



business modelling
ASSOCIATES



YorkshireWater

KeldaGroup



World Water Congress

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**Visualise, Analyse & Optimise
Your Key Decisions**



⌘ Integrated risk and cost modelling in the Water Utility Sector

– Craig Mauelshagen

 Prescriptive analytics in the Water Utility Sector

– Gary Ashby



Most Water Utilities now have a formal risk management capability

Challenge now is to leverage real value from those risk management activities

- Systemic
- Dynamic
- Objectives orientated
- Forward looking
- Integrated

Visualising our risks

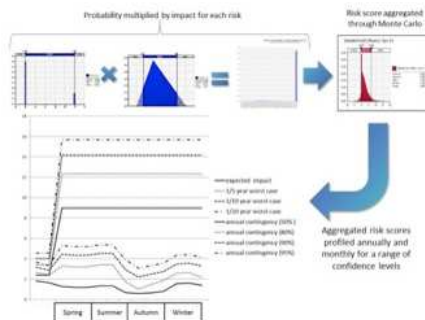


Scenario analysis

What if....

- This asset fails
- Interest rates go up
- Flooding becomes more frequent
- Demand falls
- We get more dry summers

Represent uncertainty

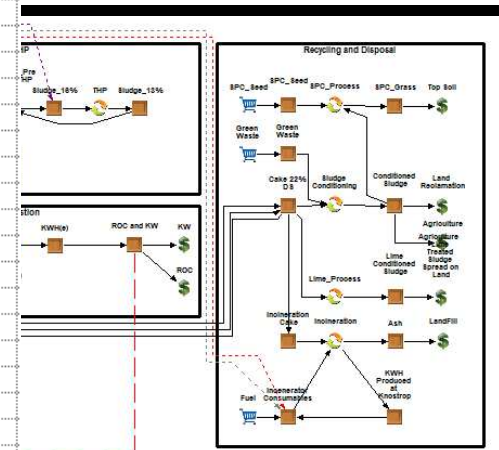
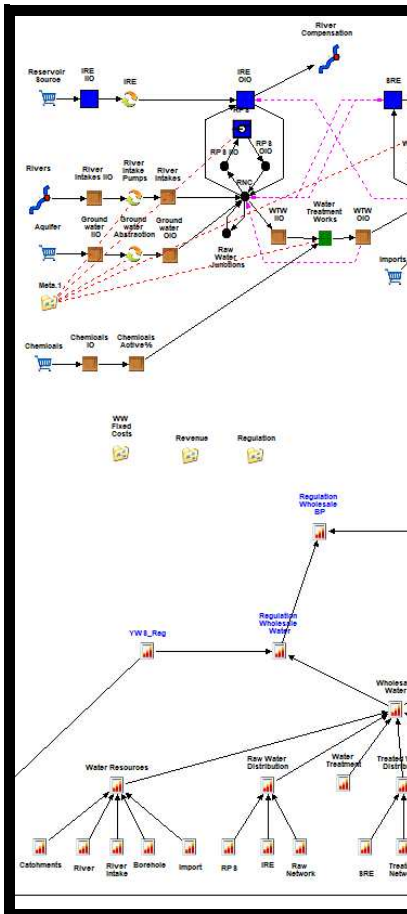


- Value at Risk
- Cash Flow at Risk
- Outperformance at Risk
- Distributable Reserves at Risk
- RCV at Risk

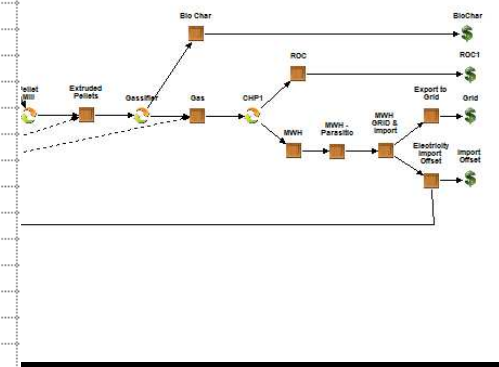
Integrated into optimisations

Probability (frequency) and impact calculated outside EO and incorporated into model solves. Model then suggests optimal way to operate given this risk. For example impact of cold winters.

