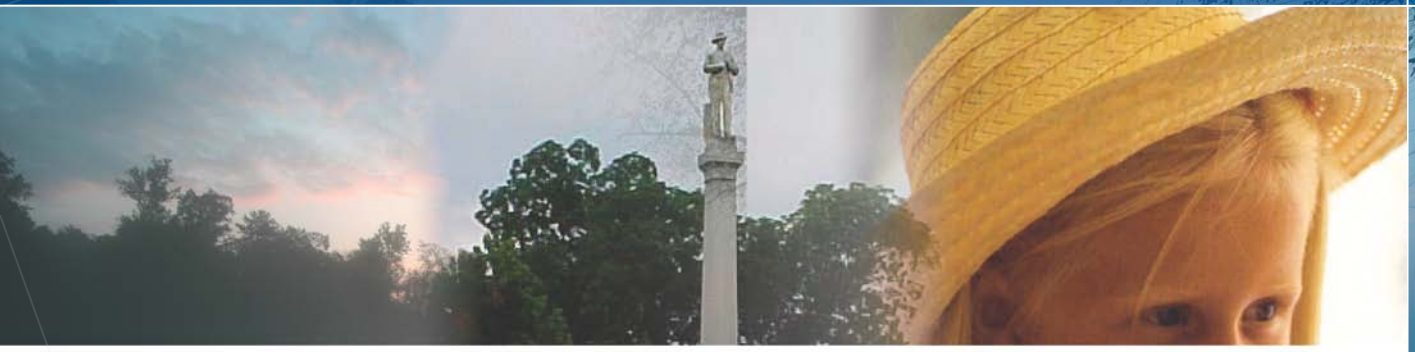
City of Franklin

Integrated Water Resources Plan

October 26, 2011



Stakeholder Meeting

CDM

Meeting Agenda

- Introductions and Workshop Goals
- Overview of Phase I & II
- Water Quality Analysis
- Review of Options
- Alternatives Rankings & Sensitivity
- Conclusions and Recommendations

Workshop Goals

- Understanding of Technical Analysis
- Consensus on Conclusions and Recommendations

Phase I Recommendations

Stakeholders Agreed to Carry 4 Alternatives Forward

- Efficiency + Safety and Security
- Water Quality Plus
- Revised Low Cost
- Reliability

Phase II Work Products

- Refined Water and Wastewater Treatment Analysis
- Detailed Water Quality Model
- Identification and Evaluation of Conservation and Stormwater BMPs
- Evaluation of Biosolids Management
- Evaluated Ecological Restoration Options

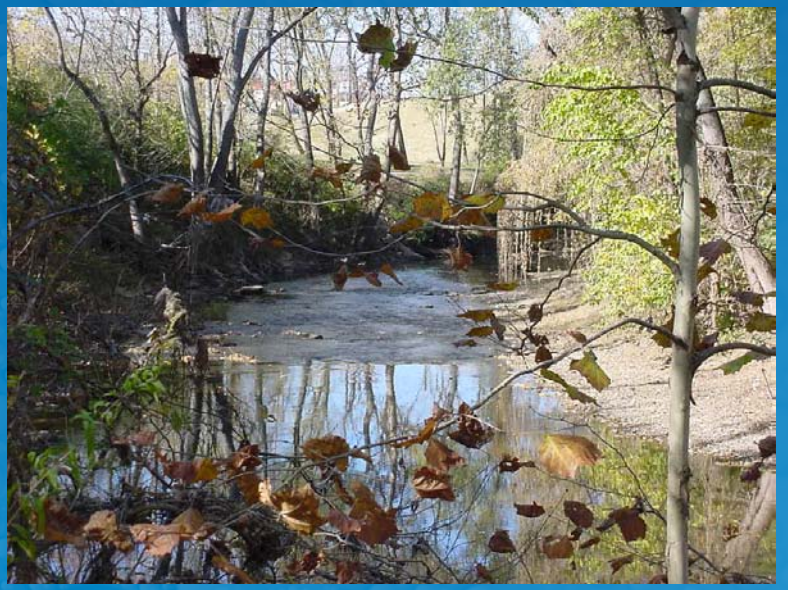
Phase II Findings

- Efficiency + Safety and Security is the top ranked alternative regardless of how objectives are weighted
  - Reliability
  - Water Quality
  - Restoration
  - Cost

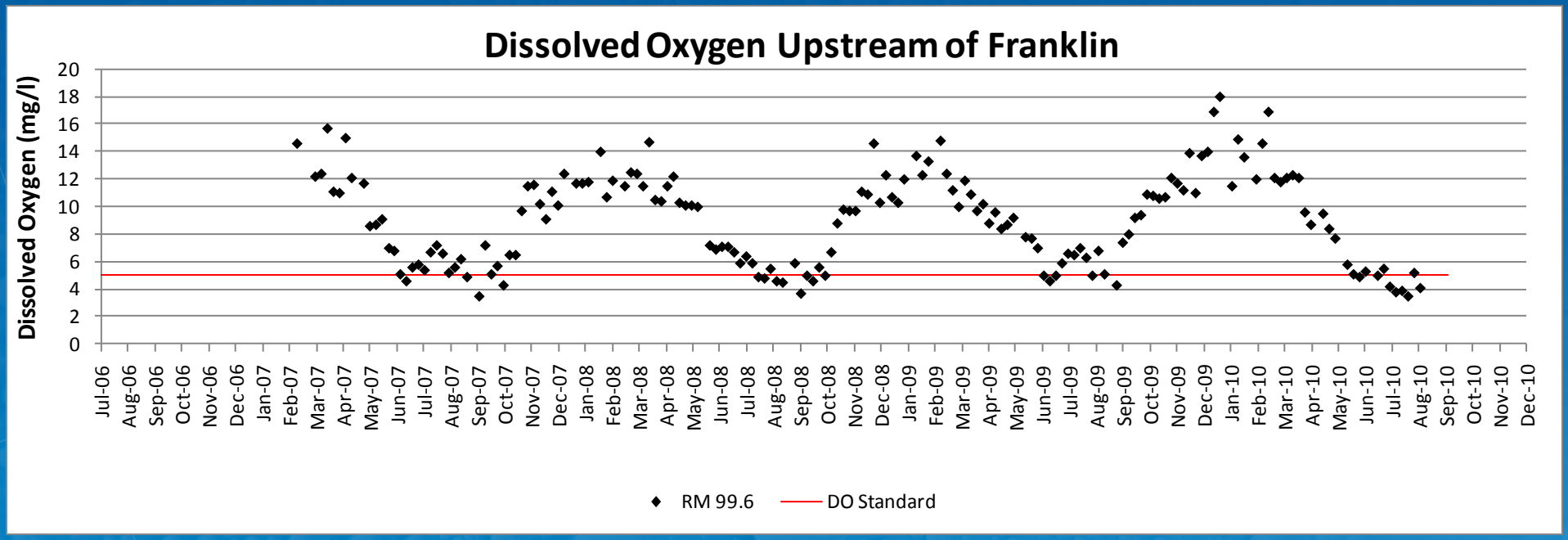
WATER QUALITY ANALYSIS

Our Understanding of the River

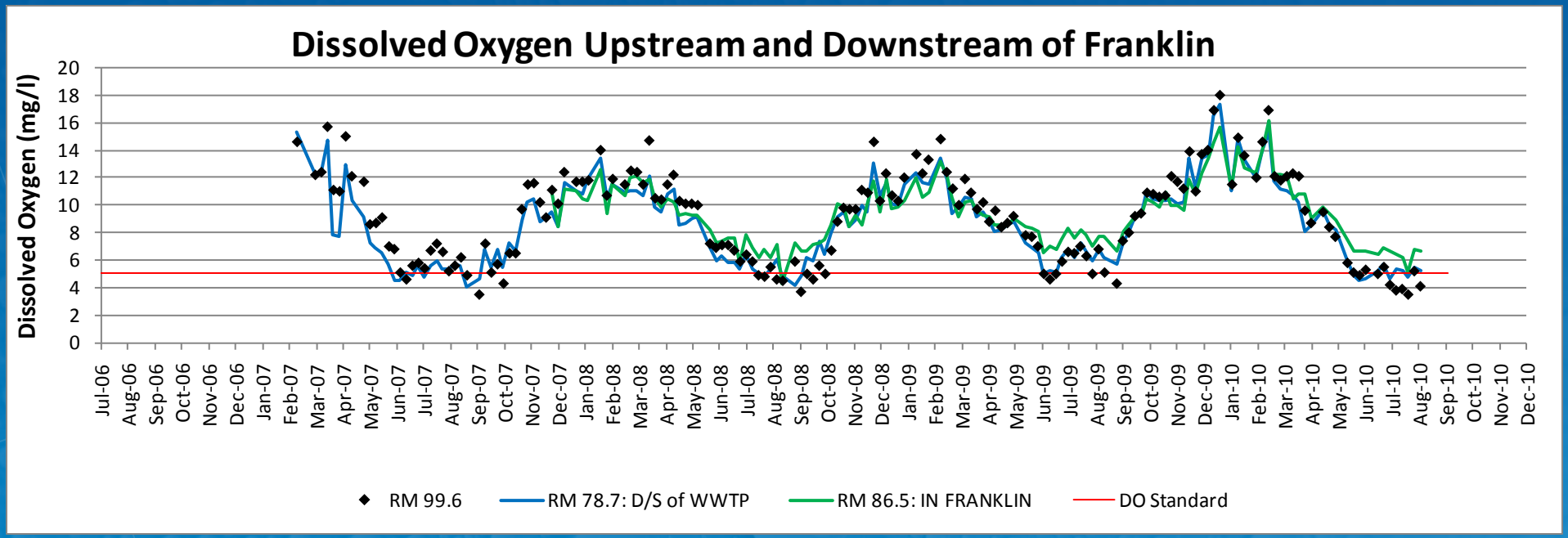
- WQ impaired by the time it reaches Franklin
- River in Franklin, and downstream is dominated by streambed dynamics
  - Sediment Oxygen Demand
  - Fixed Algae (periphyton)
- Changes to WWTP
  - May help augment low flows
  - Not likely to have significant impact on dissolved oxygen



Understanding Upstream Conditions



Understanding Upstream and Downstream Conditions

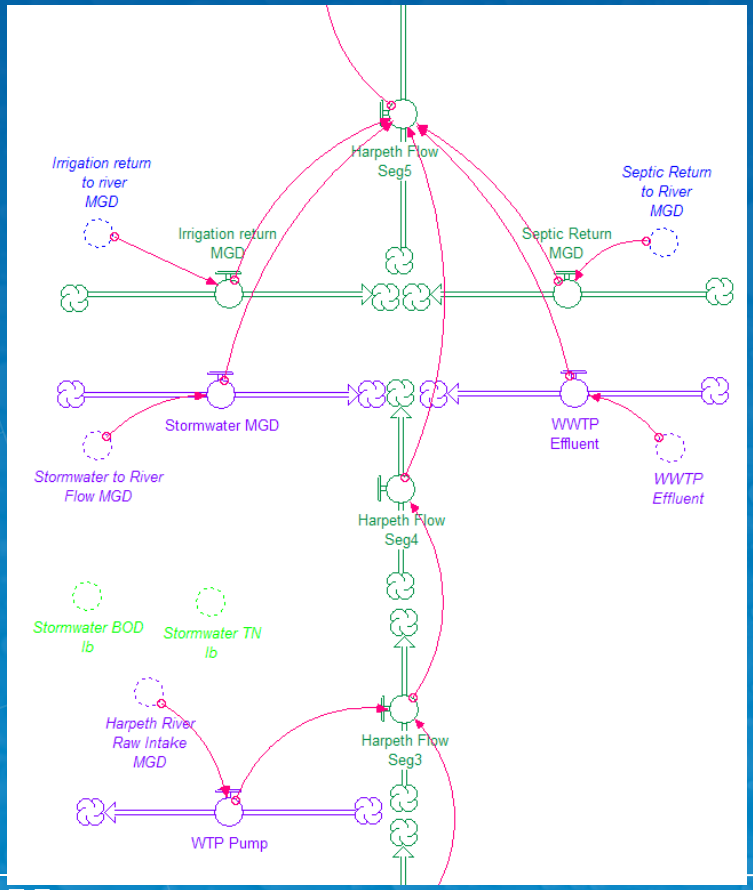


Water Quality Questions for IWRP

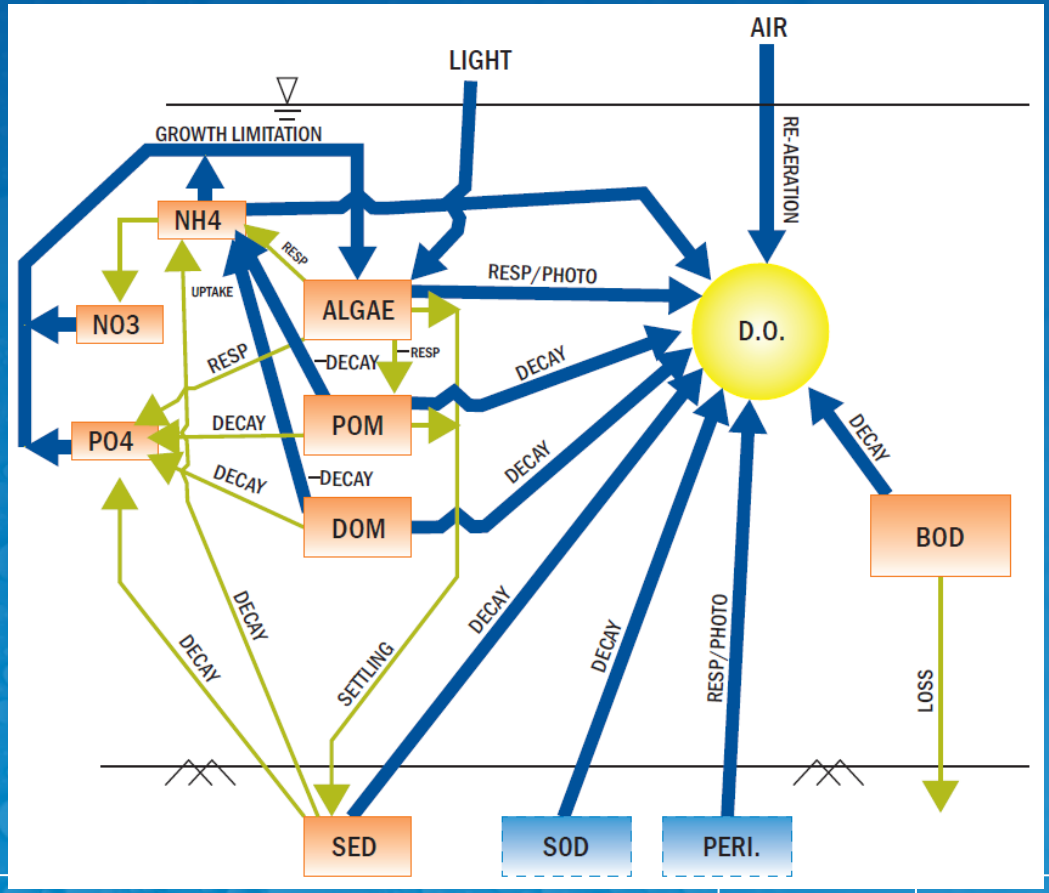
- Phase I modeling focused on river flow and pollutant loads, *but not instream water quality*
- This is not a load allocation study
- Questions for Phase II:
  - Which alternative is likeliest to yield the best water quality in the Harpeth River in Franklin and downstream?
  - What are the likely water quality impacts of the selected alternative?
  - How will Franklin's IWRP affect the river:
    - If water quality upstream meets DO standards?
    - If water quality upstream *does not* meet DO standards?

