Anytime AMPs

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IAM North American 2023 Conference

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Why do Infrastructure Asset Management?

To forecast 1) spending AND 2) infrastructure performance, to inform a decision.

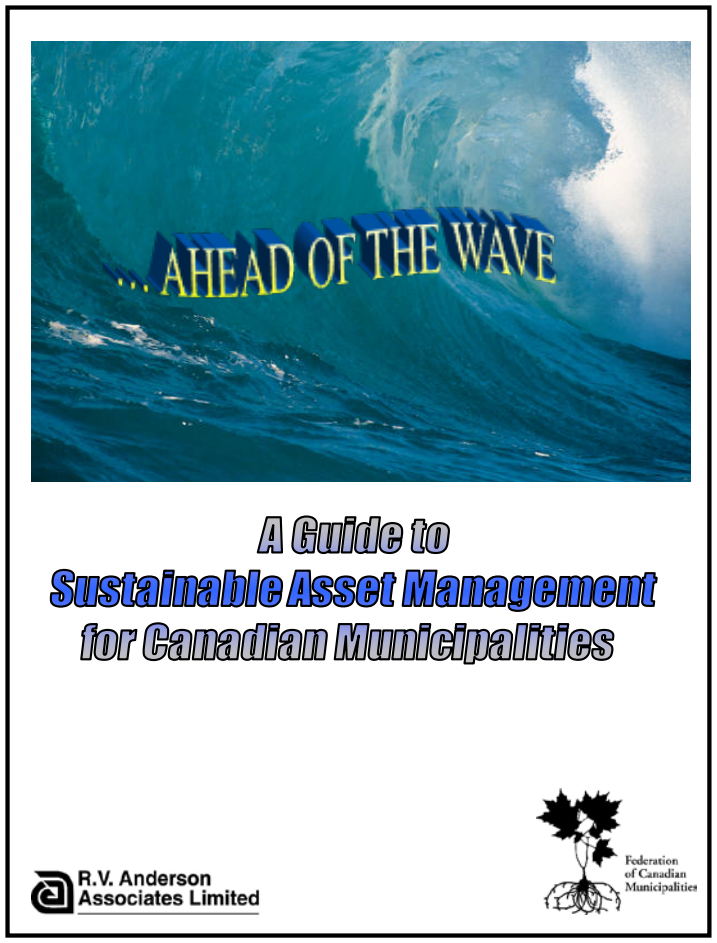
As documented in an Asset Management Plan (AMP).

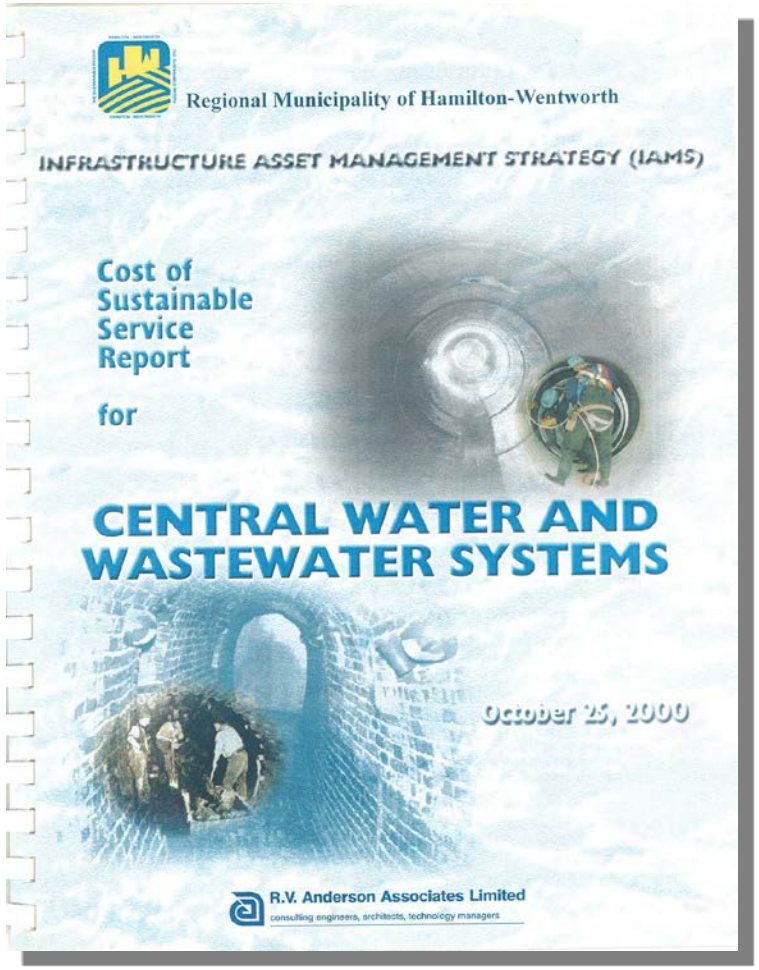
How were we trying to forecast?

- Consider ‘Condition’ or ‘Age’ rather than performance
- Forecast only spending, not spending AND performance
- Each individual asset was prescribed a future lifecycle spending pattern

Unfortunately, there is no engineering or scientific basis for using this approach to forecast infrastructure spending needs.

How did we get here?