	Facility	Location	Resource
1	Fac_SewageTr	ABERFORD/STW	ABERFORD/STW
2	Fac_SewageTr	ACKLAM/STW	ACKLAM/STW
3	Fac_SewageTr	ACKWORTH/STW	ACKWORTH/STW
4	Fac_SewageTr	ACORNS BACK LN/STW	ACORNS BACK LN/STW
5	Fac_SewageTr	ADWICK/NO 2 STW	ADWICK/NO 2 STW
6	Fac_SewageTr	AGDEN RESERVOIR/STW	AGDEN RESERVOIR/STW
7	Fac_SewageTr	AIREDALE/STW	AIREDALE/STW
8	Fac_SewageTr	AIRMYN/STW	AIRMYN/STW
9	Fac_SewageTr	AIRTON/NO 2 STW	AIRTON/NO 2 STW
10	Fac_SewageTr	ALDBROUGH/STW	ALDBROUGH/STW
11	Fac_SewageTr	ALDFIELD/STW	ALDFIELD/STW
12	Fac_SewageTr	ALDWARK BAY HORSE/2 STW	ALDWARK BAY HORSE/2 STW
13	Fac_SewageTr	ALDWARK BOAT CLUB/STW	ALDWARK BOAT CLUB/STW
14	Fac_SewageTr	Aldwarke/STW	ALDWARKE/STW
15	Fac_SewageTr	ALTOFTS/STW	ALTOFTS/STW
16	Fac_SewageTr	AMPLEFORTH VILLAGE/STW	AMPLEFORTH VILLAGE/STW
17	Fac_SewageTr	APPERSETT/STW	APPERSETT/STW
18	Fac_SewageTr	APPLETON LE MOOR/STW	APPLETON LE MOOR/STW
19	Fac_SewageTr	APPLETON WISKE/STW	APPLETON WISKE/STW
20	Fac_SewageTr	APPLETREEWICK/STW	APPLETREEWICK/STW
21	Fac_SewageTr	ARRATHORNE/STW	ARRATHORNE/STW
22	Fac_SewageTr	ASENBY/STW	ASENBY/STW
23	Fac_SewageTr	ASKHAM BRYAN/STW	ASKHAM BRYAN/STW
24	Fac_SewageTr	ASKRIGG/STW	ASKRIGG/STW
25	Fac_SewageTr	ASSELBY/STW	ASSELBY/STW
26	Fac_SewageTr	ASTWITH/STW	ASTWITH/STW
27	Fac_SewageTr	ATWICK/NO 2 STW	ATWICK/NO 2 STW
28	Fac_SewageTr	AYSGARTH FALLS/STW	AYSGARTH FALLS/STW
29	Fac_SewageTr	AYSGARTH YORE MILL/STW	AYSGARTH YORE MILL/STW
30	Fac_SewageTr	AYSGARTH YOUTH HOSTEL/STW	AYSGARTH YOUTH HOSTEL/STW
31	Fac_SewageTr	AYSGARTH/STW	AYSGARTH/STW
32	Fac_SewageTr	BAGBY/STW	BAGBY/STW
33	Fac_SewageTr	BAINBRIDGE/STW	BAINBRIDGE/STW
34	Fac_SewageTr	BALBY/STW	BALBY/STW
35	Fac_SewageTr	BALDERSBY ST JAMES/STW	BALDERSBY ST JAMES/STW
36	Fac_SewageTr	BALDERSBY/STW	BALDERSBY/STW
37	Fac_SewageTr	BARLBY/STW	BARLBY/STW
38	Fac_SewageTr	BARLOW/STW	BARLOW/STW
39	Fac_SewageTr	BARMBY BANKFIELD/STW	BARMBY BANKFIELD/STW
40	Fac_SewageTr	BARNBURGH/STW	BARNBURGH/STW
41	Fac_SewageTr	BARR LANE/STW	BARR LANE/STW
42	Fac_SewageTr	BARSEY GREEN/STW	BARSEY GREEN/STW
43	Fac_SewageTr	BARTON LE WILLOW/STW	BARTON LE WILLOW/STW
44	Fac_SewageTr	BARWICK IN ELMET/STW	BARWICK IN ELMET/STW
45	Fac_SewageTr	BEAMSLEY/STW	BEAMSLEY/STW
46	Fac_SewageTr	BEARSWOOD GROVE/STW	BEARSWOOD GROVE/STW
47	Fac_SewageTr	BECKWITHSHAW/STW	BECKWITHSHAW/STW
48	Fac_SewageTr	BEDALE/STW	BEDALE/STW
49	Fac_SewageTr	BEEFORD/STW	BEEFORD/STW
50	Fac_SewageTr	BEGGARINGTON/STW	BEGGARINGTON/STW



