

# Understanding the Massachusetts Wetlands Protection Act

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## Understanding the Massachusetts' Wetland Protection Act

Massachusetts General Laws Chap. 131 § 40  
 and Regulations 310 CMR 10.00

Minimizing Your Risk -- by knowing when you need a wetlands permit and when you don't.



### Session Overview – Part 1

- What Inland Water Resource Areas are regulated in Massachusetts?
- How close to these regulated areas can work be conducted without filing for approval?
- Common Landscaping Activities
  - when is a permit needed?
  - what activities are exempt?
- Tips for Working with the local Conservation Commission

### Session Overview – Part 2

- How to identify regulated resource areas in the landscape.
- What does a wetland look like?
- How can you determine if a “wet” area is wet “enough” to actually be regulated?
- When do I need to hire a wetland professional?
- Why should we care about wetlands? What functions do these landscapes serve?

### Mass. General Law Chapter 131, Sec. 40

- No person shall **remove, fill, dredge or alter** any bank, fresh water wetland, coastal wetland, beach, dune, flat, marsh, meadow or swamp **bordering on** the ocean or on any estuary, creek, river, stream, pond, or lake, or any land under said waters or any land subject to tidal action, coastal storm flowage, or flooding, ...

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**To “alter”** means to change the conditions of any area subject to protection, including but not limited to:

- > changing drainage conditions,
- > lowering of the water table or water level,
- > **destroying vegetation,**
- > changing water temperature or chemistry.

**Mass. General Law  
Chapter 131, Sec. 40**

- ...*other than* in the course of maintaining, repairing or replacing, *but not substantially changing or enlarging*, an existing and lawfully located structure or facility used in the service of the public and used to provide electric, gas, sewer, water, telephone, telegraph and other telecommunication services,...

**Mass. General Law  
Chapter 131, Sec. 40**

- ...*other than* in the course of maintaining, repairing or replacing, *but not*

This is the **public utility exemption**, which permits herbicide use in buffer zone areas as part of an approved Vegetation Management Plan approved by the Department of Agricultural Resources, as long as resource areas and buffer zone boundaries have been confirmed by local conservation commission.

**Mass. General Law  
Chapter 131, Sec. 40**

- ...*without filing written notice* of his intention to so **remove, fill, dredge or alter**, including such plans as may be necessary to describe such proposed activity and its effect on the environment **and without receiving and complying with an order of conditions** and provided all appeal periods have elapsed.

**Mass. General Law  
Chapter 131, Sec. 40**

- ...*without filing written notice* of his intention to so **remove, fill, dredge or alter**, including such plans as may be necessary

Basically, you need to **file a written notice** for nearly all proposed activities in or near wetland resource areas.

**What are wetlands?**

“Wetlands” are transitional land areas that occur between deep water aquatic habitats and dry upland habitats, where frequent inundation occurs or where groundwater is often at or near the soil surface.



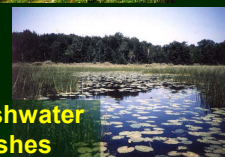
**Common Wetland Types**



**Bogs**



**Swamps**



**Freshwater Marshes**



**Tidal Marshes**

## Regulated Inland Water Resources Massachusetts General Laws Chap. 131 §40

- **Bordering Vegetated Wetland (BVW)\***
- **Stream Bank (perennial or intermittent)\***
- Land under river, pond, or lake.
- **Land subject to flooding**
- Riverfront Area (200-ft corridor along both sides of perennial river)  
\* plus buffer zone



## What are bordering vegetated wetlands?

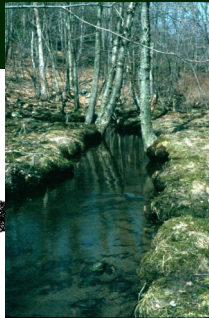
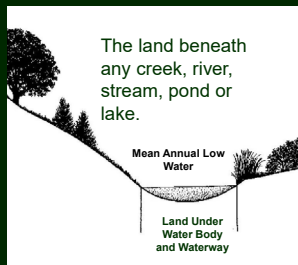
**Bordering Vegetated Wetlands (BVW)** are freshwater wetlands which border on creeks, rivers, streams, ponds, or lakes.



BVWs have a **buffer zone** extending 100 feet horizontally outward from their boundary.

## Land Under Waterbodies

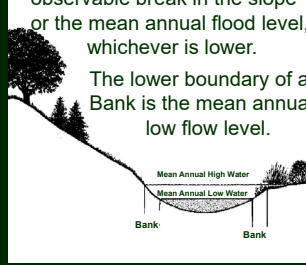
Land below Mean Annual Low water level.



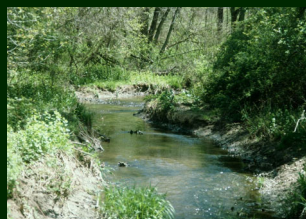
## Banks

The upper boundary is the first observable break in the slope or the mean annual flood level, whichever is lower.

The lower boundary of a Bank is the mean annual low flow level.



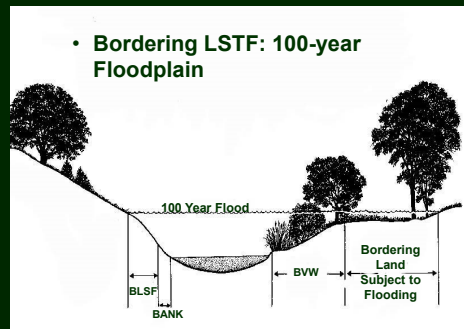
**Banks** of streams, rivers, lakes, and ponds are all protected (regardless of whether the stream is intermittent or perennial).



