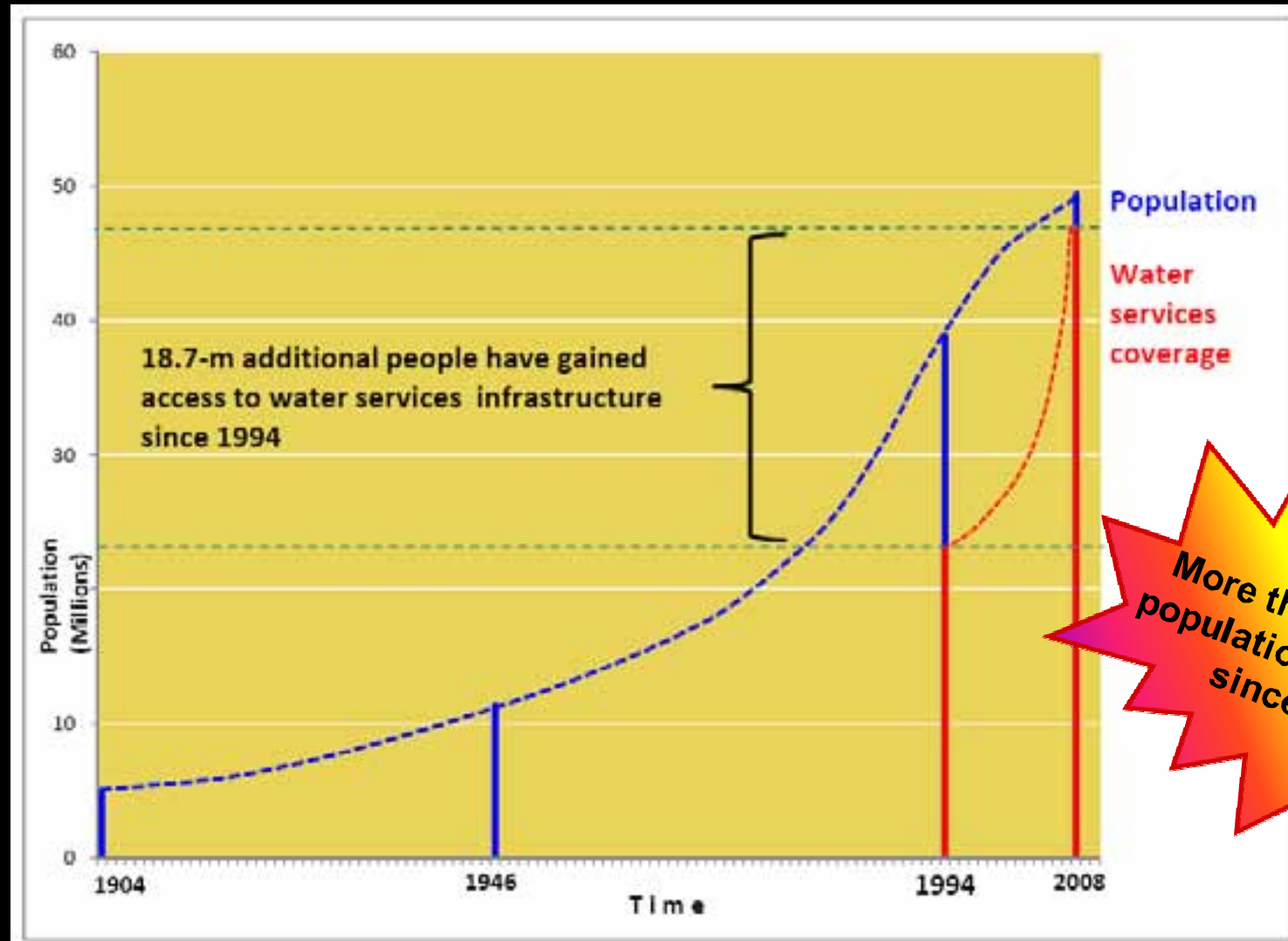


**Failures impact
most harshly on
poor people**

Huge implications for management of
return-flows and wastewater

- Water **quality** issues

Since 1994, SA has nearly doubled access to water services infrastructure



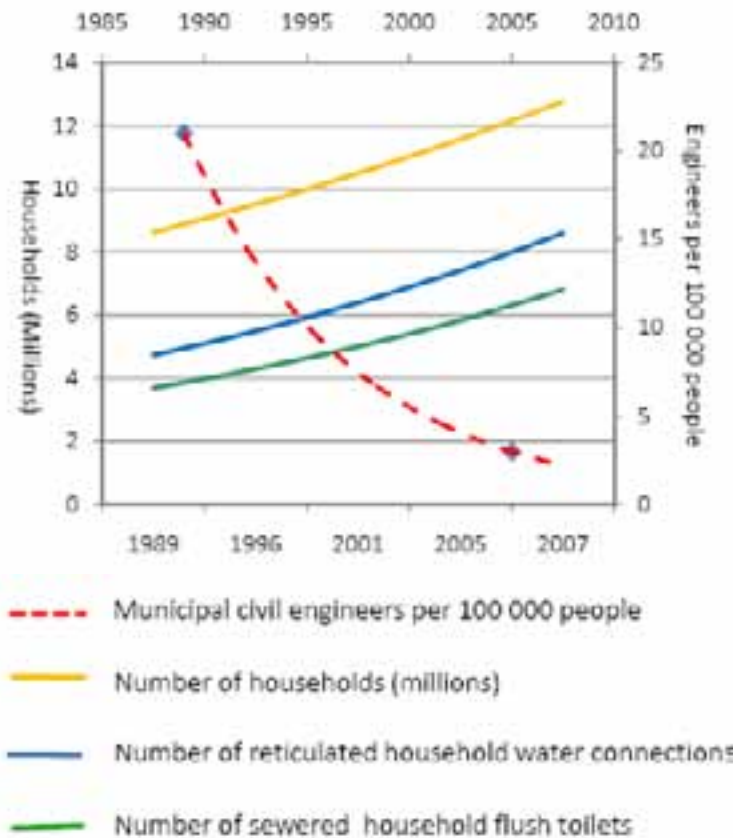
More than twice the population of Sweden since 1994!

More emphasis on new connections than on the supporting infrastructure

- New water services delivered to 18.7-m people = huge increase in **wastewater** volumes
- New houses provided to more than 2.4-million people, mostly with flush toilets
- About 290 000 bucket toilets eradicated – mostly upgraded to flush toilets
- Expanded service provision has outpaced expansion and upgrading of bulk infrastructure
 - Big bottlenecks especially around wastewater treatment systems

Infrastructure development is outpacing institutional development in many areas

Key trends in networked water and sanitation services over the past 20 years



Derived from Lawless (2007), DWA (2007, 2008) and StatsSA (2006, 2007)

- Extensive capacity development and skills support initiatives underway
- But it will take time to align institutional arrangements with infrastructure requirements

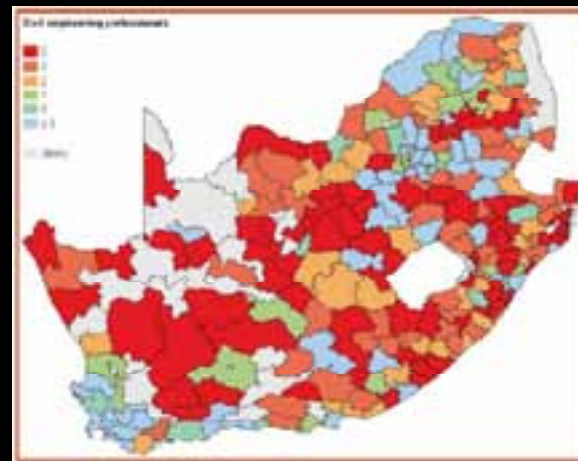


Chart showing technical capacity in municipalities in 2005. Red-shaded municipalities had no civil engineers at all

Source: Lawless, (2007)

Key challenges

- Equitable **access**
- **Scale** of development required
- **Urgency** of improvement

Plus

The urgency of **taking wastewater management more seriously**





Into the Klip River and
from there into the Vaal

Rand Water

Quarterly Water Quality Status of the Barrage Reservoir Catchment

1 Oct 2007 - 30 Sep 2008



Sample Point	Sample Point Description	Aluminium	Ammonia	Dissolved Oxygen Demand	Chloride	Conductivity	Drypoint Turbidity	Dissolved Oxygen	Faecal Coliforms	Fluoride	Iron	Magnesium	Manganese	Nitrate	pH	Phosphate	Sodium	Sulphate	Suspended Solids
K10	Bosbokgruif Weir @ Healdsburg	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
K14	Klip River Weir @ Redden Tiers Bridge	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
L11	Leucoput @ Sandburg	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
M12	Netgruif Weir @ Loch Vaal	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
S2	Suberkowat River Weir @ Three Rivers	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
V10	Stream from Veldt's Farm	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
V17	Vaal River @ Barrage Outlet	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
V2	Vaal River @ Engelbrecht's Drië Weir	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
VHR14	Vaal River Weir @ 24 km Beaun	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
VHR17	Vaal River Weir @ 27 km Beaun	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10