How This Differs from Integrated Model

Integrated Model: Flows and Loads Into River



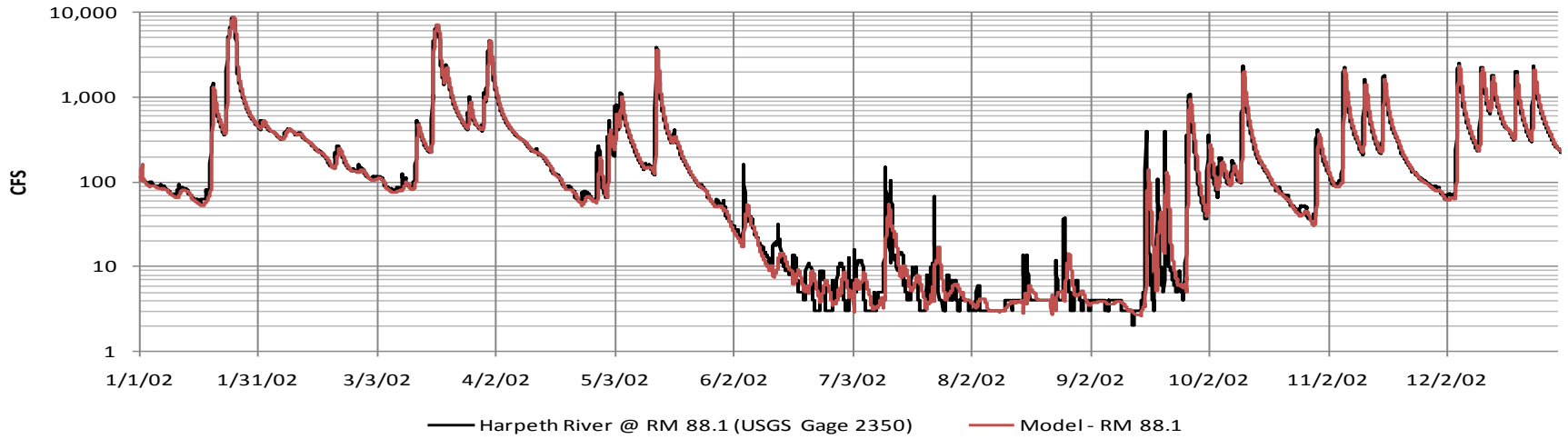
Water Quality Model: Pollutant Concentrations Within River

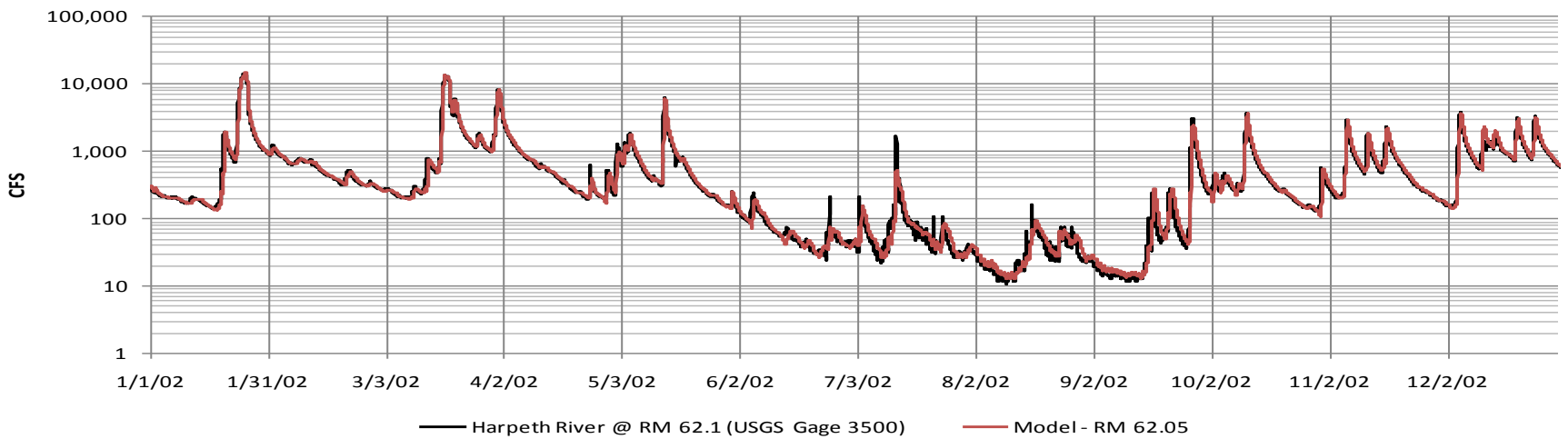


Collaboration on Model Development

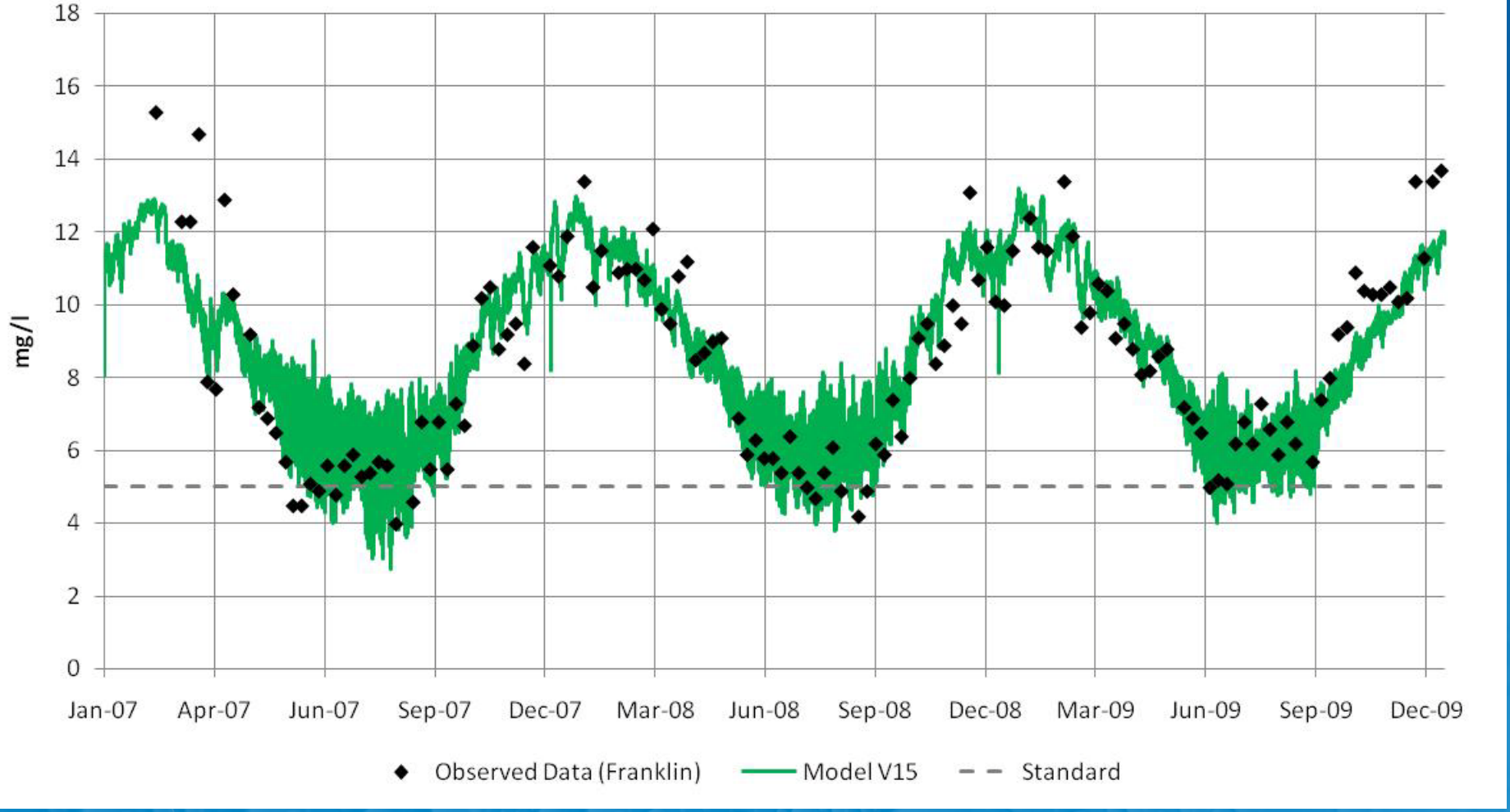
- Met with TDEC modelers to discuss parameterization
- Met with HRWA to discuss river dynamics and obtain additional monitoring data
- Regular meetings with Steering Committee to discuss tool selection and progress
- Technical Review by:
  - Dr. Gene LeBoeuf (Vanderbilt, Steering Committee)
  - Gary Mercer (CDM)
  - Dr. Ming Chen Shiao (TDEC)

Hydrologic Model Performance

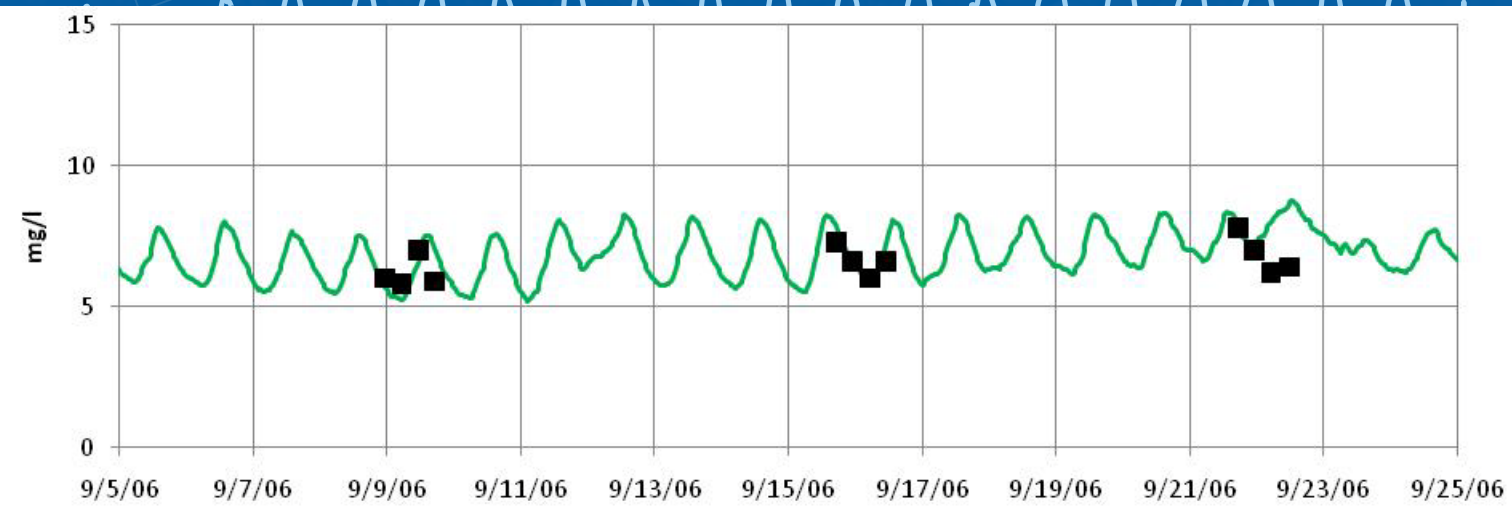




DO Performance : 2007-2009 Single DO Observations at RM78.7 (downstream of Franklin)