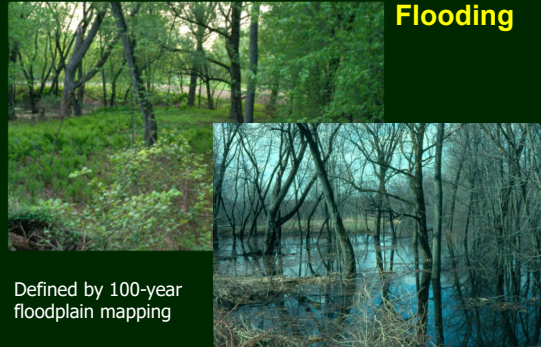
Banks also have a **buffer zone** extending 100 feet horizontally outward from the bank.

## Land Subject to Flooding (LSTF)

- **Bordering LSTF: 100-year Floodplain**



## Bordering Land Subject to Flooding



Defined by 100-year floodplain mapping

## Isolated Land Subject to Flooding

Isolated depression or closed basin without an inlet or an outlet, which at least once a year confines standing water to a volume of at least ¼ acre-feet and to an average depth of at least 6"

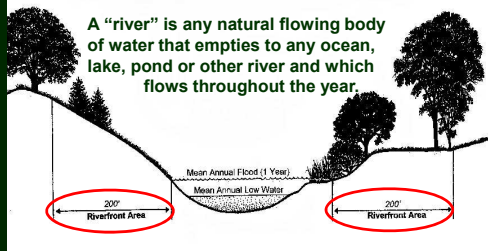


[http://www.naturalheritage.state.pa.us/VernalPool\\_Ecology.aspx](http://www.naturalheritage.state.pa.us/VernalPool_Ecology.aspx)

## Riverfront Area

The area of land between a river's mean annual high water line measured horizontally outward from the river and a parallel line located 200 feet away.

A "river" is any natural flowing body of water that empties to any ocean, lake, pond or other river and which flows throughout the year.

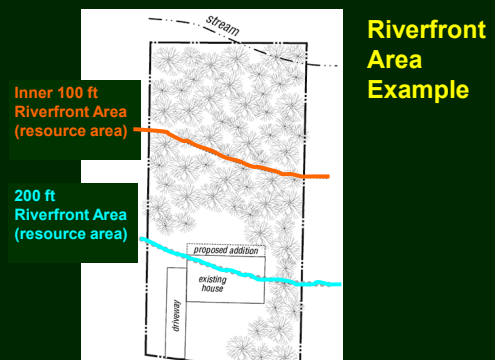


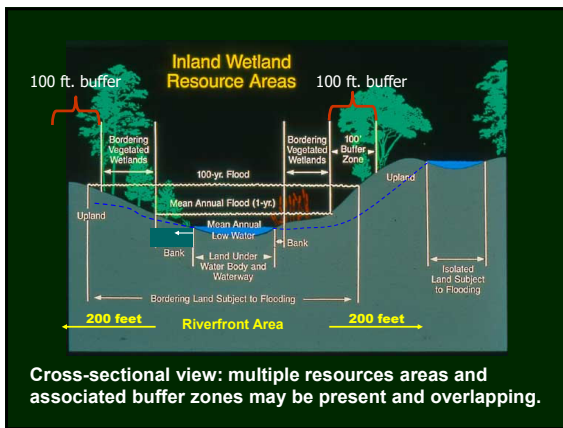
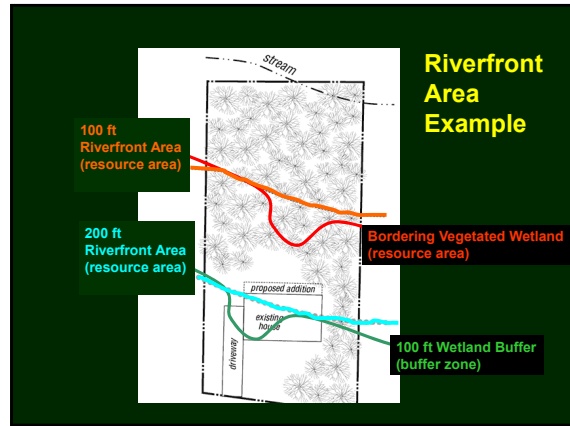
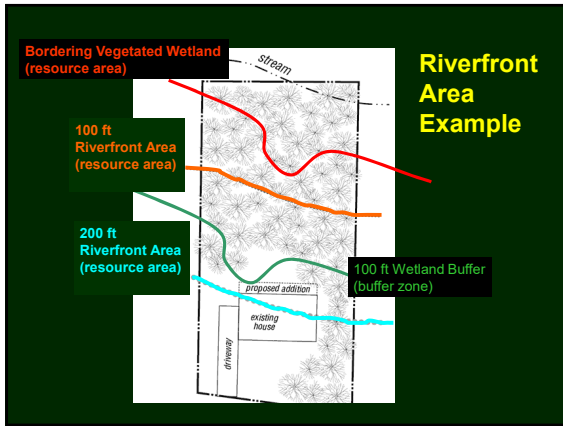
## Riverfront Area

- A corridor along all **perennial** rivers and streams, extending 200 feet horizontally from mean annual high water line.
- Divided into inner and outer 100 ft zones
- May or may not overlap a Bordering Vegetated Wetland and its associated buffer zone.
- Almost all activities will require a permit.

## Resource Area vs. Buffer Zone

- Resource Areas are protected areas
  - All activities require review and approval, except for specific exempt or minor activities.
- Buffer Zones are adjacent areas with limited restrictions on activities.
- The Riverfront Area is itself a regulated Resource Area (even though it is often thought of as a corridor to "buffer" impacts to the river system).





**Riverfront Area in Densely Developed Areas**

- The Rivers Protection Act defines **densely developed areas** as municipalities:
  - with 90,000 or more persons, and/or
  - greater than 9,000 persons per square mile.
- These areas have a Riverfront Area that extends **25 feet** horizontally from the mean annual high-water line on both sides of perennial streams (*instead of 200 ft*).

