Revenue Enhancement using smart GIS tools
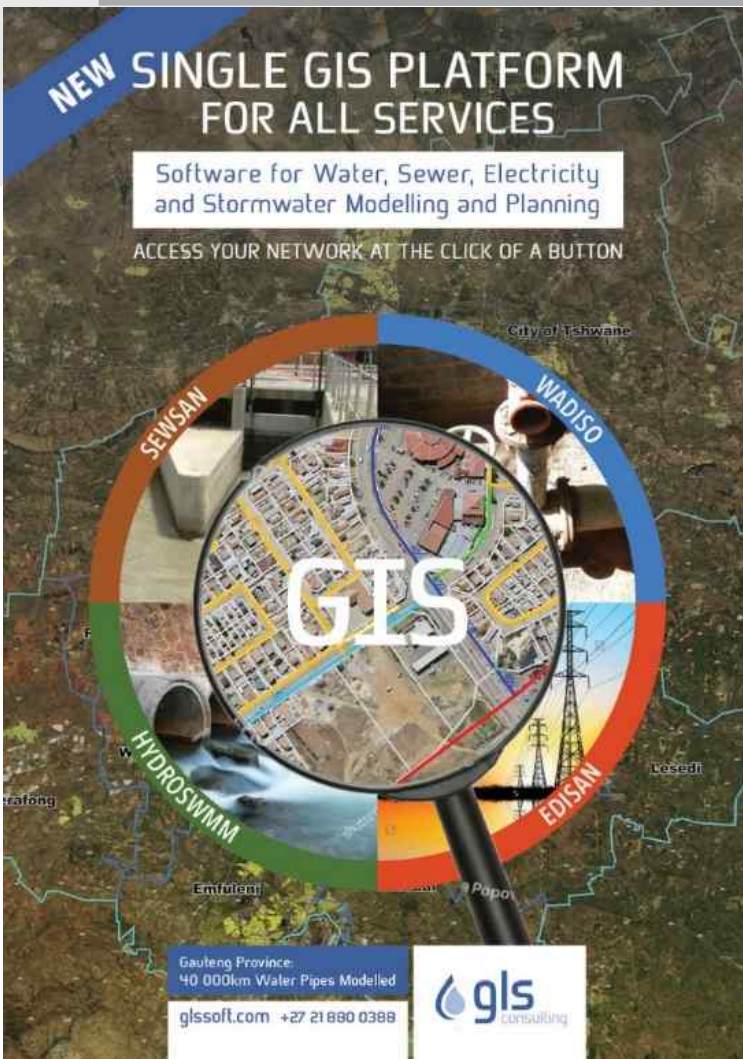
A GIS technology based approach to revenue protection

HILTON BAARTMAN

BACKGROUND: GLS SOFTWARE USED

NEW SINGLE GIS PLATFORM FOR ALL SERVICES

Software for Water, Sewer, Electricity and Stormwater Modelling and Planning

ACCESS YOUR NETWORK AT THE CLICK OF A BUTTON

Gauteng Province: 40 000km Water Pipes Modelled

glssoft.com +27 21 880 0388

Al — **Albion:** CAD/GIS System

Wa — **Wadiso:** Water system modelling

Se — **Sewsan:** Sewer system modelling

PRP — **PRP:** Pipe Replacement prioritisation

Sw — **Swift:** Water and Electricity Demand Analysis

Ed — **Edisan:** Electricity system modelling

Established in 1989 – 31 years of delivering excellence to our customers

Note: Consider Purchasing Software as Optional Extra
Developed by Engineers for Engineers

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"The kilowatt hour business is dying."

A phrase most often heard at the recent AMEU Conventions

*"Level 5 water restrictions is the new normal."*

A phrase most often heard with recent droughts

"Covid-19 lockdowns have affected municipal revenue even further."

A phrase I've made up but that we all know is true ☺

NEW NORMAL

- Electricity prices have increased dramatically over the last decade
- This will continue with further increases needed to service Eskom's debt
- Municipalities in trouble with failing and ageing infrastructure
- Sales stagnant or decreasing with EEDSM & Renewable Energies
- Revenue down, costs rising = failing business
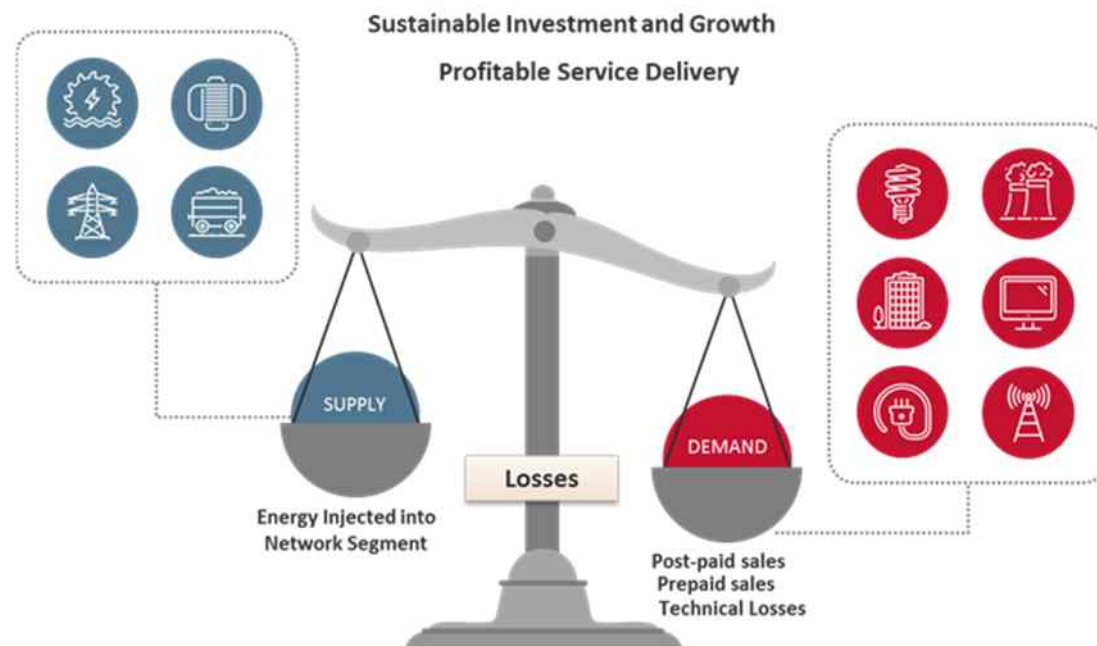- Need to maximize revenue
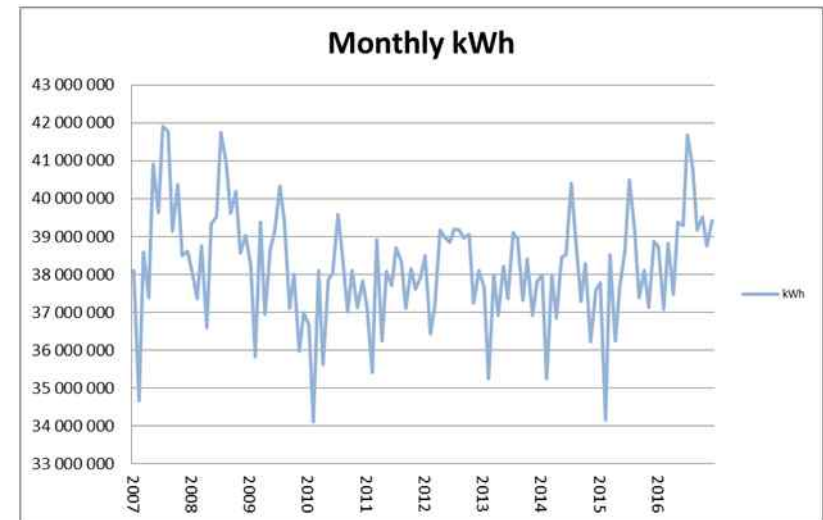
NEW NORMAL

