Large scale water resource options for London

Technical Stakeholder Meeting
7 January 2015

Welcome and introduction

Chris Lambert, Thames Water

Agenda

10:00 Welcome and introduction

10:10 Phase 1 – *Objectives and the conclusions from the September stakeholder meeting*

10:20 Options and coarse screening assessment - *Review of the options, and the methodology and output for the coarse screening assessment*

10:50 Fine screening assessment – *Overview of the methodology and presentation and discussion on each qualitative criteria*

Sandwich lunch

13:30 Further investigations

14:30 Next steps

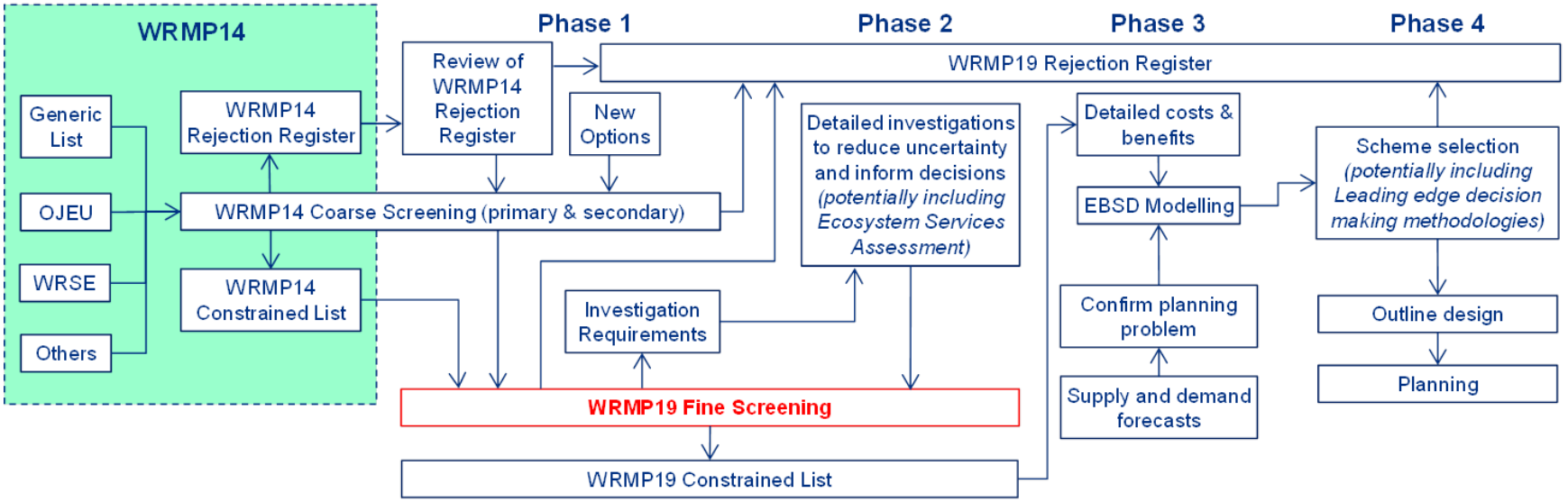
14:40 Q&A

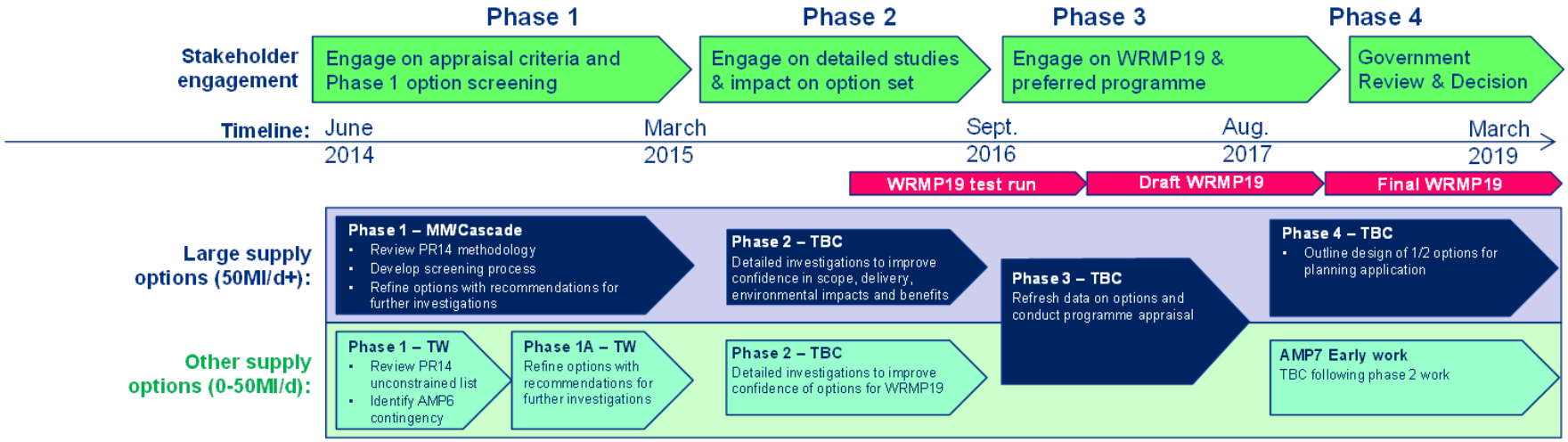
15:00 Close

Phase 1 – Objectives & approach

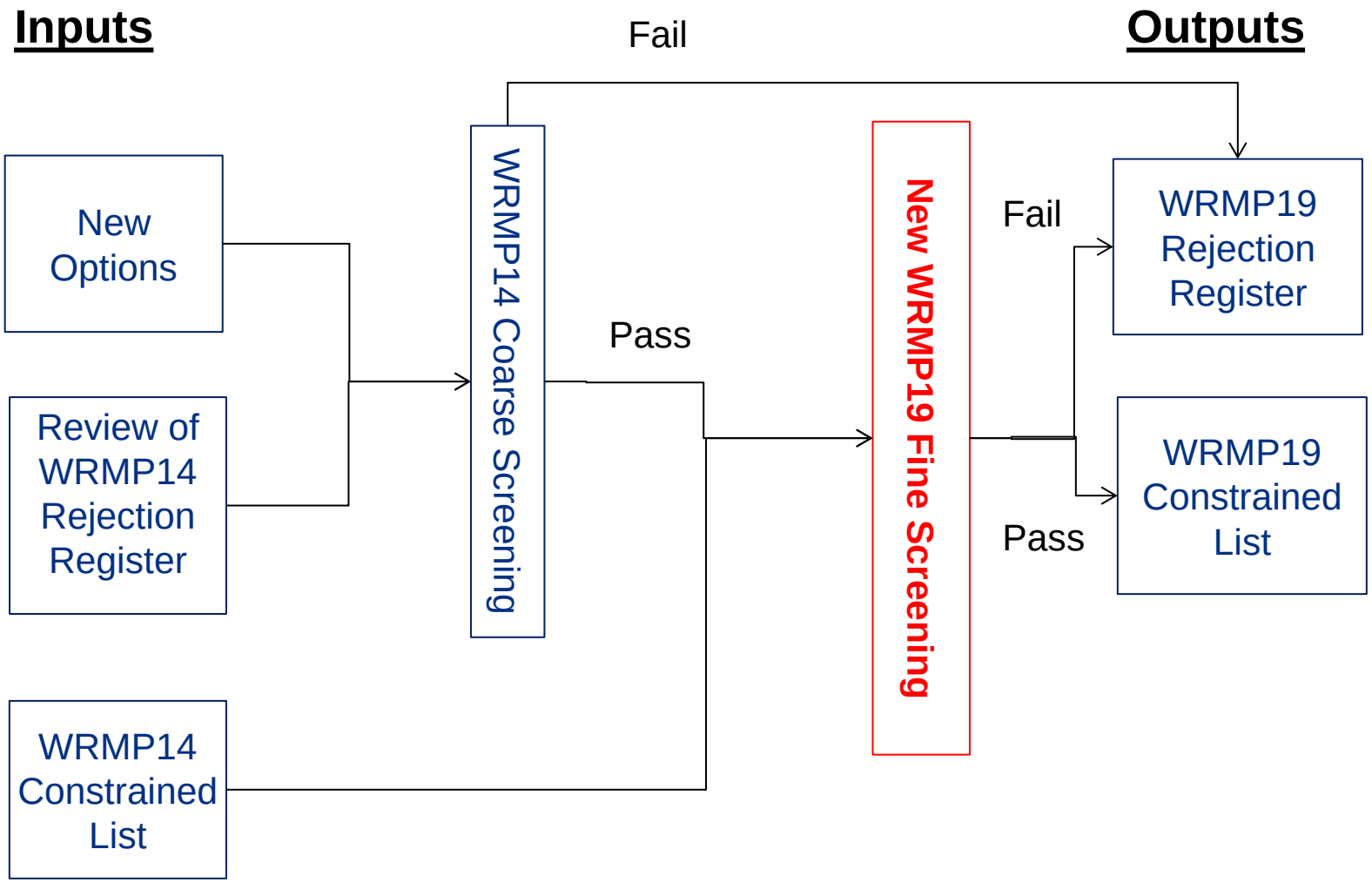
Paul Chadwick, Mott MacDonald

Overview of the appraisal process





Phase 1 process



Phase 1 – Coarse screening assessment

Paul Chadwick, Mott MacDonald

Options identified for further consideration

From review of WRMP14 rejection register

- Redevelopment of existing large scale resources
- Bulk transfers (using canal network)
- Reclaimed water – Mogden wastewater reuse

From third parties

- Bulk transfers (United Utilities & Severn Trent)
- Tankering of water by sea

New options

- Abstraction support using effluent
- Desalination (possible alternatives to existing Estuary South option)
- Direct reuse and greywater reuse

Coarse screening criteria

- Pass/Fail assessment against 14 criteria (see Table 4.1, pp16)
- Criteria as per WRMP14 primary and secondary screening covering:
  - Technical feasibility
  - Excessive cost
  - Planning and environmental constraints
  - Alignment with national policy objectives
  - Adaptability to climate change
  - Lead time and flexibility
  - Resilience