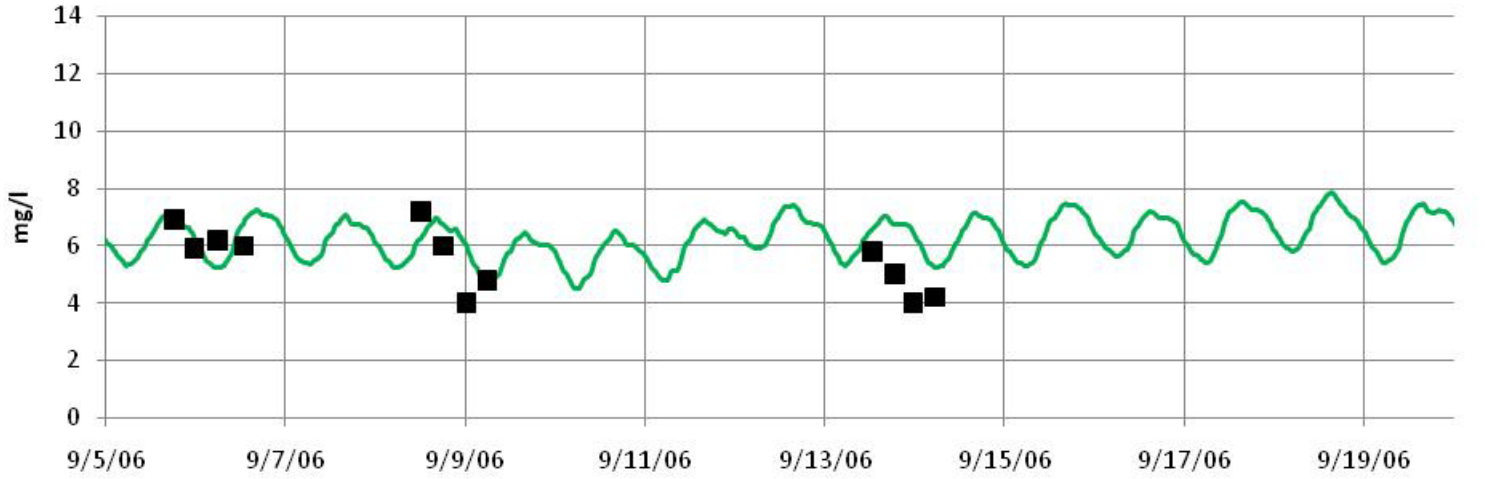
DO Performance (2006 HRWA data)



RM 82.2
(just downstream
of Franklin)

Model Data

RM 82.2 (Site 5)

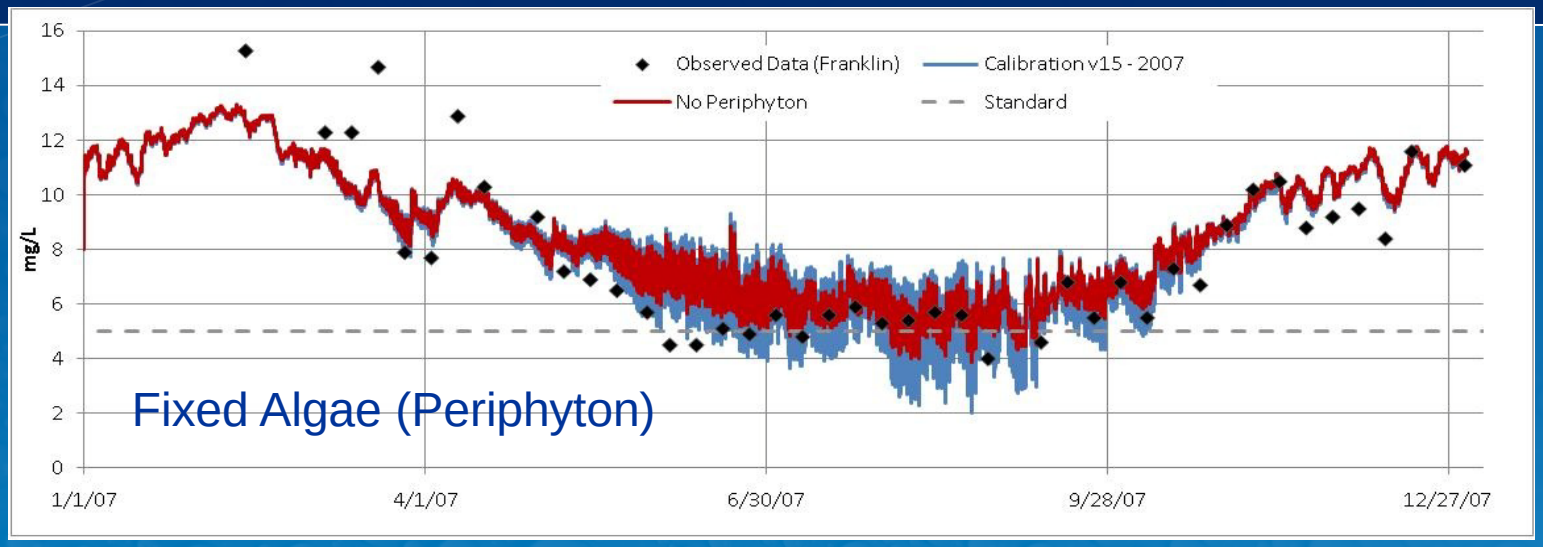


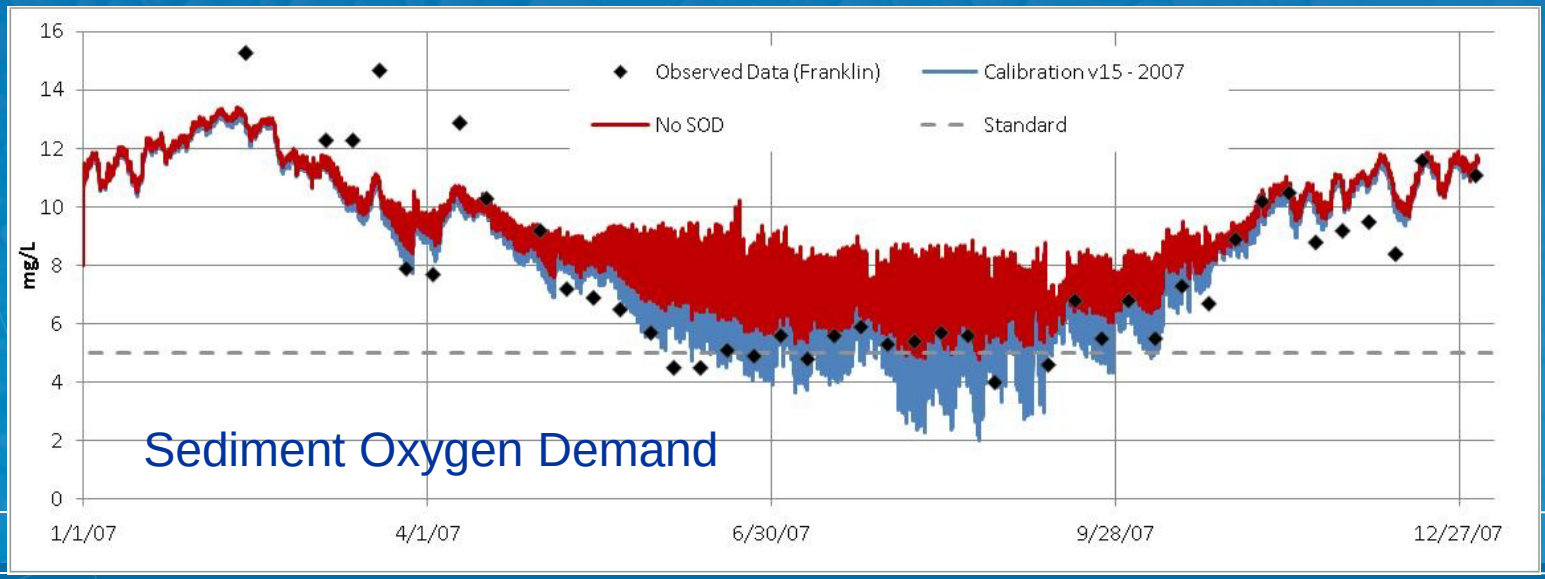
RM 66.0
(well downstream
of Franklin)

Model Data

RM 66.0 (Site 7)

Sensitivity to Sediment Effects

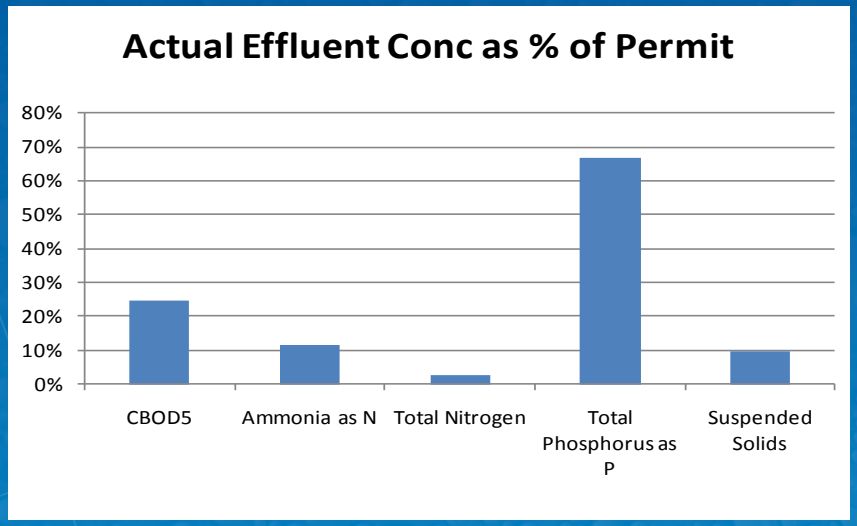


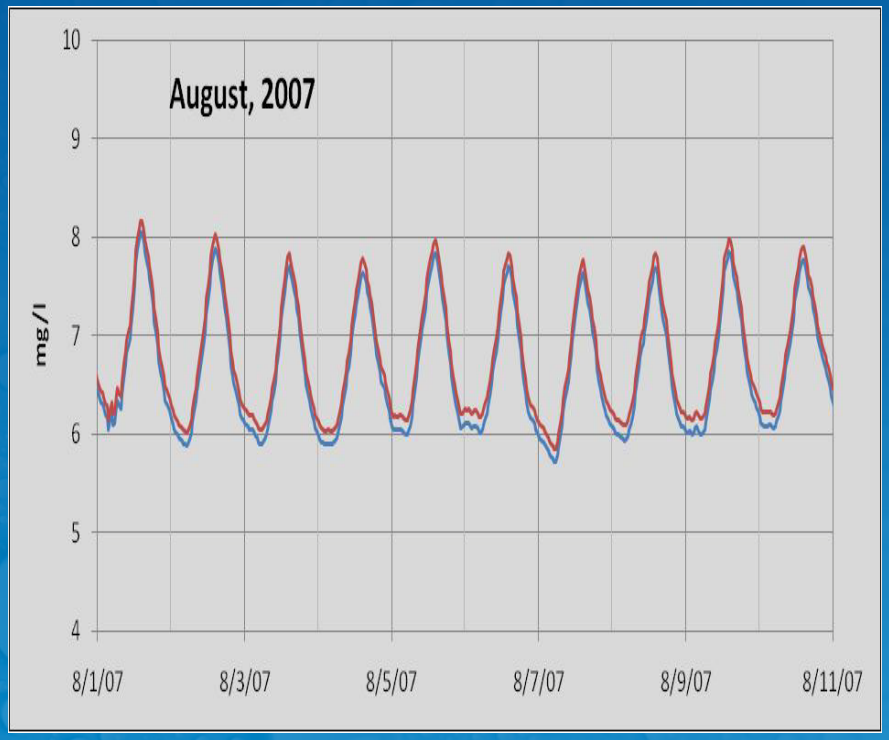


CDM

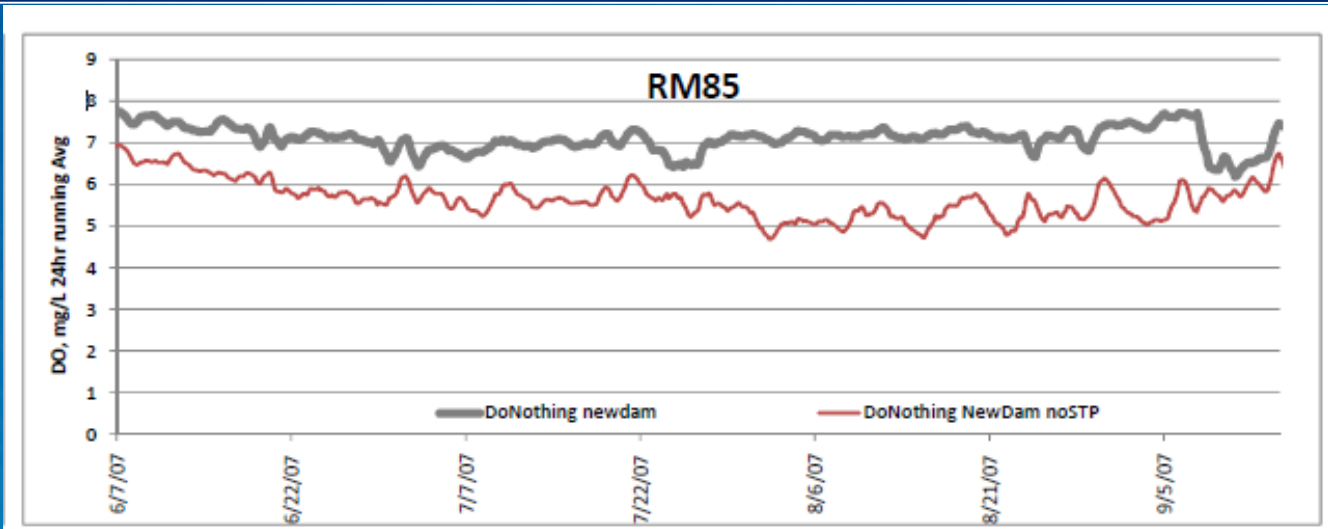
Sensitivity to WWTP Loads

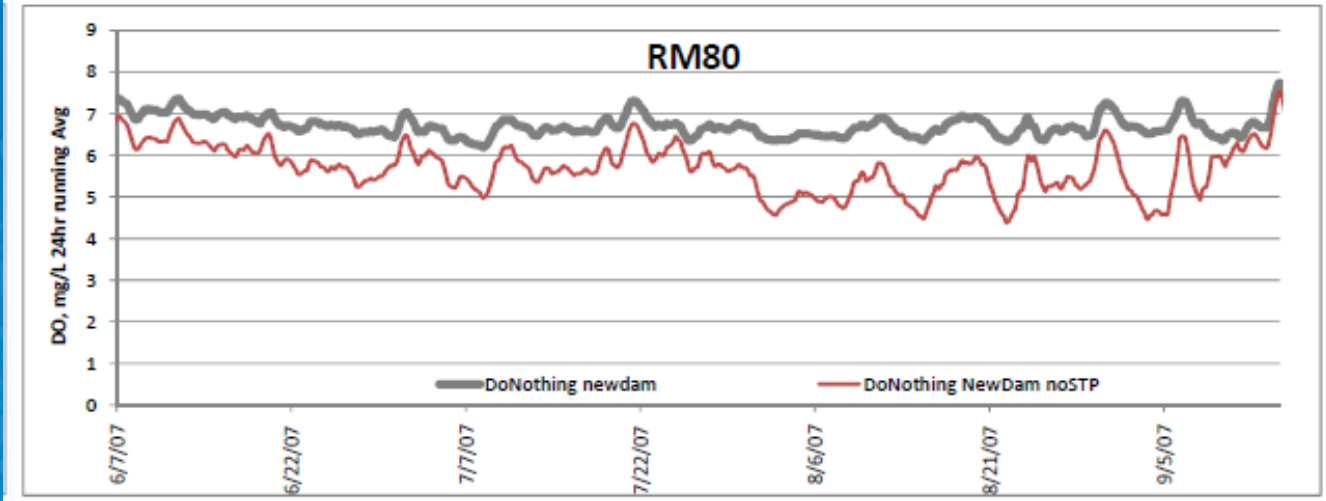
Comparing Actual Average vs. Permitted WWTP Effluent Concentrations





