Bordering Lands Subject to Flooding: How to Determine Their Extent and Meet Performance Standards

Thomas Maguire, MassDEP Wetlands Program
MACC Fall Conference October 2017

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Bordering Land Subject to Flooding

Part 1: How to determine BLSF Extent.

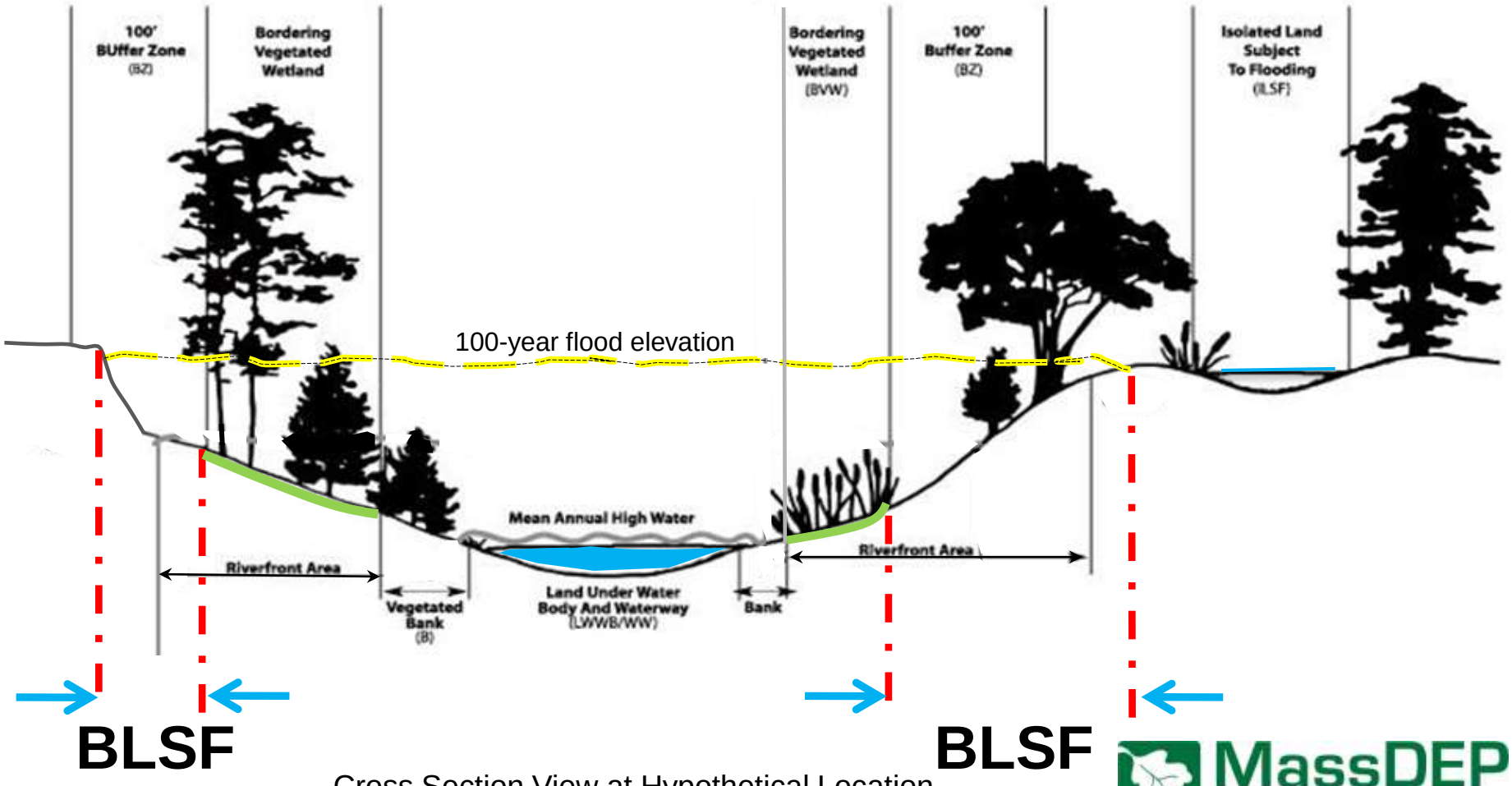
Part 2: How to determine the extent of BLSF when FEMA flood profile data is not available.

Part 3: BLSF performance standards.

What Are Bordering Lands Subject to Flooding?

- An “area which floods from a rise in a bordering waterway or water body.” 310 CMR 10.57(1)(a)
- “Where a BVW occurs, it extends from said wetland.” 310 CMR 10.57(2)(a)
- Regulated as a wetland resource area. 310 CMR 10.02(1)(e)
- Abbreviated as BLSF

Where Are the BLSF?



Cross Section View at Hypothetical Location

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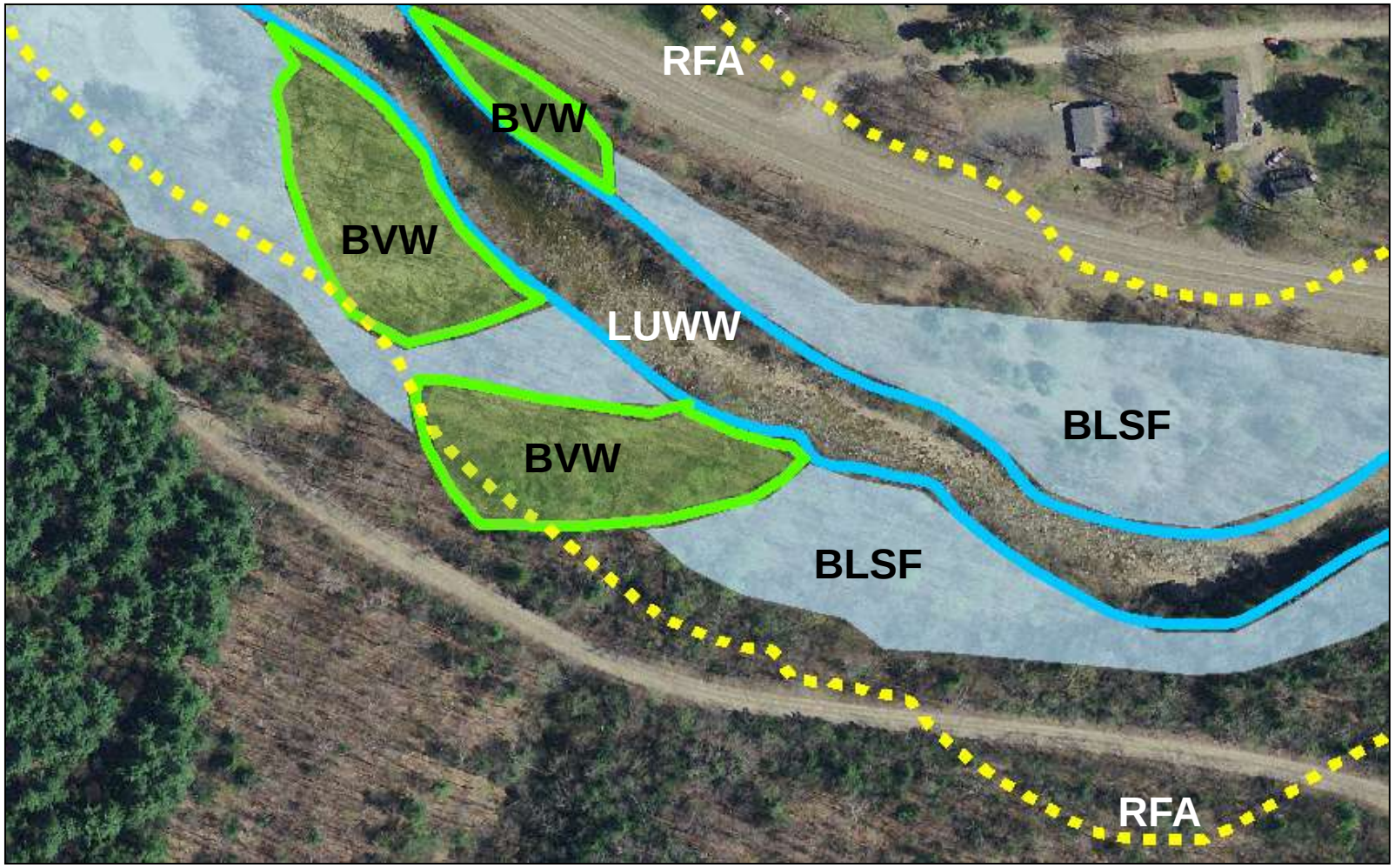
Where Are The BLSF?



Plan View at a Different Hypothetical Location

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Where Is the BLSF Boundary?

- Boundary is the estimated maximum lateral extent of flood water from 100-year frequency storm. 310 CMR 10.57(2)(a)3.
- Determined by using "most recently available" FEMA "flood profile data." 310 CMR 10.57(2)(a)3.
- FEMA flood profile boundary shall be presumed to be accurate. 310 CMR 10.57(2)(a)3.
- Presumption is rebuttable. 310 CMR 10.57(2)(a)3.

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What Is a FEMA Flood Profile?

- "Flood Profile":
  - A plan depicting a longitudinal cross section of a river or stream showing flood elevations
  - found in the FEMA Flood Insurance Study
  - not found on the FEMA Flood Insurance Rate Map
- "Most recently available":
  - Most recently available means the latest dated FEMA flood study
  - "Most recently available" includes preliminary* FEMA Flood Studies/Maps.