Summary of the coarse screening

Scheme	Key elements	Screening Decision
Reservoirs		
Redevelopment of large scale resources	Deepening of existing reservoirs and raising embankments	TBC
Bulk Transfers		
Grand Union Canal	Elements currently undefined.	TBC
Upper Severn (UU)	UU proposed to provide support to River Severn to facilitate transfer via the Deerhurst pipeline or Cotswold Canals	✔
Middle Severn (SVT)	SVT proposed a transfer from the River Severn to Farmoor Reservoir on the River Thames.	✔
Lower Severn (SVT)	SVT proposed to provide support to River Severn to facilitate transfer via the Deerhurst pipeline or Cotswold Canals	✔
Desalination		
Estuary south + new service res	As for Estuary South desalination plant but with a local service reservoir for blending instead of the transfer tunnel from Crossness to Honor Oak	TBC
Estuary North Desal	Second desalination plant to the north of the estuary.	TBC
Abstraction support using effluent		
Mogden STW - Teddington weir	Improved treatment at Mogden or off site, 300Ml/d transfer to Teddington, outfall. TBC whether any works to the intake would be required.	✔
Beckton STW - Teddington weir	Improved treatment, increase Tideway Tunnel size, pipelines, outfall, maybe intake	✖
Reuse or greywater		
Direct non-potable reuse	Elements currently undefined	TBC
Greywater reuse	Elements currently undefined	TBC
Mogden reuse	RO, pipelines to blending site	TBC
Tankering		
Albion proposal		TBC

Coarse screening – Discussion

Stakeholders comments are invited on:

- *options carried forward to the coarse screening from the review of the WRMP14 rejection register, third party options and identification of new options.*
- *initial coarse screening decisions*

Fine screening assessment

Paul Chadwick, Mott MacDonald
Topsy Rudd, Cascade Consulting
Bill Hume Smith, Mott MacDonald

Fine screening assessment

Purpose:

- To produce a revised constrained list of options
- To identify further studies required in Phase 2

Approach:

- Similar criteria to the coarse screening but extends the simple pass/fail
- Presents results of qualitative and quantitative analysis
- Compares options by type and in bands of similar capacity

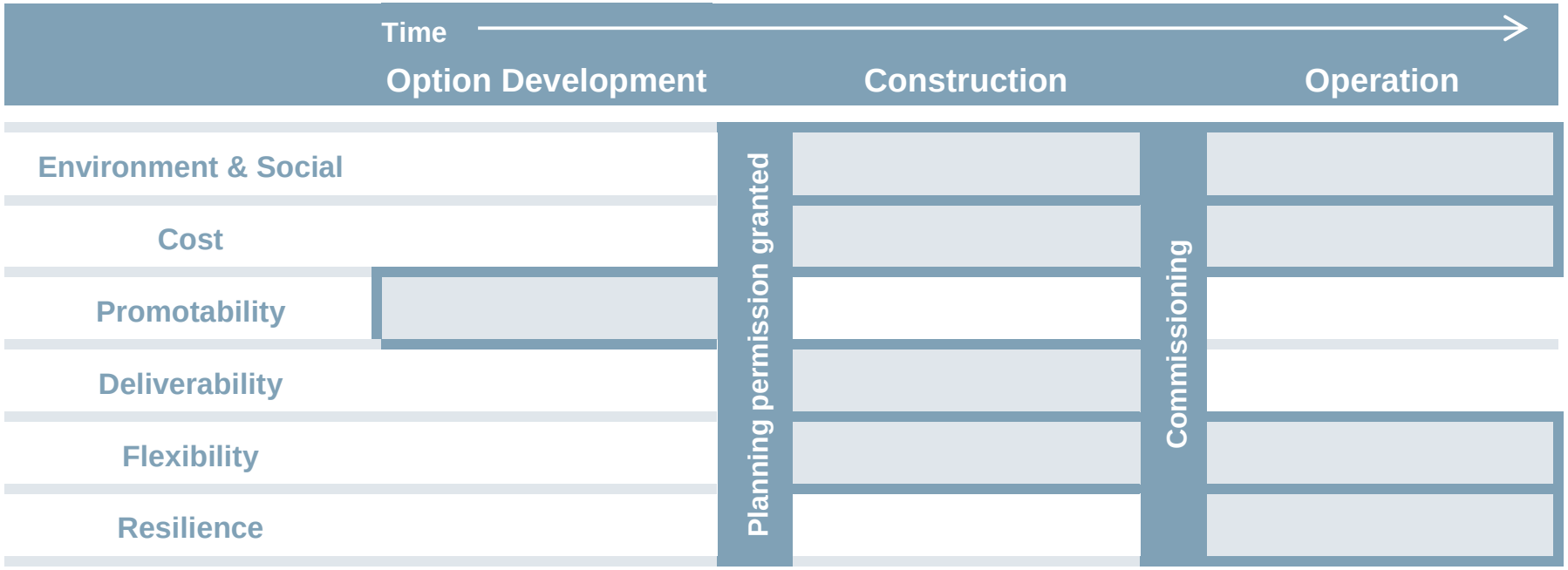
Constrained options by capacity band

Option type	Scheme Yield				
	50-74Mld	75-124Mld	125-174Mld	175-224Mld	>225 Ml/d
Transfer (supported)		Longdon Marsh + Cotswold Canals		Longdon Marsh + Deerhurst pipe	Longdon Marsh + Deerhurst pipe
Transfer (unsupported)	Deerhurst				
Desalination	Estuary South	Estuary South	Estuary South		
New storage (river regulation)	Abingdon Longworth	Abingdon Longworth	Abingdon Chinnor	Abingdon Chinnor	Abingdon
River abstraction		Lower Lee			
Wastewater reuse (MBR/RO)	Deephams Beckton Abbey Mills	Beckton Abbey Mills	Beckton Abbey Mills		

Note: WRMP14 constrained options only. Has yet to be updated for results of coarse screening.