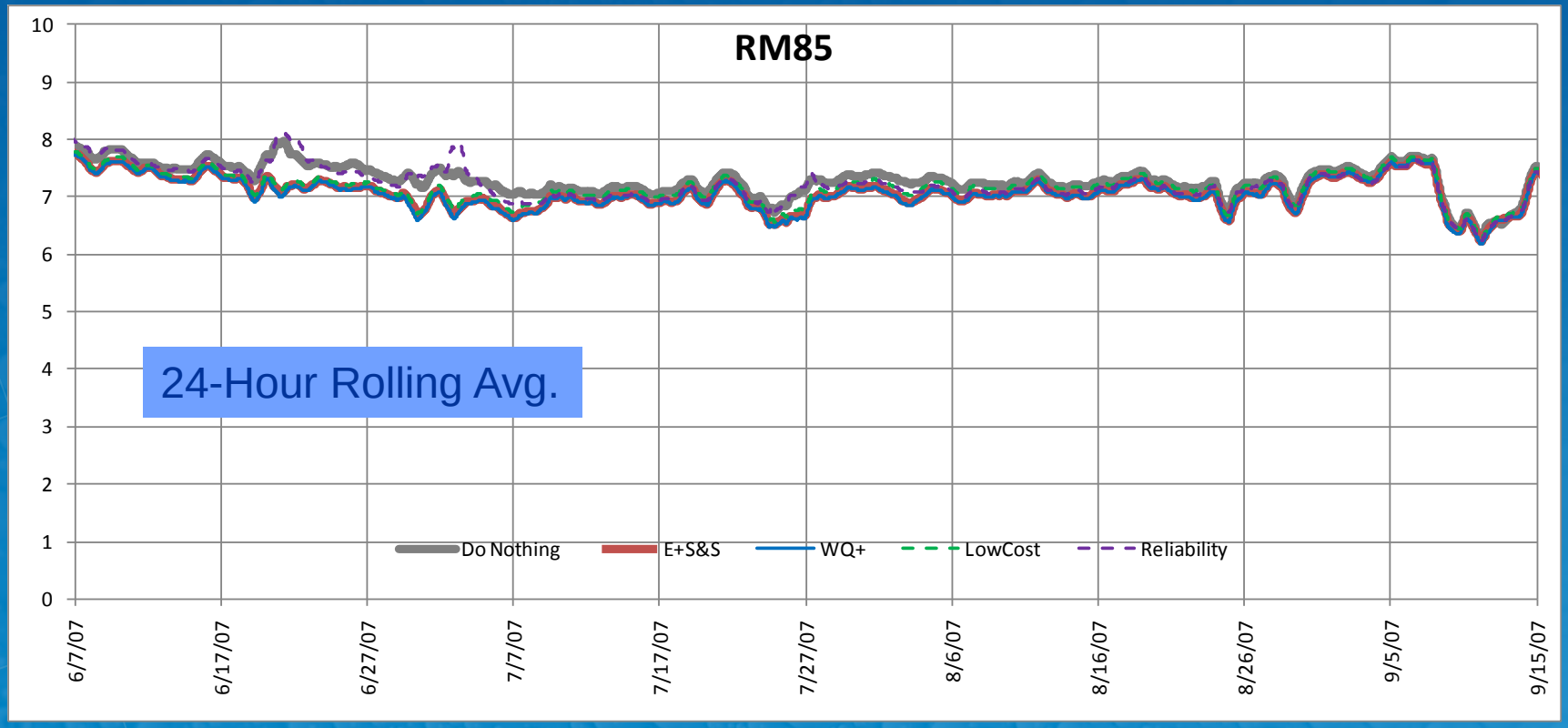
Sensitivity to WWTP Dissolved Oxygen





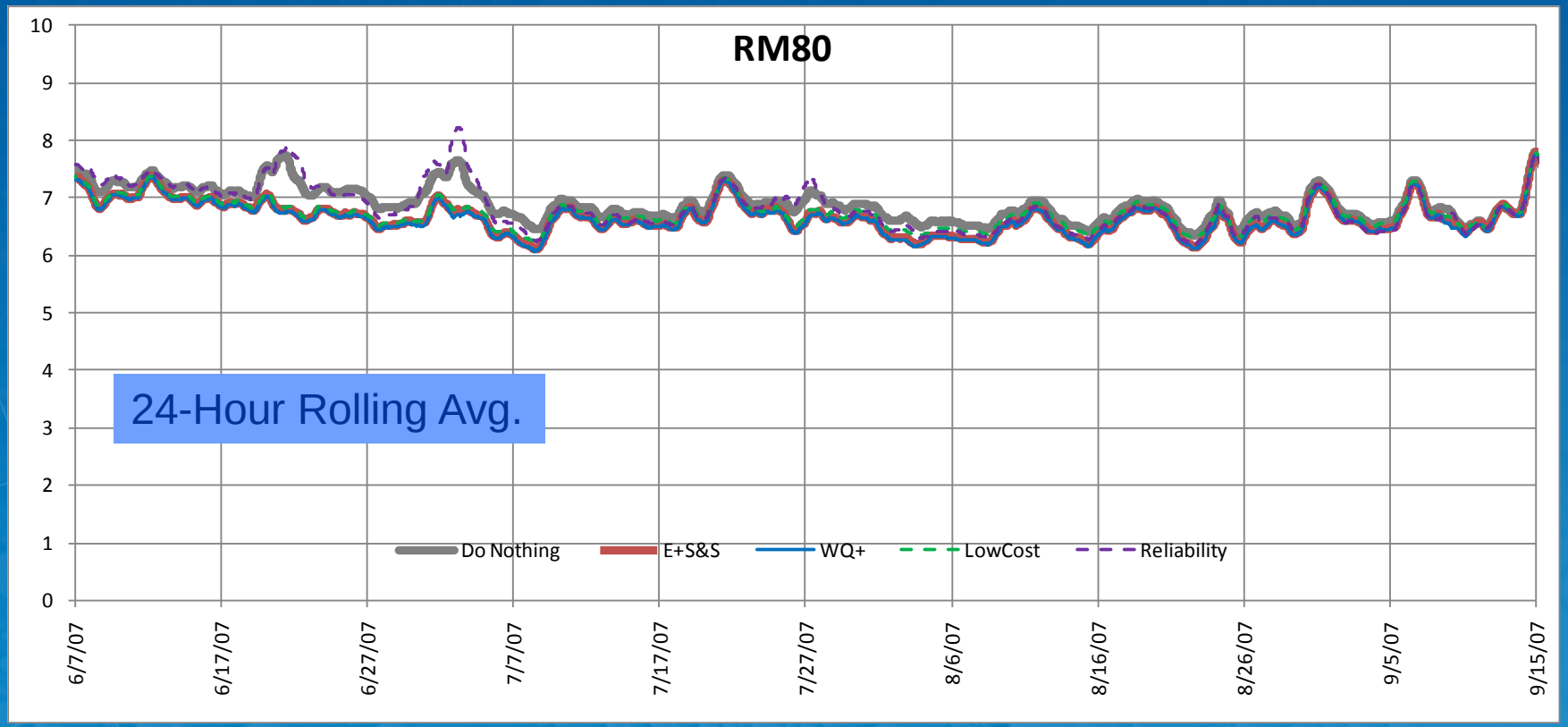
Alternatives Analysis (DO)

2007 – Existing Upstream Conditions: Downstream of WWTP



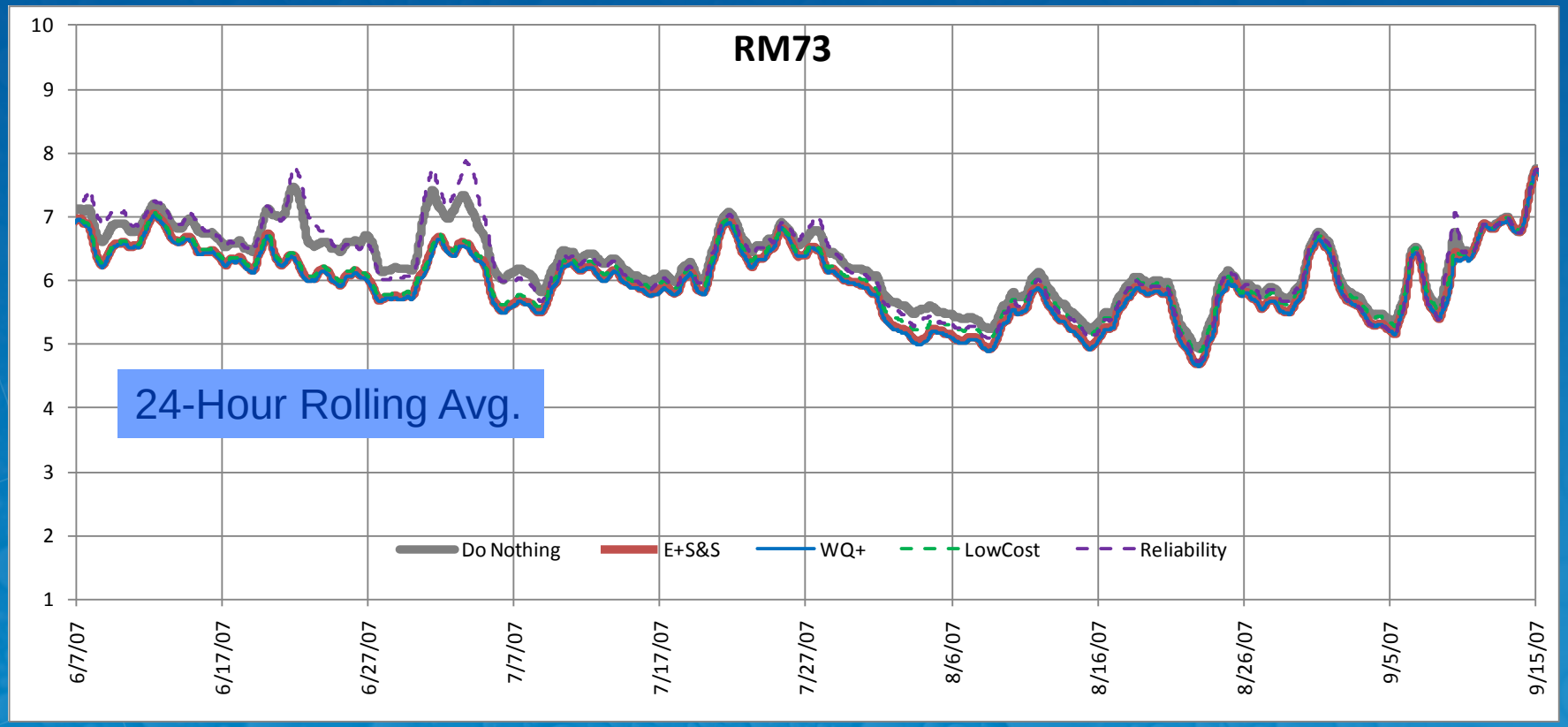
Alternatives Analysis (DO)

2007 – Existing Upstream Conditions: 5 mi. Downstream of WWTP



Alternatives Analysis (DO)