High salts – impacts on agricultural productivity, industrial processes and treatment costs

High bacteriological contamination – disease risks to people

High nutrients – feeds algal blooms

Key

K10	Klip River Weir @ Redden Tiers Bridge	0.11	0.02	20	10	150	1.5	1.5	100	0.1	0.1	10	0.1	10	7.5	0.1	10	10	10
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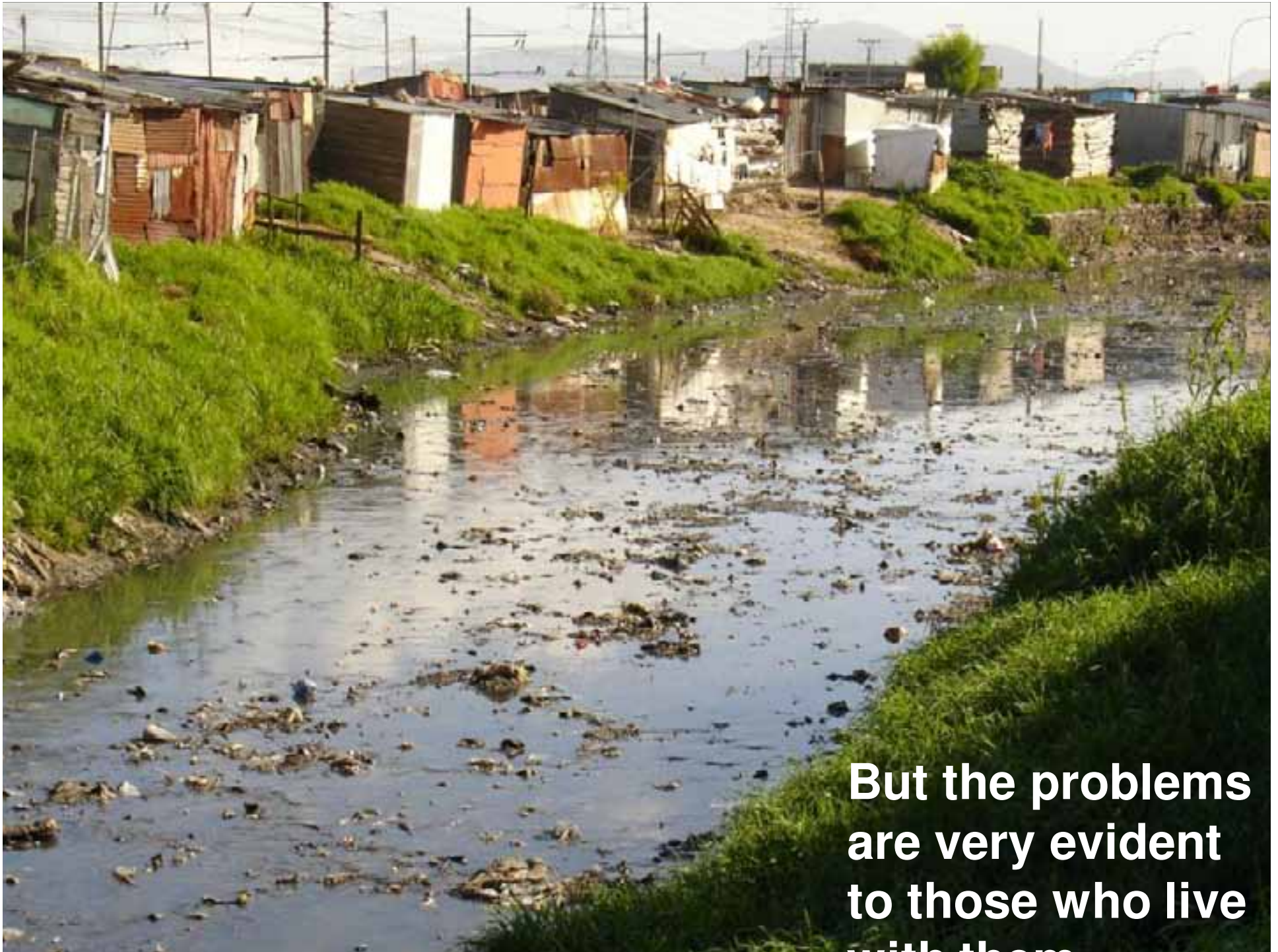
Water Quality Guidelines

Green	- Ideal
Yellow	- Acceptable
Orange	- Tolerable
Red	- Unacceptable



Often fish kills are the first time we notice that there's a problem





**But the problems
are very evident
to those who live
with them**



**We may need to rely more on groundwater
in the future**



Are we protecting our groundwater adequately?