**Densely Developed Areas:**  
designated in 310 CMR 10.58(2)(a)3.a.

- Boston
- Brockton
- Cambridge
- Chelsea
- Everett
- Fall River
- Lawrence
- Lowell
- Malden
- New Bedford
- Somerville
- Springfield
- Winthrop
- Worcester
- Waltham (certain portion)
- Milton (certain portion)

**Only 25-ft RFA**

**Other Densely Developed Riverfront Areas:** added since passage of 310 CMR 10.58

- Taunton
- Revere
- Foxborough
- Palmer
- Medford
- Attleboro
- Quincy

DDRFA include only specific portions of these municipalities. Therefore only 25-ft RFA in these zones.

**Regulated Coastal Resources  
Massachusetts General Laws Chap. 131 §40**

- Salt Marshes\*
- Other Coastal Resource Areas\* (tidal flats, beaches, dunes, coastal banks, etc. bordering on the ocean, any estuary, creek, river, or stream)

\* These areas also have a 100-ft buffer zone

- Land subject to tidal action and/or coastal storm flowage



**How Close is Too Close?**

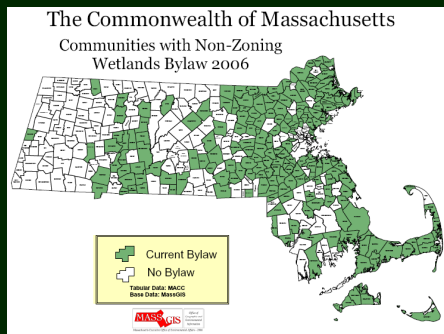
- Important to know the extent of regulated resource areas on your project site.
- Rivers and streams are evident.
  - The banks of these watercourses have a 100-ft buffer zone.
  - Does stream flow year-round?
  - If yes, then Riverfront Area restrictions also apply.
- What is the extent of BVW on the property?

**Do you need a Wetland professional?**

- Wetland professionals may be needed to delineate the actual boundary of a BVW, depending on how close you want to conduct your activities.
- You can obtain additional training to determine whether regulated wetlands are actually present on/near your project site.
- For work proposed in the buffer zone, you may not necessarily need a full delineation to receive approval to proceed.

**Who regulates Water and Wetland resources in Massachusetts?**

- The Massachusetts Wetlands Protection Act is administered by **local conservation commissions**.
- **Municipalities may have their own bylaws** (or ordinances) that regulate additional resource areas and/or prohibit work in certain buffer zones.
  - Decisions made based on local by-laws can not be appealed to MA DEP. Recourse sought through the court system.



At least 199 of 351 municipalities have local Wetland Bylaws

[http://www.maceweb.org/resources\\_bylaw\\_map.html](http://www.maceweb.org/resources_bylaw_map.html)

**When is approval needed?**

- Any work which would **remove, fill, dredge, or alter** a **resource area** is subject to regulation and **requires a permit**.
- Most activity proposed or undertaken within 100 feet of an intermittent stream bank or wetland require approval to ensure that the resource area is protected.
- **Local by-laws may be more restrictive.**

## Exempt Activities

Maintenance of existing landscaping, including lawn mowing and pruning, is exempt from review regardless of location in the buffer zone or any wetland resource area.



There are many exemptions that also apply to **commercial agricultural operations**.

## Agricultural Exemption

To qualify for the Agriculture Exemption, land must be in agricultural use.

- The regulations are quite specific about what constitutes land in agricultural or forestry use:
  - the exemption applies only to those land areas within the farm gate that presently and primarily are in production or that customarily and necessarily are related to production.
- Note: Land in agricultural use may lie inactive for up to five consecutive years

## Agricultural Exemption

The exemption applies to “**work performed for normal maintenance or improvement of land in agricultural use**”

- It is the work, or the activity, that is exempt, not the land.
- Even though a piece of land is in agricultural use, a particular activity may not necessarily qualify for the exemption. In other words, not all activities are exempt simply because they take place on a farm.

## Agricultural Exemption Examples

- All customary crop management practices
- Mowing
- Ditch cleaning (but not draining a BVW)
- Maintaining field edges
- Use of fertilizers, pesticides and herbicides

## Exempt minor activities in buffer zones and riverfront areas

- Unpaved, pedestrian walkways (private use: <30” / public use: <36” wide)
- Fencing and stonewalls
- Stacking of cordwood
- Planting of **native** trees, shrubs, or groundcover, ... but NOT turf lawns
- Conversion of impervious surfaces to lawn or natural vegetation.



No review or approval is needed

## Exempt minor activities in buffer zones and riverfront areas

- Vista pruning\* No review or approval is needed.
  - (>90% of canopy must be retained)
- Conversion of lawn\*\* to decks, sheds, patios, pools, and accessibility ramps.
- Conversion of existing accessory single family home structures to lawn.

\* Must be > 50ft from BVW and MAHWL

- Must be associated with existing single family home

### Exempt minor activities in buffer zones and riverfront areas

No review or approval is needed.

- Temporary activities for surveying and site planning: soil borings, monitoring wells, percolation tests for septic systems.
- Certain utility installations (including those within/along private driveways / roadways)
  - as long as all work conducted within the roadway and all trenches closed daily.
- Proper soil erosion and sediment control measures must be used to prevent turbidity in resource areas in all cases.

### Exempt minor activities in buffer zones and riverfront areas

No review or approval is needed.

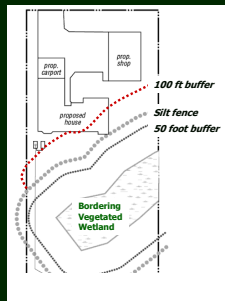
- Vegetation cutting for road safety maintenance (specific conditions apply).
  - Removal of diseased or damaged trees/branches that pose immediate and substantial threat to driver safety.
  - Removal of shrubbery or branches to clear guardrails and maintain visibility of road signage.
  - Removal of shrubbery/branches to maintain sight distances at existing intersections.
    - Must be > 10 feet from resource areas other than RA.

