

# Westford's Lakes and Ponds – 2021 and Beyond

## Presentation to the Town of Westford Key Findings and Recommendations

**ESS Group, Inc.**  
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November 18, 2021



# Presentation Overview

- Introduction to 2021 Program
- Review of 2021 Aquatic Plant Mapping Results by Water Body
- Review of 2021 Water Quality Results
- Recommendations for 2022 Management and Monitoring Program
- Looking Ahead: The 2022-2026 Management Plan



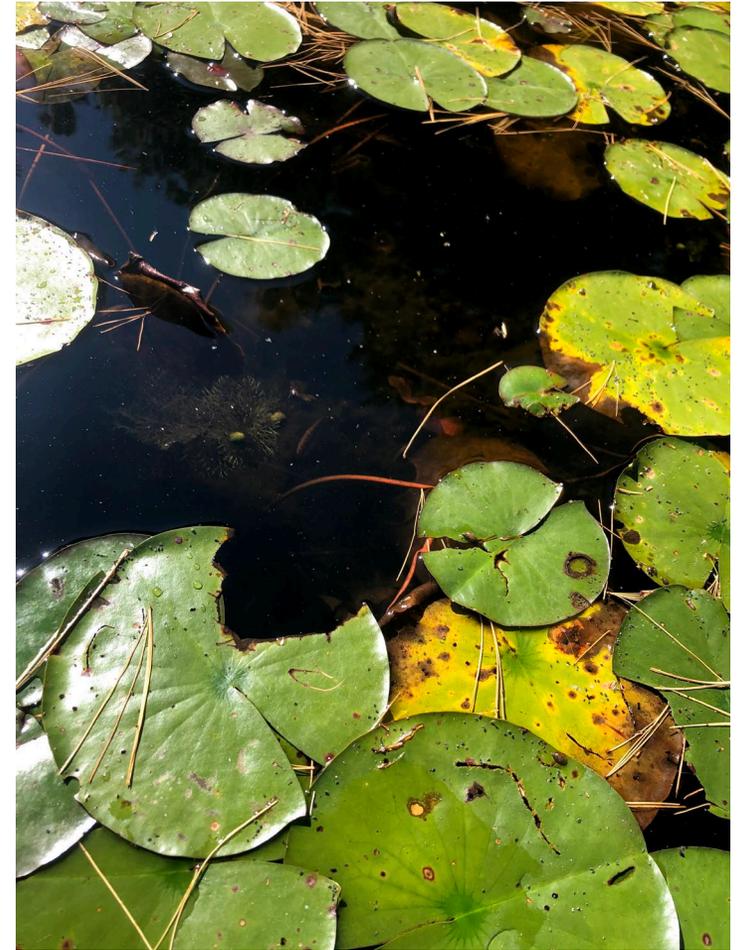
# 2021 Monitoring Program

- Sixth year of management at some of the ponds
- Early season visits to Long Sought-for Pond and Nabnasset Lake
- Late season visits to all seven ponds
- Water quality measured at three locations in each of the seven ponds
- 2021 treatments conducted at:
  - Long Sought-for Pond
  - Nabnasset Lake



# Keyes: Aquatic Plants

- Variable-leaf milfoil not observed
  - Has not been found by ESS since 2017
  - No known upstream source – possible eradication?
- Curly-leaf pondweed may still be present but hard to know from late season survey only
- Seven native species observed
  - White water lily dominant
  - Flat-stem bladderwort also common



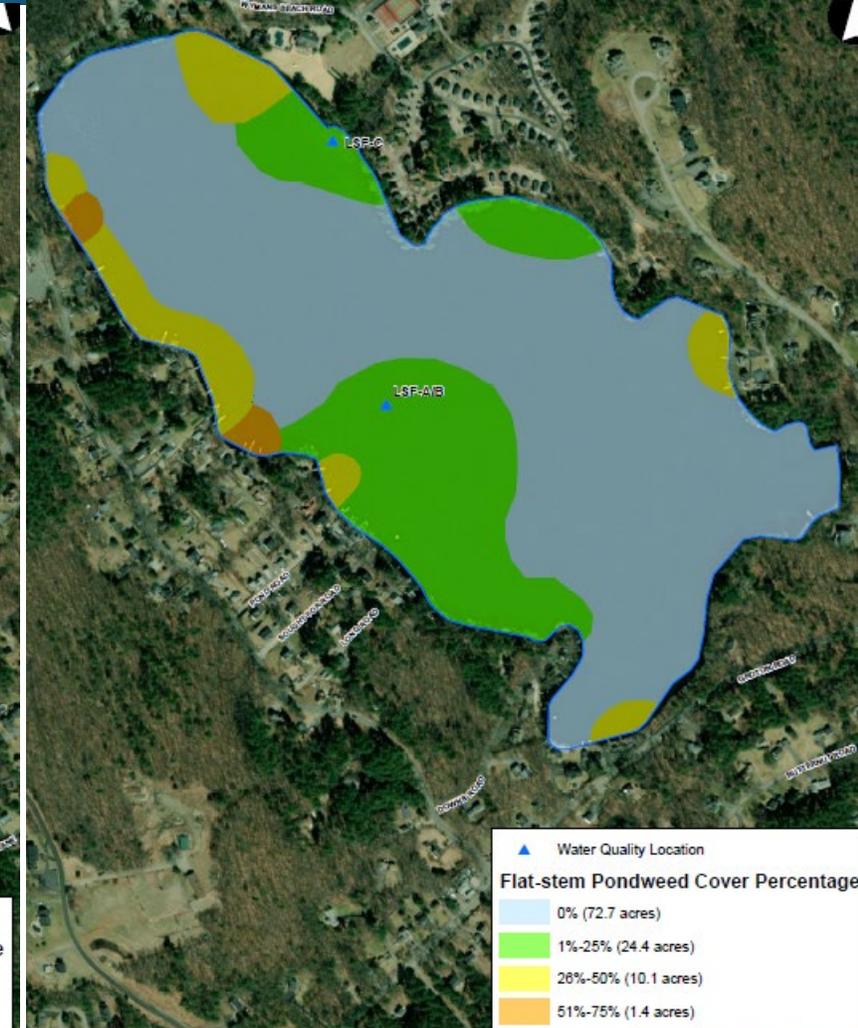
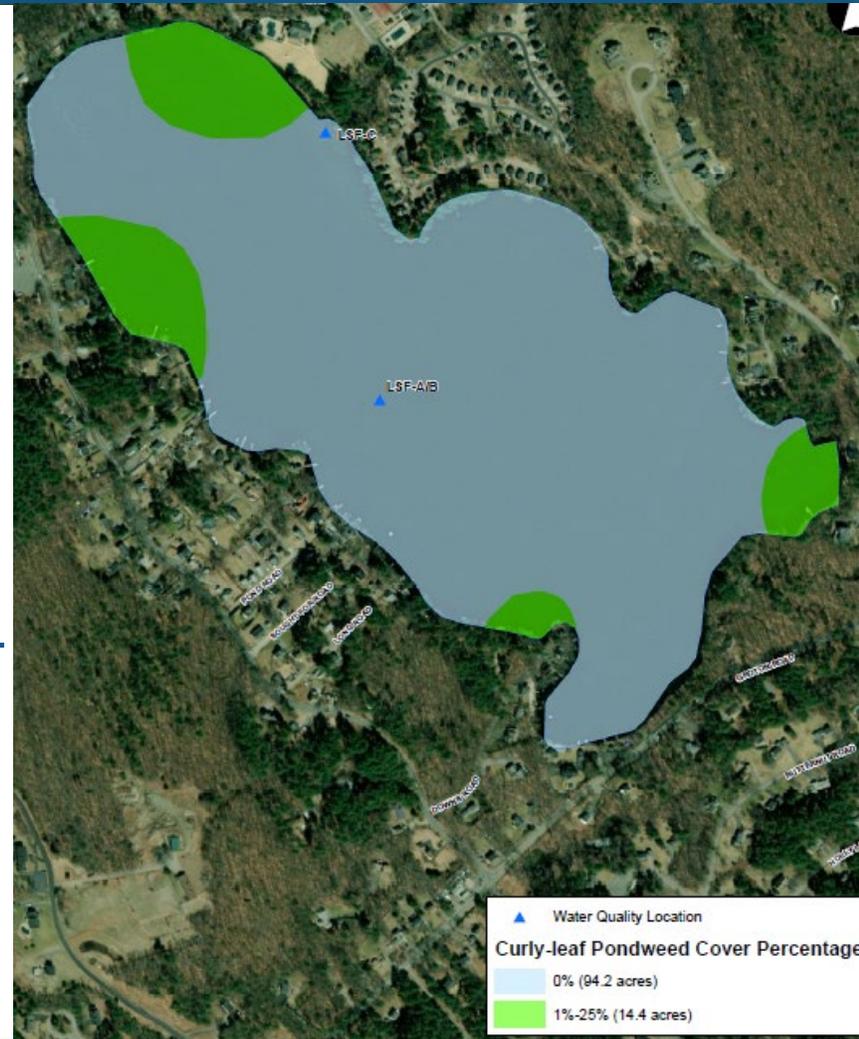
# Long Sought-For Pond: Aquatic Plants

