

(DRAFT) Regulatory Vehicles for Implementing the Topsfield Water Conservation Plan

Introduction

Working in collaboration with the Topsfield Water Working Group, MAPC has worked to create a draft water conservation plan for the Town. The plan is based on compliance with the EOEA Water Conservation Standards (2006); the Town's Massachusetts DEP Modified Water Withdrawal Permit (as modified May 19, 2003) and also utilizes analysis and information incorporated through the EPA Intermediate Guidelines for Preparing a Water Conservation Plan.

The draft Topsfield Water Conservation Plan makes the following recommendations for regulatory changes in order to improve water conservation and its efficient use in the community:

1. The adoption of a bylaw to regulate the use of private wells for irrigation.
2. Updating, as needed, the Town's Water Use Restriction Bylaw with the Massachusetts model water use restriction bylaw.
3. Making residents and contractors aware of existing wetland regulations that prohibit withdrawals from surface water sources without permission from the Conservation Commission.
4. The adoption of an Open Space and Residential Design bylaw to encourage the use of land use developments patterns that decrease the amount of impervious areas created and leave more land in an undisturbed, natural state.
5. Establishing water-wise landscaping requirements for any building undergoing site plan review.
6. Creating publicly posted and distributed development guidelines for water efficient landscaping to help educate residential and commercial water users, builders and all property owners working to build or renew existing or landscapes.

1. The adoption of a bylaw to regulate the use of private wells for irrigation.

Suggested action: Amend Section 58-2.3 of the *Topsfield Water Use Restriction Bylaw, Purpose*, by adding the following introductory sentences:

“This Bylaw is intended to create a balance between the needs of the environment, the citizens of Topsfield, and the drinking water supply. The Town is aware of the concerns about lower ground water levels in the Ipswich River Watershed Basin and the demand on its water resources during the summer season. The Town also recognizes the therapeutic, esthetic, and environmental benefits that gardening, landscaping and greenery brings to the community. It is the intent of this Bylaw to permit residents to maintain their properties, while not overburdening Town water supplies, the water distribution system and to make a positive contribution to the environment. All Topsfield residents that are either customers of the public water supply system or private well users shall be subject to this Bylaw in order to preserve and maintain the Ipswich River Watershed Basin.”

Suggested action: Amend Section 58-2.3 of the *Topsfield Water Use Restriction Bylaw, Definitions, Water Users or Water Consumers*, by adding the following sentence:

“Private well users are also water users or water consumers and shall be subject to this By-law.”

2. Updating, as needed, the Town’s Water Use Restriction Bylaw with the Massachusetts Model Water Use Restriction Bylaw

MAPC staff has compared the Topsfield Water Use Restriction By-law with the Massachusetts Department of Environmental Protection’s Model Water Use Restriction By-law and has noted some differences between the Town’s bylaw and the DEP bylaw, in the following table.

Topsfield Bylaw Section	DEP Model By-law	Topsfield By-law
Section 58-2.1 –Authority	Section 1: Notes authority to regulate under MGL c.41, S. 69B.	May wish to add authority.
Section 58-2.3- Definitions	Section 3: Agriculture defined as under MGL c.128, S. 1A.	May wish to add definition of Agriculture.
Section 58-2.5 - Restricted Water Uses	Section 5: Notes car washing as a restricted use	May wish to add car washing as a restricted use.
Section 58-2.6	Section 6: Notification of a State of Water Supply Emergency as declared by the Department is provided by furnishing a copy of the Notice to radio and television stations serving the area w/in 48 hrs.	May wish to add this notification when a state of water supply emergency is declared.
No corresponding section listed	Section 11: Suggests developing a procedure of issuing exemptions for specific uses including commercial agriculture, water to sustain animal life, swimming pools as therapeutic devices, commercial car or vehicle washing facilities	May wish to add a new Section 58-2.11, Exemptions. Renumber existing 58-2.11, Severability, to 58-2.12.

3. Make residents and contractors aware of existing wetland regulations that prohibit withdrawals from surface water sources without permission from the Conservation Commission.