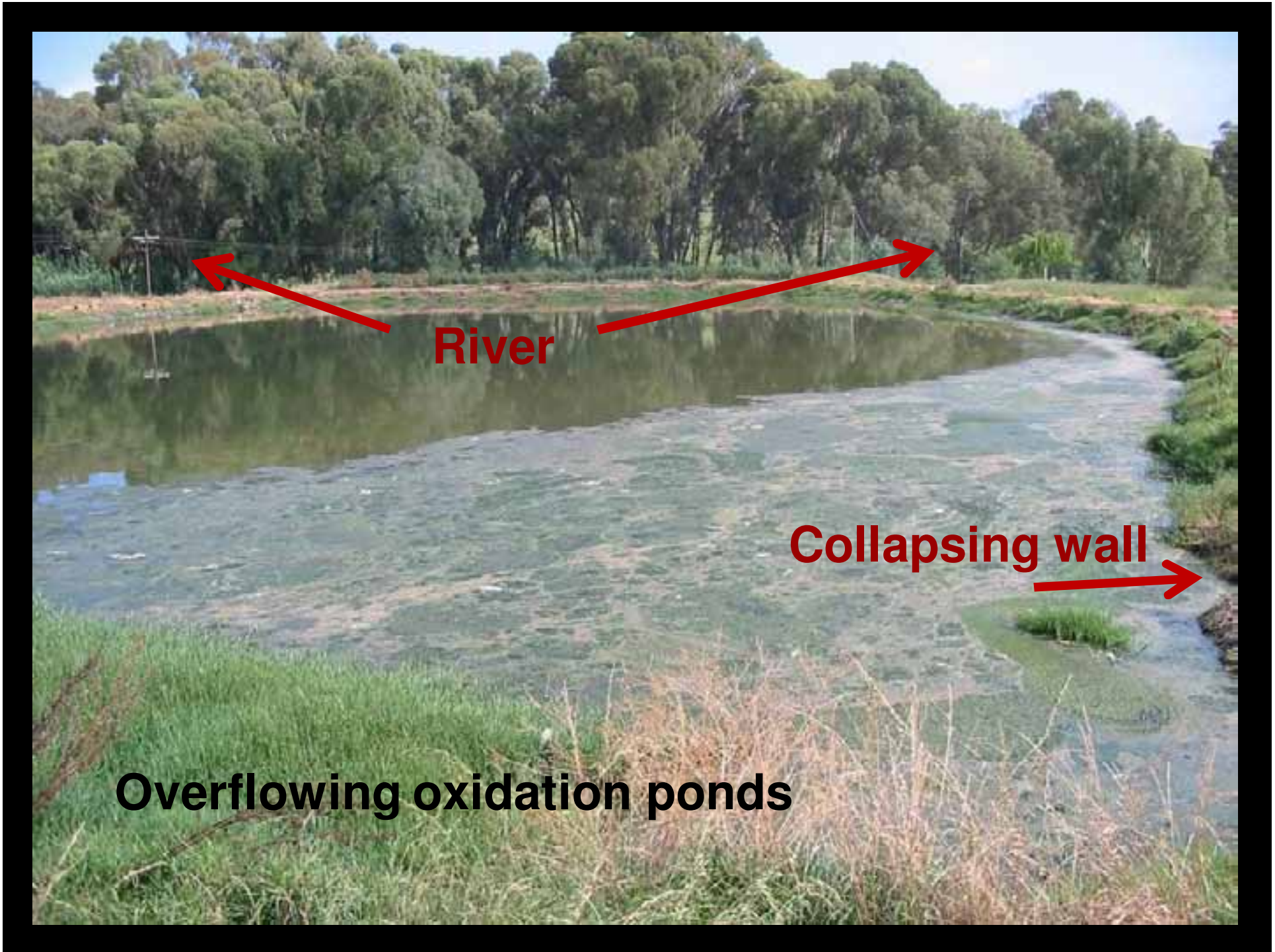


Boreholes for municipal drinking water supply



Dried sludge, following mechanical breakdown of the treatment works





River

Collapsing wall

Overflowing oxidation ponds

Witpan near Welkom



Repeated sewage treatment failure over the past decade

Raw sewage diverted to Witpan, flooding it.