Fine screening dimensions

Screening decisions will be made by looking across all the 6 dimensions.



Fine screening assessment

The assessment identifies potential benefits/opportunities as well as disbenefits/risks for each option

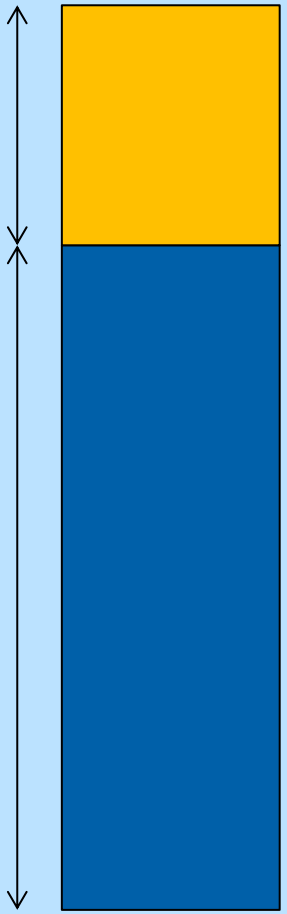
Symbol	Meaning (other)
	Substantial benefit/opportunity
	Material benefit/opportunity
	Neutral
	Material reducible disbenefit/risk
	Material irreducible disbenefit/risk
	Substantial irreducible disbenefit/risk

- Categorisation of option types and use of symbols are intended to allow the strengths and weaknesses of options to be readily identified
- Screening decisions will be evidence based and will be shared with regulators and stakeholders

Cost

Variable operating cost dependent on use

Fixed cost (operation and capital)



- Assessment of the minimum and maximum utilisation for all options to understand the sensitivity of cost (AIC+carbon) to utilisation
- Comparisons of options will be made within capacity band

Stakeholder comments are invited on the proposal to assess the sensitivity of decisions to assumptions on utilisation by assessing cost (AIC+carbon) envelopes ranging from minimum to maximum utilisation.

Environmental & Social - definition

Environmental & Social assessment includes findings from the Strategic Environmental Assessment (SEA) which involved a suite of objectives under eight SEA topic areas including:

- Biodiversity, flora and fauna
- Population and human health
- Material assets and resource use
- Soil, geology and land use
- Air and climate
- Water
- Archaeology and cultural heritage
- Landscape and visual amenity

Topic areas were also informed by other related assessments:

- Habitats Regulations Assessment (HRA)
- Water Framework Directive Assessment

Env. & Social – Example assessment

Extract from Table 5.2, pp23
Wastewater Reuse – Reverse Osmosis

Summary		Rationale			
+ve	-ve	SEA	HRA	WFD	Cumulative effects
◎	◑	Beneficial Effects ◎ • Reuse enables climate change resilience as source not vulnerable to climate change effects. • In the case of Beckton and Abbey Mills, the options make use of a resource that would otherwise be lost to the Thames Tideway. Adverse Effects ◑ • Adverse effects from the use of significant amounts of materials in construction and chemicals for treatment when in operation. • In the case of Abbey Mills, potential adverse effects to cultural heritage and Epping Forest SAC from outline design pipeline route.	○ • No LSE. • In the case of Beckton the pipeline route was designed to avoid impact on Epping Forest SAC. Abbey Mills ◔ • The Abbey Mills option outline pipeline route passes through Epping Forest SAC. Subsequent investigations identified these effects could be mitigated by re-routing the pipeline to avoid the SAC and the potential for LSE. However, pipeline rerouting costs were not included in WRMP14 cost assessment.	○ • Unlikely to adversely affect the status of nearby waterbodies. • In the case of Deephams, there is potential for some benefit to the water quality of nearby waterbodies.	○ • Deephams is mutually exclusive with the Lower Lee abstraction reuse scheme because they effectively use the same water resource. • Potential cumulative construction related effects with other reuse options if constructed at the same time. • In the case of Abbey Mills, potential cumulative construction related effects with Lower Lee abstraction if constructed at the same time.

Overall summary:

◎ **Material benefit/opportunity:** The option has some benefits/opportunities (e.g. several moderate and/or minor beneficial effects identified in SEA).

◑ **Material irreducible disbenefit/risk:** The option has residual disbenefits/risks, either individually or cumulatively, for which further mitigation is unlikely to be feasible or proportionate.