- Drought duration is increasing due to changing climate
- Recent drought in Cape saw utilities raise tariffs to cover projects for water augmentation and to deter usage
- Pressure regulation led to more pipe bursts meaning more water losses
- Sales stagnant or decreasing with WC/WDM & other water sources such boreholes
- Revenue down, costs rising = failing business
- Need to maximize revenue
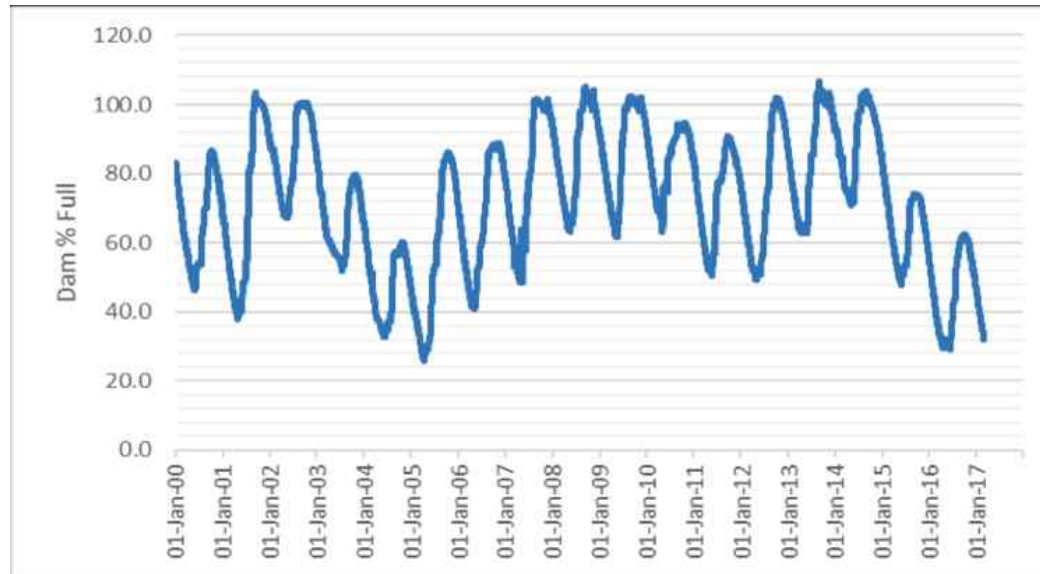
ENERGY LOSSES

- Losses for electricity are obtained from deducting sold energy from purchased energy
- 2 parts to the losses for electricity
  - Technical losses
  - Non-Technical losses
- Technical losses
  - Can't avoid but can optimize
  - $P = I^2 R$
- Non-Technical losses
  - Balance leftover
  - Theft
  - Meter Tampering
  - Non-metered
  - Non-billed
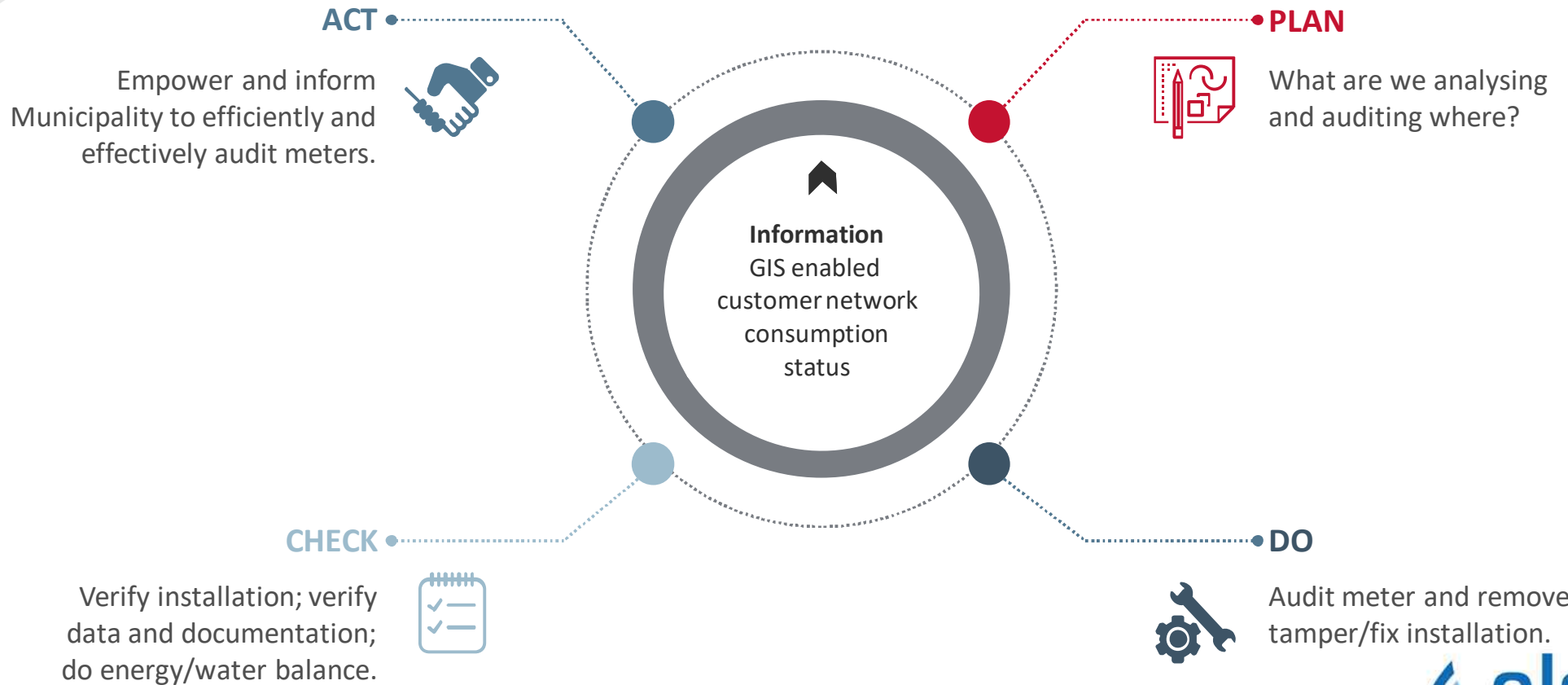 - Etc.

