Analysis of

Proposed
Hopkinton Water Connection

Initial Report

Information for Consideration

Goals for this Presentation

- Introduce the whole picture
- Look at some of the questions and data
  - Some questions are fairly easy to answer
  - Others are more difficult
- Mid-course adjustments?
- Another report might follow
  - In about one month, depending on directions

For Sure ï A Big Decision

- Supply all the water for Hopkinton
- Hopkinton use currently exceeds Southborough
  - Could become even larger –
    - If fewer water restrictions produce more usage
    - If system expands due to private well conversion
    - Population: 18,900 vs. 10,400
- This decision may last 50–100 years
- Southborough Water System:
  - 100 years of ñretailò water delivery
    - Extremely reliable service and good water quality
  - Proposed to be ñwholesaleò plus ñretailò system
    - A significant change

Schedule for Decisions

- I met with Hopkinton and PARE
  - Town Manager, DPW Chief and Engineer
  - VP PARE
- My schedule questions:
  - When would you expend bulk of engineering design funds?
    - Answer: After Southborough decides
  - Suppose we need a TM vote and that doesn't happen until Spring. Is that ok?
    - Answer: Yes.

Tonightôs Agenda

- Water System Basics
- 20 Year Trends in Southborough Water
  - Demand and Forecasts
  - Supply Side
- The Hopkinton Connection Question
  - Fair cost distribution between Towns
  - Engineering Risk
  - Management Considerations
- Next steps?

Water System Basics

- Largest Framework
  - Global warming is not expected to reduce rainfall in the Northeast
    - Predictability reduced, but models don't forecast drought
  - The big issue – water quality standards
    - Driven by discovery of unexpected toxicities
    - Hard to predict potential full impact into the future
      - Hopkinton… plus whose other wells?
      - Other chemicals yet to be identified?
    - MWRA water appears as the best supply
      - It could be hit with excess future demand
  - Right now MWRA has extra water
    - That's the good reality we have today

Water System Basics

- Water – an essential utility
  - Drinking, cooking, washing, flushing sewage
- But, discretionary use drives peak demand
  - Primarily irrigation of lawns and gardens,
  - 44 million gals per month in Summer
  - 21 million gallons per month in Winter
- Peak demand drives system size
  - System must be sized to handle peak demand
  - Peak is more than 2x average demand
- System size drives capital investment
  - When systems must expand, it is a major cost

Water System Basics

- Discretionary usage varies widely
  - From one household to another
  - From one community to another
  - From one decade to another
- Many municipal systems limit such use
  - To protect essential uses
  - Hopkinton and Ashland often limit use
- Southborough has had few limits
  - Total 250 mgpy essential. 94 mgpy discretionary
  - MWRA water has been abundant