- Eurasian milfoil not observed in 2021 and has not been seen by ESS since 2019
- Curly-leaf pondweed and nuisance flatstem pondweed observed pre-treatment
- No aquatic invasive or nuisance plant species observed post-treatment
- Ten native species observed
  - Water celery dominant



# Long Sought-For Pond: Aquatic Plants

- Pre-treatment maps show some increase in distribution of target species
- However, 2021 pre-treatment mapping conducted in July – later than usual



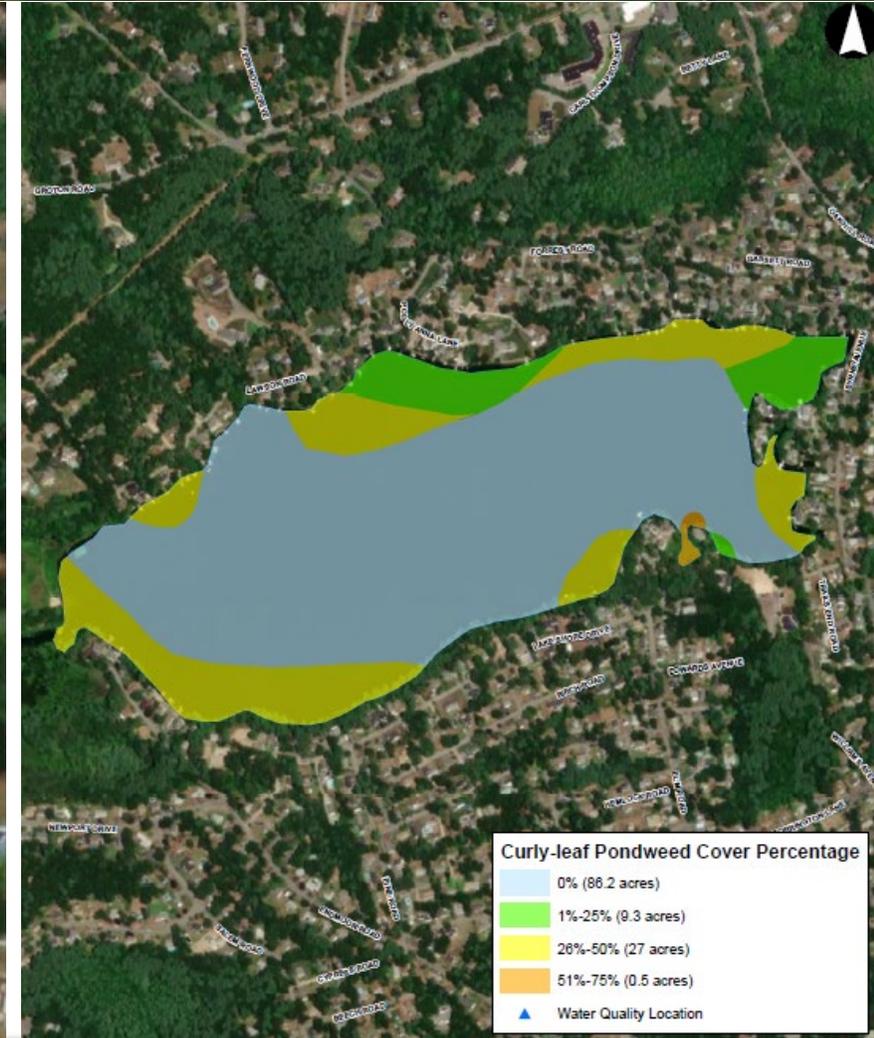
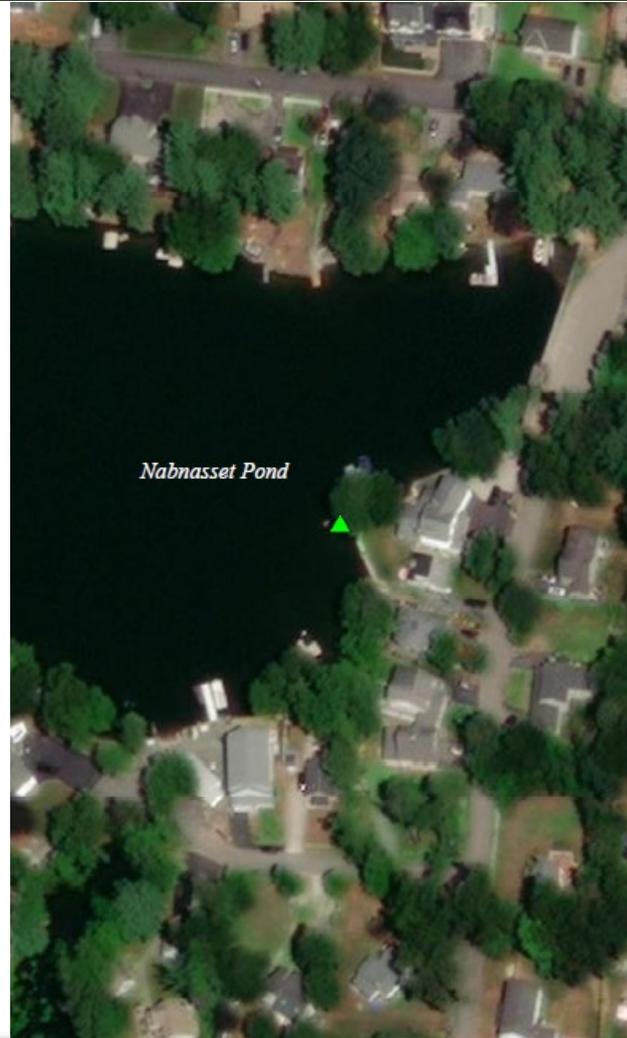
# Nabnasset Lake: Aquatic Plants