Sustainable Investment and Growth
Profitable Service Delivery

SUPPLY

DEMAND

Losses

Energy Injected into
Network Segment

Post-paid sales
Prepaid sales
Technical Losses

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WATER LOSSES

- Losses for water are obtained from deducting sold water from purchased water
- 2 parts to the losses for electricity
  - Real losses
  - Apparent losses
- Real losses
  - Can't avoid but can optimize
  - Leakages, overflows etc.
- Apparent losses
  - Balance leftover, non physical losses
  - Meter inaccuracies
  - Theft/unauthorized consumption
  - Meter Tampering
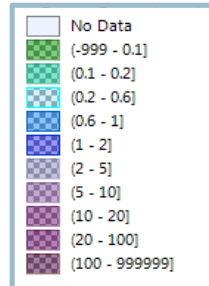 - Non-metered
  - Non-billed
  - Etc.

Plan, Do, Check, Act

ACT

Empower and inform Municipality to efficiently and effectively audit meters.

PLAN

What are we analysing and auditing where?

Information
GIS enabled customer network consumption status

CHECK

Verify installation; verify data and documentation; do energy/water balance.

DO

Audit meter and remove tamper/fix installation.

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Swift: Spatial Analysis of Billing System Data

– Billing System Data

– Linked to Cadastral

– Over background of aerial photographs

– Visualisation of data

Water consumption (kl/day)

- No Data
- (-999 - 0.1]
- (0.1 - 0.2]
- (0.2 - 0.6]
- (0.6 - 1]
- (1 - 2]
- (2 - 5]
- (5 - 10]
- (10 - 20]
- (20 - 100]
- (100 - 999999]

Electricity consumption (kWh/day)

- No Data
- >0.0 - 0.2
- >0.2 - 10
- >10 - 20
- >20 - 50
- >50 - 100
- >100 - 200
- >200 - 500
- >500 - 1000
- >1000 kWh/d
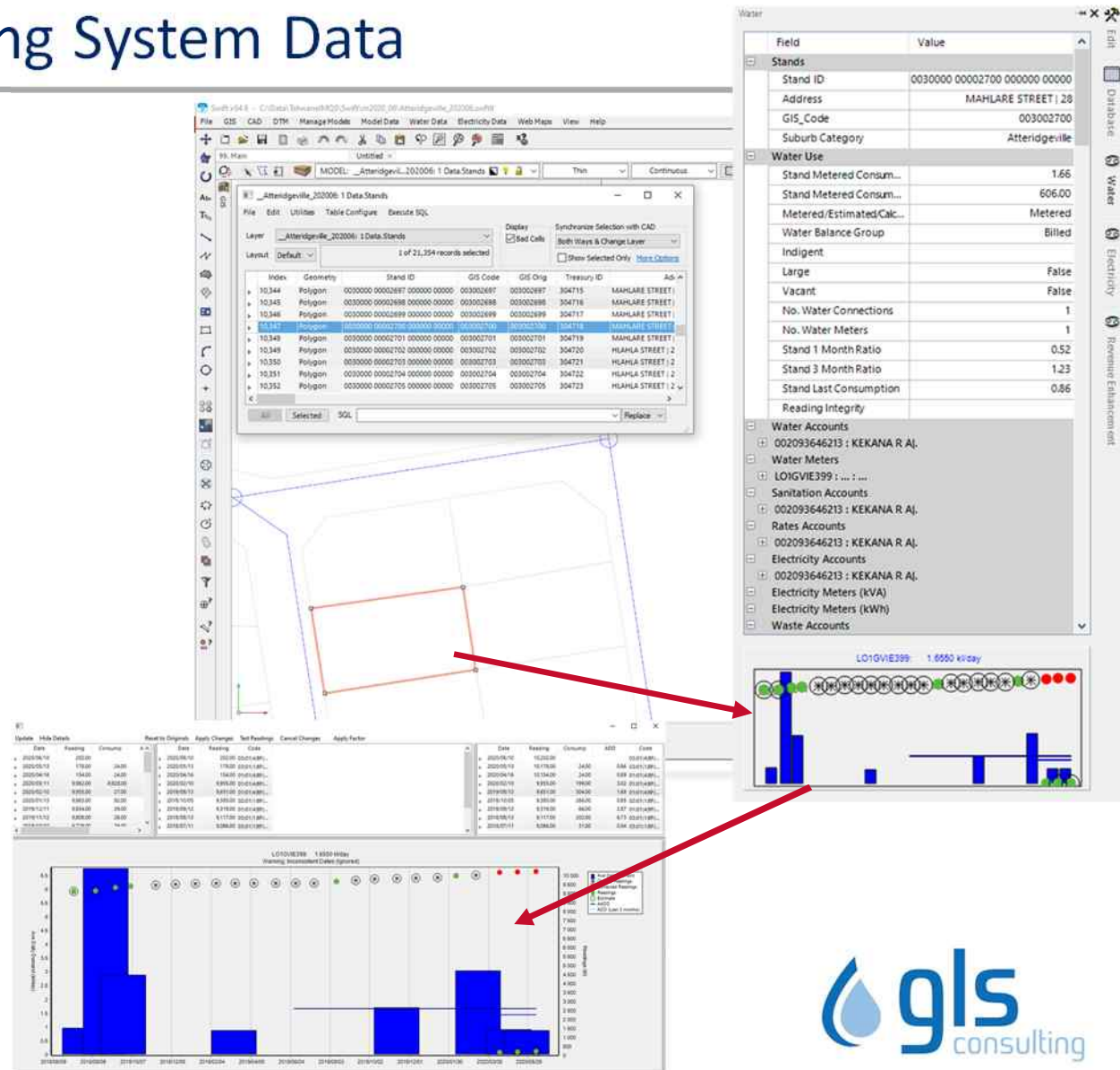
SWIFT

- Custom built
- Analysis of treasury billing data
- Consumption statistics for hydraulic/load modelling
- Water and Energy loss calculations and reporting
- Revenue Enhancement
  - Assess completeness of billing data
  - Identify revenue enhancement opportunities
- Tariff Analysis

Electricity:		Billed Revenue (R million/annum)		Ave Collection Rate (%)	Probable Revenue (R million/annum)	
Availability		R	16.7	36%	R	6.0
Consumption		R	108.3	39%	R	51.7
Prepaid installations		R	17.9	100%	R	17.9
Water:		Probable Revenue/Saving* (R million/annum)		Ave Collection Rate (%)	Probable Revenue/Saving* (R million/annum)	
Availability		R	13.0	23%	R	3.0
Consumption		R	140.9	37%	R	52.6
WDM/Retrofitting		R	48.7	100%	R	48.7
TOTALS		R	345.5		R	179.9

* Savings due to reduced SIV through water demand management or retrofitting to curb unpaid for excessive water consumption