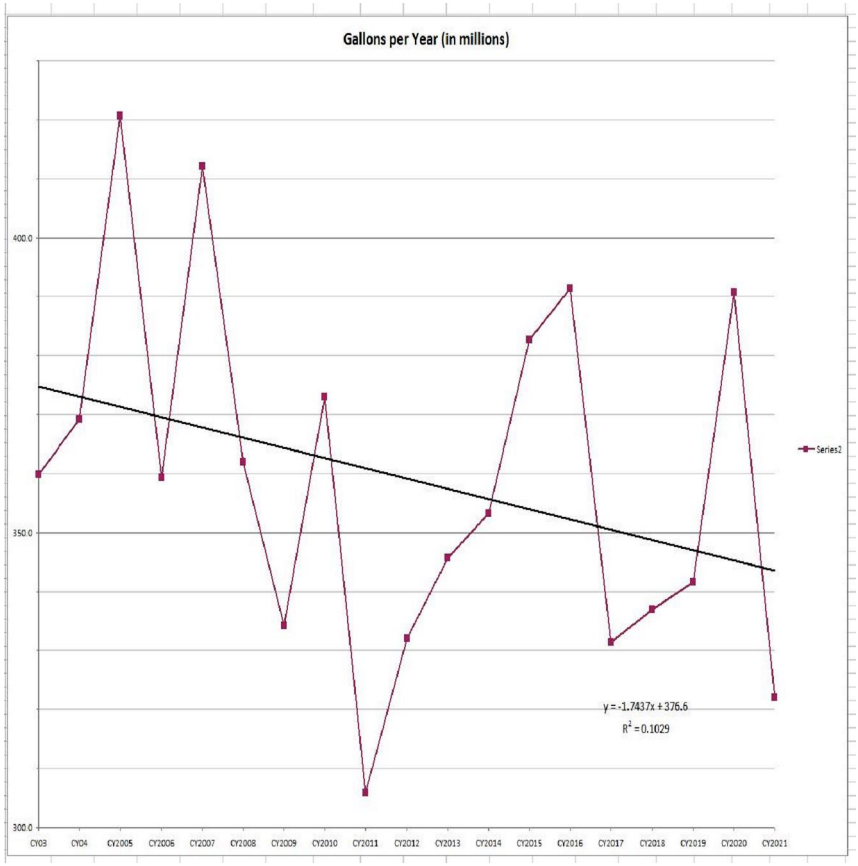
Southborough 20 Year Trends

Southborough 20 Year Trends

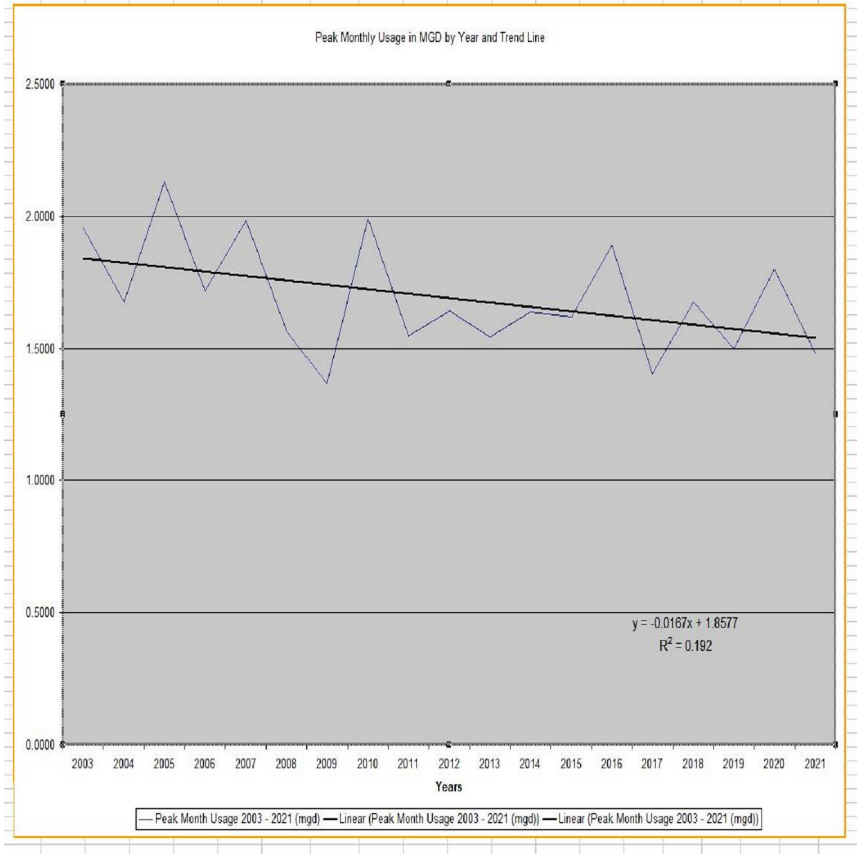
- Water Usage Peaked in 2004
  - Slowly declining for 18 years
- Population has grown
- Therefore usage per capita and usage per connection have dropped sharply
  - 124 gallons per capita per day in 2000,
  - 75 in 2019 (across all connection types)
  - Usage still above DEP usage norms
    - Therefore, not intrinsically suspicious data

Southborough 20 Year Trends

Total Annual



Peak Usage



Rainfall makes data noisy. Trend has been clear, however.

