Water Contingency Planning Task Force

Appendix III

Detailed description of options evaluated (including rationale, cost, yield, timing, and implementation feasibility)

December 2009

Overview of key options: Conserve

Conserve

- **Conservation efficiency programs (eg, fixture retrofits)**
- **Reuse**
- **Pricing**
- **Loss Reduction**

Descriptions of measures evaluated in each bundle (I)

Bundles	Measures	Method of Implementation	Description
1 Residential retrofits	1a Toilet retrofits	Current program (baseline)	Offer $50 rebate per installation of low-flow toilets in homes
		Increased incentive rebate program	Offer $25 additional on top of current rebate ($75 rebate per installation of low-flow toilets in homes)
		Direct install program	Utility provider to contract with plumbing contractors to replace toilets in all homes under jurisdiction free of charge to customer
		Retrofit on resale	Regulation requiring replacement of toilets prior to resale of property
		Building plumbing code requirement	Codes requiring all homes to install low-flow toilets by deadline
	1b Showerheads and faucets	Current give-away program (baseline)	Offer free showerheads and faucet aerators to customers upon request
		Increased incentive rebate program	Continue distribution of kits; customers get $20 credit on first month's bill
		Direct install program	Utility provider to replace toilets in all homes free of charge, and customers receive $20 credit on first month's bill
		Retrofit on resale	Regulation requiring replacement of toilets prior to resale of property
		Updated plumbing codes	Codes requiring all homes to switch to low-flow toilets by deadline
	1c Residential clothes washers	No current program (baseline)	No current program
		Washer rebate program	Offer $100 rebate for replacement of efficient clothes washer in homes
		Washer program with increased rebate	Offer $200 rebate for replacement of efficient clothes washer in homes
2 Sub-metering and water audits	2a Multi-family metering	Current ordinance program (baseline)	Local ordinance that require all new multi-family buildings to include sub-meters that bill for volume of water use
		Retrofit 50% of existing non-submetered complexes	Ordinance to require retrofitting of submeters in 50% of existing multi-family complexes that have not yet been retrofitted
		Retrofit 100% of existing non-submetered complexes	Ordinance to require retrofitting of submeters in 100% of existing multi-family complexes that have not yet been retrofitted

Descriptions of measures evaluated in each bundle (II)

Bundles	Measures	Method of Implementation	Description
3 Commercial retrofits and process improve-ments	3a Spray rinse valves	Education program (baseline)	Education program to encourage restaurant/commercial kitchen to use spray rinse valves
		Valve rebate program	Offer $50 rebate for replacement of spray rinse valves in restaurants/commercial kitchens
		Direct install program	Utility provider to install 1.6 gpm spray nozzles in restaurants/commercial kitchens
	3b Cooling towers	No current program (baseline)	No current program
		Cooling tower rebate program	Provide rebate program to commercial users to replace cooling towers, which can increase cycles of concentration from 2 to 5 and can save ~40% of water
		Cooling tower standards	Required ordinance to increase water efficiency of cooling towers, and increase cycles of concentration from 2 to 5, which can save ~40% of water
4 Outdoor water usage reduction	4a Watering restrictions	3 days/week schedule (baseline)	Ordinance that allows watering only 3 days per week
		No daytime watering	Watering ordinance that bans daytime watering
		1 day/week watering schedule	Watering ordinance that allows watering only 1 day per week
	4b Rain sensor irrigation	Current state law (baseline)	State law requires rain sensor shut-off switches on all new irrigation systems
		Retrofit 25% of existing systems without rain sensors	Ordinance to require retrofitting of rain sensor shut-off switches on 25% of existing irrigation systems that do not yet have rain sensors
		Retrofit 50% of existing systems without rain sensors	Ordinance to require retrofitting of rain sensor shut-off switches on 50% of existing irrigation systems that do not yet have rain sensors

Efficiency measures considered (I)

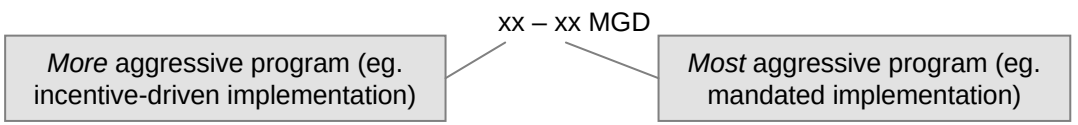
	Measures	Method of Implementation	Rationale	Key Challenges	Timing
1a	Toilet retrofits	Increased incentive rebate program	• Provide consumer with choice to participate in program	• Ensuring compliance with program and whether rebate increase will achieve anticipated increase in participation	3 year program, 100% completion by 2012
		Direct install program	• Optimize penetration in market	• Added enforcement cost to utility to ensure compliance with program • Utility liability for direct installs	
		Retrofit on resale	• Expedite adoption rate via resale market and optimize penetration	• Objection from home owners needing to retrofit homes prior to sale	
1b	Showerheads and faucets	Increased incentive rebate program	• Provide consumer with choice to participate in program	• Ensuring compliance with program and whether rebate increase will achieve anticipated increase in participation	3 year program, 100% completion by 2012
		Direct install program	• Optimize penetration in market	• Added enforcement cost to utility to ensure compliance with program • Utility liability for direct installs	
1c	Residential clothes washers	Washer rebate program	• Provide consumer with incentive to participate in program	• Extremely difficult to get participation • Added rebate cost to utility to provide increased incentive • Ensuring compliance with program and whether rebate increase will achieve anticipated increase in participation	10 year program, ~30% completion by 2012
		Washer program with increased rebate	• Increase adoption rate and penetration in market		
2a	Multi-family metering	Retrofit 50% of existing non-submetered complexes	• Retrofit existing homes in addition to new development to capture major savings	• Ensuring compliance with program and whether rebate increase will achieve anticipated increase in participation	3 year program, 100% completion by 2012
		Retrofit 100% of existing non-submetered complexes	• Optimize penetration in market	• Objection from apartment complexes, building owners, and other stakeholders	

Efficiency measures considered (II)

	Measures	Method of Implementation	Rationale	Key Challenges	Timing
3a	Spray rinse valves	Valve rebate program	• Provide consumer with choice to participate in program	• Ensuring compliance with program	3 year program, 100% completion by 2012
		Direct install program	• Optimize penetration in market • Improve business processes in long-term	• Added enforcement cost to utility to ensure compliance with program • Utility liability for direct installs	
3b	Cooling towers	Cooling tower rebate program	• Provide consumer with choice to participate in rebate program	• Added enforcement cost to utility to ensure compliance with program • Objection from commercial community	3 year program, 100% completion by 2012
		Cooling tower standards	• Optimize penetration in market • Improve business processes in long-term		
4a	Watering restrictions	No daytime watering 1 day/week schedule	• Reduce discretionary outdoor water usage	• Ensuring compliance with program • Added enforcement cost to utility to ensure compliance with program • Compromise on beautification of greenspace	3 year program, 100% completion by 2012
4b	Rain sensor irrigation	Retrofit 25% of existing systems without rain sensors	• Retrofit existing irrigation systems in addition to new irrigation systems to capture more savings	• Ensuring compliance with program • Added enforcement cost to utility to ensure compliance with program	3 year program, 100% completion by 2012
		Retrofit 50% of existing systems without rain sensors	• Increase penetration in market		

Conservation efficiency programs offer attractive cost efficiency levels

	Bundles	Measures evaluated	Incremental yield in 2012 (MGD)	Incremental yield in 2035 (MGD)	Average cost efficiency ($/MG)
1	**Residential retrofits**	Toilet retrofit Showerheads and faucets Clothes washers	5-28	3-27	$350-$400 $250-$350 $1000-$1100
2	**Sub-metering and water audits**	Multi-family sub-metering	2-3	2-3	$160 - $170
3	**Commercial retrofits and process improvements**	Spray rinse valves Cooling tower rebate/standards	3-8	3-7	$100 - $200
4	**Outdoor water usage reduction**	Watering restrictions Rain sensor controllers	10-23	10-27	$10 $50-$70
	Total:		**20 – 62 MGD**	**18 – 65 MGD**	



Key question becomes degree of mandatory measures (which increase yield) versus incentive-driven approach

Source: Technical Advisory Panel analysis

Cost/benefit estimates of water efficiency programs

Incremental water savings to programs in current District Plan

	Measure	Method of Implementation	Penetration (%)	Yield in 2035 (MGD)	Yield in 2012 (MGD)	Total cost[2] ($M)	Avg unit cost[1] ($/MG)	Timing
1a	Toilet retrofits	Current rebate program (baseline)	10%	–	–	–	–	3 year implementation program
		Increased incentive rebate program	20%	1.6	2.6	$8.5	~ $400	
		Direct install program	100%	14.6	15.6	$82.3	~ $350	
1b	Showerheads and faucets	Current give-away program (baseline)	15%	–	–	–	–	3 year implementation program
		Increased incentive rebate program	25%	1.2	2.5	$3.7	~ $350	
		Direct install program	100%	10.0	11.3	$40.5	~ $250	
1c	Residential clothes washers	No current program (baseline)	0%	–	–	–	–	3 year implementation program
		Washer rebate program	5%	0.6	0.2	$12.4	~ $1100	
		Increased washer rebates	15%	1.9	0.6	$34.2	~ $1000	
2a	Multi-family metering	Current ordinance program (baseline)	0%	–	–	–	–	3 year implementation program
		Retrofit 50% existing homes	50%	1.7	1.7	$5.1	~ $160	
		Retrofit 100% existing homes	100%	3.3	3.3	$10.2	~ $170	

1. Based upon 50 years of lifetime yield for all measures, yield by 2012 2. Total cost in 2010 dollars
Source: Technical Advisory Panel analysis

Cost/benefit estimates of water efficiency programs

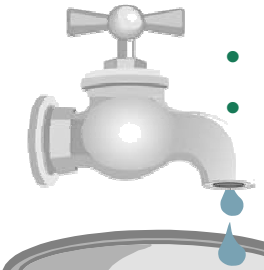
Incremental water savings to programs in current District Plan

	Measure	Method of Implementation	Penetration (%)	Yield in 2035 (MGD)	Yield in 2012 (MGD)	Total cost[2] ($M)	Avg unit Cost ($/MG)	Timing
3a	Spray rinse valves	Current education program (baseline)	10%	–	–	–	–	3 year implementation program
		Rebate program	25%	0.3	0.7	$0.4	~ $120	
		Direct install program	100%	1.8	2.2	$3.0	~ $110	
3b	Cooling towers	No current program (baseline)	0%	–	–	–	–	3 year implementation program
		Cooling tower audits	25%	2.7	2.7	$8.4	~ $170	
		Cooling tower standards	50%	5.4	5.4	$16.8	~ $170	
4a	Water restrictions	Current 3 days/week schedule (baseline)	0%	–	–	–	–	3 year implementation program
		No daytime watering	5%	7.2	4.9	$1.5	~ $10	
		1 day/week schedule	15%	21.5	14.6	$3.0	~ $10	
4b	Rain sensor irrigation	Current state law (baseline)	0%	–	–	–	–	3 year implementation program
		Retrofit 25% existing irrigation systems	25%	3.0	5.2	$5.1	~ $50	
		Retrofit 50% existing irrigation systems	50%	5.9	8.1	$10.3	~ $70	

1. Based upon 50 years of lifetime yield for all measures, yield by 2012 2. Total cost in 2010 dollars
Source: Technical Advisory Panel analysis

Potential savings from retrofit to 1.28 gallons per flush (gpf) high-efficiency toilet

Total Demand = 680 MGD



- 53% of total is residential use
- 16% of residential is toilet use

Total toilet usage: 58 MGD

% toilet usage addressable

40%

40% of housing stock still contains 3.5 or 5 gpf toilets

Addressable toilet usage: 23 MGD

% water reduction

70%

70% reduction in water usage by switching to low-flow toilets

Total potential savings: 16 MGD

% adoption of program

90%

90% adoption of program means replacement of ~ 3.5 million toilets. Back in the 1990s, NYC replaced ~1.3 million toilets in 3 years

Estimated potential savings: 15 MGD

Source: Technical advisory panel analysis

Toilet retrofits (I)

Method of implementation: increased incentive rebate program

Current plan in Metro District: current implementation is 2% per year for 5 years at $50 rebate,

Yield

Assumption	Value	Logic
Usage in consumption category	58 MGD	680MGD*53%(residential)*80%(indoor)*20%(toilets)
% addressable of total usage	40%	40% of housing stock contain 5 or 3.5 gpf toilets
% savings from conservation program	70%	Switching to 1.28 gpf toilets provides ~60% reduction
% targeted (incremental adoption rate)	10%	10% increase in adoption rate from current program
= Water savings (MGD)	**1.6 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	$7.7	Rebate of $75/toilet, increase of $25 (50% increase in rebate amount)
Utility	Equipm't/installation	-	No equipment and installation cost for utility, born by customer
Utility	Marketing /admin	$0.9	12% admin cost of total cost to utility (8% + 4% contingency)
Utility	Enforcement	-	No enforcement cost
	Cost to customer	*$4.7*	Cost to customer to install toilets
	Total cost to utility:	$8.5	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Toilet retrofits (II)

Method of implementation: direct install program

Current plan in Metro District: current implementation is 2% per year for 5 years at $50 rebate,

Yield

Assumption	Value	Logic
Usage in consumption category	58 MGD	680MGD*53%(residential)*80%(indoor)*20%(toilets)
% addressable of total usage	40%	40% of housing stock contain 5 or 3.5 gpf toilets
% savings from conservation program	70%	Switching to 1.28 gpf toilets provides ~60% reduction
% targeted (incremental adoption rate)	90%	90% increase in adoption rate from current program
= Water savings (MGD)	**14.6MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No rebate cost provided
	Equipm't/installation	$65.9	Installation cost at $225/install for utility (additional cost of $175/toilet)
	Marketing /admin	$16.5	25% admin cost of total utility cost (20% + 5% contingency)
	Enforcement	-	No enforcement cost
	Cost to customer	-	No customer cost, utility carries all cost of program
	Total cost to utility:	$82.3	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Showerheads and faucets (I)

Method of implementation: increased incentive rebate program

Current plan in Metro District: voluntary program at current implementation level of 15% over a 10-year program period

Yield

Assumption	Value	Logic
Usage in consumption category	118 MGD	680MGD*53%(residential)*80%(indoor)*41%(showerhead/faucet)
% addressable of total usage	40%	40% of housing stock contain 2 gpm showerhead/faucets
% savings from conservation program	25%	Switching to 1.5 gpm retrofits provides ~25% reduction
% targeted (incremental adoption rate)	10%	10% increase in adoption rate from current program
= Water savings (MGD)	**1.2 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	$2.2	Cost of $20 credit on first month's bill per account
	Equipm't/installation	-	No equipment or installation cost for utility, born by customer
	Marketing /admin	$1.5	40% admin cost of total utility cost (25%+15% contingency)
	Enforcement	-	No enforcement cost
	Cost to customer	*$2.0*	Cost to customer to retrofit showerheads and faucets
	Total cost to utility:	$3.7	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Showerheads and faucets (II)

Method of implementation: direct install program

Current plan in Metro District: voluntary program at current implementation level of 15% over a 10-year program period

Yield

Assumption	Value	Logic
Usage in consumption category	118 MGD	680MGD*53%(residential)*80%(indoor)*41%(showerhead/faucet)
% addressable of total usage	40%	40% of housing stock contain 2 gpm showerhead/faucets
% savings from conservation program	25%	Switching to 1.5 gpm retrofits provides ~25% reduction
% targeted (incremental adoption rate)	85%	85% increase in adoption rate from current program
= Water savings (MGD)	**10 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No rebate cost provided
	Equipm't/installation	$24.7	Installation at $45/install for utility, plus $20 credit on customer first month bill
	Marketing /admin	$15.8	50% admin cost of total utility cost
	Enforcement	-	No enforcement cost
	Cost to customer	-	No customer cost, utility carries all cost of program
Total cost to utility:		$40.5	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Residential clothes washers (I)

Method of implementation: washer rebate program

Current plan in Metro District: no current program

Yield

Assumption	Value	Logic
Usage in consumption category	52 MGD	680MGD*53%(residential)*80%(indoor)*18%(laundry)
% addressable of total usage	60%	60% of housing stock contains high usage washers
% savings from conservation program	40%	Switching to efficient washers provides ~40% reduction
% targeted (incremental adoption rate)	5%	5% increase in adoption rate from current program
= Water savings (MGD)	**0.6 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	$7.4	Cost of $100 per rebate
	Equipm't/installation	-	No equipment or installation cost for utility, born by customer
	Marketing /admin	$5.0	40% admin cost of total utility cost (25% + 15% contingency)
	Enforcement	-	No enforcement cost
	Cost to customer	*$37.2*	Total cost of washer at $300 each, additional cost to customer = $200 each
Total cost to utility:		$12.4	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Residential clothes washers (II)

Method of implementation: increased washer rebate program

Current plan in Metro District: no current program

Yield

Assumption	Value	Logic
Usage in consumption category	52 MGD	680MGD*53%(residential)*80%(indoor)*18%(laundry)
% addressable of total usage	60%	60% of housing stock contains high usage washers
% savings from conservation program	40%	Switching to efficient washers provides ~40% reduction
% targeted (incremental adoption rate)	15%	15% increase in adoption rate from current program
= Water savings (MGD)	**1.9 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	$20.5	Cost of $200 per rebate
	Equipm't/installation	-	No equipment or installation cost for utility, born by customer
	Marketing /admin	$13.7	40% admin cost of total utility cost (25% + 15% contingency)
	Enforcement	-	No enforcement cost
	Cost to customer	*$40.9*	Total cost of washer at $300 each, additional cost to customer = $100 each
Total cost to utility:		$34.2	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Multi-family sub-metering (I)

Method of implementation: incentive targeting retrofit 50% of existing non-submetered buildings

Current plan in Metro District: current program is local ordinance to install sub-meters in all new multi-family buildings

Yield

Assumption	Value	Logic
Usage in consumption category	88 MGD	680MGD*13%(multi-family)
% addressable of total usage	25%	25% of buildings not sub-metered
% savings from conservation program	15%	Switching to submetering provides ~15% reduction
% targeted (incremental adoption rate)	50%	50% increase in adoption rate from current program
= Water savings (MGD)	**1.7 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No cost of rebate
Utility	Equipm't/installation	$4.1	Retrofit cost of $50,000 per complex (with replacement every 15 years)
Utility	Marketing /admin	$1.0	20% admin cost of total utility cost (15% + 5% contingency)
Utility	Enforcement	-	No enforcement cost
	Cost to customer	*$0.2*	Customer cost of $2,500 per complex
	Total cost to utility:	$5.1	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Multi-family sub-metering (II)

Method of implementation: mandate to retrofit100% of existing non-submetered buildings

Current plan in Metro District: current program is local ordinance to install sub-meters in all new multi-family buildings

Yield

Assumption	Value	Logic
Usage in consumption category	88 MGD	680MGD*13%(multi-family)
% addressable of total usage	25%	25% of buildings not sub-metered
% savings from conservation program	15%	Switching to submetering provides ~15% reduction
% targeted (incremental adoption rate)	100%	100% increase in adoption rate from current program
= Water savings (MGD)	**3.3 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No cost of rebate
	Equipm't/installation	$8.2	Retrofit cost of $50,000 per complex (with replacement every 15 years)
	Marketing /admin	$2.0	20% admin cost of total utility cost (15% + 5% contingency)
	Enforcement	-	No enforcement cost
	Cost to customer	*$0.4*	Customer cost of $2,500 per complex
	Total cost to utility:	$10.2	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Spray rinse valves (I)

Method of implementation: increased incentive rebate program

Current plan in Metro District: current education program only, with an implementation level of ~10% over a 10-year program

Yield

Assumption	Value	Logic
Usage in consumption category	14 MGD	680MGD*25%(commercial)*80%(indoor)*10% (rinsing usage)
% addressable of total usage	40%	40% of commercial kitchens/restaurants eligible
% savings from conservation program	35%	Switching to pre-rinse spray valves provides ~35% reduction
% targeted (incremental adoption rate)	15%	15% increase in adoption rate from current program
= Water savings (MGD)	**0.3 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	$0.2	Rebate of $50/valve
	Equipm't/installation	-	No equipment and installation cost for utility, born by customer
	Marketing /admin	$0.2	40% admin cost of total cost to utility
	Enforcement	-	No enforcement cost
	Cost to customer	*$0.3*	Cost to customer to install spray rinse valves
	Total cost to utility:	$0.4	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Spray rinse valves (II)

Method of implementation: direct install program

Current plan in Metro District: current education program only, with an implementation level of ~10% over a 10-year program

Yield

Assumption	Value	Logic
Usage in consumption category	14 MGD	680MGD*25%(commercial)*80% (indoor)*10%(rinsing usage)
% addressable of total usage	40%	40% of commercial kitchens/restaurants eligible
% savings from conservation program	35%	Switching to pre-rinse spray valves provides ~35% reduction
% targeted (incremental adoption rate)	90%	90% increase in adoption rate from current program
= Water savings (MGD)	**1.8 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No rebate cost provided
	Equipm't/installation	$1.1	Installation cost at $200/install for utility
	Marketing /admin	$1.9	50% admin cost of total utility cost
	Enforcement	-	No enforcement cost
	Cost to customer	-	No customer cost, utility carries all cost of program
	Total cost to utility:	$3.0	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Cooling towers (I)

Method of implementation: incentive rebate program to retrofit cooling towers

Current plan in Metro District: no current program in place

Yield

Assumption	Value	Logic
Usage in consumption category	34 MGD	680MGD*25%(commercial)*20%(cooling towers)
% addressable of total usage	80%	80% of cooling towers are eligible
% savings from conservation program	40%	Increase from 2 to 5 cycles of concentration gives ~40% reduction
% targeted (incremental adoption rate)	25%	25% increase in adoption rate from current program
= Water savings (MGD)	**2.7 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No rebate cost provided
	Equipm't/installation	$5.0	Installation cost for utility
	Marketing /admin	$3.4	Cost for increased monitoring and auditing of cooling towers
	Enforcement	-	No enforcement cost
	Cost to customer	*$3.4*	Customer cost to improve cooling process with higher cycles of concentration
	Total cost to utility:	$8.4	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Cooling towers (II)

Method of implementation: ordinance for higher cooling tower standards for top 50% of users

Current plan in Metro District: no current program in place

Yield

Assumption	Value	Logic
Usage in consumption category	34 MGD	680MGD*25%(commercial)*20%(cooling towers)
% addressable of total usage	80%	80% of cooling towers are eligible
% savings from conservation program	40%	Increase from 2 to 4 cycles of concentration gives ~40% reduction
% targeted (incremental adoption rate)	50%	50% increase in adoption rate from current program
= Water savings (MGD)	**5.4 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No rebate cost provided
	Equipm't/installation	$7.1	Installation cost for utility
	Marketing /admin	-	No marketing/admin cost
	Enforcement	$9.7	Cost of increased monitoring and enforcement to ensure standards
	Cost to customer	*$6.7*	Customer cost to improve cooling process with higher cycles of concentration
Total cost to utility:		$16.8	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Watering restrictions (I)

Method of implementation: no daytime watering

Current plan in Metro District: current outdoor water use schedule since 2003 restricts watering to 3 days / week for all residential/commercial users

Yield

Assumption	Value	Logic
Usage in consumption category	143 MGD	1100MGD*[(53%(res.)*20%(outdoor)+25%(com.)*10%(outdoor)]
% addressable of total usage	100%	100% of outdoor water usage potentially addressable
% savings from conservation program	5%	Watering restriction able to provide ~5% reduction
% targeted (incremental adoption rate)	100%	100% adoption rate from current program
= Water savings (MGD)	**7.2 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No rebate cost
Utility	Equipm't/installation	-	No equipment or installation cost
Utility	Marketing /admin	-	No marketing/admin cost
Utility	Enforcement	$1.5	Enforcement cost of $100k per provider for the top 15 providers
	Cost to customer	-	No customer cost
	Total cost to utility:	$1.5	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Watering restrictions (II)

Method of implementation: 1 day/week watering schedule

Current plan in Metro District: current outdoor water use schedule since 2003 restricts watering to 3 days / week for all residential/commercial users

Yield

Assumption	Value	Logic
Usage in consumption category	143 MGD	1100MGD*[(53%(res.)*20%(outdoor)+25%(com.)*10%(outdoor)]
% addressable of total usage	100%	100% of outdoor water usage potentially addressable
% savings from conservation program	15%	Watering restriction able to provide ~15% reduction
% targeted (incremental adoption rate)	100%	100% adoption rate from current program
= Water savings (MGD)	**21.5MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No rebate cost
Utility	Equipm't/installation	-	No equipment or installation cost
Utility	Marketing /admin	-	No marketing/admin cost
Utility	Enforcement	$3.0	Enforcement cost of $200k per provider for the top 15 providers
	Cost to customer	-	No customer cost
	Total cost to utility:	$3.0	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Rain sensor irrigation (I)

Method of implementation: retrofit 25% of existing irrigation systems

Current plan in Metro District: current program is state law requiring rain shut-off sensors installed on all new irrigation systems for residential/commercial

Yield

Assumption	Value	Logic
Usage in consumption category	88 MGD	680MGD*[(53%(res.)*20%(outdoor)+25%(com.)*10%(outdoor)]
% addressable of total usage	90%	90% of irrigation systems do not yet have rain sensors
% savings from conservation program	15%	Installing rain sensor irrigation systems provides ~15% reduction
% targeted (incremental adoption rate)	25%	25% increase in adoption rate from current program
= Water savings (MGD)	**3.0 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No cost of rebate
Utility	Equipm't/installation	$4.1	Retrofit cost of $100 per irrigation system
Utility	Marketing /admin	$1.0	20% admin cost of total utility cost (15% + 5% contingency)
Utility	Enforcement	-	No enforcement cost
	Cost to customer	-	No customer cost
	Total cost to utility:	$5.1	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Rain sensor irrigation (II)

Method of implementation: retrofit 50% of existing irrigation systems

Current plan in Metro District: current program is state law requiring rain shut-off sensors installed on all new irrigation systems for residential/commercial

Yield

Assumption	Value	Logic
Usage in consumption category	88 MGD	680MGD*[(53%(res.)*20%(outdoor)+25%(com.)*10%(outdoor)]
% addressable of total usage	90%	90% of irrigation systems do not yet have rain sensors
% savings from conservation program	15%	Installing rain sensor irrigation systems provides ~15% reduction
% targeted (incremental adoption rate)	50%	50% increase in adoption rate from current program
= Water savings (MGD)	**5.9 MGD**	

Cost

	Cost category	Cost ($M)	Logic
Utility	Rebate/incentives	-	No cost of rebate
	Equipm't/installation	$8.2	Retrofit cost of $100 per irrigation system
	Marketing /admin	$2.1	20% admin cost of total utility cost (15% + 5% contingency)
	Enforcement	-	No enforcement cost
	Cost to customer	-	No customer cost
	Total cost to utility:	$10.3	

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted	Cost-effective measures with little negative societal/environmental impact	No	No

Water conservation programs: *background*

Total of 35 conservation measures considered qualitatively and/or quantitatively

- Measures consolidated from Metro North Georgia District Plans (2009 and 2003 plans), Task Force members, stakeholders and case studies from other regions

For ease of discussion, measures organized into 6 bundles

1. Residential retrofits
2. Sub-metering and water audits
3. Commercial retrofits and process improvements
4. Outdoor water usage reduction