*Historic, Currently Effective, and Preliminary studies/maps all available at FEMA web site

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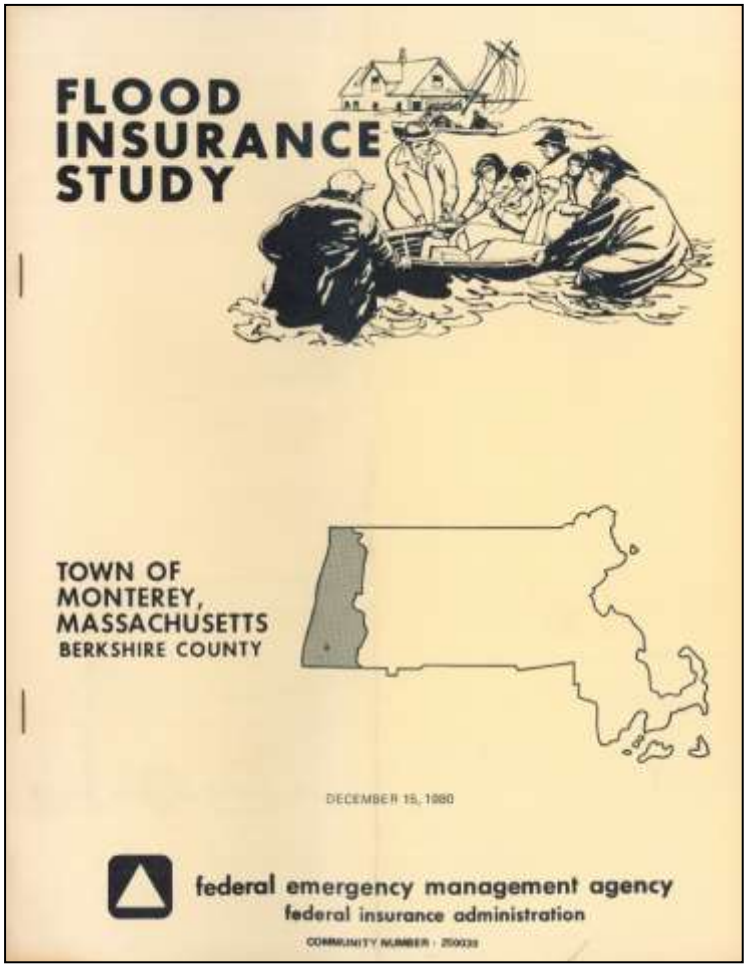
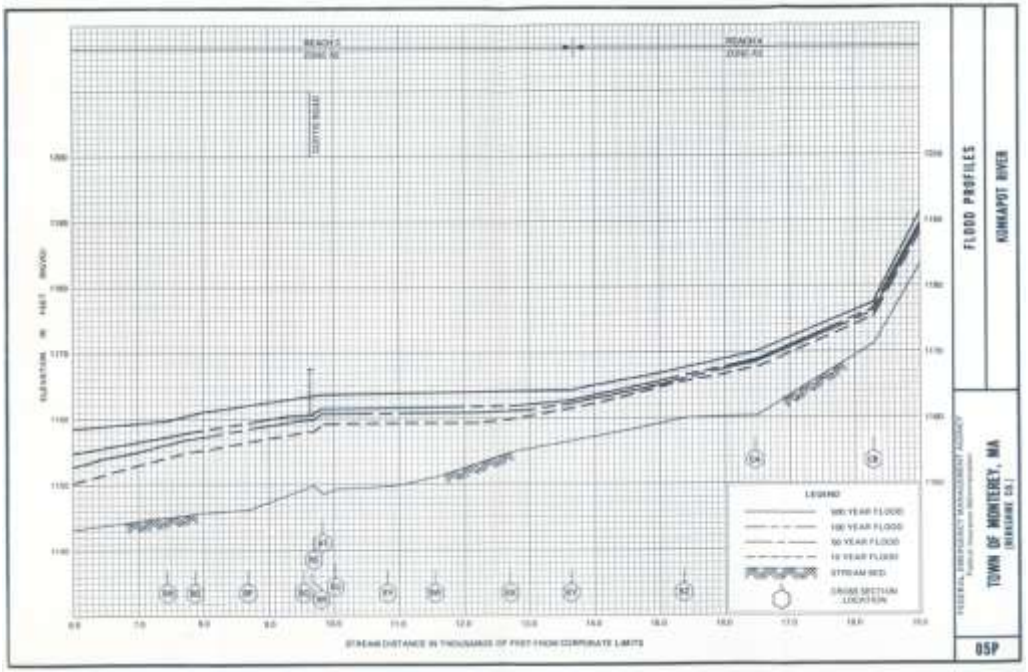
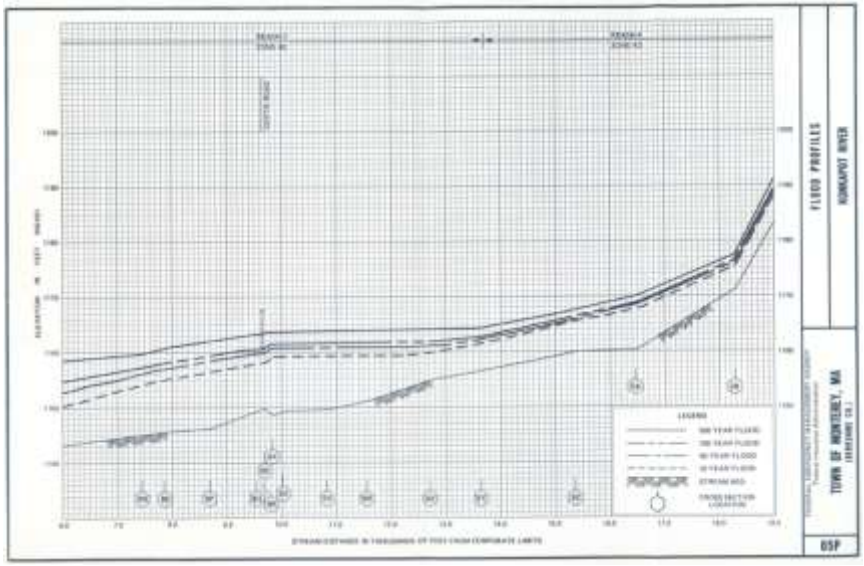
Flood Insurance Study

- The study contains the flood profiles

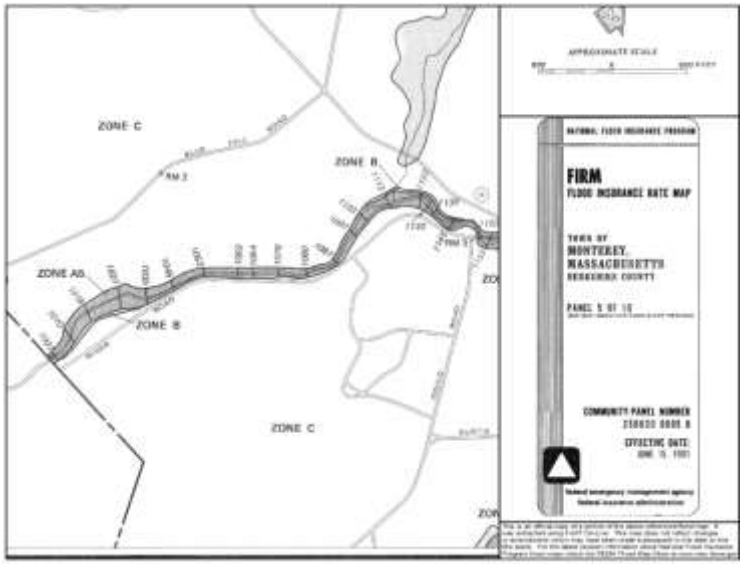




Use Flood Profile From Study



Use the FEMA Flood Profile



Don’t use the FEMA Flood Map to identify regulatory BLSF extent*

*Except for lakes, ponds, wetlands, levee areas, or rivers where a specific flood elevation is listed on FEMA map, but the flood profile is not published in the study. The FEMA map is also helpful in locating the site to see if flood hazards are identified.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Konkapot River								
BA	0	57[2]	307	12.4	1,001.9	1,001.9	1,002.0	0.1
BB	401	67	377	10.0	1,011.4	1,011.4	1,012.4	1.0
BC	1,821	78	325	11.7	1,046.4	1,046.4	1,046.4	0.0
BD	2,613	50	343	11.0	1,063.5	1,063.5	1,064.1	0.6
BE	3,553	45	273	13.9	1,086.7	1,086.7	1,086.7	0.0
BF	3,933	45	309	12.3	1,096.8	1,096.8	1,097.6	0.8
BG	4,239	130	694	5.5	1,102.9	1,102.9	1,103.2	0.3
BH	4,504	45	270	14.1	1,111.8	1,111.8	1,111.8	0.0
BI	5,237	50	280	13.6	1,139.1	1,139.1	1,139.1	0.0
BJ	5,670	60	394	9.6	1,149.4	1,149.4	1,150.3	0.9
BK	5,786	42	387	9.8	1,150.9	1,150.9	1,151.8	0.9
BL	5,816	42	458	8.3	1,152.8	1,152.8	1,153.5	0.7
BM	5,848	101	947	4.0	1,154.4	1,154.4	1,154.8	0.4
BN	7,448	90	790	4.8	1,157.1	1,157.1	1,157.9	0.8
BO	7,876	128	1,099	3.4	1,158.0	1,158.0	1,158.8	0.8
BP	8,700	112	956	4.0	1,159.2	1,159.2	1,160.0	0.8
BQ	9,550	284	2,110	1.8	1,160.2	1,160.2	1,161.1	0.9
BR	9,671	155	783	4.8	1,160.5	1,160.5	1,161.4	0.9