Continuous pollution of the Sand River



Wastewater treatment compliance in the Free State



Feb 2008

7% No or few failures
64% Non-compliance



September 2008

74% non-compliance

Aggregated by province

- **Not one province scores above 40% compliance**

Extensive rehabilitation and renewal needed

- If we invest hugely in rehabilitating them – can we be sure they won't collapse again?
- Have the factors that led to poor maintenance and poor management been addressed?



Skills, staffing, adequate budgeting for capital and operating costs, monitoring, accountability for failures, regulation, support, prosecution -

Treatment technologies and Climate Change

Activated sludge treatment



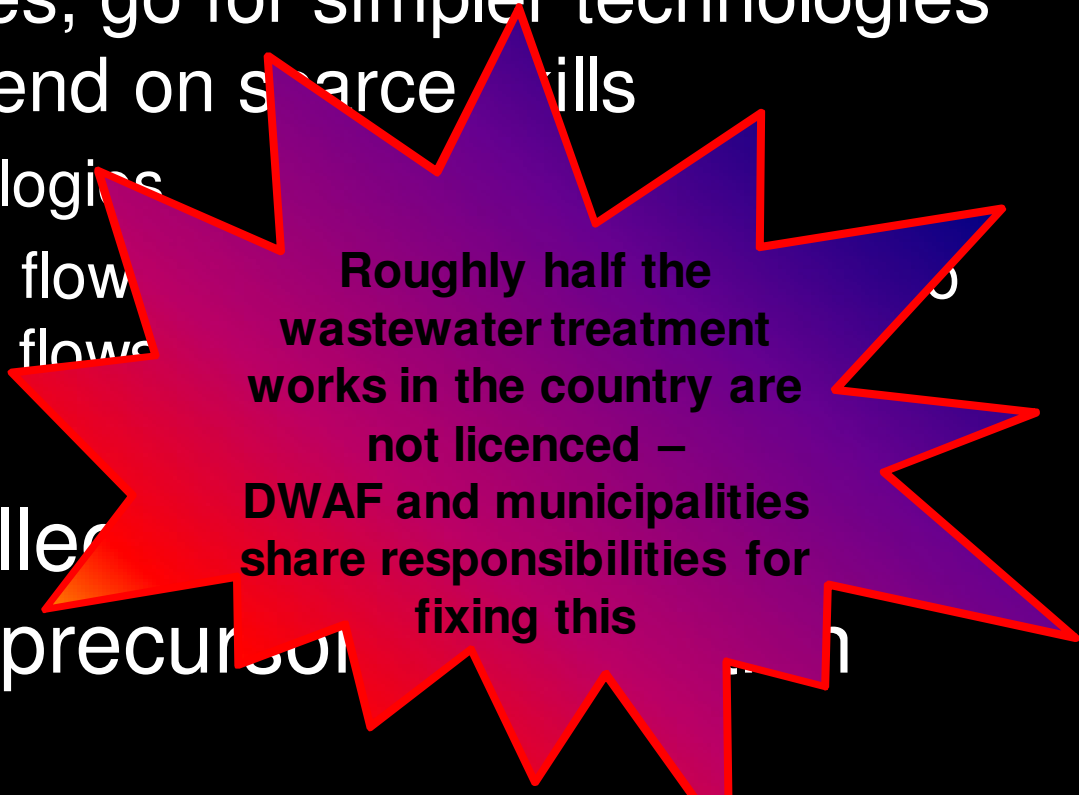
Design life: ± 40 years

⇒ 2048

- Highly energy intensive
 - Rising electricity costs
 - Progressive carbon tax
 - Stringent carbon emissions caps looming
- **The investments made in the next 10 – 20 years could lock us into very high emissions for the next half-century**
- Are we exploring some alternatives?

Key requirements going forward

- Robust wastewater treatment systems
- Factor in significant skills constraints
 - In smaller centres, go for simpler technologies which don't depend on scarce skills
 - New bio-technologies
 - Cycle the return flow
turn the nutrient flow
problem
- Improve data collection
as the essential precursor