→ ***Quantitatively evaluated a subset (with highest-potential impact) of these measures***

5. Localized water recycling capability

→ *Not quantitatively evaluated due to lower impact, but should be considered by local gov't on individual basis*

6. Enablers to encourage conservation

→ *Not quantitatively evaluated but addressed in recommendations*

Bundles of measures considered and evaluated (I)

Bundles	Options
1 **Residential retrofits**	1-4 Efficient fixtures – Low-flow toilets – Low-flow showerheads and faucets – Efficient clothes washers – Efficient dishwashers 5 Retrofit kits (containing low-flow showerheads, faucet aerators, toilet leak-detection dye tablets, and pamphlet on water conservation) 6 Building code requirements to install hot water pipe insulation 7 'Hot water on demand' system to recycle water sitting in pipes back to water heater
2 **Sub-metering and water audits**	8 Regulations on sub-metering in multi-family buildings 9 Residential water audits 10 Commercial water audits
3 **Commercial retrofits and process improvements**	11-15 Efficient fixtures – Low-flow spray rinse nozzles in restaurants – Low-flow toilets and urinals in public spaces or new developments – Washing machines in laundromats – Self-closing faucets in high-use restrooms – Air-cooled ice machines in hotels 16 Cooling tower audit and replacement to improve cooling process and reduce water use 17 Cooling tower metering to measure makeup and bleed-off water of facilities 18 Water credit program where water providers would provide credit rebate based on avoided cost of new water capacity for users who install water efficient equipment

Quantitatively evaluated in detail

Bundles of measures considered and evaluated (II)

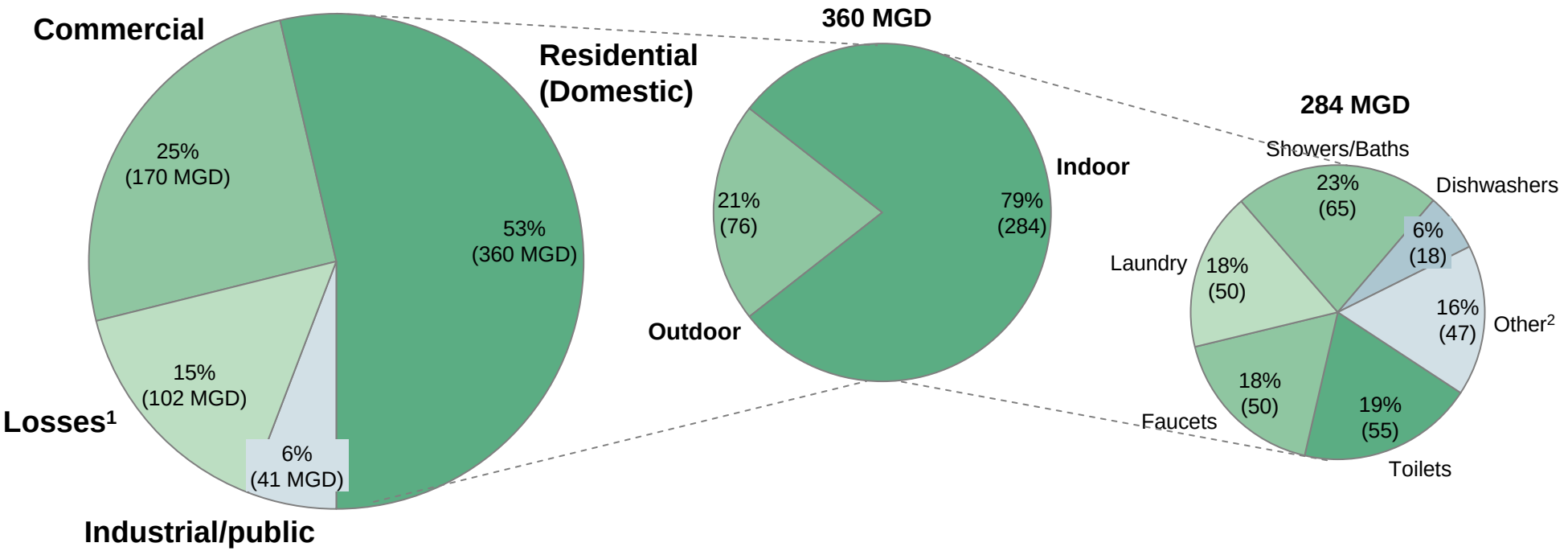
Bundles	Options
4 **Outdoor water usage reduction**	19 Rain sensor shut off devices/high-tech irrigation controllers 20 Permanent irrigation codes and time-of-day watering restrictions 21 Xeriscape or other native/water-conserving species landscaping 22 Trigger shut-off valves and hose timers 23 Irrigation audits for large turf areas to ensure property irrigation system installation 24 Prohibit HOA or CC&R conditions that mandate use of turf in developments 25 Rainwater harvesting via barrels and cisterns 26 Public/private swimming pool covers to prevent evaporative loss
5 **Localized water recycling capability**	27 Drive-through car washes to install equipment to recycle water 28 Water recycle equipm't in X-ray machine for process water, developer, filter solution 29 Prohibit water use in non-recycling water fountains, once-through cooling processes 30 Laundry recycle systems at commercial laundries
6 **'Enablers' to encourage conservation**	31 Public awareness and participation programs – Landscape training class, Xeriscape demonstration garden 32 School education and targeted high-user education programs 33 Water budgets and water saving goals/ordinances 34 Tax incentives or other low-interest rate loans 35 New home efficiency award programs for "Green Builder" developers (WaterSense)

Quantitatively evaluated in detail

Efficiency measures evaluated address all major water consumption categories

Metro Water District water use profile

Total = 680 Million Gallons/Day



Residential retrofits can address 25% of total water usage

1. Includes apparent losses (meter inaccuracies, data errors, etc) and real losses (leakage, breaks, overflows, etc) 2. "Other" not defined in Metro plan – likely includes drinking, food preparation, etc.
Source: Metro North Georgia Water Supply and Water Conservation Management Plan (May 2009)

Water conservation programs: *evaluation and prioritization*

Set of 35 efficiency measures considered; quantitatively evaluated a subset– those affecting the biggest water use consumption categories and with the highest potential water savings impact [1]

- Evaluated measures with water savings potential *incremental* to 2009 Water District Plan, leveraging that plan's underlying assumptions and baseline data
- Measures not quantified offer lower potential impact (based on type of consumption addressed) and their potential can be highly utility-specific

Two *general* methods of implementation were considered: <u>incentive-driven</u> and <u>mandated</u>

- Incentive-driven implementation via rebates and credits on bills
- Mandated implementation via ordinances and direct installs by utilities

Only those options that were quantitatively evaluated will be presented for Task Force prioritization and comment

- Assume that cost and yield data are required inputs for Task Force member prioritization

Measures not quantified should be considered by individual utilities and local governments for their applicability and local potential

1. Highest water savings impact also confirmed with evaluations from the 2009 Metro North Georgia Water District Plan
Source: Metro North Georgia Water District Plan (May 2009); Technical Advisor Panel, Ga Water Utility Manager interviews

Conserve option evaluations defined and categorized by the two methods of implementation

		Potential water savings in 2012	
	Conserve options	**Incentive-driven implementation**	**Mandated implementation**
Efficiency programs	Toilet retrofits	2.6 MGD	15.6 MGD
	Showerheads and faucets	2.5 MGD	11.3 MGD
	Residential clothes washers	0.2 – 0.6 MGD	-
	Multi-family metering	1.7 MGD	3.3 MGD
	Spray rinse valves	0.7 MGD	2.2 MGD
	Cooling towers	2.7 MGD	5.4 MGD
	Water restrictions	-	4.9 – 14.6 MGD
	Rain sensor irrigation	5.2 – 8.1 MGD	-
	Pricing	4 - 7 MGD	-
	Loss reduction	-	8 – 10 MGD
	Total	**20 – 26 MGD**	**51 – 62 MGD**

Method of implementation selected based on expected target market penetration of conservation programs

Selection of method of implementation for given conservation option based on starting point of a more accepted, incentive-driven approach incremental to district plan (eg, higher rebate than provided by current program, larger credit on water bill)

If incentive-driven approach alone incapable of reaching most aggressive market penetration for option, then mandated approach evaluated to meet adoption rate targets

- Mandates considered under context of feasibility and implementation sensitivity – else a more aggressive incentive-based option considered at lower market penetration rate

Note that some conservation options are incentive-driven or mandate-based by nature

- Eg, watering restrictions, such as no daytime watering or one day per week watering schedule, can only be mandate-based, with maximum adoption achieved by 100% compliance through strict enforcement
- Eg, conservation-based pricing is by nature incentive-driven, as behavioral adjustments to pricing signal driven heavily by financial incentive to conserve

Conserve options total potential water savings in 2012 under each scenario

Scenario	Base option (scenario 1) program descriptions	Potential savings considered in 2012 on top of current district plan
1 Options considered by TF incremental to district plan	• Toilet retrofit to 1.28 gpf HETs • Retrofit to 1.5 gpm showerheads • Retrofit to efficient clothes washers with a water factor of 4 or less • Install meters on existing un-submetered multi-family buildings • Retrofit to low flow spray rinse valves • Increase cooling tower from 2 to 5 cycles of concentration • Outdoor water usage restricted to no daytime watering or one day/week water schedule • Install rain sensors on all existing irrigation systems that do not yet have them	26 - 79 MGD
2 With additional aggressive pricing program		43 – 96 MGD *Pricing savings of 4-7 MGD (scenario 1) increase by 17 MGD*
3 With additional outdoor residential water ban		26 – 128 MGD *Total outdoor savings of 14-30 MGD (scenario 1) by 49 MGD*

Source: Metro North Georgia Water Planning District- May 09 Plan, Technical Advisory Panel analysis

Overview of key options: Conserve

Conserve

- **Conservation efficiency programs (eg, fixture retrofits)**
- **Reuse**
- **Pricing**
- **Loss Reduction**

Water re-use: *option descriptions*

Option	Description
Indirect potable reuse	Recapture treated wastewater discharges downstream from original point of discharge to replenish drinking water supplies, then pump water to upstream communities critically impacted by ruling
Direct potable reuse	Treat wastewater to extremely high standards, then bring it directly back to the drinking water supply system without any dilution with nature
Non-potable reuse	Use treated wastewater for non-potable uses such as irrigation of golf courses, parks, or for use in cooling plant processes
Grey water reuse	Localized purple pipes to directly reuse grey water (non-toilet household water such as shower and sink water) for non-potable reuse such as toilets

Source: Technical Advisory Panel analysis;

Indirect potable re-use the highest yielding, most cost-efficient re-use option

	Option	Average Yield (MGD)	Cost efficiency ($/MG)	Total cost ($M)	Capital cost ($M)	Timing (years)
1 Indirect potable reuse	6-county solution	~250	$1,070[5]	$4,900[5]	$2,800	4-5
	4-county solution (excl Hall, Forsyth)	205	$1,000[5]	$3,700[5]	$2,000	
2 Direct potable reuse	Direct potable reuse	~250	$1,700	$8,000	$5,600	3-4
3 Non-potable reuse (irrigation)	Irrigation of all outdoor usage	~70-75[4]	$11,000[2]	$14,800	$14,400	3-7
	For golf courses, parks only [1]	3	$2,000	$112	$111	
4 Grey water reuse	Retrofit on existing homes	~20-25	$9,000 - $27,000[3]	$10,000	$3,300	Localized implementation at 10% of households/year

1. Based on demand from top 10 irrigation users (golf courses and parks) in the 6 affected counties 2. Cost highly dependent on customer density 3. Cost highly dependent on cost of equalization, treatment, and pressure tank 4. Total of all outdoor water use (total use less winter use) for the 6 affected counties, with Cobb County at 53% to reflect their withdrawals from Chattahoochee only
Source: Technical Advisory Panel analysis; 5. Updated to include additional treatment cost (ozone treatment for water and wastewater) above and beyond EPD requirements based on feedback from water providers

Detailed cost estimates for water reuse options

	Option	Capital Cost					Operating Cost		
		Pump & pipe ($M)	Water treatment ($M)	Storage space ($M)	Infra-structure ($M)	Total ($M)	Pumping cost ($M)	O&M cost ($M)	Total ($M)
1 Indirect potable reuse	6-county solution	$1,370	$1350[1]	$71	$33	$2,800	$400	$1,700[1]	$2,100
	4-county solution (excl Hall, Forsyth)	$800	$1150[1]	$71	$24	$2,000	$200	$1500[1]	$1,700
2 Direct potable reuse	Direct potable reuse	$810	$4,700	$71	$14	$5,600	$200	$2,200	$2,400
3 Non-potable reuse (irrigation)	Irrigation of all outdoor usage	$14,400	-	-	-	$14,400	-	$400	$400
	For golf courses, parks only	$111	-	-	-	$111	$1	-	$1
4 Grey water reuse	Retrofit on existing homes	-	-	-	$3,300	$3,300	-	$6,800	$6,800

1. Updated to include additional treatment cost (ozone treatment for water and wastewater) above and beyond EPD requirements based on feedback from water providers
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors
Source: Technical Advisory Panel analysis;

Water reuse options considered (I)

	Description of solution	Rationale	Key challenges	Timing (years)
1 **Indirect potable reuse**	*Expand* current indirect potable reuse, which is recapturing treated wastewater discharges downstream from original point of discharge to replenish drinking water supplies– then pumping water to upstream communities critically impacted by ruling	• Already practiced on the Chattahoochee, but can be maximized in this need-based solution to directly address the gap in critically impacted counties • No negative impact on downstream users who use indirect potable reuse	• Regional cooperation and financing • Hall and Forsyth Counties may need to find alternate solutions since this option is much more costly for those two counties • Public education and acceptance • Assessing any impacts on water quality / temperature	~4-5
2 **Direct potable reuse**	Treat wastewater to extremely high standards, then bring it directly back to the drinking water supply system without any dilution with nature	• Reduces surface water demands • No negative impact on downstream users who use indirect potable reuse • Avoid pumping and piping costs associated with indirect reuse (ie, don't have to build additional conveyance network and pumping infrastructure)	• No precedent – currently not practiced in the US • There is no regulatory framework in place such as agreed upon treatment standards to implement option • Public perception and acceptance is questionable- would require very high treatment standards	~3-4

Source: Technical Advisory Panel analysis;

Water reuse options considered (II)

	Description of solution	Rationale	Key challenges	Timing (years)
3 **Non-potable reuse**	Use high quality treated wastewater for non-potable uses such as irrigation of golf courses, parks Use secondary-quality treated wastewater for use in cooling plant processes	• Reduces use of potable water for non-potable purposes	• Disruption caused by a dual distribution system construction in developed areas may be unacceptable • Limited number of potential large users (of cooling plant water) and very uncertain demand which limits potential yield	~3-7
4 **Grey water reuse**	Localized purple pipes to directly reuse grey water (non-toilet household water such as shower and sink water) for non-potable reuse such as toilets	• Reuse of grey water for toilets can reduce demand on potable water	• Some plumbing codes may not allow purple pipes to be installed in homes • Potential health risk (ie. cross connections) • Poor maintenance by home owners and lack of public oversight could result in water quality issues and concerns	Localized implementation at 10% of households/ year

Source: Technical Advisory Panel analysis;

Indirect potable reuse: *context*

Indirect potable reuse is recapturing treated wastewater, which after sufficient contact and dilution with nature, can be reused for potable purposes

- Uses water treatment technologies to return wastewater to the natural environment (eg. river, stream, or reservoir), and pumps return flow upstream to critically impacted counties to increase their drinking water supply

Indirect potable reuse is a critical component of the Metro Water District's water supply plans through 2035 and beyond

- Currently practiced in Metro Water District both in planned and incidental forms, but expansion of option can directly address the gap in critically affected counties

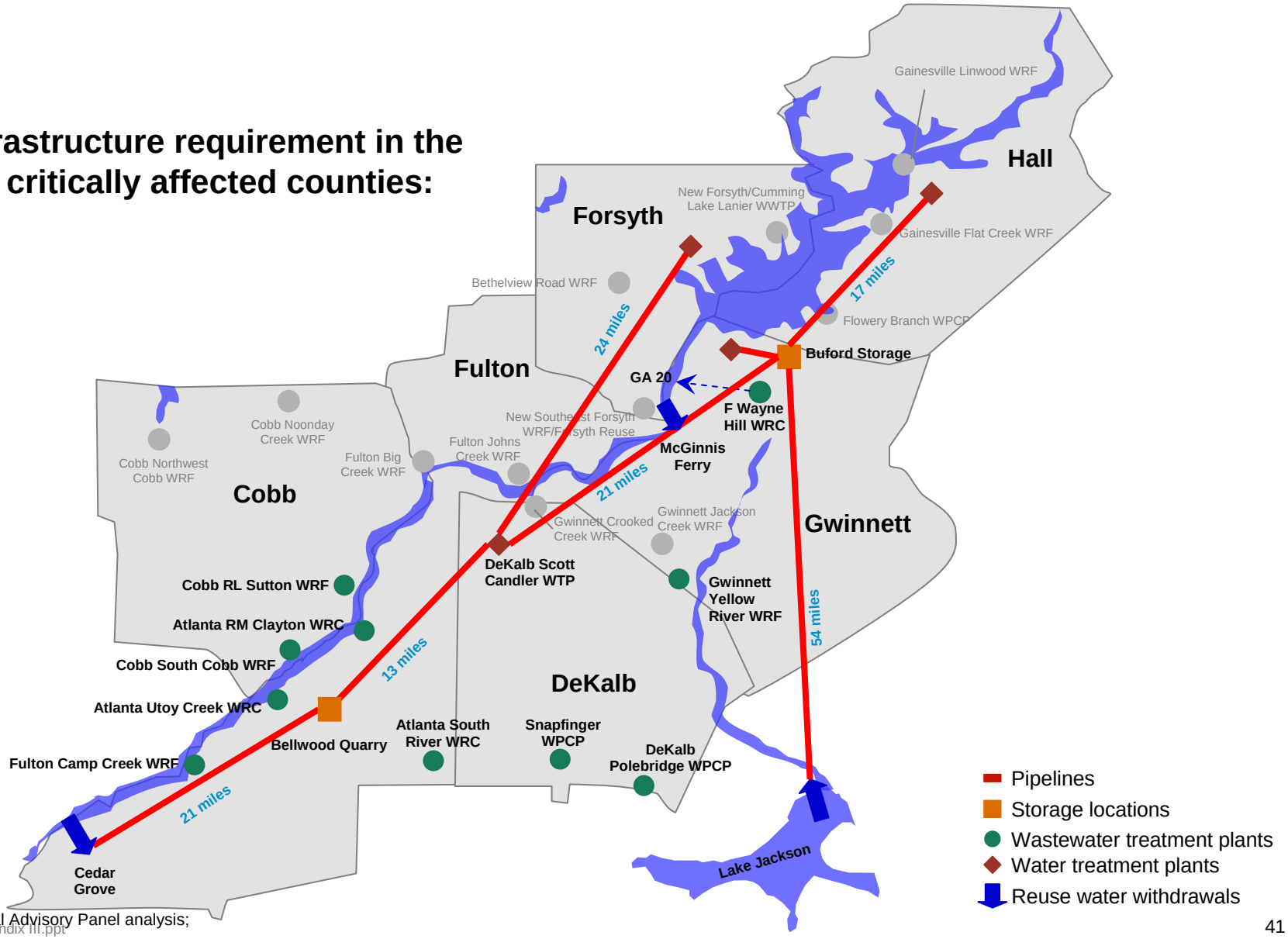
Incidental reuse common in Metro Water District, as several major water supply intakes on the Chattahoochee River are downstream of wastewater discharges

Planned reuse has been instituted by a number of local wastewater providers since 2003, mostly found in Gwinnett, Cobb and Clayton Counties

Source: Technical Advisory Panel analysis;

Indirect potable reuse: *infrastructure requirement*

Infrastructure requirement in the 6 critically affected counties:



Source: Technical Advisory Panel analysis;

Estimates of indirect potable reuse cost/benefit by region

Region	Average yield (MGD)	Total cost[1] ($B)	Cost ($/MG)
Hall County and Forsyth County	47	1.2	~1,400
Gwinnett, DeKalb, Fulton and Cobb County	205	3.7	~1,000
Total of all 6 counties	252	4.9[2]	~1,070[2]

1. Total cost in 2010 dollars 2. Updated to include additional treatment cost (ozone treatment for water and wastewater) above and beyond EPD requirements based on feedback from water providers
Source: Technical Advisory Panel analysis

Non-potable reuse: *top 10 irrigation users*

Top 10 irrigation users (golf course and parklands) in 6 county system

County	Pipelines (size in inches)	Capital cost ($M)	Peak reuse demand[1]
Gwinnett	10 miles (18")	$24.5	2 MGD
Forsyth	24 miles (18") 3 miles (12")	$63.5	3 MGD
Hall	5 miles (18")	$12	2 MGD
Fulton	7 miles (18")	$17	2 MGD
Total		$117M	9 MGD

Equivalent to $111M in 2010 dollars (PV terms)

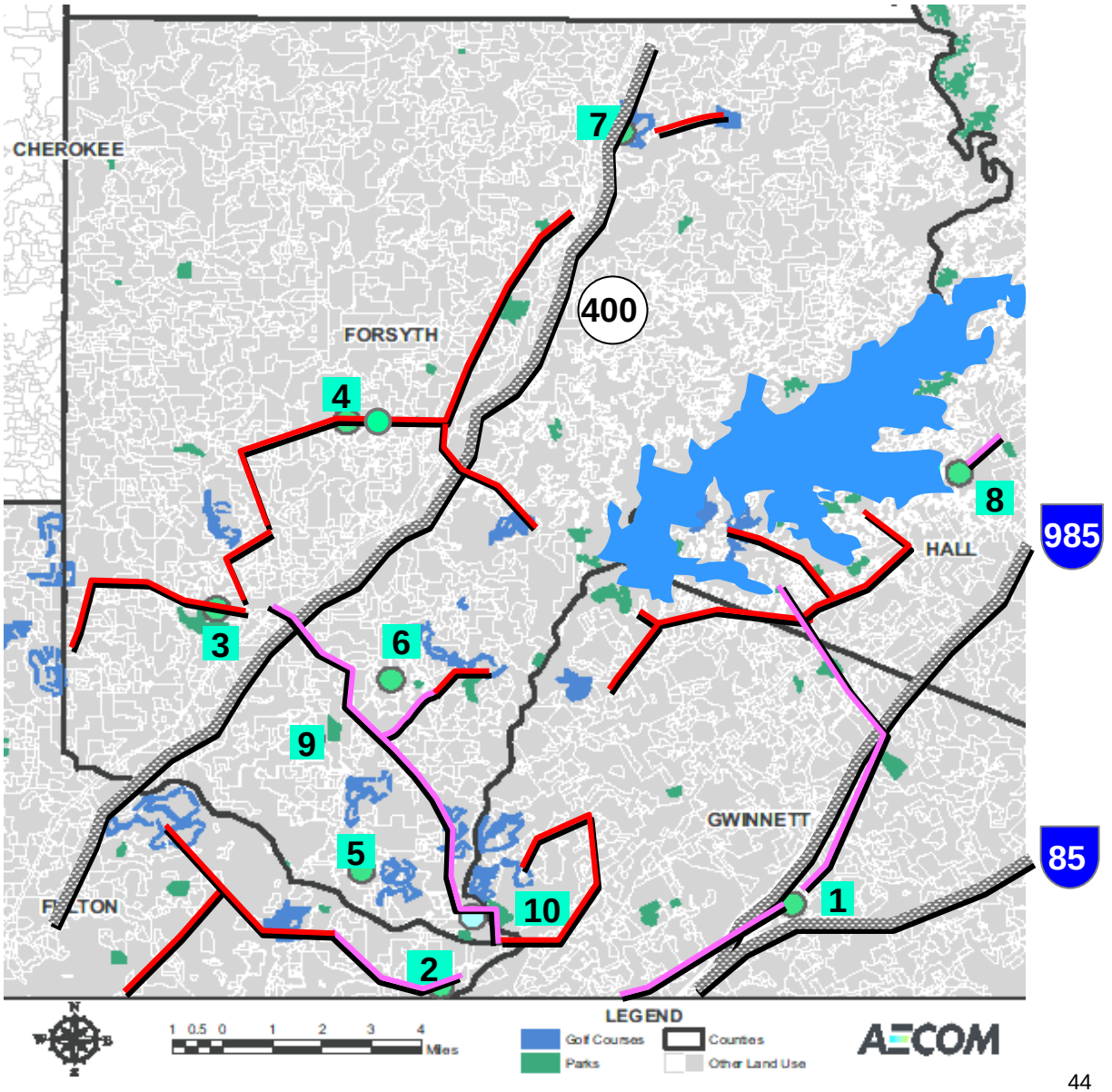
Equivalent to 3 AAD-MGD (use peaking factor of 3 for irrigation use)

1. Peak demand is seasonal high months of June to August
Source: Technical Advisory Panel analysis;

Non-potable reuse: *infrastructure requirement*

Water Reclamation Plants

1	F Wayne Hill WRC
2	Cauley Creek WRF
3	Fowler WRF
4	Cumming WRF
5	Dick Creek WRF
6	Windermere WRF
7	Hamptons WRF
8	Flowery Branch WRF
9	Laurel Springs WRF
10	Skake Rag WRF *(planning stage)*



Existing Reuse Mains

Possible Reuse Mains

Preliminary study of rainwater harvesting and stormwater reuse options suggest limited potential

Rainwater harvesting

Localized capture and storage of rainwater for irrigation and non-potable indoor uses

Preliminary analysis suggests residential use is very expensive

- Cost efficiency of ~$10,000+/MG[1]

Water professionals raise serious concerns about public health implications of this option

Potential opportunity exists for commercial use – costs and yield are very site specific

Stormwater reuse

Stormwater runoff stored in large surface ponds and used as a source of water for non-potable use, typically irrigation

Capture of stormwater partially addressed by reservoir pump-storage options evaluated by the Task Force

- River water pumped at high flows (during and after storm events) for storage and subsequent use

A full cost/benefit analysis (with the value of reducing urban runoff etc.) is outside the scope of Task Force effort

- Potentially leverage detailed study by Texas Water Development Board; report expected 12/31/09[2]