[1]Feet from corporate limits
[2]This width extends beyond corporate limits

TABLE 3

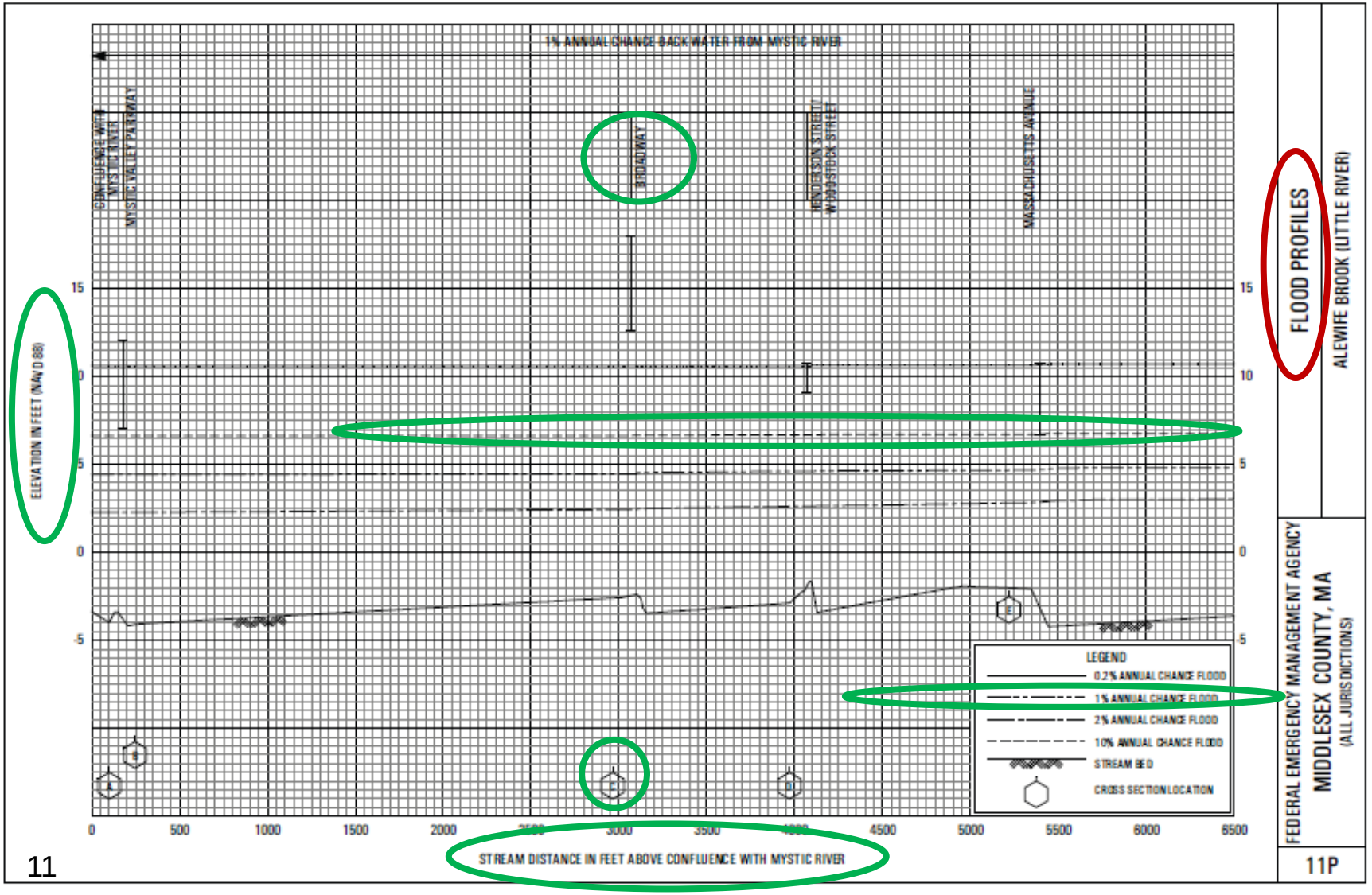
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF MONTEREY, MA
(BERKSHIRE CO.)

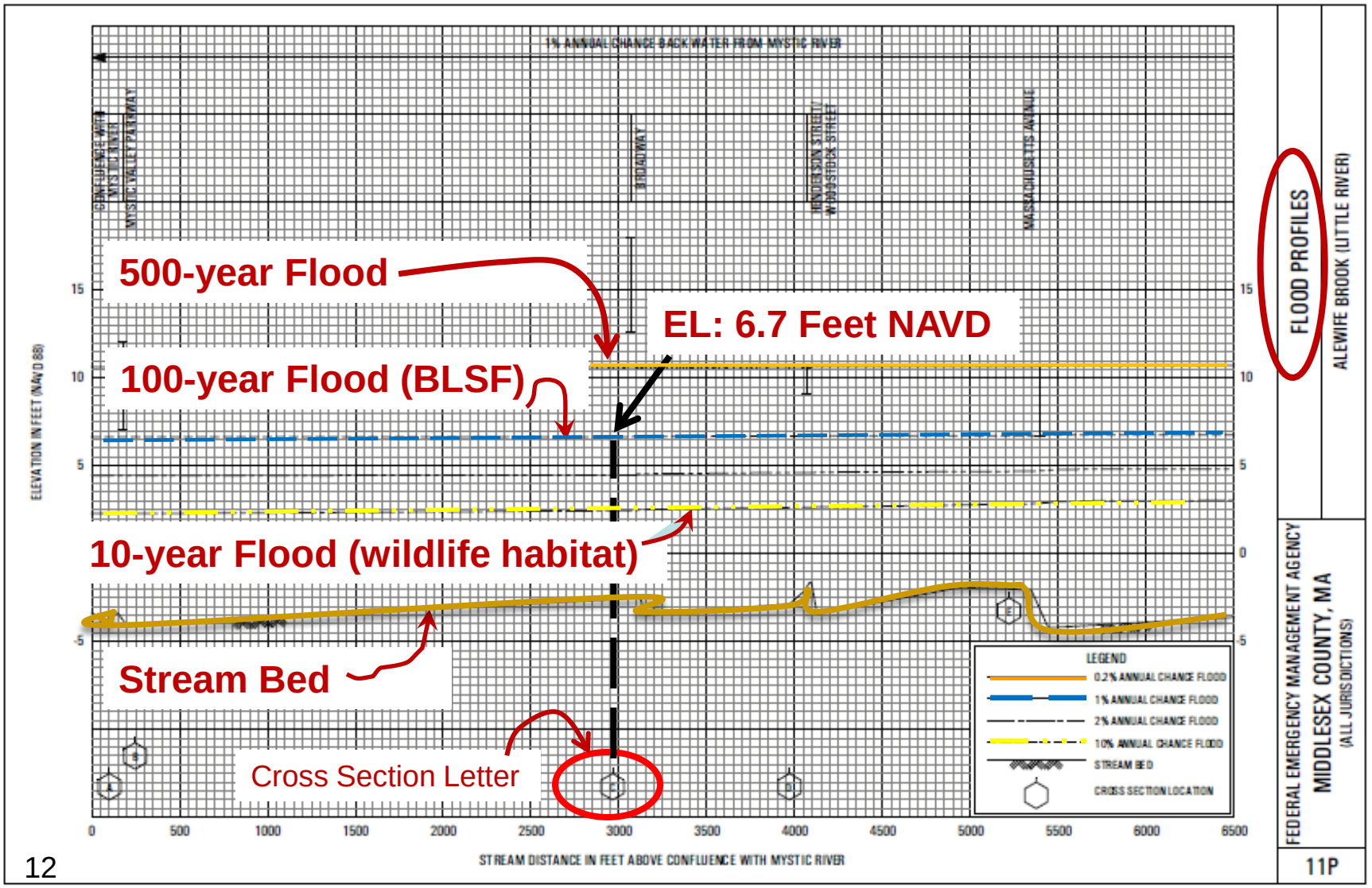
FLOODWAY DATA

KONKAPOT RIVER

How Do You Read the Flood Profile?



Flood Profile



X-Axis: Horizontal Distance in Feet From Known Point

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Aberjona River North Spur								
A	130[1]	33	148	0.9	64.3	64.3	64.3	0.0
B	2,260[1]	68*	324	0.6	68.1	68.1	68.1	0.0
C	2,860[1]	152	203	0.9	68.2	68.2	68.2	0.0
D	4,400[1]	124*	713	0.5	75.8	75.8	75.8	0.0
E	6,500[1]	18	15	2.1	78.3	78.3	78.3	0.0
F	7,880[1]	47*	68	1.1	81.5	81.5	81.5	0.0
G	9,410[1]	18*	27	0.5	83.0	83.0	83.0	0.0
Alewife Brook (Little River)								
A	100[2]	77*	427	1.1	6.7	3.9[4]	4.1	0.2
B	250[2]	101*	399	1.2	6.7	3.9[4]	4.1	0.2
C	2,960[2]	74	381	1.2	6.7	4.1[4]	4.3	0.2
D	3,970[2]	56*	372	1.5	6.7	4.5[4]	4.7	0.2
E	5,220[2]	84	327	1.2	6.7	4.6[4]	4.9	0.3
F	7,330[2]	500*	1,135	0.3	6.8	4.9[4]	5.3	0.4
G	7,770[2]	1,556*	2,294	0.2	6.8	5.0[4]	5.3	0.3
H	8,010[2]	1,675*	3,477	0.1	6.8	5.0[4]	5.4	0.4
I	11,625[2]	70	569	0.8	7.4	6.4[4]	7.2	0.8
Angelica Brook								
A	500[3]	16	23	6.9	190.1	190.1	190.1	0.0
B	1,360[3]	8	25	6.4	207.1	207.1	207.9	0.8
C	2,770[3]	100	525	0.3	223.4	223.4	223.4	0.0

[1] Feet above confluence with Aberjona River

[2] Feet above confluence with Mystic River

[3] Feet above confluence with Reservoir No. 3

[4] Elevation computed without consideration of backwater effects from Mystic River

* The measured top width on the FIRM may differ due to the effects of ineffective flow, the exclusion of small pocket areas due to map scale limitations, or is estimated due to HEC-RAS modeling limitations