The withdrawal of water from surface water supplies by private contractors and homeowners is regulated in Topsfield. Examples of such uses would be the withdrawal of water from a pond or stream by a contractor into a water truck or by a homeowner for private irrigation. The Topsfield Wetlands General By-Law, Section 62-2, JURISDICTION, states that:

“Except as permitted by the Conservation Commission or as provided in this By-Law, no person shall remove soil or vegetation from, fill, dredge, build upon, discharge into, or **alter** the following resource areas”.... including b. **Bodies of Water**.

Body of Water is defined in Section 62-3 of the Wetlands General By-Law as:

“...any lake, pond, river, or stream, whether intermittent or not, man-made or natural.”

Section 62-3 also defines **Alter** to mean “to change the condition of any area subject to protection under this By-Law. Examples include but are not limited to”: including c. Drainage or other **disturbances of water level** or water table (emphasis added).

MAPC suggests that both the Water Department and the Conservation Commission publicly post and advertise, using the Town website, the current Conservation Commission Regulation on the withdrawal of surface water from any Town Body of Water. Under current regulations, any withdrawal requires an Order of Conditions from the Conservation Commission prior to any pumping or withdrawal.

The Town could consider issuing a five-year Order of Conditions to companies or residents that seek to withdraw water from a Body of Water on a regular basis, either for contracted services or for private irrigation use. Such Orders of Conditions are often coordinated by a Conservation Commission with local Departments of Public Works to allow the regular cleaning of municipal drainage facilities located in wetland resource areas without requiring the issuance of a new Order of Conditions annually. The REGULATIONS FOR TOPSFIELD WETLANDS GENERAL BYLAW, R. 10-4, PRESUMPTION OF SIGNIFICANCE AND PERFORMANCE STANDARDS, Section g., makes reference to the maintenance and permitting of pre-existing wetland uses in the Town and could potentially be modified to include withdrawal of water from Water Bodies.

A longer-term Order of Conditions for water withdrawals could include conditions such as a limit on the amount of water taken, frequency of pumping, a limit on the months in which withdrawals could be made, notice to the Conservation Commitment when withdrawals were going to be made, require the presence of the Conservation Agent when pumping takes place (or an alternate), etc.

4. The adoption of an Open Space and Residential Design bylaw to encourage the use of land use developments patterns that decrease the amount of impervious areas created and leave more land in an undisturbed, natural state.

MAPC has met twice with members of the Planning Board to develop an OSRD model best suited for Topsfield. Suggestions from Planning Board and other attendees of the June 6, 2006 Open Space and Residential Design bylaw review meeting included:

- Include strong provisions for the assigning of conservation and agricultural restrictions within the bylaw’s open space preservation language; a conservation restriction may also include agricultural use, but make sure it is covered;
- Due to town water use concerns, do not include an affordable housing bonus or open space provision within the OSRD bylaw draft;

- Include a minimum lot size but make it waivable by the special permit granting authority (SPGA);
- Keep the minimum eligible tract size on the smaller side to encourage use: 4- 5 acres or lots;
- Maintain open space in OSRD developments for public use, if possible;
- Provide a range of options for protection and management of open space in OSRD developments.

Based on research of OSRD bylaws and interviews with municipal planners in implementing their OSRD bylaws, MAPC makes the following draft recommendations for the Topsfield OSRD and has included all of these features within the drafts of the OSRD bylaw:

- Use of the special permit type OSRD bylaw is probably a better choice for a small community with part-time planning staff like Topsfield. Special permits offer flexibility to the SPGA and their intelligent use can prevent trips to the Zoning Board of Appeals for hard to achieve variances;
- Require an OSRD permit application for **all** developments above a certain size and keep the size threshold low to capture the majority of land development applications: example: any subdivision or ANR development above 4 lots or 4 units;
- Allow dimensional flexibility: if minimum lot sizes, frontages and setbacks are required, make at least some of them waivable by the SPGA;
- Maintain a large percentage of usable open space in the preserved open space of the OSRD development: examples: 50% of uplands or “buildable area” that does not include greater than 50% wetlands or land with greater than 20% steep slopes;
- Allow siting of wastewater treatment systems in preserved open space areas to encourage the use of the OSRD bylaw and allow designer and builder some flexibility;
- Mix housing types: single family detached and detached units;
- Parking: two spaces per unit, with driveway OK for parking in.

