

Step 1: Map out your system - What do you own?

- List all your asset types. Consult with relevant staff to ensure you are not missing important components.
- Areas of responsibility: exclude assets that are not owned by your organisation (privately owned or owned by the Ministry of Transportation, regional districts, etc.)
- Simplify your inventory: try to simplify your inventory as much as possible by grouping assets together. For instance, you can include valves and all nodal fittings such as junctions, tees, crosses, bends and ferrules in the unit replacement cost of your mains.
- However, not everything can be lumped together. Break down your vertical assets into main components based on their service life (e.g. Building Structural, Electrical/Controls, Process Mechanical, Generator, etc.)

Don't get lost in small details

WATER	Count	Count (units or length)	Material	Installation Year	Service Life	Unit Cost	Condition	Source
Mains	490 km	✓	✓	✓	✓	✓	✓	LinearUtilities_Simplified1Feb2010.xls / Water Facilities.xls
Wells	19	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xls / Water Facilities.xls
Treatment facilities	1	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xls / Water Facilities.xls
Booster stations	7	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xls / Water Facilities.xls
Chlorination stations		✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xls / Water Facilities.xls
Reservoirs	7	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xls / Water Facilities.xls
SCADA systems		✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xls
PRV stations	20	✓	NA	✓	✓	✓	✓	Facilities Asset Summary.xls
Valves		✓	NA	✓	✓	✓	✓	Water Hydrants - 2009 Summary Final_r2.pdf
Hydrants	2,280	✓	NA	✓	✓	✓	✓	Water Connections - 2009 Summary Final_r2.pdf
Service connections	18,132 units	✓	NA	✓	✓	✓	✓	Water Meters - 2009 Summary Final_r2.pdf
meters	1,601	✓	NA	✓	✓	✓	✓	
Other		✓	NA	✓	✓	✓	✓	

yann.delleuvin: Is this a good representation of the water system or am I missing important components?	yann.delleuvin: Included in the mains	yann.delleuvin: Included in other facilities	yann.delleuvin: FOR WELLS, BOOSTER STATIONS, RESERVOIRS, AND PRV STATIONS: List of active facilities to be validated by relevant staff	yann.delleuvin: FOR HYDRANTS, SERVICE CONNECTIONS, AND METERS: 2 options: A- Complete inventory with installation year + ESL. B- Inventory summary (total count, ESL, unit cost) + annual \$ value spent on renewal	yann.delleuvin: If you have inspection reports, great. If not I can do without.	yann.delleuvin: FOR WELLS, BOOSTER STATIONS, RESERVOIRS, AND PRV STATIONS: I need ideally the condition, or the installation year
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Include other staff when you do this kind of exercise

It is meant to be a repeatable exercise: document every step of it

Step 2: What asset data do you need?

- To conduct this type of long-range analysis, you need to answer two questions for each asset type:

**When will this asset be replaced?
How much will it cost?**

Assumption: assets are replaced by similar assets at the end of their service life.

- To answer these two questions, you need to find out:

- A- The remaining service life of assets as well as their total service life.
An asset will be replaced at the end of its service life so you need to know when that will occur. Using current condition is always the most accurate way to get there. If no condition assessment was recently conducted, age can be used as a proxy for condition.

$First\ Replacement = Current\ year + Remaining\ service\ life$

$Second\ Replacement = First\ replacement\ year + Expected\ Service\ Life$

- B- The replacement cost of the assets.

This is not the current depreciated value of an asset. Therefore PSAB 3150 outputs are usually not a good place to look for asset valuation since they include asset depreciation.

For mains, diameter and material pipes are also important to have. However, these parameters are fairly easy to guess.

Where to look for this information?

- Databases
- Condition assessment studies
- As-built drawings
- Maintenance management systems
- Local knowledge
- GIS
- PSAB
- Paper based or digital asset inventories

PSAB 3150 outputs are a good place to look for installation years and expected service lives.

Replacement Costs data can be found in manufacturer quotes and recently completed jobs

Step 3: From raw data to data you can use

- Once you collected all asset data available, you need to translate this raw data into data you can use for the purpose of this analysis.