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

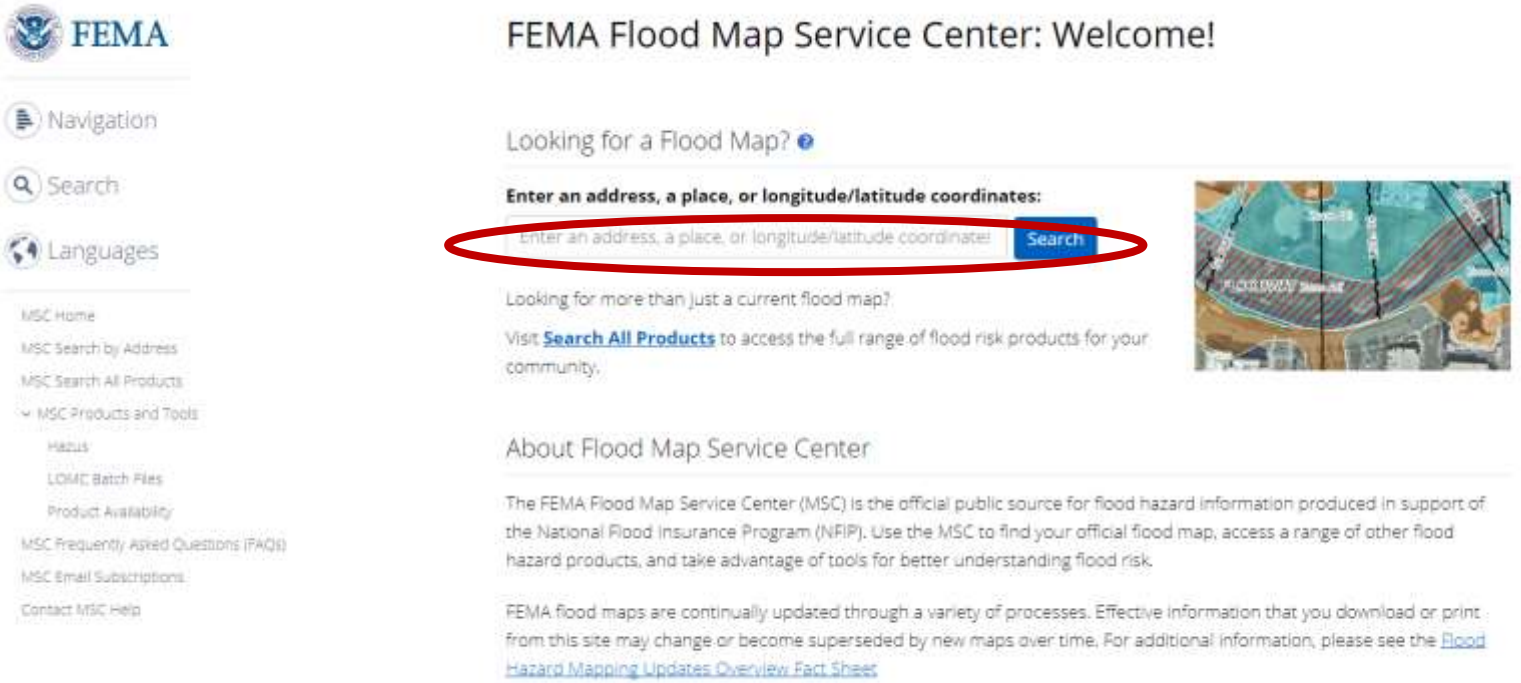
MIDDLESEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

ABERJONA RIVER NORTH SPUR – ALEWIFE BROOK (LITTLE RIVER) – ANGELICA BROOK

How do you find FEMA Profile?

- May be on file at the Town Hall
- On file on the Web: https://msc.fema.gov/portal



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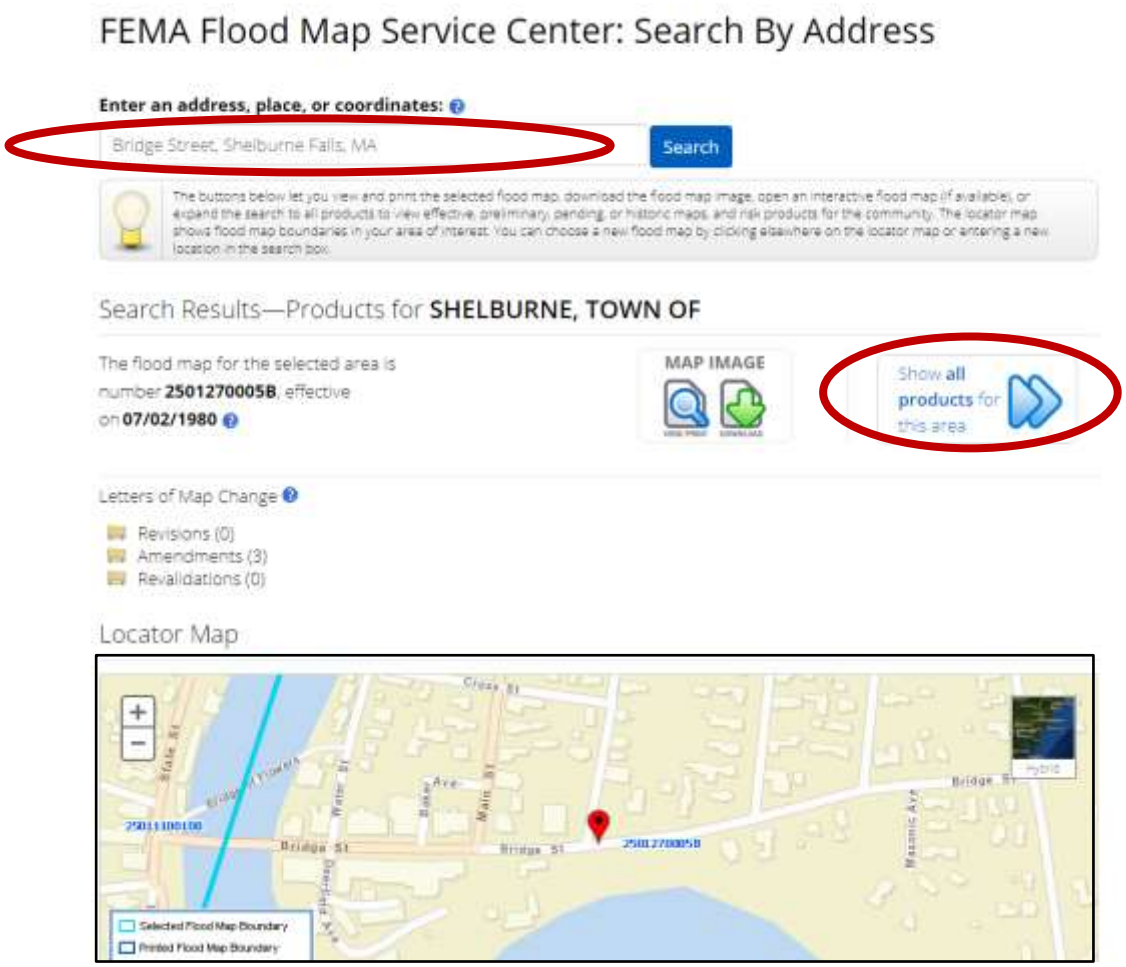
FEMA Maps/Studies Web Site



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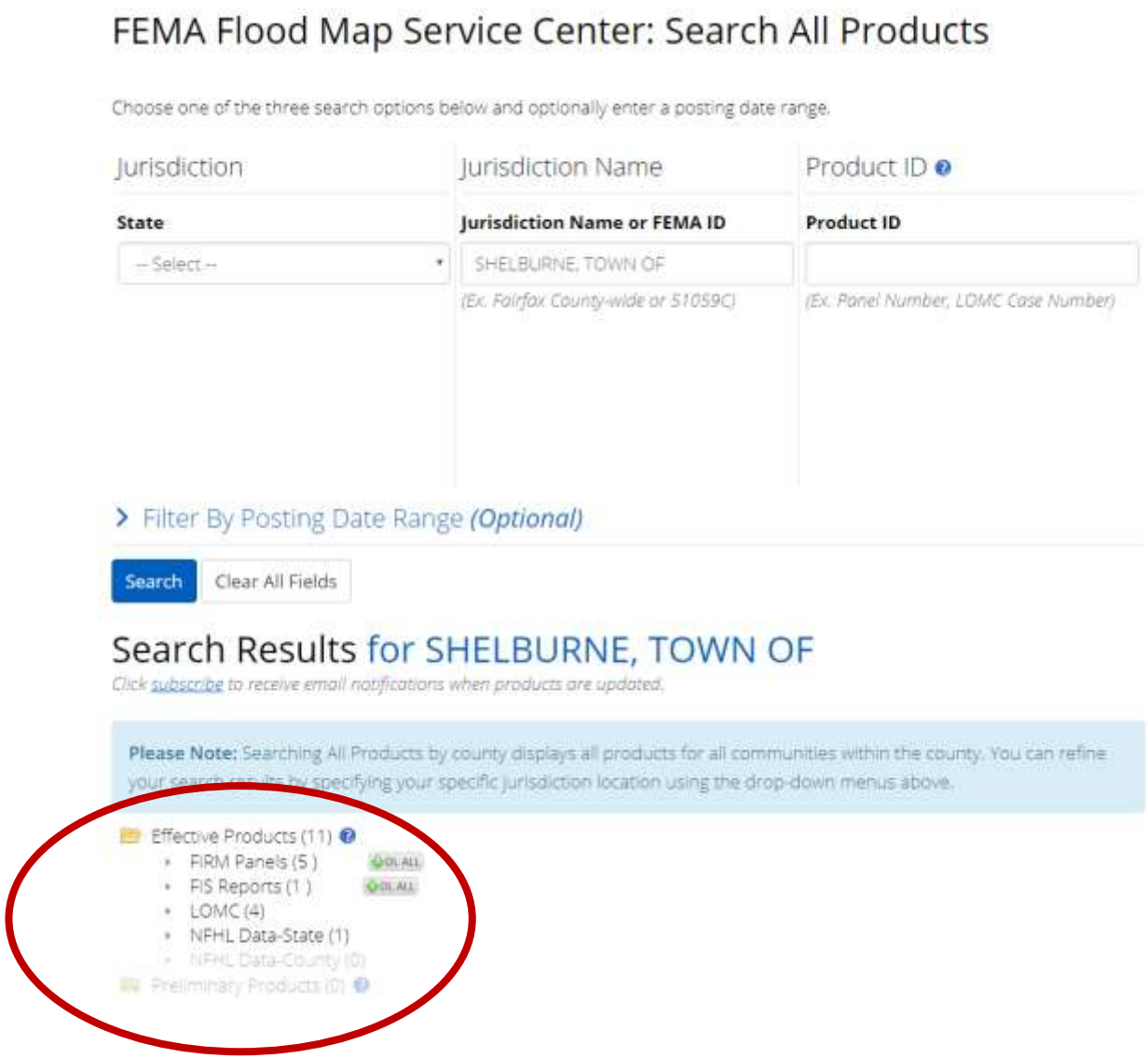
FEMA Study/Maps Down Load