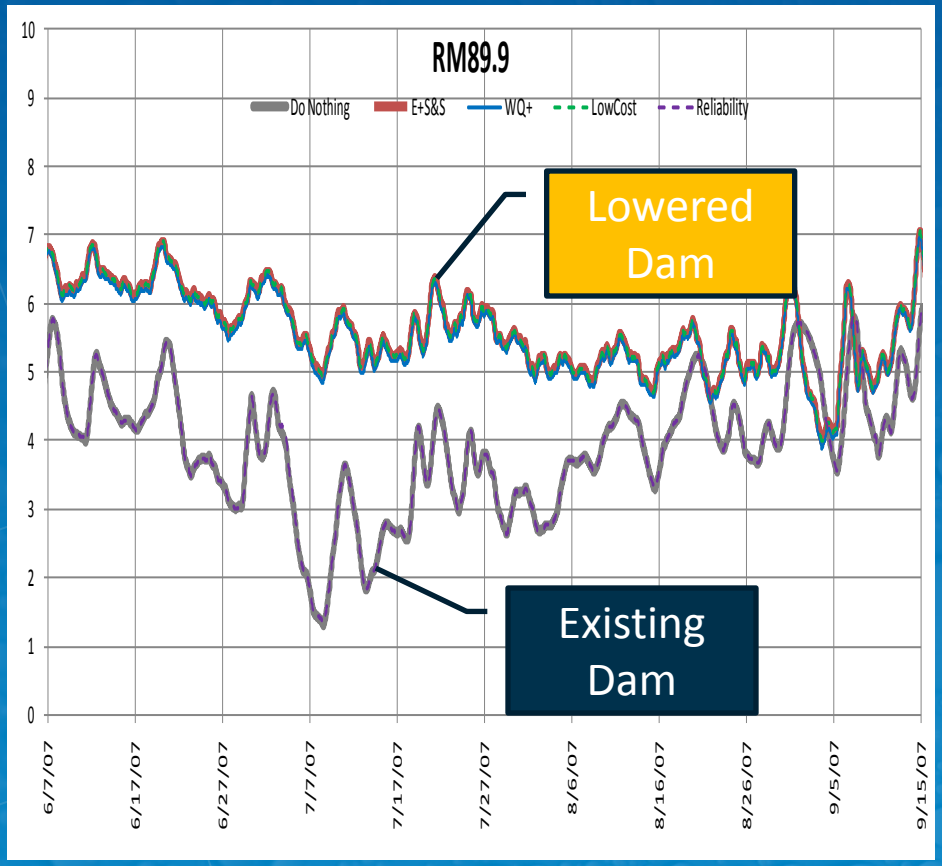
2007 – Existing Upstream Conditions: 12 mi. Downstream of WWTP



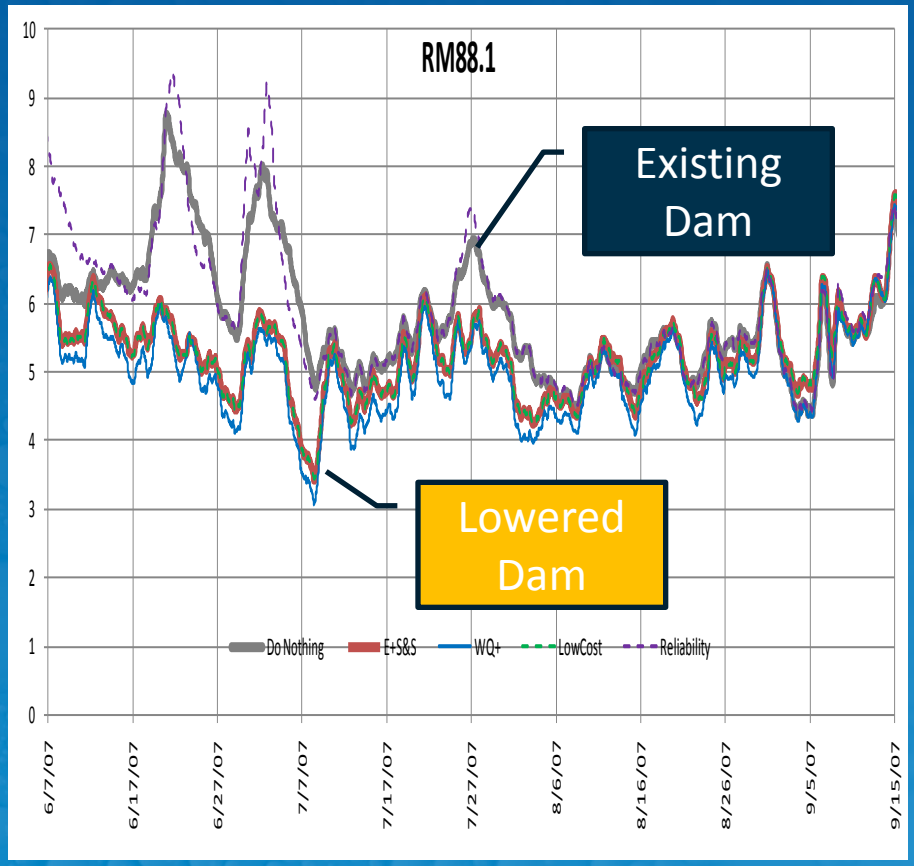
Alternatives are not affecting the downstream oxygen sag much

Effects of Low Head Dam Removal

Upstream of Dam



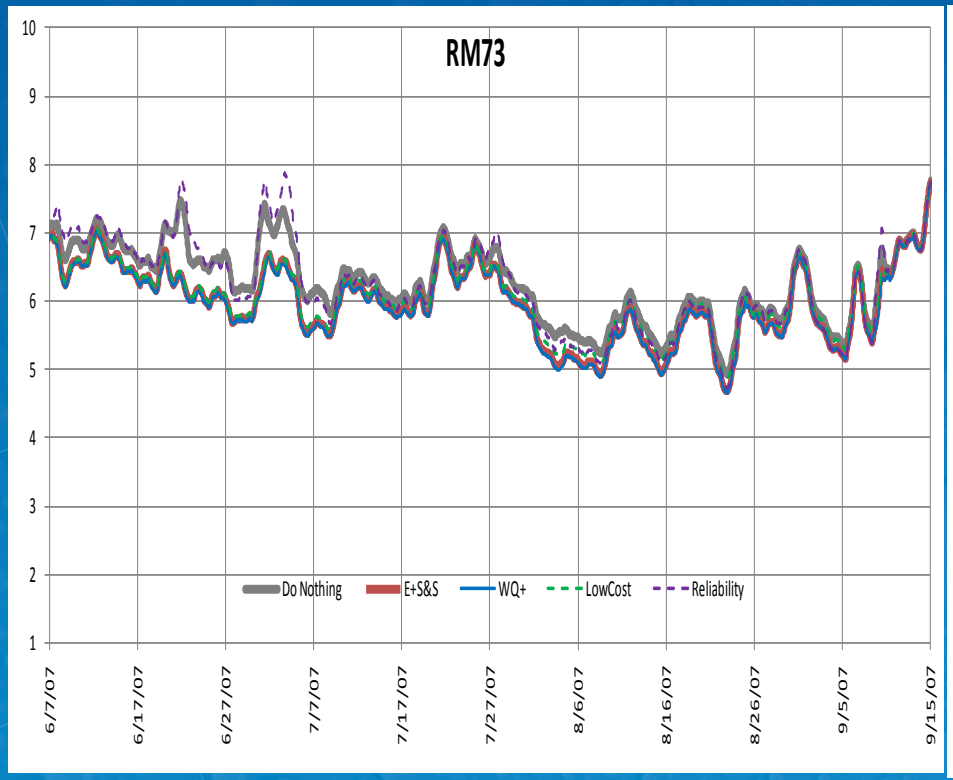
Downstream of Dam



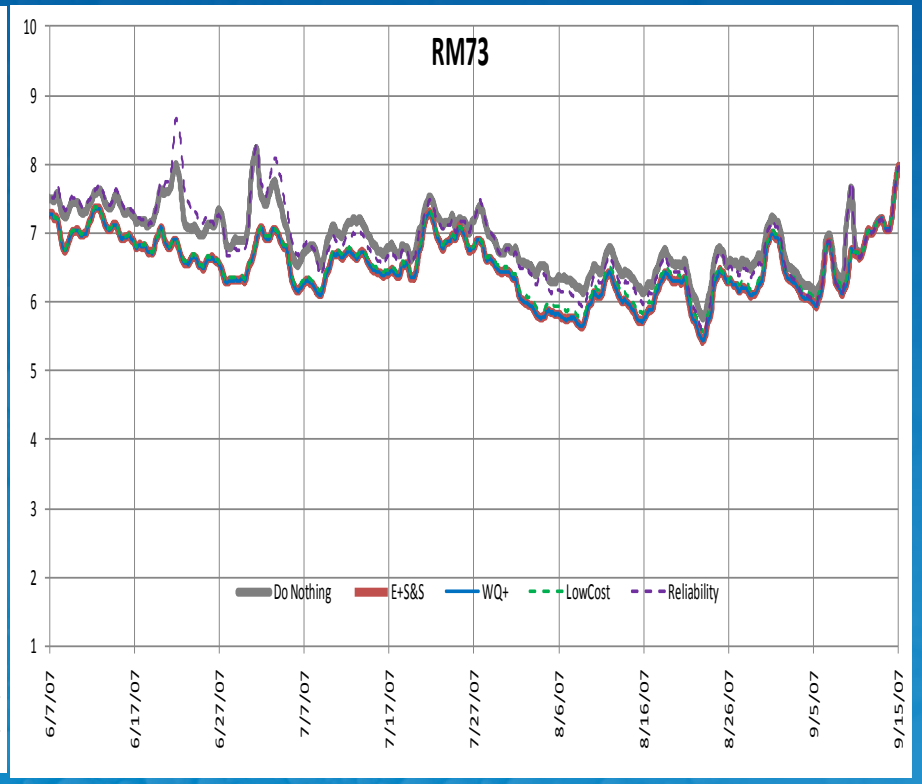
Extreme results in July/August affected by unusually high upstream BOD

Effect of Improving Upstream Water Quality (and SOD)

Existing Upstream Conditions



Improved Upstream Conditions



Conclusions from Simulation Scenarios

From a Water Quality perspective…

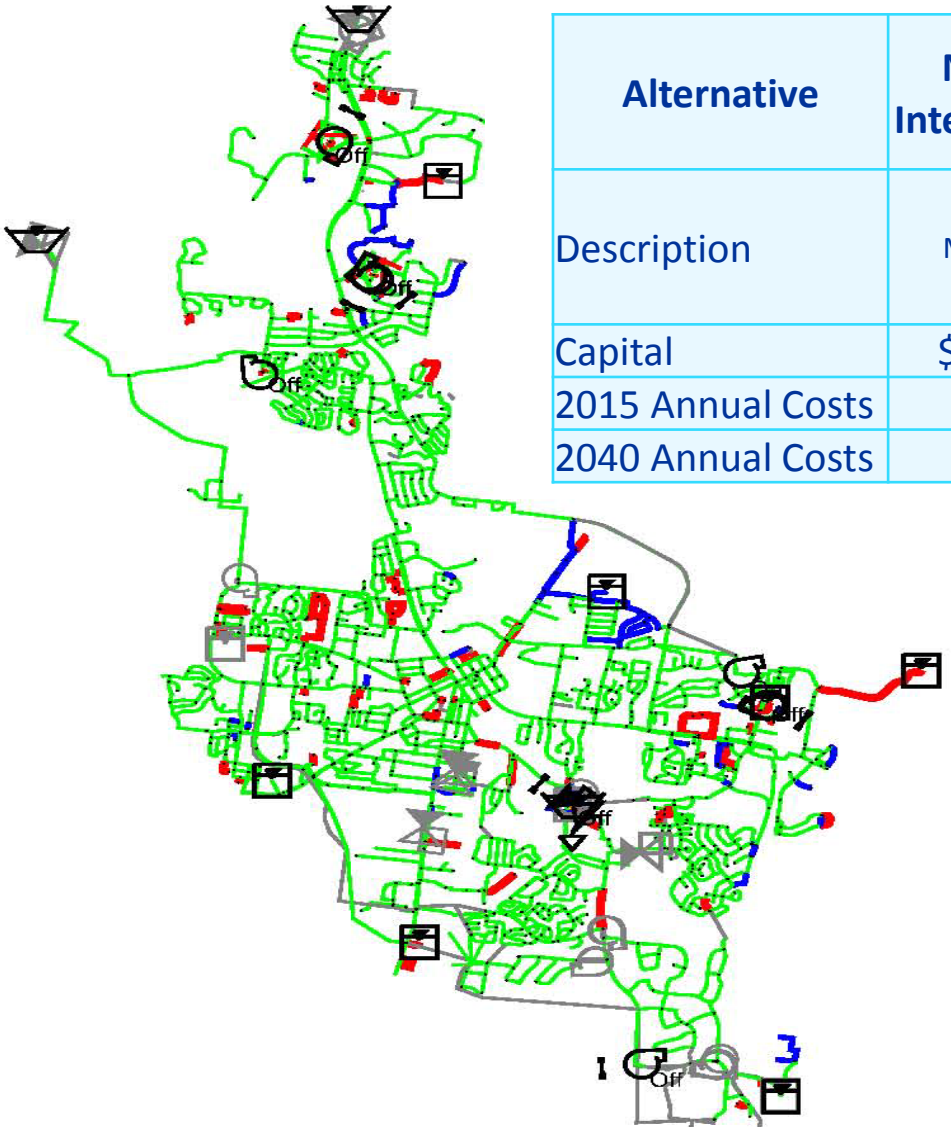
- Differences between IWRP alternatives are very small (0.0 – 0.3 mg/l)
  - SOD can affect DO by 1 – 3 mg/l
- Differences between existing and improved upstream conditions are appreciable (~1 or more mg/l)
- High quality, treated effluent can have beneficial impacts:
  - Additional Flow
  - Highly oxygenated water – benefits seen 5 miles downstream
- Low head dam removal may help improve DO upstream

REVIEW OF OPTIONS

Water Treatment Plant Options

Alternative	Non-Integrated	Efficiency + Safety & Security	Water Quality Plus	Modified Low Cost	Reliability
Description	Maintain 2.1 mgd & HVUD Purchase	Upgrade WTP to 4 mgd & HVUD Purchase	Decommission WTP & Purchase all Water from HVUD	Maintain 2.1 mgd & HVUD Purchase	Line to Cumberland River & new 12.5 mgd WTP
Capital	$4.9M	$9.1M	$1.3M	$4.9M	$117M
2015 Annual Costs	$6.6M	$5.9M	$6.7M	$6.5M	$5.3M
2040 Annual Costs	$10.9M	$9.8M	$10.8M	$10.9M	$8.4M

Distribution System Options



Alternative	Non-Integrated	Efficiency + Safety & Security	Water Quality Plus	Modified Low Cost	Reliability
Description	Model	Model, WQ/Quantity Improvements, AMI/AMR	Model, WQ/Quantity Improvements, AMI/AMR	Model and AMI/AMR	Model, WQ/Quantity Improvements
Capital	$200k	$6.2M	$6.2M	$700k	$5.7M
2015 Annual Costs	-	$1.5M	$1.5M	$1.5M	-
2040 Annual Costs	-	$1.5M	$1.5M	$1.5M	-