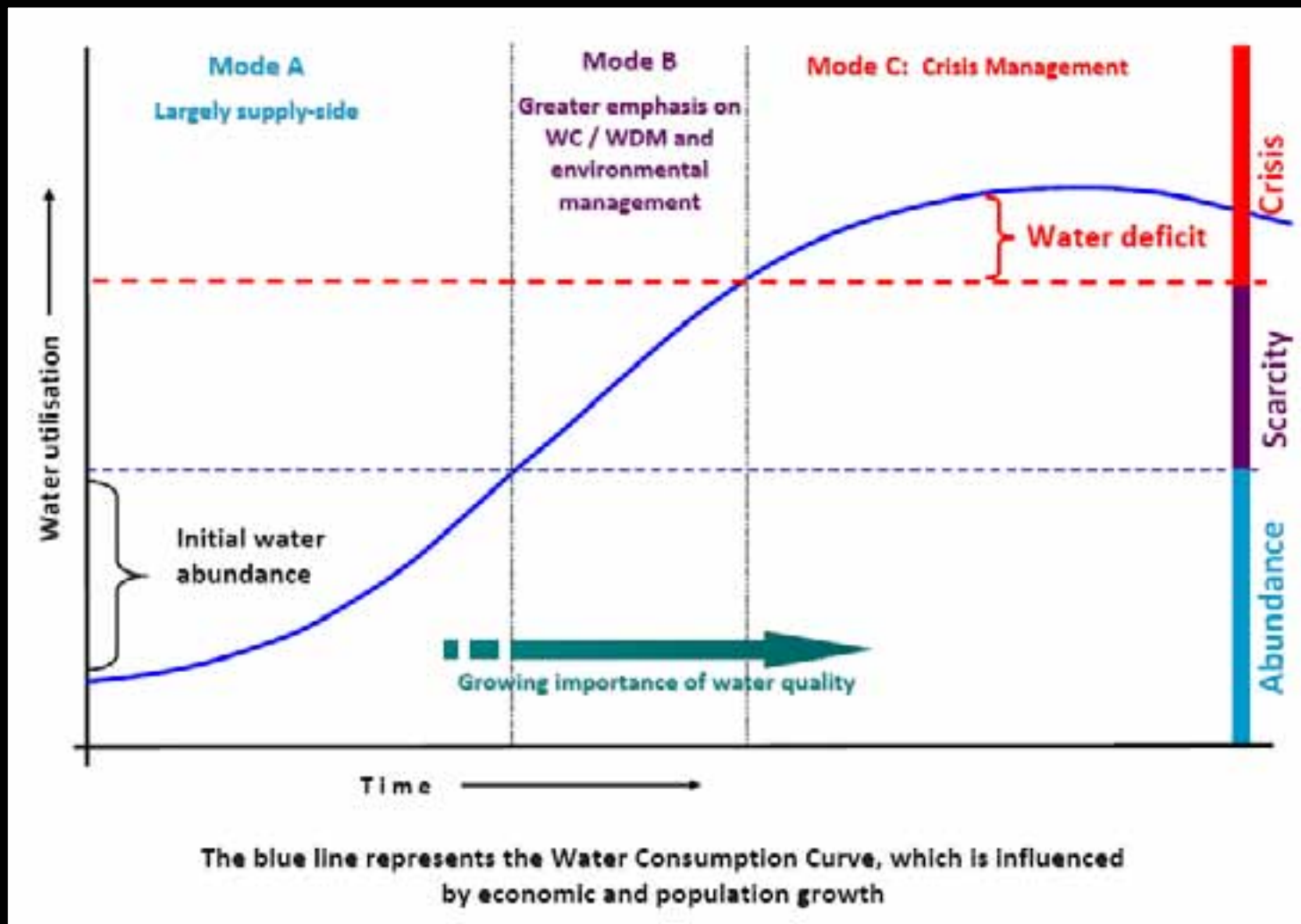


Roughly half the
wastewater treatment
works in the country are
not licenced –
DWAf and municipalities
share responsibilities for
fixing this