Got data gaps? Fill in the blanks

- Remember that the outputs of this kind of analysis do not provide information on specific assets. This allows you to make assumptions in order to account for assets for which basic data is missing. Making assumptions is a necessary step because you cannot expect your inventory to be perfect, regardless of the size of your utility. And yet, each asset requires at least an installation year.
- For each asset type, the level of effort that should be invested in bridging data gaps depends on the financial weight of this asset within the total inventory (e.g. you would not spend days on something like SCADA systems that likely represent less than 0.1% of your inventory total value)

Practicality VS Accuracy

Unknown Parameters	Length in Raw Inventory	As % of the Raw Inventory	After Assumptions
At Least One Unknown Parameter	167,790	71%	4%
Unknown Material	151,801	65%	4%
Unknown Installation Year	45,033	19%	0%
Unknown Diameter	13,360	6%	0%

Explain and document your assumptions

- There are different techniques available to fill in the blanks. Most of the time, making educated guesses or using medians and averages is good enough for the level of detail required by this exercise. However, in some instances, it can be worth spending more time on populating unknown asset data. It is the case for mains as they usually represent roughly 50% of the valuation of a typical water or sanitary sewer system in BC.

A real life example using the "quota" method:

- Pipes installed before 1970 have no material recorded.
- You make obvious assumptions ("No PVC and HDPE before 1970", "Bob remembers that the first concrete pipes were installed in 1975", etc).
- You build a profile of known data using percentages (e.g. 26% of pipe length installed in the '70s was in Asbestos Cement, 41% in ductile iron, etc)
- You apply this profile to your unknown data.
- It is not perfect but more accurate than assuming that 100% of pipes installed prior to 1970 were in one material only.

Do not underestimate the value of local expertise

IF UNKNOWN			THEN			Length in meters
Material	Installation Year	Diameter	Material	Installation Year	Diameter	
X			Unknown Materials guessed based on existing data			120,111
X	X		Unknown Materials guessed based on existing data	Unknown Installation Years guessed based on existing data		18,719
		X		Unknown Installation Years guessed based on existing data		15,599
X	X	X	Unknown Material (80 year Expected Service Life for the purpose of this study)	Unknown Installation Years guessed based on existing data	Unknown Diameters guessed based on existing data	10,465
X		X	Unknown Materials guessed based on existing data		Unknown Diameters guessed based on existing data	2,506
	X	X		Unknown Installation Years guessed based on existing data	Unknown Diameters guessed based on existing data	250
		X			Unknown Diameters guessed based on existing data	140

Step 4: Populate Template #1: Linear inventory

- Summarize your linear inventory by grouping pipes together by age, material and diameter. This should reduce the number of lines from several thousands to a few hundreds.

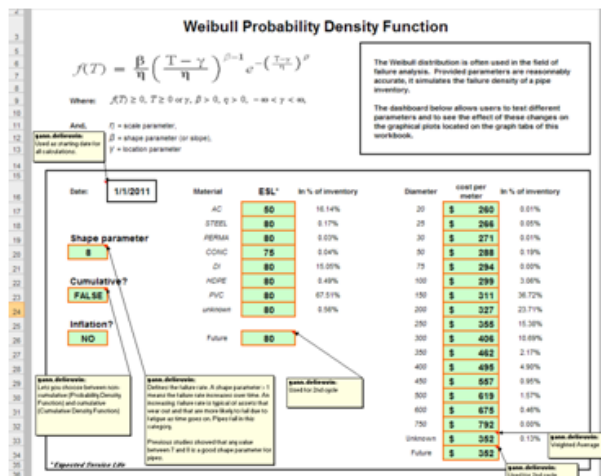
- Paste your reduced inventory (Year, Length, Material) on tab CALC_Length_1. Adjust the number of rows and years if needed.

MS Excel's Pivot Tables are very useful for this type of job.

- Repeat this step for the tab CALC_Cost_1: Paste your reduced inventory (Year, Length, Diameter, and Material) on tab CALC_Cost_1 and adjust the number of rows and years if needed.

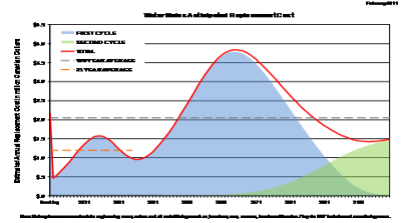
- FYI: the FIRST CYCLE line of CALC_Length_1 becomes the Length input for the calculation of your second cycle (tabs CALC_Length_2 and CALC_Cost_2). It's all linked together so you should not have to worry about that.