- Address water age/WQ by system improvements
- Long-term Water Quantity improvements
- Annual leak detection program

Conservation Options

- Conservation Options
  - Hardware Replacement
  - Water Use Ordinances
  - Accountability Measures (leak detection in distribution system)

Alternative	Non-Integrated	Efficiency + Safety & Security	Water Quality Plus	Modified Low Cost	Reliability
Description	No	Irrigation Controls, Toilet Replacement & Additional Conservation	Irrigation Controls & Toilet Replacement	No	Irrigation Controls & Toilet Replacement
Capital	-	$2.85M	$2.85M	-	$2.85M
2015 Annual Costs	-	$94.7k	$94.7k	-	$94.7k
2040 Annual Costs	-	$94.7k	$94.7k	-	$94.7k

Stormwater Management Options

- Eight stormwater projects from previous stormwater plans

ID	Stream	Watershed Plan Notes
W1	Sharps Branch	Detention, 40 ac-ft of storage, Tributary 2 near Birchwood Circle
W2	Quarry Branch	Detention, 30 ac-ft of storage, Tributary 3 near Downs Blvd and Figures Dr
W3	N. Ewingville Creek	Detention, retrofit existing facility at junction 10600
W4	N. Ewingville Creek	Detention, Junction 32450 upstream of Stanwick Dr.
W5	Liberty Creek	Detention , 10 ac-ft of storage. Main stem, upstream of Jordan Rd
W6	Saw Mill Creek	Detention in the vicinity of Model Junction 90420
W7	Donelson Creek	Detention in the vicinity of model junction 90851
W8	Goose Creek	Detention, 10 ac-ft storage, retrofit recommendation

Alternative	Non-Integrated	Efficiency + Safety & Security	WQ Plus	Modified Low Cost	Reliability
Description	No	BMPs	BMPs	No	No
Capital	-	$14.1M	$14.1M	-	-
Annual Costs	-	$125k	$125k	-	$25k

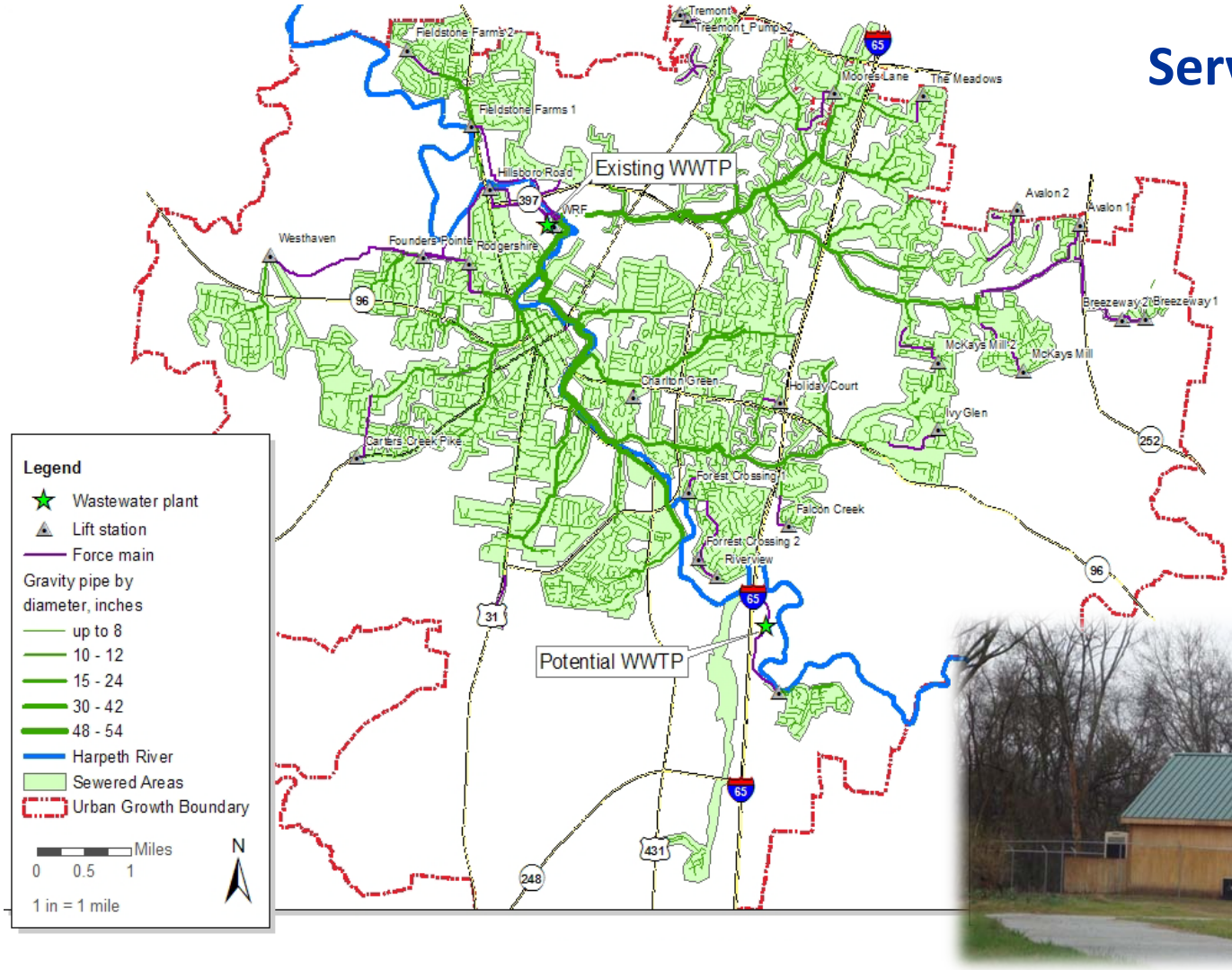
Ecological Restoration Options

- Ecological restoration projects (including cattle exclusion)
  - Low Head Dam Removal ($428k)
  - Harpeth stream bank improvements ($5.39M)
  - Five Mile Creek improvements ($2.58M)
  - Sharp's Branch improvements ($667k)
  - Additional tributaries ($20.4M)

Source: Volunteer Stream Bank Erosion Study (HRWA)

Alternative	Non-Integrated	Efficiency + Safety & Security	Water Quality Plus	Modified Low Cost	Reliability
Description	No	Low Head Dam Removal & Specific Restoration Projects	Low Head Dam Removal & Watershed Projects	Low Head Dam Removal	No
Capital	-	$9.1M	$29.1M	$428k	-

City of Franklin Wastewater Service Area



Service Area Includes

- 20 square miles of area
- 300+ miles of gravity sewer
- 22+ miles of force main
- 26 pump stations

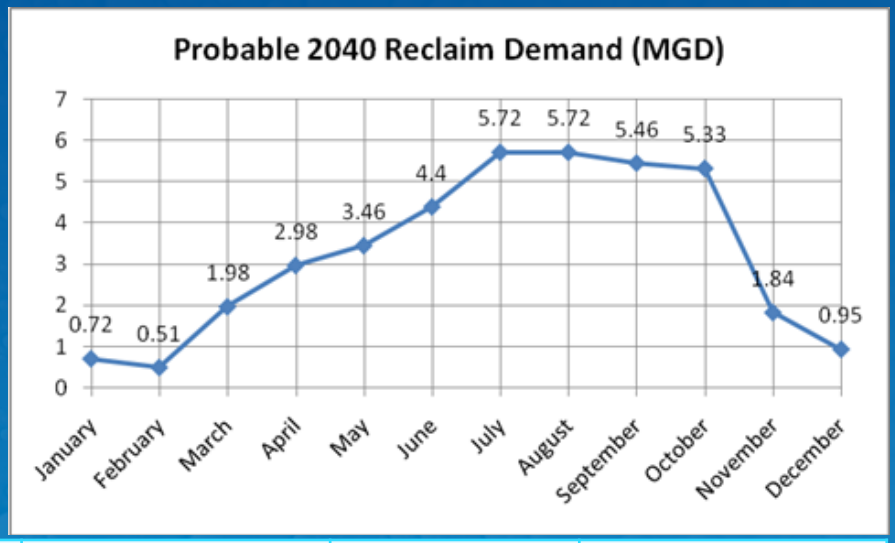
Decreasing Demand and Increasing Capacity

1. Existing WWTP maintenance and minor facility improvements are required to meet permitted capacity
2. Improvements to existing WWTP could be implemented to increase capacity
3. A new WWTP could be constructed to address flows in the southern portion of the City's service area
4. Collection system management and rehabilitation could reduce peak flows to WWTP

Wastewater Treatment & Collection System Options

Alternative	Non-Integrated	Efficiency + Safety & Security	Water Quality Plus	Modified Low Cost	Reliability
Existing WWTP	16 + 8 mgd	16 mgd	16 + 8 mgd	16 + 8 mgd	12 + 6 mgd
New South WWTP	None	8 mgd	None	None	6 mgd
Capital	$98.8M	$103.6M	$124M	$115.2M	$92.6M
2040 Annual Costs	$1.6M	$3.8M	$3.6M	$3.5M	$2.5M

Reclaimed Water Options



Alternative	Non-Integrated	Efficiency + Safety & Security	Water Quality Plus	Modified Low Cost	Reliability
Description	No	Upgrade Pumping to 12 mgd & add Probable Customers	Upgrade Pumping to 12 mgd & add Probable Customers	No	Upgrade Pumping to 12 mgd & add Probable Customers
Capital	-	$900k	$900k	-	$900k
Annual Costs	$30.4k	$69.3k	$98.9k	$30.4k	$69.3k

Biosolids Treatment Strategy

- One WWTP
  - All future biosolids treatment at Franklin WWTP
- Two WWTPs
  - Full solids treatment process at existing Franklin WWTP
  - Partial solids treatment (thickening) at potential new WWTP with transport of thickened solids to Franklin WWTP to completing the treatment process

Biosolids Process Options for 2 Plants

- Thickening
- Anaerobic Digestion and Biogas Recovery
- Dewatering
- Solar Drying

Alternative	Upgrade Existing Process	New Class A Process
Capital	$20M	$67M
Annual Costs	$2.2M	$1.2M

RANKING OF ALTERNATIVES

IWRP Objectives

1. Meet current and future water and wastewater demands reliably
2. Provide safety and security of water resources systems
3. Maximize efficiency of water use and value of water resources
4. Improve water quality and ecological health of Harpeth River and watershed
5. Provide improved access and aesthetics of Harpeth River
6. Minimize carbon footprint of water resources operations
7. Achieve sustainable biosolids management
8. Achieve regional acceptance
9. Provide excellent level of utility services at reasonable cost

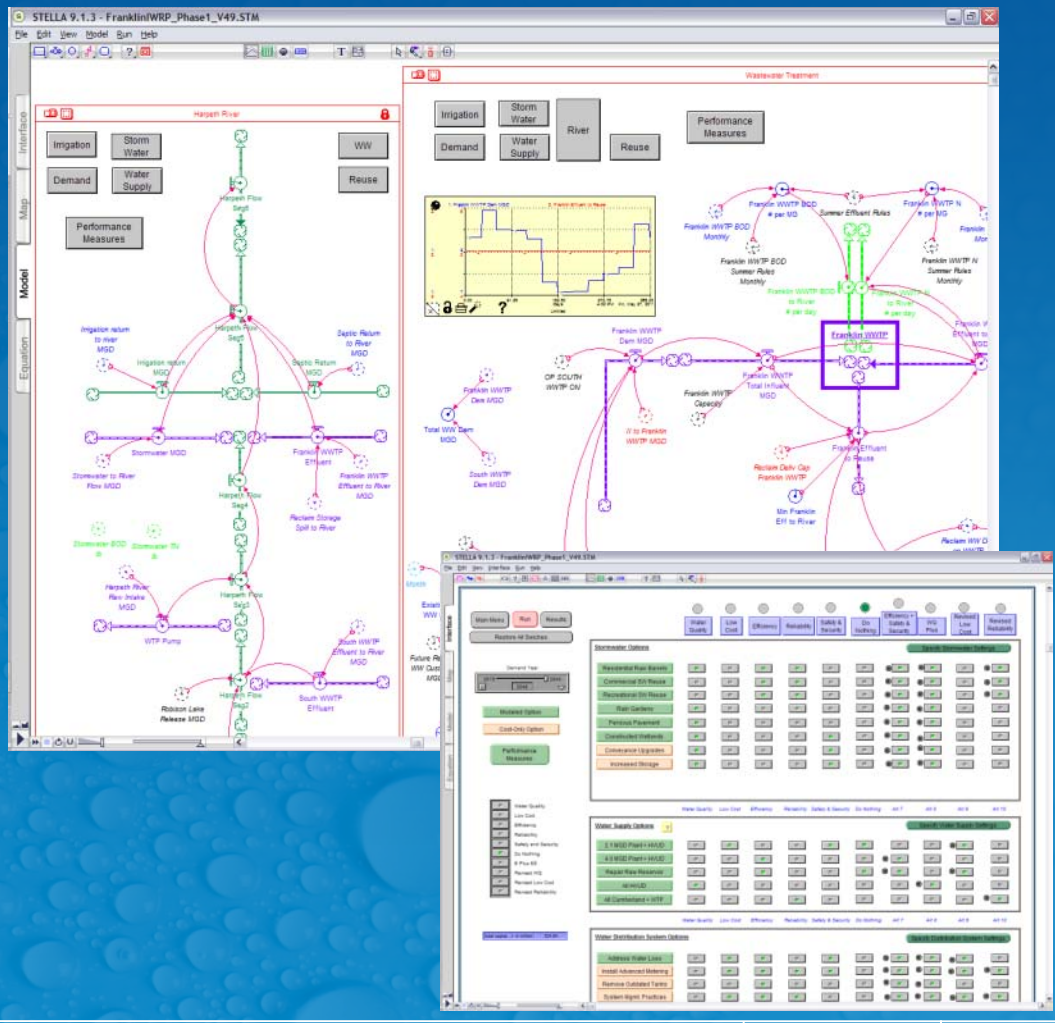
Definition of Alternatives

	Non-Integrated	Efficiency + Safety & Security	Water Quality Plus	Modified Low Cost	Reliability
Low-Head Dam Removal	No	Yes	Yes	Yes	No
Water Treatment Plant	2.1 mgd & HVUD Purchase	4 mgd & HVUD Purchase	Decommission WTP & HVUD Purchase	2.1 mgd & HVUD Purchase	Line to Cumberland & 12.5 mgd WTP
Water Distribution System	Model	WQ/Quantity Improvements, advanced metering	WQ/Quantity Improvements, advanced metering	Advanced metering	WQ/Quantity Improvements
Conservation	No	5% savings	2% savings	No	2% savings
Stormwater BMPs	No	Yes	Yes	No	No
Ecological Restoration	No	Low Head Dam Removal & Specific Restoration Projects	Low Head Dam Removal & Watershed Projects	Low Head Dam Removal	No
Existing WWTP	24 mgd	16 mgd	24 mgd	24 mgd	18 mgd
New Southern WWTP	None	8 mgd	None	None	6 mgd
Berry's Chapel/ Cartwright Flows	No	Yes	Yes	No	No
Collection System	Pump to Existing WWTP	Septic Users, I/I Reduction	Septic Users, I/I Reduction, Pump to Existing WWTP	I/I Reduction, Pump to Existing WWTP	Septic Users
Reclaimed Water	No	Upgrade Pumping to 12 mgd & add Probable Customers	Upgrade Pumping to 12 mgd & add Probable Customers	No	Upgrade Pumping to 12 mgd & add Probable Customers