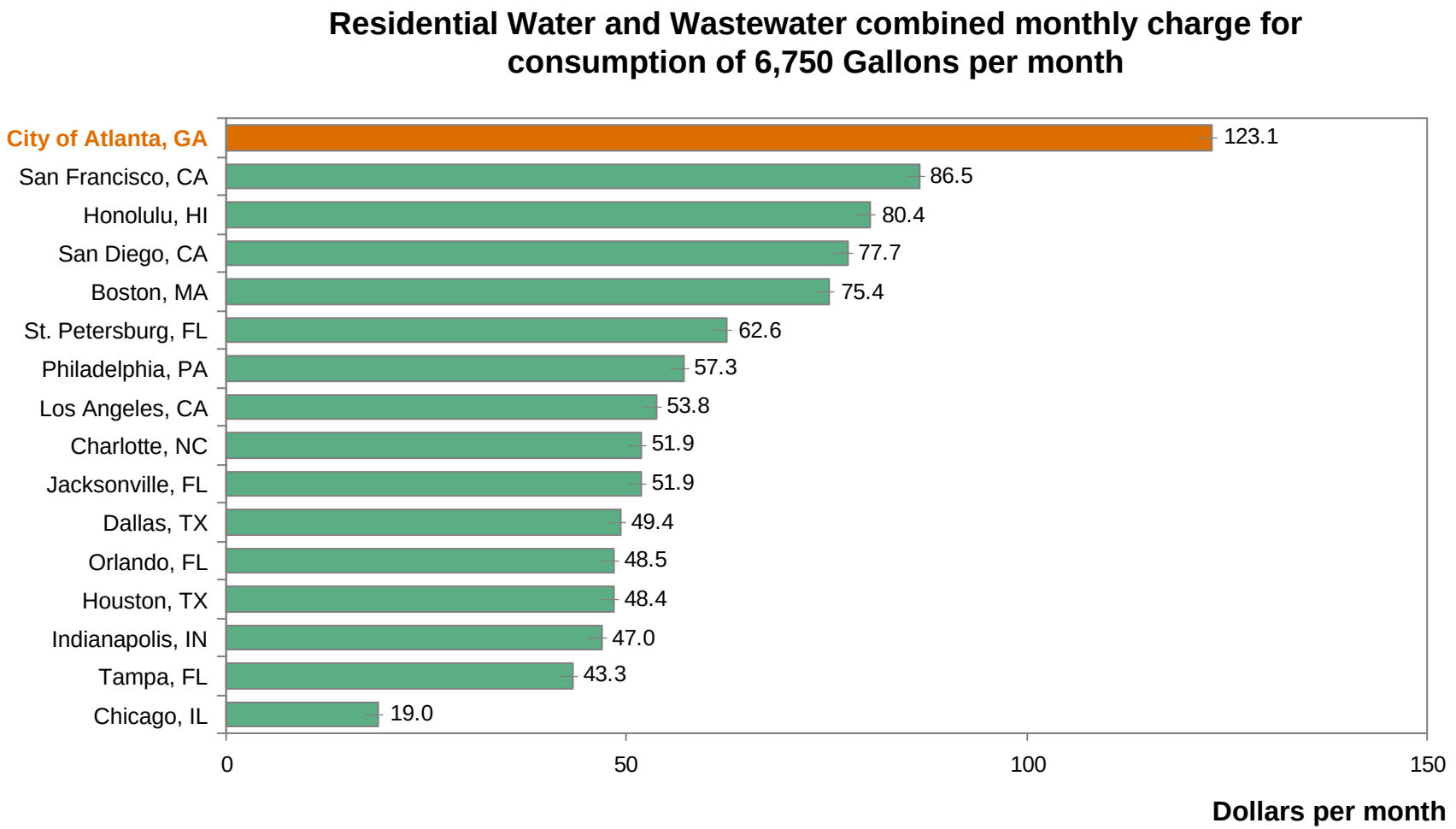
1. For a single family residence: Assumes upfront capital cost of $12.5K, refurbishment cost of $800 every 7 yrs, operating cost of $500/yr over 50 years; yield of 100 – 150 gallons/day 2. Texas water development board website (http://www.twdb.state.tx.us/iwt/reuse/projects/stormwater/milestone.html)
Source: Discussions between Task Force staff and Georgia Association of Water Professionals (GAWP), local rainwater harvesting system provider; Technical Advisor Panel

Overview of key options: Conserve

Conserve

- **Conservation efficiency programs (eg, fixture retrofits)**
- **Reuse**
- **Pricing**
- **Loss Reduction**

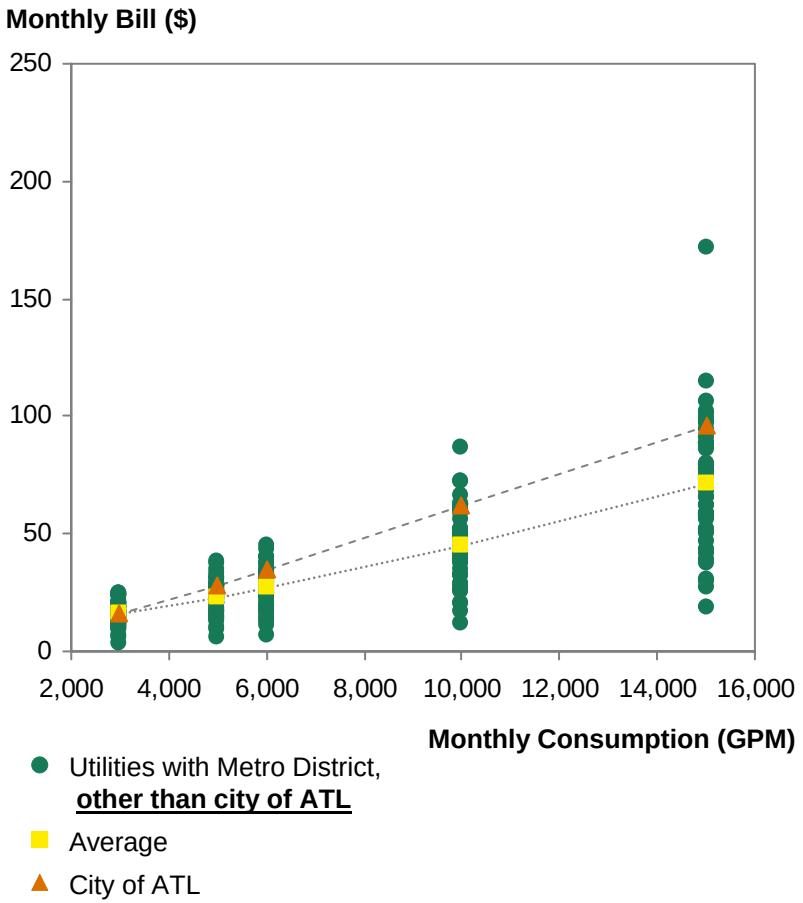
Residential water and wastewater rates in City of Atlanta are significantly higher than other US cities



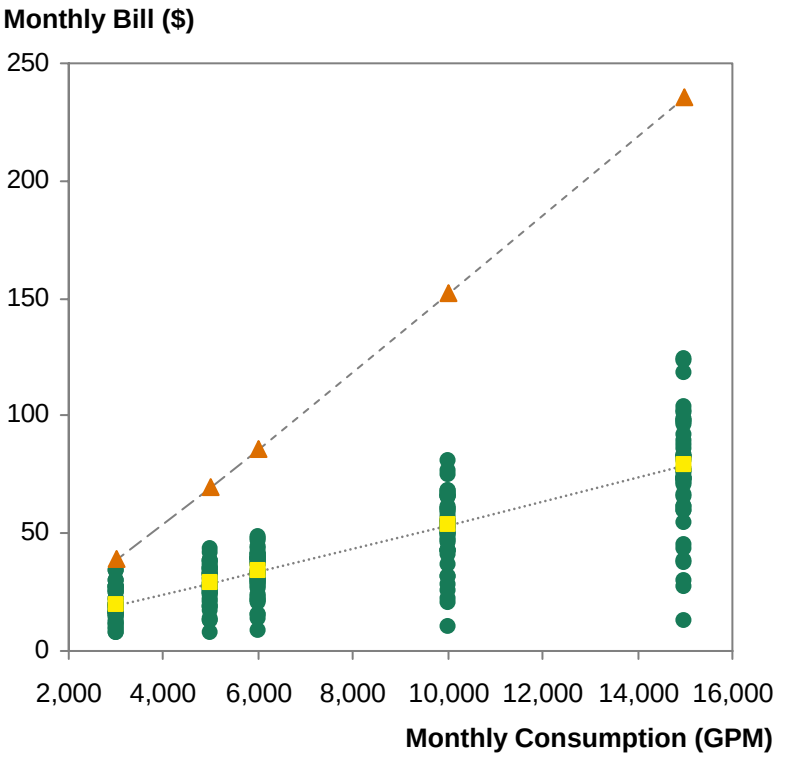
Source: Miami Dade County Water & Sewer Department (WASD), 2008

While city of Atlanta rates are high (driven by wastewater prices), the rest of Metro District utilities rates are lower

Residential water charges by utilities in the metro water district



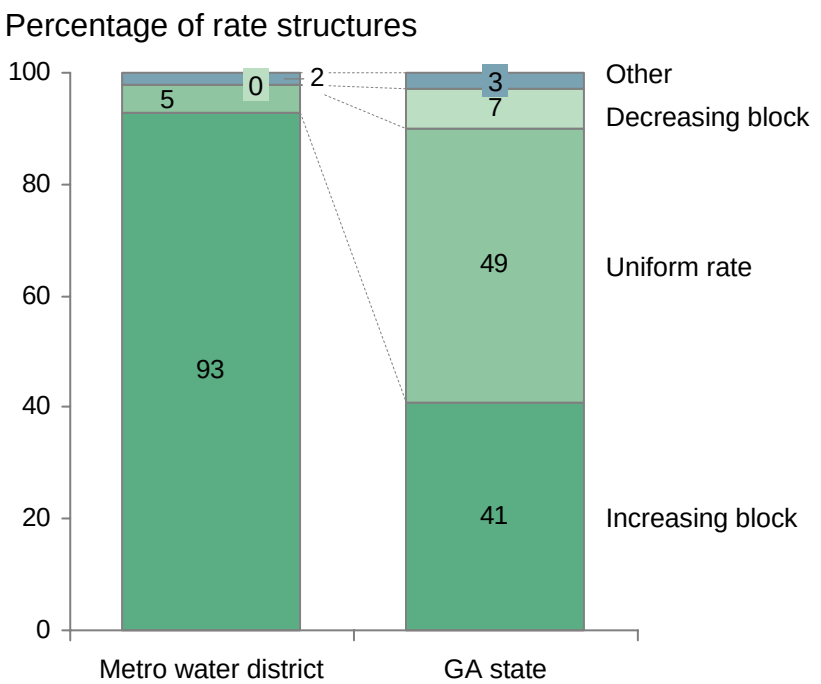
Residential wastewater charges by utilities in the metro water district



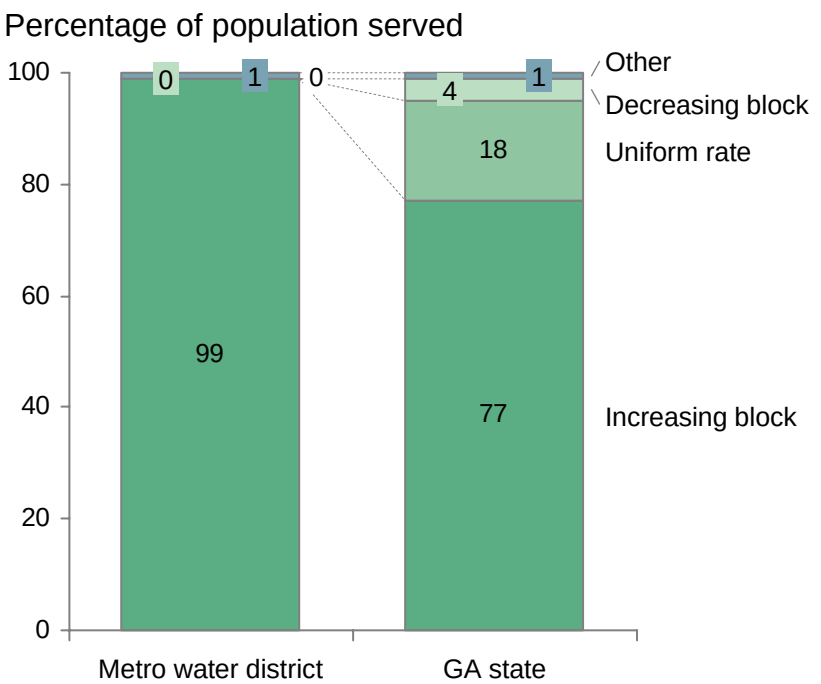
Note: GPM – Gallons Per Month
Source: GEFA, UNC Environmental Finance Center Tables of Rate Structures and Bills (May 2009)

Metro water district has made significant progress in adopting increasing block rate structures

Increasing block rate structures account for 93% of structures in Metro District



Increasing block rate structures serve 99% of population in Metro District



However, rate structures vary in their effectiveness in sending a conservation message to consumers

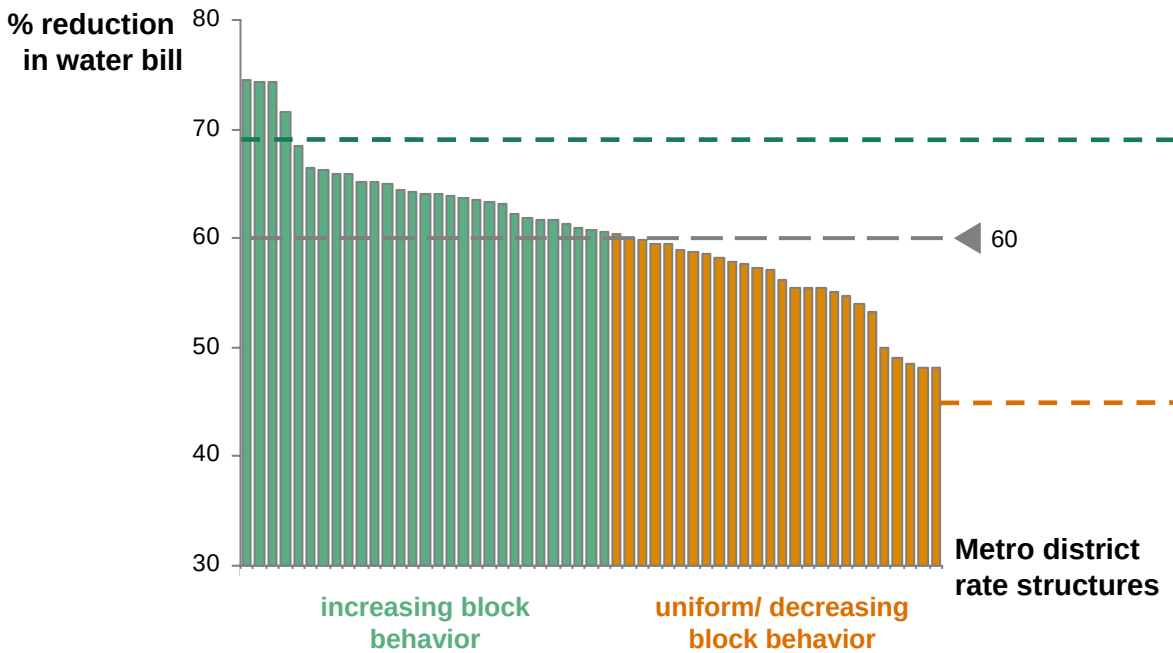
Increasing block structure: Price per unit of water increases as consumption increases. It is a tiered rate structure that may have 2 or more price tiers based on consumption levels
Uniform rate structure: Price per unit of water remains constant regardless of consumption
Decreasing block structure: Price per unit of water decreases as consumption increases
Source: GEFA & UNC Environmental Finance Center table of Rate Structures and Bills (May 2009); Possible rounding errors

Many Metro district rate structures are effectively flat for average consumers

Scenario: Heavy water user (consuming 15K GPM) drops consumption 60% to average levels (6K GPM) [1]

Scenario tests steepness of the underlying rate structure

- **If bill decreases by *more than 60%*, the rate structure is increasing block**



Actual utility rate structure examples: highlight variation in rate structure design

GPM tier	Rate (per 1000 gal)	
0 – 2000	$0 (Base Charge - $19.75)	
2001 - 4000	$5.34	
4001 - 6000	$6.67	125%
6001 - 10000	$10.68	200%
>10000	$17.09	320%

GPM tier	Rate (per 1000 gal)
0 – 2000	$0 (Base Charge - $17.60)
2001 - 20000	$3.08
>20000	$4.18

Note: 1. Average metro district residential consumption = 6000 GPM, Peak consumption (2.5x average) = 15000 GPM; GPM – Gallons Per Month
Source: GEFA & UNC Environmental Finance Center table of Rate Structures and Bills (May 2009)

Pricing option considered

Option	Description	Rationale	Key Challenges	Timing (years)
Residential conservation pricing	Institute steeper residential increasing block rate structures by increasing marginal prices at high consumption levels, with the intent of reducing outdoor water use.	• Shifts financial burden from essential uses towards non-essential uses, promoting conservation while keeping minimum level of services affordable • Economically efficient approach relative to non-pricing measures • Readily enforceable—minimal enforcement costs	• Less effective for wealthy communities, as compared with non-pricing measures • Less effective where non-essential demand and/or seasonal peaking are lower • Utility revenue stream will be more unstable, varying with seasonal demand • Impacts urban agriculture industry viability	1–3

Source: Technical Advisor Panel

Conservation pricing yield and cost estimates

Option	Yield (MGD)	$/MG	Timing (yrs)
Institute steeper increasing block rate structures for **residential** (single family + multi-family) users to reduce **outdoor** water use • Opportunity sized using current rate structures, focusing increases on subset of utilities with evidence of higher potential • Assumes marginal price increases at high consumption levels (~14,000 Gallons per Month (GPM); where average is ~6,000 GPM)	4 - 7	~100 - 200[1]	1 - 3

Note: 1. Assumes a cost per utility of ~$250K, 55 utilities impacted and a project life of 50 years; comparable to estimate in current Metro plan, Table 4-2
Source: MNGWPD Water Supply and Water Conservation Plan (May 2009), Table 4-2

Pricing focusing on addressing residential outdoor use

Rationale for scope of pricing option

Why isn't indoor use addressed?

- Discretionary outdoor demand (non-essential use) is more responsive to pricing changes relative to indoor demand (essential use)
- To avoid double counting of water savings with other indoor efficiency programs being evaluated by Task Force

Why aren't commercial users addressed?

- Conservation pricing savings from commercial outdoor use already addressed by Metro water plan i.e. Potential for incremental savings is minimal
  - Most commercial users have irrigation meters for outdoor use[1]
  - Current Metro plan recommends a steep irrigation rate (at least 200% of base rate) for irrigation meters
  - Savings from adoption of proposed irrigation pricing measures already accounted for in Metro area demand projections
- Commercial outdoor use being addressed by rain sensor water efficiency option being evaluated by Task Force

1. Based on working session between Task Force staff and Georgia Association of Water Professionals (GAWP)

Frequently asked questions on pricing option evaluation

Why aren't pricing savings higher?

- Option addresses residential outdoor water use only, out of conservatism
- Degree of price increase for any given rate structure is limited, to minimize consumer 'shock'
- Analysis uses conservative estimate of addressable outdoor consumption (50% of total outdoor consumption); detailed demand study per utility required for a precise estimate

What degree of price increase is assumed?

- Varies by utility; derived from utility categorization by relative conservation pricing potential
  - High potential: Wtd. avg. increase[1] of ~69%, addressable consumption of ~4 MGD
  - Mid potential: Wtd. avg. increase[1] of ~52%, addressable consumption of ~29 MGD
  - Low potential: Wtd. avg. increase[1] of ~6%, addressable consumption of ~10 MGD

What yield can be expected through more aggressive price increase?

- As an illustration, consider the hypothetical scenario that Metro district utilities raise their marginal price at a consumption of 14K GPM, to match that of city of Atlanta
- Under this scenario, implied wtd. avg. price increase[1] is ~152%, yielding 13 – 24 MGD; this range represents a theoretical upper bound

1. Denotes weighted average (by addressable outdoor consumption) increase to marginal price at a consumption of 14,000 GPM Note: GPM – Gallons Per Month

Six criteria used to rank utility conservation potential

Utilities ranked from 1 (high) to 3 (low) on each criterion; weighted average for overall ranking

Criteria	Logic	Weight (%)
1 **Marginal price of water**	Utilities with lower marginal prices have greater conservation potential • MP at 14,000 GPM for combined (indoor/outdoor) rate structures • MP at 10,000 GPM for irrigation rate structures	24
2 **Financial incentive for demand reduction**	Utilities that provide smaller financial incentives for reduction in use have greater conservation potential. Usage reduction scenarios: • 60% reduction (15,000 to 6,000 GPM, combined rate structures) • 100% reduction (10,000 to 0 GPM, irrigation rate structures) Indicators evaluated: • % change in total bill • Absolute ($) change in total bill	 21 21
3 **Demand seasonality**	Utilities with greater peaking ratio (ratio of summer use to winter use) have greater conservation potential	19
4 **Rate structure type**	Preferred rank order: • Increasing block > seasonal rates > uniform rates > decreasing rates	11
5 **Median household income**	Communities with higher income have lower conservation potential	2
6 **Poverty level**	Communities with lower poverty have lower conservation potential	2

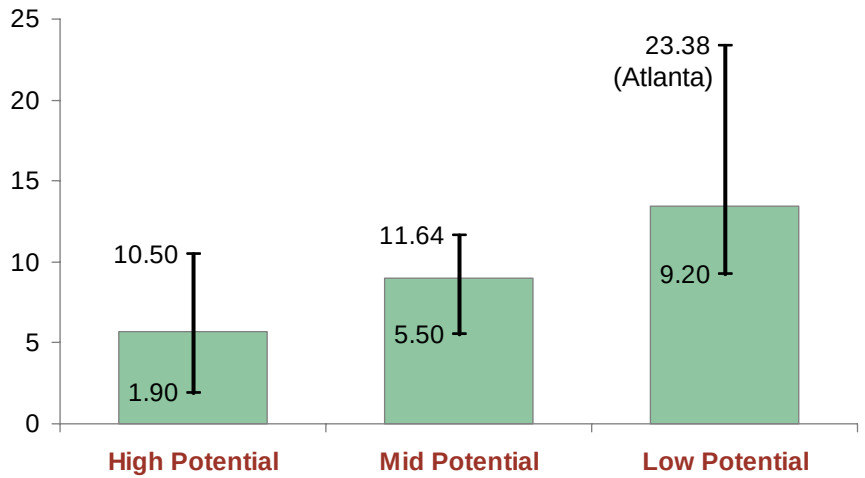
Ranking used to categorize utilities into three groups based on relative capacity to improve pricing signals

Source: Technical Advisor Panel analysis and experience

Utilities categorized into three groups based on relative capacity to improve pricing signals

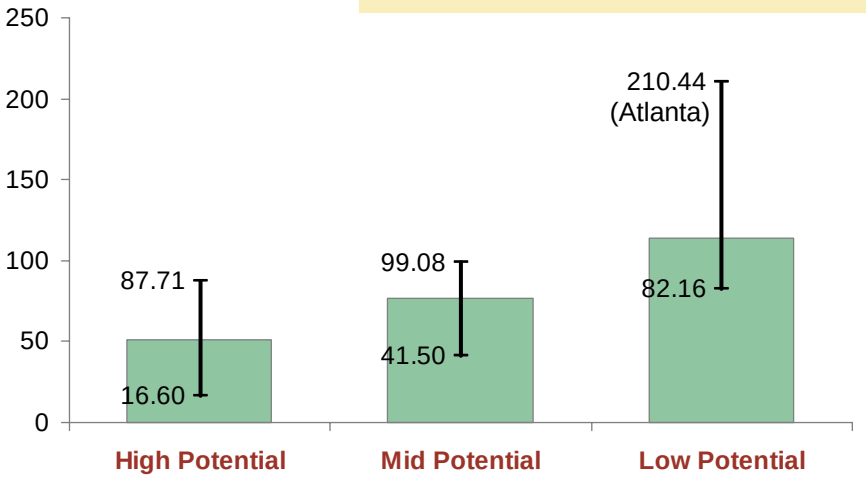
Comparison of key rate structure characteristics across groups

Average Marginal Price @ 14K[1] GPM ($)



Average reduction in total bill[2] ($)

Outdoor water reduction scenario: Household drops total consumption 33%, from 15K to 10K GPM



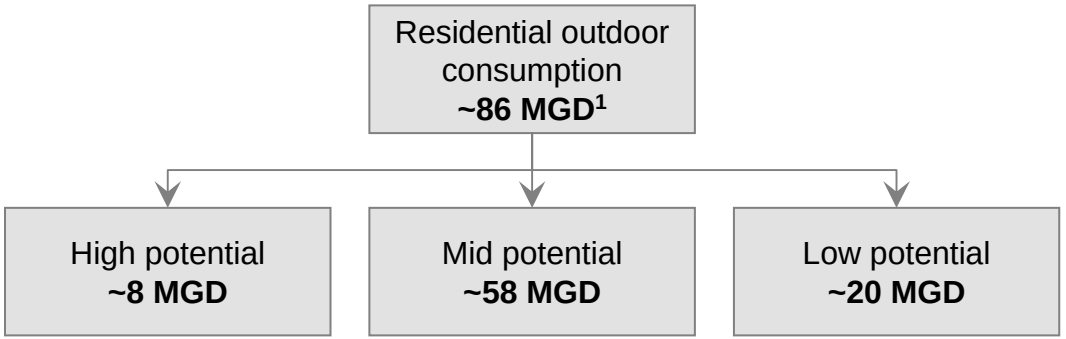
	High Potential	Mid Potential	Low Potential
Max	0.4	3.4	1.1
Pop Served (Millions)	0.4	3.4	1.1
Min	21	21	21
# Utilities	21	21	21

Significant variability in **absolute marginal price** levels for outdoor consumption

Significant variability in **rate structure steepness** across utilities

1. Pertains to combined water and sewer rate structures 2. Total bill savings for 33% reduction in consumption (15K to 10K GPM)

Approach to estimate residential outdoor water savings through pricing



	High potential ~8 MGD	Mid potential ~58 MGD	Low potential ~20 MGD
Consumption by group			
Addressable consumption (MGD)	~4	~29	~10
Weighted average increase in marginal price at 14K GPM	~69%	~52%	~6%
Price elasticity of outdoor demand	-0.2 to -0.4[2]		
Incremental savings (MGD)	0.5 – 1.0	3 – 6	0.1 – 0.2