The vital importance of strong institutions for water security

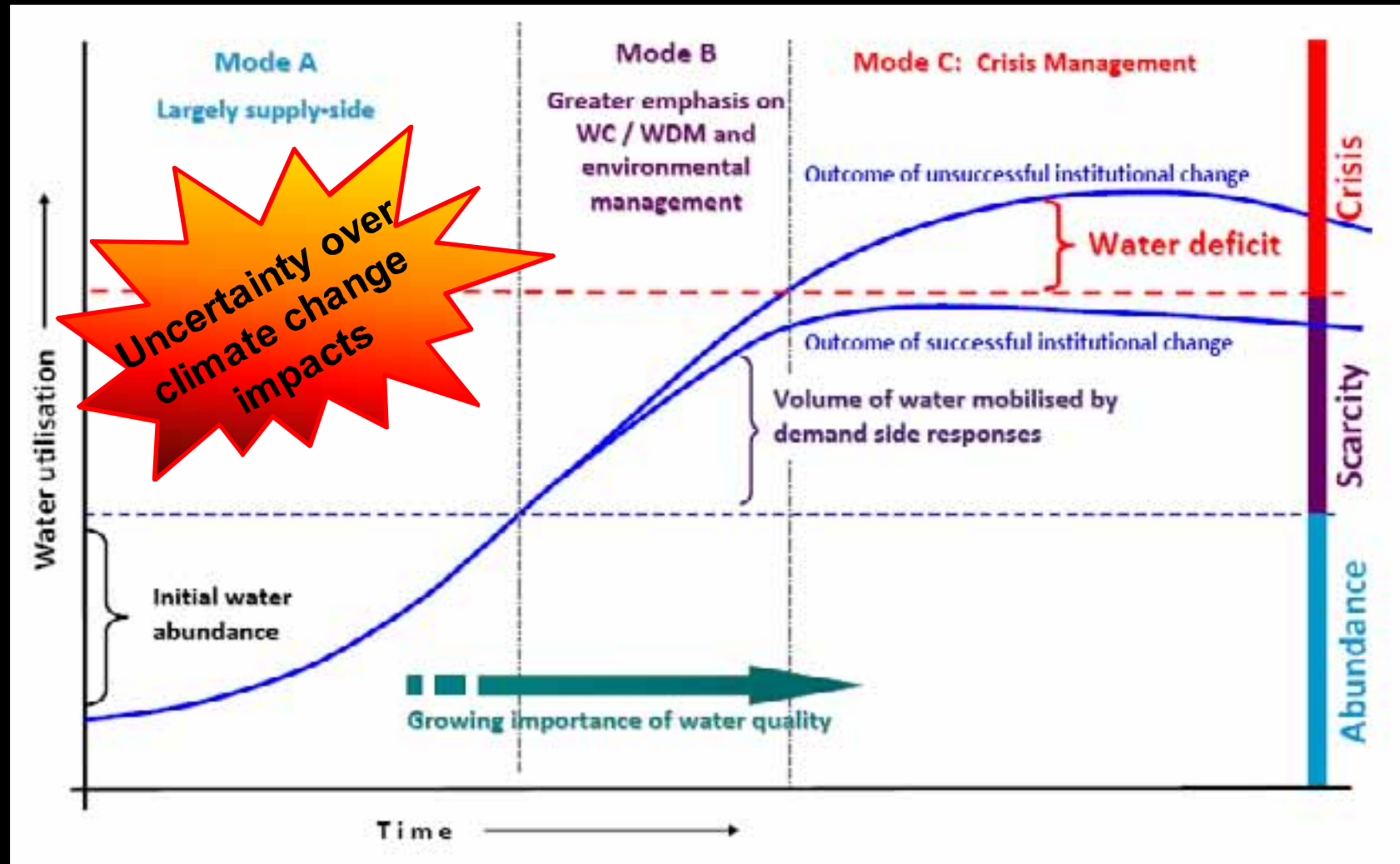
- The challenge is to strengthen institutional development
 - To enable ongoing infrastructure development
 - To maintain the functionality of existing and new infrastructure
 - To improve service levels and service standards
- Not just skills and capacities, but governance arrangements and regulatory tools
- Without this, there is a high risk of poorly run or collapsing infrastructure impacting on water security
 - Poorly treated effluent contaminates surface and ground water, with diminishing 'spare' clean water available for dilution
 - Leaking networks squander limited available water
 - Unauthorised use compromises assurance of supply

Institutional change is needed as water scarcity rises



Developed from Turton (1999, 2002)

Adapting successfully requires significant institutional change



Different institutional arrangements are needed to adapt from relative abundance to growing scarcity

Capacities, organisations, policies, processes, rules and agreements	MODE A	MODE B
	Premised on potential for significant infrastructure development	Premised on managing water in a context of growing scarcity and deteriorating water quality
	Policy guides development and management of supply	Policy and legislation is directed to <ul style="list-style-type: none"> - Making the most equitable, productive and sustainable use of available water - Safe-guarding water quality - Environmental protection - Good governance of resource management institutions
	Regulation focuses on managing supply	Regulation focuses on managing use Strong requirements for compliance enforcement

South Africa's water security depends on the strength of its institutional arrangements

- Growing water scarcity requires very different institutional arrangements for demand and environmental management
 - Emphasis on use, rather than supply
 - Effective maintenance, not just new development
 - Strong capability for regulation and compliance enforcement, especially for water quality management and minimising unauthorised use
 - Adaptative management
 - Enhanced monitoring and feedback mechanisms