Previous Water Forecasts

- Most forecasts have been too high
  - 2007 H2O, Inc. Southborough Water Report:
    - Forecast for 2016 = 1.44 mgpd
  - 2009 PARE, Inc. Water Report:
    - Forecast for 2016 = 1.52 mgpd (ñif at build-outò)
  - 2019 Actual average per day demand
    - Actual = 0.77 mgpd
- Fairness to forecasters
  - Hard to forecast the actual decline
    - The trend is much clearer now
  - The full reports had caveats
    - However, no forecasts predicted declining usage

Southborough 20 Year Trends

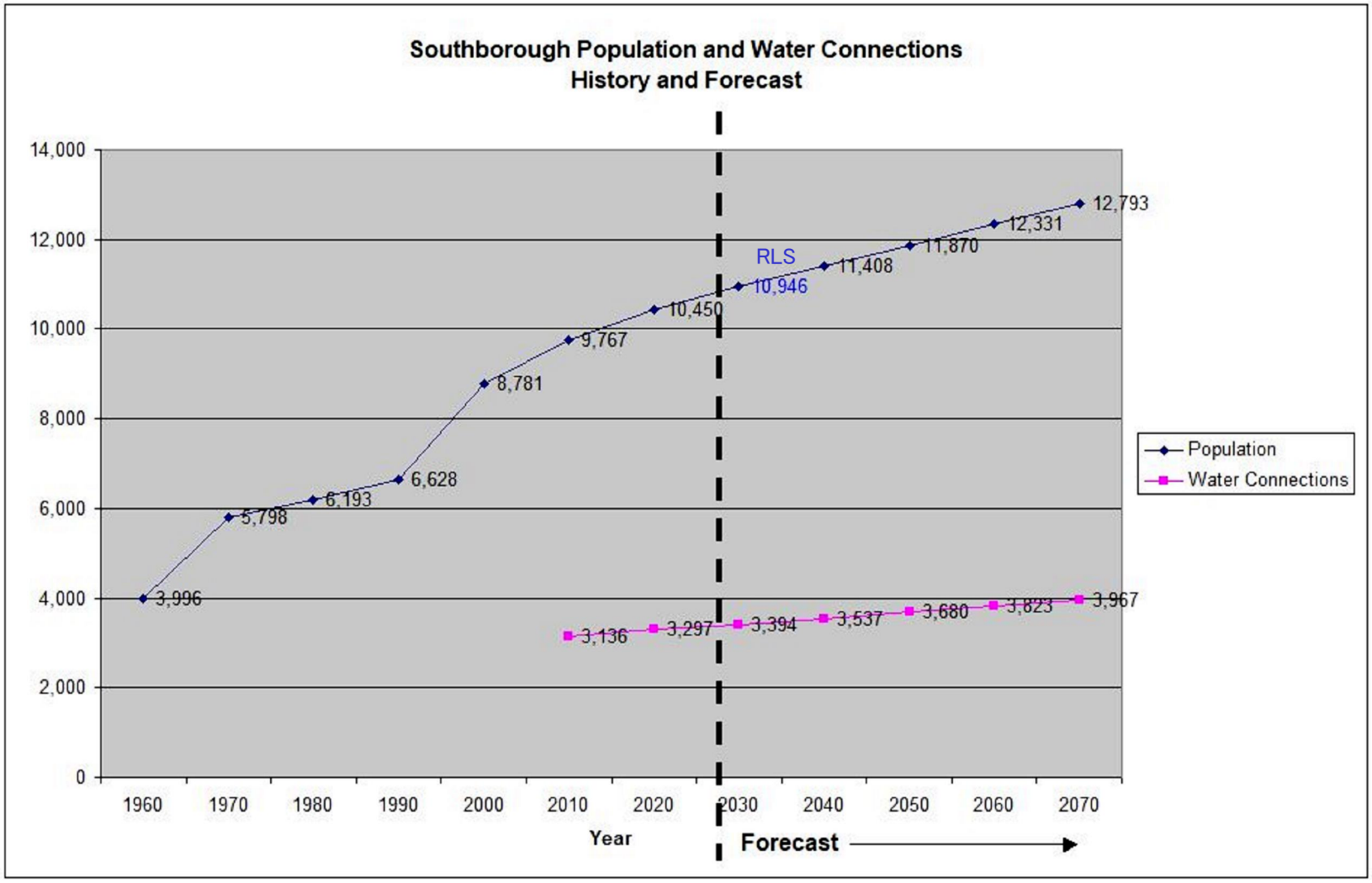
- Questions:
  - Could our usage pattern change?
  - Could the decline stop?
  - Could usage per capita start to increase?

