

The Challenge by the Mayor of London to Thames Water's Desalination Plant at Beckton

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Introduction to the Beckton Scheme

The Legal Challenge

- Source of the Controversy
- Case For and Against
- Planning Inquiry

Technical and Economic issues

- Energy Comparison of Desalination and Wastewater Reuse
- UF Pre-treatment

Conclusions



Beckton Scheme

Brackish water desalination scheme to supply East London

Tidal estuary abstraction from the River Thames

Plant output 140 mld

Expect to use plant up to 40% of the time to augment resources during design 'dry' conditions

High RO recovery (approx 75%) (suggests abstraction of up to 220 mld)

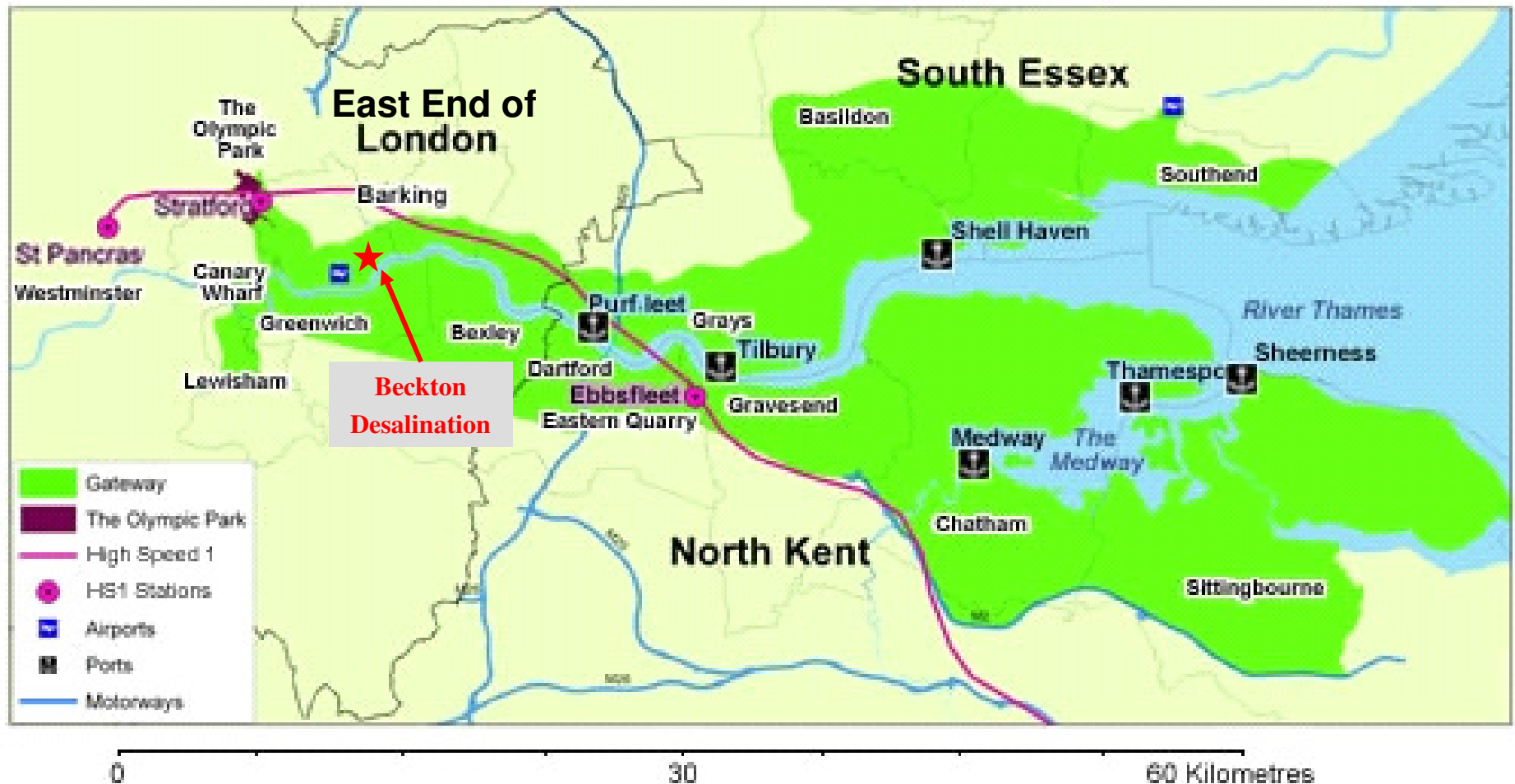
Abstraction into bank-side storage 3 hours prior to low tide