ATC Process



Financials summary CM | Financials detail CM | Service Main | Risk | Maps

Financial - summary

KeldaGroup

Scenario
 (All)
 Base
 Base case - CM

Maps

Av. Cost to Serve



Scenario
 300. Base
 301. Raw Water Colour I.
 302. No Albert WTW
 303. Dry Demand & Abst

Risk

Base Scenario
300. Base

Heat Map Scenario
 301. Raw Water Colour I.
 302. No Albert WTW

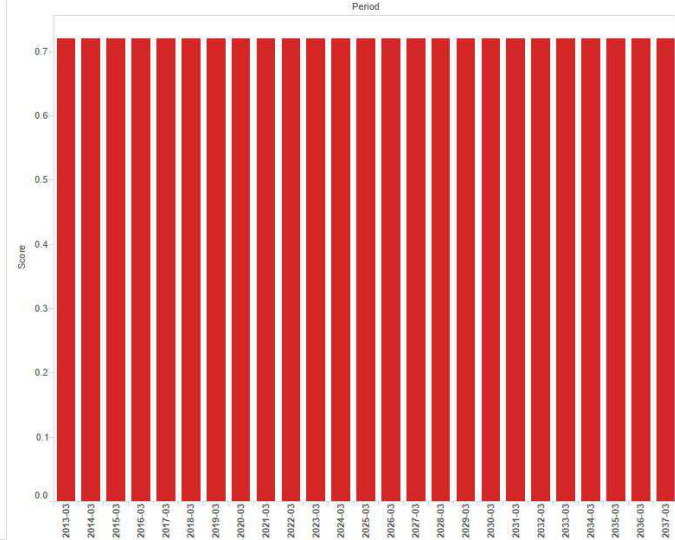
RiskPosition
 Pre-treatment risk
 Base Case treated risk
 Risk scenario

Risk through Time Scen.
 301. Raw Water Colour I.
 302. No Albert WTW

Heat Map - Comparing Risk 302. No Albert WTW vs. 300. Base

		Impact				
		VL	L	M	H	VH
Probability	VH	Green	Yellow	Yellow	Red	Red (with square)
	H	Green	Yellow	Yellow	Red	Red
	M	Green	Green	Yellow	Yellow	Red
	L	Green	Green (with circle)	Green	Yellow	Yellow
	VL	Green	Green	Green (with circle)	Green	Yellow

Risk Through Time - Comparing Risk 302. No Albert WTW vs. 300. Base



Risk Dashboards:



A close-up, profile view of a man with short, graying hair, wearing a white dress shirt and a blue and white striped tie. He is resting his chin on his hand, looking out a window with a bright, slightly blurred background. A teal-colored rectangular overlay is positioned on the left side of the image, partially covering the man's face and hand.

Gary Ashby

Past

We know what has happened.

Pipeline of events

Do we always know why it happened?

