Town of Framingham
Department of Public Works

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Agenda

- Introduction to Framingham
- Project Background
- Design Discussion
- Next Steps

Introduction to Framingham

- Established 1700

- Population: 68,000 (2010 Census)

- Population grew quickly post WWII through 1970s
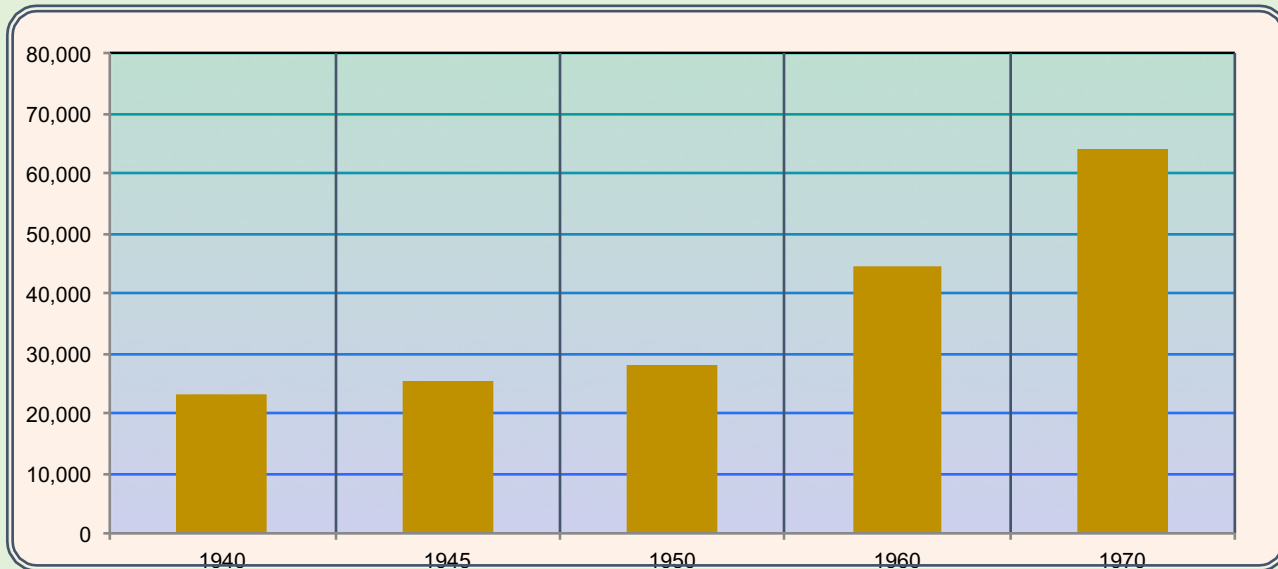
Introduction to Framingham