Feed TDS 11,000 ppm worst case (during drought); 3,000 ppm best case

Commissioning late 2009, compliance date March 2010



The Beckton Desalination Plant



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Information Sources

Public Domain Documents

Appeal Reference: APP/G5750/A/05/1184751

Mayor of London's Office (www.london.gov.uk/mayor/planning):

Proof of Evidence and Closing Submissions

Regulator:

OFWAT Statement to the Planning Inquiry for the Appeal by Thames Water of the Rejection of Planning Permission for Beckton, 2 June 2006

Thames Water Utilities Ltd authorized PR, including:

BBC Radio 4 30 minute interview programme with Thames R&D Director in 2002

The Saline Solution, A. Bennett, Water & Wastewater Treatment, pp 13-15, Nov 05

Thames Desalination Plant Construction at 25%, Water Desalination Report, Vol 44, No. 30, 18/9/08

Project Update, Global Water Intelligence, Aug 2007

IDA Conference Proceedings 2009



Beckton Desalination – Source of the Controversy

Political

Thames Water

- Privatized
- Owned by a foreign utility
- Using desalination for business development reasons (to provide a reference)

Mayor of London

- Ofwat accused of a cosy relationship with Thames Water
- Claims that Thames putting shareholder interests above their customers
- *Claims desalination is unnecessary and unsustainable for the UK*

Resource Development – the Mayor's View

- Thames should exercise leadership in reducing demand
- Thames could meet needs through leakage improvement
- Reuse should be introduced in the medium term, not desalination