- Pre-treatment aquatic invasive or nuisance plants
  - Curly-leaf pondweed
  - Variable-leaf milfoil
  - Water celery
  - Water chestnut (**new**)
- Post-treatment aquatic invasive or nuisance plants
  - Variable-leaf milfoil
  - Water celery



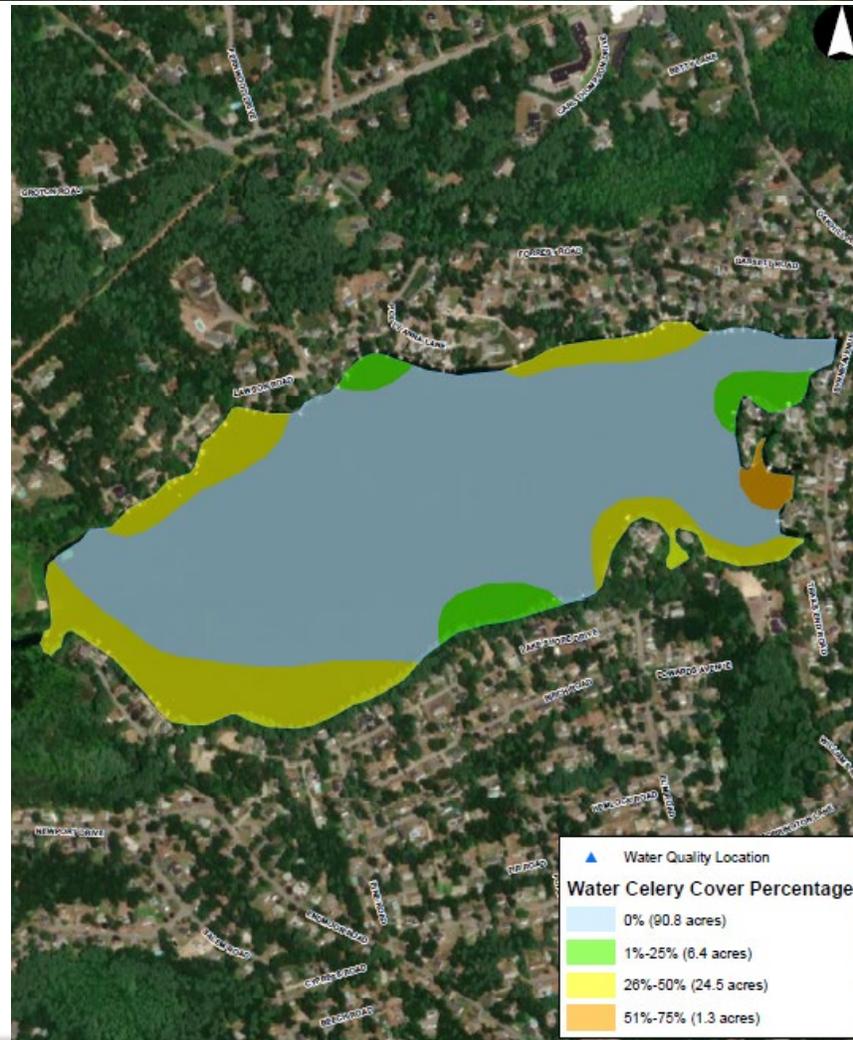
# Nabnasset Lake: Aquatic Plants

- Pre-treatment survey results
- Curly-leaf pondweed widespread along shoreline
- Variable-leaf milfoil not mapped but observed by residents
- Water chestnut was single, hopefully fluke, occurrence



# Nabnasset Lake: Aquatic Plants

- Water celery established around perimeter of the lake both pre- and post-treatment
- Some possible reduction in density and extent post-treatment?



# Old Mill/Graniteville Ponds: Aquatic Plants

- Three aquatic invasive species
  - Eurasian milfoil (**new**)
  - Fanwort
  - Variable-leaf milfoil
- Eight native species observed
  - White water lily and coontail co-dominant



# Burge's Pond: Aquatic Plants

- No aquatic invasive plants
- Eight native species observed, with three co-dominant
  - Low milfoil
  - White water lily
  - Little floating bladderwort



# Kennedy Pond: Aquatic Plants

- No aquatic invasive plants
- Eleven native species observed, with two co-dominant
  - Clasping-leaf pondweed
  - Thinleaf pondweed
- Common reed also present in a few spots along shoreline