4 – 7 MGD

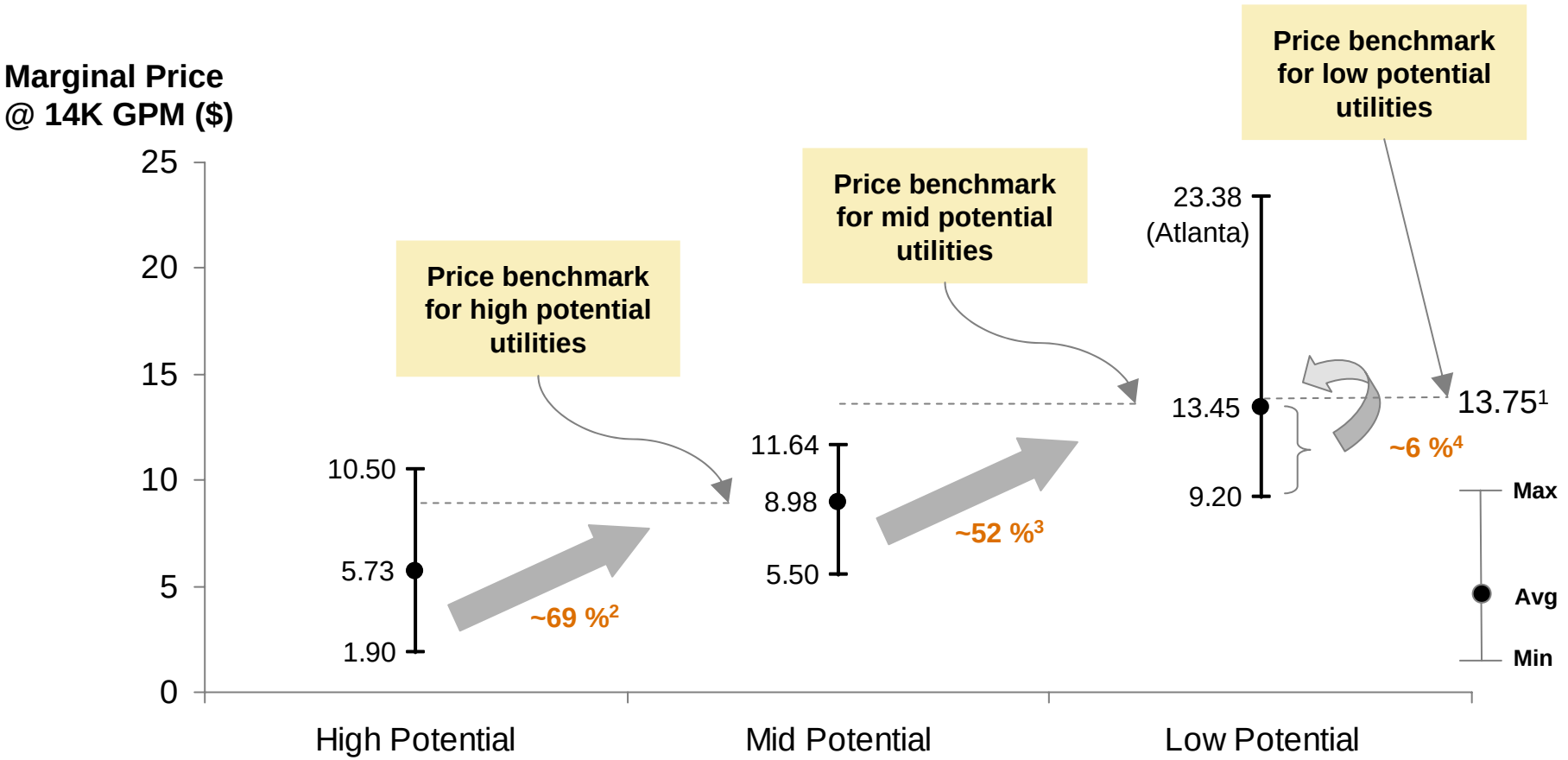
Rationale

- Utility categorization based on relative capacity to improve conservation pricing signal
- 50% of total outdoor consumption assumed to be discretionary (above 14K GPM)
- Varies by utility - derived from utility categorization[3]. Rates steepened while limiting degree of change

1. Estimated using per capita outdoor water consumption from Metro water plan (May 2009), Table 3-2 and data on population served by each utility from GEFA/UNC Rate Survey (May 2009)
2. Water and Wastewater pricing, EPA 832-F-03-027; Olmstead et al, Comparing price and non-price approaches to urban water conservation; Metro plan assumptions; TAP estimates
3. Assumes Marg. Price (MP) of utilities at 14K GPM would reach the avg. of their peers in the next category. MP for low pot. utilities assumed to reach 75th percentile within the category

Note: Numbers may not add up due to rounding errors; GPM – Gallons Per Month; Source: Technical Advisor Panel Analysis

Degree of marginal price increase for each utility based on categorization



Premise: Steepen rates while limiting degree of change

1. 75th percentile of all prices in the low potential category 2. Marginal price increase for high potential group varies from 0 – 370%, with a weighted average of 69% 3. Marginal price increase for mid potential group varies from 15 – 145%, with a weighted average of 52% 4. Marginal price increase for low potential group varies from 0 – 50%, with a weighted average of 6%
Source: Technical Advisor Panel

Pricing: general recommendations

1. **Increase marginal prices of residential outdoor water by raising rates of utilities with high conservation potential to be more in line with their higher priced peers in the District**
   - Performance Indicator: Marginal price at 14,000 gallons per month
   - Timeframe: 1 - 3 years

2. **Improve customer awareness through effective billing practices**
   - Communicate historical water use and marginal rates on monthly customer bill
   - Bill at least on a monthly basis to send more immediate price signals
   - Use utility billing data to target communication to irrigators

3. **Adopt billing best-practices**
   - Distinguish between different customer classes within your billing system
   - Require separate irrigation meters for all in-ground irrigation systems
   - Sub-meter multi –family residential and non-residential customers
   - Institute a program for customers who cannot afford bills (address affordability issues)

Source: Technical Advisor Panel

Overview of key options: Conserve

Conserve

- **Conservation efficiency programs (eg, fixture retrofits)**
- **Reuse**
- **Pricing**
- **Loss Reduction**

Leak abatement options estimated to yield ~8-10 MGD by 2012, en route to 27 MGD incremental savings by 2035

	Option	Yield in 2012 (MGD)	Yield in 2035 (MGD)	Cost efficiency[1] ($/MG)	Total cost ($M)	Capital cost ($M)	Timing
1 **Leak abatement[2]**	Leak detection Valve exercising Pressure management	8-10	27	$1,200	$262	$17	Savings to begin immediately;
2 **Pipeline replacement**	Replacement of aged pipeline infrastructure	~0.6	3	$51,000 - $100,000	$1,184 - $2,368	$1,184 - $2,368	Savings to begin immediately;

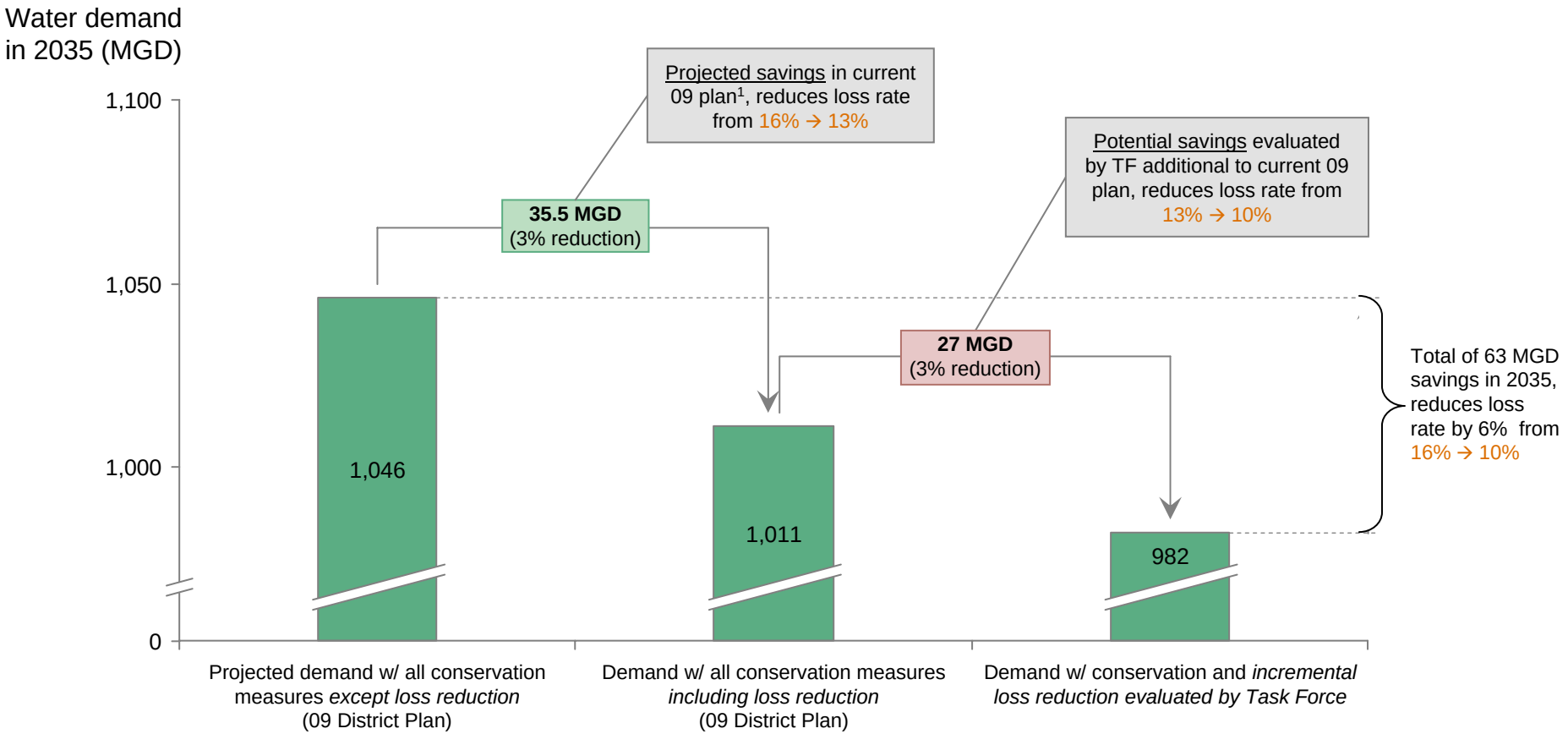
Pipeline replacement, while required in some areas, not an overall cost-effective measure to address water supply. Leak abatement (ie, rapid response) far more cost efficient

1. Based upon 25 years of lifetime yield for all measures
2. Set 10% water loss goals for all utilities, versus current plan which is to set water loss goals by individual utilities

Source: Technical Advisory Panel analysis;

Goal is to reduce current 16% water loss rate by 3% in 09 District Plan and 3% additional considered by Task Force

Metro Water District water demand forecast in 2035 and loss reduction options



Achieve 10% AWWA standard with 3% further loss reduction

1. Plan assumes reduction of all non-revenue water above 10% by half by county
Source: Metro North Georgia District Water Plan (May 2009), Technical Advisory Panel analysis;

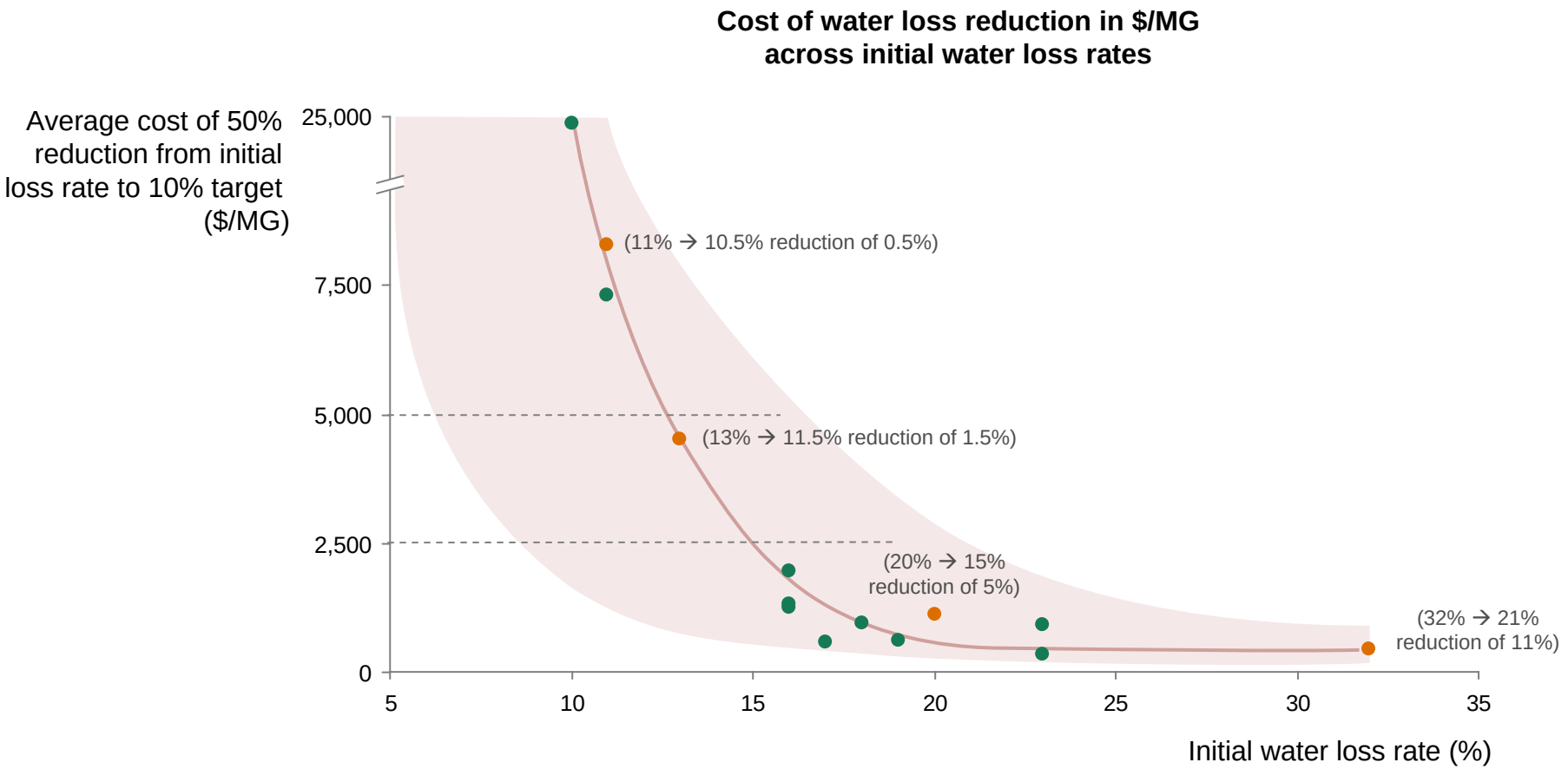
Loss reduction options considered (I)

	Description of solution	Rationale	Key challenges	Timing
1 **Leak abatement**	Expedited leak abatement program compared to current plan, targeting lower loss rate goal 1. Leak detection component to detect and repair active leaks in water pipelines 2. Valve exercising component to make sure valves are functioning properly, as they are used to isolate pipeline breaks and prevent water flow through those breaks 3. Pressure management component to use pressure sustaining valves to reduce water line breaks by reducing pressure of water during low usage periods (ie. at night when most water breaks occur)	Targeted and cost effective solutions to actively reduce water loss through leaks and breaks as they are occurring in the system	• Need regulatory framework to ensure all utilities conduct water audits to AWWA/IWA standards and have robust leak abatement program • Need accurate utility-level data for tailored loss reduction program and goals vs. arbitrary benchmarks • Funding for programs	Savings to begin immediately
2 **Pipeline replacement**	Ongoing capital program for water distribution pipeline repair and replacement to rehabilitate old pipes	Ongoing repair and replacement program can prevent future leaks, resulting in less investment on leak detection programs	• High cost of pipeline replacement program	Savings to begin immediately

Source: Technical Advisory Panel analysis;

Cost curve for loss reduction is non-linear

Loss reduction avg cost of ~$5,000/MG at loss rate of 13%, but only ~$2,500/MG at rate of 15%



Source: Metro North Georgia District Water Plan (May 2009) data provided by ARC,

Detailed cost estimates for leak abatement programs: leak detection, valve exercising and pressure mgmt

Leak detection

Population	6,000,000	persons
Population per metered unit	3	persons
# of meters	2,000,000	meters
Miles of water main	36,000	miles
# of crew persons per mile	0.003	Persons
Estimate of persons to perform leak detection	107	Persons
Estimate cost per person	$35	$/hour
Hours per year	2,000	hours/year
Estimated cost per year	$7,466,667	per year
PV of total cost:	$130,018,169	

Water savings in 2035: 20 MGD

Cost efficiency: ~ $1,400/MG

Valve exercising

Population	6,000,000	persons
Population per metered unit	3	persons
# of meters	2,000,000	meters
Miles of water main	36,000	miles
# of crew persons per mile	0.002	Persons
Estimate of persons to perform valve exercising	80	Persons
Estimate cost per person	$35	$/hour
Hours per year	2,000	hours/year
Estimated cost per year	$5,600,000	per year
PV of total cost	$97,513,627	

Water savings in 2035: 7 MGD

Cost efficiency: ~ $2,100/MG

Pressure management

Population	6,000,000	persons
# households	2,000,000	household
HHs/pressure sustaining valve	5,000	HH/PSV
# of PSVs	400	valves
Unit cost of PSV	$50,000	per valve
Total cost of PSV	$20,000,000	
PV of installing PSVs over 10-year period	$17,060,406	
Service cost for PSVs	$1,000,000	per year
PV of service/maintenance cost	$17,413,148	
PV of total cost	$34,473,553	

Water savings in 2035: 14 MGD

Cost efficiency: ~ $374/MG

Overall water savings in 2035: 27 MGD

Overall cost efficiency: ~ $1,200/MG

Note: Individual program savings not additive
Source: Technical Advisory Panel analysis;

Detailed cost estimates for pipeline replacement

Estimate of water savings	Value	Units
Current Daily Use	680	MGD
% Water Savings	0.5%	%
Water Savings	3.4	MGD
Average Savings at 25 years	5	MGD
Average Savings over 25 years (0 at begin, 5 at 2035)	2.5	MGD
Estimate of cost		
Estimate of Large Transmission Mains		
Miles of Transmission Mains/mg	3	Miles/MGD
Annual Water Use	680	MGD
Total Miles of Transmission Mains	2,267	Miles
Estimated Value of Transmission Mains/Mile	$1,500,000	$/Mile
Estimated Value of Transmission Mains	$3,400,000,000	$
Rehabilitation Costs per year as %	2%	%
Rehabilitation Costs per year	$68,000,000	$
PV of Annual Rehabilitation Costs	$1,184,094,043	$
Cost/water savings Ratio		
Averaged over 25 years	$51,341	$/MG

Use upper bound of $3,000,000/mile

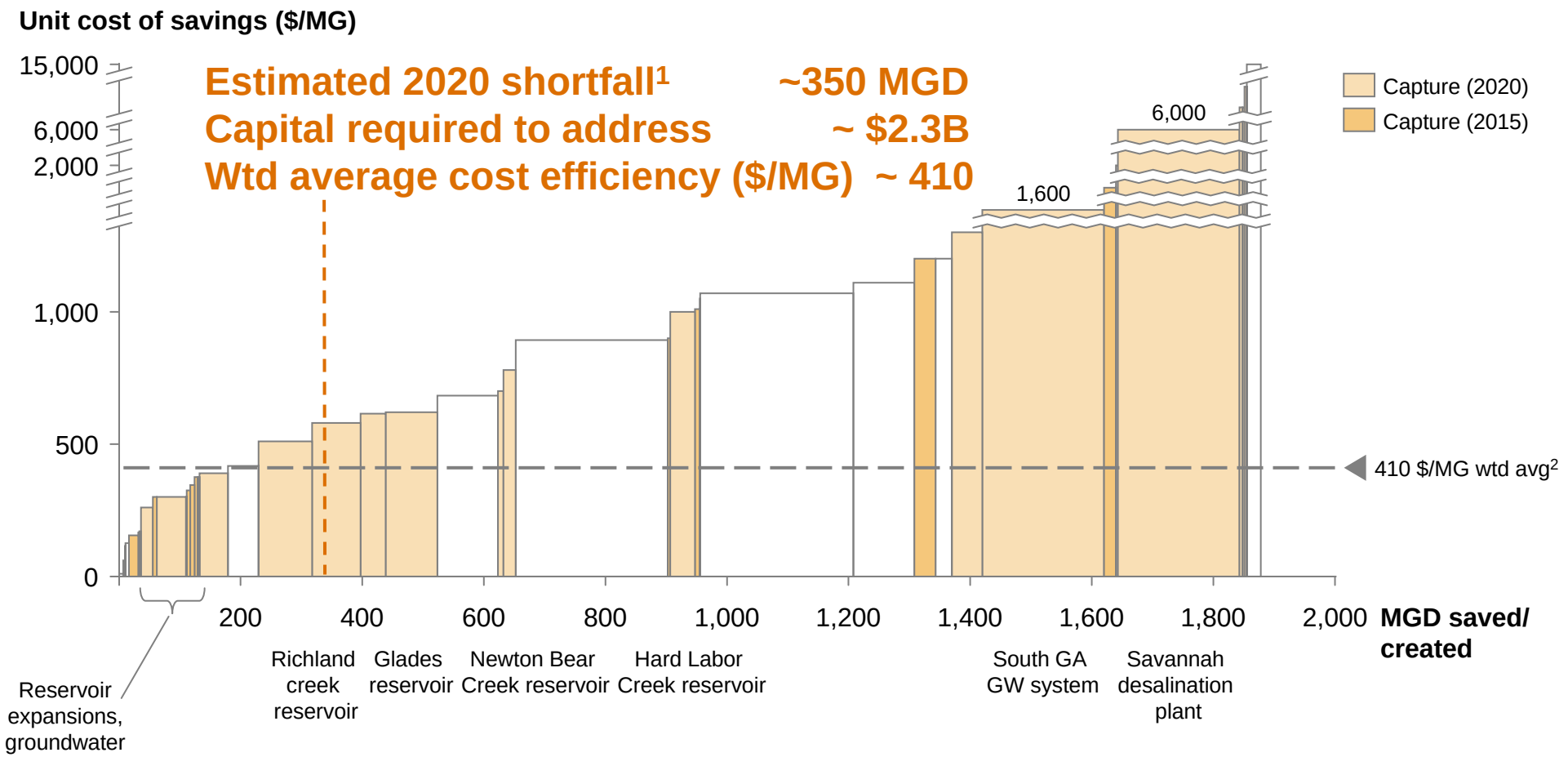
Source: Technical Advisory Panel analysis;

Overview of key options: Capture

Capture

- **Reservoirs and quarries**
- **Groundwater and ASR**
- **Desalination**
- **Water quality / treatment**

Many capture options are cost effective, potential long-term solutions

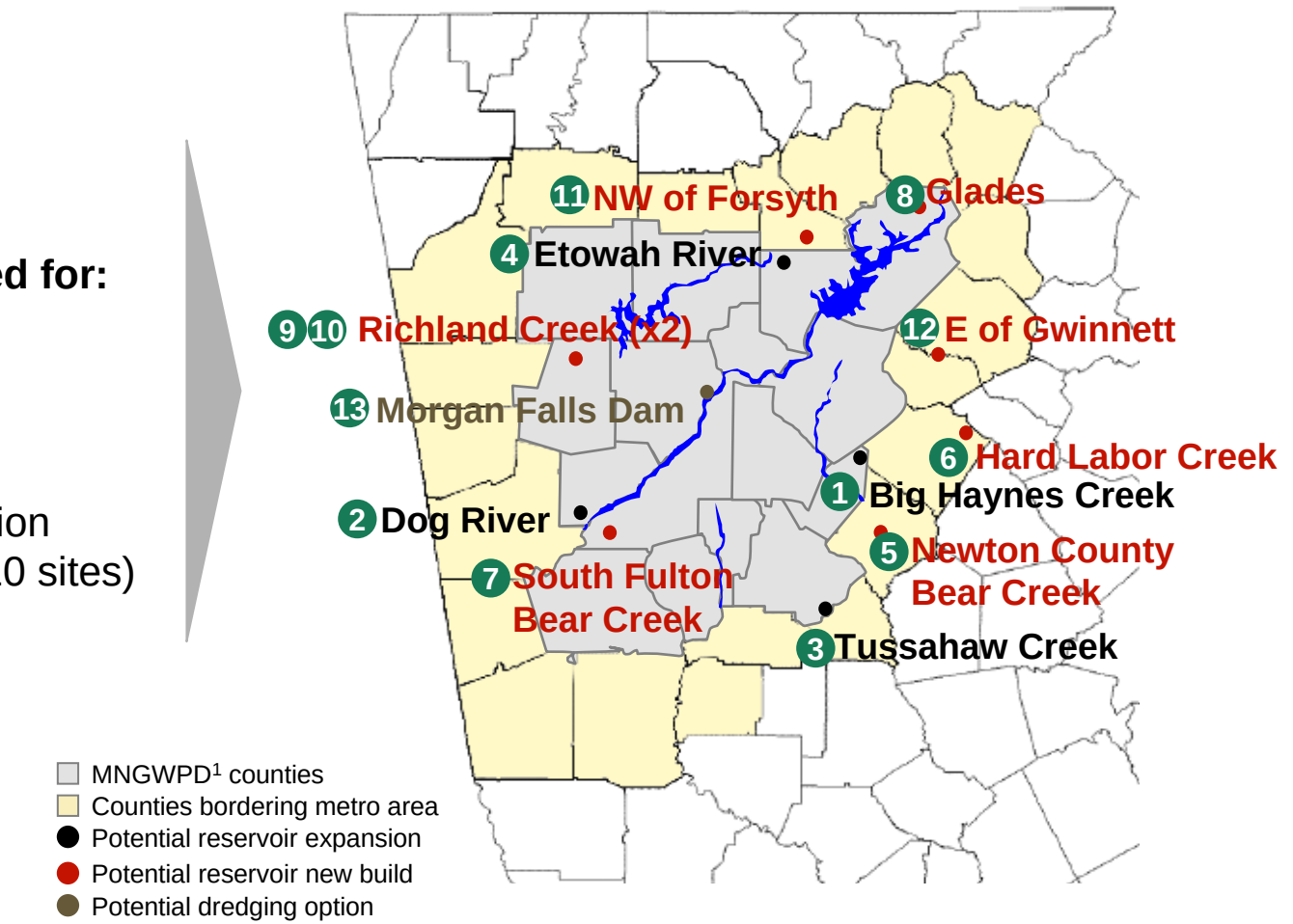


Note: 1. Shortfall = Projected 2020 demand with conservation in Metro plan – Estimated 2020 supply (Lanier and Chatt. withdrawals per ruling, all other sources at current levels). Assumes demand continues to grow until year of shortfall. Other approaches could assume demand decreases as result of ruling, thus reducing implied gap. This analysis uses existing plan demand as baseline. Shortfall only accounts for counties with deficit 2. Weighted average $/MG calculated based on options that can address 2020 gap at lowest cost
Certain option yields may not be additive due to interaction effects; cost of transfer options do not account for return to originating basin
Source: Technical Advisor Panel preliminary estimates

Total of 15 reservoir options analyzed for costs, yields, feasibility

Detailed analysis conducted for:

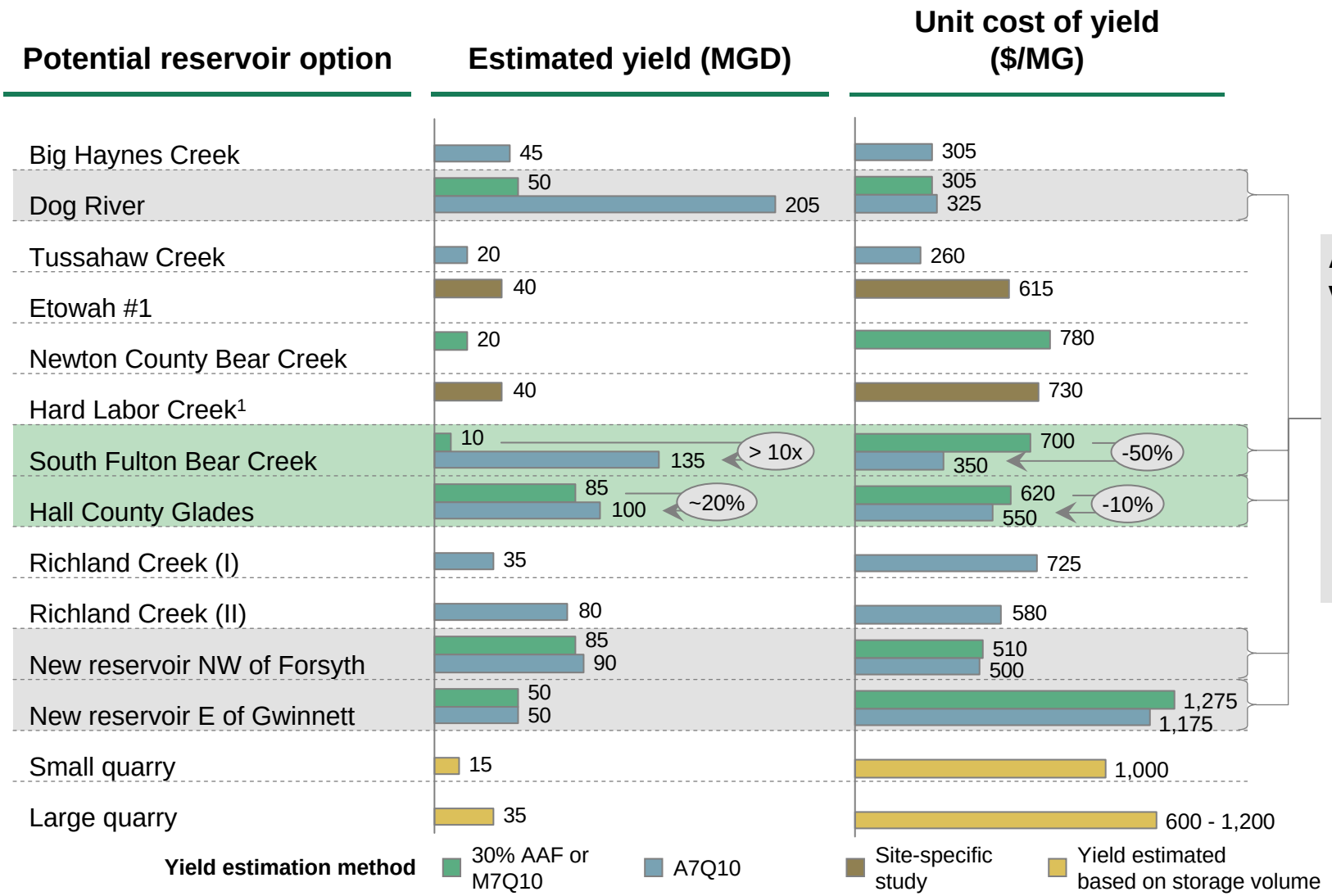
- 4 reservoir expansions
- 8 new reservoir builds
- 1 dredging option
- 2 types of quarry conversion options (could apply to ~10 sites)



1. Metropolitan North Georgia Water Planning District

Potential yields, unit costs very sensitive to min flow policy

Yields up to 10x higher and unit costs up to 50% lower possible with lower instream requirement



1. Updated cost estimates based on input from Hard Labor Creek engineering team

Source: Technical Advisory Panel

Cost, yield estimates for reservoir options (I)

	Option	Min flow policy assumption	Yield (MGD)	Cost ($/MG)	Timing (years)
Expand	Big Haynes Creek	A7Q10	45	305	8-12
	Dog River	30% AAF	50	305	8-12
	Dog River	A7Q10	205	325	8-12
	Tussahaw Creek	A7Q10	20	260	8-12
	Etowah River Dam #1	Site-specific study	40	615	8-12
Build	Newton County Bear Creek	M7Q10	20	780	8-12
	Hard Labor Creek[1]	Site specific study	40	730	8-12
	South Fulton Bear Creek	30% AAF	10	700	8-12
	South Fulton Bear Creek	A7Q10	135	350	8-12
	Hall County Glades	30% AAF	85	620	8-12
	Hall County Glades	A7Q10	100	550	8-12
	Richland Creek (I)	A7Q10	35	725	10-12
	Richland Creek (II)	A7Q10	80	580	10-12

1. Updated cost estimates based on input from Hard Labor Creek engineering team
Note: Estimates based on 50 year project life

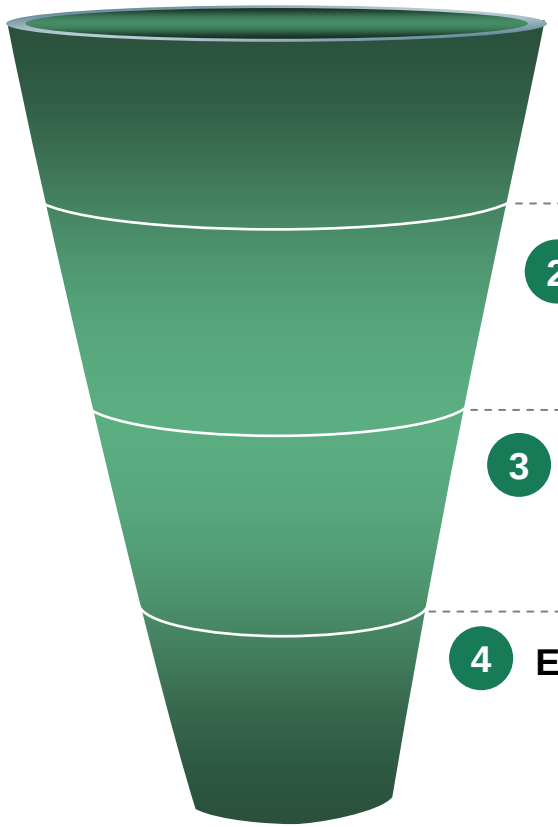
Cost, yield estimates for reservoir options (II)

	Option	Min flow policy assumption	Yield (MGD)	Cost ($/MG)	Timing (years)
Generic site reservoirs	New reservoir NW of Forsyth	30% AAF	85	510	8-12
	New reservoir NW of Forsyth	A7Q10	90	500	8-12
	New reservoir E of Gwinnett	30% AAF	50	1,275	8-12
	New reservoir E of Gwinnett	A7Q10	50	1,175	8-12
Quarries	'Small' quarries (combined total of 3 quarries)	Ample stream flow, yield limited by storage volume	15	1,000	8-12
	'Large' quarry (1 large active quarry)	Ample stream flow, yield limited by storage volume	35	600-1,200[1]	8-12
Dredge	Morgan Falls Dam (Bull Sluice Lake)	*Estimates are pending further analysis; potential yields could be highly sensitive to Buford Dam operations assumptions, which the Task Force lacks at this time*			

1. Depends significantly on acquisition cost
Note: Estimates based on 50 year project life

Four primary filters used to identify *reservoir* sites for detailed cost/ benefit analysis

Potential reservoir options



Resulting consideration set

1 Proximity to shortfall area
- Within 15 county Metro North GA Water Planning District, or
- Within a county bordering the district

2 Yield
- Estimated to provide at least 20 MGD incremental yield
- Cost effectiveness proxy + analytical resource prioritization

3 Timing (speed to impact)
- Existing reservoir that could be expanded (generally quicker)
- Potential new reservoirs in permitting / consideration phase

4 Environmental impact
- Expansions generally lower impact than new builds

Specific "instream flow" policy dictates amount of water available to withdraw from streams

Concept

Water withdrawers must leave some amount of water in streams to avoid harming aquatic life

Issue

How much water must be left in stream, and therefore how much is available for water users to withdraw?

Options

Varying opinions, but three statistically calculated values normally referenced...

	Annual 7Q10	30% AAF	Monthly 7Q10
Instream water requirement	• Lowest average flow expected to occur for 7 consecutive days once every 10 years	• 30% of stream's annual average flow • Similar in magnitude to Monthly 7Q10	• Same as Annual 7Q10, but calculated for each month • More water left instream during wet season
Water available for withdrawal	Most	Less	Least

Actual values highly site-specific, but generally...

Alternatively, a site-specific study can be completed to determine minimum flow requirements

Reservoirs: *assumptions*

Yield

For existing reservoirs that do not currently incorporate pumped storage, evaluate increased yield achieved by adding capability where feasible

For reservoirs in permitting/planning, evaluate incremental yield achieved by building higher dam or using lower instream flow requirement

All yields estimated via sophisticated modeling software, based on "usable storage" levels, and minimum instream flow as indicated per option

Costs

Wherever applicable, cost of conveyance from reservoir to a new distribution network was estimated using standardized, across-team assumptions

Costs include 30% contingency factor for dam structures

No cost included for potential water quality compatibility concerns with distribution system interconnections

Frequently asked questions on reservoir estimates

How were costs developed?

- Estimated cost of infrastructure upgrades (expansions) or new infrastructure (new builds) based on previous and current projects – effectively a rough "bid" as if a new project
- Used standardized across-team assumptions where applicable (including contingencies)

What do these costs include?

- Initial capital expense + estimated operating expense over a 50 year period
- Includes legal, permitting, design, engineering, land acquisition, infrastructure, environmental mitigation (15%), treatment, new pumps/pipes to distribution if required
- Actual dam infrastructure costs include 30% contingency factor

Are these values aggressive (low cost)?

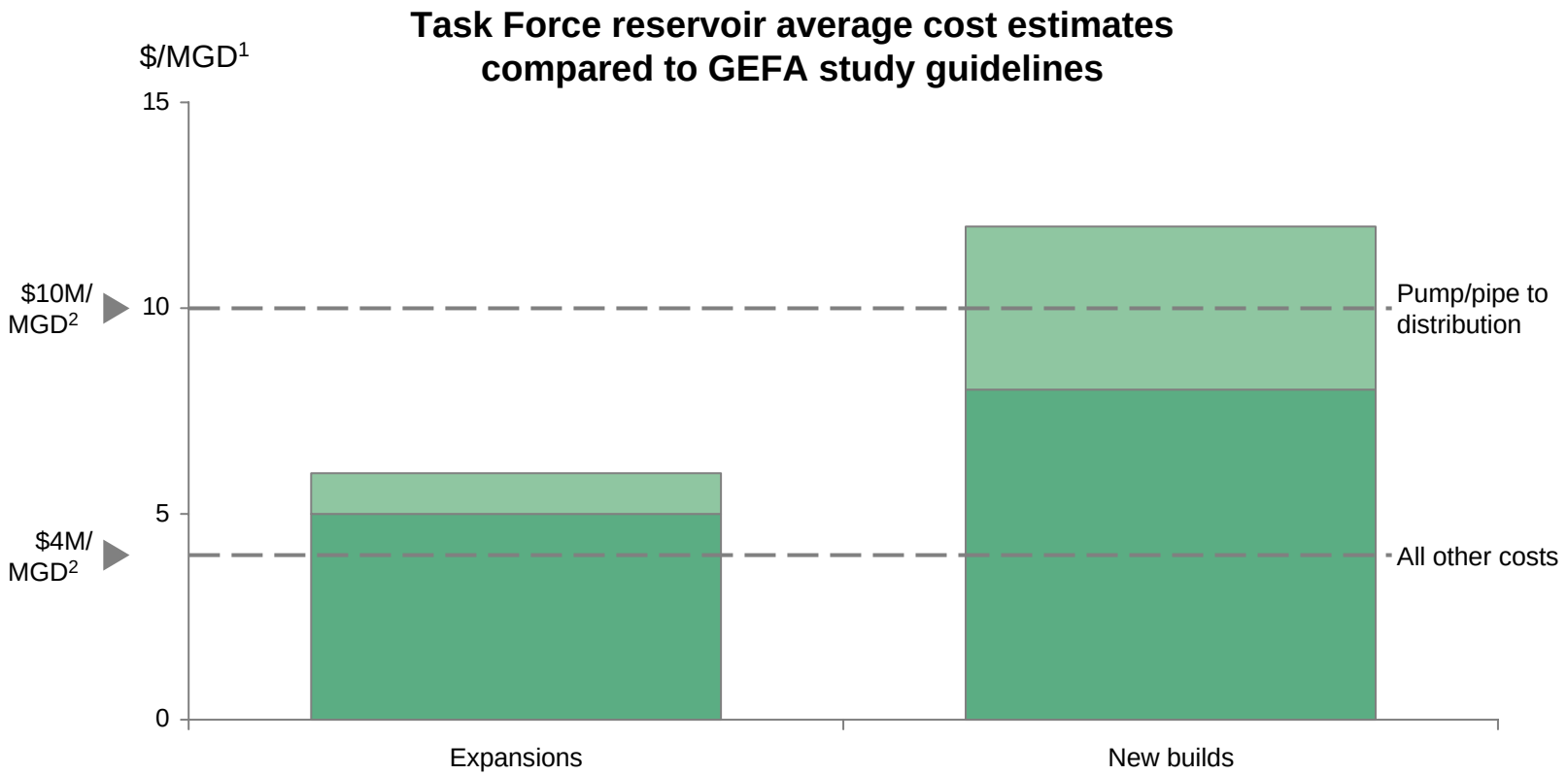
- Costs represent reasonable approximation of mid-range, conservative estimates

How do these estimates compare?

- GEFA study notes "rough estimate" of $4-10M per MGD for reservoir expansions or builds
- Task Force estimates range ~$4-6M per MGD for reservoir expansions
- Task Force estimates range ~$8-19M per MGD for new reservoir builds (~$5-11M excluding pump + pipe infrastructure to distribution systems)

Reservoir cost estimates fall within industry guidelines

Expansions at lower end of range, with new builds middle to high end



1. Total cost (capital expense + operating expenses) per MGD of new supply yield 2. Endpoints of $4M-$10M per MGD range reported in GEFA study as guidelines for reservoir costs based on contemporary experience in Georgia
Source: GEFA study "Georgia Inventory and Survey of Feasible Sites for Water Supply Reservoirs", October 2008

Reservoir options considered (I)

Expand

	Option	Description	Rationale	Key challenges	Timing (years)
1	Big Haynes Creek Reservoir	Add pumped storage from Yellow River (when surplus available in this larger nearby river, pump into reservoir for storage rather than allowing it to flow downstream unused); Rockdale county water treatment plant (WTP) treat and sell extra yield to Gwinnett	Not an interbasin transfer (IBT), not a long distance movement of water, not an interstate basin, significant new yield, increased water reuse, existing purchase connection between counties	Public acceptance of indirect wastewater reuse	8-12
2	Dog River Reservoir	Raise dam height, add pumped storage from Chattahoochee River; Douglas county WTP treat and sell extra yield to Cobb County	Not an IBT, not a long distance movement of water, reasonable new yield, increased water reuse, existing purchase connection between counties	Corps of Engineers (COE) permit for reservoir expansion, Public acceptance of indirect reuse of wastewater, interstate stream	8-12
3	Tussahaw Creek Reservoir	Add pumped storage from Jackson Lake (at Newton/ Butts/ Jasper lines); Henry Co treat and sell extra yield to DeKalb County	Not an IBT, not an interstate stream, existing purchase connection between counties	Limited new yield, long distance movement of water, new use of Lake Jackson (Federal Energy Regulatory Commission (FERC) and Georgia Power approval)	8-12
4	Etowah River Dam 1 NRCS Reservoir	Raise dam height, convert from flood control to water supply, pump yield to Forsyth County WTP	Existing reservoir, not an IBT	COE permit for new water supply reservoir, interstate stream, limited yield	8-12

Source: Technical Advisory Panel

Reservoir options considered (II)

Build

	Option	Description	Rationale	Key challenges	Timing (years)
5	Newton County Bear Creek Reservoir	Build reservoir, add pumped storage from Jackson Lake, Newton Co sell 20 MGD from Cornish Creek to Gwinnett	Not an IBT, not an interstate stream	Limited new yield, long distance, new use of Lake Jackson (FERC and Georgia Power approval, COE permit for new reservoir	8-12
6	Hard Labor Creek Reservoir	Build reservoir, pumped storage from Apalachee, new WTP, pipeline to Gwinnett, sell excess water to Gwinnett	Reservoir permitted, dam designed, not an IBT, significant new yield, strong local support	Long distance movement of water	8-12
7	South Fulton Bear Creek Reservoir	Build reservoir, pumped storage from Chattahoochee, new WTP, pipeline to Atlanta, sell excess water to South Fulton and City of Atlanta	Not an IBT, significant new yield, local government support, increase water reuse, existing purchase connection between counties	Public acceptance of indirect wastewater reuse, interstate stream, COE permit for new reservoir, City of Atlanta opposition	8-12
8	Hall County Glades Reservoir	Build reservoir, pumped storage from Chattahoochee, new WTP, half yield to Gainesville, half to Gwinnett	No new IBT, very significant yield, local support, land owned by local government, located to serve several governments	COE permit for reservoir, interstate basin, long distance movement of water	8-12
9	Paulding County Richland Creek Reservoir (#1)	Build reservoir, pumped storage from Etowah, pipe to Paulding Co WTP	Significant new yield, reservoir land purchased, strong local government support	COE permit for reservoir, potential IBT, interstate basin	10-12
10	Paulding County Richland Creek Reservoir (#2)	Build larger reservoir, pumped storage from Etowah, new WTP, sell excess yield to Cobb and/or Bartow counties	Very significant new yield	COE permit for new reservoir, potential IBT, interstate basin	10-12

Source: Technical Advisory Panel

Reservoir options considered (III)

	Option	Description	Rationale	Key challenges	Timing (years)
Build	11 New reservoir NW of Forsyth	Build reservoir to supply Forsyth County, pumping raw water to the Forsyth WTP	Very significant new yield, no IBT	COE permit for new reservoir, interstate stream, EPD approval of instream flow	8-12
	12 New reservoir E of Gwinnett	Build reservoir with pumped storage east of Gwinnett County, pumping raw water to Gwinnett WTP	Significant new yield	Potential IBT, potential interstate stream, long distance movement of water, COE permit for new reservoir, EPD approval of instream flow	8-12
Dredge	13 Dredge Bull Sluice Lake (behind Morgan Falls dam)	Dredge Bull Sluice Lake (behind Morgan Falls Dam) to create additional storage and provide incremental yield to existing water treatment plants	Increase capacity of Bull Sluice Lake; some additional yield for Cobb County, City of Atlanta	Limited new yield, environmental permitting; access to land (purchase or lease) for dewatering/loading; local resident impacts (heavy truck traffic, noise); damage to public roads, wildlife impacts; 2.75 years of field operations; significant permitting time	8-12
Quarries	14 Convert 'small' quarry (~3 BG) to water storage	Add pumped storage from any sizeable stream, pump raw water to an existing WTP	No reservoir needed, may help augment localized storage needs	Limited new yield, few inactive quarries available in proximity to area of shortfall	8-12
	15 Convert 'large' quarry (~15 BG) to water storage	Add pumped storage from any sizeable stream within 10 miles, pump raw water 10 miles to an existing WTP	No reservoir needed, significant new yield	Long distance movement of water, only one 'large' quarry in area and it is still active, significant acquisition cost likely	8-12

Source: Technical Advisory Panel

Reservoir options submitted by Task Force

Source	Option	Yield (MGD)	Comparison to options considered by TAP team
GSWCC	Expand Raccoon Creek #8	11	Similar location/costs, lower yield than Richland Creek options Could it be implemented more quickly?
	Expand Ellijay River #1	10	No direct impact to affected counties w/o adding high transport costs
	Expand Talking Rock Creek #13	2	No direct impact to affected counties w/o adding high transport costs
	Expand Etowah River #1	24	Included in detailed analysis set
Habersham EMC	Build Habersham Reservoir	TBD (max <99)	Impounding a major stream not likely to be permitted Costs higher (longer transport), yields lower (in-stream vs. off-stream pump storage from same source) than Hall County Glades Reservoir

Source: "Inventory and Assessment of USDA/Soil and Water Conservation District Watershed Dams" (Mar 16, 2009); email communications from GSWCC and Habersham EMC

Detailed cost estimates for options (I)

Team: Reservoirs

		Capital Cost				Annual Operating Cost				
	Option	Pump & pipe ($M)	Water treat-ment ($M)	Other capital costs[1] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint ($M)	Total ($M)	Total cost[2] ($M)
Expand	Big Haynes Creek	0	117	108	225	0.9	0.1	0.5	1.5	262
	Dog River (30% AAF)	0	119	112	231	0.7	0.2	0.5	1.4	267
	Dog River (A7Q10)	391	438	122	951	8.9	0.4	0.5	9.8	1,202
	Tussahaw Creek	0	54	10	64	0.6	0.1	0.5	1.2	95
	Etowah River Dam #1	91	102	158	351	3.5	0.3	0.5	4.3	460
Build	Newton County Bear Creek	163	54	8	225	1.7	0.1	0.5	2.3	285
	Hard Labor Creek[3]	58	219	151	428	4.1	0.2	0.5	4.8	750
	South Fulton Bear Creek (30% AAF)	0	27	68	95	0.1	0.1	0.5	0.6	110
	South Fulton Bear Creek (A7Q10)	332	300	87	719	5.6	0.2	0.5	6.3	882
	Hall County Glades (30% AAF)	355	201	226	782	6.8	0.3	0.5	7.6	978
	Hall County Glades (A7Q10)	364	226	213	803	7.2	0.3	0.5	8.0	1,008
	Richland Creek (I)	114	89	138	341	4.0	0.2	0.5	4.7	462
	Richland Creek (II)	171	185	260	616	7.8	0.3	0.5	8.6	837

1. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 2. Indicates total cost in 2010$ over the life of the project, discounted at 3% 3. Updated cost estimates based on input from Hard Labor Creek engineering team
Note: All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Detailed cost estimates for options (II)

Team: Reservoirs

	Option	Capital Cost: Pump & pipe ($M)	Capital Cost: Water treat-ment ($M)	Capital Cost: Other capital costs[1] ($M)	Capital Cost: Total ($M)	Annual Operating Cost: Annual Pumping (Power) ($M)	Annual Operating Cost: Annual O&M ($M)	Annual Operating Cost: Annual res. maint ($M)	Annual Operating Cost: Total ($M)	Total cost[2] ($M)
Generic	Reservoir NW of Forsyth (30% AAF)	161	202	294	657	5.3	0.3	0.5	6.1	815
	Reservoir NW of Forsyth (A7Q10)	161	206	283	650	5.3	0.3	0.5	6.1	806
	Reservoir E of Gwinnett (30% AAF)	497	122	343	962	7.1	0.3	0.5	7.9	1,170
	Reservoir E of Gwinnett (A7Q10)	497	122	252	871	7.1	0.3	0.5	7.9	1,073
Quarry	'Small' quarry	37	23	34	95	1.1	0.1	0.5	1.7	140
	'Large' quarry	78	95	77 - 577[3]	250 – 750	3.6	0.2	0.5	4.3	360 – 860
Dredge	Morgan Falls dam (Bull Sluice Lake)	*Estimates are pending further analysis; potential yields could be highly sensitive to Buford Dam operations assumptions, which the Task Force lacks at this time'*								

1. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 2. Indicates total cost in 2010$ over the life of the project, discounted at 3% 3. Highly uncertain acquisition costs for a large, active quarry
Note: All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Big Haynes Creek Reservoir

Reservoirs: expansion

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
A7Q10	45	305	2-4	6-8	8-12

Costs

Instream flow	Capital Cost				Annual Operating Cost				Total cost[3] ($M)
	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint ($M)	Total ($M)	
A7Q10	0	117	108	225	0.9	0.1	0.5	1.5	262

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some minor sensitivities	Minimal concern, mainly over public acceptance of indirect wastewater reuse	Water withdrawal Drinking water	No

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Dog River Reservoir

Reservoirs: expansion

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
30% AAF	50	305	2-4	6-8	8-12
A7Q10	205	325	2-4	6-8	8-12

Costs

Instream flow	Capital Cost				Annual Operating Cost				Total cost[3] ($M)
	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	
30% AAF	0	119	112	231	0.7	0.2	0.5	1.4	267
A7Q10	391	438	122	951	8.9	0.4	0.5	9.8	1,202

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some significant sensitivities	Interstate stream, some concern over public acceptance of indirect wastewater reuse	Water withdrawal Drinking water Safe dams 404	No

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Tussahaw Creek Reservoir

Reservoirs: expansion

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
A7Q10	20	260	2-4	6-8	8-12

Costs

	Capital Cost				Annual Operating Cost				
Instream flow	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
A7Q10	0	54	10	64	0.6	0.1	0.5	1.2	95

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	Long movement of water, new use of Jackson Lake, requires FERC and GA Power approval	Water withdrawal Drinking water	No

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Etowah River Dam #1 Reservoir

Reservoirs: expansion

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
Site-specific study	40	615	2-4	6-8	8-12

Costs

	Capital Cost				Annual Operating Cost				
Instream flow	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
Site-specific study	91	102	158	351	3.5	0.3	0.5	4.3	460

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some significant sensitivities	COE permit for new reservoir, EPD approval of instream flow, interstate stream, limited yield	Water withdrawal Drinking water Safe dams 404	No

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Newton County Bear Creek Reservoir

Reservoirs: new build

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
M7Q10	20	780	2-4	6-8	8-12

Costs

	Capital Cost				Annual Operating Cost				
Instream flow	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
M7Q10	163	54	8	225	1.7	0.1	0.5	2.3	285

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some significant sensitivities	Long distance movement of water, new use of Lake Jackson (FERC and Georgia Power Co. approval , COE permit for new reservoir	Water withdrawal Drinking water Safe dams 404	No

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Hard Labor Creek Reservoir

Reservoirs: new build

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
Site-specific study	40	730	2-4	6-8	8-12

Costs[5]

Instream flow	Capital Cost				Annual Operating Cost				Total cost[3] ($M)
	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	
Site-specific study	58	219	151	428	4.1	0.2	0.5	4.8	750

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some minor sensitivities	Long distance movement of water	Drinking water	No

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance" 5. Updated cost estimates based on input from Hard Labor Creek engineering team
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

South Fulton Bear Creek Reservoir

Reservoirs: new build

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
30% AAF	10	700	2-4	6-8	8-12
A7Q10	135	350	2-4	6-8	8-12

Costs

Instream flow	Capital Cost				Annual Operating Cost				
	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
30% AAF	0	27	68	95	0.1	0.1	0.5	0.6	110
A7Q10	332	300	87	719	5.6	0.2	0.5	6.3	882

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	Public acceptance of indirect wastewater reuse, interstate stream, COE permit for new reservoir, EPD approval of instream flow, City of Atlanta opposition	Water withdrawal Drinking water Safe dams 404	Yes (SDS restriction)[5]

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance" 5. Cannot proceed until a new Service Delivery Strategy (SDS) is developed for Fulton County, or HB 406 is passed exempting multigovernmental reservoirs from the SDS restrictions.
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Hall County Glades Reservoir

Reservoirs: new build

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
30% AAF	85	620	2-4	6-8	8-12
A7Q10	100	550	2-4	6-8	8-12

Costs

	Capital Cost				Annual Operating Cost				
Instream flow	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
30% AAF	355	201	226	782	6.8	0.3	0.5	7.6	978
A7Q10	364	226	213	803	7.2	0.3	0.5	8.0	1,008

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	COE permit for reservoir, interstate basin, EPD approval of instream flow, long distance movement of water	Water withdrawal Drinking water Safe dams 404	Yes (IBT)

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Richland Creek Reservoir (I)

Reservoirs: new build

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
A7Q10	35	725	2-4	6-8	8-12

Costs

	Capital Cost				Annual Operating Cost				
Instream flow	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
A7Q10	114	89	138	341	4.0	0.2	0.5	4.7	462

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	COE permit for reservoir, potential IBT, interstate basin, EPD approval of instream flow	Water withdrawal Drinking water Safe dams 404	Yes (IBT)

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Richland Creek Reservoir (II)