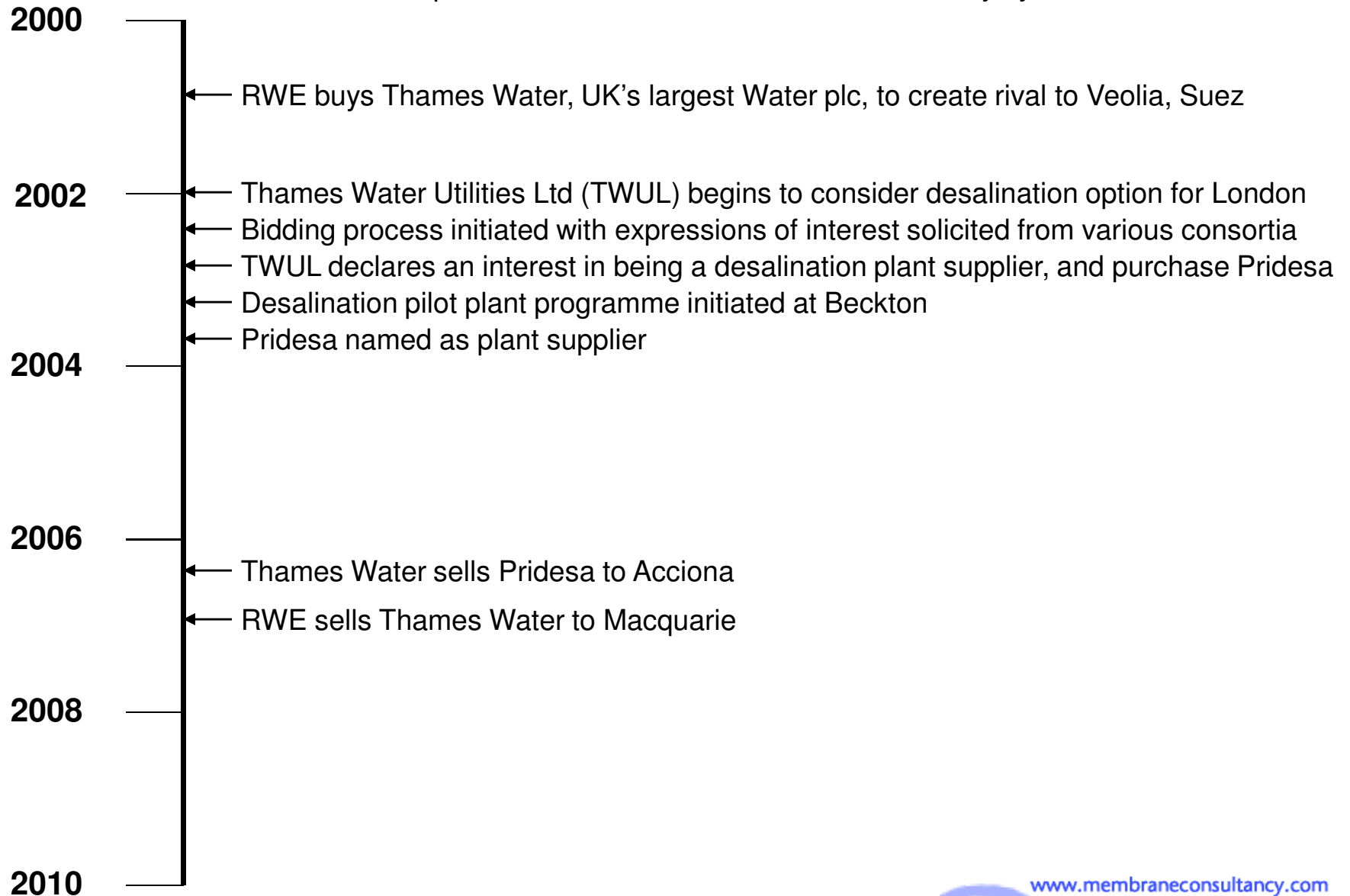
Examine the sustainability of Desalination for the UK cf Reuse

Consider the pre-treatment choice and bio-fouling control for the plant



Timeline – Background To Thames Water

Thames Water plc created from the Thames Water Authority by the 1989 Water Act



Beckton: The 'Needs' Case

Thames Water supported by OFWAT

Supply/Demand balance

Unacceptable risk of supply interruption during prolonged dry spells

Design 'dry' shortfall of 236 mld in 2004/5,

Increasing to 380 mld in 2009/10 due to Thames Gateway development (and Olympics)

Supply shortfall

Reduce leakage by 190 mld (OFWAT noted Thames poor leakage record)

Accept risk of hosepipe ban frequency of one in 10 years

Provide additional resources

Short term: Build desalination plant – impact from 2010 (originally 2008)

Medium term: Wastewater reuse – impact from 2015 (public acceptance)

Long term: Abingdon reservoir – impact from 2020 (planning issues)

Beckton scheme intended to give 140 mld and reduce risk of shortfall from 90% to 20%