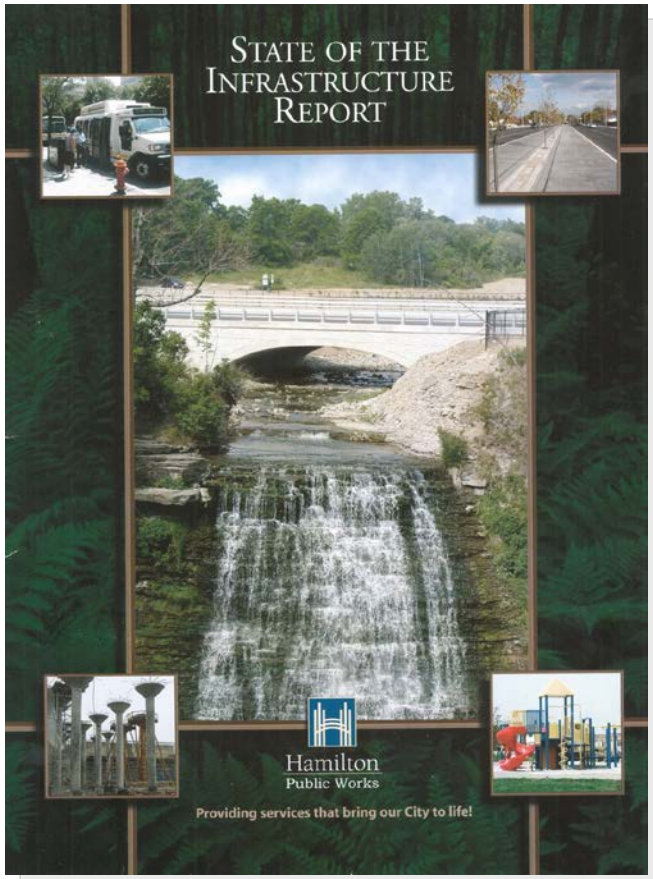




Circa 2000:

- Infrastructure noticeably deteriorating
- No stockpile of cash to fix it
- Taxes/user fees are insufficient to fund what we want/need

How did we get here?



Tangible Capital Asset accounting requires this:

Asset	Purchase Price	Purchase year	Amortization Period
1	$	1990	10 years
2	$$$$	1950	30 years
3	$$$	1970	50 years

Accountants asked Engineers for this

PSAB Public Sector Accounting Board
Conseil sur la comptabilité dans le secteur public CCSP

How did we get here?

Asset	Purchase Price	Purchase year	Amortization Period	Replacement Year	Cost
1	$	1990	10 years	2000	= $+inflation
2	$$$$	2000	30 years	2030	= $$$$+inflation
3	$$$	1970	50 years	2020	= $$$+inflation

There is no scientific or engineering rationale for single asset forecasts of complex civil or environmental engineered systems!

But…prescribed single asset forecasting is easy to do, so we did it ☹

But…what's the Problem?

Prescribed Single Asset Forecasts result in incorrect spending forecasts for complex repairable infrastructure systems:

- Spending forecasts to maintain current asset network **are 200% of actual needs**
- Spending needs to achieve **societal wants/needs are not accounted for** in the modeling parameters

Repairable vs Non-Repairable Systems

Only 2 Types of Municipal Infrastructure Systems

Non-repairable systems:

- Typically mechanical engineered assets
- Approximately 5 % of municipal portfolio
- Fleet, equipment, HVAC

Repairable systems:

- Typically civil and environmental engineered assets
- Approximately 95 % of municipal portfolio
- roads, sidewalks, trails, bridges, culverts, sanitary pipes, water pipes, storm pipes, storm water management ponds, creeks, parks, parking, facilities

How are they analyzed?

Non-repairable systems:

- Estimate Service Life (ESL) testing at full scale
- Typical full cost replacement at end of ESL
- Design, manufacturing, full-scale testing independent of municipality sold to

Repairable systems:

- Typical treatment is repair or rehabilitation
- ESL = mean time to treatment (repair) not replacement
- Design and construction changes based on municipality specific characteristics
- Reliable forecasting is only possible for aggregate system

Diverting our Attention and Resources

Application of non-repairable system logic to repairable system forecasting has resulted in:

- Excessive focus on collecting current asset condition to forecast better
- Excessive focus on populating dozens of data fields to make a more ‘unique’ prescribed lifecycle spending plan
- Not enough focus on forecasting approach
- Not enough effort spent analyzing currently available information

About the Ontario Clean Water Agency

- Financially independent Agency of the Province of Ontario
- 1,000 staff working to operate over 1,200 water and wastewater facilities/systems valued at over $20 Billion CAD
- Huge range of facility sizes
- 100,000+ assets, 90% with planned preventative maintenance activity
- We don’t own the assets, but we recommend asset repair/rehab/replace

OCWA
ONTARIO CLEAN WATER AGENCY
AGENCE ONTARIENNE DES EAUX

The bottom-up: Individual Asset Record

Asset: 0000102348 TANK STORAGE WET WELL SPS 04
Status: OPERATING
Owner: CLIENT
* Classification: TANK

Details

Maintain Hierarchy?
Location: 6816-SPS4 6816, Sewage Pumping Stn 04
Building: PUMPING STATION BUILDING
Level: S01
Qualifier: ROCKLAND WASTEWATER SYSTEM: SPS 04 POULIOTTE
Meter Group:

Asset Location and Picture

Address Information

Service Address:
Formatted Address: 1797 Albert St, Rockland, ON K4K 1C9, Canada
Street Address: 1797 Albert St
City: ROCKLAND
State/Province: ON Ontario
Address: 6816-SPS4 6816 Sewage Pumping Stn 04

Purchase Information

Vendor:
Manufacturer:
Installation Date: 1/1/00
Purchase Date:
* Purchase Price: 100,000.00
* Replacement Cost: 500,000.00