Reservoirs: new build

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
A7Q10	80	580	2-4	6-8	8-12

Costs

	Capital Cost				Annual Operating Cost				
Instream flow	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
A7Q10	171	185	260	616	7.8	0.3	0.5	8.6	837

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	COE permit for reservoir, potential IBT, interstate basin, EPD approval of instream flow	Water withdrawal Drinking water Safe dams 404	Yes (IBT)

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

New Reservoir NW of Forsyth

Reservoirs: new build

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
30% AAF	85	510	2-4	6-8	8-12
A7Q10	90	500	2-4	6-8	8-12

Costs

	Capital Cost				Annual Operating Cost				
Instream flow	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
30% AAF A7Q10	161	202	294	657	5.3	0.3	0.5	6.1	815

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	COE permit for new reservoir, interstate stream, EPD approval of instream flow	Water withdrawal Drinking water Safe dams 404	No

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

New Reservoir E of Gwinnett

Reservoirs: new build

Yield

Instream flow assumption	Yield (MGD)	Cost ($/MG)	Timing (years) Pre-const	Const	Overall[1]
30% AAF	50	1,275	2-4	6-8	8-12
A7Q10	50	1,175	2-4	6-8	8-12

Costs

	Capital Cost				Annual Operating Cost				
Instream flow	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	Total cost[3] ($M)
30% AAF A7Q10	497	122	343	962	7.1	0.3	0.5	7.9	1,170

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	Potential IBT, potential interstate stream, long distance movement of water, COE permit for new reservoir, EPD approval of instream flow	Water withdrawal Drinking water Safe dams 404	Yes (IBT)

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Quarry options

Reservoirs: convert quarries

Yield

Size of quarry	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-const	Const	Overall[1]
Small (~3 BG)	5 (per quarry)	1,000	2-4	6-8	8-12
Large (~15 BG)	35	600 - 1,200	2-4	6-8	8-12

Costs

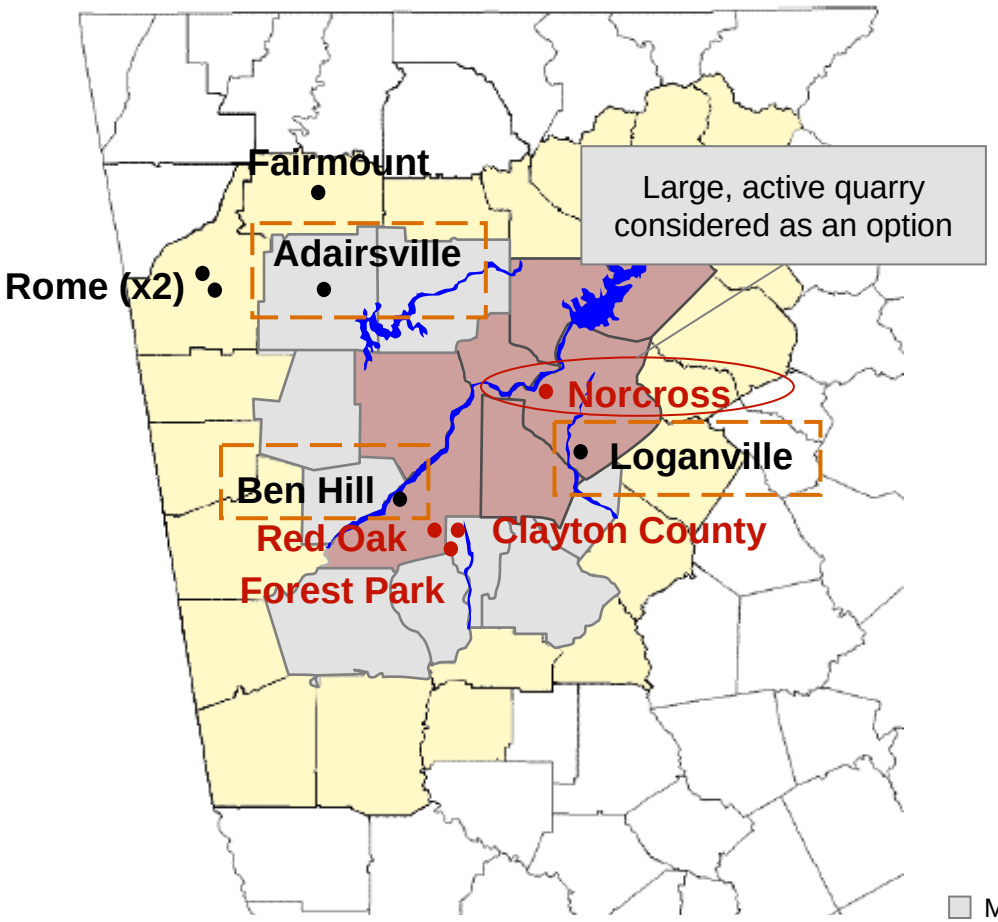
Size of quarry	Capital Cost				Annual Operating Cost				Total cost[3] ($M)
	Pump & pipe ($M)	Water treatment ($M)	Other capital costs[2] ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Annual res. maint[4] ($M)	Total ($M)	
Small	37	23	34	95	1.1	0.1	0.5	1.7	140
Large	78	95	77 – 577	250 – 750	3.6	0.2	0.5	4.3	360 - 860

Stakeholder sensitivity

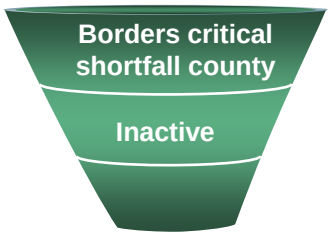
Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some minor sensitivities	Potential long distance movement of water, highly uncertain acquisition costs of active quarries	Water withdrawal Drinking water	No

1. Includes 1 year for reservoir to fill with water 2. Includes pre-construction, reservoir system infrastructure, and environmental mitigation costs 3. Indicates total cost in 2010$ over the life of the project, discounted at 3% 4. "Annual reservoir maintenance"
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Three small, inactive quarries within Metro area could provide 5-25 MGD yield at cost of $1,000-1,500/ MG



Filtering for inactive status + proximity to critical shortfall area suggests 3 potential options



3	**Quarries**
2 – 8 MGD	**Estimated yield per quarry**
~5 – 25 MGD	**Total small quarry potential**

1. In development for water storage use by City of Atlanta 2. Metropolitan North Georgia Water Planning District
Source: EPD - Metropolitan Atlanta abandoned quarries (greater than 50 acres); City of Atlanta DWM - Atlanta Area Quarry Inventory

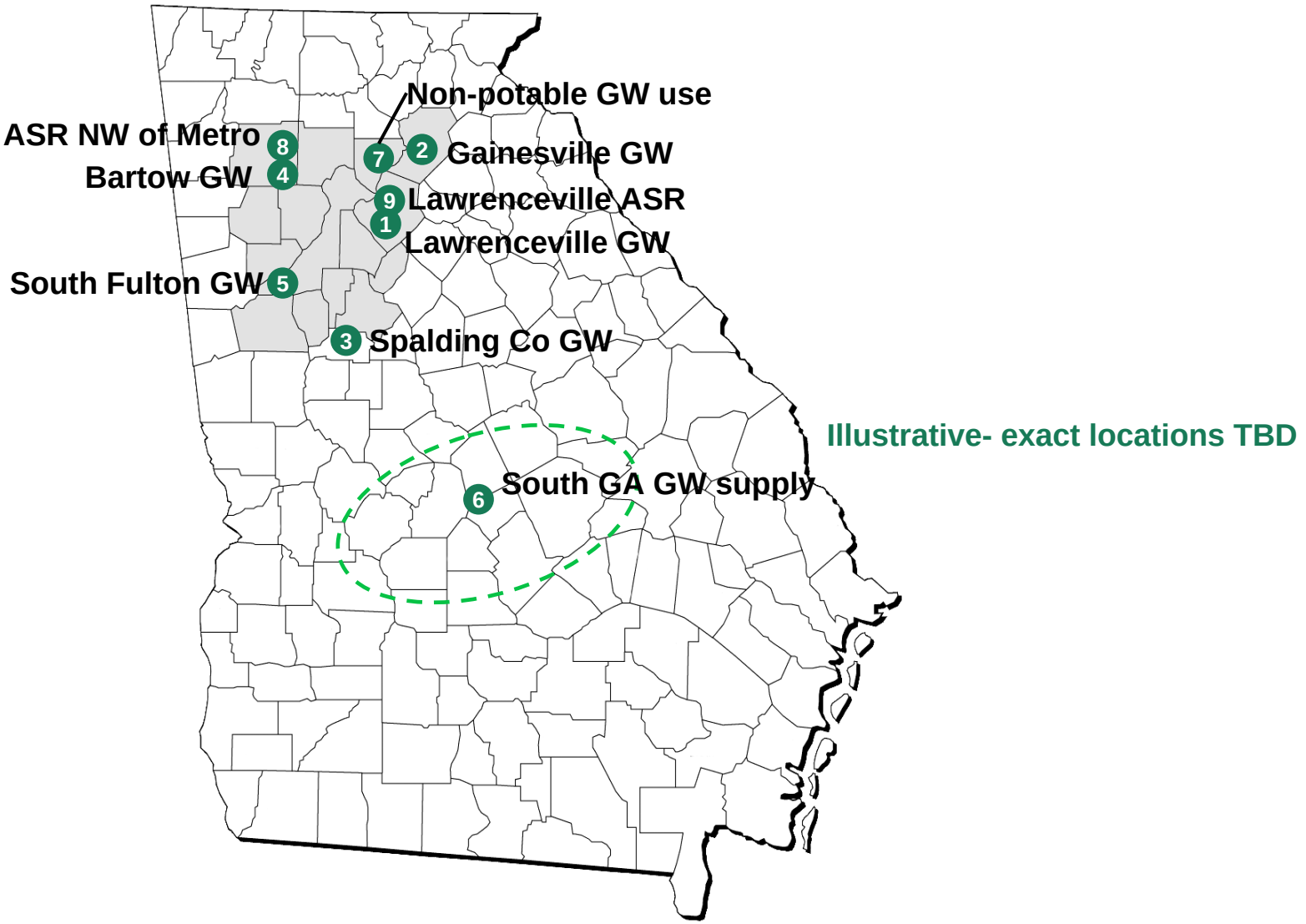
Overview of key options: Capture

Capture

- **Reservoirs and quarries**
- **Groundwater and ASR**
- **Desalination**
- **Water quality / treatment**

Total of 9 specific groundwater options evaluated

Topic: Aquifer Storage and Recovery (ASR) / Groundwater (GW)



ASR/Groundwater option summary

	Option	Yield (MGD)	Cost ($/MG)	Timing (years)
Ground-water	Lawrenceville groundwater	6	300	3
	Gainesville groundwater	5	375	3
	Spalding county groundwater	6	325	3
	Bartow groundwater	7	345	4
	Palmetto groundwater	2	375	4
	South GA groundwater	200	1,600	8-10
	Groundwater for non-potable use in Metro area	15	155	3
ASR	ASR northwest of Metro area	20	1,840	4-6
	ASR to augment Lawrenceville groundwater	4	900	3-5

Note: Estimates based on 50 year project life

ASR/Groundwater: *context*

Ground Water System

What is an aquifer?
- A geological formation containing water which supplies wells and springs.

What is groundwater?
- Water contained within an aquifer

How is groundwater used?
- Over 50% of the US population uses ground water as their primary water source
- Many cities use ground water as primary supply or to augment other supply sources

Is groundwater used in Georgia?
- Groundwater serves ~20% of all GA water use
- Largest uses are irrigation, public supply (drinking, household use, etc), and industrial

Is groundwater used in Metro North Georgia?
- Groundwater <1% of Metro public supply use
- Regional geology not conducive to large yield, but does provide some yield in localized areas

Aquifer Storage and Recovery

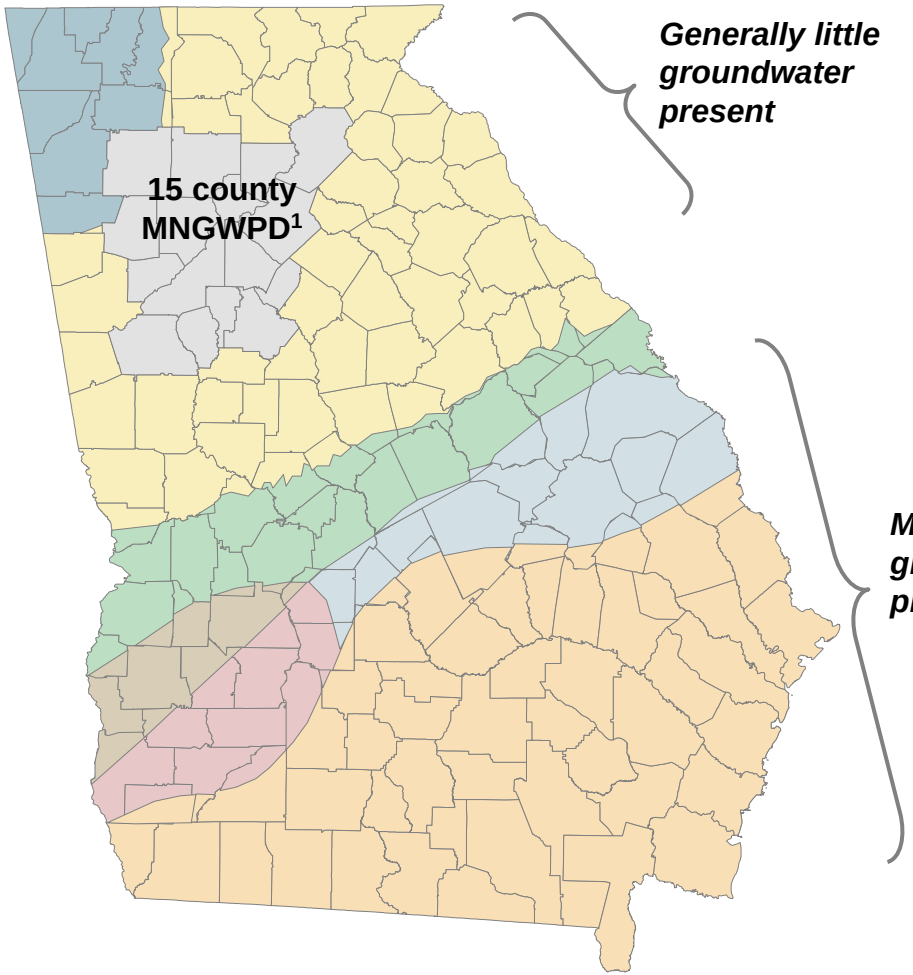
What is ASR?
- A system designed to inject surplus water into an aquifer for extraction at a later time
- Can be thought of as an underground reservoir without evaporative losses and with minimal environmental impacts

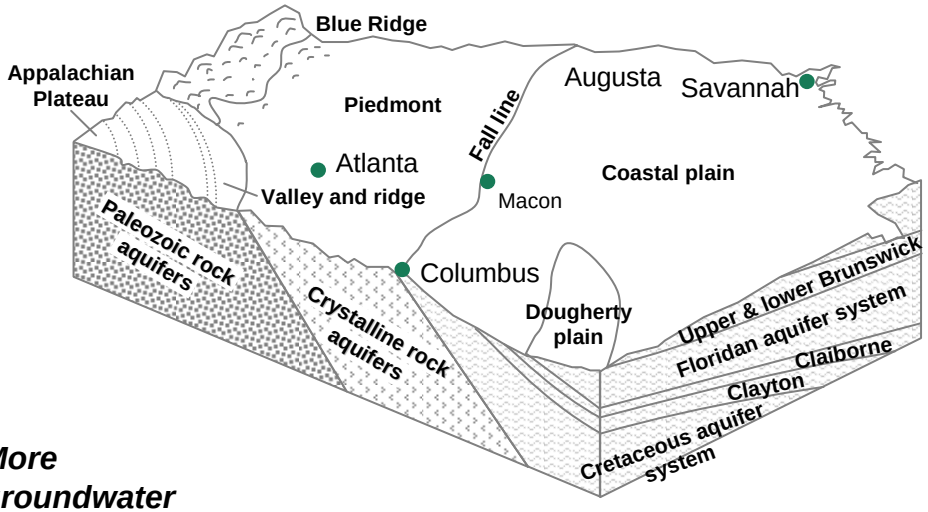
How is ASR used?
- When water is available (periods of high flow or off-peak demand), excess water is injected into the aquifer
- During peak demand periods, water is recovered to augment supply
- Note: water would be treated both before injection and after recovery in Georgia
- There are currently ~95 ASR well fields in operation in 20 US states
- Etowah Water Bank, currently in development in Rome, GA, is an example of ASR

Source: USGS, Etowah Water Bank fact sheet, Metro Water Plan (2009)

Major aquifers in Georgia

Geologic formations in south GA generally contain more abundant groundwater





Coastal plain aquifers
- Floridan
- Floridan, Claiborne, Clayton, Cretaceous
- Floridan, Cretaceous
- Claiborne, Clayton, Cretaceous
- Cretaceous

Piedmont and Blue Ridge aquifers
- Crystalline rock

Valley and Ridge and Appalachian Plateau
- Paleozoic rock

1. Metropolitan North Georgia Water Planning District

Description of options in consideration

Topic: Aquifer Storage and Recovery (ASR) / Groundwater (I)

Groundwater

	Option	Description	Rationale	Key challenges	Timing (years)
1	Lawrenceville	New groundwater supply system in Lawrenceville (Gwinnett)	Hydrogeologic investigations completed, 6 existing wells ready for permitting; 6 new well sites available (70-350 gallons per minute (gpm))	EPD permitting; many wells in industrial or highly developed areas; minor volatile organic compounds (VOC's) locally present in groundwater	~3
2	Suwanee to Gainesville corridor	New groundwater supply system in Suwanee to Gainesville Corridor (Hall County)	Area contains unique geologic environment that locally contains marbles; generally highly solutioned and provide very high yields (200-400 gpm); some existing wells produce up to 1 MGD; option plans for 12 wells, 5 MGD total	EPD permitting; by nature, wells in marbles very turbid; may require additional treatment; potential for land subsidence if over pumped	~3
3	Spalding County, near Griffin	New groundwater supply system in Spalding county, reduce upper Chattahoochee withdrawals	Unique geologic environment near Griffin would allow for very productive well fields (100-600 gpm); existing water supply and finished water lines in area	EPD permitting; many existing wells and new well sites are in industrial areas, pumping during summer of 2000 showed low levels of VOC's	~3
4	Bartow County	New groundwater supply system in Bartow county, provide additional water to Bartow, Cobb, Paulding counties	Geology of the Valley and Ridge had provided extremely high yielding wells, ranging up to 3,000 gpm (4.3 MGD); new wells for Emerson are promising; within 15 county Metro region	EPD permitting; potential for land subsidence if not properly managed; could require extensive development to remove turbidity from the system	~4
5	South Fulton (Palmetto)	New groundwater supply system in South Fulton (Palmetto), reduce upper Chattahoochee withdrawals	Many high yielding wells (80-400 gpm) have been drilled for industrial uses; none of the wells have been used or tested for drinking water	EPD permitting; retrofitting wells to drinking water standards; existing wells are privately owned	~4

Source: Technical Advisory Panel

Description of options in consideration

Topic: Aquifer Storage and Recovery (ASR) / Groundwater (II)

	Option	Description	Rationale	Key challenges	Timing (years)
Groundwater	6 Large, south GA supply system	Develop large (~200 MGD) groundwater supply system in south GA, create new water authority to manage supply, Metro area buy water	High yield aquifers in SW GA; well field development will financially benefit rural GA	Public perception (Atlanta taking water), possible basin transfer issues.	8-10
Groundwater	7 Non-potable groundwater supply	Use localized groundwater systems for non-potable uses in Gwinnett, Hall, Forsyth such as irrigation, cooling facilities, industrial process water	Replace use of treated water with groundwater for non-potable applications; process has been operating for decades, with great success, by those unable to receive adequate service from government-mandated central water suppliers	Resistance to invest in individual well system. Irrigation use is seasonal, so demand in summer is reduced.	~3
ASR	8 ASR northwest of Metro area	Install ASR system northwest of Metro area; provide additional yield directly to Metro area counties (Cobb, Bartow, Paulding), pump water to existing WTP's	Develop ASR well field in Floyd and/or Bartow Counties; store off-peak treated water; reduces evaporative loss from reservoirs; meet peak demand requirements	Public perception (Atlanta taking water), permitting; requires feasibility testing in NW Georgia; ultimately yield is based on excess water supply available to recharge ASR well field	4-6
ASR	9 ASR in Lawrenceville area	Install ASR system in Lawrenceville to provide additional yield directly to Gwinnett	Use ASR to supplement recharge in the Lawrenceville system; store off-peak treated water; provide water to Gwinnett County	Permitting due to well head protection issues (physical security of wells against tampering); public perception of contamination issues (VOC's)	3-5

Source: Technical Advisory Panel

Detailed cost estimates for options

Team: Aquifer Storage and Recovery (ASR) / groundwater

		Capital Cost				Annual Operating Cost				
	Option	Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Other annual costs ($M)	Total ($M)	Total cost[2] ($M)
Ground-water	Lawrenceville groundwater	3.9	0.3	0.3	4.5	0.5	0.6	0.1	1.1	35
	Gainesville groundwater	9.5	0.3	0.4	10.2	0.4	0.5	0.1	0.9	35
	Spalding county groundwater	6.3	0.3	0.5	7.2	0.5	0.6	0.1	1.1	35
	Bartow groundwater	9.5	0.5	1.0	11.0	0.5	0.7	0.1	1.3	45
	Palmetto groundwater	2.6	0.3	0.4	3.2	0.2	0.2	0.1	0.4	15
	South GA groundwater	2,535	10	102	2,647	50	37	37	124	5,840
	Groundwater for non-potable use in Metro area	n/a	n/a	8	8	1	0	0	1	35
ASR	ASR northwest of Metro area	350	n/a[1]	100	450	2.9	5.5	0	8.5	670
	ASR to augment Lawrenceville groundwater	3.9	n/a[1]	15	19	0.7	1.1	0	1.8	65

1. Option would use available capacity at existing WTP's 2. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Lawrenceville groundwater

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-const	Const	Overall
~6	300	2	1	3

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
3.9	0.3	0.3	4.5	0.5	0.6	0.1	1.1	35

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some minor sensitivities	Many wells in industrial or highly developed areas, minor Volatile Organic Compounds locally present in ground water	Water withdrawal Drinking water	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Gainesville groundwater

Yield

		Timing (years)		
Yield (MGD)	Cost ($/MG)	Pre-const	Const	Overall
~5	375	2	1	3

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
9.5	0.3	0.4	10.2	0.4	0.5	0.1	0.9	35

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some minor sensitivities	Potential development of land subsidence if over pumped	Water withdrawal Drinking water	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Spalding County groundwater

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-const	Const	Overall
~6	325	2	1	3

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
6.3	0.3	0.5	7.2	0.5	0.6	0.1	1.1	35

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some minor sensitivities	Potential low level Volatile Organic Compounds present in ground water	Water withdrawal Drinking water	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Bartow groundwater

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-const	Const	Overall
~7	345	3	1	4

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
9.5	0.5	1.0	11.0	0.5	0.7	0.1	1.3	45

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some significant sensitivities; some chance of delayed implementation	Potential for development of land subsidence if not properly managed	Water withdrawal Drinking water	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Palmetto groundwater

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-const	Const	Overall
~2	375	3	1	4

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
2.6	0.3	0.4	3.2	0.2	0.2	0.1	0.4	15

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some minor sensitivities	Requires retrofitting wells to drinking water standards, existing wells privately owned	Water withdrawal Drinking water	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

South GA groundwater

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-const	Const	Overall
~200	1,600	2-3	3-10	5-13

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
2,535	10	102	2,647	50	37	37	124	5,840

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	Potential opposition from existing ground water users (agriculture, industry, municipalities), interbasin transfer, sustainable yields subject to results of ongoing EPD modeling efforts	Water withdrawal Drinking water	Yes (IBT)

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Groundwater for non-potable use

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-const	Const	Overall
~15	155	2	1	3

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
n/a	n/a	8	8	1	0	0	1	35

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
No significant sensitivities noted		Water withdrawal	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

ASR NW of Metro area

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-const	Const	Overall
~20	1,840	1-2	2-4	4-6

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
350	n/a[2]	100	450	2.9	5.5	0	8.5	670

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some significant sensitivities	Concerns over "contaminating" ground water sources with surface water	Water withdrawal Drinking water	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3% 2. Utilize existing WTP capacity
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

ASR to augment Lawrenceville groundwater

Yield

		Timing (years)		
Yield (MGD)	Cost ($/MG)	Pre-const	Const	Overall
~4	900	1	2-4	3-5

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
3.9	n/a[2]	15	19	0.7	1.1	0	1.8	65

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some significant sensitivities	Concerns over "contaminating" ground water sources with surface water	Water withdrawal Drinking water	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3% 2. Utilize existing WTP capacity
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

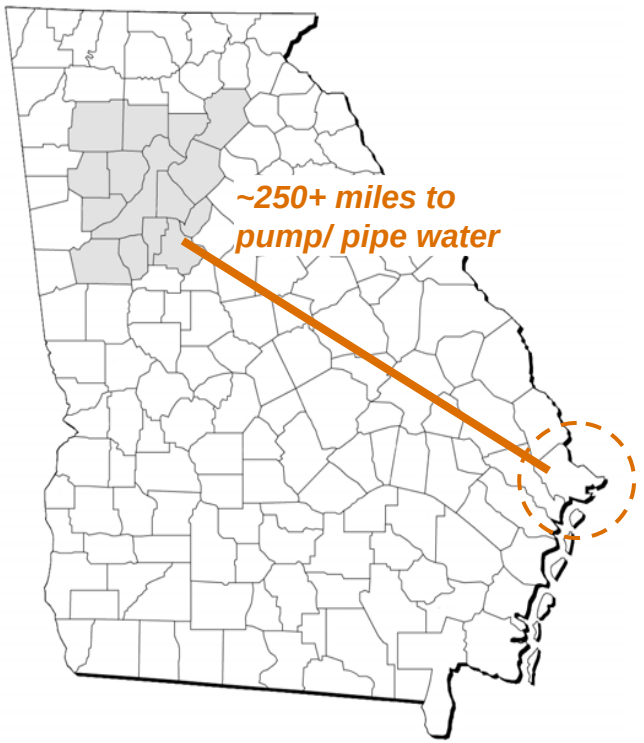
Capture

Capture

- **Reservoirs and quarries**
- **Groundwater and ASR**
- **Desalination**
- **Water quality / treatment**

Desalination option expensive at ~$6,000/MGvd

Option	Description	Rationale	Key challenges	Timing (years)
~200 MGD desal plant	Build large desalination plant near Savannah, pump water to nearest Metro area water supply connection	Tap large source of potential water supply, relieve dependence on river and creek surface water	Long distance movement of water, significant transport cost, relatively high cost, environmental concerns with disposal of waste product (highly concentrated brine)	8-10



Yield (MGD)	Cost ($/MG)
200	~6,000

Source: Technical Advisory Panel

Savannah desalination plant

Yield

		Timing (years)		
Yield (MGD)	Cost ($/MG)	Pre-const	Const	Overall
~200	6,000	2-3	6-8	8-10