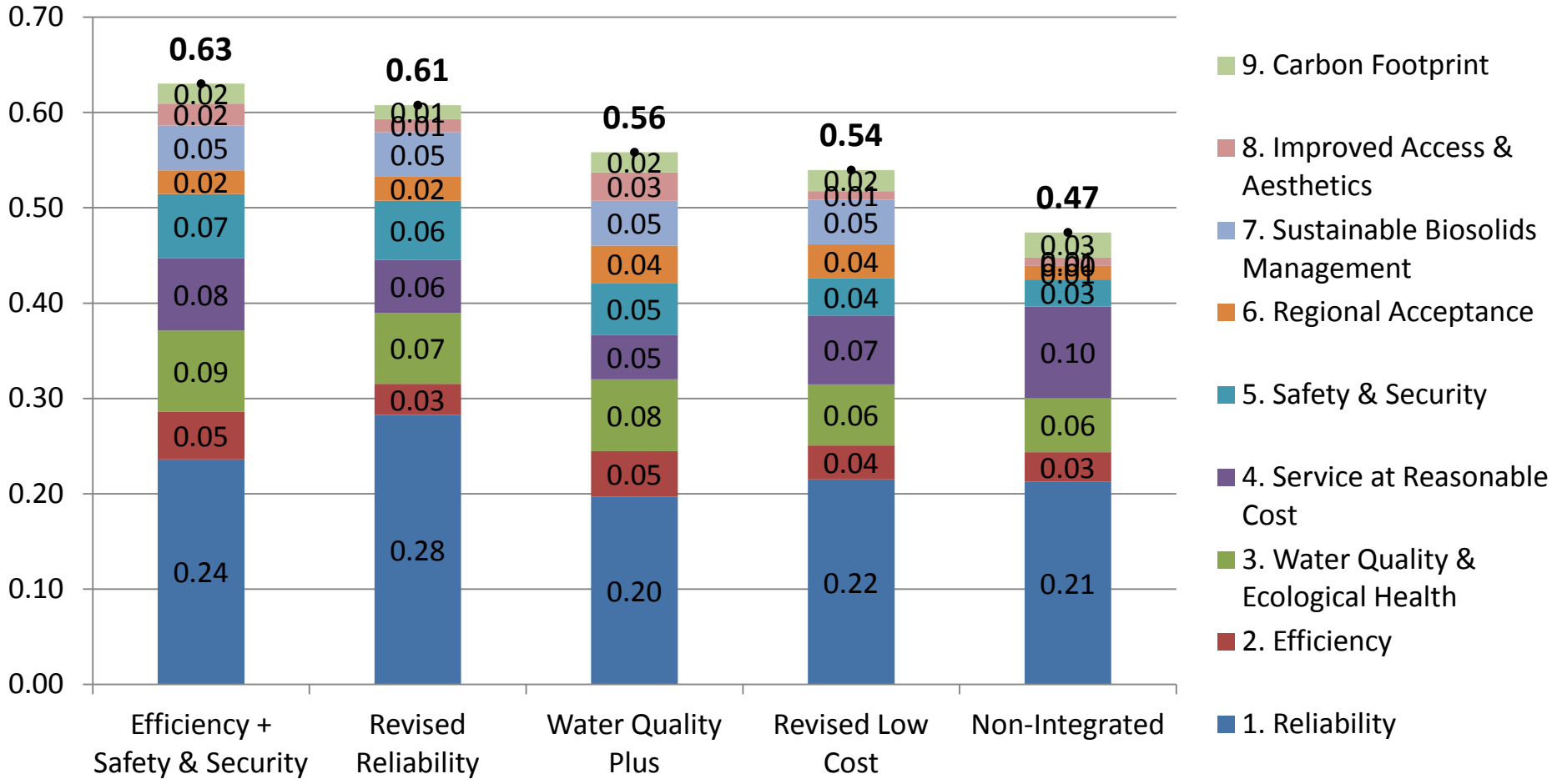
Updates to Integrated Model based on Phase II Technical Analysis

Update inputs:

- Unit costs ($ per gallon treated, etc)
- Capital and maintenance costs
- Unit energy requirements (kWh/gal treated or pumped)
- Treatment capacities
- Inflow/Infiltration estimates
- Stormwater BMP performance
- Phasing of capital projects
- WWTP effluent concentrations



Phase II Alternatives



Objective Weighting Sensitivity Analysis

	Stakeholder Weights	Equal Weights	Reliability 30%	Water Quality 30%	Safety & Security 30%	Cost 30%
1. Reliability	31.1%	11.1%	30.0%	8.75%	8.75%	8.75%
2. Efficiency	15.5%	11.1%	8.75%	8.75%	8.75%	8.75%
3. Water Quality & Ecological Health	13.5%	11.1%	8.75%	30.0%	8.75%	8.75%
4. Service at a Reasonable Cost	13.2%	11.1%	8.75%	8.75%	8.75%	30.0%
5. Safety & Security	8.3%	11.1%	8.75%	8.75%	30.0%	8.75%
6. Regional Acceptance	5.7%	11.1%	8.75%	8.75%	8.75%	8.75%
7. Sustainable Biosolids Management	4.7%	11.1%	8.75%	8.75%	8.75%	8.75%
8. Improved Access & Aesthetics	4.5%	11.1%	8.75%	8.75%	8.75%	8.75%
9. Carbon Footprint	3.5%	11.1%	8.75%	8.75%	8.75%	8.75%

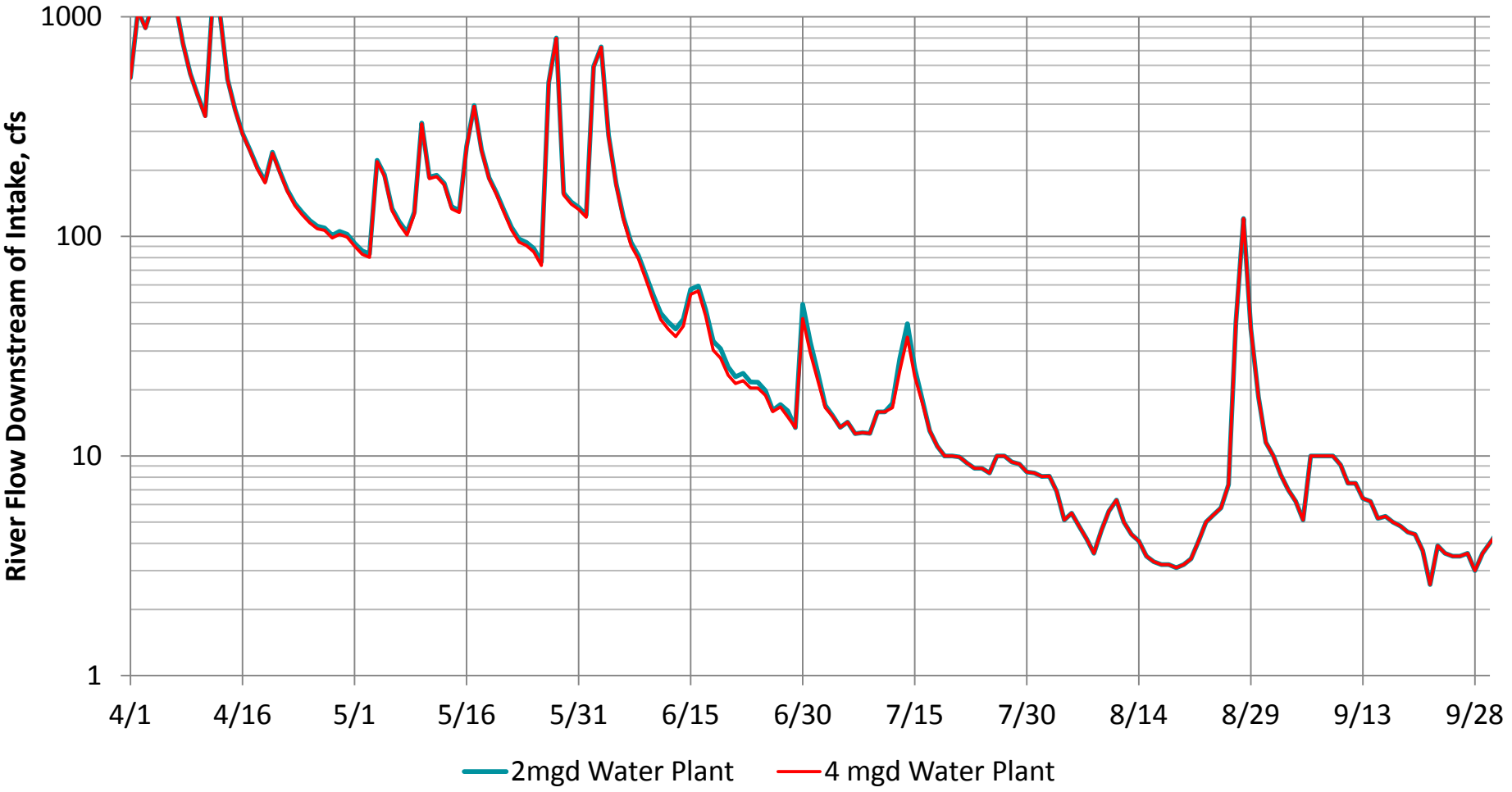
Ranking Results
Sensitivity Analysis of Alternatives Results

	Efficiency + Safety & Security	Revised Reliability	Water Quality Plus	Revised Low Cost	Non-Integrated
Stakeholder Weights	1	2	3	4	5
Equal Weights	1	3	2	4	5
Reliability 30%	1	2	3	4	5
Water Quality 30%	1	3	2	4	5
Safety & Security 30%	1	3	2	4	5
Cost 30%	1	4	3	2	5

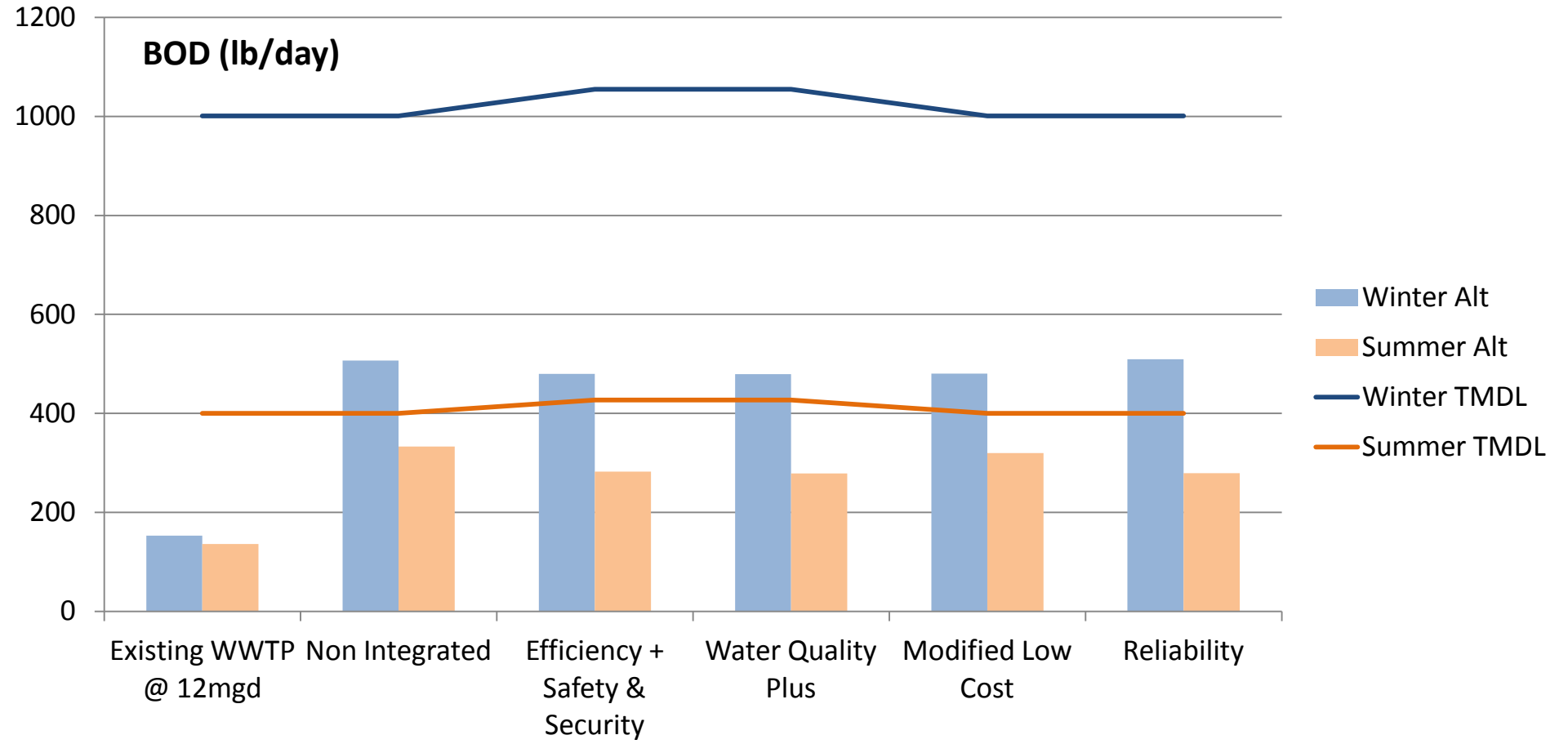
Addressing Key Questions

1. Does expansion of the WTP affect river flow?
2. Do the alternatives comply with the City's TMDL requirements?
3. What impact does the water supply options have on the preferred alternative?