Thank you



Upgrading services in a middle class area, replacing septic tanks with DEWATS

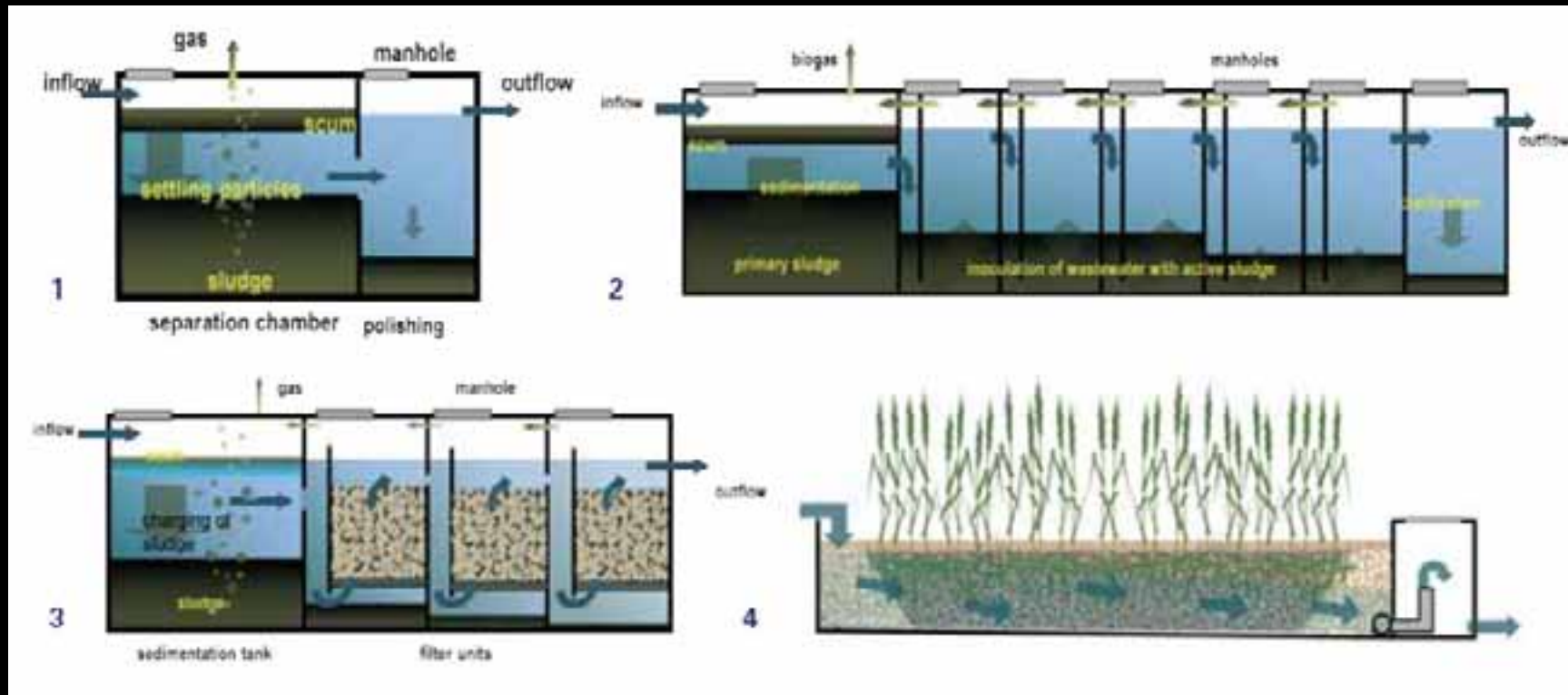




**Community
sanitation
centres**

Four basic technical treatment modules

- Primary treatment: sedimentation and floatation
- Secondary anaerobic treatment in fixed-bed reactors: baffled upstream reactors or anaerobic filters
- Tertiary aerobic treatment in sub-surface flow filters
- Tertiary aerobic treatment in polishing ponds.



Treating hospital wastewater



DEWATS Treatment Efficiency

No	Parameter	Unit	Anlytical-Results Inlet	Outlet	Reduction [%]
1	Temp.	°C	27	27	–
2	pH	–	7,6	7,3	4 %
3	BOD 5	mg/l	290	53,6	83 %
4	COD	mg/l	590	84	86 %
5	Phosphate	mg/l	18,33	3,67	80 %
6	TSS	mg/l	172	84	51 %
7	Ammonia	mg/l	0,19	0,07	63 %

Source: Graha Asih Hospital Bali, Anaerobic Filter + Horizontal Sandfilter + Purification Pond