Costs

Capital Cost				Annual Operating Cost				
Pump & pipe ($M)	Water treatment ($M)	Other capital costs ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual WTP cost ($M)	Annual O&M ($M)	Total ($M)	Total cost[1] ($M)
9,100	4,600	30	13,730	31	275	n/a	305	21,600

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Contentious	Potentially highly sensitive: costly option, possible environmental concerns of disposing highly concentrated saline waste product	Water withdrawal Drinking water	Yes (IBT)

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
All estimates have been rounded to the nearest tenth, numbers may not add up due to rounding errors

Capture

Capture

- **Reservoirs and quarries**
- **Groundwater and ASR**
- **Desalination**
- **Water quality / treatment**

Water quality/treatment options considered

Topic: Water quality/treatment

Option	Description	Rationale	Key Challenges	Timing (years)
Septic to sewer conversion	Conversion of septic systems to sewer in critical Metro North counties (Gwinnett, Forsyth and Hall)	• Reduction in consumptive water use i.e. quicker return of wastewater to treatment plants and ultimately back into the system	• High cost of implementation	8–10

Source: Technical Advisory Panel

Cost, yield and timing estimates for options

Topic: Water quality/treatment

Option	Yield (MGD)	$/MG	Timing (yrs)		
			Pre-const.	Const.	Total
Conversion of septic systems to sewer in Gwinnett county	5	6,600[1]	1	8 – 10	~10
Conversion of septic systems to sewer in Forsyth county	3	6,600[1]	1	8 – 10	~10
Conversion of septic systems to sewer in Hall county	4	6,700[1]	1	8 - 10	~10

1. Does not include wastewater treatment cost

Septic to sewer conversion options

Topic: water quality/treatment

Yield

County	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-construction	Construction	Overall
Gwinnett	5	6,600	1	8 – 10	~10
Forsyth	3	6,600	1	8 – 10	~10
Hall	4	6,700	1	8 – 10	~10

Costs

County	Capital Cost			Annual O&M ($M)	Total cost[1] ($M)
	Pump & Pipe Infrastructure ($M)	Water treatment ($M)	Total ($M)		
Gwinnett	480	0	480	2.4	600
Forsyth	336	0	336	1.7	420
Hall	408	0	408	2.9	510

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Permits required	Requires legislation
Some significant sensitivity	Economics to implement the option are not justified unless population density is significant	No	No

1. Indicates total cost in 2010$ over the life of the project, discounted at 3%
Estimates have been rounded to the nearest integer, numbers may not add up due to rounding errors

Control

Control: water transfers

Water transfer options considered (I)

Option	Description	Rationale	Key Challenges	Timing (years)
Lake Burton transfer	Transfer water from Lake Burton in the Savannah basin to the main Gwinnett County water treatment plant on Lake Lanier for distribution into the Gwinnett County system	• Potential source of water supply to Metro North counties • Mountainous watershed produces high unit runoff • Relatively low environmental impacts to exisitng water body • Access to relatively high quality water of Lake Burton	• Requires legislative approval to allow transfer of water from outside Metro district Significant increase to flow volumes in Raper Creek • Lake drawdown may potentially affect high value areas • FERC licensing required for use of GA Power reservoir • Requires legislative approval to allow transfer of water from outside Metro district	8–10
Lake Hartwell transfer	Transfer water from Lake Hartwell in the Savannah basin to the main Gwinnett County water treatment plant on Lake Lanier for distribution into the Gwinnett County system	• Potential source of water supply to Metro North counties • Relatively low environmental impacts to existing water body • Access to relatively high quality water of Lake Hartwell	• Requires congressional authorization for withdrawing water for the purpose of water supply • Potential opposition by South Carolina & downstream communities • Requires permit to withdraw water • Requires legislative approval to allow transfer of water from outside Metro district	8–10

Source: Technical Advisory Panel

Water transfer options considered (II)

Option	Description	Rationale	Key Challenges	Timing (years)
Tennessee basin transfer	Transfer water from the Tennessee basin to the Metro Water district as a long term supply source	• Potential alternate water supply to the entire Metro district • Sustainable, reliable supply from closest, largest fresh water source available	• Requires legislative approval to allow transfer of water from outside Metro district • Legal access must be confirmed • Significant transport distance, capital costs	8–10
West Point Lake transfer	Transfer water from West Point Lake to a new regional water treatment plant located near Union City, Fulton County. Gwinnett could obtain finished water from DeKalb and Fulton Counties' connections	• Potential source of water supply to multiple counties in Metro district • Use of water from an existing lake would create fewer environmental impacts and would have high reliability	• Requires congressional authorization for withdrawing water for the purpose of water supply • Long distance pumping 'uphill' to Atlanta area	8–10

Source: Technical Advisory Panel

Control options yield and cost estimate detail

Option	Brief Description	Yield (MGD)	$/MG	Timing (yrs) Pre-const.	Const.	Total
Lake Burton transfer	Transfer water from Lake Burton in the Savannah basin the main Gwinnett County WTP on Lake Lanier for distribution into the Gwinnett County system	50	415	3 – 5	5	8 – 10
Lake Hartwell transfer	Transfer water from Lake Hartwell in the Savannah basin the main Gwinnett County WTP on Lake Lanier for distribution into the Gwinnett County system	100	680	3 – 5	5	8 – 10
Tennessee basin transfer	Transfer water from the Tennessee basin to the Metro Water district as a long term supply source	250	890	4 – 5	4 – 5	8 - 10
West Point Lake transfer	Transfers from West Point Lake to a new regional WTP located near Union City, Fulton County; Gwinnett obtains finished water from DeKalb and Fulton Counties' connections[1]	100	1,110	3 – 5	5	8 – 10

1. Interconnection costs not included; WTP – Water Treatment Plant

Detailed cost estimates for transfer options

Option	Capital Cost			Annual Operating Cost			
	Transport Infrastructure[1] ($M)	Water treatment ($M)	Total ($M)	Annual Pumping (Power) ($M)	Annual O&M ($M)	Total ($M)	Total cost[2] ($M)
Lake Burton transfer	362	0	362	0.6	0.1	0.7	380
Lake Hartwell transfer	1108	0	1,108	5	0.2	5	1,246
Tennessee basin transfer	1,701	492	2,193	29	69	98	4,075
West Point Lake transfer	828	375	1,203	4	28	32	2,027

Note: 1. Includes pump and pipe, intake and storage costs associated with transporting water 2. Indicates total cost in 2010$ over the life of the project, discounted at 3%
Estimates have been rounded to the nearest integer, numbers may not add up due to rounding errors

Lake Burton transfer

Topic: Integrated supply management

Yield

Scenario	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-construction	Construction	Overall
No return flow	50	416	3 – 5	5	8 – 10
With return flow	50	729	3 – 5	5	8 – 10

Costs

Scenario	Capital Cost			Annual Operating Cost			Total cost[2] ($M)
	Transport Infrastructure[1] ($M)	Water treatment ($M)	Total ($M)	Annual Pumping Power ($M)	Annual O&M ($M)	Total ($M)	
No return flow	362	0	362	0.6	0.1	0.7	380
With return flow	626	0	626	1	0.5	1.5	670

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Key Permits required	Requires legislation
Highly contentious	Risk of litigation from South Carolina and other downstream communities, Interbasin transfer required, Potential for significant environmental impact	• EIS (FERC) • 404 Individual (USACE) • Water withdrawal (EPD) • NPDES Discharge (EPD) • NPDES Stormwater (EPD)	Yes, to allow transfer from outside the Metro district

1. Includes pump and pipe, intake and storage costs associated with transporting water 2. Indicates total cost in 2010$ over the life of the project, discounted at 3%
Estimates have been rounded to the nearest integer, numbers may not add up due to rounding errors; Source: Technical Advisor Panel

Lake Hartwell transfer

Topic: Integrated supply management

Yield

Scenario	Yield (MGD)	Cost ($/MG)	Timing (years)		
			Pre-construction	Construction	Overall
No return flow	100	683	3 – 5	5	8 – 10
With return flow	100	1,073	3 – 5	5	8 – 10

Costs

Scenario	Capital Cost			Annual Operating Cost			
	Transport Infrastructure[1] ($M)	Water treatment ($M)	Total ($M)	Annual Pumping Power ($M)	Annual O&M ($M)	Total ($M)	Total cost[2] ($M)
No return flow	1,110	0	1,110	5.2	0.2	5.4	1,250
With return flow	1,730	0	1,730	8.5	0.5	9	1,960

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Key Permits required	Requires legislation
Highly contentious	Risk of litigation from South Carolina and other downstream communities, Interbasin transfer required, Potential for significant environmental impact	• EIS (USACE) • 404 Individual (USACE) • Water withdrawal (EPD) • NPDES Discharge (EPD) • NPDES Stormwater (EPD)	Yes, to allow transfer from outside the Metro district

1. Includes pump and pipe, intake and storage costs associated with transporting water 2. Indicates total cost in 2010$ over the life of the project, discounted at 3%
Estimates have been rounded to the nearest integer, numbers may not add up due to rounding errors; Source: Technical Advisor Panel

Tennessee basin transfer

Topic: Integrated supply management

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-construction	Construction	Overall
250	893	3 - 5	5	8 - 10

Costs

Capital Cost			Annual Operating Cost			
Transport Infrastructure[1] ($M)	Water treatment ($M)	Total ($M)	Annual Pumping Power ($M)	Annual O&M ($M)	Total ($M)	Total cost[2] ($M)
1,701	492	2193	29	69	98	4,075

Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Key Permits required	Requires legislation
Highly contentious	Legal access to water needs to be confirmed, Interbasin transfer required	• EIS (TVA) • 404 Individual (USACE) • Water withdrawal (EPD) • NPDES Discharge (EPD) • NPDES Stormwater (EPD)	Yes, to allow transfer from outside the Metro district

1. Includes pump and pipe, intake and storage costs associated with transporting water 2. Indicates total cost in 2010$ over the life of the project, discounted at 3%
Estimates have been rounded to the nearest integer, numbers may not add up due to rounding errors; Costs do not account for return of water to originating basin
Source: Technical Advisor Panel

West Point Lake transfer

Topic: Integrated supply management

Yield

Yield (MGD)	Cost ($/MG)	Timing (years)		
		Pre-construction	Construction	Overall
100	1,111	3 - 5	5	8 - 10

Costs

Capital Cost			Annual Operating Cost			
Transport Infrastructure[1] ($M)	Water treatment ($M)	Total ($M)	Annual Pumping Power ($M)	Annual O&M ($M)	Total ($M)	Total cost[2] ($M)
828	375	1,203	4.5	28	32	2,027

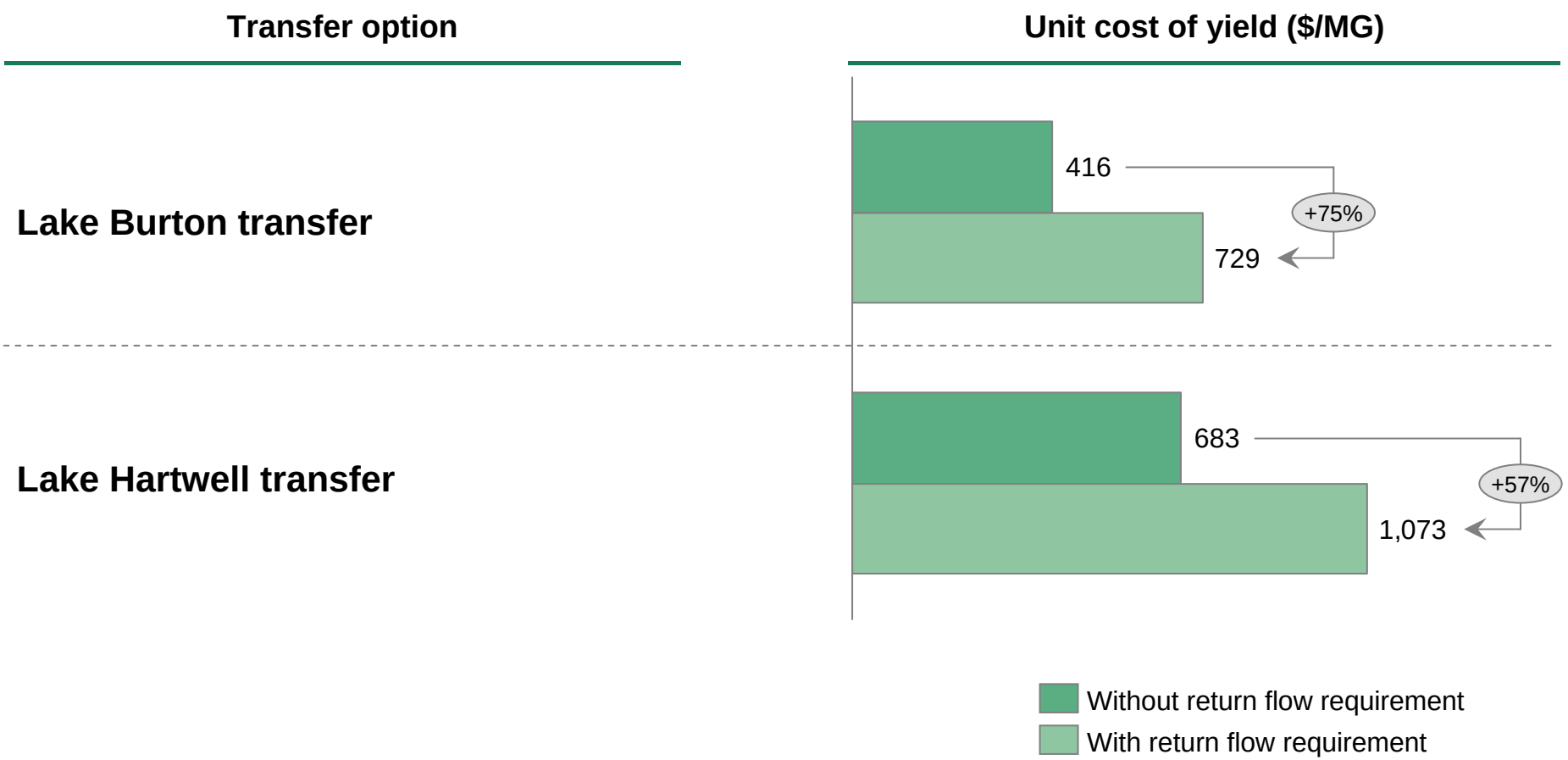
Stakeholder sensitivity

Stakeholder sensitivity	Reasons	Key Permits required	Requires legislation
Highly contentious	Interbasin transfer may be required depending on final destination, Potential for significant environmental impact	• EIS (USACE) • 404 Individual (USACE) • Water withdrawal (EPD) • NPDES Discharge (EPD) • NPDES Stormwater (EPD)	No- would be ***intra*** basin transfer

1. Includes Includes pump and pipe, intake and storage costs associated with transporting water 2. Indicates total cost in 2010$ over the life of the project, discounted at 3%
Estimates have been rounded to the nearest integer, numbers may not add up due to rounding errors; Costs do not account for return of water to originating basin
Source: Technical Advisor Panel

Unit costs for transfers sensitive to return flow policy

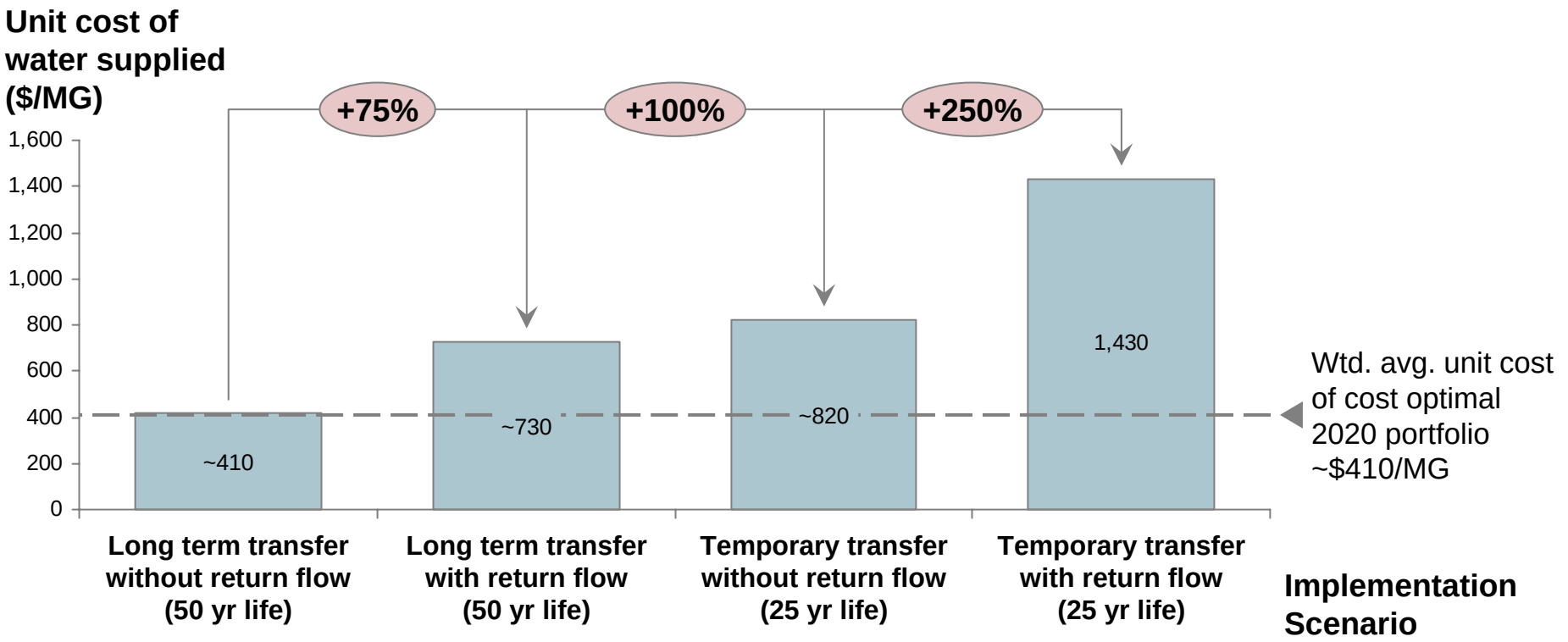
Unit costs increase over 50% with mandated return flow requirement to originating basin



Source: Technical Advisor Panel estimates

Large scale interbasin transfers not economically feasible as temporary solutions

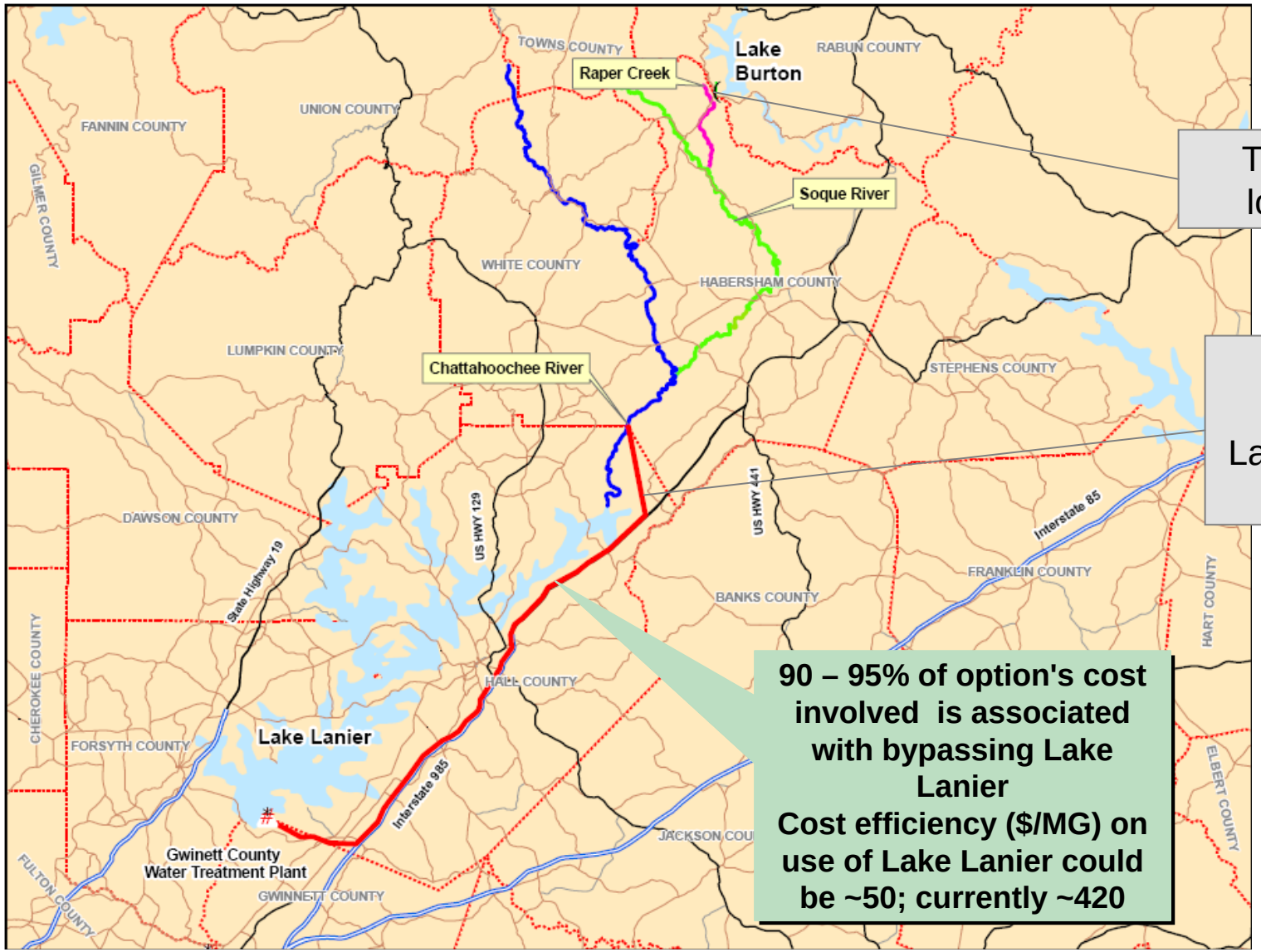
Analysis of **Lake Burton transfer** under different implementation scenarios[1]



Less-infrastructure intensive transfers potentially viable on temporary basis

1. Lake Burton transfer option chosen as an illustrative example since it is the only interbasin transfer that is present in the cost optimal 2020 portfolio of options
Note: Return flow scenarios assume that the receiving basin returns an equal volume of treated wastewater (as was originally transferred) back to the originating basin, thus requiring supporting infrastructure to enable return flows
Source: Technical Advisor Panel Analysis

Proposed transfer from Lake Burton to Gwinnett WTP



Transfer location

Supply line circumvents Lanier to comply with ruling

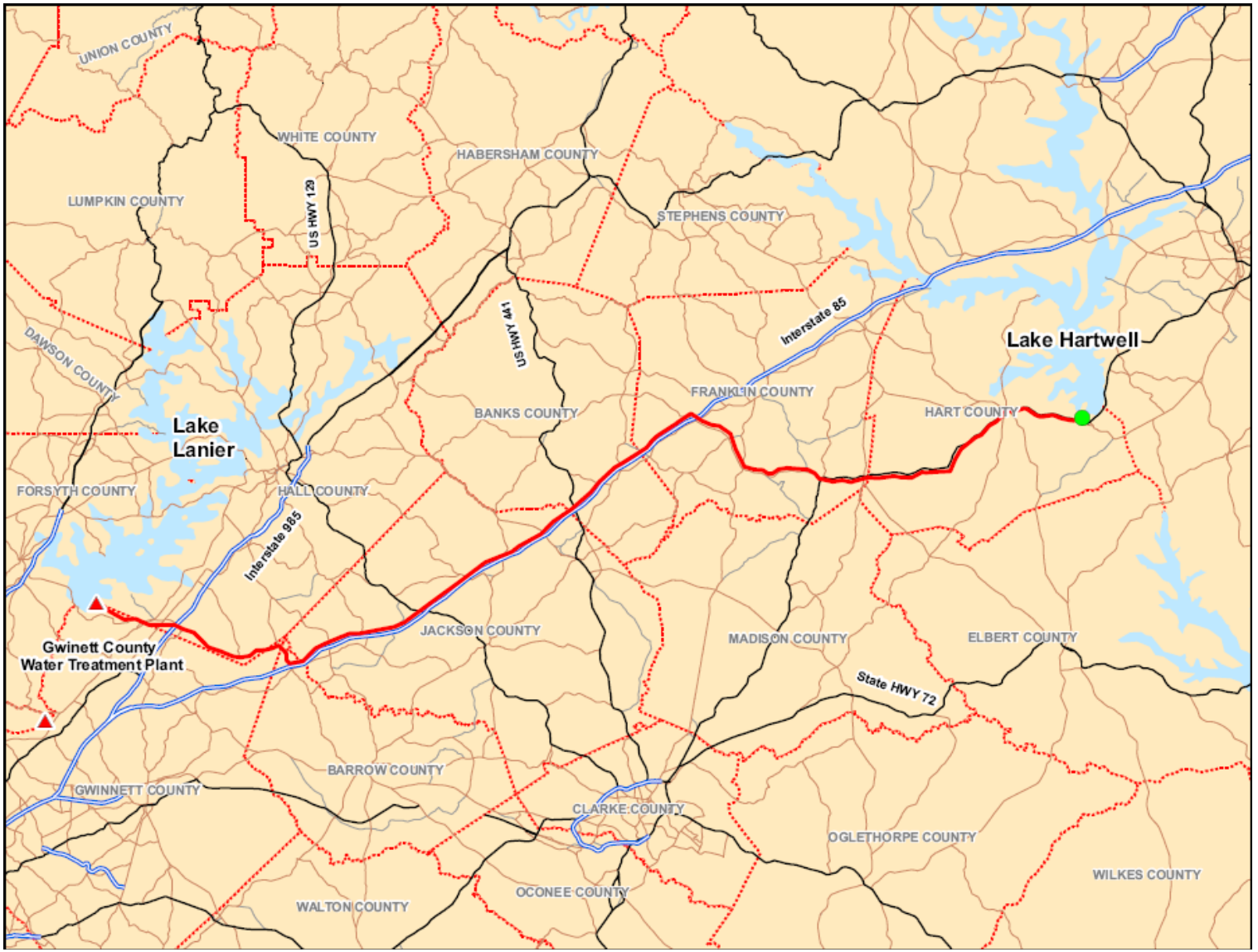
90 – 95% of option's cost involved is associated with bypassing Lake Lanier
Cost efficiency ($/MG) on use of Lake Lanier could be ~50; currently ~420

Legend
- Proposed Pumping Station
- Gwinnett Water Treatment Plant
- Proposed Supply Line

Rivers & Streams
- Chattahoochee River
- Raper Creek
- Soque River
- County Boundaries

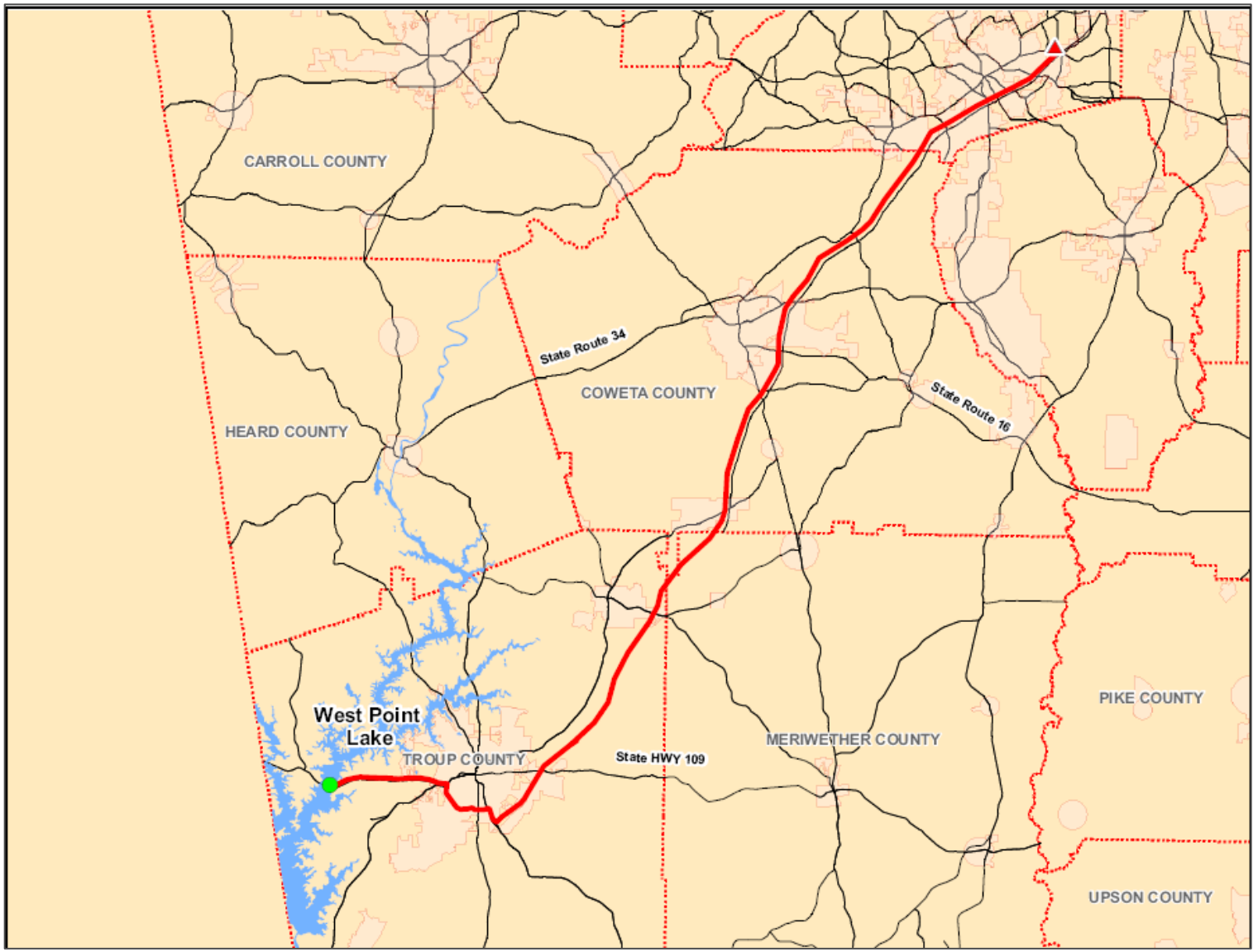
Source: Technical Advisory Panel

Illustration of option: Transfer from Lake Hartwell to Gwinnett WTP



Source: Technical Advisory Panel

Illustration of option: Transfer from West Point Lake to Fulton county



Source: Technical Advisory Panel

Illustration of option: Return of water to originating basin for Lake Hartwell transfer under mandated return flow req.