The Topsfield Planning Board is working with MAPC staff to consider and further refine initial town and MAPC OSRD recommendations. The OSRD draft bylaw is a separate document.

5. Establish water-wise landscaping requirements for any building undergoing site plan review.

Research includes two possible models for updating Topsfield's zoning bylaw for water efficient landscaping practices.

I. Consider adding to the *Topsfield Zoning Bylaw* Article 9.06, Section 12:

Minimum Landscaped Open Space Coverage (from Sharon, MA)

In Business Village, Business Highway and Business Park Districts: thirty (30%) percent. The total landscaped area including landscaping, screening, pedestrian ways and areas, and bike pathways, may be reduced during site plan review to not less than fifteen (15%) percent of the total lot area provided in landscaping, screening, and pedestrian and bike amenities. In approving any reduction, the Planning Board shall determine that the proposed amenities or facilities provide for the public benefit or convenience. The following are typical improvements which shall be deemed as public benefits or convenience in the Business Village, Business Highway and Business Park Districts:

Street Plantings: Plantings are required along the entire street frontage for non residential uses, except at drives, and except where neither a street setback nor a buffer zone is required. The required plantings should generally be located between the street and the build-to line.

II. Consider adding the following to the *Topsfield Zoning Bylaw* Article 9.06, Section 12 as Landscape Plan Performance Standards:

A. Xeriscape. To aid in conserving the Town of Topsfield's drinking water supply, xeriscape is required for all applicable development projects unless the applicant installs an irrigation system but only those which drip or mist. Spray or sprinkle irrigation using town water is prohibited.

B. Planting medium. To reduce the need for watering and fertilizing and to help maintain healthy plants, in formal and naturalized landscapes, soil shall be no more than twenty-five percent (25%) sand, no more than ten percent (10%) clay and no less than sixty-five percent (65%) silt, and decayed organic matter in an amount equal to twenty-five percent (25%) of the soil by volume shall be added. This is required to the following depths:

(1) Where trees are planted, to a minimum of four (4) feet within a four-foot radius of the trunk.

(2) Where shrubs are planted, to a minimum of two (2) feet within a two-foot radius of the trunk(s).

(3) Where ground covers, herbaceous perennials, annuals or bulbs are planted, to a minimum of one (1) foot within the planting area.

C. Mulch. To prevent soil erosion, weed growth and to help retain moisture and insulate young plants, mulch is required in formal and naturalized landscapes wherever soil is not covered by vegetation.

(1) Mulch shall be applied on the soil surface in a layer two (2) to four (4) inches deep.

(2) Mulch shall be used as a temporary cover during the first three (3) growing seasons until vegetation grows to completely cover the ground. Mulch shall not be used as a substitute for ground covers.

(3) Ground or shredded bark, peat moss, pine needles, tree leaves, straw or hay may be used as a mulch.

(4) Gravel or stone chips may be used in areas of high pedestrian traffic, but shall not exceed ten percent (10%) of the landscaped area.

D. Street trees. To reduce heat and glare on streets and sidewalks, street trees are required to the following specifications:

(1) Street trees shall be planted no greater than thirty (30) feet apart on a line five (5) feet behind the street frontage. Where an access driveway interrupts this pattern, street trees shall be planted on either side of the driveway, five (5) feet from the edge of pavement and behind the sight triangle at the intersection. Existing vegetation meeting the intent of this Article may be substituted for these requirements.

(2) When planted, street trees shall have a trunk diameter of at least two (2) inches at a height of four (4) feet six (6) inches, and shall be free of limbs below seven (7) feet.

(3) Street trees shall be maintained so as to reach a height of at least forty-five (45) feet at maturity.

E. Front yards. Front yards may be formal, naturalized or undisturbed so long as all surface areas which are not parts of walkways or driveways are completely covered by vegetation within three (3) years.