- Yes to all three questions
- However, nothing in the data says it will
  - We can't plan on usage pattern suddenly reversing, based on nothing

Population Forecasts

- Population change is also hard to forecast
- Method:
  - Reviewed the RLS forecast done for our school system in 2022
    - Could not improve on their methods
  - But, it only goes out to 2030
    - Looked at 40 year growth of Lexington and Needham from 1980 to 2020
      - ñBuilt-outò communities in 1980, as a model for our future
      - 17% increase in Lexington over 40 years, 15% in Needham
    - Applied the Lexington growth rate to the 2030 Southborough RLS forecast to extend it to 2070
  - Applied recent ñconnections per capitaò data to forecast water connections

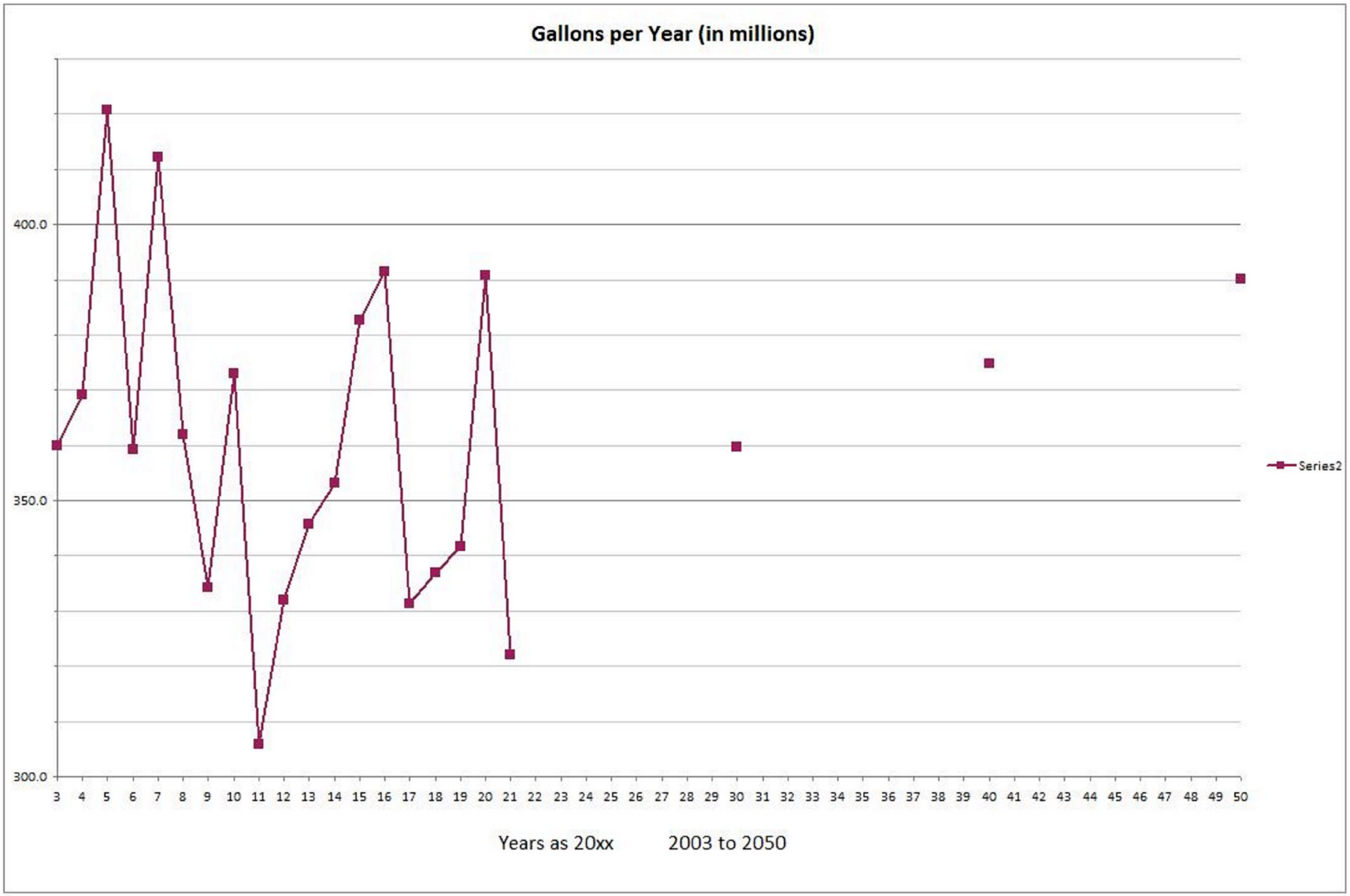
Population and Connections



Water Forecast

- Effect of population forecast smaller than usage change
- Assumption for planning:
  - Usage per capita holds constant at current level
    - Across all connection types (Residential/Commercial)
    - In other words, decline in usage stops now
    - Current level defined as point on trend line for 2021
      - Slightly above 2021 actual
  - More conservative than predicting continued decline
- Outcome of this
  - Usage remains within range of historic peak
    - 2050 usage approximately in range of 2000–2005

Water Forecast



Southborough 20 Year Trends

- Supply Side
  - We have increased distribution capacity, a lot
    - For pumping
    - For transmission (pipes)
  - While usage has declined
  - But not increased storage tanks
- Comparison made difficult by Ashland
  - Hard to quantify increase from historical data now
    - Because of new Ashland obligation
    - We have the simulation, but not actual data yet

Southborough 20 Year Trends

- There are always improvements possible
  - Minimal storage capacity and dual levels
    - Makes tank maintenance a significant problem
  - We've had two zones, high/low, a long time
    - One zone would be simpler and better
  - Other small issues in system balance
    - Identified in PARE water report
    - Not tied into Hopkinton question

Southborough 20 Year Trends

- Summary:
  - Demand is down
  - Capacity is up
  - Water quality is great
  - Mains and pumps newer, bigger, better
- Overall:
  - The system is better than ever
    - But, always, improvements are possible

20 Year History
What does it all mean?

- Hard to justify spending on expansion
- We have headroom from past usage, low population growth and would have warning lead time before needing expansion
- Tank maintainability is the biggest issue now
  - Not a crisis
- What could we improve
  - We could use more tank capacity – depending on design, it could help with tank offline maintenance
  - Having a one zone system would make more sense

Hopkinton Connection

- Hopkinton Need
- The Connection Question
  - Fair cost distribution between Towns
  - Engineering Risk Analysis
  - Management Considerations
  - Contractual Approaches (preliminary)

Hopkinton Need

- Hopkinton has water quality problems
  - PFAS in largest well
    - A man-made "forever chemical"
  - Above acceptable levels. Not easily filtered
  - Some quality problems in other wells
  - Recommending bottled water for many residents
- This problem is unacceptable
- A solution must be found
  - And will be found
- Whole picture: MWRA is an obvious answer
  - Question is, how to do it

Fair Distribution of Costs

- Can costs be distributed fairly?
  - If Southborough becomes water "wholesaler"
- Three types of costs in a Water System
  - Directly variable costs – vary by gallon
  - Maintenance and overhead costs
    - Vary by time-in-ground and pipe-miles
  - Capital expansion costs

Fair Distribution of Costs

- First type
  - Costs chargeable pro rata, by gallon, to wholesale customer:
    - 1. MWRA costs (probably direct bill)
    - 2. Pumping electricity
    - 3. Pump depreciation/maintenance
- No allocation problems for these
  - Charge Hopkinton per quarter based on usage

Fair Distribution of Costs

- Second Cost Type
  - Maintenance of the Distribution System
    - System divides into:
      - Mostly retail pipes
      - Heavily wholesale pipes
    - Allocate maintenance and overhead cost
      - Based on pipe-miles of wholesale pipes only
        - As fraction of total miles
        - Might need a pipe-size adjustment factor (tbd)
    - Pipes classified by system simulator
      - Wholesale vs. retail miles
      - Adjust wholesale fraction every 5 years
        - More often for big demand shifts
  - Conclusion: These costs can be handled fairly