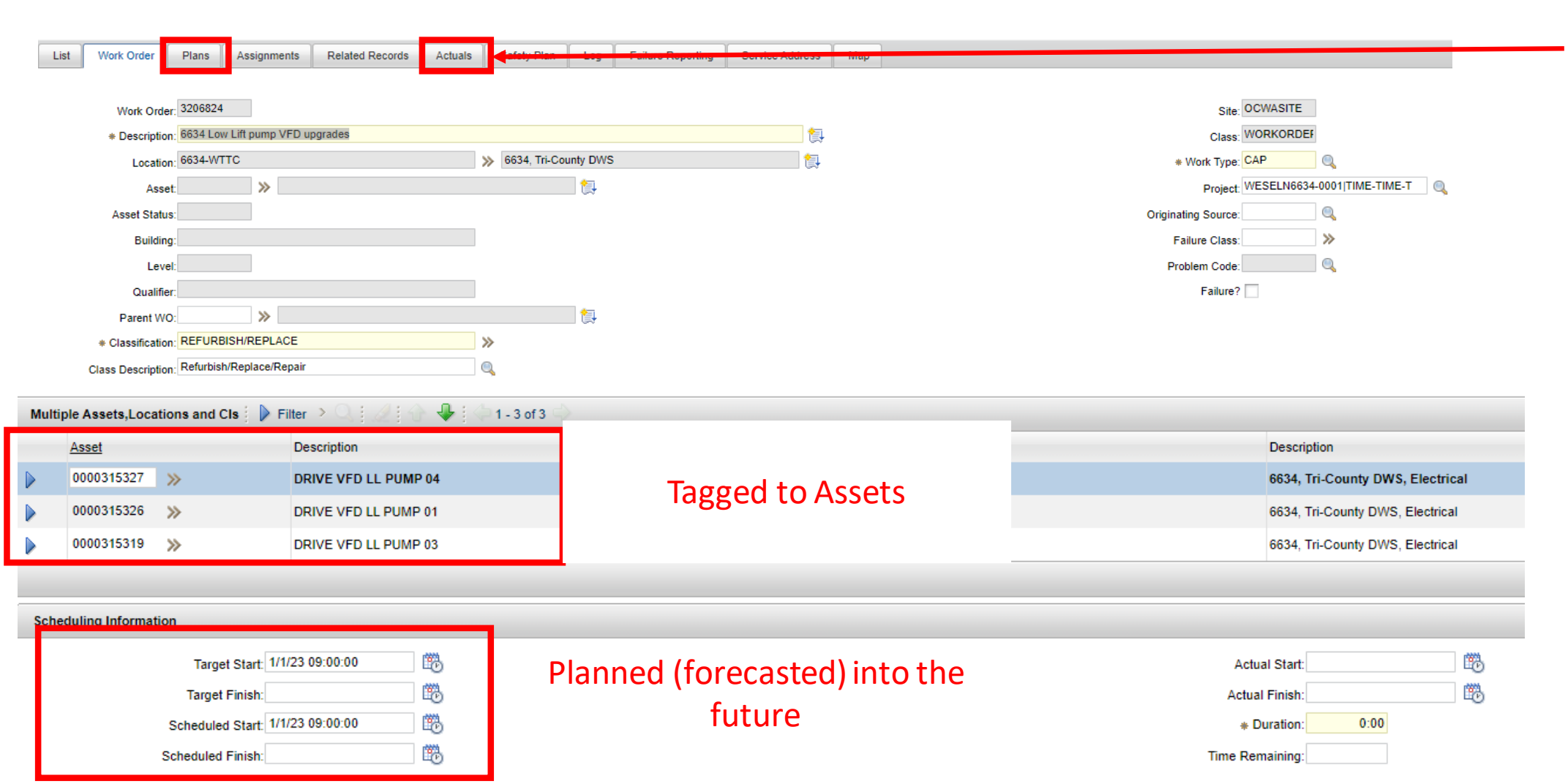
Asset Cost and Installation Date

Condition

Warranty Expiration Date:
Expected Life: 25
Remaining Life:
Third Party Condition:
Performance Score: 0.75 Good
Performance Score Rationale: Good

Asset Performance Info

The bottom-up: Capital Work Orders



Planned and Actual Costs

Tagged to Assets

Planned (forecasted) into the future

So how do we Forecast?

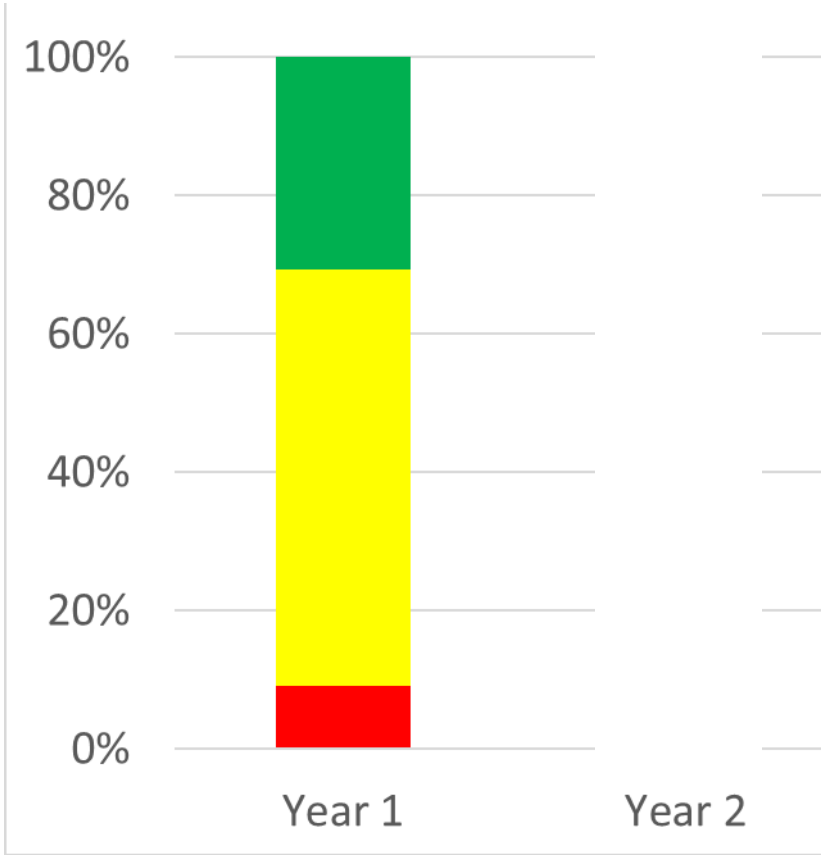
Performance (not 'Condition') as Fundamental Term