- Diverse Land Use – Residential, Commercial, Industrial, Institutional, Recreational
  - Corporate HQ's – Bose, Staples, Genzyme, TJX
  - Framingham State University & Mass. Bay Community College
  - Transportation: Interstate 90, Route 9, Railroad (MBTA/CSX)
  - Callahan State Park
  - Lake Cochituate
  - MWRA Infrastructure
    - Aqueducts (4): Sudbury, Weston, Hultman, Metrowest Tunnel
    - Reservoirs (3): Foss, Sudbury, Bracket
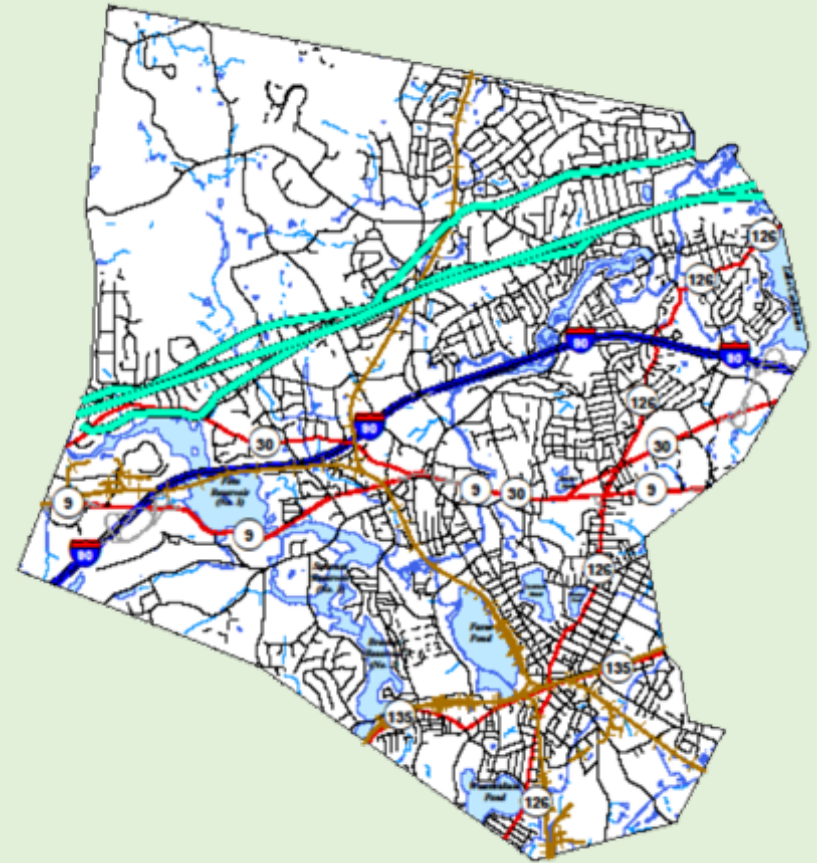
Introduction to Framingham

- ■ MWRA Supplies Water and Treats Wastewater (7 MGD)

- ■ Town manages distribution and collection:
  - Wastewater Pump Stations:
    - 42 (19 SCADA, 23 Phone Alarms)
  - Water Pump Stations:
    - 4 Connections to MWRA Aqueduct
    - 3 Booster Stations
  - Water Tank Sites:
    - 5

- ■ Capital projects require approval at Annual Town Meeting

Sewer System
■ Sewer Pump Station
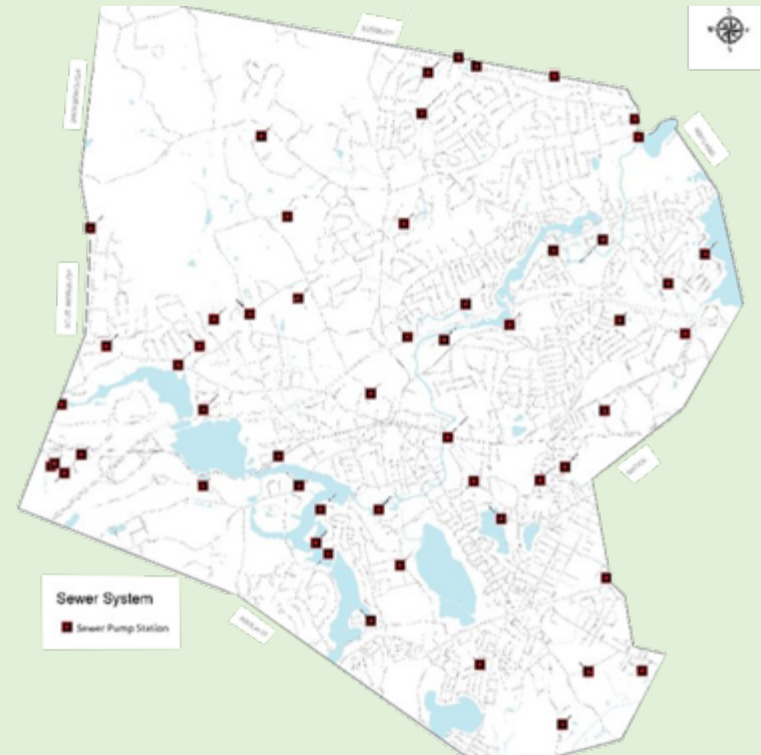
Project Background