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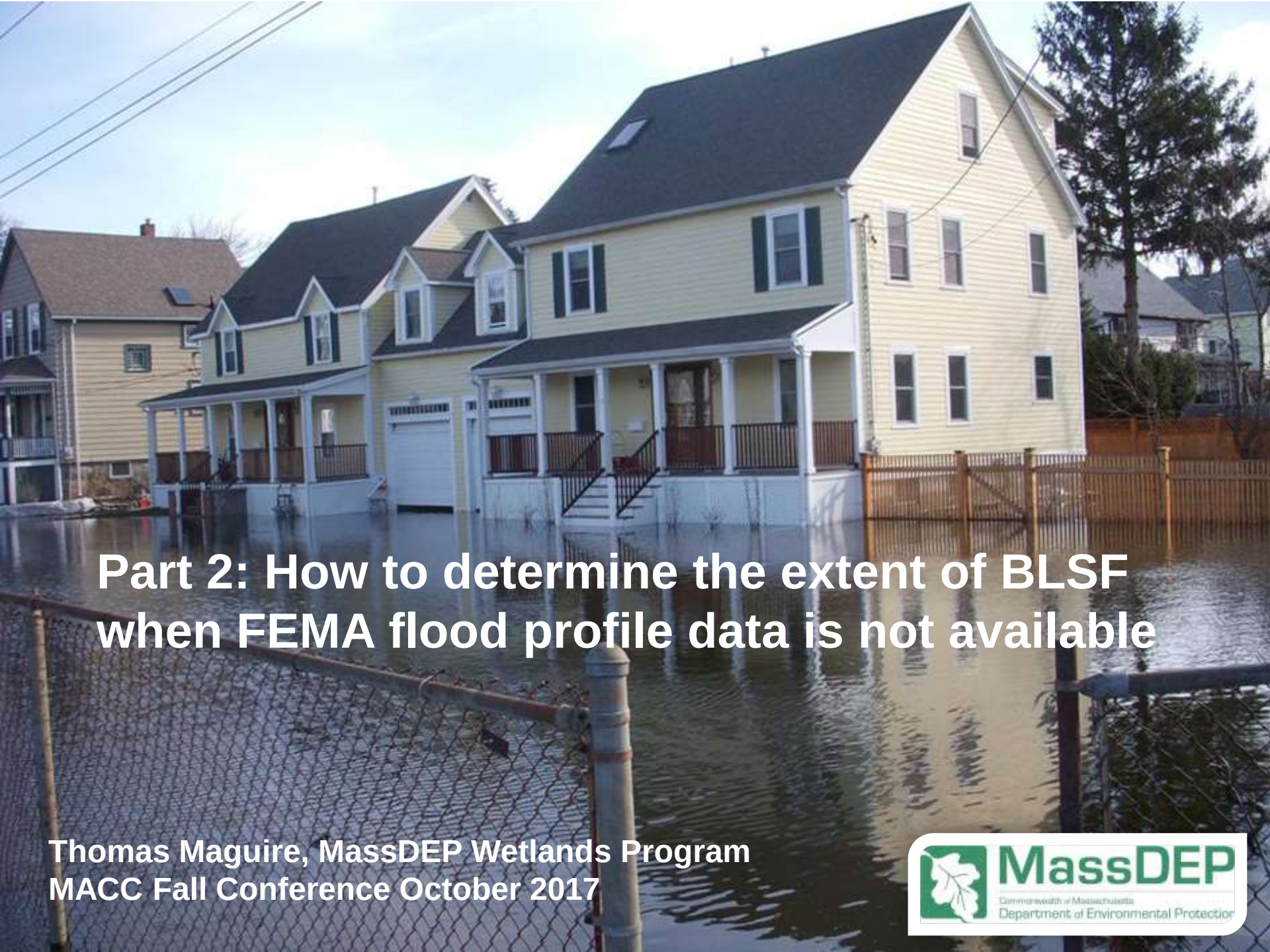
BLSF Elevation On the Ground

- After FEMA Flood Profile elevation obtained:
  - The FEMA elevation needs to be surveyed onto the ground by a surveyor using established bench and reference marks.
  - For projects that parallel a river or stream, BLSF may be a series of different flood elevations, rather than a single flood elevation.



Part 2: How to determine the extent of BLSF when FEMA flood profile data is not available

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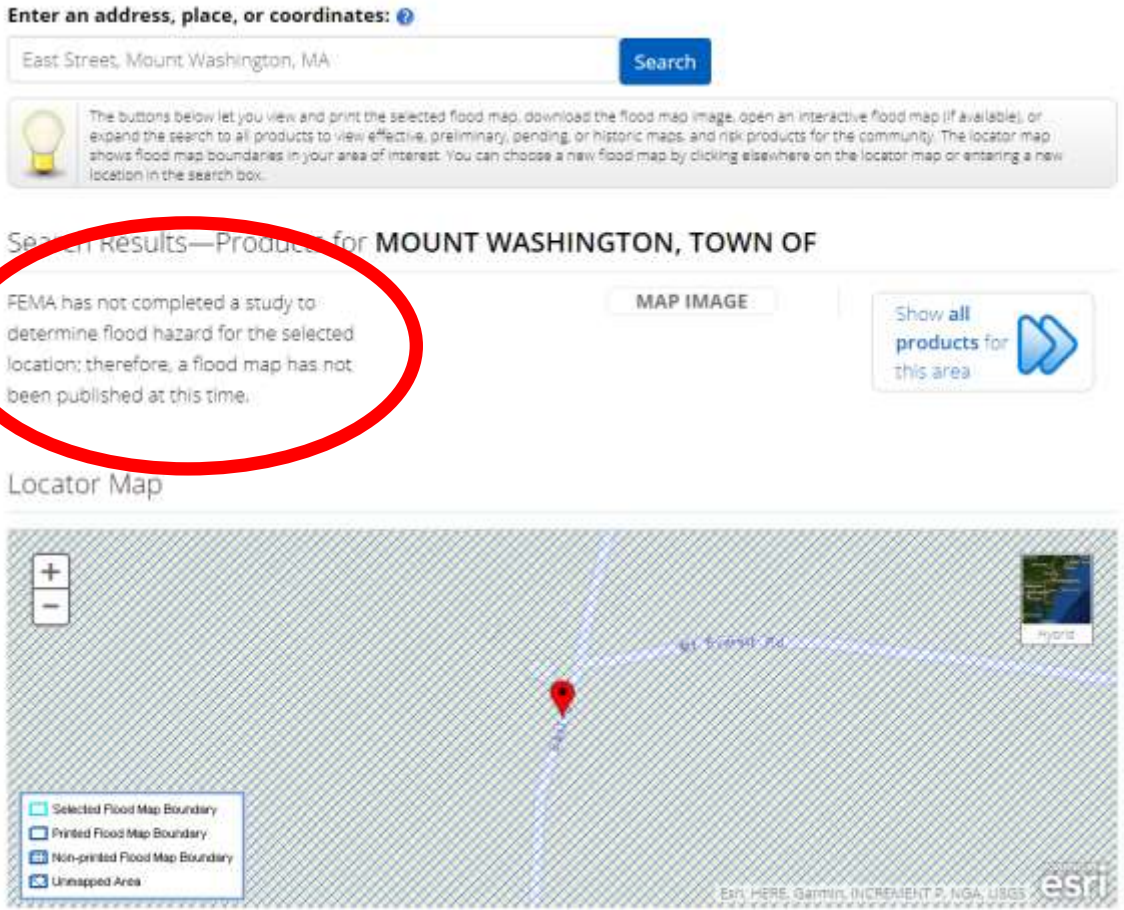
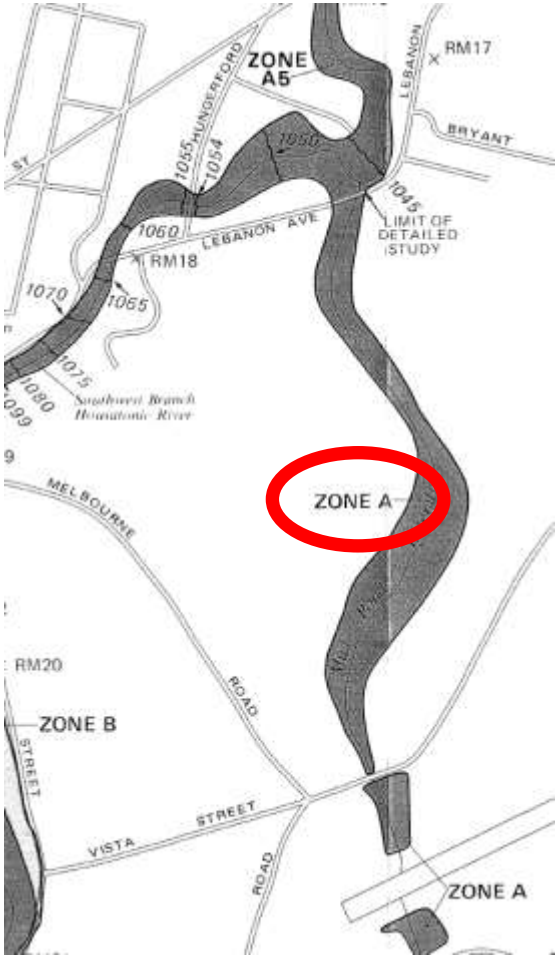
When Is A FEMA Flood Profile Not Available