Asset Performance = ability to fulfill objectives/requirements

PERFORMANCE CATEGORY	STATE OF INFRASTRUCTURE ASSET
Good	No Deficiencies, Fit for Purpose
Fair	Has Deficiencies, Fit for Purpose
Poor	Requires Treatment/Spending

Asset is in Poor Performance because…insufficient capacity, requires too much maintenance, failing more than it should, functionally obsolete, poor physical condition, etc., etc., etc…

System Current Performance Distribution



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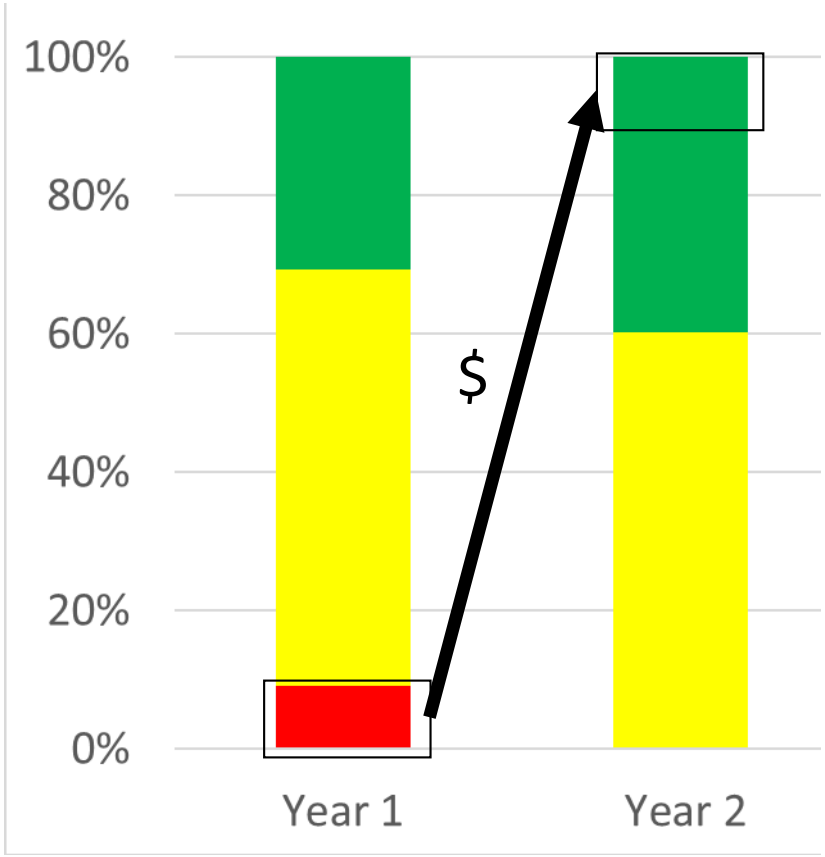
Forecasting Performance and Spending

2 competing forces:

1. Performance deterioration (i.e. how quickly asset performance is consumed by the community)

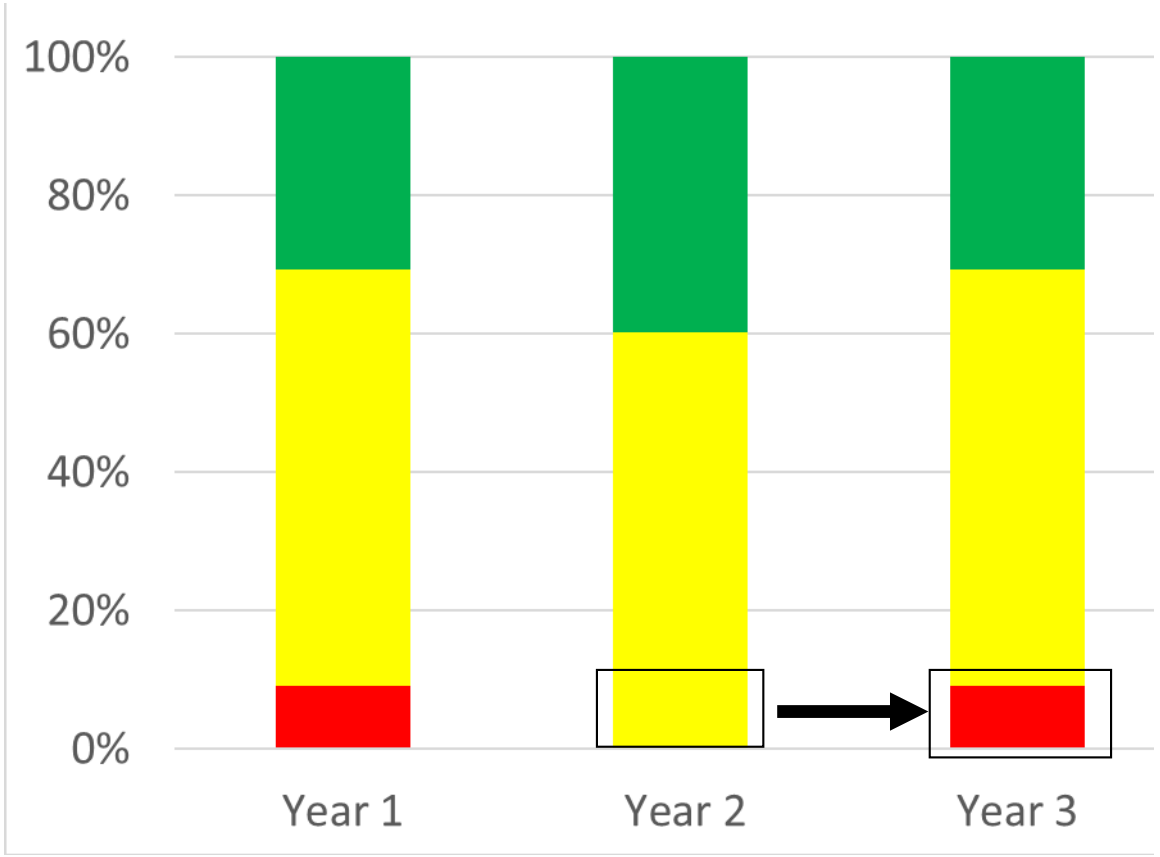
2. Performance improvement resulting from spending