Introduction to Swift

- Billing system data
  - Stands,
  - Accounts (rates, electricity, water, refuse)
  - Meters (water, electricity)
  - Meter readings (water, electricity)

- Prepaid meter data
  - If available – link to billing data
  - Or
    - identify through availability account tariff code
    - Estimated consumption

- Arrears data
  - Age of debt per account
  - Aggregated to debt per stand

Spatial Link

- Required for mapping
  - Correcting GIS Link
  - Manual corrections
  - Address linking
  - Manipulate portion or sub-portion
  - General link
    - suburb/street/meter reading route

- Important for data integrity
  - Quantify in % of stands unlinked
  - Quantify in % of consumption unlinked

Identify Unbilled Stands

- Calculate Consumption from meter readings
- Map stands with and without consumption
- Average consumption per landuse per suburb
- Over aerial photo
- Identify unbilled stands
- Estimate consumption

Integrity Metered

- Low Metered Consumption
- Metered consumption
- Supply via another stand
- Prepaid
- Developed Stand with no consumption
- Stands are metered with no consumption
- Stands are not prepaid or deemed (but should be?)
- Not metered

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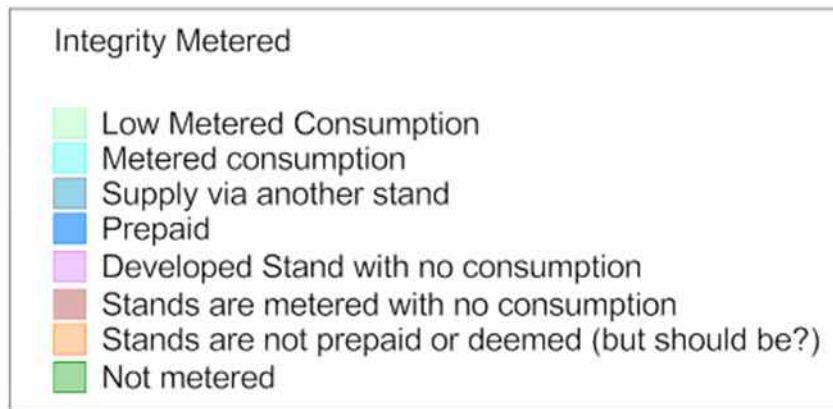
Estimate Potential Revenue

- Estimate consumption - average consumption suburb & landuse
  - Limited in High risk suburbs (residential)
    - 18 kL.month   (WDM)
    - 600 kWh.month   (Prepaid)

- Estimated Billed amount
  - Predominant tariff code / most likely for landuse

- Risk Based Approach
  - Estimated Bill x Likelihood of payment (suburb)

Billing Data Analysis: Electricity consumer profile

- 21% conventional metered (paid)

- 9 % non-payment

- 10% consumption unbilled

- 60% prepaid
  - Debt > 90 days:
    - 50% consumers
    - 37% consumption

Consumers (No. Stands)

6% 1% 0% 1%
1%
12%
50%
29%

Consumption (kWh.day)

7% 14%
0%
2%
37%
7%
10%
23%
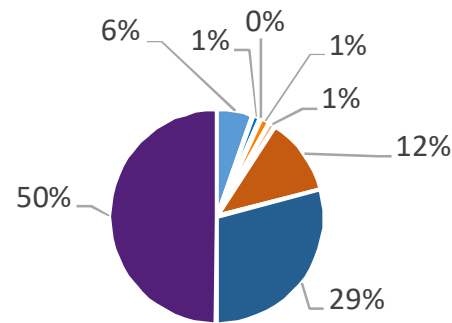
- Residential: Debt < 90 days
- Residential: Indigent
- Non Residential: Debt >= 90 days
- Prepaid (Municipal Debt < 90 days)
- Non Residential: Debt < 90 days
- Residential: Debt >= 90 days
- Unbilled Unmetered
- Prepaid (Municipal Debt >= 90 days)
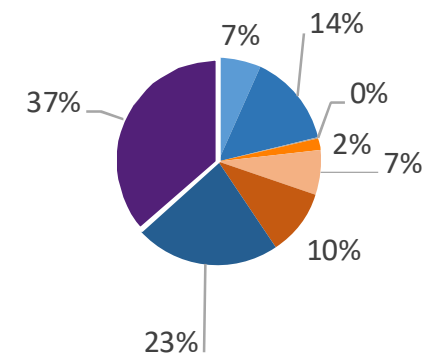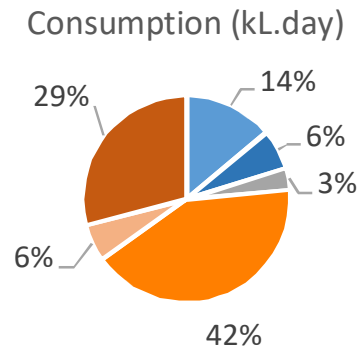
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Billing Data Analysis: Water consumer profile

- Revenue collected from
  - 15% of consumers
  - 20% of consumption

Consumers (No. Stands)

14%
1%
7%
47%
1%
30%

Consumption (kL.day)

14%
6%
3%
42%
6%
29%

- Residential: Debt < 90 days
- Non Residential: Debt < 90 days
- Residential: Indigent
- Residential: Debt >= 90 days
- Non Residential: Debt >= 90 days
- Unbilled Unmetered

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Billing Data Analysis: Electricity residential consumer profile

- Debtors with prepaid electricity meters

Residential Consumption (No. Stands)

Residential Consumption (kWh.day)

Consumption categories (kL/month)

■ Debt < 90 days ■ Debt >= 90 days ■ Indigent
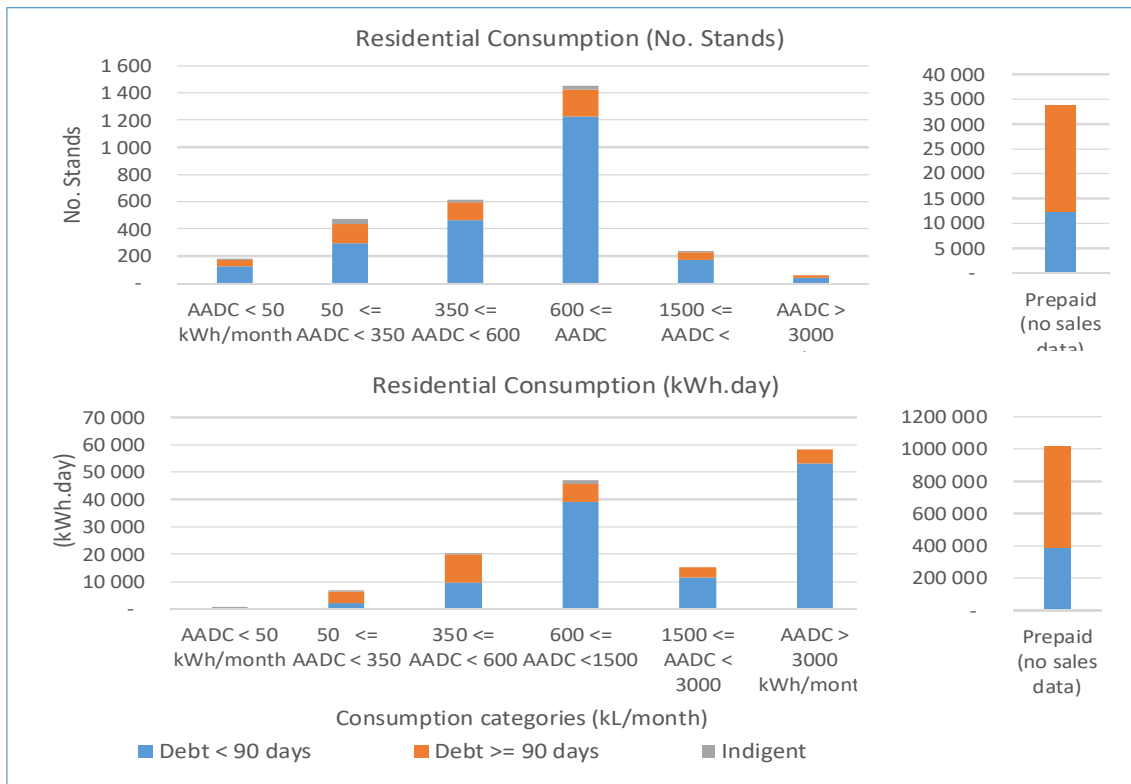
Billing Data Analysis: Water residential consumer profile