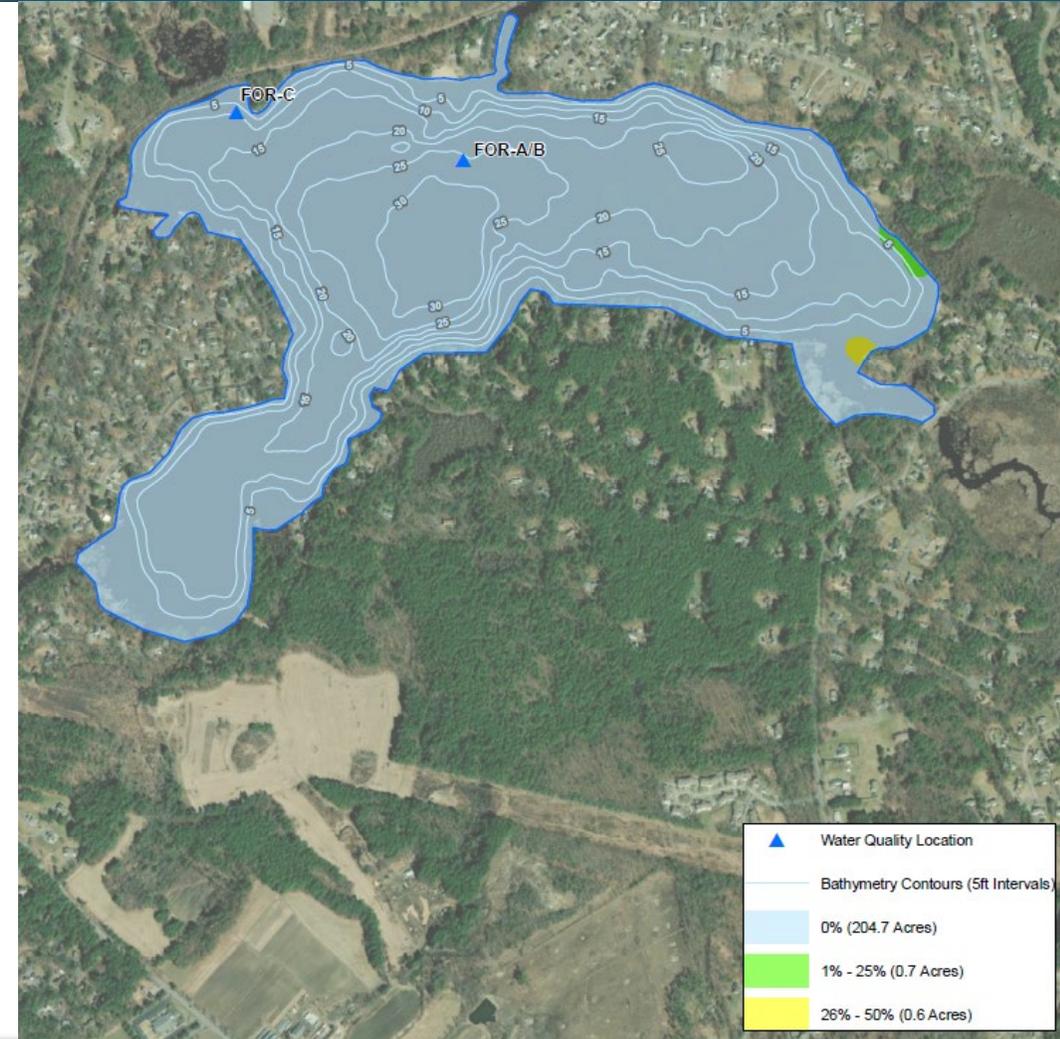
# Forge Pond: Aquatic Plants

- Mapped entire pond this year
- Four aquatic invasive species
  - Brittle naiad
  - Eurasian milfoil
  - Fanwort
  - Variable-leaf milfoil
- Nine native species observed
  - White water lily dominant
  - Common bladderwort also abundant



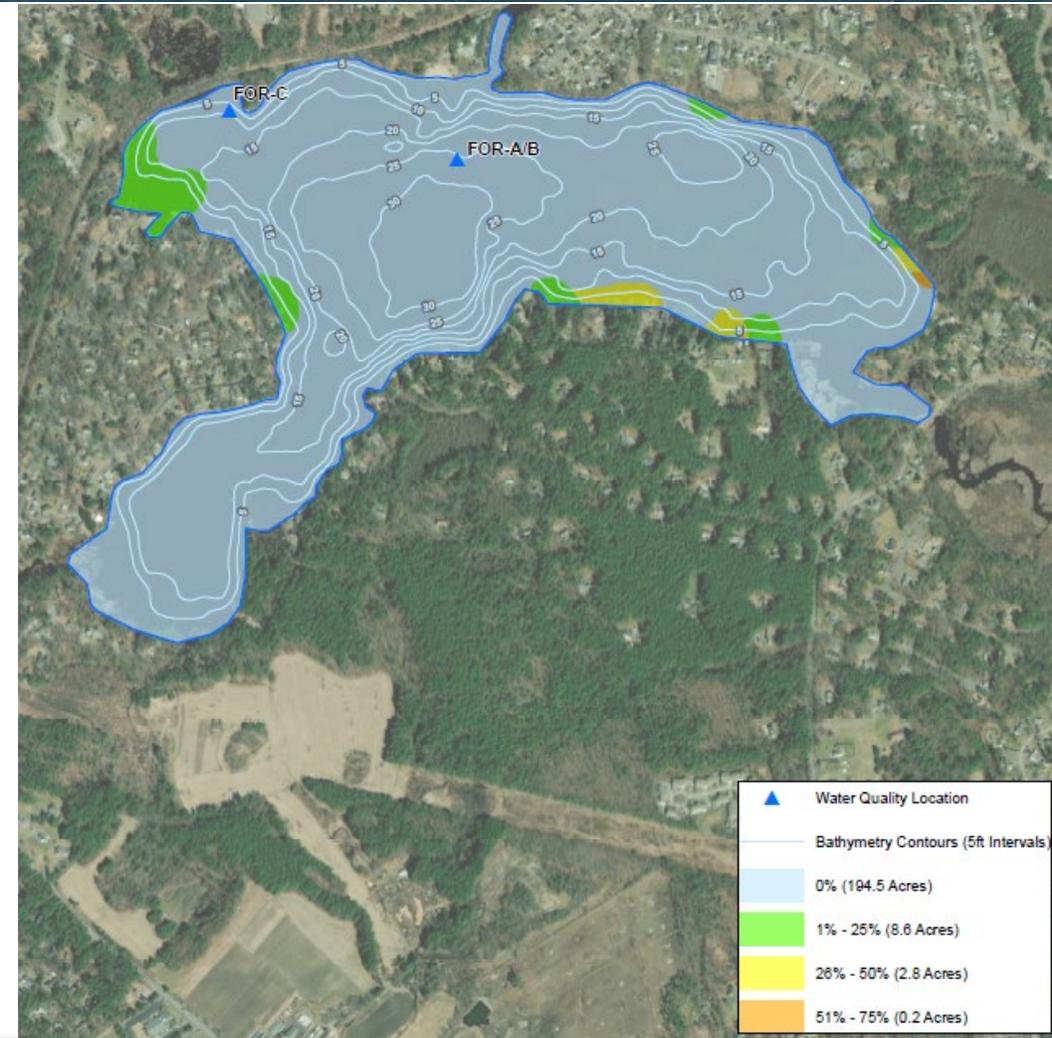
# Forge Pond: Aquatic Plants

- Brittle naiad not seen previously here by ESS (have mapped since 2018)
- Now a little more than an acre in a couple of patches near the boat launch



