



MENDOCINO COUNTY EMPLOYEES
RETIREMENT ASSOCIATION

Infrastructure Risks and Case Studies



MENDOCINO COUNTY EMPLOYEES RETIREMENT ASSOCIATION

Information comes from:

- The Volatility of Unlisted Infrastructure Investments – Blanc-Brude, Gupta, Lu, Wee (2021)
- Low Tide: Benchmarking Risks in Infrastructure Investments – Blanc-Brude, Gupta, Whittaker (2024)
- IFM
- JPM
- Ofwat
- U.K. Government
- Virginia State Corporation Commission
- Supreme Court of Virginia
- Other publicly available information





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Outline

- Infrastructure Risk Factors
- Thames Water – United Kingdom water company
 1. U.K. water market history
 2. Cost of Capital
 3. Future of Market? (New Regulator)
- Portfolio Company Examples
 1. Southern Water Services
 2. Arqiva
 3. Atlas Arteria – Dulles Toll Road

How do you price infrastructure assets?

- Like real estate you can use comparator sales, however this can be difficult due to the unique nature of each asset.
- You might be able to find a reasonable comparator asset, or you might not
- A more typical approach is to use discounted cash flow.

$$\bullet \text{ Price}_j = \sum_{t=1}^T \frac{\text{Cashflow}_{j,t}}{(1 + \text{Riskfree}_t + \text{Risk Premium}_j)^t}$$

Where,

$\text{Riskfree}_t = \text{Long - term bond yield}$

$$\text{Risk Premium}_j = \sum_{k=1}^K (\beta_{j,k} \times \gamma_k) + \varepsilon$$

Risk Factors
contribute to the risk
premium of the asset

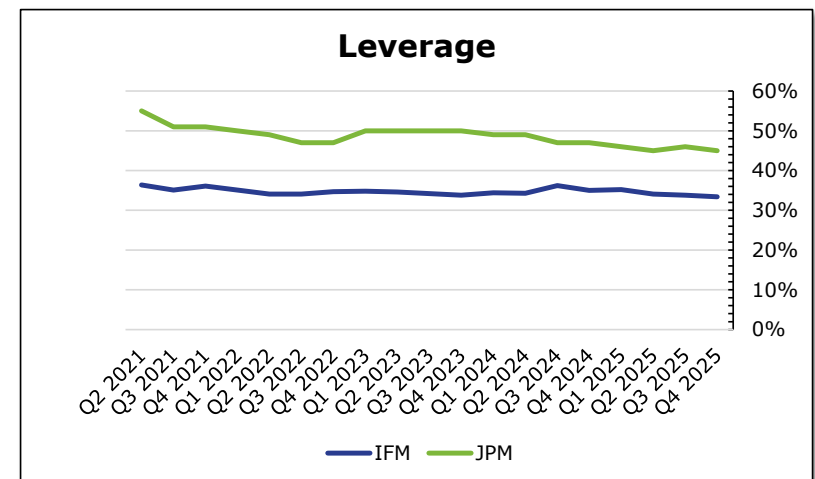


Risk Factors - Leverage

Leverage: $\frac{\text{Total Debt}}{\text{Total Assets}}$

- Effect on price is negative
- Why?
 - Higher leverage increases the risk of future cash flows to shareholders
- More leverage requires risk premium in transaction pricing
- Leverage is biggest contributor to risk premium
- Proxy for credit risk