- Excessive consumption by debtors

Revenue Enhancement Opportunities

Electricity:		Billed Revenue (R million/annum)	Ave Collection Rate (%)	Probable Revenue (R million/annum)	
Availability		R 16.7	36%	R 6.0	
Consumption		R 108.3	39%	R 51.7	
Prepaid installations		R 17.9	100%	R 17.9	
Water:		**Probable Revenue/Saving* (R million/annum)**	**Ave Collection Rate (%)**	**Probable Revenue/Saving* (R million/annum)**	
Availability		R 13.0	23%	R 3.0	
Consumption		R 140.9	37%	R 52.6	
WDM/Retrofitting		R 48.7	100%	R 48.7	
TOTALS		**R 345.5**		**R 179.9**	

* Savings due to reduced SIV through water demand management or retrofitting to curb unpaid for excessive water consumption

Revenue Enhancement Opportunities

Opportunities for Revenue Enhancement and Non Revenue Water Demand Management

Prioritisation per suburb: Electricity
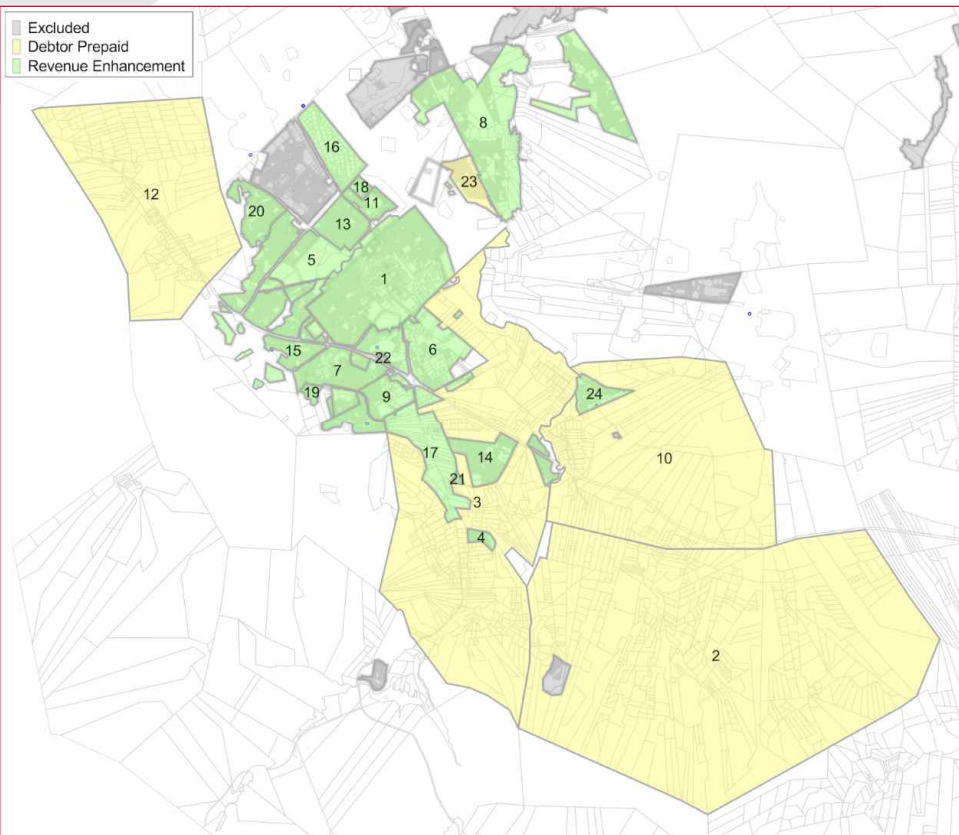
Risk	Suburb	Preferred Opportunity	Debtor Prepaid (R million/annum)	Revenue Enhancement* (R million/Annum)	Probable Revenue* (R million/annum)
Medium Risk	RU	Revenue Enhancement	1.4	12.1	13.6
High Risk	FAI	Debtor Prepaid	6.0	3.1	9.2
High Risk	FAI	Debtor Prepaid	3.9	3.0	6.8
Low Risk	BO	Revenue Enhancement	-	6.2	6.2
Medium Risk	GEI	Revenue Enhancement	1.1	2.7	3.7
High Risk	WA	Revenue Enhancement	0.1	3.7	3.7
Medium Risk	SAI	Revenue Enhancement	0.4	3.1	3.6
High Risk	BO	Revenue Enhancement	0.0	3.4	3.4
Medium Risk	CA	Revenue Enhancement	0.4	2.3	2.7
High Risk	FAI	Debtor Prepaid	1.5	0.8	2.3
Medium Risk	ZIN	Revenue Enhancement	0.4	1.8	2.2
High Risk	FAI	Debtor Prepaid	1.4	0.8	2.2
High Risk	RU	Revenue Enhancement	0.7	1.3	2.0
Low Risk	WA	Revenue Enhancement	-	2.0	2.0
Medium Risk	PRO	Revenue Enhancement	0.5	1.3	1.8
Medium Risk	RU	Revenue Enhancement	-	1.1	1.1
High Risk	WA	Revenue Enhancement	0.0	0.9	0.9
High Risk	KAI	Revenue Enhancement	0.1	0.6	0.7
Medium Risk	BO	Revenue Enhancement	0.0	0.5	0.6
Medium Risk	TLF	Revenue Enhancement	-	0.5	0.5
High Risk	SAV	Revenue Enhancement	-	0.2	0.2
Medium Risk	AZ	Revenue Enhancement	0.0	0.1	0.1
High Risk	RU	Debtor Prepaid	0.0	0.0	0.0
High Risk	IKE	Revenue Enhancement	-	-	-
	Grand Total		**17.9**	**51.7**	**69.5**
	Grand Total (Excl Farms)		**5.1**	**44.0**	**49.1**