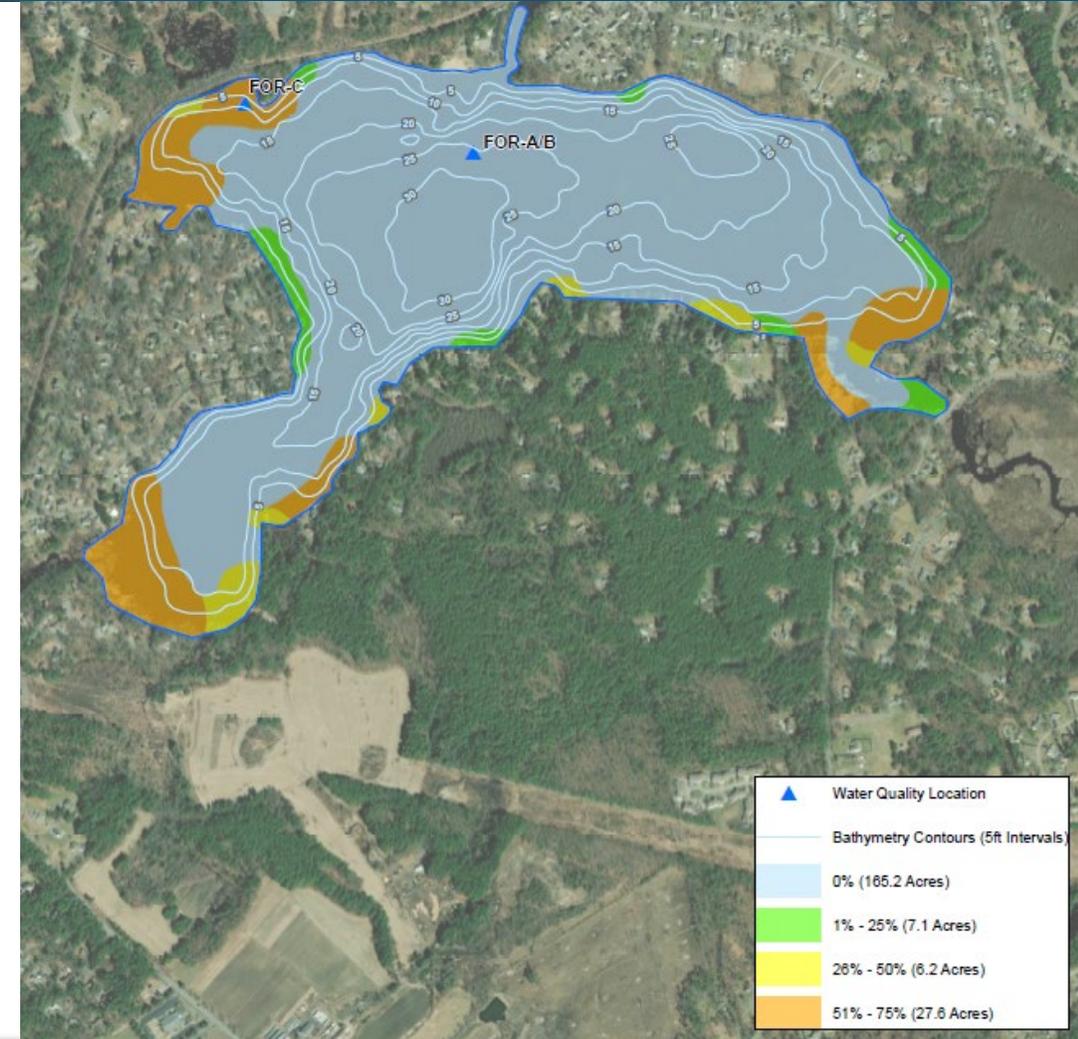
# Forge Pond: Aquatic Plants

- Eurasian milfoil covers about 12 acres
- Appears to have re-expanded toward shoreline after some recession last year
- Also some new growth along western and northeastern shorelines
- Mostly sparse growth on Littleton side



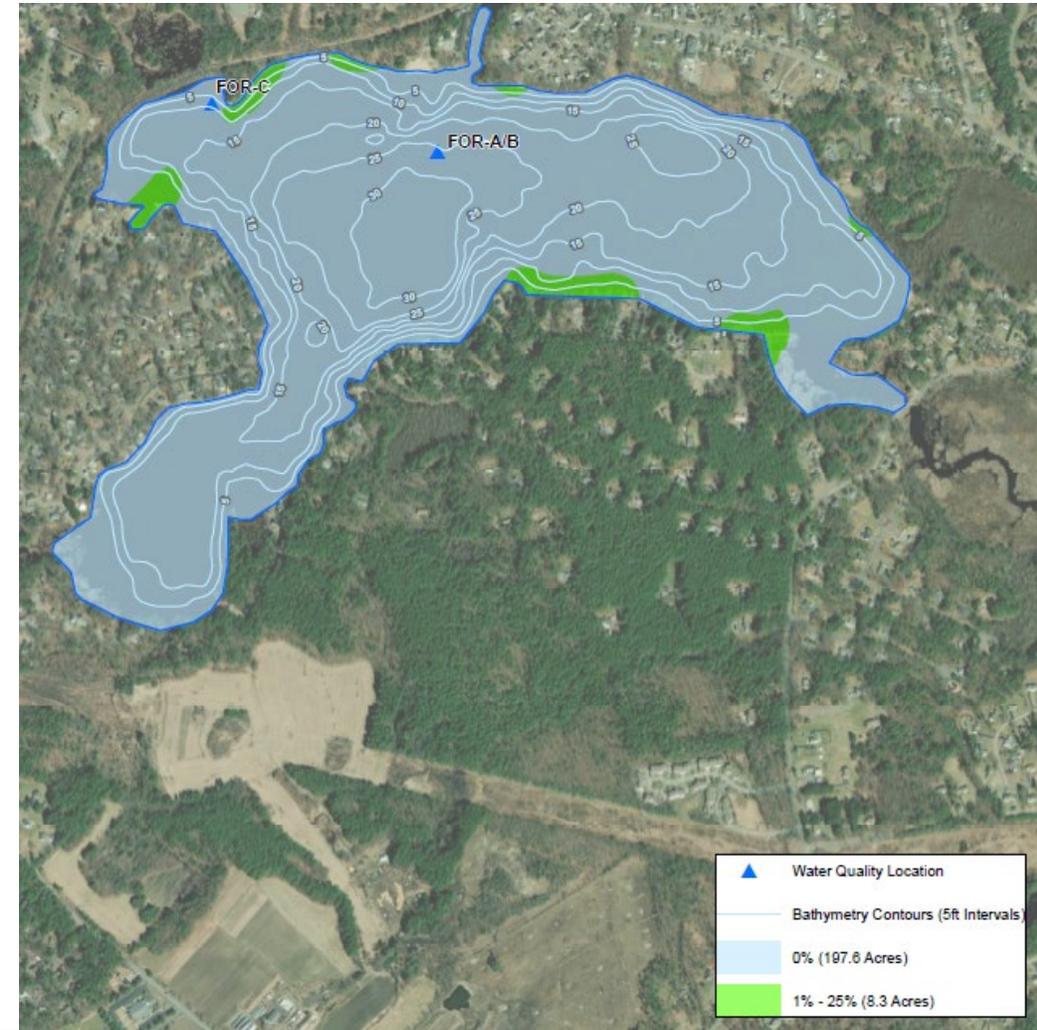
# Forge Pond: Aquatic Plants

- Fanwort covers about 41 acres
- Appears to have re-expanded toward shoreline after some recession last year
- Also some new growth along western shoreline
- Dense beds also on Littleton side