F. Parking lot screens. Between the front yard and the parking area, a screen is required so that automobiles cannot be viewed from the street. This may be achieved using any combination of the following:

(1) A row of evergreen and deciduous trees at least six (6) feet high, with no more than fifty percent (50%) being deciduous.

(2) A hedge at least three (3) feet high, to grow to a minimum of four (4) feet high at maturity.

(3) A berm at least four (4) feet high with no slope greater than three to one (3:1), mulched and planted so as to be completely covered by vegetation in three (3) years.

(4) A solid fence or wall at least four (4) feet high, the faces of which shall be planted with shrubs at an interval of not less than one (1) every twenty (20) feet with the intervening faces planted with herbaceous perennials, annuals or bulbs in an area not less than two (2) feet wide.

G. Parking lot interiors. Vegetated islands are required within paved areas behind the street setback according to the following specifications:

(1) For each parking stall, forty (40) square feet of vegetated island shall be provided within the paved area. The minimum dimension of each vegetated island shall be four (4)

feet, except at corners, and the minimum area shall be one hundred sixty-two (162) square feet.

(2) No less than one (1) street tree shall be planted for each one hundred sixty-two (162) square feet of vegetated island.

(3) The remainder of the parking area not used for stalls or driveways shall be planted with any combination of trees, shrubs, ground cover, herbaceous perennials, annuals or bulbs so that the ground is completely covered after three (3) growing seasons.

(4) Plants within necessary sight triangles shall be no greater than two (2) feet high.

(5) Vegetated islands are required to separate rows of parking stalls and interior driveways.

H. Service area screens. Where service areas exist, they shall be screened from view of the street, parking areas and adjacent properties. This may be achieved using any combination of the following:

(1) A row of evergreen and deciduous trees, at least six (6) feet high, with no more than thirty percent (30%) being deciduous.

(2) A solid fence or wall at least six (6) feet high.

I. Residential buffers. A buffer is required between business or industrial uses and residences, nursing homes, hospitals or similar uses. The buffer shall protect abutting properties from glare, noise, dust, fumes, heat and traffic. This may be achieved using any of the following:

(1) Two (2) rows of evergreen trees, at least six (6) feet high, and faced with a row of shrubs at least three (3) feet high.

(2) One (1) row of evergreen trees, at least six (6) feet high and faced with a row of shrubs at least three (3) feet high and backed with a solid fence or wall at least six (6) feet high.

(3) A berm a minimum of five (5) feet high, with no slope greater than three to one (3:1), planted with trees and shrubs so that the ground is completely covered with vegetation.

DEFINITIONS: Add to *Topsfield Zoning Bylaw*, Section 1, Definitions

ANNUAL - A plant with soft and fleshy stems which lives for only one (1) or two (2) years.

BERM - A mound of earth covered with plants and used as a screen.

BUFFER OR SCREEN - Any landscape object or structure (such as a fence, berm or hedge) used to hide something from view or as a barrier for privacy, security or from noise, wind or dust.

DECIDUOUS - Any woody perennial which drops its leaves in autumn or winter.

EVERGREEN - Any woody perennial which retains its leaves throughout the year.

FORMAL - A landscape designed primarily on classical geometric lines, usually requiring high maintenance.

GROUND COVER - Low shrubs, herbaceous perennials or reseeding annuals which are planted to cover the ground completely at maturity to stabilize slopes or substitute for a lawn.

HEDGE - Shrubs planted close together in a solid line to delineate a space, form a border or create a screen for privacy.

HERBACEOUS PERENNIAL - A perennial plant with soft and fleshy stems which dies back to the ground in winter.

LANDSCAPE

- i. the spatial relationship of the topography, structures and vegetation.
- ii. to modify or ornament nature by altering topography, structures or vegetation.

LANDSCAPE OBJECT - Any fixed feature in the landscape which does not require a building permit.

MULCH - Organic material used to temporarily cover the ground until plants can reach maturity and cover it.

NATURALIZED - A landscape designed primarily on curved lines to mimic nature which usually requires little maintenance.

PERENNIAL - A plant which lives for more than two (2) years.

SERVICE AREA - Any area which contains a loading dock, dumpster or outdoor storage of merchandise, vehicles or equipment.