Strategy	Fund Leverage
IFM GIF	33%
JPM IIF	45%

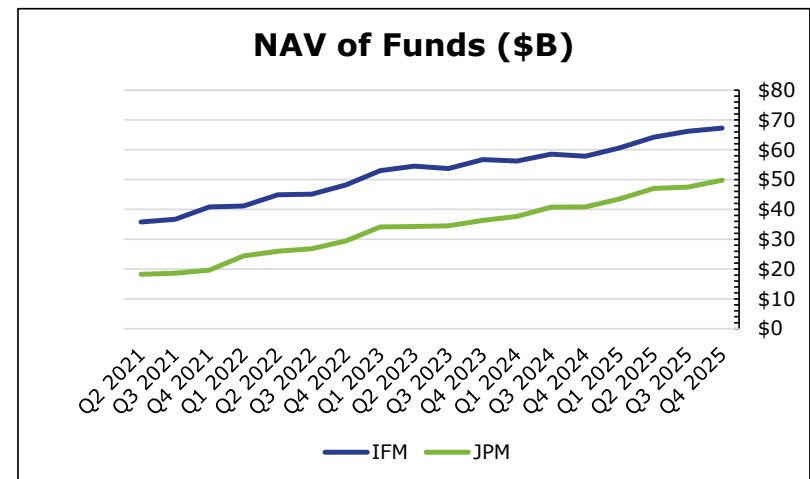


Risk Factors - Size

Size: Total Assets

- Effect on price is negative
- Why?
 - Larger assets are more illiquid and complex transactions
- Size has positive relationship with risk premium
- Investors can expect higher risk premium compared to smaller assets
- Proxy for liquidity

Company	Asset Size
South Jersey Industries	\$6.3B
Summit Utilities	\$3.1B
Nieuport Aviation	\$0.7B
Aleatica	\$14.1B
Indiana Toll Road	\$7.5B



Risk Factors - Profitability

- Effect on price is positive
- Why?
 - Higher profitability decreases future uncertainty of dividend payouts
- Decreases risk premium
- A sign of relative risk aversion in buyers of unlisted infrastructure
- Smallest contribution to risk premium

- Profitability:

$$\frac{\text{Net Profit After Tax}}{\text{Total Assets}}$$



Risk Factors – Investment, Capital Expenditures

Investment: $\frac{\text{Capital Expenditures}}{\text{Total Assets}}$

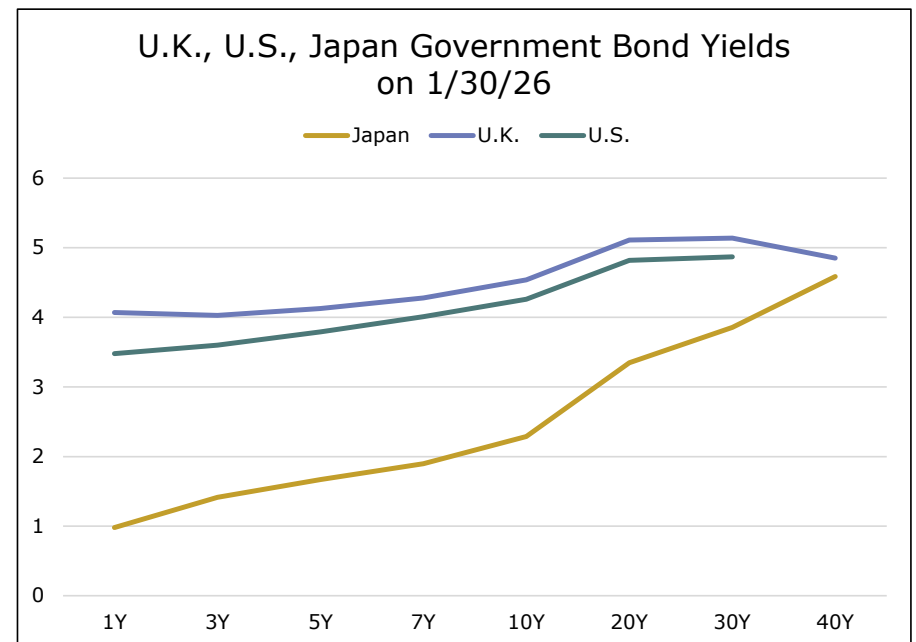
- Effect on price is negative
- Why?
 - More investment can lead to possibility of delays or cost overruns which make future cash flows more uncertain
- Leads to higher risk premium
- Understood to also capture the difference between greenfield and brownfield investments

Strategy	Planned Expenditures	% of Fund NAV
IFM GIF	\$12.5B over 5 years	19%
JMP IIF	\$25.0B over 5 years	50%

Risk Factors – Term spread and Country Risk

Term Spread: Steeper Yield Curve

- Effect on price is negative
- Why?
 - More uncertain long term macro uncertainty (steeper yield curve) correlates with greater risks for infrastructure investors
- Increases risk premium
- Chen and Tsang(2013)





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Thames Water

Brief History of U.K. Water Market

In 1989 Prime Minister Margaret Thatcher changed the water delivery model from publicly managed systems to a market based for-profit model.