Forecasting Performance and Spending



Spending Improves Asset Performance

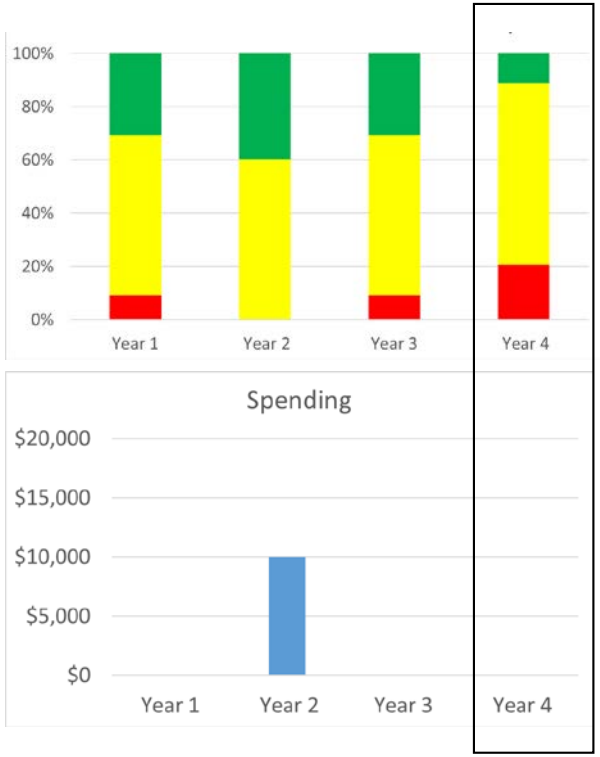
Forecasting Performance and Spending



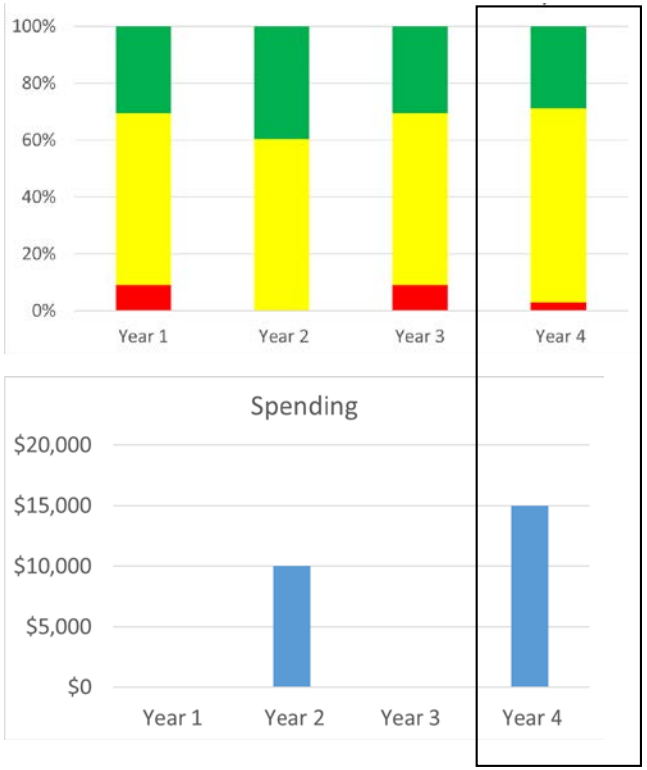
Asset Performance Deteriorates without Spending