- No FEMA Flood Profile published for locus
- FEMA Map identifies locus as “Zone A”
  - Zone A: no flood elevation established
  - Zone AE or Zone A followed by a number (e.g. A10): Flood elevation established (in a flood profile in most instances)
- FEMA Map available but doesn’t identify flood prone area adjacent to a land under water or BVW at the locus



No FEMA profile or map at the locus, so no flood elevation has been established



FEMA identifies locus as Zone A: no flood elevation established

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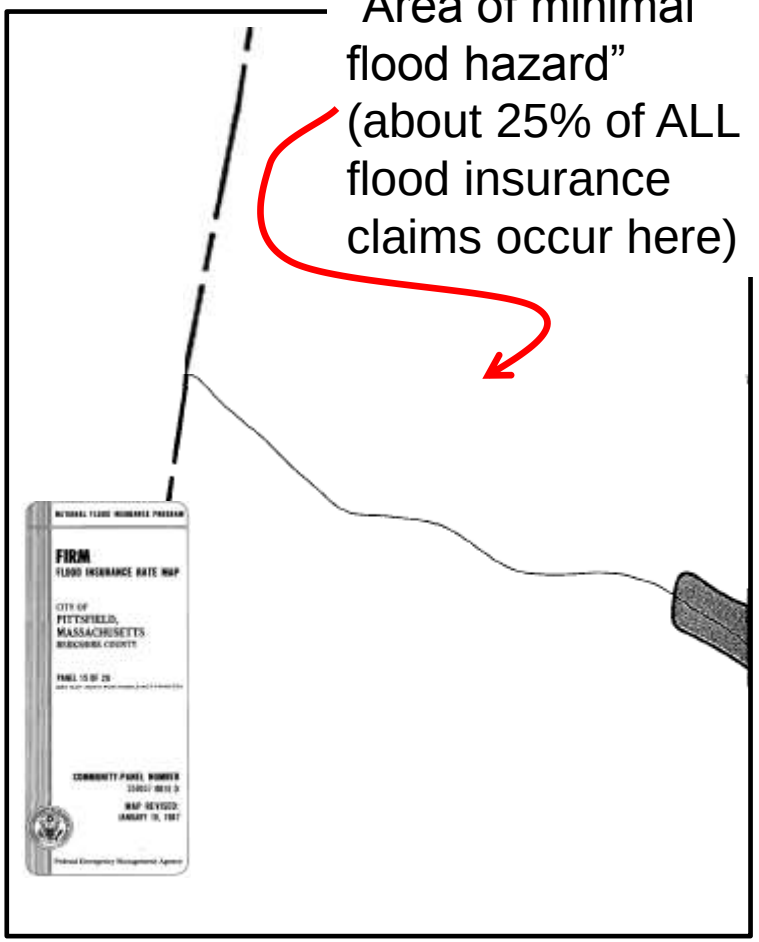
FEMA Zone C or Unshaded Zone X: "Area of minimal flood hazard" (about 25% of ALL flood insurance claims occur here)



FEMA map available but doesn't identify any flood prone area adjacent to the stream or BVW at the locus.

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When FEMA Flood Profile Is Not Available

- BLSF boundary shall be maximum lateral extent of flood water observed or recorded
- In the event of a conflict, issuing authority may require the applicant to conduct a flood study:
  - 7-inch storm in 24-hours (NRCC or NOAA may be used provided applicant consents, NRCC avg.=8.2-inches, NOAA avg.=7.7-inch)
  - TR55 Method (includes TR20) for hydrology
  - River routing (HEC-RAS)/Pond routing
  - Prepared by a RPE or other professional competent in such matters

Observed or Recorded

- USGS River Gages
- USGS Reports documenting flood elevations
- Pictures from local newspapers
- Videos on web
- Historical societies
- Local library
- Photographs or videos from local residents

Part 2: For More Information

	WEB
MassDEP Wetland Regulations	https://www.mass.gov/regulations/310-CMR-1000-wetlands-protection-act-regulations
MassDEP Hydrology Handbook for Conservation Commissioners	http://www.mass.gov/eea/docs/dep/water/laws/a-thru-h/hydrol.pdf
FEMA Map Store	https://msc.fema.gov/portal
USGS MA/RI Home Page (access to river gage data, reports with flood marks	https://ma.water.usgs.gov/

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Part 3: Bordering Lands Subject to Flooding Performance Standards

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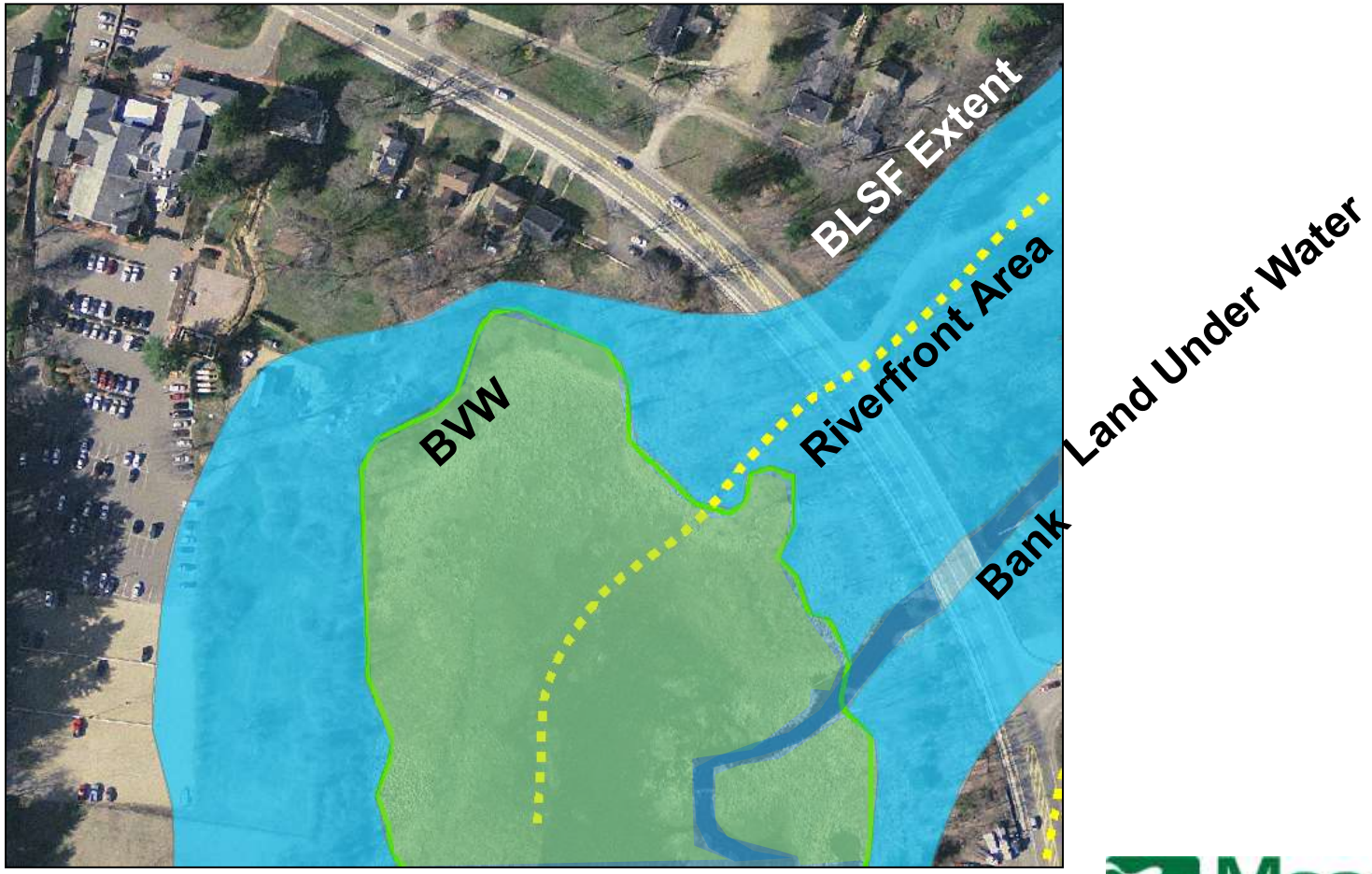
Flood Prone Areas Extend to Multiple Resource Areas



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Where Do the Inland Wetland Regulations Address Flooding?