- **Preliminary Study**
  - Radio Study
  - System Assessment
    - Existing Motorola
- **Design**
  - 75% All Stations
    - PLC Based System
  - 100% Radio Backbone
    - 12 Facilities (+1)
      - 6 Pump Stations
      - 5 Tank Sites
      - 1 PRV Site
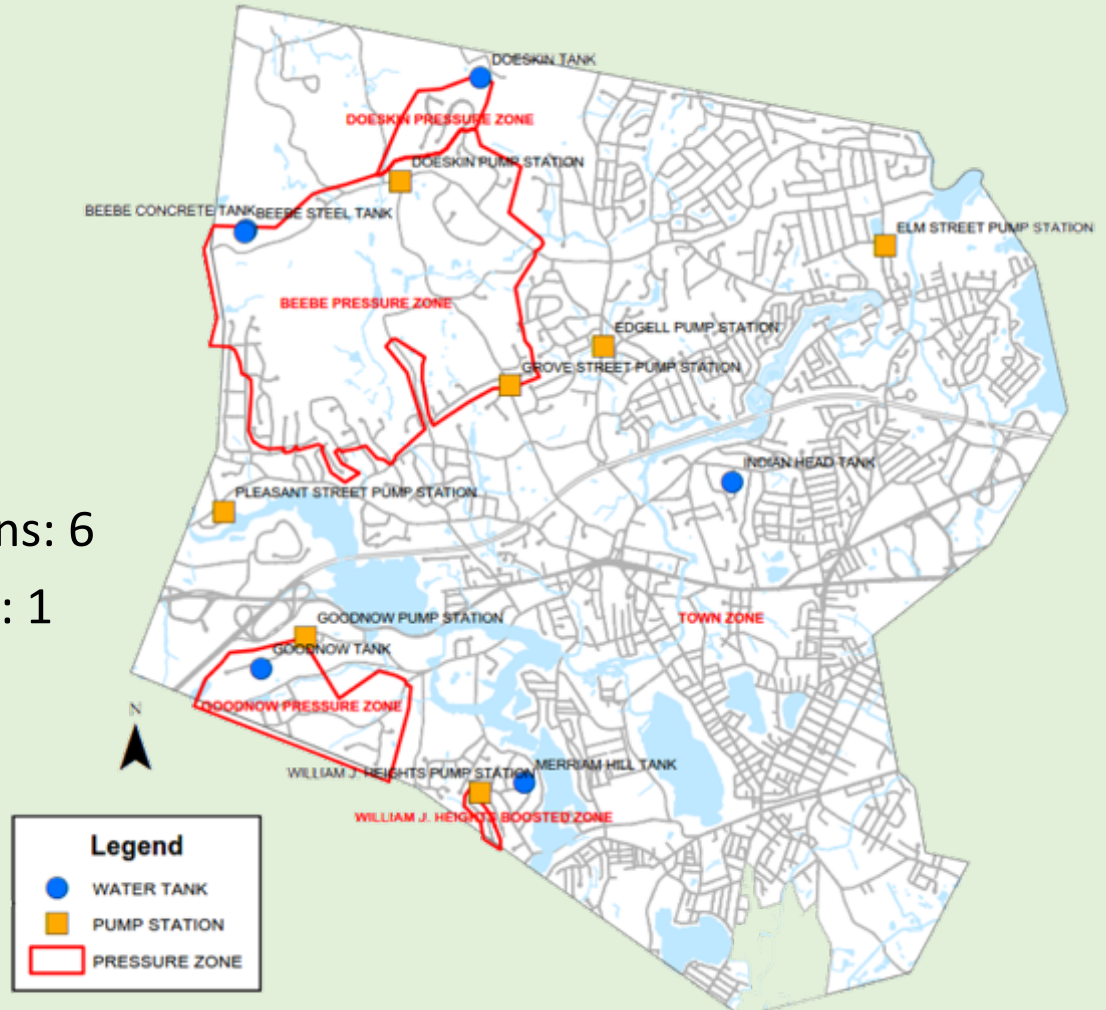   - DPW Headquarters

Project Background

- First Construction

Phase:

Radio Backbone &

Critical Water Sites

Water Tank Sites: 5
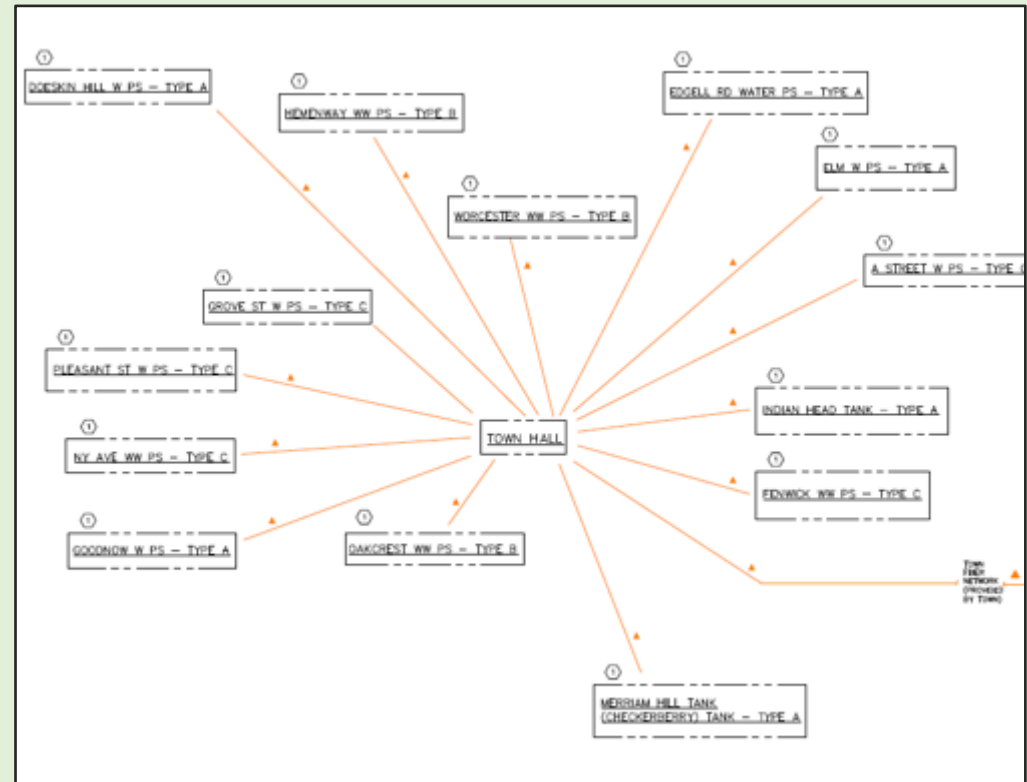
Water Pump Stations: 6

DPW Headquarters: 1

PRV Sites: 1

Design Discussion Agenda

- SCADA System Assessment

- Radio Propagation Study

- Design Solution

- 75% Design

- Phase 1
  - 100% Design
  - Bid Results
  - Construction

SCADA System Assessment

- High level overview of existing SCADA system
  - Condition of equipment and instruments
  - Life cycle of existing controls equipment
  - Network configuration
  - Computer and software condition, including lifecycle
  - Utility to operations staff
- Solicited feedback from all levels of organization to improve overall solution and increase buy-in to project and end product
- Proposed projects to upgrade system
- Phases and cost estimates tailored to capital improvements plan funding

Radio Propagation Study

- Identified radio equipment requirements
- Determined antenna hardware requirements
- Determined installation requirements (antenna mounting heights, cable and connectors needed, etc.)

- Determined best telemetry paths for sites to the polling master;
- Developed construction cost estimate
- Collected FCC radio frequency licensing requirements.

Design Solution
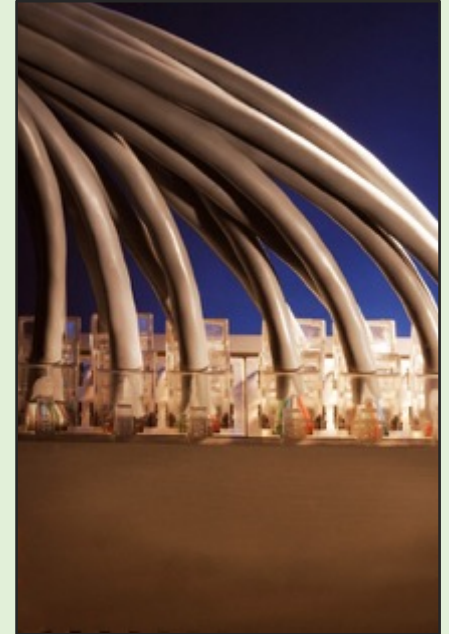
- Existing Motorola PLC and communication network no longer an industry standard