SHRUB - A woody perennial plant growing to a height of fifteen (15) feet or less at maturity.

SIGHT TRIANGLE - An area free of obstructions which might interfere with a driver's ability to see other vehicles approaching an intersection.

STREET TREE - A tree with characteristics (such as sturdy limbs, deep root system or lack of low branches) which make it desirable for planting near pavement or underground utilities.

TREE - A woody perennial plant growing to a height of fifteen (15) feet or more at maturity.

UNDISTURBED - A landscape design which primarily utilizes existing plants in a natural state and requires no maintenance.

VEGETATED ISLAND - An area inside a paved parking area covered with vegetation instead of pavement.

XERISCAPE - A landscape designed with native, drought-tolerant species which require little fertilizer.

6. Revise the Town’s Planning Board policies to suggest standards for lot clearance and soils preparation for new subdivision lots

Planning Board members and Water Working Group members both expressed their desire to encourage the use of water saving lot clearance and soils preparation for new subdivision lots without expressly regulating it under a new zoning bylaw or by adding new Planning Board regulations. As per Massachusetts General Law Chapter 41A, Section 81 Q, the scope allowed to Planning Boards for developing regulations is quite narrow: “to regulate the laying out and construction of ways and to ensure sanitary conditions in subdivisions” (Bobrowski, *Handbook of Massachusetts Land Use Planning Law*, pg. 573) Lot shape, size, width, frontage or use of the lot itself, except to require conformance with local zoning, may not be regulated by the Planning Board.

The town does not wish to pursue the adoption of a zoning by-law regulating the percentage of land which may be planted as grass or turf, as per the town of Sharon, or consider adopting a formal landscaping bylaw, as per the town of Falmouth. It has indicated its preference for developing a set of non-regulatory guidelines for developers to follow. These guidelines could be discussed and refined, just as the model Ipswich Open Space Guidelines are being discussed as an adjunct to the draft model OSRD bylaw.

Topsfield Water-Wise Development Guidelines could be drafted by Town Boards and the Water Department, handed out to builders/developers, and posted in Town Hall and other public meeting spaces. MAPC suggests the following guidelines as a starting point for further discussion, as taken from the Massachusetts Water Resource Commission’s 2002 *Guide to Lawn and Landscape Water Conservation*.

Elements of Water Efficient Landscaping: Design, Construction, and Maintenance

The following elements of landscaping are provided to help water suppliers and municipalities educate their residential and commercial water users on how they can develop and maintain an aesthetically pleasing landscape that uses little or no water. These guidelines can be used by all types of property owners to ensure that work to build new or restore existing landscapes is done in a manner to minimize water use.

1. Landscape Design: The Most Important Step – Reduce Lawn Area

When planning a landscape, consider how it will be used, what space and site attributes are necessary, and how much work and resources will be required for maintenance. These recommendations are appropriate for a relatively low maintenance, residential landscape.

- Minimize lawn size and maintain existing native vegetation when designing landscapes. Consider alternatives to grass, especially for steep slopes, shady areas, and near streams and ponds, where grass is difficult to maintain.
- Use drought resistant and native species of grasses. Generally, an insect resistant mixture of grasses that includes a high percentage of fine fescues will ensure a drought tolerant lawn. For more information regarding the appropriate grasses for site-specific conditions contact the Massachusetts Horticultural Society Master Gardener Hotline at (781) 235-2116.
- Some native species of shrubs, trees, and wildflowers are drought tolerant. Planting these species will create wildlife habitat and build a more drought resistant landscape. For information regarding the appropriate native species for site specific conditions contact the Massachusetts Horticultural Society Master Gardener Hotline at (781) 235-2116

Additionally, shrubs and trees create shade that helps to keep lawns green during hot, dry weather.

- Be aware of the various zones in your yard (hot/sunny, cool/shady, moist, or dry) and choose plants according to the conditions. Sloping grass areas (i.e., areas with a 6% slope or greater) tend to be difficult to maintain due to water runoff and mowing difficulty and might best be planted with a drought resistant ground cover.
 - Cluster plants that require extra care together to save time and water by watering just one area.
- Design contours or “grades” in the landscape to prevent water from draining to areas off the site.