Agreements with neighbouring water companies to provide 30 mld

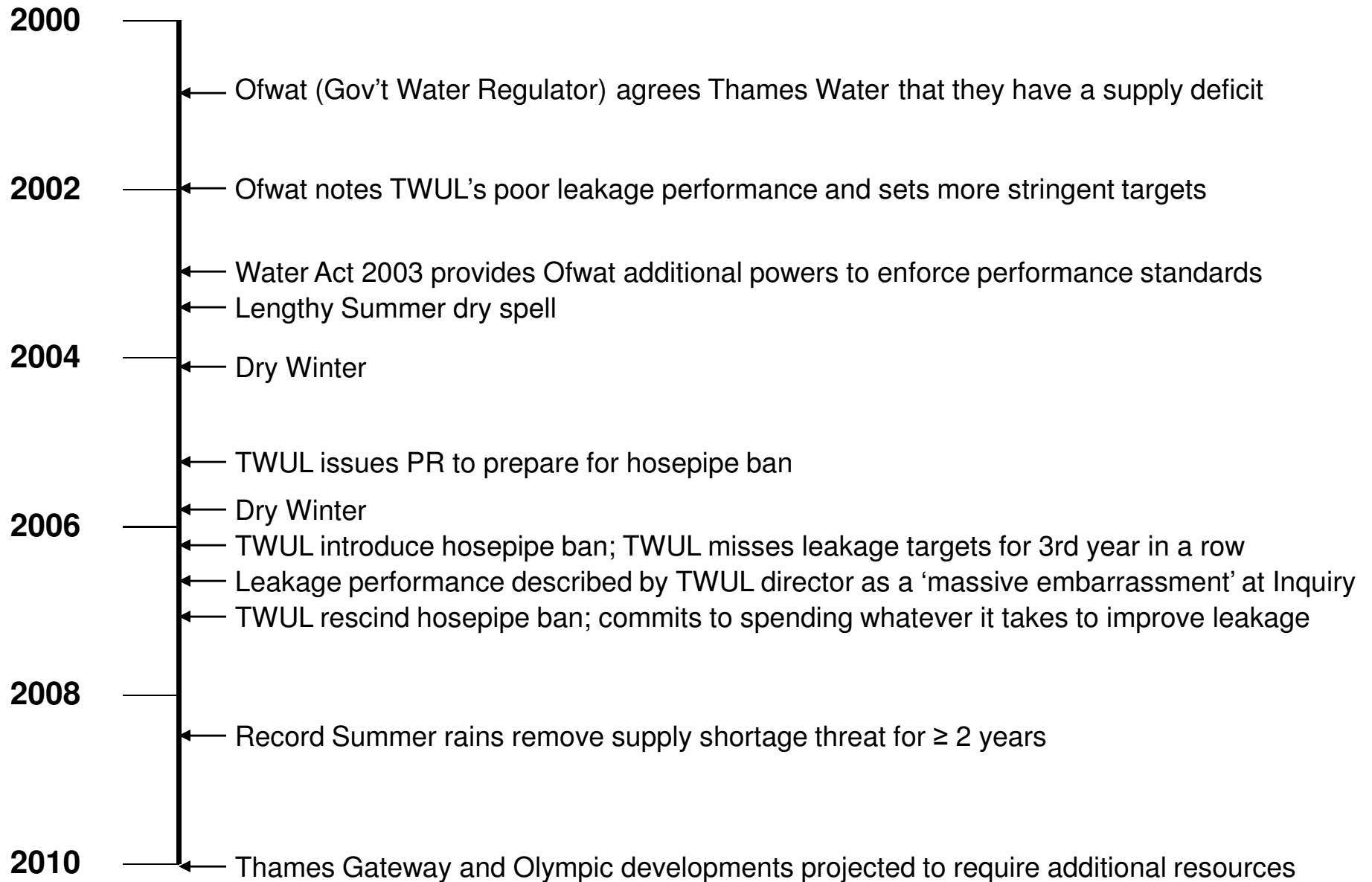
Demand

Reduce consumption (unspecified)

Introduce metering (save 10 mld); Conduct efficiency initiatives (save 10 mld)



Timeline – Water Resources in the Thames Area



Beckton: The Case Against

(Mayor of London's Office supported by EA)

Supply Management

Cheaper and more sustainable alternatives than desalination

Augmentation of existing resources

Wastewater reuse

Leakage Management

Lamentable record

Severely criticised by OFWAT

Missed 3 years of targets leading up to Inquiry

Acknowledged by TWUL Director to be a 'massive embarrassment'

Demand Management

Poor metering uptake

Unambitious plan to change consumption behaviour



Planning Inquiry and Appeal

Participants

Arbiter:

DEFRA – Government Ministry responsible for the Environment, including Water

Regulator:

OFWAT – Government Regulator for the Water Industry (drinking water supply)