- Soon to be difficult to find components (product obsolescence)

- Only one integrator in the area had the knowledge and experience to maintain the system

Design Solution

- Utilize Allen Bradley PLC Hardware
  - Readily available
  - Strong market presence in the Northeast
  - Most area integrators have experience with Allen Bradley

- Licensed Frequency Radio Communication
  - Robust, reliable alternative to phone line communications
  - Effectively deployed in municipalities throughout the state and region
  - Frequency and equipment owned by Town so more control of maintenance and troubleshooting

- At sites where fiber optic communication is available, the two communication systems to be configured with automatic failover

Design Solution

- Proposed solutions would combine all stations on one communication platform
  - Fiber optic connection to act as backup to licensed frequency radio where available
- Standardize on PLC equipment and control panel design philosophy
  - Easier for operators during regular use, maintenance and troubleshooting

75% Design (Complete System)

- Design documentation developed to be 'modular', so Town could select sites to be included in each phase of construction

- Produced fabrication level control panel design packages
  - Panel groups were chosen, so one drawing set could represent multiple sites
  - I/O lists unique to each site, but similar in structure and organization

- Produced electrical site layouts, antenna mounting details and site riser diagrams (with information from radio propagation study)

75% Design (Complete System)

- Worked closely with Town operations to maintain critical functionality and add new signals, monitoring, etc. where appropriate

- Coordinated with Town's IT staff to properly identify computer and communication equipment at sites to remain and incorporate into new approach

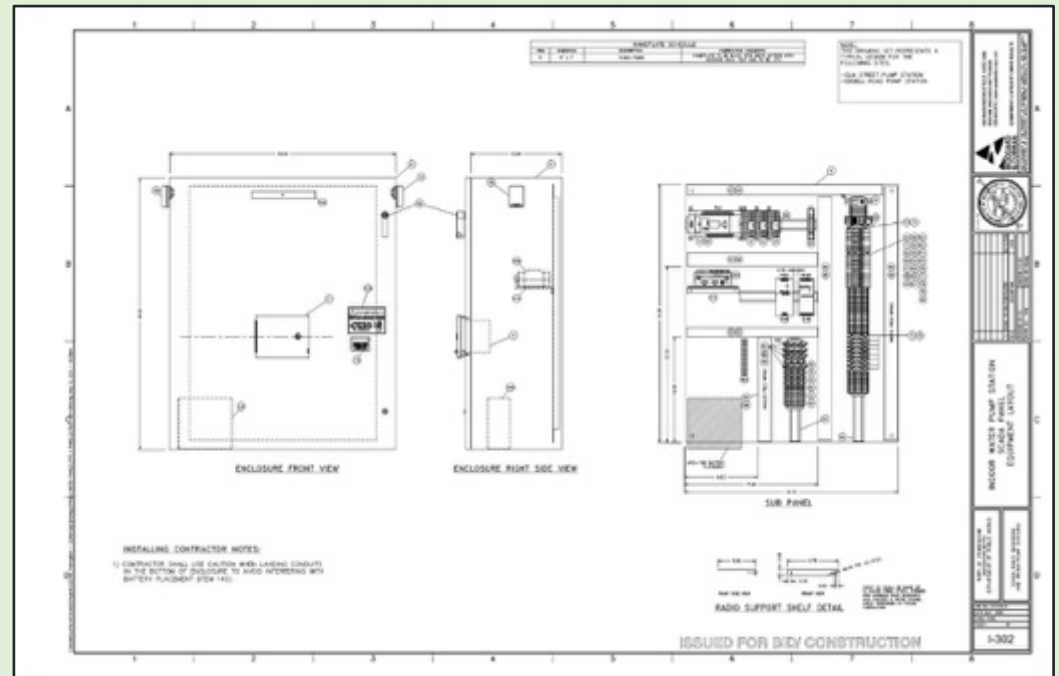# Phase 1 (100% Design)