Hindsight
(data)

Drives Data Requirements

Present

Real-Time Analysis
(removing uncertainty)

Cause-Effect Relationships

Insight
(knowledge)

Future

Multiple Forces

Multiple Constraints

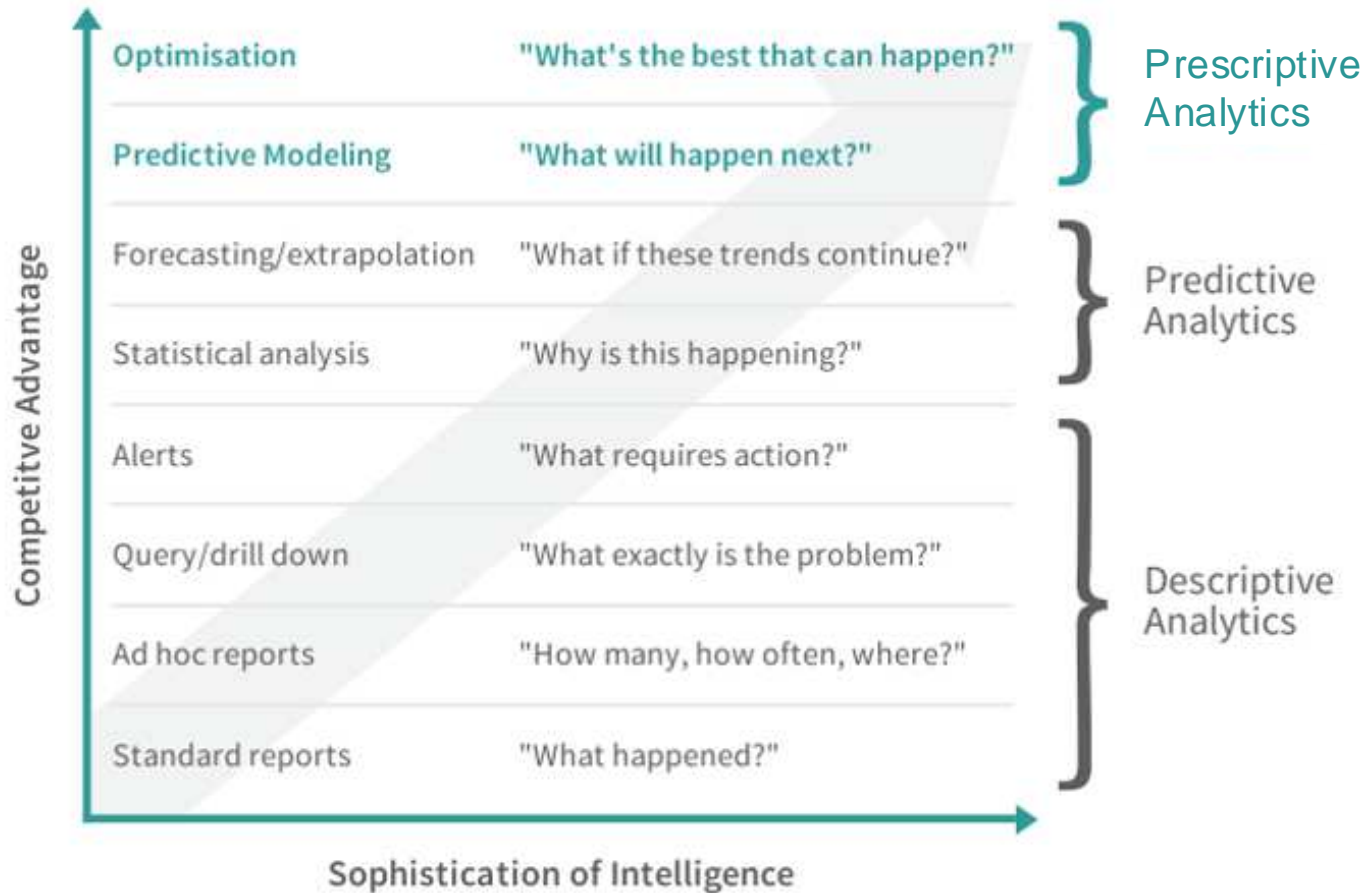
Multiple (infinite) Futures

or Most desirable future?