Forecasting Performance and Spending

Plan A
No spending, no performance increase

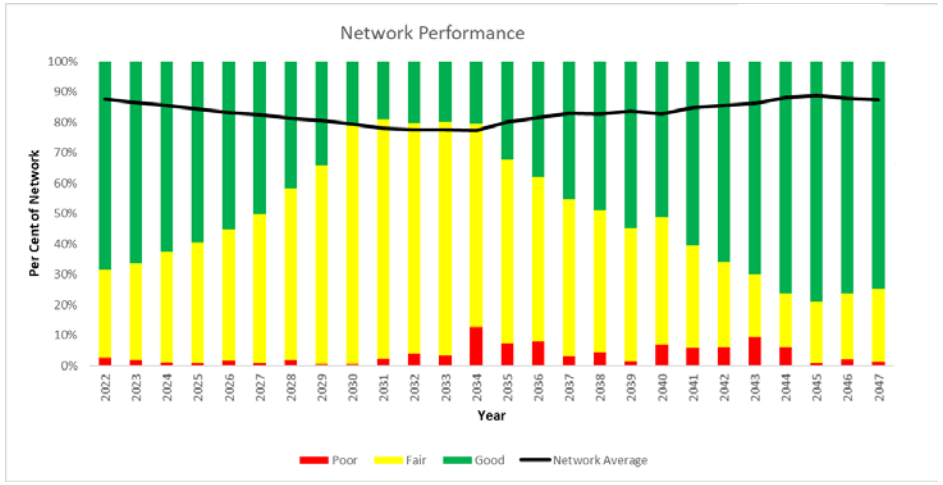


Plan B
Spending results in performance increase



Forecasting Future Performance vs Spending

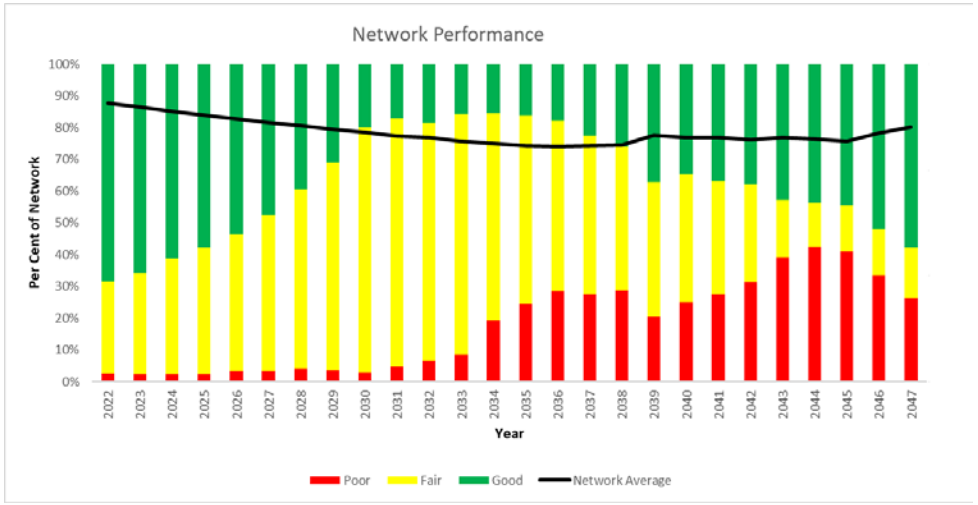
Forecasting Performance and Spending

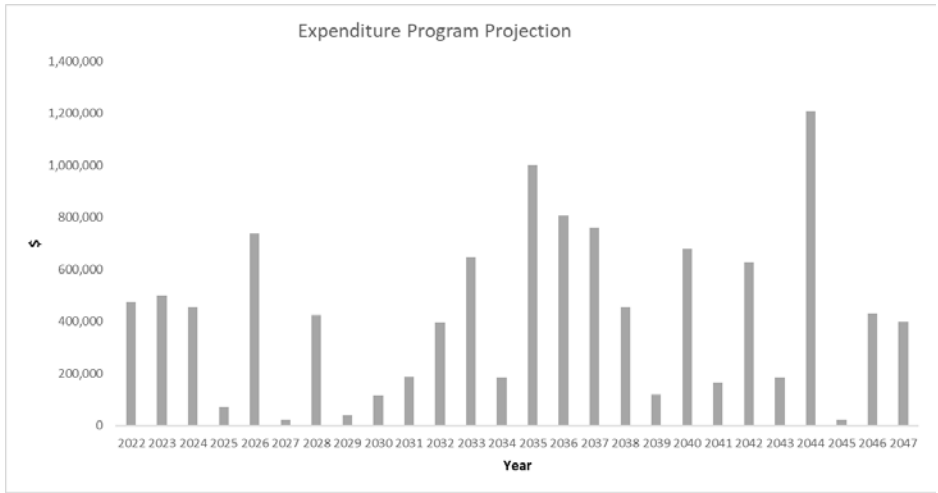


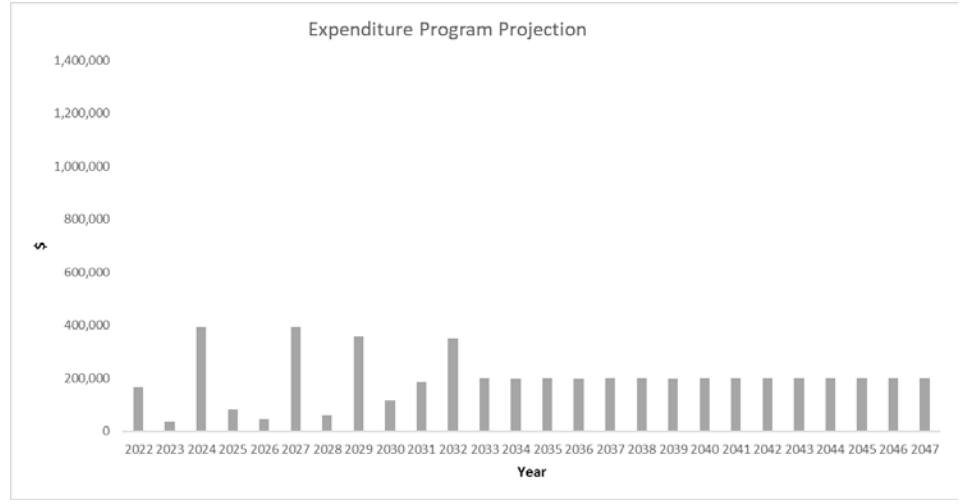
Plan a
$500k/yr

VS

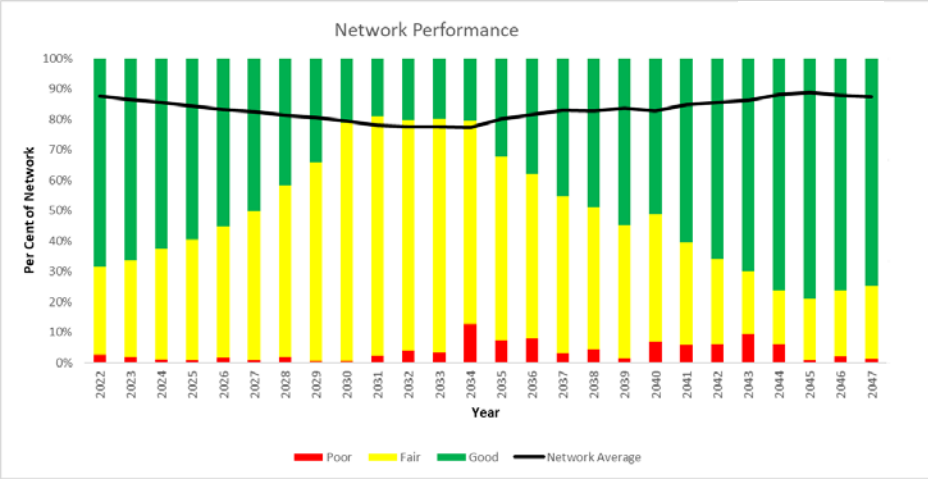
Plan B
$200k/yr

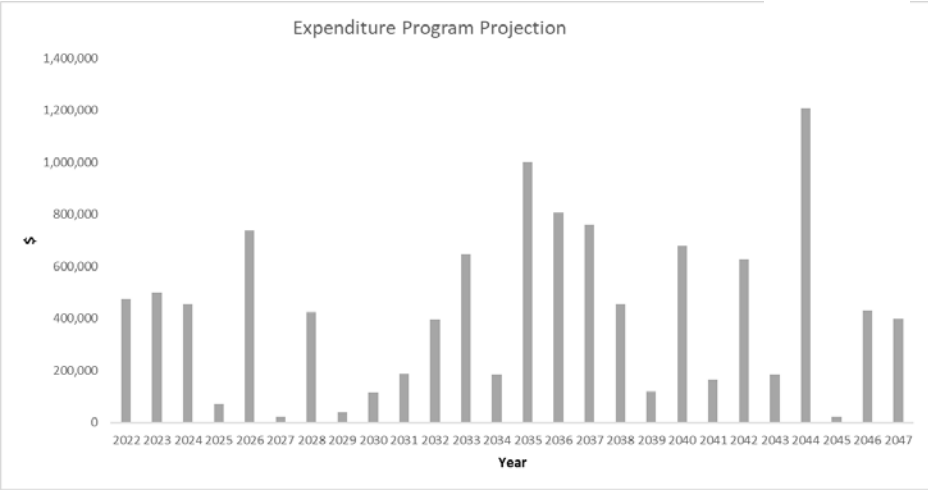






Forecasting Performance and Spending





Asset ID	Description	Treatment Description	Forecast Cost ($)	Forecast Year
142945	UPS SCADA	Reconstruction	40,000.00	2023
143334	PANEL CONTROL OUTPOST 5	Maintenance	10,000.00	2023
143338	ANALYZER TURBIDITY BACKWASH	Rehabilitation	8,000.00	2023
143339	ANALYZER TURBIDITY RAW WATER	Rehabilitation	8,000.00	2023
143345	ANALYZER CHLORINE TREATED	Reconstruction	10,000.00	2023
143368	ANALYZER CHLORINE FILTRATE	Reconstruction	10,000.00	2023
155395	PANEL ALARM/DIALER 01 PLUMMER	Reconstruction	15,000.00	2023
142929	TANK PROCESS T-2A REVERSE FILTRATION	Maintenance	3,000.00	2024
143388	PUMP SUBMERSIBLE 02 RAW WATER	Reconstruction	10,000.00	2024
143384	PANEL CONTROL LPF	Reconstruction	12,000.00	2024
143370	VALVE GATE ISOLATION HLP-3	Rehabilitation	1,480.00	2026
155401	METER FLOW INFL. FROM B.M. PLUMMER	Rehabilitation	4,680.00	2026

Q: What does ‘operationalized’ really mean?

A: Forecast cycle time < time to make decision

Anytime AMPs

Current AMP → Need to Change Plan → Consider Options → Updated AMP

"Our supplier just informed us that there will no longer be reliable spare parts for the current UV disinfection system, so we need to replace with new technology"

"Is there something we can defer to next year?

Can we get additional funding? How Much?

If we defer something, what impact will that have on future year plans?

Etc. "

Process Supported by our AM System

1

- Asset Performance Score updated to Poor
- Capital Work Order prepared (but not scheduled)

2

- Multiple scenarios analyzed for various considerations
- Scenarios presented in minutes/seconds
- Decision makers compare objective scenario data during deliberations

3

- Agreed upon scenario published in updated AMP

Anytime AMPs

Key Concepts:

- Non-repairable vs repairable systems
- Reliable forecasts can be produced with your existing information
- AM System ‘cycle time’ must be < decision making time needed

Thanks for your time!