- This phase incorporated the sites and modifications required to create a telemetry 'backbone' for the SCADA system

- These sites facilitate communication with all other sites in the system, creating flexibility for future phases

Phase 1 Bid Results

- Engineer's Estimate of Probable Cost: $262,000

- Bids Received (2)
  - Low Bid: $363,700
  - Second Low Bid: $420,507

- Contributors to the discrepancy
  - Underestimated installation of antennas on storage tanks
  - Larger than anticipated material cost and labor cost increases
  - Suspected bidding climate change (project was bid during construction season, so contractors were not as eager to bid aggressively with work schedule filled)
  - Construction estimating methodology (accurate in previous years) experienced 'misses' in 2016

Phase 1 Bid Results

- Based on results from Phase 1 bid, table with subsequent construction cost estimates updated accordingly

- These estimates used to request construction funds through Town meeting over 4 years

Phase 1 Construction

- Member of Engineer's design team performing construction administration duties

- Utilizing Engineer's in-house integration staff for implementation, startup and training

  - More cohesive project team reduced finger pointing, RFIs and change orders

- Working closely with management and operation staff to sequence replacement of equipment, reducing downtime and service interruptions
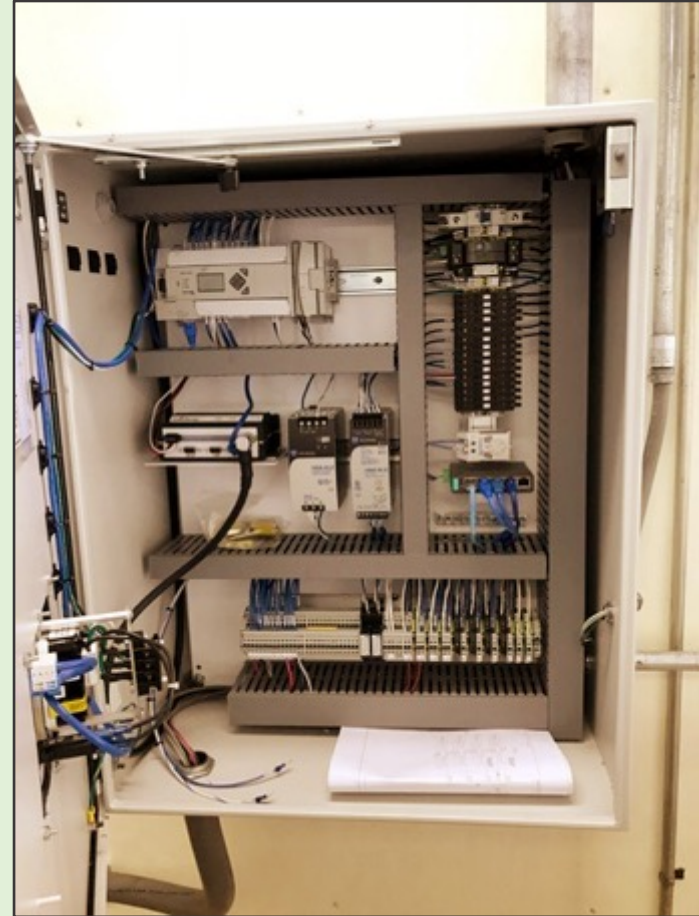
Phase 1 Construction

- Current Status (January 2017):
  - Antenna installations complete at all sites, with the exception of the DPW tower; communication testing to begin once all antennas are installed
  - Control panels installed at all sites; cable and conduit connections complete
  - I/O checkout, integration and startup activities to begin after radio communication testing is complete

Phase 1 Construction – Doeskin Tank

Phase 1 Construction – Elm Street PS

Phase 1 Construction – Pleasant Street PS

Next Steps

- Phase 2 Design Spring 2017
  - Prioritized stations not currently monitored by SCADA
  - Construction dependent upon funding (ATM)

- Additional Pump Station upgrade projects will include SCADA upgrades in 2017 (3 this year)

- Phase 3 Design planned Spring 2018 (ATM)

- Construction completion all water and wastewater facilities 2019-2020 (ATM)

- Total cost for all projects: estimated to be $3.9M through 2020

Questions ?

Thank you!

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