The change was driven by both economic and political factors.

The economic factors were:

- attract investment - Years of underinvestment in delivery systems meant large amounts of capital were required to comply with upcoming European Union water quality standards.
- Selling assets to private investors would lessen the burden on local governments and help lower public expenditures helping to balance the budget
- Private ownership should increase operational efficiency of the water systems and drive down costs by promoting competition.

Political factors were:

- Thatcher administration wanted to reduce government involvement in industries and promote free-market solutions
- U.K. water sector historically suffered under investment, had poor water quality standards, and was thought to be largely inefficient.
- Consumer interests would be safeguarded through the creation of new regulatory authorities which can balance public and private interests.

Brief History of U.K. Water Market

What happened?

- Water bills increased more than reported inflation (per Bloomberg in 2023)
- Companies paid out between £52B – £78B dividends to investors
- Between £190B - £236B (adjusted for inflation) invested in water infrastructure
- Competition remained monopolistic for households; businesses have a competitive market
- Sewage spills and environmental cleanup costs, are less frequent
- Some rivers now support wildlife when they previously did not (Thames, Mersey, Taff)
- Public backlash due to affordability, equity, and corporate stewardship

Overall, water quality did improve but some claim profit motives undermine long-term sustainability

U.K. Water Market Companies

Major Water Companies by Number of Customers Served

Company	Number Customers Served
Thames Water	16M
Severn Trent	8M
Anglian Water	6M
Yorkshire Water	5M
Northumbrian Water	4M
United Utilities	3M
Welsh Water	3M
Southern Water	3M

Anglian Water is part of our IFM GIF portfolio

Southern Water was part of our JPM IIF portfolio

Thames Water - History, performance, and controversies

Initial Privatization: 1989 - 2006

- Privatized with zero debt
- Initially publicly listed company on London Stock Exchange
- Acquired by German utility company RWE in 2001
- Debt rises to approximately £3.4B
- Under RWE ownership the company missed multiple leakage targets, was subjected to numerous penalties for pollution, and paid out approximately £1B in dividends

Macquarie: 2007 - 2017

- Debt rises from £3.4B to £10.8B
- £2.7B in dividends during this period
- Operational failures led to the largest fine up to that point in time of £20.3M for sewage spills into the River Thames over 2012-2014
- Missed multiple leakage targets in 2016-2017, fined £8.5M
- Invested about £11B in capex
- Leakage reduced ~22% and pollution incidents fell by 75%

Thames Water - History, performance, and controversies

Current Consortium: 2017 - 2026

- Debt continues to rise to upwards of £20B
- Interest rate increases by the BOE made the debt unsustainable
- By 2023 the company was under severe strain and crisis
- In 2023 the U.K. government proposed contingency plans for a takeover
- CEO Sarah Bentley resigns after 2 years on the job following criticisms over sewage spills and her own bonuses
- In 2024 shareholders refuse to inject £500M in equity
- Loses investment grade status in July 2024, downgraded to junk status
- Operational failures continue to draw record penalties and create public outrage
- KKR backs of proposed equity deal (£4B raise) after due diligence process
- To attract new investment the company is requesting a 53% increase in customer bills by 2030.
- Regulator only allowing 35% increase
- Latest proposal includes over £20B in infrastructure investment over the next five years

Thames Water

Who are the water regulators?