Weibull Distribution Calculation Sheet LENGTH - FIRST CYCLE										
Year	Length	Material	Expected Life (years)	Remaining Service Life	Weibull ALPFA (Weibull parameter)	Combinatorial	2013	2014	2015	2016
2007	70	PVC	70	0	1.0	1	0	0	0	0
2007	80	PVC	80	0	1.0	1	0	0	0	0
2007	100	PVC	100	0	1.0	1	0	0	0	0
2007	4,339	PVC	80	0	1.0	1	0	0	0	0
2007	2,899	PVC	80	0	1.0	1	0	0	0	0
2007	236	PVC	80	0	1.0	1	0	0	0	0
2007	402	HDPE	80	0	1.0	1	0	0	0	0
2008	45	PVC	80	0	1.0	1	0	0	0	0
2008	427	PVC	80	0	1.0	1	0	0	0	0
2008	3,981	PVC	80	0	1.0	1	0	0	0	0
2008	9	PVC	80	0	1.0	1	0	0	0	0
2008	709	PVC	80	0	1.0	1	0	0	0	0
2008	222	PVC	80	0	1.0	1	0	0	0	0
2008	2,882	PVC	80	0	1.0	1	0	0	0	0
2009	69	DI	80	0	1.0	1	0	0	0	0
2009	425	DI	80	0	1.0	1	0	0	0	0
2009	3	DI	80	0	1.0	1	0	0	0	0
2009	141	PVC	80	0	1.0	1	0	0	0	0
2009	129	PVC	80	0	1.0	1	0	0	0	0
2009	3,424	PVC	80	0	1.0	1	0	0	0	0
2009	1,997	PVC	80	0	1.0	1	0	0	0	0
2009	3,824	PVC	80	0	1.0	1	0	0	0	0
2009	189	PVC	80	0	1.0	1	0	0	0	0
2009	199	PVC	80	0	1.0	1	0	0	0	0
2009	271	PVC	80	0	1.0	1	0	0	0	0
2009	143	PVC	80	0	1.0	1	0	0	0	0
2009	69	PVC	80	0	1.0	1	0	0	0	0
2009	729	PVC	80	0	1.0	1	0	0	0	0
2009	129	PVC	80	0	1.0	1	0	0	0	0
2010	180	PVC	80	0	1.0	1	0	0	0	0
2010	91									
2017	490,834		490,831				4,508	1,402	1,001	1,200
2018	490,790						4,508	1,402	1,001	1,200
2019	472,248						4,508	1,402	1,001	1,200
2020	453,706						4,508	1,402	1,001	1,200
2021	435,164						4,508	1,402	1,001	1,200
2022	416,622						4,508	1,402	1,001	1,200
2023	398,080						4,508	1,402	1,001	1,200
2024	379,538						4,508	1,402	1,001	1,200
2025	360,996						4,508	1,402	1,001	1,200
2026	342,454						4,508	1,402	1,001	1,200
2027	323,912						4,508	1,402	1,001	1,200
2028	305,370						4,508	1,402	1,001	1,200
2029	286,828						4,508	1,402	1,001	1,200
2030	268,286						4,508	1,402	1,001	1,200
2031	249,744						4,508	1,402	1,001	1,200
2032	231,202						4,508	1,402	1,001	1,200
2033	212,660						4,508	1,402	1,001	1,200
2034	194,118						4,508	1,402	1,001	1,200
2035	175,576						4,508	1,402	1,001	1,200
2036	157,034						4,508	1,402	1,001	1,200
2037	138,492						4,508	1,402	1,001	1,200
2038	120,950						4,508	1,402	1,001	1,200
2039	102,408						4,508	1,402	1,001	1,200
2040	83,866						4,508	1,402	1,001	1,200
2041	65,324						4,508	1,402	1,001	1,200
2042	46,782						4,508	1,402	1,001	1,200
2043	28,240						4,508	1,402	1,001	1,200
2044	9,698						4,508	1,402	1,001	1,200
2045	1,156						4,508	1,402	1,001	1,200
2046	0						4,508	1,402	1,001	1,200
2047	0						4,508	1,402	1,001	1,200
2048	0						4,508	1,402	1,001	1,200
2049	0						4,508	1,402	1,001	1,200
2050	0						4,508	1,402	1,001	1,200
2051	0						4,508	1,402	1,001	1,200
2052	0						4,508	1,402	1,001	1,200
2053	0						4,508	1,402	1,001	1,200
2054	0						4,508	1,402	1,001	1,200
2055	0						4,508	1,402	1,001	1,200
2056	0						4,508	1,402	1,001	1,200
2057	0						4,508	1,402	1,001	1,200
2058	0						4,508	1,402	1,001	1,200
2059	0						4,508	1,402	1,001	1,200
2060	0						4,508	1,402	1,001	1,200
2061	0						4,508			



- The output of your second cycle is looked up on the line SECOND CYCLE of CALC_Length_1 and CALC_Cost_1. Both cycles are then summed up on the line TOTAL of the same tabs.
- All parameters (Service lives, unit costs, cumulative and shape parameter) are conveniently centralised on the parameter tab. Once your model is built, these parameters are the only changes you have to make to run scenarios.