Environment Agency (EA) – Government agency for environmental protection

Planning:

Mayor of London's Office

Newham Borough Council

Supplier:

Thames Water

User:

Consumer/water rate payer/tax payer



Planning Inquiry - Participant Responsibilities

Thames Water

- Supply safe drinking water, based on DWI (EU) regulations (WHO guidelines)
- Privatized utility; charges based on regulated price structure
- Detailed 5 year spending plan
- Outline 25 year resource plan

OFWAT

- Defines output required
- Sets prices
- Monitors performance and efficiency

Environment Agency

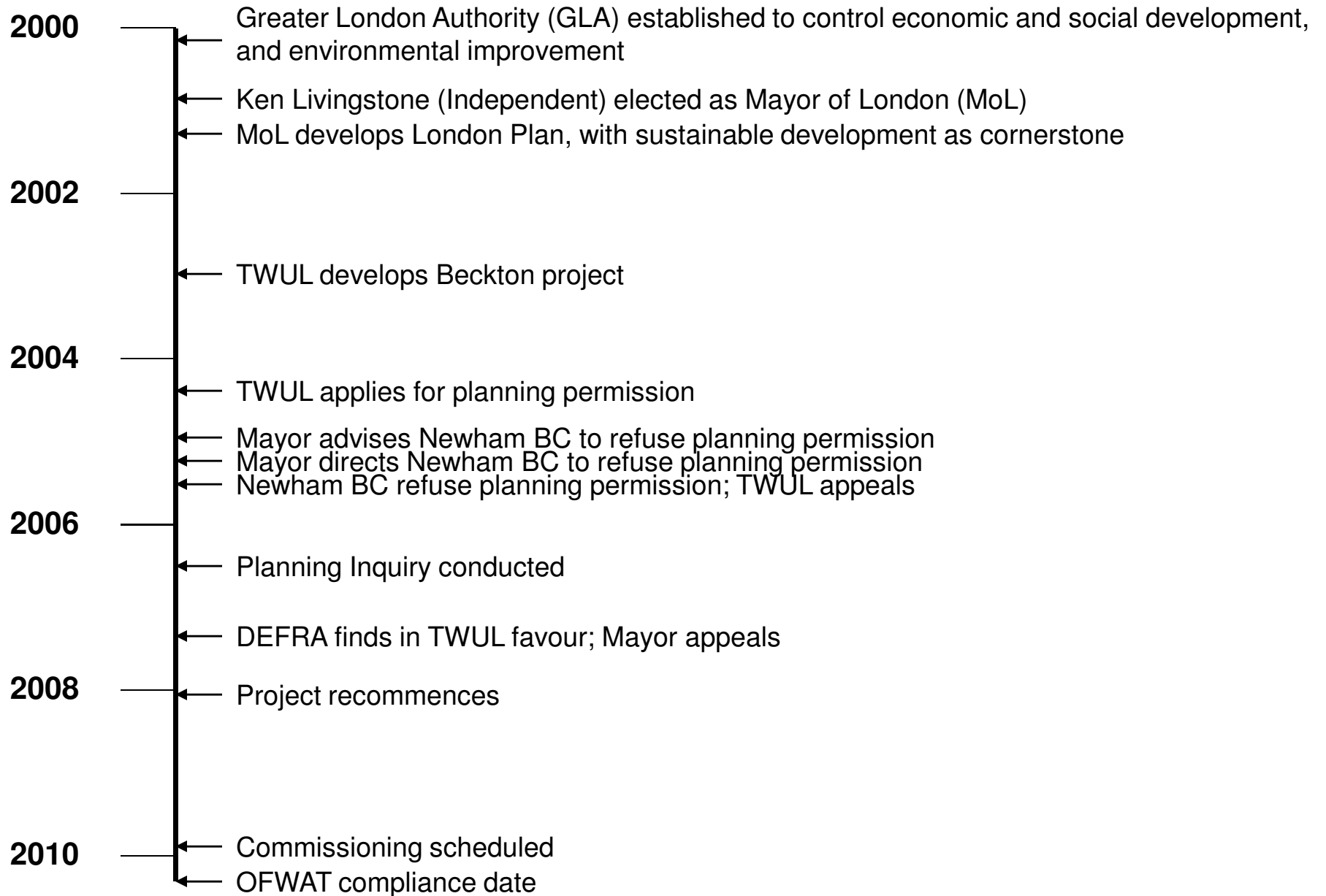
- Issues permit for wastewater discharge to water course, eg River Thames
- responsible for environmental protection, including climate change issues