### Other Activities in the Buffer Zone

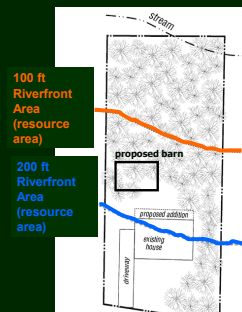
Other activities within the buffer zone require some form of preconstruction submission, review and oversight.

#### Examples:

- > home construction
- > creation of lawn from woodland.
- > any regrading activities



### Activities in the Riverfront Area



Other than the exempt minor BZ activities, all proposed activity within the riverfront area requires a permit.

- This includes the removal of invasive plants.

### The permit & approval process

- Three different application processes for obtaining permission to work in or near wetland resource areas.
  - Request for Determination of Applicability (RDA);
  - Abbreviated Notice of Resource Area Delineation (ANRAD); and
  - Notice of Intent (NOI)

### Request for Determination (RDA)

Use this process whenever possible.

Relatively quick and inexpensive (no filing fee) for work proposed outside Resource Areas.

Appropriate to determine:

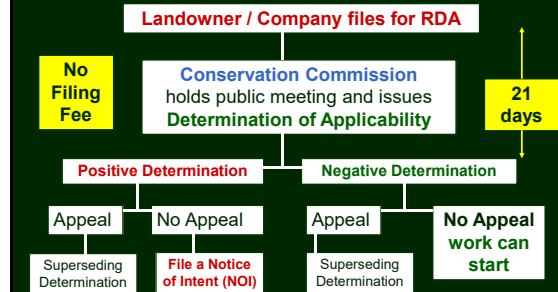
- (1) If an area is subject to jurisdiction under the Wetlands Protection Act
- (2) If proposed work is subject to jurisdiction under the Wetlands Protection Act
- (3) Confirmation of resource area delineation
- (4) Whether any local bylaw applies



### Request for Determination (continued)

- In response to an RDA, the Commission will visit the site and hold a public meeting.
- Two possible outcomes:
  - **Negative determination:** the area is not subject to jurisdiction or the activity **will not** affect the resource area, **work can proceed.**
  - **Positive determination:** the area is subject to jurisdiction or the work **will** affect the resource area and **the applicant must file a Notice of Intent (work cannot proceed).**

### RDA Process



### Abbreviated Notice of Resource Area Delineation (ANRAD)

“Simplified” filing process to confirm delineation of resource areas and review buffer zone projects meeting specific requirements.

**Pro’s:** More predictable outcome than Notice Of Intent (NOI) route, assuming that all buffer zone conditions have been met.

**Con’s:** Very strict parameters. **Limited applicability.** Requires formal delineation of resource areas, with full-scale drawings. **Filing fee = \$2 per linear ft. of BVW, RA, or bank reviewed** (up to \$200 for single family house project, and up to \$2,000 for all others)

### Notice of Intent

**Notice of Intent (NOI)** is an application to perform work in a resource area (and sometimes needed for buffer zone activities).

**\$ Application Fee (minimum \$110 for single activity)**

> including vegetation control & resource improvement

**\$ Resource Areas** often must be formally delineated

**\$ Formal site plans/scaled drawings usually required**

- Copy of application sent to MA DEP for review
- Abutters and landowners within 100 feet must be notified by certified mail
- **May also require submission of filing to NHESP**

### Natural Heritage & Endangered Species Program

If any portion of the proposed project is located in **Estimated Habitat of Rare Wildlife** as indicated on NHESP maps, the project is subject to the endangered species protection provisions of the Massachusetts Wetlands Protection Act Regulations. Projects located within Estimated Habitat are also subject to Massachusetts Endangered Species Act (MESA) review.

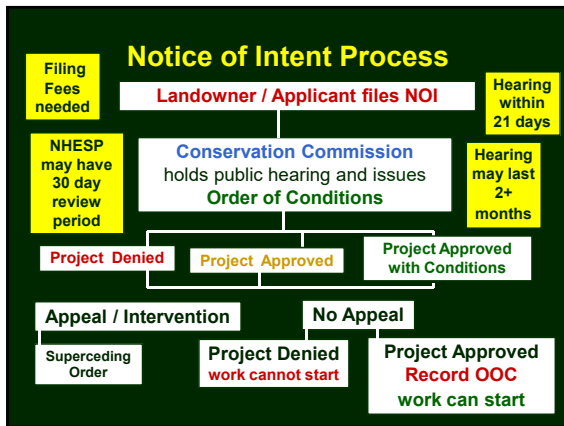
### Notice of Intent (NOI) - continued

The outcome of an NOI is an **Order of Conditions**, which either:

- approves the project,
- **denies the project**, or
- approves the project with conditions.

**The ‘Order of Conditions’ is a permit.**

This permit must be **Recorded with County Deed of Registry** against the subject property.



**“Newer” Category of General Permit**  
 – *approved October 2014*  
**Ecological Restoration Project (ERP)**  
**310 CMR10.13**

...a project whose primary purpose is to restore or otherwise improve the natural capacity of a Resource Area(s) to protect and sustain the interests identified in the Wetlands Protection Act, where such interests have been degraded or destroyed by anthropogenic influences.