- **Ofwat is the economic regulator.**
 - It sets the limits on what the company can charge and ensures they can finance operations
- Environment Agency is the environmental regulator.
 - It protects river quality and enforces pollution standards
- Drinking Water Inspectorate is the quality regulator.
 - It ensures tap water is safe to drink and meets legal standards

Thames Water

Regulated Cost of Capital

Weighted Cost of Capital (WACC) = (Cost of Equity X %Equity)+(Cost of Debt X %Debt)

Cost of Equity = 5.10%

Cost of Debt = 3.15%

Ofwat assumes leverage of 55%

$$\text{WACC} = (5.10\% \times 45\%) + (3.15\% \times 55\%)$$

$$\mathbf{WACC = 4.03\%}$$

This is the allowed return on capital by the water regulator...

Thames Water

Requested Regulated Cost of Capital per Thames

Weighted Cost of Capital (WACC) = (Cost of Equity X %Equity)+(Cost of Debt X %Debt)

Cost of Equity = 6.24%

Cost of Debt = 3.26%

Ofwat assumes leverage of 55%

$$\text{WACC} = (6.24\% \times 45\%) + (3.26\% \times 55\%)$$

$$\mathbf{WACC = 4.60\%}$$

This is the requested return on capital by Thames...

Thames Water

Market Cost of Capital for Thames

Weighted Cost of Capital (WACC) = (Cost of Equity X %Equity)+(Cost of Debt X %Debt)

Cost of Equity = 10.4%

Cost of Debt = 6.1%

Thames actual leverage of ~86%

$$\text{WACC} = (10.4\% \times 14\%) + (6.1\% \times 86\%)$$

$$\mathbf{WACC = 6.70\%}$$

This is the actual return on capital needed by Thames to be breakeven

Thames Water

Market Cost of Capital

- There is a proposal by the current consortium, **London & Valley Water**, that relies on reducing the debt service burden so that the actual cost of capital falls below the regulatory allowed return
- Applying a 25% haircut to Thames Water's roughly £19bn debt pile (reducing it to ~£14.25bn) fundamentally shifts the capital structure and the WACC calculation.
- Junior lenders will take a 100% write down – they lose all their money (Class B)

U.K. Water Market

Leverage ratios

Company	Leverage
Thames Water	85.9%
Severn Trent	62.7%
Anglian Water	71.0%
Yorkshire Water	74.2%
Northumbrian Water	70.0%
United Utilities	58.0%
Welsh Water	62.0%
Southern Water	74.0%

Ofwat leverage target of 55 - 60.0%

Thames Water

Why do these companies have more leverage than Ofwat assumes?

- **Tax Efficiency:** Unlike equity dividends, interest payments on debt are tax-deductible. High leverage reduces taxable profits, often allowing companies to minimize or eliminate their UK corporation tax bills while still paying out substantial dividends.
- **Lower Cost of Equity:** Using debt to fund operations, investors can maintain a smaller slice of equity, which boosts their internal rate of return (IRR). This makes the business appear more profitable to shareholders even if operational performance is stagnant.
- **Regulatory Loopholes:** The regulatory framework prioritizes keeping customer bills low rather than mandating high levels of equity. Thus, investors perceive the sector as low-risk, allowing them to load companies with debt while interest rates were near zero.
- **Offshore Financing:** Some firms have used high-interest loans from their own overseas parent companies. This allowed them to move money out of the UK as "interest payments" tax-free, further incentivizing high debt levels over equity investment.

U.K. Water Market – Current and Future

Current status - 2025

Interim legislation – Water (Special Measures) Bill

- Block bonuses for executive who pollute waterways
- Bring criminal charges against persistent law breakers
- Enable automatic and severe fines
- Ensure monitoring of every sewage outlet

More information available at:

[Water \(Special Measures\) Act: policy statement - GOV.UK](#)

A new white paper published January 2026 by U.K. government lays out its proposed plans for the sector, titled [A New Vision for Water](#)

Major reforms proposed:

- Create a single regulator that combines Ofwat, EA, and DWI
- Mandatory, proactive, health checks on water lines
- End self-monitoring by companies and make monitoring data available to the public
- Shift the industry to a 25-year long-term planning cycle, estimating £290B (GBP) total investment over this period

Thames Water - Conclusion

The U.K. water market highlights a central regulatory risk of infrastructure investments:

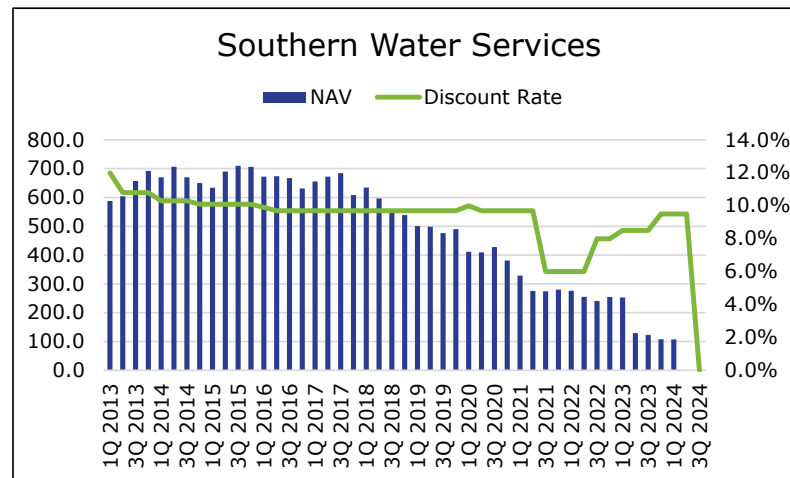
1. Governments tend to underinvest in infrastructure
2. Governments tend to view privatization as a remedy for previous structural underinvestment in infrastructure
3. Private capital is brought in to fund this gap – which can be very large
4. Private capital pays for upgrades, maintenance, and repair of infrastructure assets
5. Private capital can assume a return on investment higher or lower than the amount regulatory authorities approve
6. Private companies recoup the cost of upgrades, maintenance, and repair of public infrastructure through increases to customer billing or excessive company debt
7. Regulatory authorities may come under public pressure to slow or stop increases in customer billings, thereby impairing recoupment of infrastructure investment

In the case of Thames Water, a large contributor to insolvency was the fact that the regulator Ofwat set the regulated cost of capital below the actual cost of capital set by the market.

What would you do if you had someone telling you to spend more money on a project than you were able to recoup over a reasonable period of time?

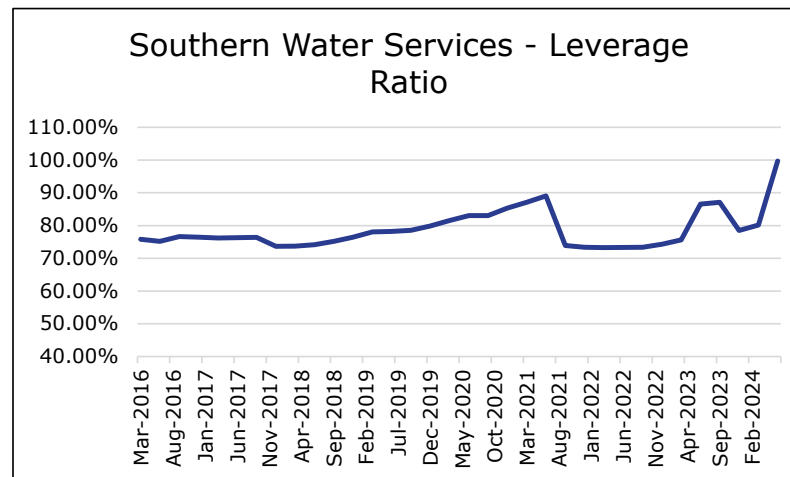
Southern Water Services – IIF Ownership

- In October 2007, IIF acquired an interest of approximately 28% in SWS for approximately £360M (GBP), or \$735.4M
- In February 2008 holding companies sold 6.4% of their interest in SWS to unrelated third party for £24.8M (GBP), or \$48.7M. As a result of the transaction interest in SWS decreased from approx. 28% to approx. 26%.
- From 2011 to 2022, there has been a total of £60.2M (GBP) or \$94.3M in additional contributions.
- In Sept 2021 Macquarie Asset Management (MAM) recapitalizes the owner of SWS by investing over £1B (GBP) which dilutes IIF's interest to approximately 11.8% from 31.24%.
- In July 2023 a £550M (GBP) equity raise was coordinated by MAM. The equity raise was completed at a significant discount to the previous quarters NAV for Southern Water. IIF did not participate in the equity raise and ownership was diluted further to 5.6%
- IIF's interest in SWS sold in Q3 2024