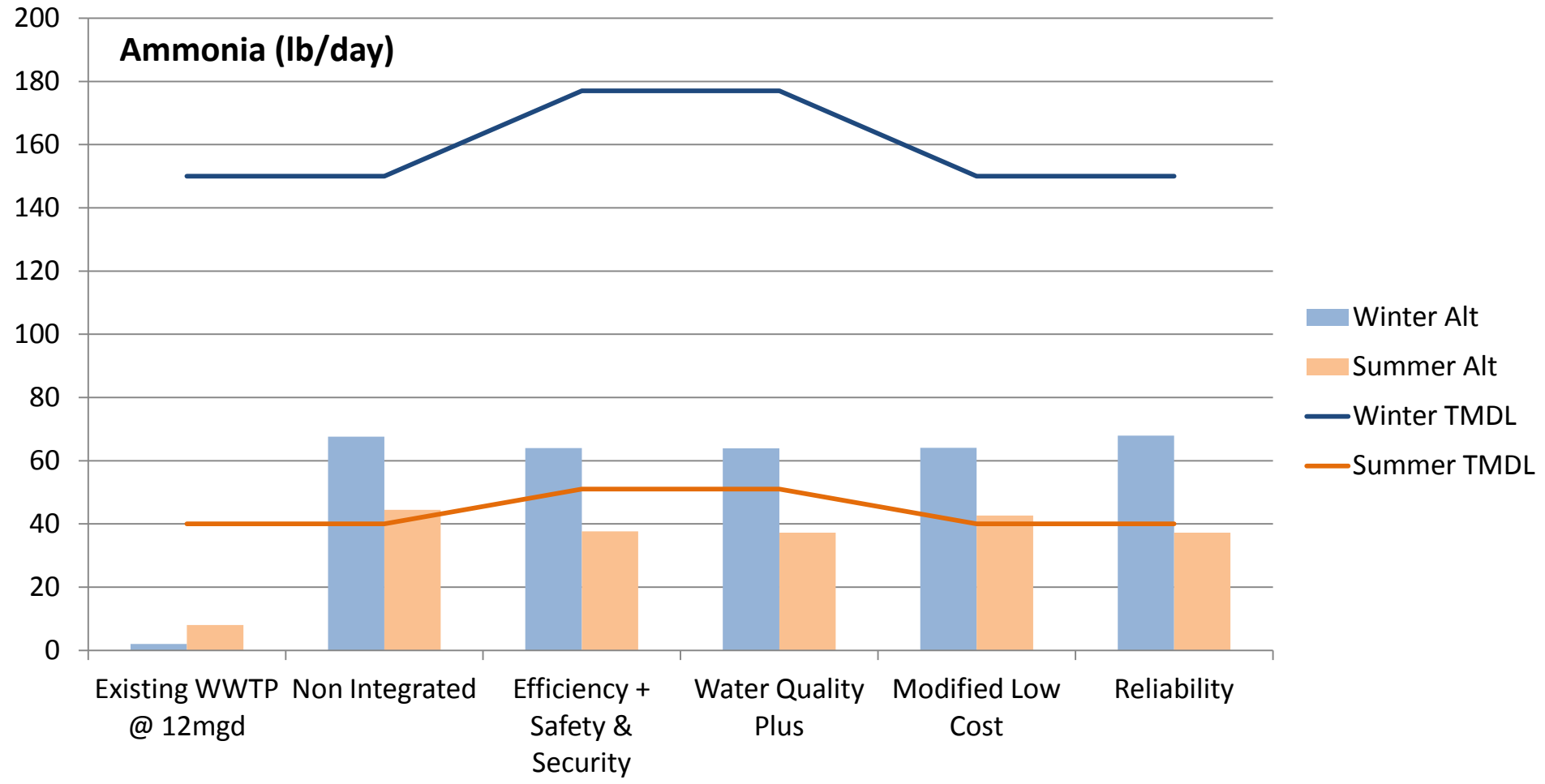
Impacts of 2 versus 4 mgd WTP



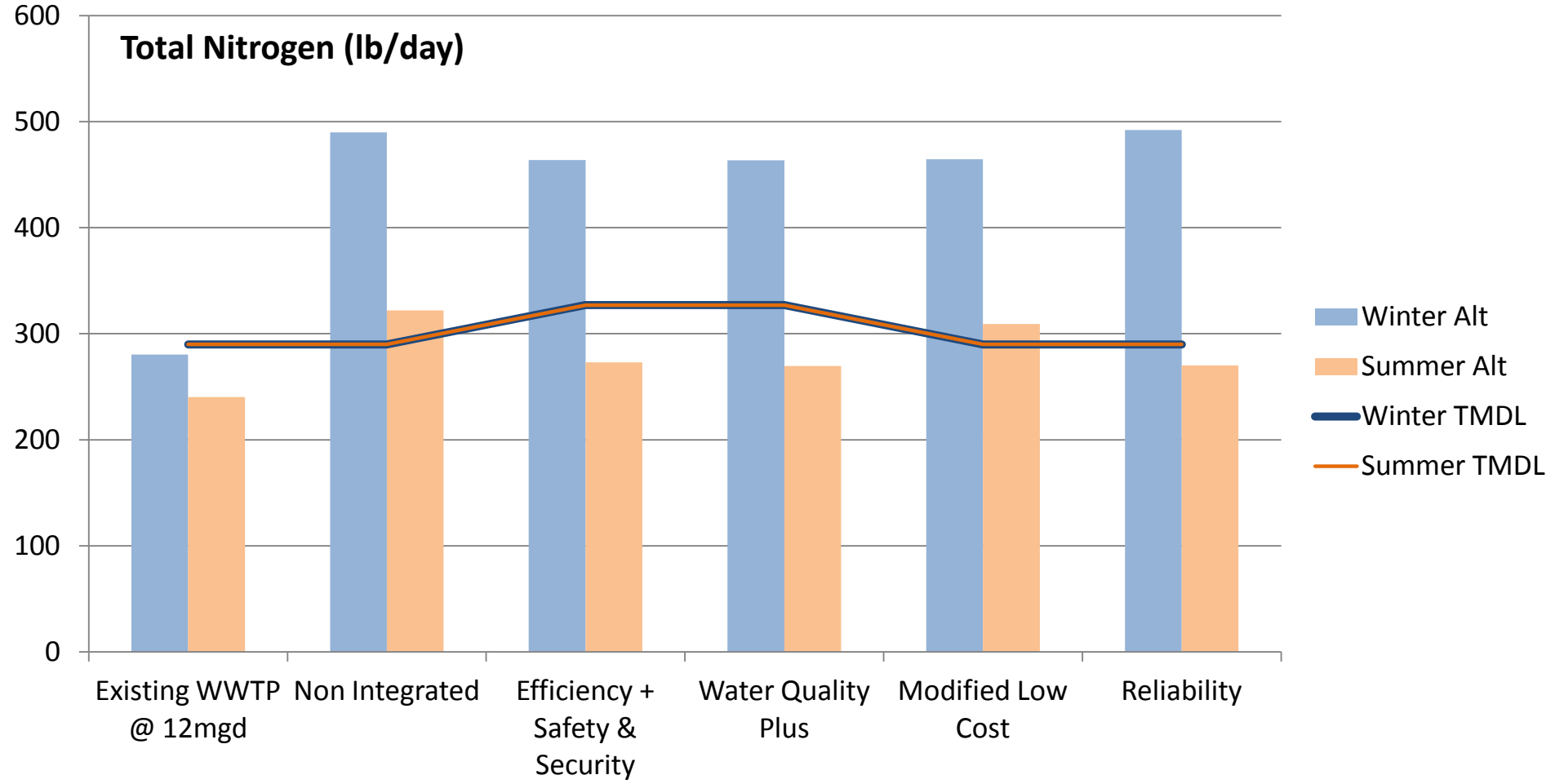
WLA for BOD


BOD (lb/day)
1200
1000
800
600
400
200
0
Existing WWTP @ 12mgd
Non Integrated
Efficiency + Safety & Security
Water Quality Plus
Modified Low Cost
Reliability
Winter Alt
Summer Alt
Winter TMDL
Summer TMDL

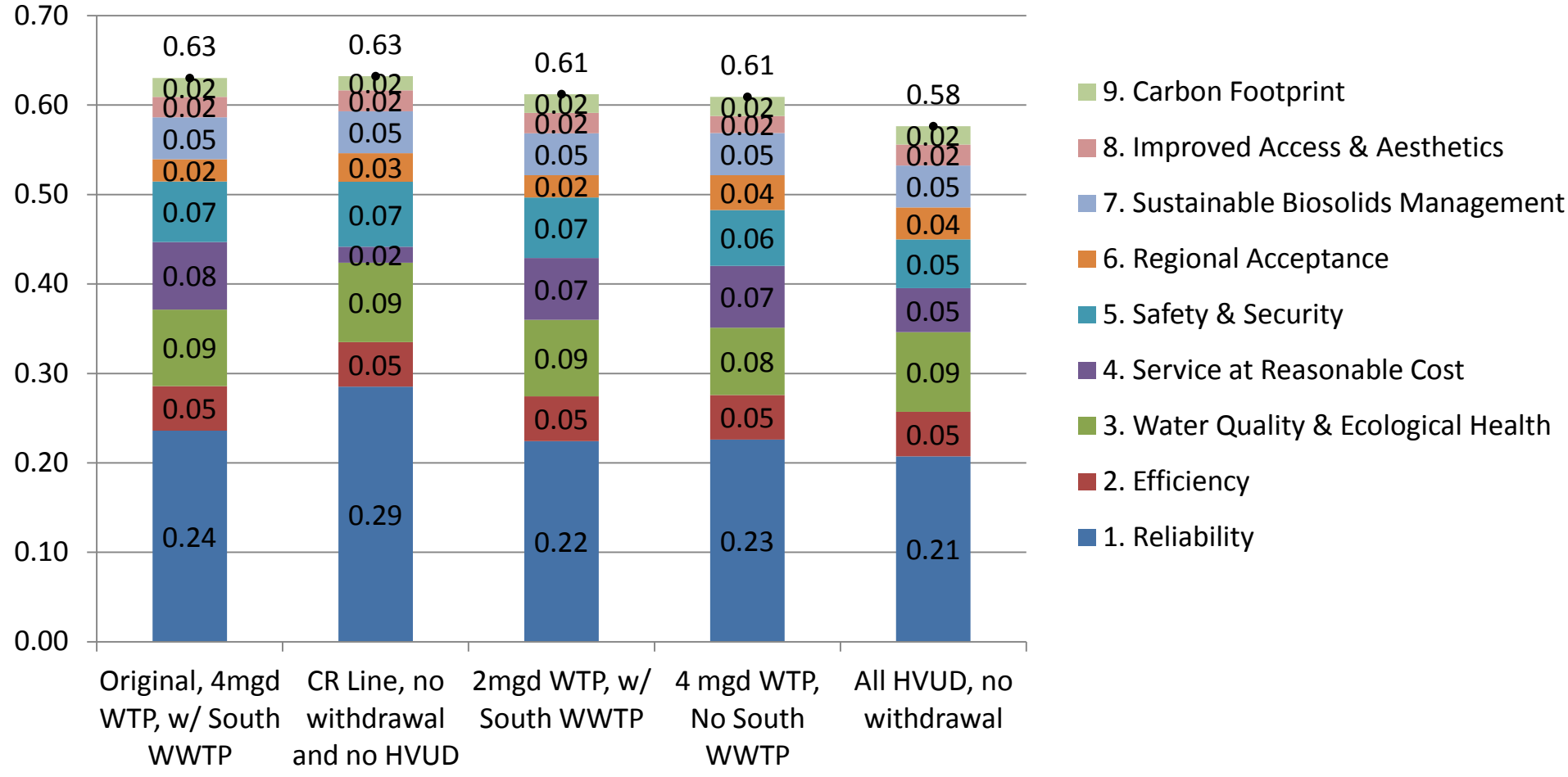
WLA for Ammonia



WLA for Total Nitrogen



Sensitivity of Preferred Alternative to Supply Options



E + S&S	Reliability	WQ +	Low Cost	Non-Integrated
0.63	0.61	0.56	0.54	0.47

CDM

CONCLUSION AND FINDINGS

Efficiency + Safety & Security is the Preferred Alternative

Benefits:

- 100% Reliable in meeting future water wastewater demands
- Greater control and flexibility
- Meets most of the city's waste load allocations
- 30 miles of river restoration and stormwater BMPs
- Sustainable biosolids management
- Within 4% of the life-cycle cost of the low cost alternative and $100 million less than the most expensive alternative