- Bank: 310 CMR 10.54(4)(a)2.
- Land Under Water: 310 CMR 10.56(4)(a)1.
- Riverfront Area: 310 CMR 10.58(4)(a)
- Bordering Vegetated Wetlands: 310 CMR 10.55(4)(b)
- BLSF: 310 CMR 10.57(4)
- ILSF: 310 CMR 10.57(4)(b)*

*Not Addressed by this Presentation

Bank, LUW, and RFA

Flood Control Interest Performance Standards

- Bank: Work shall not impair "the water carrying capacity of the existing channel within the Bank" 310 CMR 10.54(4)(a)2.*
- Land Under Water: Work shall not impair "the water carrying capacity within the defined channel." 310 CMR 10.56(4)(a)1.*
- Riverfront area: Work shall met performance standards for all other resource areas within Riverfront Area. 310 CMR 10.58(4)(a)

*Coincides with FEMA Floodway Regulation: No Flood Rise

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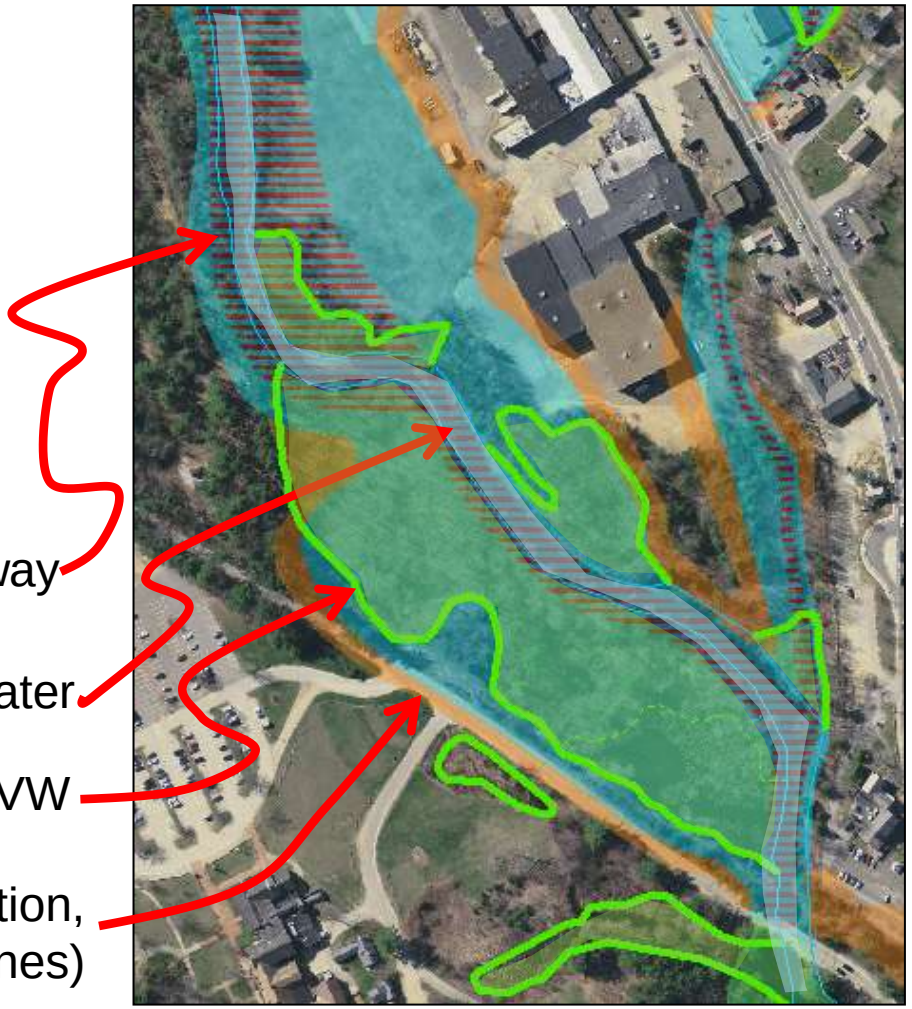
Water Carrying Capacity

- 310 CMR 10:56(1):
  - " land under water, in conjunction with banks, serves to confine floodwater within a definite channel during the most frequent storms."
  - "Filling within this channel blocks flow which in turn causes backwater and overbank flooding."



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BVW

Flood Control Interest Performance Standards

- Issuing authority may issue an Order which results in loss of up to 5,000 square feet of BVW when said area is replaced in accordance with the following:
  - surface of replacement area shall be equal to the lost area;
  - the ground water and surface elevation of the replacement area shall be approximately equal to lost area;
  - the replacement area shall have an unrestricted hydraulic connection to the same water body or waterway;
  - the replacement area shall be located within same general area or reach of the lost area;
  - At least 75% of the replacement area shall be re-established in hydrophytic plants;
  - replacement area shall be provided in a manner consistent with all other General Performance Standards for each resource area.

Is the Water Carrying Capacity Impaired or Stream Crossing Standards Met?

Image: Michael McHugh, MassDEP Wetlands Program

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BLSF Performance Standards

- Compensatory flood storage (CFST) shall be provided. 310 CMR 10.57(4)(a)1.
- CFST shall be a volume not previously used for flood storage.
- CFST shall be incrementally equal to the volume of flood water at each elevation up to and including the 100-year flood.
- “Incrementally” means foot-by-foot increments
- CFST volume shall have an unrestricted hydraulic connection. 310 CMR 10.57(4)(a)1.
- CFST shall be provided in same reach

BLSF Performance Standards

- Work within BLSF shall not restrict flows so as to cause an increase in flood stage or velocity. 310 CMR 10.57(4)(a)2.
- Work in BLSF found to be significant to wildlife habitat shall not impair its capacity to provide important wildlife habitat functions. 310 CMR 10.57(4)(a)3.

Compensatory Flood Storage

Fill and Cut Table

- A fill and cut table should accompany the NOI
- The table should contain at least 4 columns listing the fills and cuts proposed at each elevation increment.
  - First column: Elevation increment foot-by-foot
  - Second column: proposed fills
  - Third column: proposed cuts to offset the fills
  - Fourth column: accounting demonstrating the proposed cuts offset the fills

Fill and Cut Table

Elevation (Feet, NAVD)	Incremental Volume of Fill (cubic feet)	Incremental Volume of Excavation (cubic feet)
292		
	1100	1150
293		
	900	925
294		
	650	670
295		
	145	135
296		
Total Volume	**2745**	**2880**
	(Fill)	**(Cut)**

MassDEP Comment: CFST requirement not met due to loss from EL 295 to EL 296

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Problems With Fill and Cut Tables

FLOODPLAIN IMPACT & MITIGATION SUMMARY			
ELEVATION (FT)	FLOODPLAIN IMPACT (CY)	FLOODPLAIN MITIGATION (CY)	FLOODPLAIN NET (CY)
100–100.64	–222.7	43.6	–179.1
99–100	–414.8	473.3	58.5
98–99	–267.6	445.8	178.2
97–98	–170.2	372.3	202.1
96–97	–100.7	109.7	9.0
95–96	–57.9	113.3	55.4
94–95	–31.1	57.9	26.8
93–94	–4.9	22.1	17.2
92–93	–0.4	12.7	12.3
91–92	0.0	16.1	16.1
90–91	0.0	19.6	19.6
89–90	0.0	12.3	12.3
88–89	0.0	0.0	0.0
TOTALS	**–1270.4**	**1,698.7**	**428.3**

100-year flood

10-year flood

MassDEP comment: Loss of flood storage from EL 100 feet NGVD to 100.64 NGVD

MassDEP Comment: CFST requirement not met due to loss from EL 100 to EL 100.64

MassDEP comment: This shouldn't be counted as mitigation.

OVERALL NET INCREASE IN FLOODPLAIN STORAGE

(Fill) **(Cut)**

MassDEP comment: Table format confuses cuts and fills.

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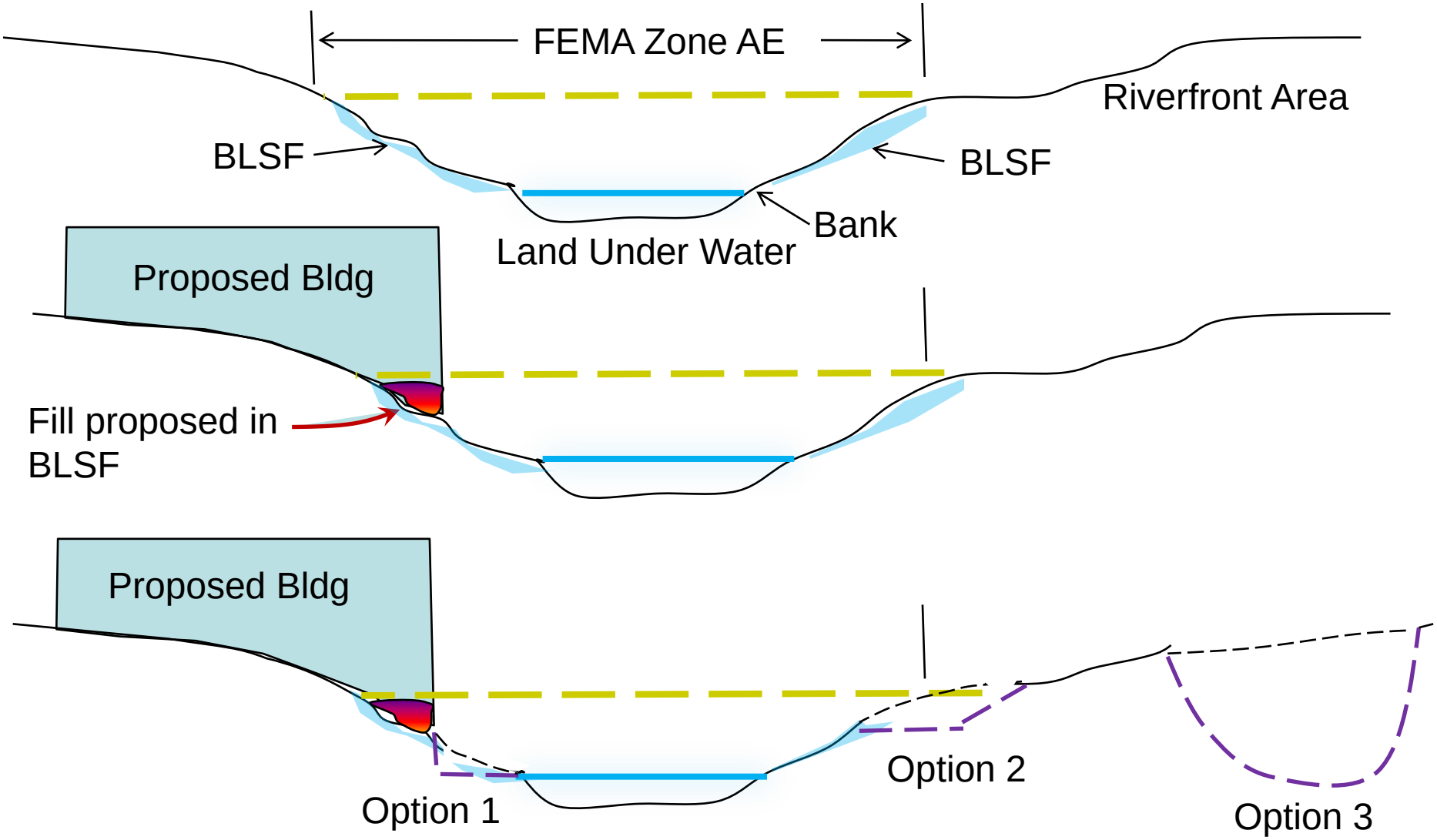
Which Option Meets Performance Standards?