Change parameters, see the results →

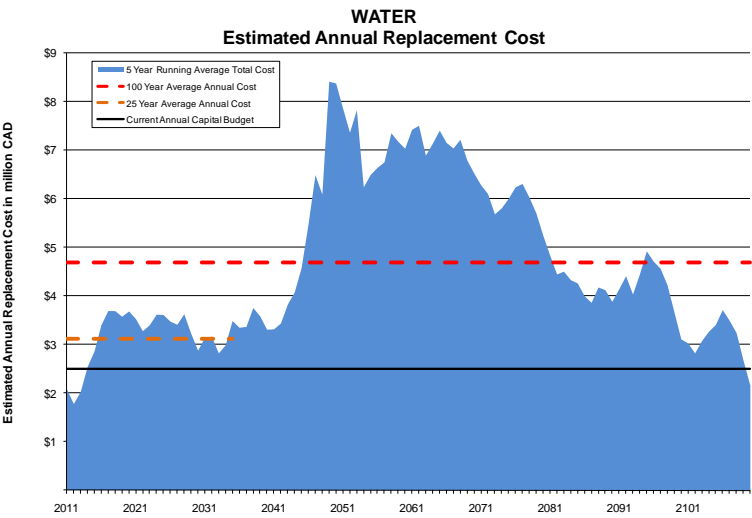
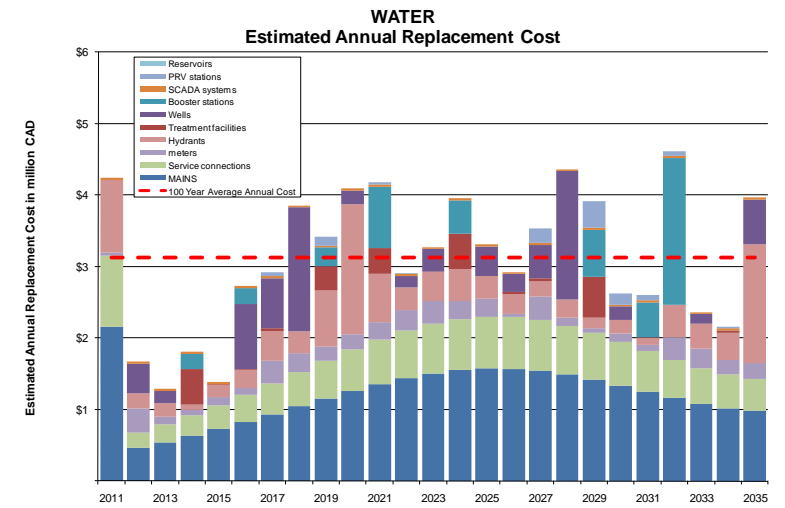


Step 5: Populate Template #2: Vertical inventory

- Import your raw data tabs in the file for future reference.
- Summarize and merge your data when needed.

Link all your ESL's to a look up table. You can then make changes on the fly

- Paste your summarized data into the source data tabs.
- All calculations are already entered in the source data tabs but you will have to adjust the number of rows according to the number of assets, and the number of columns according to the number of cycles that fit in 100 years.



- Link Expected Service Lives to a look-up table for easy update.
- Total life cycle costs are automatically calculated on tab CALCULATIONS
- Paste Special/Transpose the output of the Linear Template (line TOTAL of CALC_Cost_1) in the column MAINS of the tab CALCULATIONS.
- Tab CALCULATIONS is the source data tab for all graphs.
- Paste your data from column A to G in the INVENTORY tab for a printable summary of all your assets.

That's it, you're done!
You just completed a Long-Range Renewal Capital Plan for your utility.

Top Down Asset Management for Dummies: Template User Guide

This guide is a resource for the use of MS Excel templates
AECOM_TOPDOWN_Template_1_Linear.xlsx
AECOM_TOPDOWN_Template_2_Summary.xlsx

Available free of charge at
www.nationalbenchmarking.ca

Prepared by:
Yann Delieuvin
Asset Management Analyst
AECOM – Burnaby, BC
604 444 6436
yann.delieuvin@aecom.com



Key Points

1. You don't need perfect data and you don't need expensive software or equipment
2. If kept simple, it can be done quickly
3. Communicate your results within (and outside) the organisation