Environmental & Social – Initial findings

Findings from initial assessment of WRMP14 constrained list options:

- all options have some material **negative environmental and social impacts**, although in some cases these may be reducible by changes to scheme design and/or development of additional mitigation
- all options have **positive environmental and social effects** that are assessed as either material or substantial. Substantial environmental and social benefits are associated with the longer term (post construction) phases of the options that involve either creation of a new reservoir or the reopening of the Cotswold Canal

Environmental & Social – Discussion

Stakeholders' comments are invited on:

- *The approach to making the qualitative assessments, including the interpretation of the criteria used for fine screening*
- *The findings of the fine screening of each option type (see Table 5.2, pp23)*

Post its are provided for any further points on the approach and also specific option assessments – please leave your name on the post it so that we can follow up if we need clarification

Promotability - definition

Promotability assessment includes:

- Synergies (e.g. with Water Resources in the South East)
- Customer acceptability (e.g. including Customer Challenge Group)
- Local acceptability (e.g. in relation to planning challenges)
- Regulatory acceptability (e.g. DWI, EA, Ofwat, Natural England & English Heritage)
- Views of other representative groups

Promotability – Example assessment

Extract from Table 5.5, pp31
Wastewater Reuse – Reverse Osmosis

Summary		Rationale				
+ve	-ve	Synergies	Customer acceptability	Local acceptability	Regulatory acceptability	Wider stakeholder acceptability
◎	◑	◎	○	◔	◔	◑
		• Could potentially also indirectly support other water companies in the South East, but with a reduced DO for London.	• Uncertainty around public perception of reuse. Possible customer support. • Any opposition reducible with promotion of RO treatment over NRO. • Opposition to high energy schemes. Reducible with inclusion of renewable energy sources, such as at Thames Gateway.	• Planning permission challenges – land required for IPR site. • Significant impacts of pipeline construction on local residents through heavily urbanised area. • Possible construction restrictions when located within the floodplain.	• Risk of regulatory opposition to any required quality of quantity modifications of STW discharge permits.	• Risk of media campaign associated with perceptions of reuse

Overall summary:

◎ **Material benefit/opportunity:** The option has some benefits/opportunities in terms of promotability.

◑ **Material irreducible disbenefit/risk:** The option has residual disbenefits/risks, either individually or cumulatively, for which further mitigation is unlikely to be feasible or proportionate.

Promotability – Initial findings

All WRMP14 constrained list options have some material issues around promotability, although in some cases these are considered reducible. **Key issues** identified are:

- local acceptability
- Public acceptability of wastewater reuse

Some WRMP14 constrained list option types have **positive** characteristics due to synergies including:

- Potential to provide other water companies with additional resources.
- Synergies with the navigational needs of canal users for options that use the Cotswold Canal.

Promotability – Discussion

Stakeholders' comments are invited on:

- *The approach to making the qualitative assessments, including the interpretation of the criteria used for fine screening*
- *The findings of the fine screening of each option type (see Table 5.5, pp31)*

Post its are provided for any further points on the approach and also specific option assessments – please leave your name on the post it so that we can follow up if we need clarification

Flexibility – definition

Flexibility assessment relates to how flexible an option is to changes in requirements including:

- Lead time - WRMP14 lead times used to inform this assessment
- Phasing - Potential for the scheme to be incrementally built and/or commissioned
- Adaptability - Whether, once built, the option lends itself to being adapted to enhance the resource in a manner that was not originally planned
- Ramp-up - How quickly the system can respond to changes in demand over its operational life

Flexibility – Example assessment

Extract from Table 5.8, pp38
Wastewater Reuse – Reverse Osmosis

Summary		Rationale			
+ ve	-ve	Lead time	Phasing	Adaptability	Ramp-up
○	◑	○	◑	○	◑
		• Lead time of 6 years.	• Treatment options can be implemented incrementally at low cost. • Phasing often less economic for long distance pipelines (pipeline transfer to River Lee reservoirs).	• May be opportunities to adapt treatment works to increase capacity, depending on space constraints and source water (effluent). • Adaption to treatment of water from different sources dependent on raw water quality.	• Estimated ramp-up time of 4 weeks to 8 weeks

Overall summary:

○ **Neutral:** The option does not have significant residual effects.

◑ **Material irreducible disbenefit/risk:** The option has substantial residual disbenefits/risks, either individually or cumulatively, for which further mitigation is unlikely to be feasible or proportionate.

Flexibility – Initial findings

All WRMP14 constrained list options have some **negative** flexibility characteristics.

- Options involving construction of a reservoir are considered to have a material irreducible disbenefit around the lead time
- Most non-reservoir storage options, involve long pipelines, tunnels or canal transfers that represent a substantial proportion of the cost.
- The desalination and re-use options are considered to have a material irreducible disbenefit associated with the ramp-up time

Some WRMP14 constrained list options have **positive** flexibility characteristics:

- Bulk transfers, and to a lesser extent reservoir options, offer material benefits through adaptability as new sources and demand centres may be added.
- Desalination is identified as having a material benefit in terms of lead time.

Flexibility – Discussion

Stakeholders' comments are invited on:

- *The approach to making the qualitative assessments, including the interpretation of the criteria used for fine screening*
- *The findings of the fine screening of each option type (see Table 5.8, pp38)*

Post its are provided for any further points on the approach and also specific option assessments – please leave your name on the post it so that we can follow up if we need clarification

Deliverability - definition

Deliverability assessment relates to assessment of construction, technology and other implementation risks including:

- Constructability - Uncertainties surrounding construction (e.g. unknown technologies, land availability, or contamination risks)
- Operability - Whether there is a track record of successfully using the technology and if it is a dependable and proven technology
- Dependencies - Dependencies on other assets, activities or third parties
- Data confidence - Reliability and uncertainty of design data and Deployable Output assessment methodologies

Deliverability – Example assessment

Extract from Table 5.10, pp44
Wastewater Reuse – Reverse Osmosis

Summary		Rationale			
+ve	-ve	Constructability	Operability	Dependencies	Data confidence
○	◔	◔	◔	○	◔
		• TWUL have limited experience in RO and no experience in IPR construction.	• Some limited experience with RO technology. No experience of IPR. • Treatment stream highly complex and likely to be challenging.	• Dependent upon STW/PS and Coppermills WTW. • No dependencies on third party asset delivery.	• High yield confidence • Slight, reducible uncertainty and risk over understanding of existing effluent water quality.