Southern Water Services – Past Issues and Current Status

- Prior to IIF ownership, fine in 2007 of £20M (GBP) for misleading regulator and misreported information that allowed it to increase prices by more than it should have done. Affected customers were reimbursed. Ownership was mostly the Royal Bank of Scotland.
- In 2013 shellfish were found to be contaminated with E.coli. This kicked off a criminal Environment Agency (EA) investigation.
- The company pled guilty to illegal discharges, over 2010 – 2015, of sewage across 17 sites in Hampshire, Kent, West Sussex. EA found the company deliberately diverted raw sewage from treatment works into waterways to reduce the costs associated with maintaining and upgrading their infrastructure.
- In total, £216M (GBP) in fines were levied for the period.
- Today owned primarily by MAM – fresh equity raise in late 2025 of £1.2B (GBP). Undergoing recapitalization right now.
- Expects to have the largest increase of 11 private water companies agreed to by Ofwat by 2023



Arqiva – Company & Major Events

- Owner operator of broadcast and wireless communications in U.K.
- Customer base comprises over 1300 organizations including television networks, radio broadcasters and government agencies.
- Approximately 85% of revenue comes from the Terrestrial & Radio Broadcast, Digital Platforms, and Satellite divisions, while remaining comes from the Smart Metering business
- Long-term business model has been challenged by increasing competition and viewership of internet television
- Since 2020 has reduced workforce and sold Telecoms division (cell towers)
- Bilsdale Mast fire in 2021

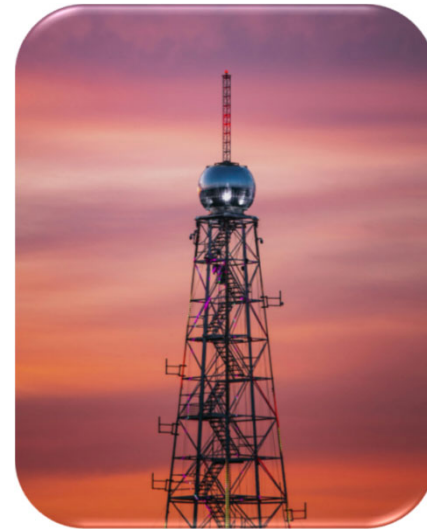
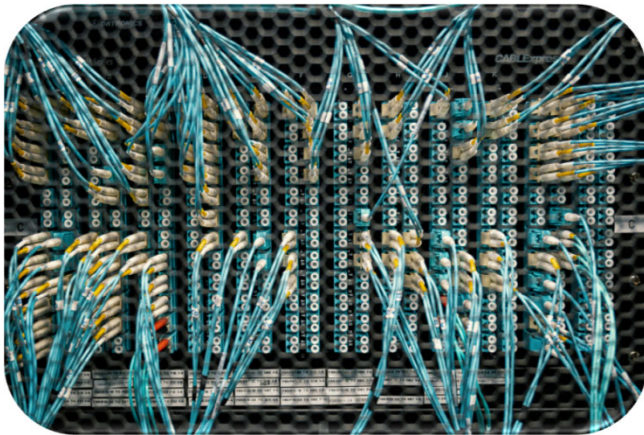