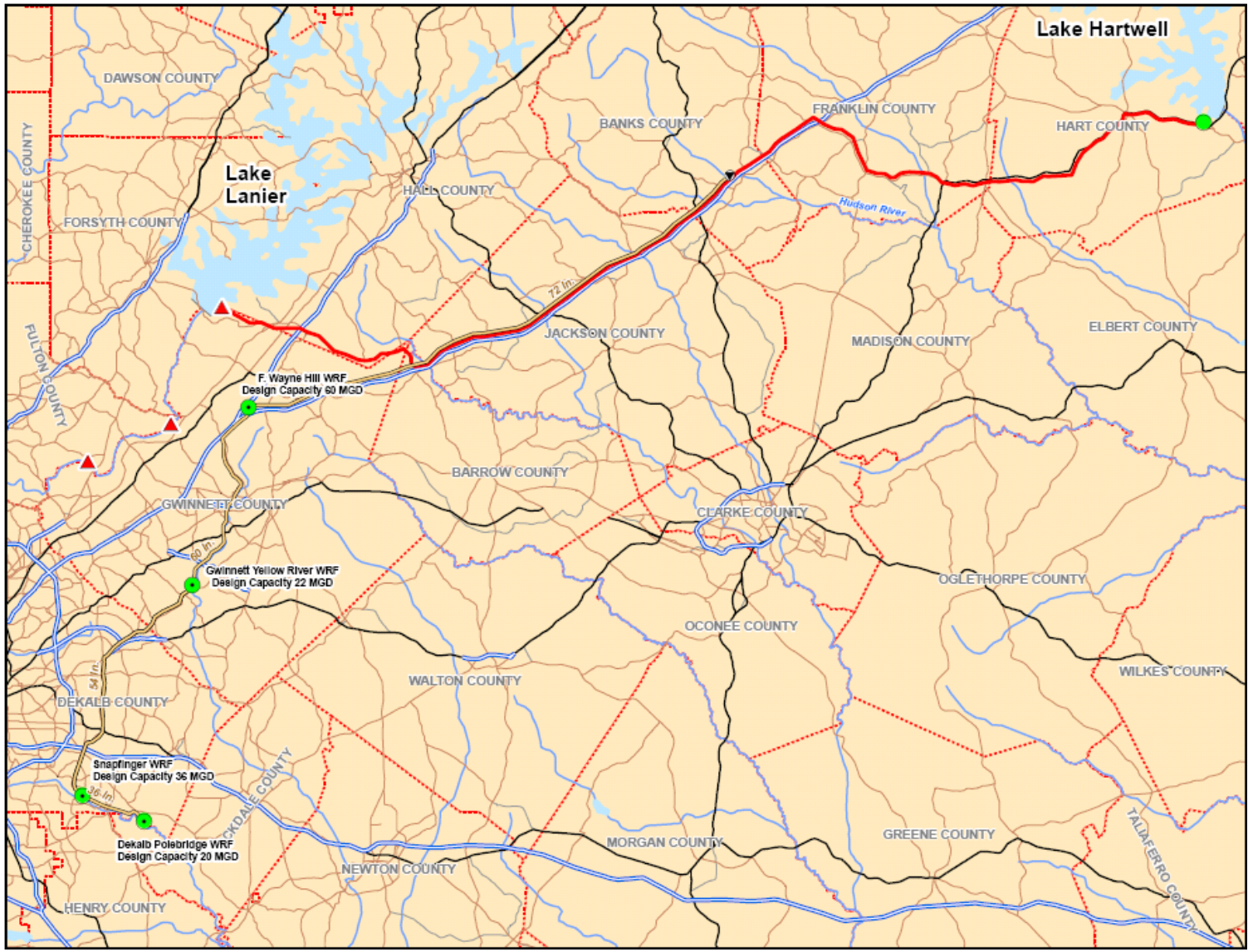
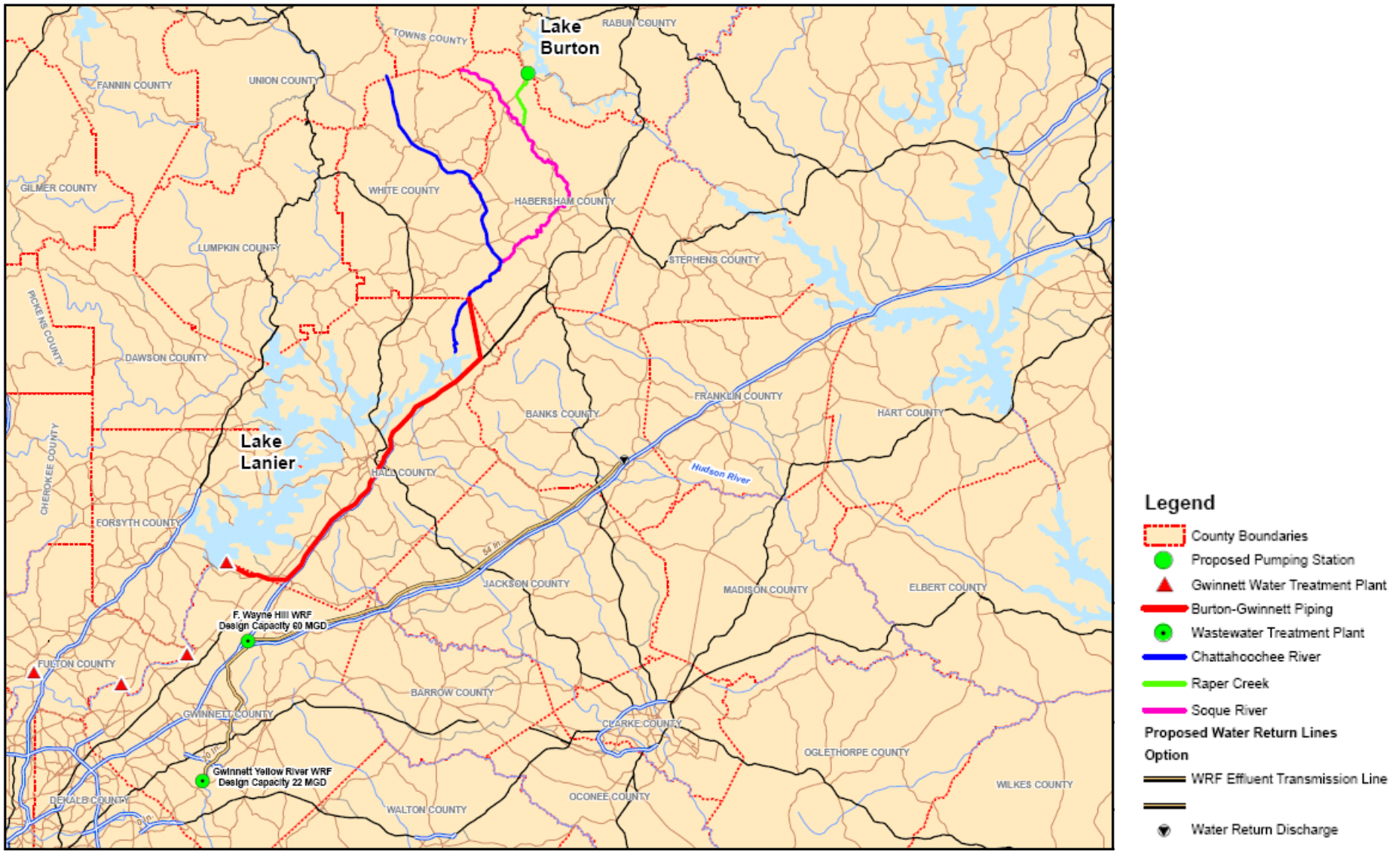
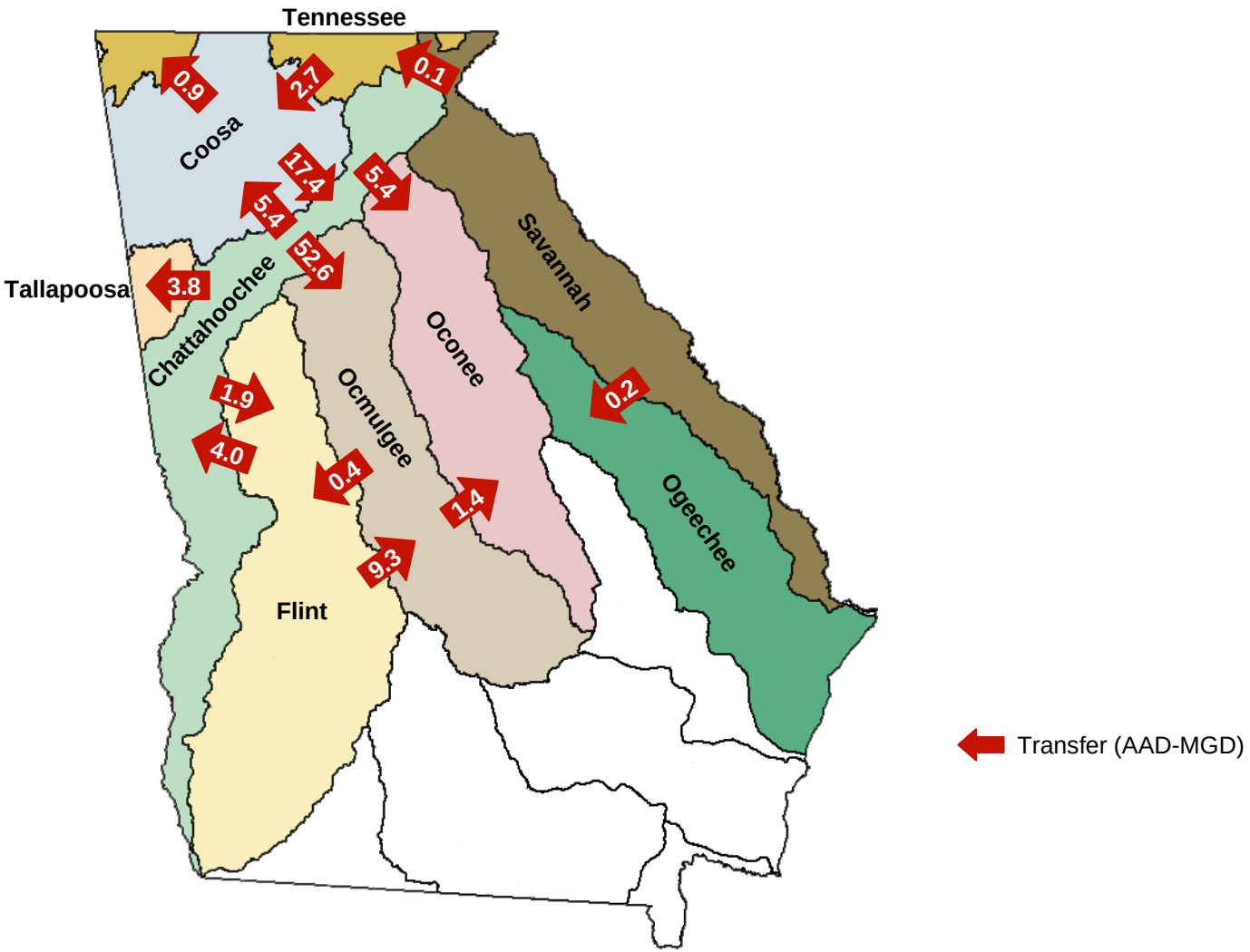


Illustration of option: Return of water to originating basin for Lake Burton transfer under mandated return flow req.



Existing interbasin transfers in Georgia



Note: An interbasin transfer of water is any surface water which is withdrawn from one major river basin and discharged, sold to, or otherwise utilized in another major river basin
Source: Environmental Protection Division (EPD) Data for 2008

Major (> 1 AAD-MGD) interbasin water transfers in Georgia

Water system transferring	Basin transfer	Net Transfer (AAD-MGD)	Water system receiving transfer	County receiving transfer
DeKalb County	Chattahoochee to Ocmulgee	37.2	S. DeKalb	DeKalb, Rockdale, Henry
Gwinnett County	Chattahoochee to Ocmulgee	15.3	Gwinnett Co., Rockdale Co., Walton Co., City of Loganville	Gwinnett, Rockdale, Walton
City of Gainesville	Chattahoochee to Oconee	5.0	E. Hall County	Hall
City of Atlanta	Chattahoochee to Flint	1.6	Union City, Fayette Co., Clayton Co.	Fulton, Fayette, Clayton
Carroll Co…Auth.	Chattahoochee to Tallapoosa	3.6	Haralson Co. WSA, Cities of Temple, Mt. Zion and Villa Rica	Carroll, Haralson
Cobb Co…Auth.	Coosa to Chattahoochee	16.6	SE. Cobb Co., Douglas Co., Paulding Co., Lockheed	Cobb, Douglas, Paulding
Clayton County	Flint to Ocmulgee	5.7	Clayton Co.	Clayton
City of Griffin	Flint to Ocmulgee	3.6	E. Spalding Co.	Spalding
Forsyth County	Chattahoochee to Coosa	3.3	NW Forsyth Co., Etowah Water & Sewer Authority	Forsyth, Dawson
City of Cumming	Chattahoochee to Coosa	1.3	NW Forsyth Co.	Forsyth
Newnan Water System	Flint to Chattahoochee	4.0	Coweta Co., City of Newnan	Coweta
Eastside Utilities	Tennessee to Coosa	2.3	Dalton Utilities	Whitfield

Source: Environmental Protection Division (EPD) Data for 2008

Minor (< 1 AAD-MGD) interbasin water transfers in Georgia

Water system transferring	Basin transfer	Net Transfer (AAD-MGD)	Water system receiving transfer	County receiving transfer
Atlanta-Fulton County	Chattahoochee to Coosa	0.7	N. Fulton Co.	Fulton
City of Dahlonega	Chattahoochee to Coosa	0.1	West Lumpkin County	Lumpkin
City of LaGrange	Chattahoochee to Flint	0.2	City of Greenville	Meriwether
City of Social Circle	Ocmulgee to Oconee	0.5	East Social Circle	Walton
Etowah Water Auth.	Coosa to Chattahoochee	0.8	East Dawson Co.	Dawson
Douglas Co…Auth.	Chattahoochee to Tallapoosa	0.1	City of Villa Rica	Carroll
Heard Co.…Auth.	Chattahoochee to Tallapoosa	0.1	City of Ephesus	Heard
Henry Co.…Auth.	Ocmulgee to Flint	0.4	City of Hampton, Bear Creek LAS	Henry
City of Union Point	Savannah to Ogeechee	0.2	City of Union Point	Greene
Dalton Utilities	Coosa to Tennessee	0.9	West Whitfield Co.	Whitfield
City of LaFayette	Tennessee to Coosa	0.4	City of LaFayette	Walker
Monroe Utility Network	Ocmulgee to Oconee	0.9	City of Monroe, Walton Co.	Walton
Gwinnett County	Chattahoochee to Oconee	0.4	Walton Co., Cities of Auburn, Braselton and Loganville	Barrow, Walton, Jackson
City of Atlanta	Chattahoochee to Flint	0.1	Fayette County	Fayette
DeKalb County	Chattahoochee to Ocmulgee	0.1	Henry Co. Water & Sewerage Authority	Henry
Clayton-Rabun Co. W&SA	Savannah to Tennessee	0.1	City of Clayton/North Loop	Rabun

Source: Environmental Protection Division (EPD) Data for 2008

Feasibility considerations for option implementation

Number of considerations impact option feasibility

Description of criteria levels

Considerations	Levels
Congressional authorization	• Required (eg, if given lake is not authorized for water supply use) • Not required
Legislative change	• Required (eg, Interbasin transfers into Metro District) • Not required
Permitting (incremental requirements)	• Not required (or completed) • *Some* additional permitting required; but some portions already completed or not required (annotate requirements for given option) • Full Section 404 individual permitting required
Environmental Impact Study	• Required (by specific agency) • Not required
Right-of-way / Easements	• Required • Not required / already obtained
Qualifies for public funding sources	• Federal funds: State Revolving Funds– Green Project Reserve • Federal funds: State Revolving Funds • Ga Fund / Ga Reservoir Fund • None (or no precedent for use of Ga Fund in this way)
Joint and severable liability clause required	• Required • Not required

Feasibility considerations for conserve options

	Option	Congressional Authorization Required	Legislative change Required	Permitting	EIS Required	Right of way needed	GEFA funding sources	Joint liability clause required
Indirect Potable Reuse	Indirect Potable Reuse	No	No	Full permitting needed	Likely, if contested by downstream interests	Yes	GA fund, GA reservoir and water supply fund, DWSRF – base program	Yes

Most criteria not applicable to efficiency programs; Some options qualify for advantageous forms of funding

Source: Technical Advisor Panel, Georgia Environmental Facilities Authority (GEFA)

Feasibility considerations for capture options (I)

	Option	Congressional Authorization Required	Legislative change Required	Permitting	EIS Required	Right of way needed	GEFA funding sources	Joint liability clause required
Reservoir expansion	Big Haynes Creek expansion	No	No	Partial (EPD water withdrawal)	Yes	No		Yes
	Dog River expansion	No	No	Full permitting needed	Yes	Yes		Yes
	Etowah River Dam 1expansion	No	No	Full permitting needed	Yes	Yes		No
	Tussahaw Creek	No	No	Partial (EPD water withdrawal)	Yes	No		Yes
New reservoir	Newton County Bear Creek	No	No	Full permitting needed	Yes	Yes		Yes
	Hard Labor Creek	No	No	Partial (EPD water withdrawal)	No (complete)	Yes		Yes
	South Fulton Bear Creek	No	Yes - Storage Delivery Strategy (SDS)	Full permitting needed	Yes	Yes	GA fund, GA reservoir and water supply fund	Yes
	Glades	No	No	Full permitting needed	Yes	Yes		Yes
	Richland Creek	No	No	Full permitting needed	Yes	Yes		Yes
	Reservoir NW of Forsyth	No	Yes (IBT)	Full permitting needed	Yes	Yes		Yes
	Reservoir E of Gwinnett	No	Yes (IBT)	Full permitting needed	Yes	Yes		Yes
Quarries	Quarries	No	No	Partial (EPD water withdrawal)	Yes	Yes	N/A	No

Source: Technical Advisor Panel, Georgia Environmental Facilities Authority (GEFA)

Feasibility considerations for capture options (II)

	Option	Congressional Authorization Required	Legislative change Required	Permitting	EIS Required	Right of way needed	GEFA funding sources	Joint liability clause required
Groundwater	Lawrenceville GW system	No	No	Partial (EPD water withdrawal)	Yes	Yes	GA fund, GA reservoir and water supply fund, DWSRF – base program	No
	Suwanee/Gainesville GW system	No	No	Partial (EPD water withdrawal)	Yes	Yes		No
	Spalding county GW system	No	No	Partial (EPD water withdrawal)	Yes	Yes		No
	Bartow county GW system	No	No	Partial (EPD water withdrawal)	Yes	Yes		No
	Palmetto GW system	No	No	Partial (EPD water withdrawal)	Yes	Yes		No
	South GA GW system	No	Yes (IBT)	Partial (EPD water withdrawal)	Yes	Yes		Yes
	GW for non-potable use	No	No	Partial (EPD water withdrawal)	Yes	Yes		No
ASR	Floyd/Bartow ASR	No	No	Partial (EPD water withdrawal)	Yes	Yes	No precedent; requires GEFA Board approval	Yes
	Lawrenceville ASR	No	No	Partial (EPD water withdrawal)	Yes	Yes		No
Desal	Savannah Desalination plant	No	No	Full permitting needed	Yes	Yes	GA reservoir and water supply fund	Yes

Source: Technical Advisor Panel, Georgia Environmental Facilities Authority (GEFA)

Feasibility considerations for control options

	Option	Congressional Authorization Required	Legislative change Required	Permitting	EIS Required	Right of way Needed	GEFA funding sources	Joint liability clause required
Interbasin transfer	Lake Burton	No	Yes (IBT)	Full permitting needed	Yes	Yes	GA fund, GA reservoir and water supply fund[1]	Yes
	Lake Hartwell	Yes	Yes (IBT)	Full permitting needed	Yes	Yes		Yes
	Tennessee Basin	No	Yes (IBT)	Full permitting needed	Yes	Yes		Yes
	West Point Lake	Yes	Yes (IBT)	Full permitting needed	Yes	Yes		Yes

1. Transfer of finished water qualifies for funding; no precedent to fund infrastructure to return treated wastewater
Source: Technical Advisor Panel, Georgia Environmental Facilities Authority (GEFA)

Select public funding sources for option implementation

Agency	Fund	Nature of projects that qualify
Georgia Environmental Facilities Authority (GEFA)	• Georgia fund • GA reservoir and water supply fund • Drinking Water (DW) SRF—Base program • DWSRF—Green project reserve • Clean Water (CW) SRF—Base program • CWSRF—Green project reserve	• General water infrastructure • Water supply infrastructure • Public-health drinking water projects • Set aside for specific types of projects • Sewer and non-point projects • Set aside for specific types of projects
Georgia Dept. of Community Affairs (DCA)	• Community development block grant program • OneGeorgia authority equity fund • Appalachian regional commission area development fund	• To improve housing and economic development (water and sewer) for low and moderate income communities • Water and sewer projects that create jobs in rural areas • Water and sewer
US Dept. of Agriculture (USDA) rural development	• Water and wastewater loans and grants • Emergency community water assistance grants • Very low-income housing repair loans and grants (Section 504)	• Water, sewer, storm sewer, and solid waste projects • Water and sewer in rural communities in event of natural disaster • Individual wells in rural areas
Georgia Dept. of Natural Resources (DNR), Environmental Protection Division (EPD)	• Clean water Act Section 319(h) grants • Coastal incentive grant program	• Non-point, water quality projects • Coastal and natural projects
Other	• Public works and development facilities grant program[1] • Individual household well loan program[2] • Household water well system grant[3]	• Water and sewer for economic development in distressed areas • Individual wells • Individual wells for low-income homeowners

1. Economic Development Administration (EDA), Department of Commerce 2. Southeast Rural Community Assistance Project 3. The Foundation for Affordable Drinking Water
Source: Georgia Environmental Facilities Authority (GEFA)

Potentially ~$285M in GEFA funding available for option implementation in FY 2011

	Current balance[1] ($M)	Expected FY 2011 funds ($M)
Georgia fund	74.4	55.0
GA reservoir and water supply fund	27.4	27.4
Drinking Water (DW) SRF—Base program	36.8	36.0
DWSRF—Green project reserve	0	6.3
Clean Water (CW) SRF—Base program	137.2	153.0
CWSRF—Green project reserve	0	6.9
	~275	**~285**

1. Balance as of September 30, 2009; Does not reflect loans in process
Source: Georgia Environmental Facilities Authority (GEFA)

Option qualification for GEFA funds based on designated fund purpose

		Georgia fund	GA reservoir and water supply fund	Drinking Water (DW) SRF—Base program	DWSRF—Green project reserve	Clean Water (CW) SRF—Base program	CWSRF—Green project reserve
Conserve	Fixture retrofits				✓ (Note 1)		✓ (Note 2)
	Leak abatement	✓		✓	✓		
	Sub-metering	✓		✓	✓		✓
	Conservation pricing	✓		✓ (Note 3)			
	Indirect potable reuse	✓	✓	✓			✓
	Non-potable reuse	✓	✓ (Note 4)			✓	✓
Capture	Reservoir expansions	✓	✓				
	New reservoirs	✓	✓				
	Groundwater	✓	✓	✓			
	ASR	✓ (Note 5)	✓ (Note 5)				
	Desalination	✓ (Note 5)	✓				
Control	Finished water transfer	✓	✓	✓ (Note 6)			
	Return flows of treated wastewater	✓ (Note 5)	✓ (Note 5)				

✓ Option qualifies

✓ Option may qualify subject to conditions

1. Depends on EPA guidance; might not fund equipment 2. Might not fund equipment 3. If part of a larger project 4. If clearly augments potable supply
5. No precedent; Requires GEFA Board approval 6. If addresses needed redundancy
Source: Georgia Environmental Facilities Authority (GEFA)