Overall summary:

○ **Neutral:** The option does not have significant residual effects.

◔ **Material reducible disbenefit/risk:** The option has residual disbenefits/risks but these could potentially be reduced further by additional development of mitigation measures during detailed design or are not considered, either individually or cumulatively, to be critical.

Deliverability – initial findings

All WRMP14 constrained list options have some **negative** deliverability characteristics, with the exception of new reservoir storage. Key issues include:

- Non RO wastewater reuse – Constructability and operability are considered material irreducible risks as TW does not have experience of this technology at large scale, and there are catchment pollution risks
- Lower Lee river abstraction – complexity of the treatment required create constructability and operability material irreducible risks
- Cotswold Canal option – material irreducible risks from dependencies and operability issues as need to balance the needs of the boating community

Positive deliverability characteristics include

- Desalination – high data confidence in source yields

Deliverability – Discussion

Stakeholders' comments are invited on:

- *The approach to making the qualitative assessments, including the interpretation of the criteria used for fine screening*
- *The findings of the fine screening of each option type (see Table 5.10, pp44)*

Post its are provided for any further points on the approach and also specific option assessments – please leave your name on the post it so that we can follow up if we need clarification

Resilience – Definition

The resilience assessment considers the reliability of the option for providing the stated volume and required quality of water in the future, and includes:

- Vulnerability to climate change and severe drought
- Vulnerability to other failure modes
- Contribution to resilience of system to outages
- Predictability of resource availability (important in emergency or drought conditions)
- Vulnerability of option type to regulatory changes

Resilience – Example assessment

Extract from Table 5.12, pp50
Wastewater Reuse – Reverse Osmosis

Summary		Rationale			
+ve	-ve	Vulnerability of option type to climate change & severe drought	Vulnerability of option type to other 'failure modes'	Net contribution to system outage resilience and future resource predictability?	Vulnerability of option type to regulatory changes
○	◑	◔ • Yield highly dependent upon effluent returns. As reuse will be a small proportion of the effluent volume then effluent volumes should be drought resilient (except possibly in Level 4 drought), but there may be issues with availability of water in reservoirs for blending.	◑ • Option subject to high power costs so vulnerable to OPEX increases as a result of commodity prices. Potentially reducible, if renewable energy opportunities maximised. • Highly vulnerable to catchment pollution and changes in effluent quality. • High dependency on chemical supply chain. • Complex treatment processes increases vulnerability to failure. • Vulnerability to coastal flooding will require adequate flood protection (depending on location).	Outage ◔ • Outage at Coppermills WTW would cause outage for reuse and existing Lee valley resources Predictability ○ • Availability of water from reuse options generally predictable although reliant on effluent - risk that wastewater catchment pollution could reduce reliability.	◔ • Treatment options would be more likely to be affected by any changes to water quality regulations.

Overall summary:

◎ **Material benefit/opportunity:** The option has some material benefits/opportunities in terms of resilience Includes material benefits to resilience of water resources in one or more WRZs.

◑ **Material irreducible disbenefit/risk:** The option has residual disbenefits/risks, either individually or cumulatively, for which further mitigation is unlikely to be feasible or proportionate.

Resilience – Initial findings (1)

- All WRMP14 constrained list options have some **negative** resilience characteristics
- Options including desalination and reservoirs also have **positive** characteristics

Severe Drought:

- All options reliant on surface water sources are vulnerable to severe drought worse than the historical record
- For options with storage:
  - the risk is partially mitigable by increasing storage
  - There are potential benefits under wetter winter + drier summer climate change scenarios
- Unsupported transfers perform worst for drought resilience.
- Wastewater reuse is assessed to be materially vulnerable - need for blending water and concern over performance in extreme drought
- Desalination provides substantial benefit - not reliant on natural hydrology

Resilience – Initial findings (2)

Vulnerability to other failure modes:

- Most option types materially vulnerable to other failure modes
- Transfers including pipelines less vulnerable than those using canals
- New reservoir options least vulnerable

Predictability:

- Desalination most predictable in a drought…
- …followed by reservoir storage options
- Unsupported transfers least predictable in a drought

Outage resilience:

- Reservoir storage increases resilience to outage
- Reuse using Coppermills increases outage risk
- Unsupported transfers performed worst

Regulatory change:

- All options were assessed as vulnerable
- This risk was considered reducible

Discussion

Stakeholders' comments are invited on:

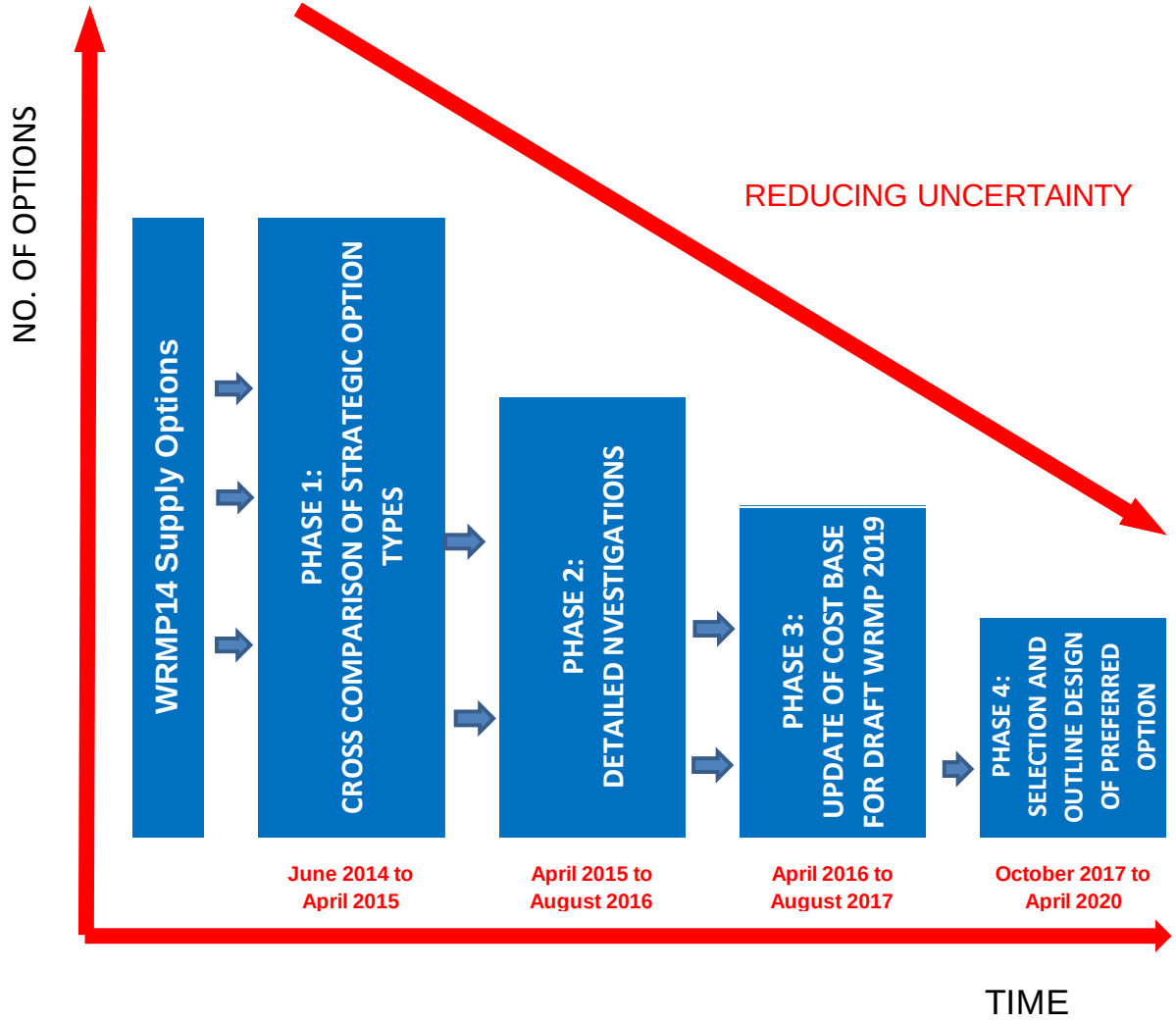
- *The approach to making the qualitative assessments, including the interpretation of the criteria used for fine screening*
- *The findings of the fine screening of each option type (see Table 5.12, pp50)*

Post its are provided for any further points on the approach and also specific option assessments – please leave your name on the post it so that we can follow up if we need clarification