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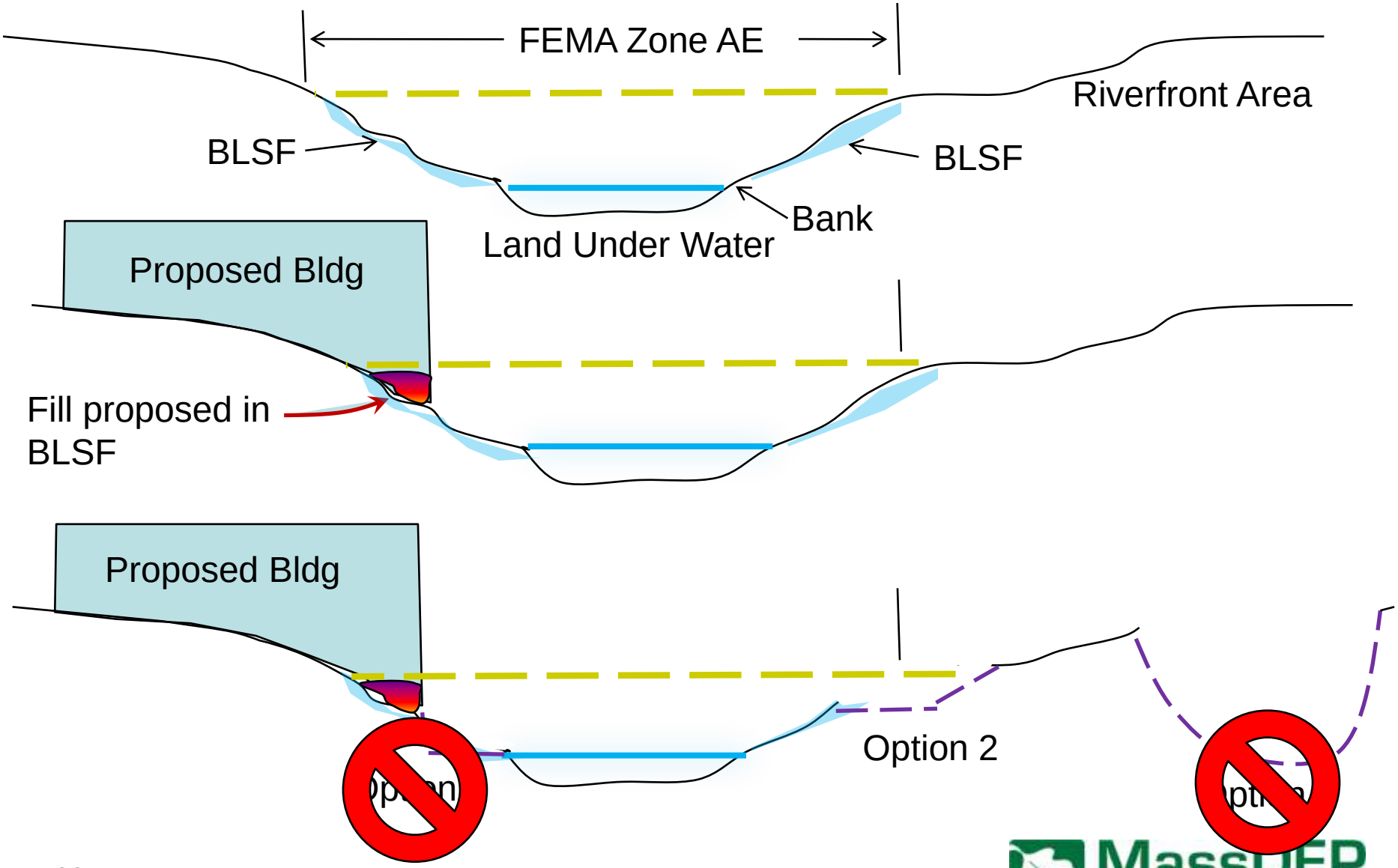
Which Option Meets Performance Standards?



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Unrestricted Hydraulic Connection

- Contrast “unrestricted hydraulic connection” between the BVW and BLSF provisions.

BVW: 310 CMR 10.55(4)(b)4.	BLSF: 310 CMR 10.57(4)(a)1.
The replacement area shall have an unrestricted hydraulic connection to the same water body or waterway as the lost area	Such compensatory volume shall have an unrestricted hydraulic connection to the same waterway or water body.

- The “unrestricted hydraulic connection” language is the same in both the BVW and BLSF provisions so must be interpreted to mean the same thing.

Unrestricted Hydraulic Connection

- What is an "unrestricted hydraulic connection"?
  - Not defined in the wetland regulations
  - "The requirement that compensatory storage must have an unrestricted hydraulic connection to …the waterway ensures that flood flows will pass freely in an equivalent manner post construction." MassDEP, In the Matter of M.G. Hall, Recommended Final Decision, May 7, 2013.
  - A connection where flood water can flow freely without any impediment at each elevation increment
- "Unrestricted hydraulic connections" do not include:
  - Elevated topography
  - Pipes
  - Culverts
  - Manmade Channels
  - Canals
  - Swales
  - Raceways
  - Flood Vents in buildings

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Same Reach

- Reach is not defined in the wetland regulations.
- Same reach: A length of stream located between two confluences, two culverts, or two road crossings, provided the characteristics are heterogeneous.
- Uniform cross section, similar elevation and same slope are examples of heterogeneous characteristics.
- “Same reach” does not refer to reaches in the FEMA study

Reach “A” Road Crossing Reach “B”

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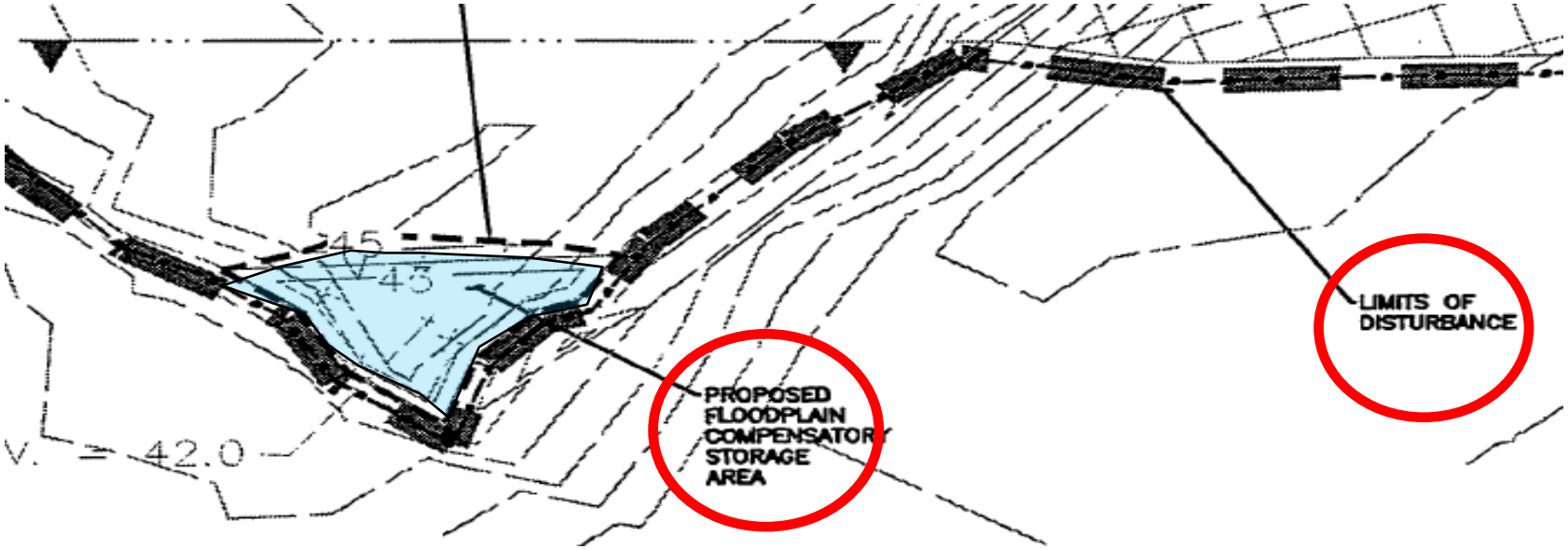
NOI Plans

- Need to show proposed fills and cuts.



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Commonwealth of Massachusetts
Department of Environmental Protection

NOI and COC Plans

- The CFST cannot be part of a stormwater basin
- Natural vegetation “should” be proposed in the CFST for at least the portion significant to wildlife habitat.
- Stormwater O/M plan must address snow disposal, including not disposing of snow in CFST, BVW, BVW replication areas, and stormwater basins
- If the cut is approved as CFST, it becomes BLSF.
- The as-built plans submitted as part of the COC must indicate whether the project was built according to the plan (including the CFST).

Part 3: For More Information

	WEB
MassDEP Wetland Regulations	https://www.mass.gov/regulations/310-CMR-1000-wetlands-protection-act-regulations
MassDEP Hydrology Handbook for Conservation Commissioners	http://www.mass.gov/eea/docs/dep/water/laws/a-thru-h/hydrol.pdf

END