* after non-payment

Prioritisation per suburb: Water

Risk	Suburb	Preferred Opportunity	WDM (R million/annum)	Revenue Enhancement* (R million/Annum)	Probable Improvement* (R million/Annum)
Medium Risk		Revenue Enhancement	0.76	20.84	21.60
High Risk		Water Demend Management	11.22	1.99	13.21
Medium Risk		Revenue Enhancement	1.96	7.06	9.02
High Risk		Water Demend Management	7.08	0.26	7.34
Medium Risk		Water Demend Management	3.38	3.28	6.67
High Risk		Water Demend Management	4.52	0.55	5.08
Low Risk		Revenue Enhancement	0.00	4.90	4.90
High Risk		Water Demend Management	3.81	0.02	3.83
Medium Risk		Revenue Enhancement	1.17	2.20	3.37
High Risk		Revenue Enhancement	-	3.33	3.33
High Risk		Water Demend Management	2.88	0.38	3.27
High Risk		Water Demend Management	3.19	0.00	3.19
Low Risk		Revenue Enhancement	-	2.46	2.46
High Risk		Water Demend Management	1.75	0.36	2.11
High Risk		Water Demend Management	2.00	0.02	2.02
Medium Risk		Water Demend Management	1.44	0.51	1.96
High Risk		Water Demend Management	1.12	0.74	1.86
Medium Risk		Water Demend Management	0.85	0.54	1.39
Medium Risk		Revenue Enhancement	0.35	0.73	1.08
Medium Risk		Revenue Enhancement	0.33	0.55	0.87
Medium Risk		Revenue Enhancement	0.00	0.86	0.87
High Risk		Revenue Enhancement	-	0.62	0.62
High Risk		Water Demend Management	0.22	0.16	0.39
High Risk		Water Demend Management	0.38	0.00	0.38
Medium Risk		Revenue Enhancement	0.11	0.19	0.30
High Risk		Water Demend Management	0.09	0.03	0.12
Medium Risk		Water Demend Management	0.10	0.00	0.10
High Risk		Revenue Enhancement	-	-	-
Grand Total			**48.7**	**52.6**	**101.3**

Maps per Suburb
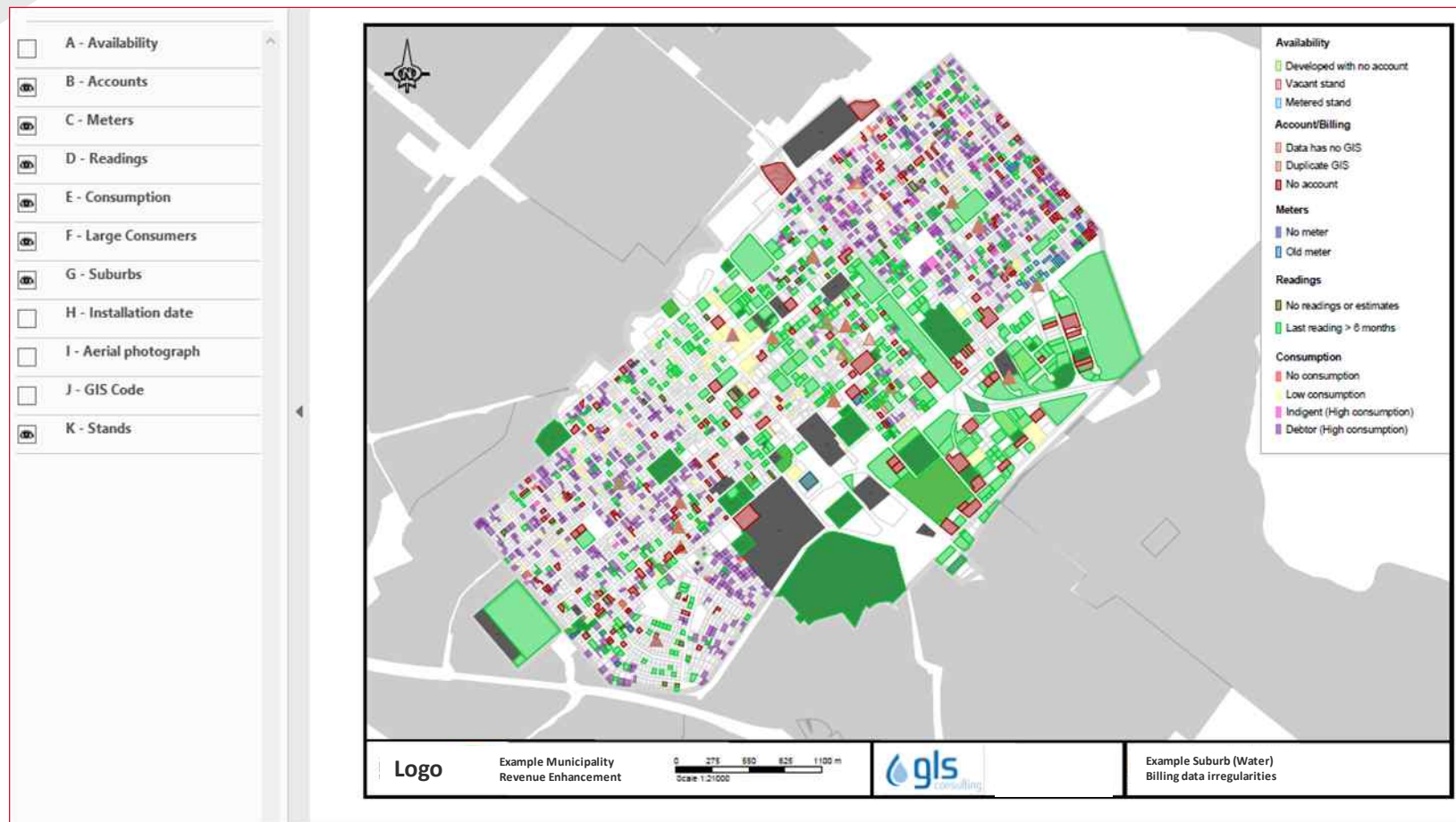
Summaries per Suburb

Developed Stands

	No. Stands	Authorised consumption (kWh.day)
Supplied by Eskom	–	n/a
Total Stands supplied with electricity*	4 614	419 854
Residential	3 647	119 364
Non residential	967	300 488
Total Stands* (Occupied and vacant)	4 977	

*Restricted to study area (supplied by RLM with cadastral data)

Consumer Profile

No. Developed Stands	Total	Debt < 90 days	Debt >= 90 day	Indigent
Non-Residential: Billed Metered	286	176	110	
Unmetered Unbilled Stands	341			
Prepaid (no sales data)	3 011	1897	1114	
Residential Stands: Billed Metered	1005	800	189	16
AADC < 50 kWh/month	72	50	19	3
50 <= AADC < 350	154	92	54	8
350 <= AADC < 600	176	136	38	2
600 <= AADC <1500	503	450	51	2
1500 <= AADC < 3000	74	52	21	1
AADC > 3000 kWh/month	26	20	6	-