arqiva

Enabling a switched-on
world to flow

Arqiva – Company & Major Events

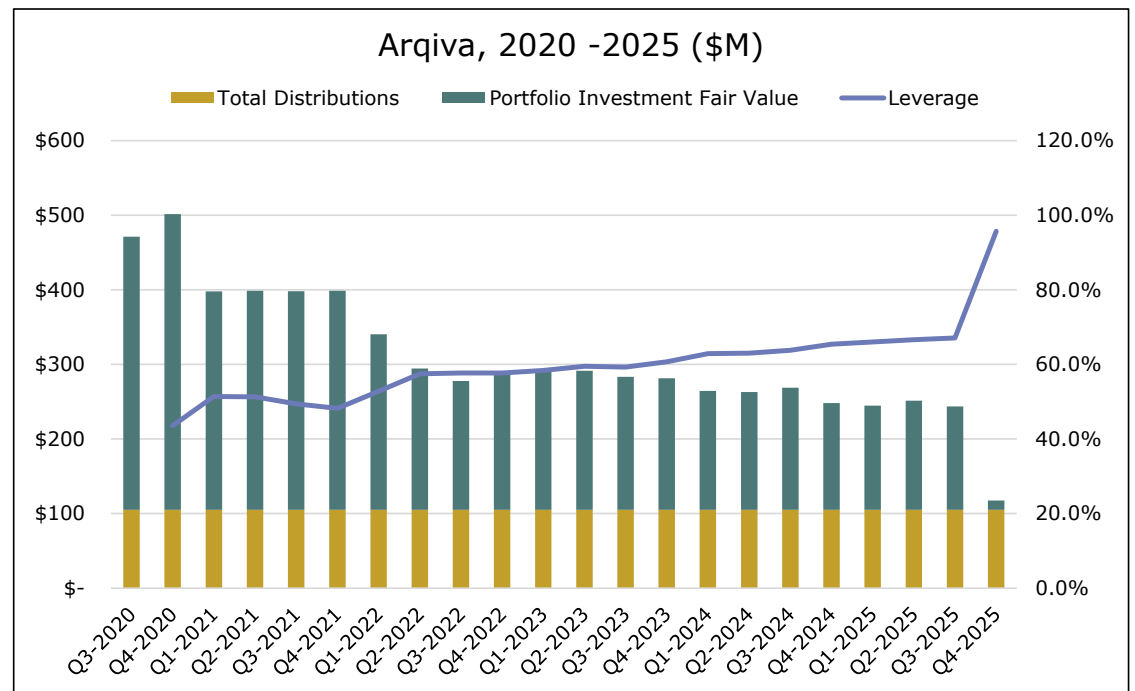
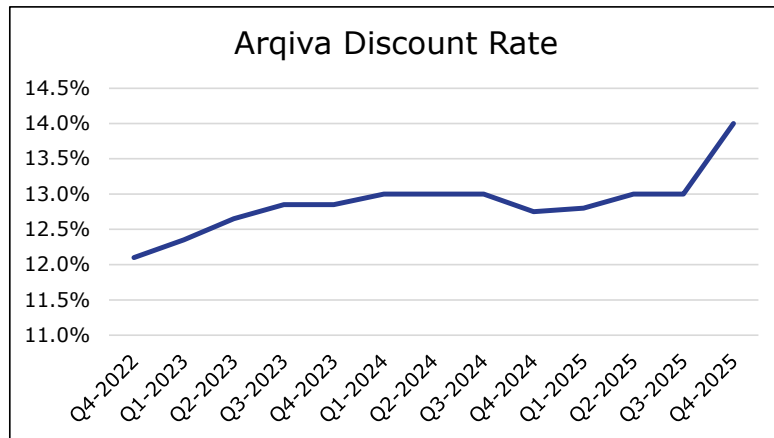
- In 2022 Conservative U.K. government questioned the longevity of the business (given competition of internet)
- In June 2022 Digital 9 Infrastructure acquired Canada Pension Plan Investment Board's 48% stake in Arqiva (459M GBP, \$565M)
- In 2024 Digital 9 decided to wind-down the infrastructure fund, selling all wholly owned assets except Arqiva
- In 2024 company awarded a contract by Anglian Water (also owned by IFM) for their smart metering network for the 2025-2030 period, with total additional volumes of 1.1 million meters.
- In November 2025 Macquarie's MEIF Fund agreed to sell its 26.5% stake for 16.5M GBP
- The sale implies a total value of Arqiva of 62M GBP
- **IFM GIF didn't exercise its Right of First Refusal**



Arqiva

- Portfolio Cost of \$558M
- Current discount rate of 14% (IIF airports at 12%-13%, GETEC at 11%)
- As of March 27, 2024, the Regulator uses 10.4% as a discount rate

- Arqiva is the only national provider of television signals to U.K. households.