Fair Distribution of Costs

- Third Cost Type
  - Costs of Capital Expansion
- Initial Southborough Expansion for Hopkinton
  - Need Bigger Pumping, Mains and Storage (tanks)
  - Some benefit to Southborough as proposed
    - But, offset by
      - Added ongoing management attention and complexity
      - Engineering risk compared to local-only solution
  - The proposal that the costs for initial expansion be shared may be hard to justify
    - Given the 18 years of declining demand in Southborough
      - On balance, no part of the expansion proposal is something we would probably undertake right now for our Town alone

Fair Distribution of Costs

- Later capital expansion. After Hopkinton online.
  - Hypothetical:
    - Suppose we proceed as planned with Hopkinton
      - Test. Find system works at designed capacity
    - Then, later,
      - Hopkinton peak demand grows to exceed design
      - But, problems manifest in the Southborough retail side
    - Upgrades to wholesale supply system should be paid by Hopkinton
  - Conversely, if Southborough retail demand growth triggers wholesale supply problems
    - Then Southborough must pay to upgrade
      - Nothing in the data suggests this is immanent

Fair Distribution of Costs

- Conclusions about Costs
  - Variable and Maintenance costs
    - Fairly easy to allocate
  - Capital Expansion costs
    - Initial costs can there be agreement?
    - Later Costs of expansion
      - Will need careful stipulations in contract to avoid future disputes

Engineering Risk

- No reason to doubt PARE
  - Everything I see about PARE is positive
  - The software simulators of the water system are probably very good,
    - Derived from Federal EPA software in wide usage
- However,
  - More than doubling the flow is a huge change
  - Any fundamental miscalculation could be very disruptive and costly
  - Many places at which errors can enter the design

Engineering Risk

- Ashland Connection
  - Hopkinton Reservoir must be below 293ft elev.
    - Therefore, no usage in some years
- But, since water systems must operate at peak demand, Southboroughôs system must be prepared for 30 –50% of peak demand
  - Legally can be 1.6 mgd
  - 1 mgpd Ashland capacity today
  - 0.5 mgpd usage in first plans
  - Approximately Southboroughôs average day demand
- We donôt have real–world experience yet
  - Adding Hopkinton before much Ashland actual usage adds some risk

Engineering Risk

- Before any actual construction work
  - The contract could require:
    - An independent engineering review
      - There are multiple qualified firms operating in the region
    - A benefit to both parties
    - Maybe we should require an independently parameterized simulation
      - If they just take existing design assumptions, any errors, may silently replicate into the review
      - This requires more examination

Management Considerations

- Question: What are we trying to manage?
  - A Southborough & Hopkinton Water System
    - Not large by geography, usage, population or connections
      - 29,000 population is not a big water system
    - Not extremely complex as a water system
      - Many systems evolve over time
  - Shouldn't be too hard to manage??

Management Considerations

- The Management System
  - Not something anyone would ever design
    - One water system, de facto
    - Two independent water departments
    - Two department heads reporting to two DPW Chiefs reporting to two elected Select Boards
    - Two P&Ls for different parts of the system
    - A third entity, Ashland, using water at peak times
      - Has the the same management structure
  - All joined at the middle by two primary contracts:
    - Southborough–Hopkinton
    - Southborough–Ashland
    - (And, a third contract Hopkinton–Ashland, also)

Management Considerations

- Only contract law is available
  - Inter-municipal Agreement
  - Mass General Law provides no appropriate other governance method for water systems
- Imagine trying to run Algonquin HS
  - With just a contract
  - Without a Regional Committee or Administration
  - No shared supervisory management
    - Just two Superintendents reporting to two School Committees and a contract between them
  - OK. Not a fair comparison!
    - But still, the management of this needs careful thought

Management Considerations

- Consider some scenarios:
  - Many medium sized engineering problems could lead to much bigger decision problems
    - Imagine 2031: "With Hopkinton's expansion in usage, when Ashland takes water, Oak Hill Road water drops to near zero."
      - (This engineering example may be entirely improbable, but all engineering problems are not collectively improbable)
  - Unified management would respond
    - Just fix the problem

