Monitoring and Evaluation of Water and Sewer Flows

Presented to African Water Leakage Summit
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Monitoring and Evaluation of Water and Sewer Flows

- Need for water use efficiency improvement
- Role of Monitoring and Evaluation (M&E) in water use efficiency improvement
- Current M&E focus: IWA Water Balance
- Proposed M&E focus
- Examples of enhanced M&E
- Conclusion

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The Need for Water Use Efficiency Improvement in Water Sector

- DWA has capped Rand Water's abstraction license to 1600 Mm3/a until 2020
- RW actual abstraction in 2013 was already 1618 Mm3/a and growing at > 2% pa
- Unsustainable if water use efficiency is not improved across the whole water sector, including sanitation

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The Role of Monitoring and Evaluation in Efficiency Improvement

- To measure is to know
- Demand can only be reduced if it is known how excessive it is and where
- Decisions regarding intervention planning and implementation should be informed by M&E
- Scepticism exists at high levels: If the water losses are so high, why is Gauteng not a marshland?

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The Role of Monitoring and Evaluation in Efficiency Improvement

- The answer is simple: Gaudrain!
- Most of the leaks and excessive consumption is removed by means of stormwater and sewerage systems – Out of sight, out of mind
- M&E is necessary to measure important indicators, to benchmark them against own history and actuals of others

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Current M&E Focus

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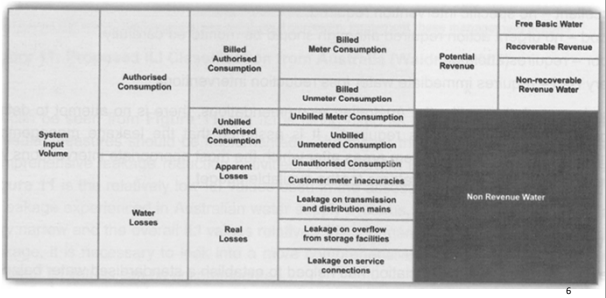
- All familiar with IWA Water Balance Model



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Current M&E Focus

- The current focus is on the municipal water distribution system
- IWA model determines Non-Revenue Water, which is only a fraction of the water use inefficiency.
- The major part of current urban inefficiency lies with the end users:
  - Wasteful consumptive use
  - Wasteful use returned to sewers
  - Excessive plumbing leakages
  - Excessive tap and toilet leakages

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Proposed M&E Focus

- The focus should remain on NRW in municipal (and water board) systems
- But water use efficiencies on end user properties must also receive M&E
- To do this, it is necessary to combine water supply and sewer discharge data to obtain a better assessment of the nature and extent of the problem
- To date this has been done on small a scale (project level)

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Proposed M&E Focus

- However, it should ideally be expanded to cover bulk water supply zones, sewer drainage areas, regions, towns, municipalities, water board areas of supply and DWA river management areas
- The frequency and intensity of M&E should also be stepped up:
  - Monthly, daily, continuous
  - Manual and automated reading, logging, telemetry, internet access
  - Integration of multiple data sources such as water supply, billing and sewer effluent measurements

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Examples of enhanced M&E

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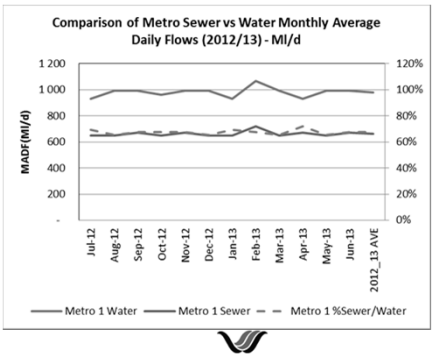
Comparison of annual and monthly bulk water supply flows to sewer flows: Rand Water bulk water supply vs Metro sewer flows



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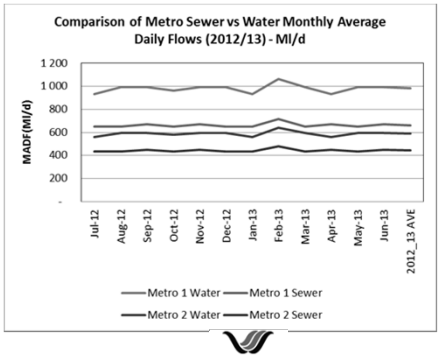
Comparison of annual and monthly bulk water supply flows to sewer flows: Rand Water bulk water supply vs Multiple Metro sewer flows



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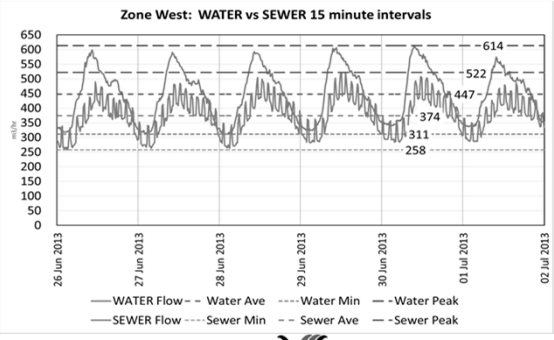
Comparison of hourly bulk or zonal water supply flows to sewer flows:



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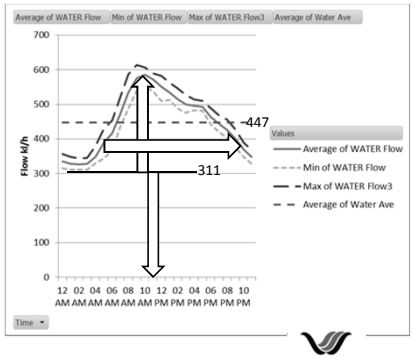
Determination of some water inefficiency sub-components: Active and Passive Water Demand



Active Water Cons
= AveWater minus MinWater
= 447 -311 kl/h
= 136 kl/h
= 30% (area) of AveWat

Passive Water Cons
= 311 kl/h
= 70% of AveWater

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Determination of some water inefficiency sub-components: Active and Passive Water Demand

Active water demand:

- Consumptive use, not returned to sewer
  - Productive use – drinking & cooking; normal irrigation, washing of paving, pool filling
  - **Wasteful use – excessive irrigation, washing of paving, pool filling**
- Use returned to sewer
  - Productive use – normal washing, bathing, showering, toilet flushing
  - **Wasteful use – excessive washing, bathing, toilet flushing**

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Determination of some water inefficiency sub-components: Active and Passive Water Demand

Passive water demand:

- Losses, not returned to sewer
  - **Leaking municipal pipes, overflowing reservoirs, not supplied to end user, not billed to end user, not returned to sewer**
  - **Leaking private plumbing pipes, supplied to end user, not utilised by end user, not returned to sewer**
- Losses, returned to sewer
  - **Leaking taps and toilets, supplied to end user, not utilised by end user, returned to sewer**
- Continuous use (24/7 factories), returned to sewer

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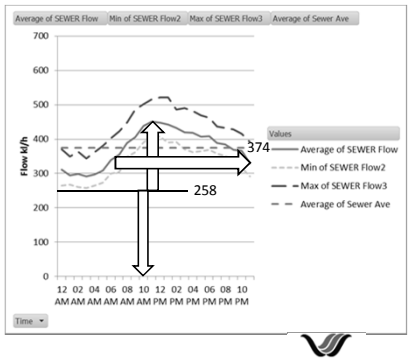
Determination of some water inefficiency sub-components: Active and Passive Sewage Discharge



Active Sewage Discharge
= AveSew minus MinSew
= 374-258 kl/h
= 116 kl/h
= 31% (area) of AveSew
=

Passive Sewage Discharge
= 258 kl/h
=69% of AveSew
=58% AveWat

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Determination of some water inefficiency sub-components: Active and Passive Sewage Discharge

Active sewage discharge:

- Use returned to sewer
  - Productive use – normal washing, bathing, showering, toilet flushing
  - **Wasteful use – excessive washing, bathing, toilet flushing**
- **Ingress of stormwater**
- **Sewer manhole overflows due to stormwater**

Passive sewage discharge:

- Losses, returned to sewer
  - **Leaking taps and toilets, supplied to end user, not utilised by end user, returned to sewer**
- **Ingress of groundwater**
- **Sewage spillage due to blocked sewers**
- Continuous use (24/7 factories)

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Determination of some water inefficiency sub-components: Public vs plumbing pipe losses

Total distribution and plumbing pipe losses
= difference between Passive Water and Passive Sewer flow
=311-258 kl/h
=53 kl/h
=12% AveWat

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Determination of some water inefficiency sub-components: Consumptive Use

Consumptive Use
= diff Active Water and Active Sewer
=136-116 kl/h
=20 kl/h
=4% AveWat

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Determination of some water inefficiency sub-components: Private Tap and Toilet losses

Tap and Toilet Losses
= Passive Sewer and 24/7 (=0 in township or suburb) and Stormwater (= zero in dry weather)
=258 kl/h
=70% AveSew
=58% AveWat

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Determination of some water inefficiency sub-components: Active Water Returned to Sewer

PassSew = PassWat Returned
=258 kl/h

Active Wat Returned = Ave Sew – Pass Sew
= 374-258
=116 kl/h
= 31% AveSew
= 26% AveWat

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Determination of some water inefficiency sub-components: Consumptive Use

Cons Use = Active Water – Active Wat Returned to sewer
= 136-116
=20 kl/h
= 4% AveWat

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Determination of some water inefficiency sub-components: Public and Plumbing pipe losses

Total Pipe Losses = AveWat - Cons Use - Active Water Returned to sewer - Passive Water Returned)
= 447-20-116-258
=447 – 394
=53 kl/h
= 14% AveSew
= 12% AveWat

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Determination of some water inefficiency sub-components: Public pipe losses

Mun Pipe Losses = AveWat minus Real Water Supplied to End User

= 447-NRW+Meter Errors (estimated)

=5% (estimated)

= 22 kl/h

= 5% AveWat

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Determination of some water inefficiency sub-components: Public vs Plumbing pipe losses

Priv Pipe Losses = Total Pipe Losses – Mun Pipe Losses

=53 - 22 (estimated at 5%)

= 31 kl/h

= 7% AveWat

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Conclusion

- Some of the above Monitoring is not currently done because of a lack of knowledge and awareness regarding its benefits.
- Some of the above Monitoring is done to some extent, but sometimes the Evaluation part insufficient
- Some of the Water data might be available but the Sewer data might be lacking and vice versa
- If all these issues are treated with equal determination, then improved decisions can be made based on better information
- More pieces of the puzzle can be fit together to start showing a clearer picture

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THANK YOU

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