### Ecological Restoration Projects (ERP)

- Still requires the filing of an extensive (*specialized*) Notice Of Intent (NOI)...with additional pre-filing requirements.
- **Benefits** – standards and guidelines provided in the regulations to help local issuing authorities make more consistent evaluations of project performance.
- **Types of specific ERP identified:**
  - Dam Removal                      -- Tidal Restoration
  - FW Stream Culvert Repair/Replacement
  - Stream Daylighting            --Improving Fish Passage
  - Rare Species Habitat Restoration

### Ecological Restoration “Limited Projects” (ERLP)

*310 CMR 10.24(8) coastal & 10.53(4) inland*

- Projects for the above-listed categories that cannot meet the strict performance standards set forth in the General Permit.
- **Other projects include, but are not limited to:**
  - the restoration/enhancement/management...of Rare Species habitat,
  - the restoration of hydrologic and habitat connectivity,
  - the removal of aquatic nuisance vegetation to retard pond and lake eutrophication, (*...continued*)

### Ecological Restoration “Limited Projects” (ERLP)

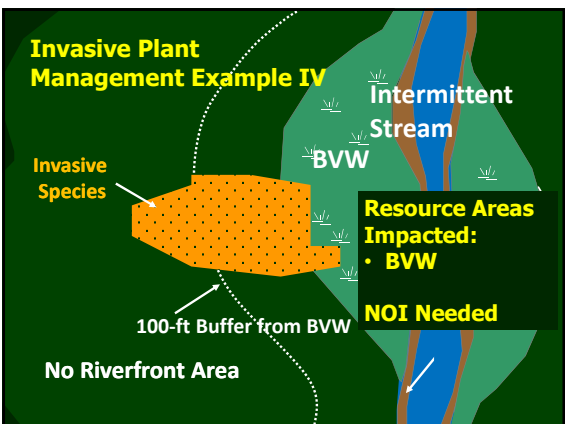
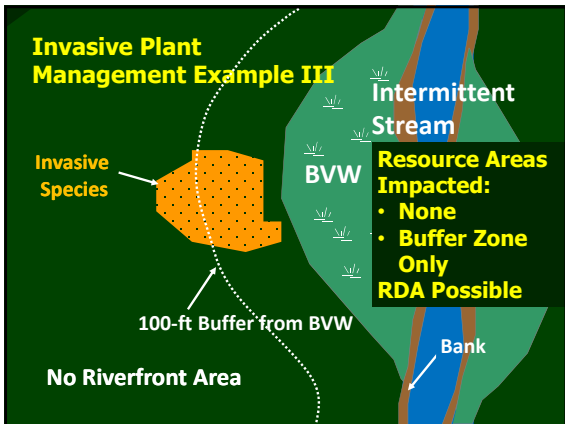
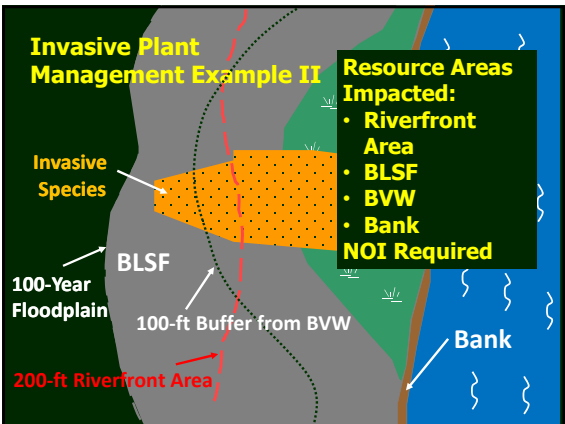
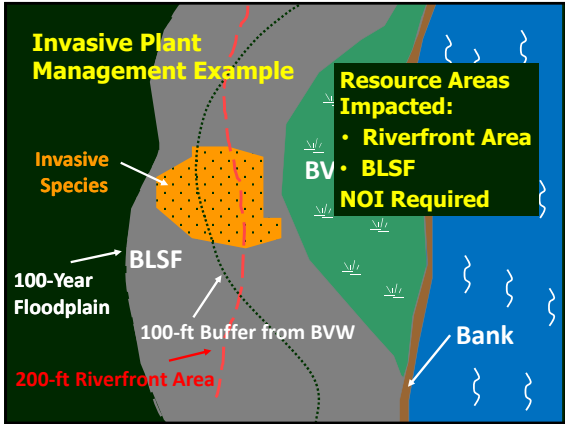
- **Other projects include, but are not limited to:**
  - the thinning or planting of vegetation to improve habitat value,
  - riparian corridor re-naturalization,
  - river floodplain reconnection,
  - in-stream habitat enhancement,
  - fill removal and regrading,
  - installation of fish passage structures, and
  - *Invasive species management (specifically listed under coastal regulations, but not inland).*

### Ecological Restoration “Limited Projects” (ERLP)

- ....may be permitted as long as the project meets definition of ERP,
  - Will have no adverse impacts on rare species habitat (as determined by NHESP),
  - Negative impacts to Resource Areas have been **Avoided, Minimized, and Mitigated; and alternative project scenarios have been evaluated.**
  - BMP will be utilized to prevent soil erosion and sedimentation, along with proper construction sequencing and timing.

### Filing Fees Ecological Restoration "Limited Projects"

- Removal / control of invasive species (other than aquatic) is not specifically listed under 310 CMR 10.53(4) – but it is listed in the fee structure for the regulations 310 CMR10.03(7).
- **Category 1 Activity (\$110 -if in BVW & RA, add 50%)**  
Control of nuisance vegetation by removal, herbicide treatment or other means, from a resource area, on each single family lot, as allowable under 310 CMR10.53(4).
- **Category 2 Activity (\$500-if in BVW & RA, add 50%)**  
Control of nuisance vegetation, other than on a single family lot, by removal, herbicide treatment or other means, reviewable under 310 CMR 10.53(4).



### Working with the local Conservation Commission

- When planning a project, contact the local Conservation Commission in advance.
  - Ask if there is a local wetland bylaw (if yes, get a copy and review it.)
  - Offer to attend public meeting to have informal discussion with Commissioners prior to filing.
  - Find out if your proposal warrants full NOI filing, even if only in buffer zone.
  - Find out if your project meets the requirements for an ER limited project.
  - Save Time. **Save Money.** Avoid Penalties.