Management Considerations

- Decision process under proposed management:
  - Southborough: ñWe didnôt have this problem before Hopkinton was on. If we simulate the system with Hopkinton turned off we donôt have the problem. Hopkinton should pay for the capital improvement to the wholesale infrastructure, or reduce their peak demand.ò
  - Hopkinton: ñThe problem is caused because Southborough underestimated the effect of Ashland demand. Southborough and Ashland need to determine who pays for the fixò
  - Ashland: ñIt has nothing to do with us. Our contract says Southborough needs to reserve 1.6 million gallons per day for us and weôre only taking 1 million. Clearly Hopkinton is the problem but Southborough should never have agreed to supply them.ò

Management Considerations

- Water systems often present options
  - Many possible ways to fix a problem
  - Debatable engineering decisions
  - Costs may fall in different places.
    - Do we increase the size of a ―retail‖ pipe or size of the ―wholesale‖ pipe supplying it, or the capacity of the nearest pump? Different choices have costs falling in different systems.
    - Real example: In 2007 and 2008 we had recommendations to build a new water tower first at one location, then another
      - The problem ended up being fixed by fixing a valve between the high and low regions
      - It is not always obvious what to do

Management Considerations

- ñContractò can be brittle, expensive, awkward and ill-informed in dispute resolution
  - The key is to be able to avoid court-adjudicated disputes, over the long term
    - Litigation of engineering problems in a water system is not a good process
      - You donôt want to be operating your water system under a court order
      - You donôt want a judge deciding engineering questions
  - Neither party wants a management structure that is unwieldy and prone to conflict

Management Considerations

- Currently looking for comparables
  - Seeking to interview DPW chiefs who have lived with something like this for a long time
    - Lexington supplies Bedford (may be part time, like Ashland deal)
      - I have a call in to Lexington
    - Looking for other examples
  - Unusual aspect of ours
    - A smaller system serving two larger systems.

Management Considerations

Approaches to Management questions

- Two ideas:
  1. Limiting risk of dispute with contract stipulations

  OR

  2. Changing the design
     - To match the existing management structure

Management Considerations

- 1. Contract stipulations to reduce dispute risk
  - Optimistic outlook
    - Water systems can be very stable and just work
    - Can have a large resiliency zone
  - The management problem may be addressable, adequately, with careful contract stipulations
    - Provisions that recognize situational ambiguity <u>in advance</u> and declare how they will be resolved.
    - For example,
      - ñThe parties acknowledge that it may be inherently difficult to determine the best solution for problems that may arise in the Southborough retail part of the the combined system. Therefore the decisions of the Southborough DPW Managment about corrective measures to be taken in Southborough shall be final, and the costs thereof shall be shared between the parties using the formula given for Maintenance costs.ò

Management Considerations

- 2. The management structure can't be changed
  - So, consider changing the design to match the management
- Concept, a different design:
  - Hopkinton runs its own pumping station(s) at the aqueduct.
  - Southborough acquires and/or grants any necessary rights of way, and pumping station space
  - Southborough's pipes are only an emergency backup
    - But this is estimated to be as expensive as being primary
- This has been discussed with PARE
  - This whole system, apparently, would cost more to implement
    - But, maybe, could be considered further by PARE

Summary

- Hopkinton has severe problem
- Southborough: water demand is down, capacity is up
  - Therefore, no need for major expansion now
  - This ramifies into initial cost sharing assumptions
- The proposed combined system
  - Could have some Southborough benefits
    - Maintainability and simplicity of a single level with more storage
  - Needs very careful, independent, engineering review
- Management
  - Misalignment of management structure and system
    - Really one system with two managements over it, and a contract
  - At the very least, will require careful contract stipulations
    - To reduce potential for future disputes
  - Might suggest consideration of a different design

Next Steps

- Ideas
  - Try to frame LOI key terms and stipulations
    - Review with SB and then with Hopkinton
  - Look for comparables
    - Municipalities that have water supply contracts with others for long term
    - What can we learn from their experience?