# Forge Pond: Aquatic Plants

- Variable-leaf milfoil covers about 8 acres
- Appears to have re-expanded toward shoreline after some recession last year
- Otherwise, similar distribution
- Picked up a few sparse beds on Littleton side



# Water Quality

| Parameter               | Units | Keyes Pond |              |              | Old Mill/Graniteville Ponds |        |              | Burge's Pond |        |         | Kennedy Pond |        |              | Long Sought-for Pond |        |              | Nabnasset Lake |        |              | Forge Pond |        |              |
|-------------------------|-------|------------|--------------|--------------|-----------------------------|--------|--------------|--------------|--------|---------|--------------|--------|--------------|----------------------|--------|--------------|----------------|--------|--------------|------------|--------|--------------|
|                         |       | Station ID | KEY-A        | KEY-B        | KEY-C                       | OLD-A  | OLD-B        | OLD-C        | BUR-A  | BUR-B   | BUR-C        | KEN-A  | KEN-B        | KEN-C                | LSF-A  | LSF-B        | LSF-C          | NAB-A  | NAB-B        | NAB-C      | FOR-A  | FOR-B        |
| Location                |       | Deep hole  | Inlet        | Outlet       | Deep Hole                   |        | Inlet        | Deep Hole    |        | In-pond | Deep Hole    |        | In-pond      | Deep Hole            |        | Inlet        | Deep Hole      |        | Outlet       | Deep Hole  |        | Inlet        |
|                         |       | mid-depth  |              |              | Surface                     | Bottom |              | Surface      | Bottom |         | Surface      | Bottom |              | Surface              | Bottom |              | Surface        | Bottom |              | Surface    | Bottom |              |
| Total depth             | m     | 6.0        | 1.0          | 0.5          | 5.0                         |        | 1.5          | 6.0          |        | 2.0     | 8.0          |        | 1.0          | 9.0                  |        | 0.5          | 8.0            |        | 2.0          | 8.0        |        | 2.3          |
| Sample depth            | m     | 3.0        | 0.5          | 0.5          | 0.5                         | 5.0    | 0.5          | 0.5          | 5.0    | 0.5     | 0.5          | 7.0    | 0.5          | 0.5                  | 8.0    | 0.5          | 0.5            | 7.0    | 0.5          | 0.5        | 7.0    | 0.5          |
| Temperature             | C     | 15.5       | 19.0         | 20.8         | 22.6                        | 19.2   | 22.3         | 23.4         | 20.5   | 23.5    | 22.9         | 14.6   | 24.2         | 22.9                 | 15.3   | 22.0         | 22.7           | 16.4   | 22.4         | 22.5       | 14.1   | 21.8         |
| Dissolved oxygen        | %     | 1.7        | 29.4         | 48.5         | 54.4                        | 0.7    | 63.2         | 67.9         | 0.8    | 70.0    | 90.9         | 0.9    | 90.5         | 83.0                 | 1.0    | 71.0         | 104.2          | 0.8    | 92.4         | 81.0       | 0.7    | 71.9         |
|                         | mg/L  | 0.17       | 2.73         | 4.36         | 4.68                        | 0.07   | 5.48         | 5.81         | 0.07   | 5.95    | 7.71         | 0.09   | 7.60         | 7.24                 | 0.10   | 6.35         | 9.02           | 0.08   | 8.04         | 6.98       | 0.07   | 6.30         |
| Turbidity               | NTU   | 3.23       | 1.66         | 2.41         | 2.20                        | 3.41   | 2.13         | 2.35         | 2.95   | 1.91    | 1.88         | 3.26   | 2.62         | 2.17                 | 6.98   | 1.94         | 2.92           | 3.77   | 1.40         | 2.65       | 1.87   | 1.65         |
| pH                      | SU    | 6.5        | 6.8          | 6.8          | 7.6                         | 7.2    | 7.2          | 6.6          | 6.1    | 6.2     | 6.8          | 6.4    | 7.1          | 7.4                  | 7.2    | 7.3          | 7.4            | 7.0    | 6.8          | 7.4        | 7.2    | 7.2          |
| Secchi Depth            | m     | 1.5        | bottom (1.0) | bottom (0.5) | 2.5                         |        | bottom (1.5) | 3.0          |        | 2.0     | 4.5          |        | bottom (1.0) | 5.0                  |        | bottom (0.5) | 2.75           |        | bottom (2.0) | 1.8        |        | bottom (2.3) |
| Hardness                | mg/L  | 31.5       | 23.0         | 24.4         | 58.7                        | 59.0   | 59.2         | 1.6          | 1.6    | 1.5     | 39.7         | 77.9   | 38.5         | 39.1                 | 45.4   | 38.1         | 49.2           | 58.8   | 49.5         | 58.4       | 77.9   | 59.0         |
| Alkalinity              | mg/L  | 21.6       | 14.3         | 13.5         | 41.1                        | 40.6   | 41.2         | <5.00        | <5.00  | <5.00   | 13.4         | 36.2   | 13.0         | 26.6                 | 40.4   | 24.4         | 28.6           | 45.2   | 26.7         | 39.0       | 64.6   | 38.9         |
| Total phosphorus        | mg/L  | 0.039      | 0.046        | 0.031        | 0.022                       | 0.020  | 0.026        | 0.013        | 0.032  | 0.006   | 0.012        | 0.046  | 0.021        | 0.005                | 0.019  | 0.006        | 0.017          | 0.053  | 0.023        | 0.031      | 0.079  | 0.020        |
| Nitrate nitrogen        | mg/L  | 0.03       | <0.02        | <0.02        | 0.06                        | 0.05   | 0.04         | <0.02        | 0.03   | <0.02   | <0.02        | 0.02   | <0.02        | <0.02                | <0.02  | <0.02        | 0.14           | 0.04   | 0.14         | <0.02      | <0.02  | <0.02        |
| Total Kjeldahl nitrogen | mg/L  | 0.57       | 0.51         | 0.65         | 0.47                        | 0.47   | 0.49         | 0.52         | 0.72   | 0.48    | 0.49         | 0.67   | 0.38         | 0.42                 | 1.00   | 0.63         | 0.54           | 1.16   | 0.74         | 0.52       | 11.2   | 0.88         |
| Ammonia nitrogen        | mg/L  | 0.05       | 0.08         | <0.10        | 0.06                        | 0.06   | 0.08         | 0.07         | 0.06   | 0.06    | 0.09         | 0.08   | <0.05        | 0.07                 | 0.54   | 0.26         | <0.05          | 0.63   | 0.07         | <0.05      | 0.92   | <0.05        |