## Summary- Part 1

- Minimize your risk when working around wetlands, by knowing:
  - 1) Whether there are regulated resources areas located on your project site
  - 2) What minor activities are exempt from review
  - 3) If work is not exempt, is proposed work limited to buffer zone (perhaps only requiring a simple Request for Determination)
  - 4) If work will occur in a Resource Area, does project qualify under ER Limited Project
  - 5) Consult the local conservation commission early in the planning process.

## Mass. General Law Chapter 131, Sec. 40

**Right-of-Way Management is separately addressed in the WPA regulations:** when part of an approved Vegetation Management Plan approved by the Department of Agricultural Resources, the local Conservation Commission has jurisdiction only over confirmation of the resource areas and buffer zone boundaries.



## Wetland Delineation Questions

- When does “wet” land become a regulated “wetland”?
- Where’s the edge?
- When do you need to hire a wetland scientist to determine the boundary?

## What do you look for?



- Wetland Hydrology
- Hydrophytic Vegetation
- Hydric Soils

## Basic Components of all wetlands:

- 1) Wetland Hydrology
  - source of water that saturates / inundates soils for a significant portion of the growing



This may be easy to see in April.....

### Basic Components of all wetlands:

#### 1) Wetland Hydrology



... but this water may no longer be apparent in July.

We must look for evidence of wetland hydrology based on the plant community and the soil color patterns.

### Basic Components of all wetlands:

#### 2) Specialized Vegetation

- Area must have prevalence of *hydrophytic* plants species

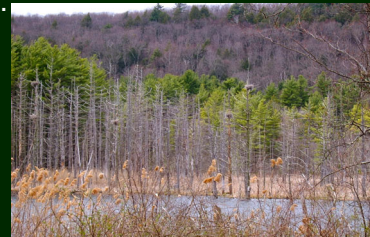


### Wetland Vegetation:

- Wetland vegetation is called **hydrophytic** (meaning water-loving plant)
- These plants have special adaptations that allow them to survive in saturated (**anaerobic**) soils.
- How do their roots respire (i.e., “breathe”) without air in the soil pores?



- Most plants do not have these adaptations and require a supply of oxygen from the soil.



- Tree death is common shortly after beaver create an impoundment.

### Wetland Vegetation - Adaptations

Shallow rooting systems (avoidance)

Buttressed trunks



### Wetland Vegetation Adaptations:

**Aerenchyma** - special stem and root tissue  
“sponge-like” air spaces which allow oxygen to diffuse from the aerial parts of the plant down to lower plant organs (like a snorkel).

Some plants have true metabolic adaptations.



### National Wetland Plant List

(Maintained by USACE on behalf of FWS, EPA, NRCS)

Species categorized as to their likelihood of occurrence in wetlands.

**Obligate (OBL)** – Almost always occur in wetlands

**Facultative Wetland (FACW)** – Usually occur in wetlands, but may occur in non-wetlands

**Facultative (FAC)** – Occur in wetlands and non-wetlands

**Facultative Upland (FACU)** – usually occur in non-wetlands, but may occur in wetlands.

**Upland (UPL)** – almost never occur in wetlands

### Continuum of Indicator Statuses:

OBL FACW FAC FACU UPL

Important to assess the characteristics of the entire *plant community* – and not over emphasize the occurrence of a species present only in low amounts.



Skunk Cabbage (OBL)

### Continuum of Indicator Statuses:

OBL FACW FAC FACU UPL

Important to assess the characteristics of the entire *plant community* – and not over emphasize the occurrence of a species present only in low amounts.



### Near the wetland / upland edge:

- There will be as many hydrophytic species present as non-hydrophytic species.
- The wetland boundary can rarely be determined based on vegetation alone.
- **Exception:** When topography has sharp break at toe of slope and lowland vegetation is dominated by “OBL” and “FACW” plant species.



- When steep slope is present and vegetation at the toe of slope is strongly hydrophytic (and different than the slope vegetation), then this is enough evidence to identify the wetland and mark toe of slope as the boundary.

Example without steep slope: Is this a wetland?



A dominance of Skunk Cabbage (OBL) very strongly suggests that this is a wetland

Many species of sedges and rushes are common wetland indicators.

**Could this be a wetland?**

In the middle of summer, it could be hard to tell...unless you know what to look for.

Soils provide the answer.

Soil color patterns indicate if the water table fluctuates near the ground surface.

- Under well-drained soil conditions, oxygen is able to move through the soil pore spaces.

When the soil is saturated (and all the pores are full of water), chemical changes take place due to lack of oxygen.

**Basic Components of all wetlands:**

3) Hydric Soils

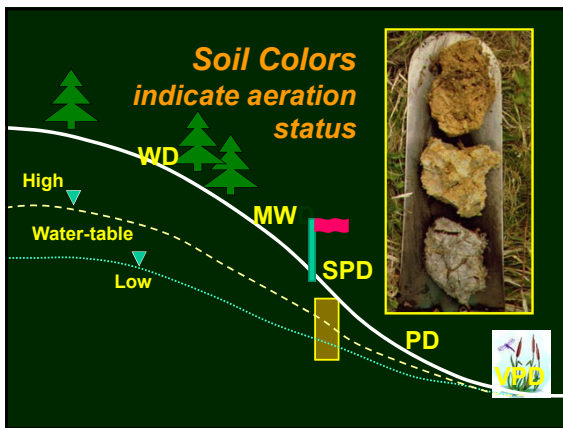
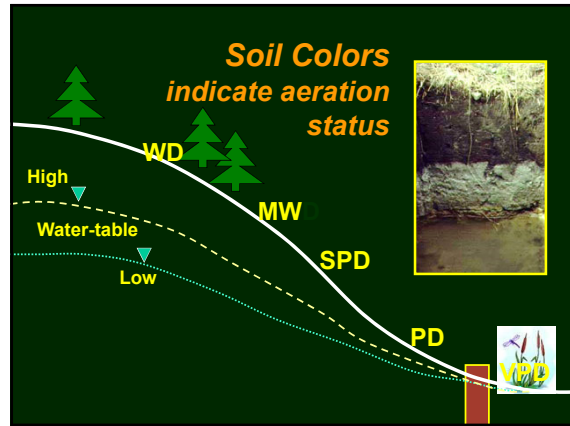
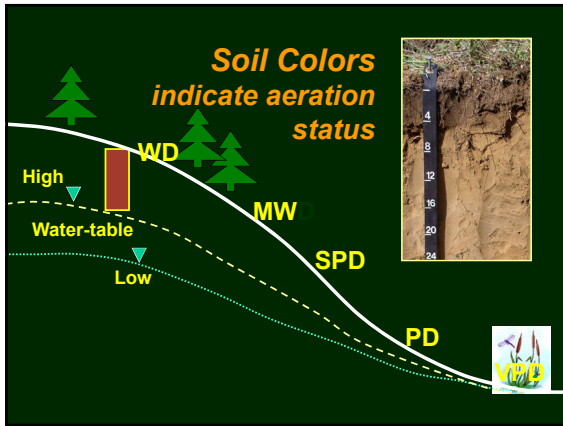
Area must have soils that show evidence of long term saturation conditions