Mayor of London's Office

- Overall responsibility for economic and social development and environmental improvement in London through Borough Councils
- Responsible for London Plan (15-20 year timeframe) focusing on sustainable development, health, and equal opportunity, and Energy Plan



Timeline –Planning Inquiry



Beckton: Resource Issues

Leakage

25%, significantly > than other UK Water Utilities

Thames water position

- Distribution system comprises old iron pipes; 1/3rd is 150 years old
- Corrosive clays are causing degradation
- Heavy traffic causes stress on mains
- Limited access due to extensive urbanization

Mayor of London's position

- Thames Water has insufficient incentive to spend more on leak repairs
- Thames Water prices rose by 24% and profits by 31% in a 3 year period while consistently missing leakage targets
- Regulator does not enforce action

Beckton: Resource Issues

Wastewater Reuse

Thames water position

- Wastewater reuse is inflexible compared to desalination if based on MBR-RO since bioreactor cannot be turned down during low demand
- Planned for medium term by treatment of CAS plant effluent by MF-RO
- Concern with removal/breakdown of pharmaceutical, agricultural residuals
- Concern with public acceptance

Mayor of London's position

- Energy cost of wastewater reuse would be much lower than desalination
- Thames Water has not developed public acceptance; meanwhile neighbouring Essex and Suffolk have introduced an award winning reuse

scheme

Water has not been energetic/imaginative in developing alternatives



Energy Comparison of Treating Various Water Sources

Brackish – Surface, Florida ground source, and Beckton

Wastewater – Conventional Activated Sludge (CAS)

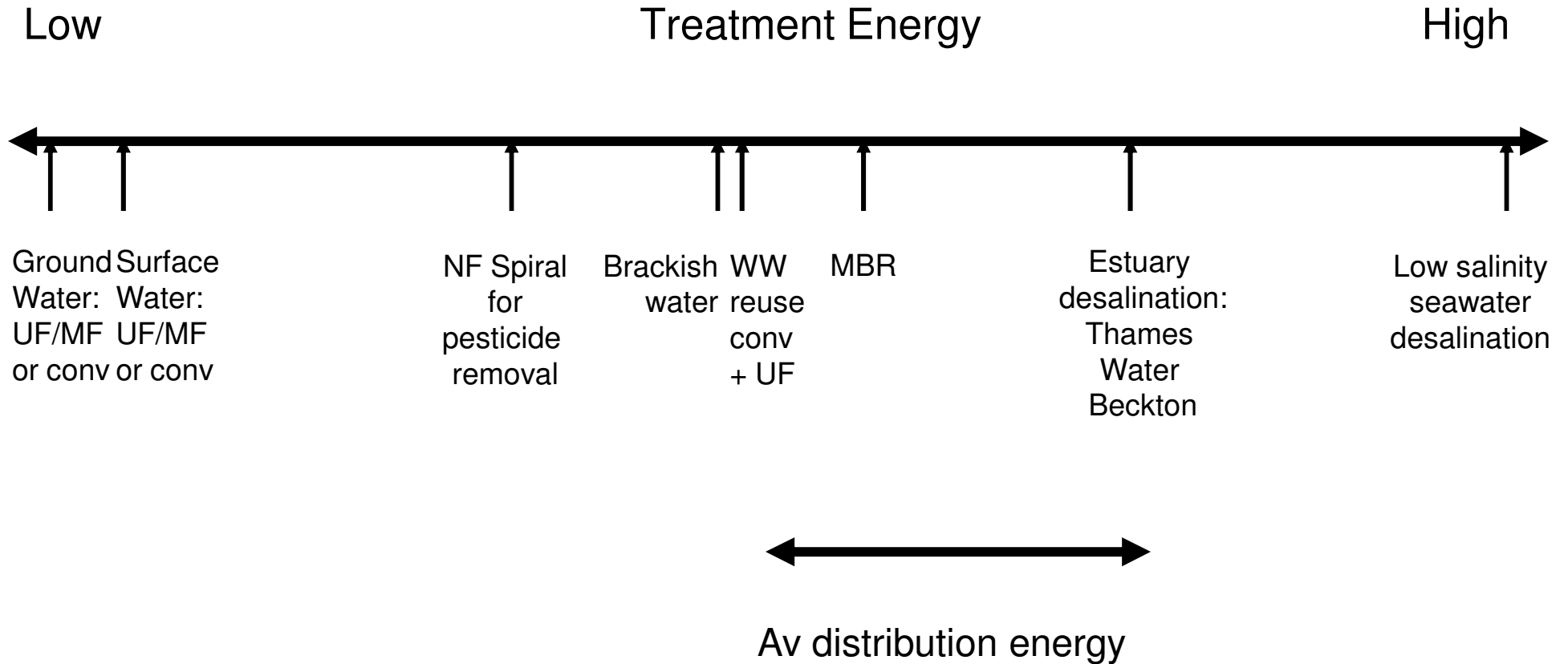
Wastewater – Membrane Bio-reactor (MBR)