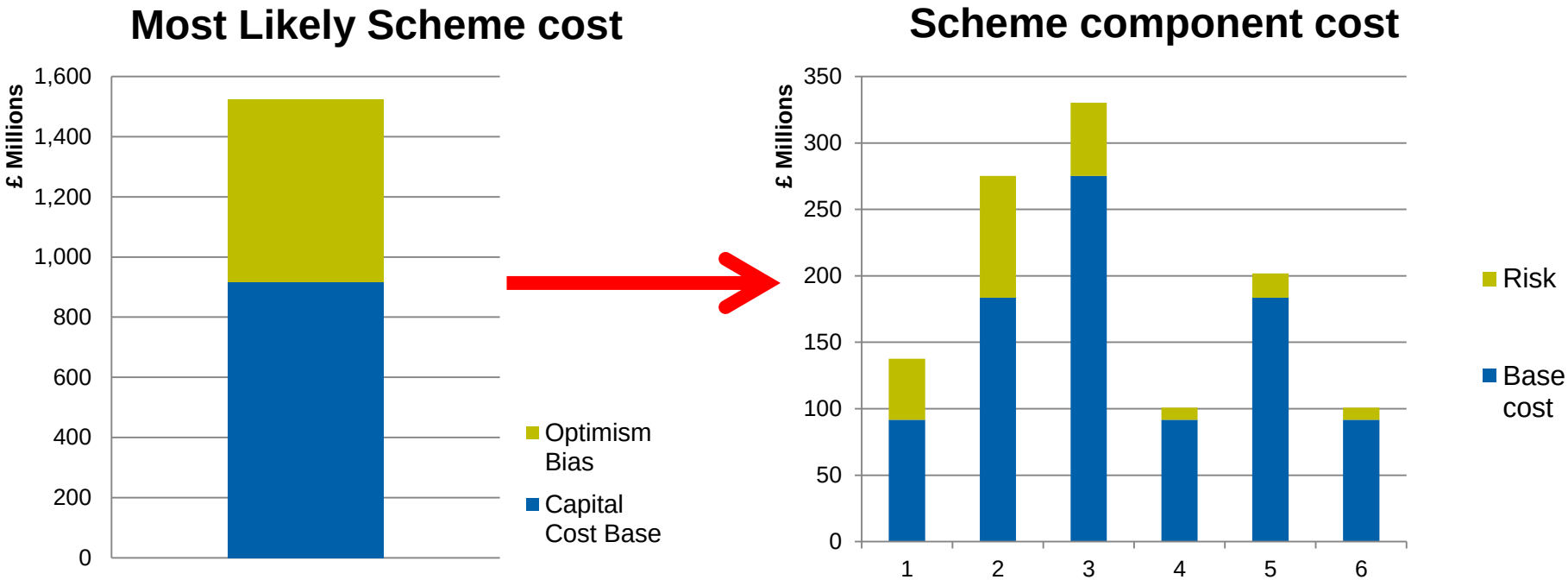
Further Investigations

Paul Chadwick, Mott MacDonald

The purpose of this phase of work is to refine the number of options to focus on those that are most feasible, to understand gaps in our knowledge on these options and instigate work to increase our knowledge and reduce the risks associated with them.



Understanding scheme costs



- Different elements of scheme have different risk
- By understanding where the largest uncertainties are allows prioritisation of investigations

Prioritisation of Further Investigations

Primary investigations

These will be undertaken where the results could influence the decision on the preferred option. That is when:

- The option is not currently preferred (e.g. transfers, desalination, reservoirs) and the investigation could potentially improve the position of the option
- The option is preferred (currently wastewater reuse) and the investigations could either discredit or improve the position of the option

Secondary investigations

These will be undertaken where: primary investigations have improved the position of the option and show that these would add value.

Stakeholders comments are invited on:

- *Whether stakeholders agree with the proposed approach to prioritisation of questions for investigation.*
- *Whether there are any other key investigations that should be considered*

Further Investigations

General

Primary

- Clearly set out the **constraints and uncertainties** around existing supplies
- Update **forecasting of demand and utilisation**
- Develop bottom up **assessment of risks and costs**
- **Develop scenarios** for testing robustness of screening decisions (including on water demand and sustainability reductions)
- Review **lead times** for different option types
- Development of WRMP19 **rejection register** building on the WRMP14 register

Secondary

Further Investigations

Raw water transfers

Primary

- Are there **other opportunities** using the canal network to transfer water?
- Are there any **water quality or ecological issues** that would prevent a transfer?
- What is the **Deployable Output** for the supported and unsupported options?
- How significant are the benefits that a transfer could deliver in terms of unlocking **wider water resource opportunities** for future development and **wider benefits** for communities along the route?

Secondary

- What is the **feasible capacity limit** on the Cotswold Canal transfer?
- **Refine engineering solution and costs** for Cotswold canal transfer
- Review **site selection and benefits** of supporting transfer in Severn catchment compared with Upper Thames reservoir.
- What are the **environmental impacts** of Vyrnwy discharge and potential **mitigant costs**?
- Understanding **enabling works, risks and costs** required
- What are the **impacts on other abstractors** of diverting effluent from Minworth STW?
- What are the **environmental impacts from diverting Minworth effluent**?

Further Investigations

Desalination

Primary

- Review of **potential options/sites** for blending and for desal plants.

Secondary

Reservoirs

Primary

- Review of reservoir **costing estimates**.

Secondary

- **Environmental impacts** of a managed flow regime on the River Thames.

River abstraction (Lower Lee)

Primary

Secondary

- What would be the **environmental impact** of removing flows from Lower Lee / tributaries
- What **treatment processes** would be required and are drinking water quality risks acceptable?.

Further Investigations

Wastewater reuse

Primary

- What will be the **public perception** of Wastewater Reuse?
- Are the **trade effluent catchment risks** acceptable for the reuse options?
- Does MBR provide a **satisfactory alternative to RO**?

Secondary

Abstraction support through effluent transfer

Primary

- Would Mogden effluent support to Teddington flows be **acceptable to EA and PLA**?

Secondary

Further Investigations

Redevelopment of existing resources

Primary

- Would increasing reservoir capacity in London increase **DO**? (would need to link to LTCD discussions with EA)
- What **capacity** could be created and what would it **cost**?

Secondary

Greywater recycling and direct non-potable reuse

Primary

- **Literature review** of current state of technology?

Secondary

Next Steps

- Review the impact of different utilisation assumptions on AICs and categorise options on the basis of cost
- Develop costs for new options that pass the coarse screening and assess the options using qualitative criteria
- Undertake assessment by capacity band
- Conduct preliminary fine screening and consult stakeholders
- Refine prioritised list of questions for investigation in the light of screening and stakeholder feedback

Timeline

Date	Activity
Post 7th January	Incorporate feedback and discussion points
20th January	Water Resources Forum – Summary of approach, discuss findings and set out the next steps
January & February	Progress technical work
March	Draft report and technical stakeholder meeting to discuss finalised screening assessment and updated Phase 2 investigations
April	Finalised report

Open discussion


Thames
Water