# Recommendations for 2022

- Treatment recommended for Long Sought-For and Nabnasset (possibly Keyes if curly-leaf returns)
  - Sonar for Long Sought-For in 2022 – would control curly-leaf and suppress growth of nuisance pondweed
  - Diquat spot treatments for curly-leaf and other nuisance pondweeds in May/June
  - Consider ProcellaCOR for milfoils going forward – systemic and selective
  - Nautique/Diquat for water celery
  - Could be useful at Forge and OMG if improved control sought?

| Herbicide   | Keyes Pond | Long Sought-for Pond | Nabnasset Lake |
|---|------------|----------------------|----------------|
| Fluridone (Sonar)   |            | X <sup>c</sup>       |                |
| Diquat dibromide (Reward/Diquat)                                |            | X                    | X              |
| Copper Ethylenediamine and Triethanolamine Complexes (Nautique) |            |                      | X <sup>a</sup> |
| Florpyrauxifen-benzyl (ProcellaCOR)                             |            |                      | X <sup>b</sup> |

# Recommendations for 2022

- Keep eye on water chestnut at Nabnasset and hand pull aggressively
- Winter drawdown at Forge Pond and Nabnasset Lake
  - Unclear whether benefits extended into 2021 at Forge but makes sense to repeat
  - Reappearance of variable-leaf milfoil in Nabnasset proper makes deeper drawdown more attractive
  - Need to repeat often enough that the weather odds allow for control
- Low dose alum treatment(s)?
- Return to prior monitoring schedule

# The 2022-2026 Management Plan: Current Management

- Four of seven ponds being actively managed
- Three of these incorporate chemical treatments
- Two incorporate winter drawdown

| Water Body                    | Active Vegetation Management | Active Water Quality Management | Monitoring and Prevention | Notes  |
|-------------------------------|------------------------------|---------------------------------|---------------------------|--|
| Keyes Pond                    | Y                            | Y                               | Y                         | Herbicides for curly-leaf pondweed   |
| Long Sought-For Pond          | Y                            | Y                               | Y                         | Herbicides for multiple species<br>Algaecides as needed                              |
| Nabnasset Lake                | Y                            | Y                               | Y                         | Herbicides for multiple species<br>Algaecides as needed<br>Winter drawdown as needed |
| Old Mill / Graniteville Ponds | N                            | N                               | Y                         | Last herbicide application was in 2017   |
| Burge's Pond                  | N                            | N                               | Y                         | Last herbicide application was in 2016   |
| Kennedy Pond                  | N                            | N                               | Y                         |  |
| Forge Pond                    | Y                            | N                               | Y                         | Winter drawdown for multiple species   |

# The 2022-2026 Management Plan: Current Aquatic Plant Condition

- Only one pond has remained free of aquatic invasive species
- Two in excellent condition
- Three in poor condition with widespread target species

| Element                           | Keyes Pond  | Long Sought-For Pond | Nabnasset Lake | Old Mill / Graniteville Ponds | Burge's Pond     | Kennedy Pond     | Forge Pond  |
|-----------------------------------|-------------|----------------------|----------------|-------------------------------|------------------|------------------|-------------|
| <b>Overall Aquatic Vegetation</b> | <b>Good</b> | <b>Fair</b>          | <b>Poor</b>    | <b>Poor</b>                   | <b>Excellent</b> | <b>Excellent</b> | <b>Poor</b> |
| Brittle Naiad                     | N           | N                    | Y              | N                             | N                | N                | Y           |
| Curly-leaf Pondweed               | Y           | Y                    | Y              | Y                             | N                | N                | Y           |
| Eurasian Milfoil                  | N           | P                    | N              | Y                             | N                | N                | Y           |
| Fanwort                           | N           | N                    | N              | Y                             | N                | N                | Y           |
| Variable-leaf Milfoil             | P           | N                    | Y              | Y                             | P                | N                | Y           |
| Water Chestnut                    | N           | N                    | Y              | N                             | N                | N                | N           |
| Other Nuisance Species            | N           | Y                    | Y              | N                             | N                | N                | N           |

# The 2022-2026 Management Plan: Current Water Quality Condition

- All seven ponds have at least one water quality issue
- Three of the seven suffer from substantial water quality issues
- Kennedy Pond in best shape
- Keyes in worst

| Element                                | Keyes Pond  | Long Sought-For Pond | Nabnasset Lake | Old Mill / Graniteville Ponds | Burge's Pond | Kennedy Pond | Forge Pond  |
|--|-------------|----------------------|----------------|-------------------------------|--------------|--------------|-------------|
| <b>Overall Water Quality</b>           | <b>Poor</b> | <b>Good</b>          | <b>Fair</b>    | <b>Poor</b>                   | <b>Good</b>  | <b>Good</b>  | <b>Poor</b> |
| Algae                                  | Poor        | Fair                 | Fair           | Fair                          | Good         | Excellent    | Fair        |
| Dissolved Oxygen (Epilimnetic)         | Poor        | Good                 | Excellent      | Poor                          | Good         | Good         | Good        |
| Dissolved Oxygen (Hypolimnetic)        | Poor        | Poor                 | Poor           | Poor                          | Poor         | Poor         | Poor        |
| Transparency                           | Poor        | Excellent            | Fair           | Fair                          | Good         | Excellent    | Poor        |
| Phosphorus                             | Poor        | Good                 | Fair           | Fair                          | Fair         | Fair         | Poor        |
| Dissolved Inorganic Nitrogen           | Good        | Fair                 | Fair           | Good                          | Good         | Good         | Poor        |
| Acid Neutralizing Capacity (Buffering) | Low         | Moderate             | Moderate       | Moderate                      | Very Low     | Low          | Moderate    |