2. Landscape Construction: Please Don’t Call It “Dirt”

A key factor in constructing a low water use landscape is to have proper soil conditions for the landscape. Landscapes on poor and shallow soils can be extremely water intensive because root systems remain shallow and require increased water to survive during summer months. Also, poor soils are unable to absorb and hold water, resulting in high water run-off that does not benefit the landscape. Finally, adequate organic material in the soil not only helps to hold water, but provides a source of nutrients for the plants.

Soil is a complex mixture of minerals, organic matter, microorganisms, water, and air. As the foundation of the landscape, the type and quality of the soil directly influences

water use. It is important to know the composition of the soil in order to improve it. There are 3 broad categories of soil:

A clay soil consists of small particles, is slow to absorb water, has good water retention, and has poor drainage capacity.

A sand soil consists of large particles, absorbs water quickly, retains water poorly, and drains well.

A silt soil consists of medium particles, absorbs water quickly, has moderate retention and drainage capacity, and is ideal for most gardens.

For more information on the composition of the soils on residential properties, the University of Massachusetts' Extension Service offers a wide variety of soil test options that range in cost from \$3.00 to \$30.00. Call the UMass Extension Soil Testing Lab (413) 545-2311 or through their web site at www.umass.edu/plsoils/soiltest.

- Add compost or an organic material as necessary, preferably adding it to soil to a depth of 6"-8" inches for grass areas and 12" to 18" inches for shrub and tree areas to improve soil conditions and water retention. Organic soils can hold water significantly longer than sandy soils.
- Use mulch in flower beds and around shrubs and trees to minimize evaporation, reduce weed growth, and decrease erosion.

3. Landscape Maintenance: Don't Be A Slave To Your Lawn

a. *Watering*

Lawn watering accounts for the majority of landscape water use. Maintaining adequate water supplies during summer months has become a critical problem for many Massachusetts communities causing some towns to impose annual restrictions on outdoor water use. Citizens should be aware of the situation and should strive to conserve water at every opportunity.

- Abide by water restrictions and other conservation measures put into effect by the municipality or water supplier.
 - Lawns should only be watered when necessary, generally no more than once per week. The rule of thumb is to apply an inch of water (from all sources, both natural and watering) to the lawn. An easy way to measure this by putting out one or more shallow containers and then measuring the depth of the water collected. To determine when to water, walk across the lawn and look for footprints. If the grass springs up after being walked on, it does not need to be watered.

- If watering is necessary, watering techniques (especially the length of time spent watering) should be matched to soil needs. Watering slowly and deeply during the spring and fall months will allow the water to be absorbed and will train grass roots to grow deeply (grass is generally not growing in the summer, so deep water does not promote root growth at this time); frequent shallow watering results in root systems that stay near the surface making the lawn drought intolerant. Ideally, root zone areas of a lawn should be thoroughly moistened during watering.
- Water between sunset and early morning to reduce evaporation. Avoid watering at night if disease is present and actively damaging the lawn or during periods of very hot humid weather.
- In newly seeded lawns, keep soil moist, but beware of over watering.
- Install shutoff nozzles on hoses to prevent water loss from unattended hoses. Hoses without a nozzle can spout 10 gallons or more per minute.
- Use drip irrigation systems to deliver water more efficiently to flower beds, shrubs, vegetable gardens, and newly planted trees.
- Use cisterns or rain barrels to capture and recycle rain water from downspouts to use for flower beds, shrubs, and newly planted trees. Use a lid, mesh fabric or several drops of baby oil on the surface of the water to prevent mosquitoes from breeding.

i. Recommendations for Automatic Irrigation Systems:

The growing proliferation of automatic irrigation systems is part of the cause of increasing summertime water demands. While communities with severe water shortages should consider a moratorium on the installation of these systems, other communities should work to ensure that their use promotes efficient water use. For property managers and owners in these communities:

- Determine the best irrigation system to fit lawn size and configuration. Install matched precipitation sprinkler heads and keep them in good repair. Matched precipitation sprinkler heads are designed and installed to apply irrigation water to a particular region in site-specific quantities according to landscape needs. These systems ensure that one area of the landscape is not over watered while another is under watered. Check the sprinkler heads frequently for proper direction and even spray pattern. Use the controller to adjust the system according to seasonal and climate changes and reschedule the controller if runoff occurs. An irrigation system's efficiency is measured by what is called the coefficient of uniformity (CU). A highly efficient CU ranges from .75-.85.
- Consider installing a controller with the following features:

- At least two independent programs to allow watering different parts of the yard on different days;
 - Station run times from one to 99 minutes;
 - Two start times per program;
 - Odd, even, weekly, and interval program capability up to 30 days; and
 - Rain shutoff device capability.
- Install a rain shutoff device on the irrigation system. Ensure that the shutoff device is adjusted to shut off the system after only a small amount of rain, generally 1/8 of an inch.
 - Install a master valve that is connected directly to the system control timer that prevents any water from entering the system when it is not running. This can prevent water loss from leaks in the system. Check valves on sprinkler heads can also prevent water from draining from low sections of the system.
 - Install flow-sensing devices that detect excess flow that may be the result of a broken sprinkler head or pipe.
 - Use drip irrigation systems to deliver water more efficiently to flower beds, shrubs, vegetable gardens, and newly planted trees.
 - Locate irrigation heads at least eight inches from paved areas and ensure they are directed only to landscape areas. Locating heads too close to pavement or misdirected sprinkler heads result in wasted water.
 - Repair broken sprinkler heads (which can waste up to twelve gallons per minute).
 - Turn off the irrigation system if runoff occurs and allow the soil to absorb the water.
 - Set controllers to water between sunset and early morning and adjust them bi-monthly to correct run times. Controllers need to be rescheduled to account for current weather conditions and for seasonal changes.
 - Undertake an irrigation system audit every one to two years to ensure the system is working properly.

ii. Recommendations for Property Owners and Managers Using Private Wells or Water Sources:

The use of private wells for lawn and landscape watering can reduce demands on public systems and therefore help water suppliers avoid the impacts that large peak demands can cause. However, property owners and managers who use water from private wells or other private sources should follow the same practices as those on public systems in order to minimize water use for lawn and landscape watering purposes. In addition, property

owners and managers should closely monitor whether their water withdrawals are having negative environmental impacts and reduce use accordingly. In particular, users of private water sources should:

- Abide by water restrictions and other conservation measures put into effect by the municipality or water supplier. This is particularly true if the private well is located in the zone of contribution to the municipal groundwater supply, is within the watershed of a surface water supply and if the local restrictions are caused by dry conditions rather than a water shortage caused by a system problem.
- Users of private water sources should not hook up pumps to withdraw water directly from any small ponds/lakes, streams, or rivers. These withdrawals can have negative environmental impacts, including impacts to fisheries and wildlife resources, particularly if multiple properties are drawing water from these surface water bodies.

b. Mowing

Mow lawns at the highest recommended height and do not mow when grass is under drought stress. A lawn's ideal length will vary with the type of grass, but many turf grass species are healthiest when kept to a height of at least 2-1/2 to 3 inches. Longer grass has more leaf surface to take in sunlight allowing it to grow thicker and develop a deeper root system, which in turn helps the grass survive drought, tolerate insect damage, and fend off diseases. Longer grass also shades the soil surface keeping it cooler, helping it retain moisture, and making it difficult for weeds to germinate and grow.

- Mow often enough that you never cut more than one-third of the height of the grass blades. Keep lawnmower blades sharp. Dull mower blades tear the grass blade and create a brownish appearance of the turf and may make it more susceptible to pests and diseases.

c. Soil Maintenance

- Aerate compacted soils to improve lawn rooting and moisture absorption. Compacted soil inhibits lawn rooting and water absorption. Options to improve rooting and counteract compaction include the use of mechanical core aerators: create holes by pulling out plugs of soil to improve rooting and water absorption. Aerators can be rented or used by a lawn care professional.
- Leaving grass clippings to decompose into the soil can both add organic matter and nutrients to the soil.