- Microbial decomposition processes *slow down* when saturated.
- This causes organic matter to accumulate in the soil, resulting in a dark color at the surface.

**Wetland Soil Colors**

- Changes in soil chemistry occur when oxygen is no longer present.

These changes transform the subsoil making it gray, sometimes with orange and red mottles.



**Wetland Soil Colors**

- Under prolonged saturated (*water-logged*) conditions, iron becomes soluble and is stripped from the soil grains –leaving gray colors behind.
- When dissolved iron encounters oxygen in the soil, it forms rusty-colored mottles.

**Where's the Edge?**

- Wetlands do have a legal definition.
- This definition translates into **field indicators** that document the presence of:
  - **wetland hydrology** (standing water, stained surface leaves, hydric soil color patterns)
  - **wetland indicator plants** (those adapted to grow in wetland conditions)

**Wetlands Defined**

“...those areas that are **inundated or saturated by surface or groundwater** at a frequency and duration sufficient to support, and that under normal circumstances do support, a **prevalence of vegetation** typically adapted for life in **saturated soil conditions.**”

33 CFR § 328.3



## Where's the edge?

- **Toe of slope.** When topography has sharp break at toe of slope and lowland vegetation is dominated by "obligate" wetland plant species.
  - 'Obligate' species are those listed on NWPL as almost always occurring in wetlands.
- It is usually not necessary to hire an expert in these situations.



<https://11left.wordpress.com/category/nature/page/4/>

## Delineation Methodology

- When the topography has a gentle slope and/or the vegetation community is not 'obligate' wetland species...
  - a formal wetland delineation may be needed that documents vegetation, soils, and hydrology.



<http://www.nhdfi.org/about-forests-and-lands/bureaus/natural-heritage-bureau/photo-index/>

## Delineation Methodology

Locate area where hydrophytic species are dominant.

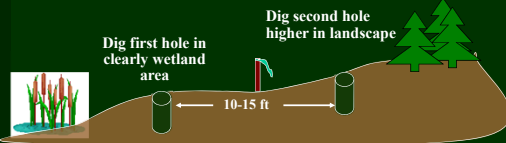
Identify area that is clearly upland based on vegetation.



- First, assess vegetation communities to determine where "transitional area" is located on the landscape.

## Delineation Methodology

- Then, dig a hole to confirm the presence of hydric soil in the presumed wetland area.



- Describe the soil profile, looking for redoximorphic features. How deep do they begin? Is the soil hydric?
- Next, dig another hole ~10 to 15 feet higher on landscape and confirm that non-hydric soil conditions exist.

## Workshops offered through Massachusetts Association of Conservation Commissions (MACC)

[http://www.maccweb.org/events/event\\_list.asp](http://www.maccweb.org/events/event_list.asp)



## Why Do We Care About Wetlands?

- Wetlands are protected (to varying extents) by Federal, State, and local regulations.
  - With each successive level become more (and never “less”) restrictive.
- These protections have been put in place because wetland ecosystems provide many important functions to society.

## Wetland Functions:

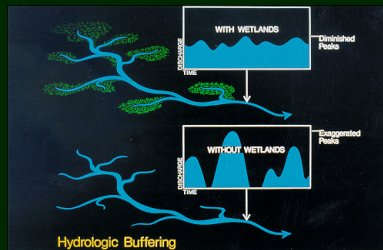
Why should we care about wetlands? ....  
What functions do wetlands perform?

### A. Flood control / prevent stormwater damage

– de-synchronizing peak flows

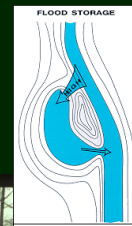
Wetlands act as sponges that absorb up to 80% of peak storm discharge that would otherwise rush downstream.

## Wetland Functions: Flood Control



Without wetlands, streams quickly fill with runoff water, leading to erosion damage along banks and extra water volume leads to flooding.

## Wetland Functions:



### Flood Control & Groundwater recharge



## Wetland Functions: Filtering Impurities

Backwater zones let suspended sediments settle out, and streamside wetlands filter runoff and infiltrating water before allowing it to return slowly to stream channel.

Vegetation stems slow moving waters, causing suspended sediments to drop out.



## Wetland Functions: Filtering Impurities

Many sediments (particularly clays) may have toxic substances adhered to their surfaces. (Ex., road oils and greases)

These pollutants settle out of the water with the sediments, and microbes are able to break them down and detoxify them.



### Wetland Functions: Nutrient Removal

Wetlands make effective (natural) filters which buffer and protect streams and rivers from harmful inputs from the surrounding landscape.

For example: **Agricultural run-off.**

But excessive nutrient inputs can lead to a condition known as **eutrophication.**

### Wetland Functions: Nutrient Removal - Prevent Eutrophication

Oxygen Consumption due to decomposing plants and algae lead to fish kill.