# The 2022-2026 Management Plan: Recommended Options

| Option                       | Keyes Pond | Long Sought-For Pond | Nabnasset Lake | Old Mill / Graniteville Ponds | Burge's Pond | Kennedy Pond | Forge Pond |
|------------------------------|------------|----------------------|----------------|-------------------------------|--------------|--------------|------------|
| <b>Water Quality</b>         |            |                      |                |                               |              |              |            |
| Aeration/Circulation         | P          | N                    | N              | P                             | N            | N            | N          |
| Algaecides                   | A          | A                    | A              | A                             | N            | N            | P          |
| Nutrient Inactivation (Alum) | P          | N                    | P              | P                             | N            | N            | P          |
| <b>Aquatic Vegetation</b>    |            |                      |                |                               |              |              |            |
| Benthic Barriers             | N          | N                    | Y              | N                             | N            | N            | P          |
| Chemical Controls            | A          | Y                    | Y              | P                             | A            | N            | P          |
| Drawdown                     | N          | N                    | A              | P                             | N            | N            | A          |
| Hand Harvesting              | A          | A                    | A              | A                             | A            | A            | A          |
| Hydroraking                  | N          | N                    | A              | N                             | N            | N            | N          |

P = provisional (needs further study or community interest)

A = as-needed, based on monitoring results

# The 2022-2026 Management Plan: Timeline and Costs for “Wish List” Scenario

| Water Body                            | Estimated Costs by Year |                  |                  |                  |                  | Five-Year Projected Costs |
|---------------------------------------|-------------------------|------------------|------------------|------------------|------------------|---------------------------|
|                                       | 1                       | 2                | 3                | 4                | 5                | Total                     |
| <b>All - Monitoring and Reporting</b> |                         |                  |                  |                  |                  |                           |
| Subtotal                              | \$42,000                | \$44,000         | \$46,000         | \$48,000         | \$50,000         | \$230,000                 |
| <b>Keyes</b>                          |                         |                  |                  |                  |                  |                           |
| Subtotal                              | \$20,000                | \$46,000         | \$27,000         | \$29,000         | \$31,000         | \$153,000                 |
| <b>Long Sought-For</b>                |                         |                  |                  |                  |                  |                           |
| Subtotal                              | \$50,000                | \$20,000         | \$21,000         | \$22,000         | \$23,000         | \$136,000                 |
| <b>Nabnasset</b>                      |                         |                  |                  |                  |                  |                           |
| Subtotal                              | \$57,000                | \$259,000        | \$56,000         | \$72,000         | \$62,000         | \$506,000                 |
| <b>Old Mill / Graniteville</b>        |                         |                  |                  |                  |                  |                           |
| Subtotal                              | \$35,000                | \$61,000         | \$42,000         | \$44,000         | \$46,000         | \$228,000                 |
| <b>Burge's</b>                        |                         |                  |                  |                  |                  |                           |
| Subtotal                              | \$3,000                 | \$4,000          | \$5,000          | \$6,000          | \$7,000          | \$25,000                  |
| <b>Kennedy</b>                        |                         |                  |                  |                  |                  |                           |
| Subtotal                              | \$3,000                 | \$4,000          | \$5,000          | \$6,000          | \$7,000          | \$25,000                  |
| <b>Forge</b>                          |                         |                  |                  |                  |                  |                           |
| Subtotal                              | \$27,500                | \$300,000        | \$45,000         | \$95,000         | \$43,000         | \$510,500                 |
| <b>Total</b>                          | <b>\$237,500</b>        | <b>\$738,000</b> | <b>\$247,000</b> | <b>\$322,000</b> | <b>\$269,000</b> | <b>\$1,813,500</b>        |

# The 2022-2026 Management Plan: Timeline and Costs for “Status Quo” Scenario

| Water Body                     | Estimated Costs by Year |                  |                  |                  |                  | Five-Year Projected Costs |
|--------------------------------|-------------------------|------------------|------------------|------------------|------------------|---------------------------|
|                                | 1                       | 2                | 3                | 4                | 5                | Total                     |
| <b>All</b>                     |                         |                  |                  |                  |                  |                           |
| <b>Subtotal</b>                | <b>\$38,500</b>         | <b>\$40,000</b>  | <b>\$42,000</b>  | <b>\$44,000</b>  | <b>\$46,000</b>  | <b>\$210,500</b>          |
| <b>Keyes</b>                   |                         |                  |                  |                  |                  |                           |
| <b>Subtotal</b>                | <b>\$5,000</b>          | <b>\$6,000</b>   | <b>\$7,000</b>   | <b>\$8,000</b>   | <b>\$9,000</b>   | <b>\$35,000</b>           |
| <b>Long Sought-For</b>         |                         |                  |                  |                  |                  |                           |
| <b>Subtotal</b>                | <b>\$10,000</b>         | <b>\$11,000</b>  | <b>\$12,000</b>  | <b>\$13,000</b>  | <b>\$14,000</b>  | <b>\$60,000</b>           |
| <b>Nabnasset</b>               |                         |                  |                  |                  |                  |                           |
| <b>Subtotal</b>                | <b>\$20,000</b>         | <b>\$21,000</b>  | <b>\$22,000</b>  | <b>\$23,000</b>  | <b>\$24,000</b>  | <b>\$110,000</b>          |
| <b>Old Mill / Graniteville</b> |                         |                  |                  |                  |                  |                           |
| <b>Subtotal</b>                | <b>\$15,000</b>         | <b>\$16,000</b>  | <b>\$17,000</b>  | <b>\$18,000</b>  | <b>\$19,000</b>  | <b>\$85,000</b>           |
| <b>Burge's</b>                 |                         |                  |                  |                  |                  |                           |
| <b>Subtotal</b>                | <b>\$3,000</b>          | <b>\$4,000</b>   | <b>\$5,000</b>   | <b>\$6,000</b>   | <b>\$7,000</b>   | <b>\$25,000</b>           |
| <b>Kennedy</b>                 |                         |                  |                  |                  |                  |                           |
| <b>Subtotal</b>                | <b>\$3,000</b>          | <b>\$4,000</b>   | <b>\$5,000</b>   | <b>\$6,000</b>   | <b>\$7,000</b>   | <b>\$25,000</b>           |
| <b>Forge</b>                   |                         |                  |                  |                  |                  |                           |
| <b>Subtotal</b>                | <b>\$3,000</b>          | <b>\$4,000</b>   | <b>\$5,000</b>   | <b>\$6,000</b>   | <b>\$7,000</b>   | <b>\$25,000</b>           |
| <b>Total</b>                   | <b>\$97,500</b>         | <b>\$106,000</b> | <b>\$115,000</b> | <b>\$124,000</b> | <b>\$133,000</b> | <b>\$575,500</b>          |

# The 2022-2026 Management Plan: Funding

- MassDEP 604(b) Watershed Assessment Grants – water quality assessment, planning, and concepts
- MassDEP 319 Non-Point Source Grants – water quality design, permitting, and implementation
- MassDEP Monitoring Grants – water quality monitoring programs by non-profits
- Community Preservation Act Funding – subject to rules of local CPC for open space & recreation projects but typically limited to acquisition and non-maintenance actions
- Municipal Vulnerability Preparedness Action Grants – funding to address climate change impacts

Thank You



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