Consumption (kWh/day)	Total	Debt < 90 days	Debt >= 90 day	Indigent
Non-Residential: Billed Metered	207 122	138 638	68 484	
Unmetered Unbilled Stands (Estimated Consumptic)	20 839			
Prepaid (no sales data)	159 345	98 854	60 491	
Residential Stands: Billed Metered	34 071	25 753	8 090	228
AADC < 50 kWh/month	172	51	120	1
50 <= AADC < 350	1572	687	815	70
350 <= AADC < 600	5 452	2 257	3 162	33
600 <= AADC <1500	16 900	15 042	1786	72
1500 <= AADC < 3000	4 919	3 506	1363	50
AADC > 3000 kWh/month	5 053	4 212	841	-

Large Consumers	No.
AADC > 800 kWh/day	1042

Consumers (No. Stands)
Consumption (kWh.day)
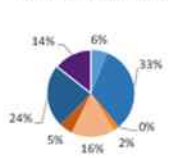
- Residential: Debt < 90 days
- Non Residential: Debt < 90 days
- Residential: Indigent
- Residential: Debt >= 90 days
- Non Residential: Debt >= 90 days
- Unbilled Unmetered
- Prepaid (Municipal Debt < 90 days)
- Prepaid (Municipal Debt >= 90 days)

Residential Consumption (No. Stands)
Residential Consumption (kWh.day)
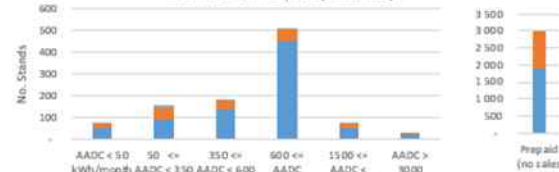
Consumption categories (kL/month)
- Debt < 90 days
- Debt >= 90 days
- Indigent

Note: Analysis excludes informal areas and consumers not on the billing system
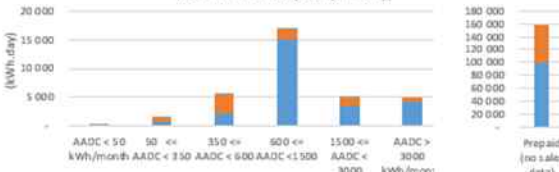
Logo

Example Municipality
Revenue Enhancement
Billing Data Analysis

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Example Suburb
Customer Profile

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Summaries per Suburb

Database of stands

Meter Audit Summaries

Location of Meters
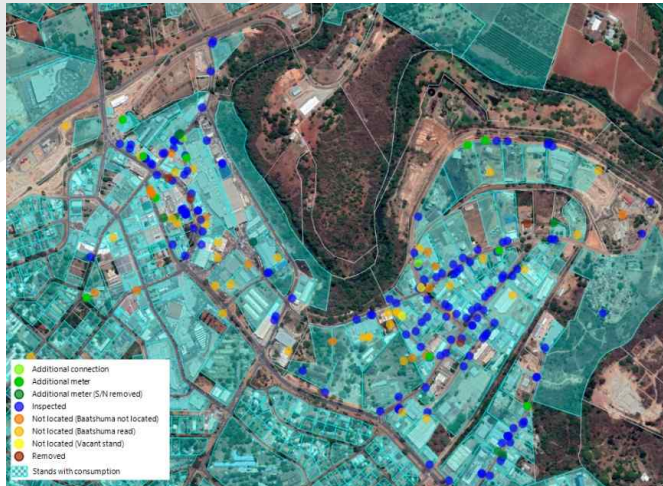
Item		Number
⊟ **Additional**		**20**
	Unmetered Connection	2
	Meter (S/N removed)	8
	Meter	10
⊞ **Duplicate**		**1**
⊞ **Inspected**		**146**
⊟ **Located (not accessible)**		**2**
	Inside/Buried	2
⊟ **Not Located**		**61**
	Not located	17
	Read	38
	Vacant Stand	2
	Removed	4
Grand Total		**230**

Serial No. Correlation

Item		No. Meters
⊞ **Match**		**119**
⊟ **Mismatch**		**27**
	Not Legible	7
	S/N removed	11
	Mismatch	9
Grand Total		**146**

Condition & Legibility
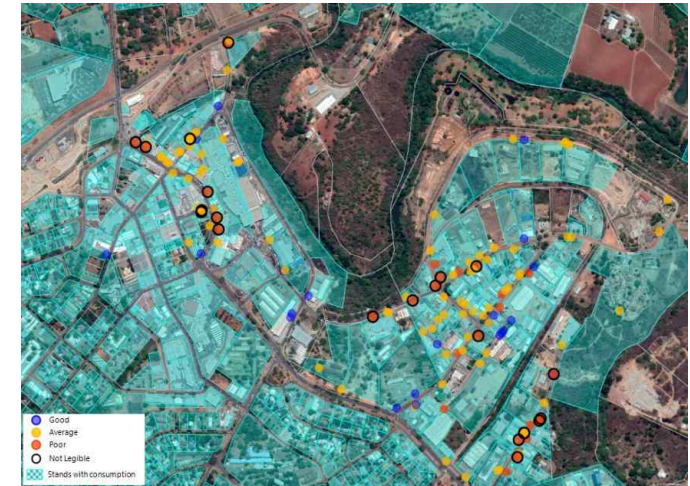
Item		No. Meters
Legible		123
Not Legible		23
Grand Total		**146**

Item		No. Meters
Average		93
Good		23
Poor		30
Grand Total		**146**

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Meter Audit Summaries

Item	No. Meters
⊞ Clean	5
⊞ Fix Leak	3
⊞ Meter new connection	10
⊞ No action required	53
⊟ Replace	63
Not Legible	4
Helix 3000/4000	19
Installation	3
Not working	4
Condition	33
⊟ Verify Account	32
Address	2
Serial numbers	30
Grand Total	**166**