### Wetland Functions: Nutrient Removal

- Wetlands are sometimes called the “kidneys” of the landscape because they can reduce nutrient concentrations in water by 50-90%.
- Of course, there is a natural limit to how much pollution a natural wetland can remove.
  - Artificial (Constructed) wetlands are better suited to treating large pollutant loads.

### Wetland Functions: Fisheries & Wildlife Habitat

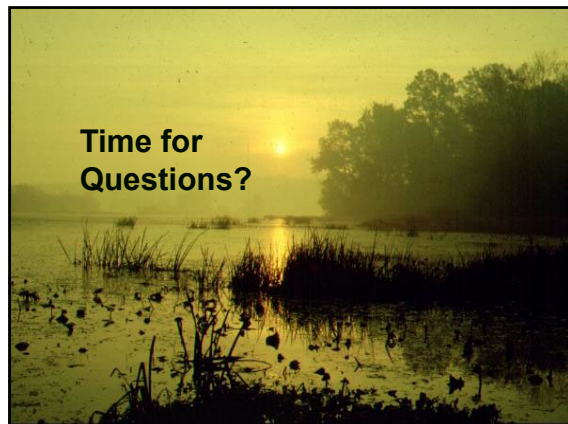
Wetlands protect and provide habitat for many species of plants, wildlife, waterfowl, fisheries, and shellfish.

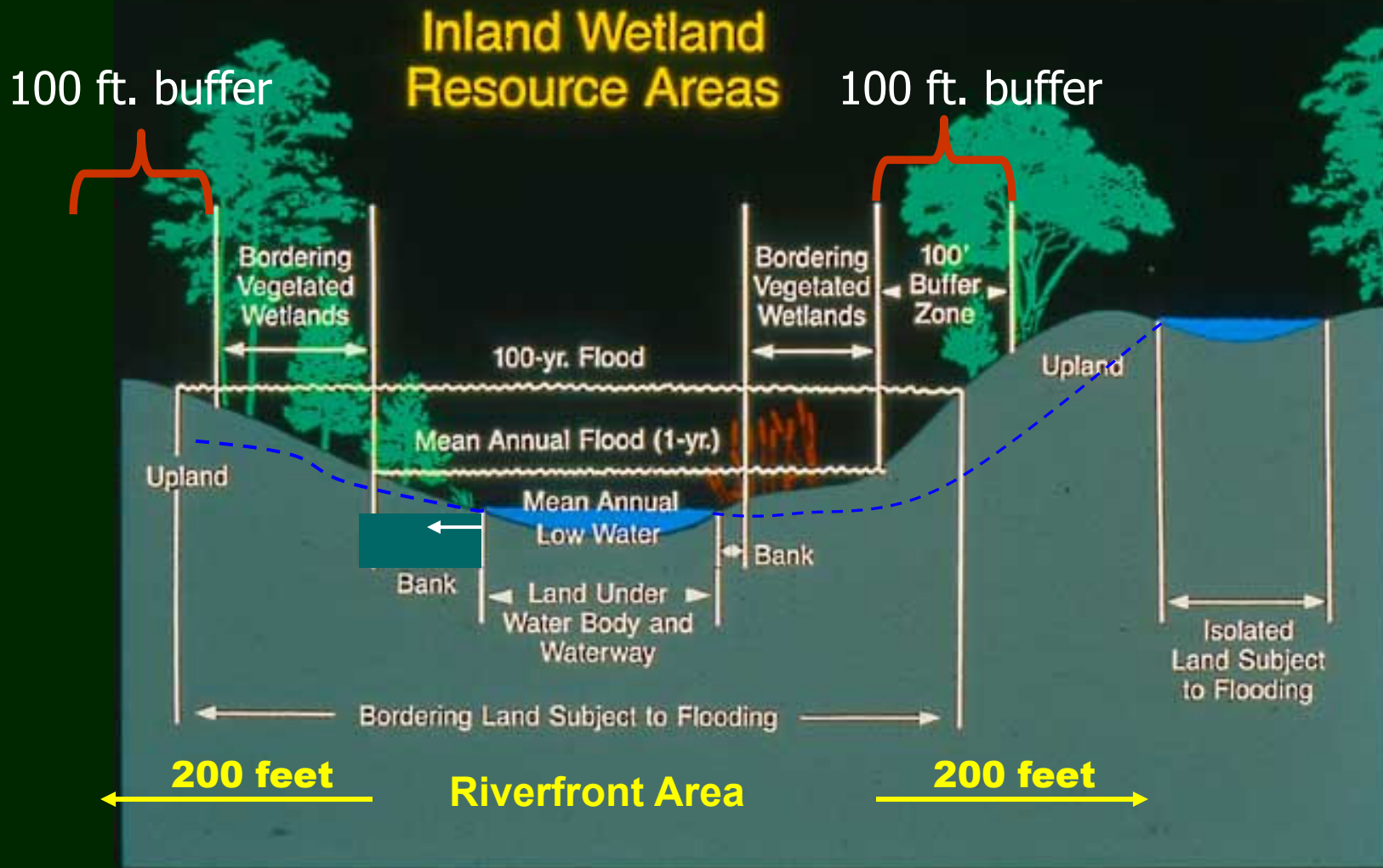


### Economic Value of Wetlands

- Wetlands economic benefits are significant and have been documented:
  - Mass Audubon estimated that freshwater and saltwater wetlands in MA provide \$2.3 billion in annual ecosystem service value;
  - The Army Corps of Engineers estimated that wetlands in the Charles River Basin prevent \$18 million in flood damage annually;
  - The cost of a new \$180 million filtration plant was avoided because of natural waste treatment provided by wetlands near the Quabbin and Wachusett reservoirs.

Time for Questions?





**Cross-sectional view: multiple resources areas and associated buffer zones may be present and overlapping.**