Comparison summary including wastewater, surface and seawater sources

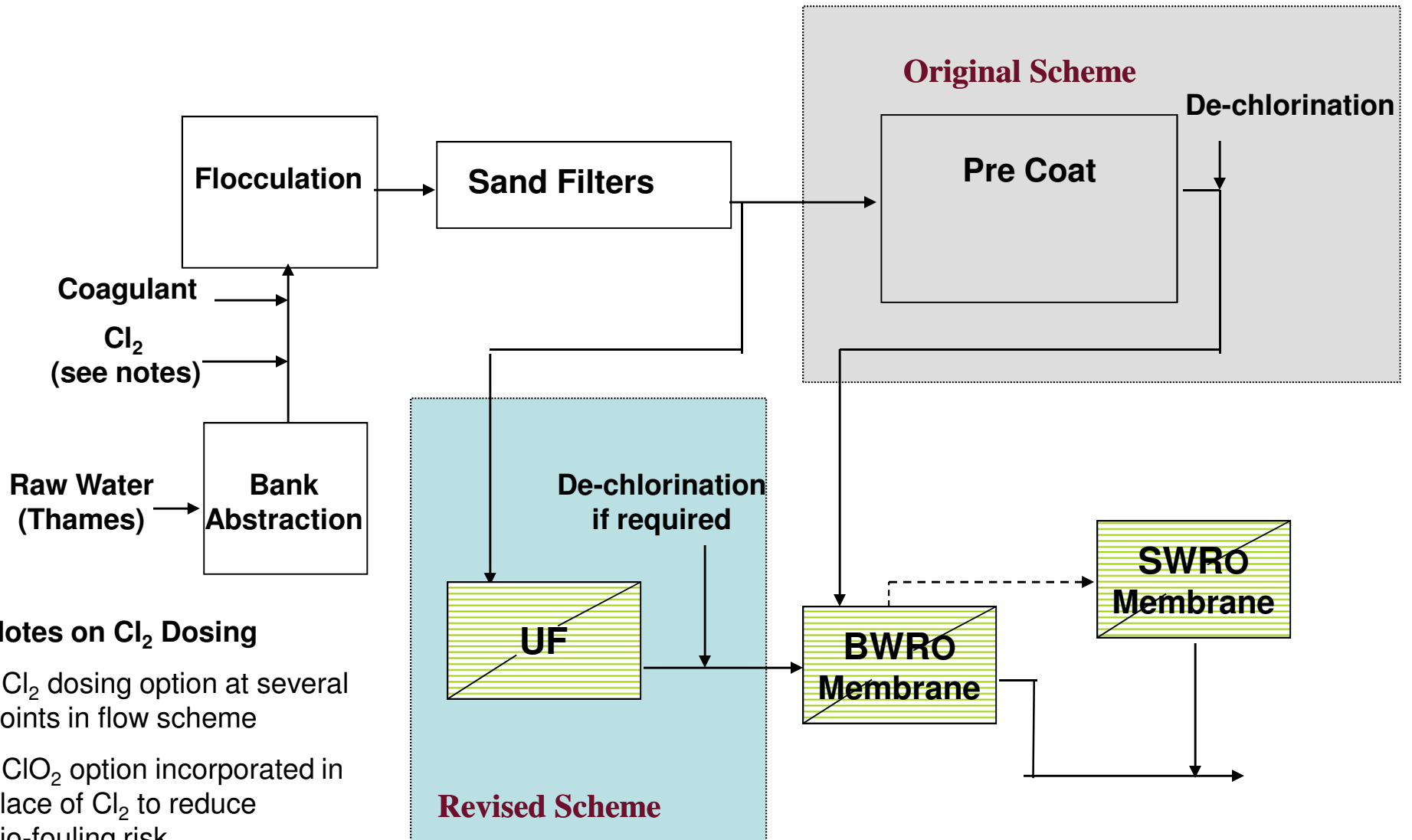
Power Usage – All Water Sources

Feed	Conv Act Sludge	Pre-treatment	RO System	Total Treatment
	kWhr/m ³			
Surface water				0.15 - 0.3
Wastewater	0.3 - 0.6	0.1 - 0.2	0.4 - 0.5	0.8 - 1.0 (1.3)
Wastewater MBR		0.8 - 1.0	0.4 - 0.5	1.2 - 1.5
Brackish (930 - 2200 ppm)		0.1 - 0.3	0.6 - 0.9	0.8 - 1.0
Brackish - Tidal Estuary		0.29	1.38	1.67
Seawater (medium salinity)		0.3 - 1.0	2.0 - 3.0	2.3 - 4.0

Energy Requirements of Treating Different Water Sources



Beckton Desalination Process Flow Scheme



Pre-treatment Selection

- Extensive pilot carried out of pre-coat and several different UF/MF options
- Both schemes provided satisfactory filtrate quality for RO
- Similar cost for pre-coat and UF/MF
- Pre-coat selected due to limited track record in SWRO pre-treatment when decision made in 2004
- 3 year Planning Inquiry delay allowed decision to be subsequently revisited
- Reference and experience position for UF/MF improved
- Concerns over bio-fouling risk for continuous Cl_2 dosing in pre-coat scheme
- UF offered virus barrier and improved integrity, thereby reducing super chlorination requirement
- UF selected due to:
 - good pilot performance
 - high virus rejection
 - simple adaptation of civils plan in main plant layout for Pressure Driven format

Conclusions

- Privatization and foreign ownership of Thames Water provided the basis for the political controversy at Beckton
- The Mayor of London claimed that desalination was unnecessary and unsustainable; the wastewater reuse option should have been developed more vigorously
- A comparison shows that wastewater reuse has lower energy than desalination, but transfer costs are relatively high, making location relative to need a key factor
- At the Planning Inquiry, the Government Inspector found in favour of Thames Water
- Membrane pre-treatment and pre-coat were both successfully piloted, and had similar cost; initially pre-coat selected due to limited references for UF/MF in 2004
- UF system was selected after inquiry due to
 - rapidly developing reference and experience position
 - integrity testable and repairable
 - high virus rejection, eliminating need for super chlorination
 - good pilot performance, and excellent particle barrier with variable feed
 - simple adaptation of civils plan in main plant layout
- ClO_2 to provide an alternative option to Cl_2 , and reduced reliance on oxidation prior to pre-treatment due to use of UF; expected to reduce possibility of bio-fouling