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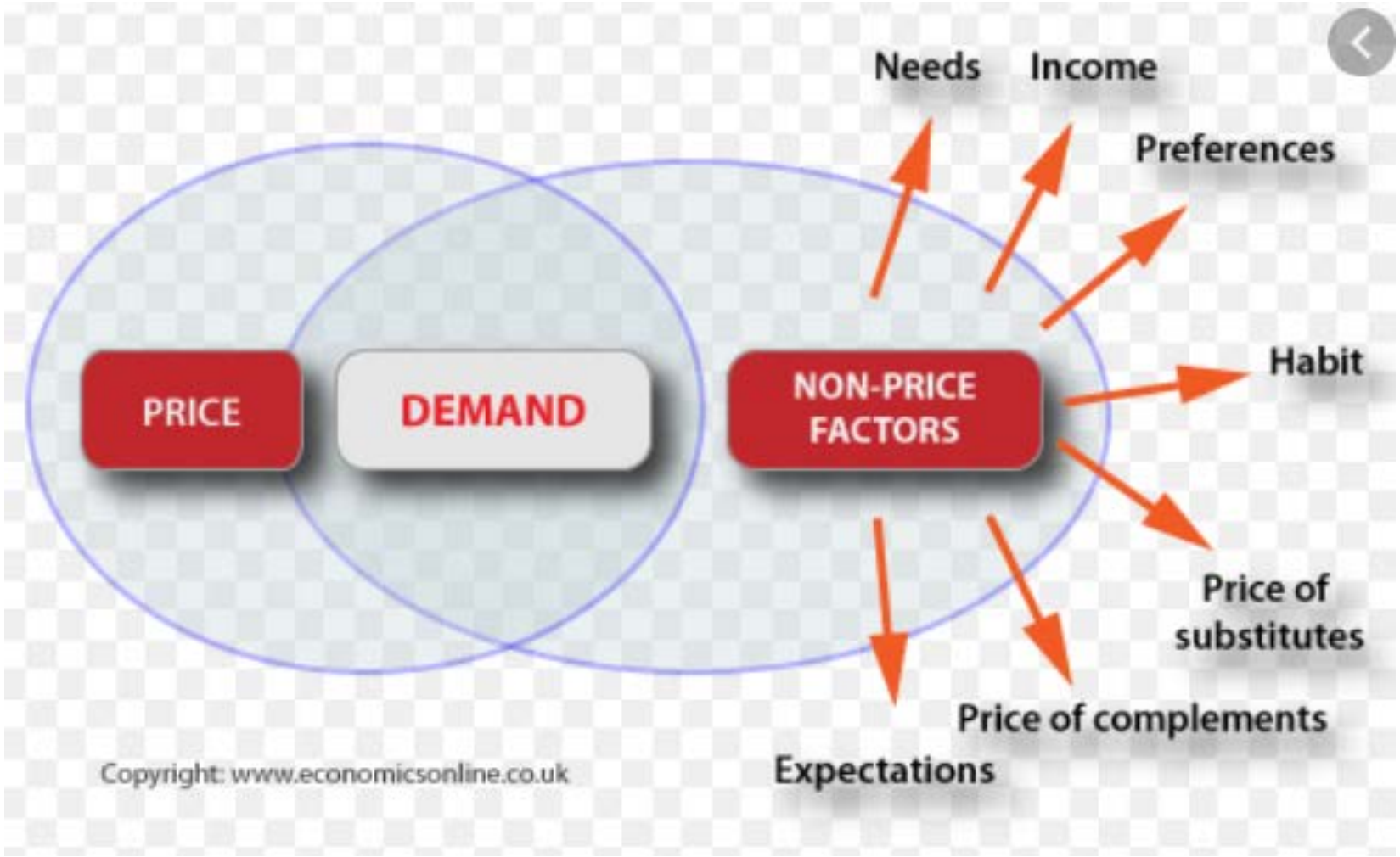
A Community is a Consumer of Infrastructure



A Community is a Consumer of Infrastructure

Decision Factors Not Accounted for by Performance Measures

Corporate decision factors directly affecting past, present and future asset performance	Asset class applicability	Examples of questions/comments considered by public administrations making infrastructure asset management decisions
Economies of scale	All asset classes	'In order to group projects in proximity, we have to delay or move up treatment of certain assets.'
Level of service – community category	All asset classes	'"Good" asset performance category for our small town and "good" for a larger city is not the same, nor should it be.'
Funding capacity	All asset classes	'We have maxed out all possible funding means; this is the best we can do without exponentially raising taxes.'
Project delivery capacity	All asset classes	'Even if we had the funds to address all needs according to SEPMs, we would have to expand drastically our project management team and then decrease it once the backlog needs are addressed.'
Specific funding accommodation	All asset classes	'The global green infrastructure fund is providing funding only for these specific assets; therefore, we are moving up their treatment.'
Cost-sharing potential	All asset classes	'The regional government is treating this regional road in year X; we should wait or move up our underground work to line up with their timing.'
New design standards' accommodation	All asset classes	'If we go with the replacement of the asset as planned, the like-for-like replacement does not meet the new standard; therefore, let us push it out until we have the funds for the option that does meet the new standards.'
Portion of asset network expressed by SEPMs	All asset classes	'Do we know what sort of overall impact this project will have on the overall performance of the network? Perhaps another project should go forward first.'
Timeliness of SEPMs' information	All asset classes	'How up to date is our SEPMs information which we are taking into account for decision-making?'