Atlas Arteria – Dulles Greenway



Atlas Arteria – Dulles Greenway

- Atlas Arteria – Australian global toll road operator
 - 2010: Formed as part of restructure of Macquarie Infrastructure Group
 - 2018: Rebranded as Atlas Arteria
 - 2019: Brought leadership team in-house by terminating management agreements with Macquarie
 - IFM GIF is largest current shareholder with 35% ownership.
- Control of the Greenway
 - 2005: Macquarie Infrastructure Group acquired 100% economic interest for \$617M
 - 2006: Half of interest sold to Macquarie Infrastructure Partners (separate private fund)
 - 2017: Atlas Arteria bought back the half stake for \$445M to regain 100% ownership
 - Holds the concession until 2056

Atlas Arteria – Dulles Greenway

Revenue growth comes from increases in toll rates instead of additional drivers

However, traffic volumes remain below pre-2020 levels

As of late 2025 the Greenway has just over \$1B in outstanding debt

Lower traffic volumes and large outstanding debt lower the profitability and debt-service coverage ratios

Accordingly, the Fitch (ratings agency) Rating Outlook is Negative

- Major Contributor to the Negative outlook is the Greenway's inability to raise rates to accommodate increasing debt service

Atlas Arterial – Dulles Greenway

Inability to raise tolls:

- Must request toll increases from the Virginia State Corporation Commission (SCC)
- In 2024, the SCC rejected toll increase for peak hours from \$5.80 to \$8.10
- In 2025, Supreme Court of Virginia unanimously upheld the SCC decision

The Three-Part Legal Test

Under [Virginia Code § 56-542](#), the SCC must ensure that any new toll rate meets these three requirements:

Reasonable Benefit: The toll must be reasonable to the user in relation to the benefit obtained (e.g., time saved compared to free alternatives like Route 7).

No Material Discouragement: The rate cannot "materially discourage" the public from using the road. This typically means the hike shouldn't cause a significant drop in traffic.

Limited Return: The toll should provide the operator with "no more than a reasonable return" on their investment, similar to how a public utility is regulated.

Atlas Arteria – Dulles Greenway

Supreme COURT SAYS....

“The story told by the voluminous record before us is not that of a governmental agency dragging a profitable business down to the depths through regulatory overreach. Instead, the consistent narrative going back to the very first years of the Greenway is that of a Commission taking actions to keep afloat a business that was launched with flawed assumptions. Greenway investors anticipated a volume of trips on the Greenway that never has materialized. That faulty assumption in short order propelled the operators of the Greenway into insolvency....

...Investments present opportunities for gain but also come with the risk of loss. A “reasonable” rate of return is not an ironclad guarantee of profit. It is one that is reasonable under the circumstances. ...

...As to the reasonable rate of return, even if the toll rate increase had been approved, its investors would still see no return on their investment for the foreseeable future, due to the restrictions imposed on TRIP II’s ability to provide equity distributions discussed earlier in this opinion....”

Atlas Arteria – Dulles Greenway

Toll increase process:

- **Annual Application:** Atlas Arteria (via TRIP II) can apply for a toll increase once every 12 months.
- **Forward-Looking Analysis:** The company must submit an independent traffic and revenue study that projects how the new rates will affect traffic over the next year, considering current social and economic conditions (like the rise of remote work).
- **VDOT Review:** The Virginia Department of Transportation (VDOT) reviews the company's analysis and provides formal comments to the SCC.
- **Public Feedback:** The SCC holds public hearings where residents and local governments (like Loudoun County) can testify against the increase.
- **Debt Service vs. Profit:** While the company often argues it needs higher tolls to service its \$1 billion+ debt, the SCC and the Virginia Supreme Court have ruled that the state is not obligated to guarantee a profit if the business model itself is flawed.



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Thank you