Legend:
- No Action
- Clean
- Fix Leak
- Locate meter
- Verify Account (Address)
- Verify account (Serial Number)
- Verify account (Serial number)
- Meter new connection
- Replace (Condition)
- Replace (Helix 3000/4000)
- Replace (Installation)
- Replace (Not Legible)
- Replace (Not working)
- Stands with consumption
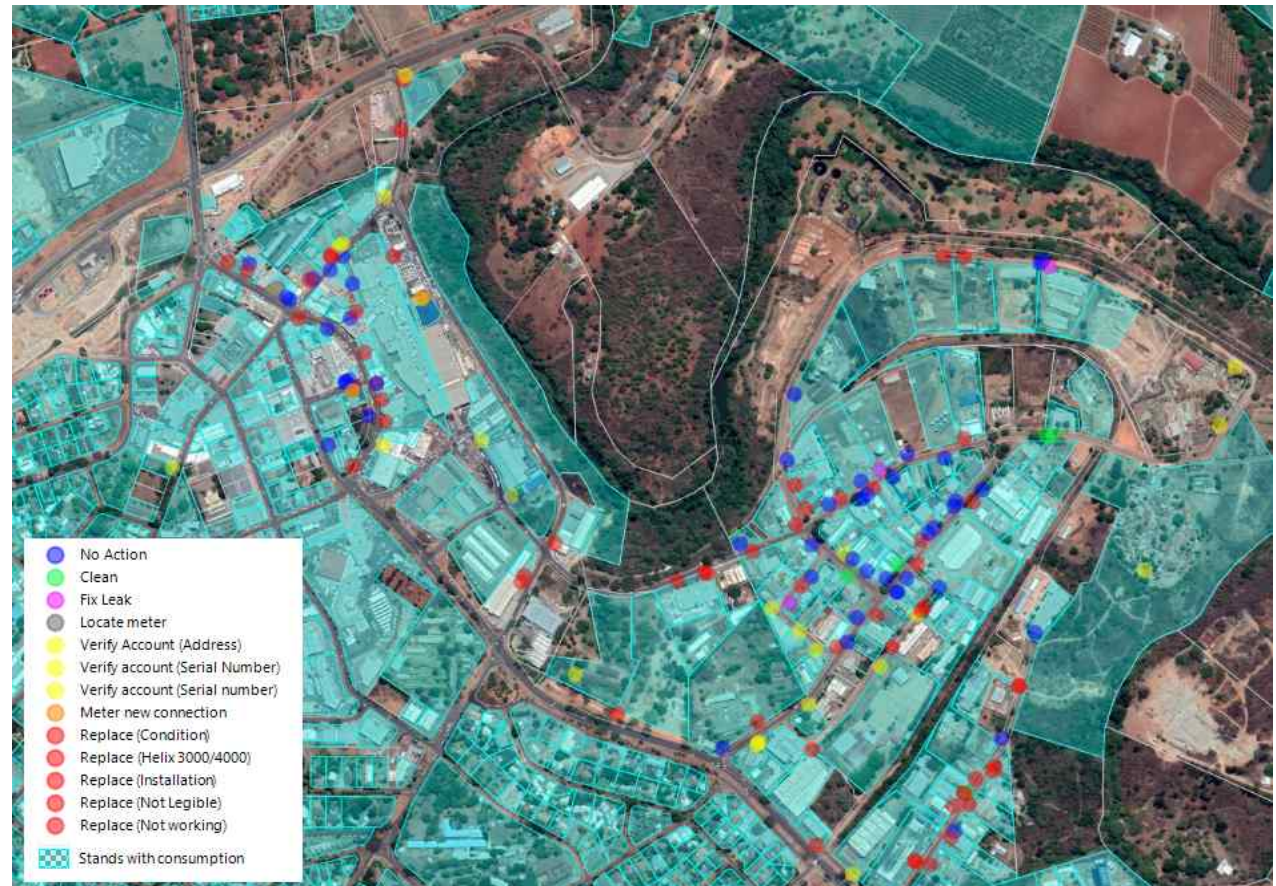
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Revenue enhancement – Identify & actions
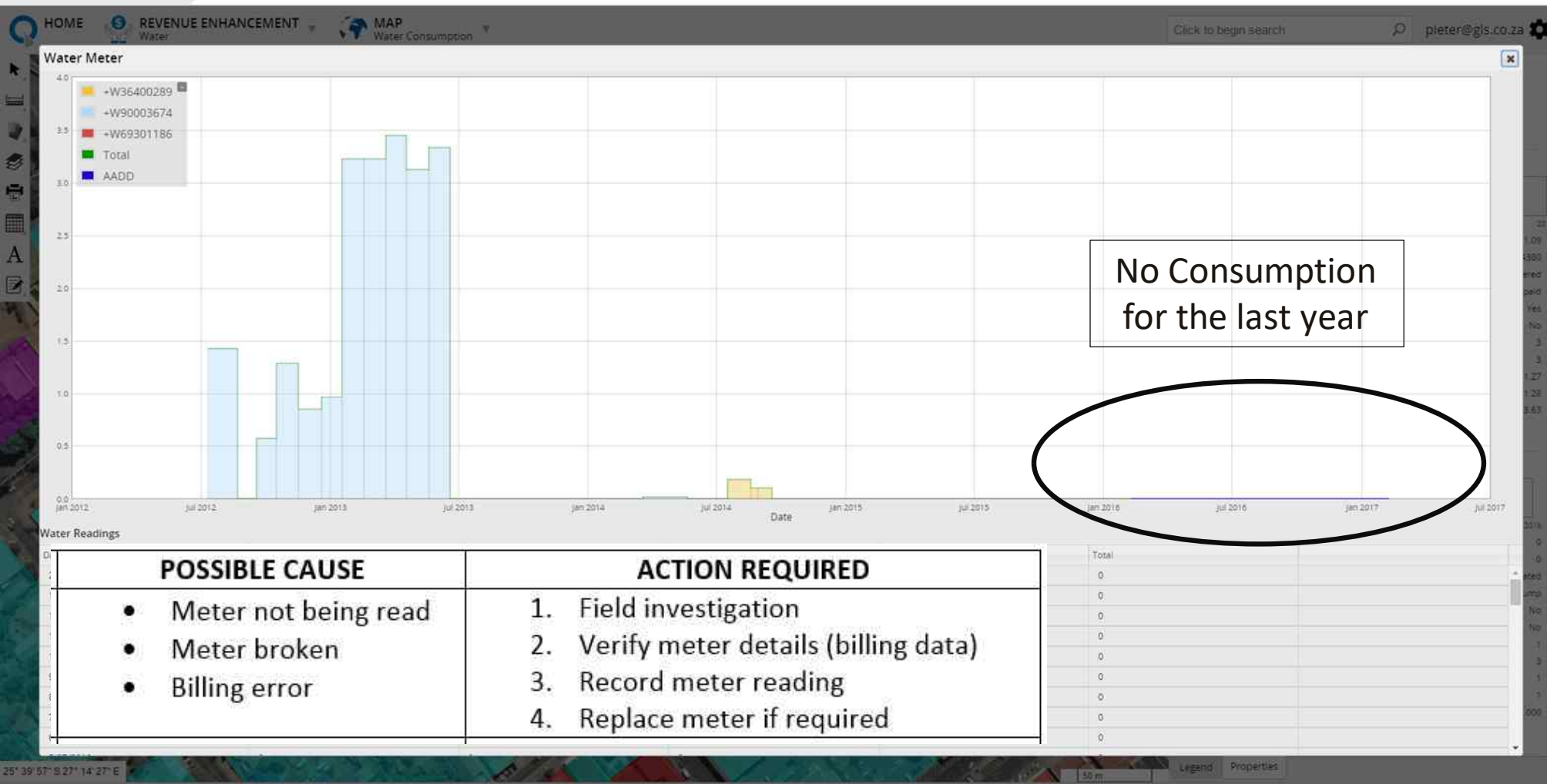
Contact information

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- www.gls.co.za
- www.glssoft.com