Data & Analytics

Data & Analytics

Analytics Definition

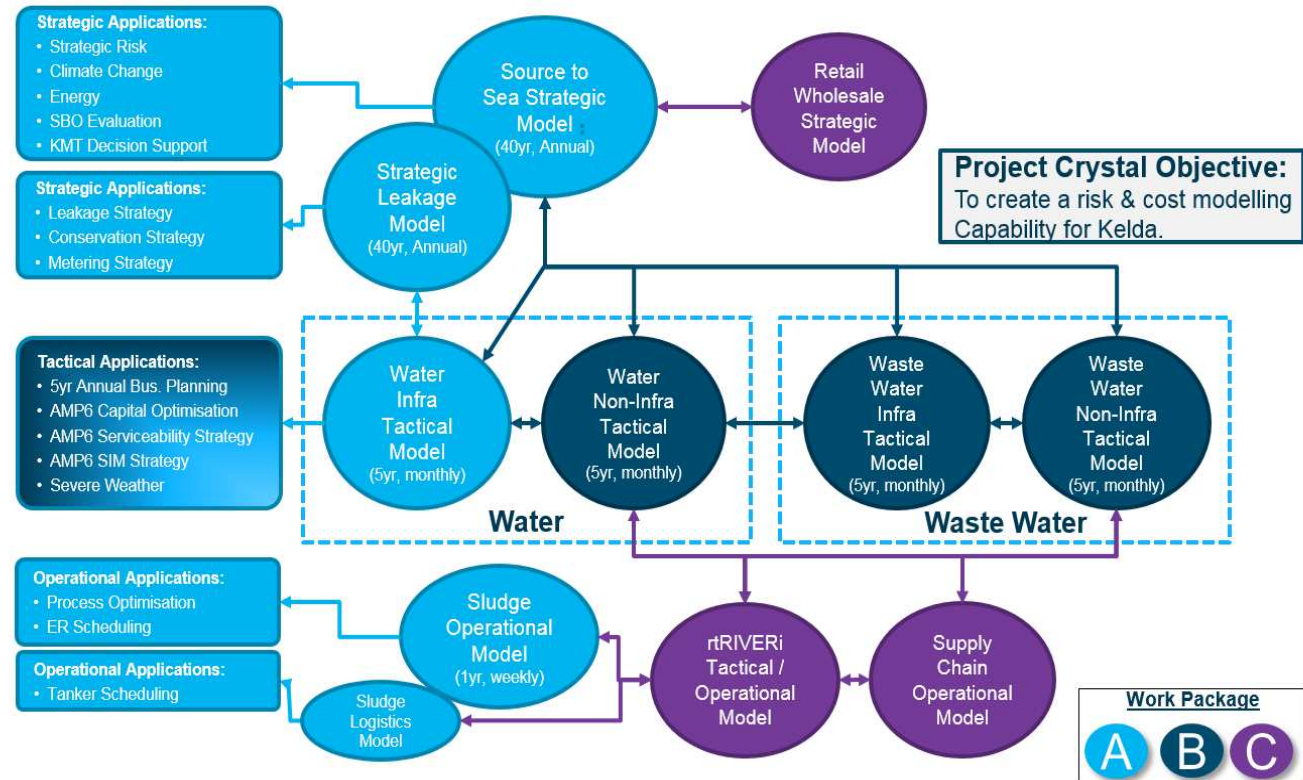


Evolution of Questions



Source: Competing on Analytics: The Science of Winning (Davenport / Harris)

- Deployment of leading edge Risk & Analytics software (EO)
- Development of integrated model suite to tackle multiple challenges
- Consultant support to develop models & YW colleagues
- Wide range of strategic, tactical & operational applications
- Enhance & integrate YW Model Landscape



- Financial & Business Planning
 - Asset Management & Operations
 - Risk Management
-
- Water Processes
 - Waste Water Processes
 - Customer & Stakeholder Management
-
- Operational
 - Tactical
 - Strategic

Future Business Challenges

- PR19
- Challenging out-performance targets & sustaining the gains
- Our strategic ambitions remain
- Process improvement & governance
- Data improvement & governance
- Managing within an increasingly complex business environment
- Competition & realising future commercial opportunities
- **Improved decision making**

- Output driven
- Embedded
- Thought leading
- Innovative, technology & commercial
- True partnering, really work to understand the business

- **Focus on sustainable client value creation**



Thank you

...any questions?